LIST OF ACRONYMS

AUPRF Alberta Upstream Petroleum Research Fund  
CAPP Canadian Association of Petroleum Producers  
CBTAP Clean Bitumen Technology Action Plan  
CEPA Canadian Energy Pipeline Association  
CONRAD Canadian Oil Sands Network for Research and Development  
COSIA Canada’s Oil Sands Innovation Alliance  
DEEPP Distributed Energy Efficiency Projects Platform  
EOR Enhanced Oil Recovery  
EPAC Explorers and Producers Association of Canada  
FWAL Fresh Water Aquatic Life  
GHG Greenhouse Gas  
HWVP Hot Water Vapour Process  
ICT Information and Communication Technology  
InSAR Interferometric Synthetic Aperture Radar  
IRAP Industrial Research Assistance Program  
JIPs Joint Industry Projects  
MOU Memorandum of Understanding  
NAMA Nationally Appropriate Mitigation Action Plan  
NRC National Research Council of Canada  
NRC-IRAP National Research Council of Canada Industrial Research Assistance Program  
OSLI Oil Sands Leadership Initiative  
PEMA Petroleum Emissions Management Accelerator  
PHC Petroleum Hydrocarbon  
SAGD Steam Assisted Gravity Drainage  
SAR Sodium Adsorption Ratio  
SME Small and Medium Enterprises  
SPE Society of Petroleum Engineers  
SSRO Site-Specific Remediation Objectives  
SST Subsoil Salinity Tool  
TEREE Technology for Emissions Reduction and Eco-Efficiency  
TIS Technology Information Sessions  
UOG Upstream Oil and Gas

Mission

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

Vision

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

Contact Us

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In 2013 PTAC Petroleum Technology Alliance Canada propelled projects, partnerships, events, and programs to the next level. Holding true to our proven collaborative model, we launched more new projects in 2013 than ever before. New strategic partnerships allowed PTAC to recognize substantial benefits from cooperation across diverse disciplines and PTAC’s successful programs are poised for greater industry impact as a result of 2013 expansions. The challenges facing Canada’s hydrocarbon industry today are significant, but PTAC continues to accelerate the pace at which we are facilitating innovation and developing, demonstrating, and deploying technology solutions for a responsible Canadian hydrocarbon energy industry.

PTAC remains grounded in our firm belief that the deployment of new technologies will improve oil and gas recovery, lower costs, make operations safer, and reduce impact on the environment. Encouraging industry stakeholders to work together in a structured way, PTAC’s collaborative model identifies and addresses industry challenges in a timely and cost-effective manner for research and development within Canada’s hydrocarbon industry. The launch of an unprecedented forty new PTAC projects in 2013 testifies to the gathering momentum of industry interest in collaborative research and development.

Collaborative projects continued to be PTAC’s primary focus throughout 2013. Spanning such topics as pipeline abandonment, quantification of CO$_2$ purity findings, analysis of hydraulic fracturing, and the development of new recovery technology for bitumen and heavy oil, our 2013 projects showcase the diversity of PTAC’s technology interests while sharing the overarching goals of reducing environmental impact, reducing development costs, increasing recovery, and adding value to industry. To help control the costs and risks involved, several of PTAC’s new projects are structured as multi-phase endeavours. In addition to facilitating new projects, PTAC also maintained a steady pace for ongoing project development including the completion of field trials.

Some of PTAC’s 2013 projects progressed with extraordinary speed, moving from initial launch to completion within the year. Among these were Phase One of the Distributed Energy Efficiency Projects Platform (DEEPP), Phase One of the Airborne Microseep Mapping Project, and Phase One of the Petroleum Emissions Management Accelerator (PEMA) study. Several additional PTAC projects were also completed in 2013, introducing new research and technologies to the hydrocarbon energy industry. The Nationally Appropriate Mitigation Action Plan (NAMA) project, which completed Phase One field measurement campaigns in the first quarter of 2013, established baselines for greenhouse gas emissions for the oil and gas industry in Colombia and Mexico. Phase One of the Artificial Reservoir Project determined the value and cost of a physical model for heavy oil and bitumen recovery technologies with substantially better scale up performance than existing models, and Phase One of the Alberta CO$_2$ Purity project exemplified the PTAC collaborative model by bringing together project participants representing over twenty different stakeholders working towards a common goal.

PTAC continued to develop a rich roster of new partnerships in 2013. These relationships enabled us to expand the scope and depth of our research and technology interests. MOUs with TRItech, Genome Alberta, and Water Cluster Scientific Inc., establish a framework of strategic working relationships to explore the unconventional application of these diverse technologies within the hydrocarbon industry. Upon the closure of CONRAD and OSLI in 2013, PTAC worked closely with OSLI and CONRAD to transfer projects/consortia and ensure continued momentum. PTAC launched the Phoenix Network from the former OSLI, to focus on non-environmental in-situ oil sands activities and projects. This network, composed of oil sands operating companies, will leverage collective expertise to identify Joint Industry Projects (JIPs) for research, technology development, demonstration and deployment for in-situ oil sands.

PTAC also expanded our successful SME and AUPRF programs in 2013. 30 projects were launched under AUPRF in 2013, and a bold decision was undertaken to consider revising current funding structures to ensure the program remains financially viable for years to come. PTAC, with the support of the National Research Council of Canada Industrial Research Assistance Program (NRC-IRAP) continued to provide support to SMEs to help unleash SME innovations that benefit the hydrocarbon industry. The kickoff of the Virtual Centre for Commercialization in 2013 was a major milestone for PTAC’s SME program. This new
centre will provide support to SMEs seeking facilitation and coordination of field tests to commercialize their technologies. The number of SME projects launched tripled in 2013 compared to the previous year. PTAC continues to develop partnerships with organizations such as Innovate Calgary, TECTERRA, LOOKNorth, and TRTech to broaden the outreach and assistance we can provide to the hydrocarbon industry’s SME community.

PTAC is committed to the ongoing communication of research results and emerging opportunities. In 2013, PTAC hosted a variety of large and small events showcasing current technological innovations and sharing ongoing research developments. These 47 events served to encourage and sustain interest in industry-specific innovation, research, and technology by engaging stakeholders in unique discussions and networking opportunities. Bringing together representatives from all categories of industry has helped identify challenges, investigate technology solutions, and disseminate research and technology results.

Since October 1996, PTAC has progressed from a conceptual model to a vibrant and respected organization with numerous achievements to its credit. 2013 was a year of extraordinary progress for PTAC: More new projects were launched than ever before, more new partnerships were established, and more events were facilitated than PTAC has hosted in the past five years.

We humbly acknowledge that PTAC’s strength as an organization lies in the dedicated service of our exceptional volunteers and the support of our members. In 2013, more than 275 volunteer technical experts served on PTAC’s 22 technical steering committees. It is their passion for innovation and ongoing investment of time and talent that have enabled PTAC to achieve new heights of success. We extend to you our most sincere thanks – we could not have done it without you. We now face 2014 eager to embrace new opportunities, confident that we are only getting stronger as we continue to push forward in our mission to facilitate innovation, collaborative research, and technology development, demonstration, and deployment for a responsible Canadian hydrocarbon energy industry.

Soheil Asgarpour, Ph.D., P.Eng.  Dave Rushford
President     Chairperson

PTAC TECHNOLOGY AREAS

Improve Oil and Gas Recovery
- Conventional Oil and Gas Recovery
- Enhanced Oil and Gas Recovery
- Coalbed Methane, Shale Gas, Tight Gas, and other Unconventional Gas
- CO₂ Enhanced Hydrocarbon Recovery
- Development of Remote Resources
- Enhanced Heavy Oil Recovery
- Enhanced Oil Sands Recovery
- Emerging Technologies to Recover Oil Sands from Deposits with Existing Zero Recovery
- Tight Oil, Oil Shale, and other Unconventional Oil
- Development of Arctic Resources

Reduce Capital, Operating, and G&A Costs
- Automation
- Reduce Operating Costs Related to Energy and Chemical Consumption
- Emerging Drilling and Completion Technologies
- Eco-Efficiency and Energy Efficiency Technologies
- Technologies to Reduce Waste Energy
- Surface Facilities

Improve Value-Added Products
- Gasification
- Hydrocarbon Upgrading
- Hydrogen Generation
- Integration Petrochemicals, Refining, and Value-Added Opportunities
- Pipeline Transportation
- Transportation

Manage Environmental Impacts
- Air Quality
- Alternative Energy
- Ecological
- Emission Reduction / Eco-Efficiency
- Energy Efficiency
- Resource Access
- Soil and Groundwater
- Water
- Wellsite Abandonment

PTAC Technical Areas
- e-Business
- Geosciences
- Health and Safety
- Instrumentation/Measurement
- Operations
- Production Engineering
- Reservoir Engineering
- Security
- Telecommunications
- Photonics
- Remote Sensing
- Geomatics
Partnerships

Partnerships have always been critical to PTAC’s success, and in 2013 PTAC forged several new relationships and strengthened existing inter-organizational ties. Through these partnerships, PTAC expanded its technology areas and created a springboard from which to launch several innovative new projects.

New Opportunities in ICT with TRTech

PTAC welcomed an opportunity to partner with TRTech, an Alberta-based not-for-profit company with a mandate to grow the information and communications technology (ICT) industry in western Canada. An MOU signed in July 2013 opened up opportunities for PTAC to facilitate ICT-related innovation and the commercialization of new ICT technologies.

Discovering Metagenomics with Genome Alberta

PTAC and Genome Alberta have partnered up to pursue exciting new technologies with the potential to increase recovery and mitigate environmental impact by applying gene sequencing to ecosystems, a scientific field known as “metagenomics.” An MOU between PTAC and Genome Alberta has established a framework for a collaborative and strategic working relationship between the two organizations. Possible applications of genomics technologies include reducing super heavy oil with complex molecular structures and reducing the occurrence of hydrogen sulfide.

Synergy of Services with Innovate Calgary

In 2013, PTAC struck an MOU with Innovate Calgary, the technology-transfer and business-incubation center for the University of Calgary. As both organizations share the common goal of bridging the gap between discovery and innovation, this agreement brings about a seamless synergy of services that provide SMEs comprehensive support during the development of new products for the hydrocarbon energy industry. PTAC helps SMEs secure test sites and funding to field test their new technologies, while Innovate Calgary provides business support for SMEs to market their technologies.

Exploring Possibilities with Water Cluster Scientific

The application of Terahertz technology has the potential to provide substantial advantages to the hydrocarbon energy industry, such as touchless inspection of high pressured sour vessels, pipelines, and gathering systems. In September 2013, PTAC signed an MOU with Water Cluster Scientific Inc., a company that proposes to establish a world-class terahertz application and testing development centre at the University of Alberta (Terahertz Alberta Inc.). This agreement establishes the framework for a collaborative and strategic working relationship to further develop and commercialize terahertz applications for the Canadian hydrocarbon energy industry.

Accelerating Research and Development with COSIA

PTAC signed an agreement with Canada’s Oil Sands Innovation Alliance (COSIA) to reduce duplication in the energy industry while ensuring that research and development gaps are filled. COSIA is an alliance of oil sands producers focused on accelerating the pace of improvement in environmental performance in Canada’s oil sands through collaborative action and innovation. While COSIA focuses on four specific environmental priority areas - tailings, water, land, and greenhouse gases, PTAC’s activities encompass conventional and unconventional hydrocarbon technology development but specifically except oil sands environmental, so there is minimal overlap with PTAC’s scope, focus areas, or functions. Structured collaboration between PTAC and COSIA has the potential to create synergy that will increase industry R&D capacity by leveraging the complementary strengths of these two organizations.

KEY ACCOMPLISHMENTS

2013 was another year of driving progress and meeting challenges through partnerships, projects, programs and events.
Programs

PTAC continued to facilitate the National Research Council of Canada (NRC) Industrial Research Assistance Program (IRAP) and the Alberta Upstream Petroleum Research Fund (AUPRF) in 2013. Once again, these programs yielded significant benefits for program participants, PTAC members, and the Canadian hydrocarbon energy industry.

AUPRF

Since 2001, the AUPRF program has provided funding for peer-reviewed environmental research on air, water, biodiversity, and surface impacts arising from both conventional and unconventional oil and gas activities (excluding oil sands). PTAC facilitated 30 projects under the AUPRF program in 2013. PTAC disseminates the results of AUPRF research projects via posts on the PTAC website, in industry publications such as the Journal of Canadian Petroleum Technology, and through targeted presentations at annual forums.

In 2013, the AUPRF program was tasked with developing a sustainable long-term funding mechanism. PTAC is working closely with CAPP, EPAC, and the Alberta government to make mandatory the well levy that funds the AUPRF program or failing this approach, to find a new sustainable funding model to ensure the continuation of AUPRF. The development of a sustainable long-term funding mechanism will allow the hydrocarbon energy industry to continue to reap the tremendous benefits of the program for years to come. The AUPRF program offers:

- Increased efficiency in developing regulatory models, such as the recently implemented Barite Guidelines (Broad) and Modified Salinity Guidelines (SST). By providing objective scientific evidence upon which to base regulatory models, AUPRF projects help to ensure regulations make sense while saving industry and government the time and expense of lengthy hearings that can delay implementation of new regulations.
- Cost-saving technologies and methods. The AUPRF research projects are informed by industry and are grounded in practical application. For example, four AUPRF projects conducted under the soil program with an R&D cost of $450K resulted in the implementation of practices that have resulted in significant savings. To understand the magnitude of the industry savings from this R&D work, two companies with combined production in Alberta that is less than 10% of the total industry were asked to provide the value of the saving in 2013. The savings from just these two companies was more than $4.2 million in 2013 alone.
- Continuous improvement of environmental and social performance. Companies have an opportunity to support research and development of new environmental technologies that can lead to step-changes in environmental performance and advance corporate citizenship.
- Ease of Operations: Projects may lead to improved operating practices including reduced complexity in practices, methodologies or techniques.

SMEs

History has proven that some of the most innovative technologies to impact the hydrocarbon energy industry originate not with the biggest players, but from small and medium enterprises (SMEs). However, significant barriers exist for small companies trying to bring new ideas to the market, especially when moving their technologies from prototype to commercialization. The biggest challenge currently facing SMEs is securing sites and funding for field testing their technologies, leaving many good ideas in what is commonly referred to as “the valley of death”. PTAC remains committed to helping SMEs overcome these hurdles and launch projects that add value to the oil and gas sector. During 2013, PTAC’s SME program tripled the number of SME projects launched compared to 2012.

PTAC facilitated the 2013 SME program with support from NRC-IRAP, identifying industry needs and sharing this information to help SMEs better align their products with the current market. At the same time, PTAC worked with operating companies and producers to raise awareness of emerging SME technologies and helped them mitigate financial risk by following PTAC’s proven collaborative model. SMEs are embracing these new opportunities. In 2013, PTAC facilitated 24 Technology Information Sessions showcasing SME technologies and subsequently introduced several SME technology solutions to PTAC industry committees. Three SME Technology projects were launched in 2013 and four more are ready for imminent launch in early 2014. Over 600 individuals representing SME companies participated in PTAC’s 2013 events.

PTAC created the Virtual Centre for Commercialization at PTAC in 2013. Through this Centre, SMEs can access up-to-date information about industry needs and connect with resources to assist with facilitating, coordinating, and managing the field tests critical to commercializing their technologies.

PTAC and Innovate Calgary joined together to launch the Energy Technology Centre initiative. This Centre blends the strengths of these two organizations to provide a one-stop shop for SMEs throughout the development and commercialization process. PTAC helps secure test sites and funding to field test new technologies, while Innovate Calgary provides business support for SMEs to market their technologies. As a result, SME’s can realize growth and market potential faster than ever before. Ongoing cooperation with partner organizations TECTERRA, LOOKNorth, and TRTech continue to broaden the outreach and assistance PTAC provides to SMEs.
Projects

Effective project management was at the heart of PTAC’s 2013 operations, leveraging collaborative expertise and funding to rapidly move technology from research to industry application.

Project Highlights

**Improve Oil and Gas Recovery**

PTAC made significant progress within the ‘Improve Oil and Gas Recovery’ portfolio in 2013, launching several new projects and advancing ongoing initiatives.

In early 2013, under the leadership of a government-sponsored Steering Committee, PTAC launched an important study of current practices, future trends, and environmental impacts of hydraulic fracturing in Alberta. Although the initial research work has been completed, the committee determined that the study will continue to be expanded moving into 2014. Work also progressed on the Ultra Light Weight Proppant project as participating companies analyzed the results of field trials with support from a major reservoir engineering firm, additional trials are expected in 2014 as the technology is optimized to ensure maximum value. Likewise, PTAC made major gains in developing the Altering Wettability project; during 2013, the technology was successfully tested in a number of different wells. A consortium project to share the resulting technology learnings is planned for 2014. Finally, PTAC launched the Phoenix Network to focus on non-environmental oil sands activities and projects. This network, composed of major oil sands operating companies, will leverage collective expertise to identify Joint Industry Projects (JIPs) for technology research, development, demonstration and deployment. The JIPs will be funded and governed as entities separate from the Network.

**Improve Value-Added Products**

PTAC’s Pipeline Abandonment Research Steering Committee (PARSC) was formed following an MOU signed with the Canadian Energy Pipeline Association (CEPA). As a result of this agreement, a multi-year research program for sustainable development of the Canadian pipeline industry was established. The priority of this program was to address pipeline abandonment, and to this end two projects were launched in 2013. The first project, “Understanding the Mechanisms of Corrosion and their Effects on Abandoned Pipelines”, seeks to validate corrosion models for abandoned pipelines, carry out a structural integrity study, and research the collapse of soil under different void sizes, soil types, and depths of pipeline cover. The majority of the research was completed during the course of 2013, and the final report is expected to be completed in early 2014. The second project launched in 2013 under the PARSC is the “Frost Heave Effects on Pipeline Exposure Rates” project. The objective of this project is to understand the mechanism of heaving of abandoned pipelines. The focus will be on agricultural land and roadway/railway crossings and will exclude permafrost.

Working in collaboration with the Pipeline Engineering Centre at the University of Calgary, PTAC continued to invest significant time in the ongoing development of the Innovation Roadmap for Transmission Pipeline Transportation of Petroleum Products. This roadmap identifies research needs and technology investment opportunities in pipeline innovation to support continuous improvement in reliability, integrity, and environmental impact. Providing an overall and aggregated perspective with emphasis on Alberta and Canada, the roadmap will be used as a blueprint for leveraging expertise, infrastructure capabilities, and financial resources to jointly deliver technology solutions that would benefit the sector as a whole.

As part of the Clean Bitumen Technology Action Plan (CBTAP) network, PTAC maintained a steady pace developing projects that explore the transformation of oil sands raw bitumen and asphaltenes into value-added products. The committee continued to consider and evaluate several potential technologies, and a new project has been prepared for launch in 2014.

**Reduce Capital, Operating, and G&A costs**

Moving forward at an accelerated pace, the Airborne Microseep Mapping project was launched and implemented in 2013. The project conducted airborne surveys of oil sands projects and analyzed the data collected. The project employs a novel geospatial visualization technology for their data analysis, significantly lowering costs compared to existing seismic survey methods, and eliminating environmental disturbance. Upon review, the Airborne Microseep Mapping Project Steering Committee determined that additional surveys should be conducted in 2014 to validate these initial results.

**Manage Environmental Impacts**

PTAC’s Technology for Emissions Reduction and Eco-Efficiency (TEREE) committee launched two projects in 2013 to improve energy efficiency and reduce emissions from operations: The Distributed Energy Efficiency Projects Platform (DEEPP Phase One), and Petroleum Emission Management Accelerator (PEMA).

The rather complex goal of PTAC’s DEEPP project is to create a streamlined technology solution to overcome the challenges associated with the development, aggregation, tracking and financing of distributed oil and gas energy efficiency projects, thereby promoting additional energy efficiency investment and reducing GHG emissions while providing transparent reporting to government. Under the direction of the project steering committee, Phase One was both launched and completed in 2013. A large, sophisticated database was created to aggregate energy efficiency project data, analyze the data, and produce a standard report – all in compliance with existing protocols and regulations. This automation cut management and reporting costs in half. As a result, many more energy efficiency projects now meet economic thresholds and have become eligible for implementation. The DEEPP project has led to improvements in fuel gas utilization and substantial reductions in GHG emissions. Phase Two of this project is currently in development.

Launched and completed in 2013, the Inventory of Greenhouse Gas Emission Equipment and Near Term Emissions Reduction Potential project is the first step in a large-scale multi-phase PEMA study developed by a broad stakeholder group in 2013. PEMA Phase One focused on creating an inventory of equipment that emits GHGs but could be replaced by currently available commercial-ready GHG-efficient alternative. An Alberta inventory of the following equipment was prepared: pneumatic instrument conversions, engine fuel management, vent gas capture, pneumatic pump conversions, and green completions. In addition to informing government and industry, the study allowed the PEMA project to estimate the GHG reduction potential that would likely be achieved from implementation of these alternative technologies.

PTAC also reached substantial goals in the continuation of the Zero Emissions Well Site project, originally launched in 2012. The project explores the use of solar energy in combination with high efficiency motors to operate small air compressors. The compressed air is then used to operate pneumatic instrumentation and a chemical injection pump. Field installation of this technology was completed and commissioned in 2013. After a short learning curve, the technology operated reliably.
Almost immediately after completing Phase One of the Alberta CO₂ Purity Project, Phase Two was launched in early 2013. Phase Two of the project seeks to fill a crucial knowledge gap by determining how the presence of impurities from anthropogenic sources affects an integrated CCS system. The project brings together a new complement of industry experts and stakeholders to investigate and determine the most cost-effective balancing point with respect to purity and contaminants for CO₂ capture, transport via pipeline, and end use markets. Phase Two will be completed in 2014.

Completed Projects

Seeing a project through to completion is just as critical to PTAC’s project management strategy as launching new endeavors, and a record number of PTAC projects concluded in 2013.

Benefitting from a combination of passionate support from steering committee volunteers, favourable economic conditions, and test-site availability, some of PTAC’s 2013 roster of projects were completed in record time. PTAC’s DEEPP project, PEMA 1 project, and Phase One of the Airborne Microseep Mapping Project, all share the distinction of having been both launched and completed within 2013.

PTAC continued work on the Hot Water Vapour Process project in the first half of 2013, concluding the project at year end. The purpose of the HWVP project was to develop a new technology to reduce greenhouse gas (GHG) intensity while improving recovery from conventional and non-conventional resources. HWVP stands to lower GHG emissions, and minimize both water usage and land impact compared to alternative EOR approaches for heavy oil resources in Alberta and Saskatchewan. The successful commercialization of a new heavy oil EOR technology could potentially open the door for adapting the same technology to cold-produced oil sands. Husky Oil is pursuing Phase Two of this project independently.

PTAC completed Phase One of the Artificial Reservoir project in early 2013 to determine the value and cost of a physical model facility for heavy oil and bitumen recovery technologies with substantially better scale up performance than existing models. The steering committee is currently looking at developing a second phase of the project that would include a workshop component and student competitions.

PTAC, in collaboration with Environment Canada, NRCan, Ecopetrol and Pemex, launched the groundbreaking NAMA project in late 2011 to mitigate the impact of emissions from short-lived climate pollutants. Under the direction of the NAMA steering committee, this project was completed in the first quarter of 2013. Field measurement campaigns were completed in Colombia and Mexico early in 2013. Building upon the information collected in the field, in-depth discussions were held at the second series of PTAC-hosted workshops. Overall, the project participants sought to develop nationally appropriate mitigation actions (NAMA) for reducing greenhouse gas (GHG) emissions under the Cancun Agreement Fast-Start financing mechanism.

Events

PTAC is committed to communicating project results in a timely manner, and PTAC’s collaborative approach often includes workshops and information sessions. PTAC’s 2013 events provided several opportunities throughout the year for stakeholders to learn about new and ongoing research, contribute ideas, and network with peers from government, industry, SMEs, and academia.

During the course of 2013 PTAC facilitated:

- Thirty Technology Information Sessions (TIS) attended by 861 participants
- Nine forums that attracted over 561 participants
- Seven workshops that engaged 239 stakeholders in meaningful discussion.
- PTAC-facilitated SPE Heavy Oil Conference welcomed 1120 participants

A highlight of PTAC’s 2013 events was the second series of Canadian NAMA workshops. Delegates from both Colombia and Mexico participated in this five day workshop focusing on three key areas of improvement with demonstrable GHG reductions: CO₂ for enhanced oil recovery, carbon capture and storage, and waste heat recovery. The classroom component of the workshop, simultaneously translated into English and Spanish, allowed delegates to explore and discuss a wide range of issues, technologies, services, regulations, and challenges. The delegates then toured two Keyera field sites in the Strachan and Rimbey areas. These site visits provided a first-hand look at Canadian oil and gas facilities waste heat recovery practices, GHG policy, fugitive emissions management, as well as acid gas injection. Relevant Canadian technology and service providers then presented potential ‘made in Canada’ solutions for possible implementation in Mexico and Colombia.
Projects

Project management will remain at the forefront of PTAC’s 2014 activities with significant progress expected across PTAC’s entire roster of Technology Portfolios:

Manage Environmental Impacts

PTAC’s TEREE Steering Committee will host a technology showcase in 2014 to review and evaluate new technology development opportunities. Projects that accumulate significant industry support will be considered for launch in 2014. Technologies under active consideration include methane venting reduction technologies and field testing of high efficiency burner technologies. It is expected that further phases of the DEEPP and PEMA projects that were at the proposal stage at the close of 2013 will proceed in 2014.

PTAC’s DEEPP project was stage-gated to control costs and risk. Building upon the results of the initial phase completed in 2013, Phase Two-A will extend the database to include a quantification module for methane venting reduction projects and a quantification module for pneumatic instruments. Phase Two-B will focus on analysis, running sophisticated analytics against the extended database to validate source data quality. Trends in operational excellence will be identified, such as effective asset tracking and document management. Reports, dashboarding, and alerts will follow.

Through the widespread deployment of new commercial-ready technologies (defined as having only a small number of units in commercial operations), Phase 2 of PTAC’s PEMA project will accelerate the pace and magnitude of real near-term GHG emissions reductions from energy efficiency and methane control projects in the Alberta oil and gas industry. A third stage of the project that aims to significantly increase the development and commercialization of technologies to reduce GHG emissions in the oil and gas industry has also been proposed. With all stages enacted, the 5 year PEMA project would result in direct reduction of 20 million tCO₂e over 10 years.

PTAC will continue to facilitate projects related to CO₂ Capture and Storage in 2014. The Alberta CO₂ Purity project will continue through March 31, as the steering committee focuses on quantifying findings so the implications of impurities can be directly related to costs. At the same time, PTAC is working closely with the University of Calgary to facilitate the funding and implementation of world-class research into new CO₂ capture technologies. In the first five years, this program would design a pilot plant from the most promising technology; in the second five years the plant would be constructed and demonstrations conducted under the guidance of industry partners.

Improve Oil and Gas Recovery

Canada’s oil sands continue to be fertile ground for new technology development. New well configurations, reservoir recovery methods, and issues related to the wind-down of SAGD projects will receive considerable attention. PTAC industry committees have identified a number of potential solutions that are being considered for collaborative technology development projects in 2014. Among these are an examination of vacuum insulated tubing, a study of caprock integrity workflow in collaboration with Canadian Discovery, and a study to develop low-cost InSAR for oil sands monitoring.

In the highly competitive tight oil and gas segment, PTAC will continue to facilitate joint projects that operators deem appropriate. Such projects may include Phase 2 of the successful study of Current Practices, Future Trends and Environmental Impacts of Hydraulic Fracturing in Alberta. PTAC will collaborate with several government departments and with industry to map the challenges and opportunities presented by unconventional oil and gas technologies in the regions holding prospective resources.

Reduce Capital, Operating and G&A Costs

New technology trends such as cloud computing, geomatics, photonics, and metagenomics have begun to impact the petroleum industry. We are already starting to see the potential for improved operational effectiveness, cost reductions, and the development of value-added products and services. Working in collaboration with partners such as LOOKNorth,
In 2013, PTAC facilitated the launch of 40 new research projects and project phases to address industry challenges.

**Improve Oil and Gas Recovery**
- Bitumen Production Fundamentals Research Group
- Current Practices, Future Trends, and Environmental Impacts of Hydraulic Fracturing in Alberta

**Improve Value-Added Products**
- Frost Heave Effects on Pipeline Exposure Rates
- Understanding the Mechanisms of Corrosion and their Effects on Abandoned Pipelines
- Froth Treatment Consortium

**Reduce Capital, Operating and G&A Costs**
- Airborne Microseep Mapping

**Manage Environmental Impacts**
- Alberta CO2 Purity Project – Phase Two
- Distributed Energy Efficiency Projects Platform Phase One
- Alberta’s Upstream Oil and Gas Assets Inventory Study

**Small and Medium Enterprises**
- SME Innovation and Technology Commercialization in the Hydrocarbon Industry

Among the 2013 projects, PTAC facilitated the following 30 AUPRF projects:

**AUPRF**
- Development of N2O Emission Factors for UOG Fired Equipment
- Efficiency and Emissions of Flares Burning Non-Hydrocarbon Aerosols in the Flare Stream
- Investigation of the Characteristics of Ultrafine Particles for Improved PM Emission Factor Reporting for Flares
- Development of a Model to Predict Benzene Emissions from Glycol Dehydrators with Condensation Tanks
- Gap Analysis for the Stationary Combustion Filterable and Condensable Particulate Matter Emissions Factors

**ECOLOGICAL**
- Assessing Spatial Factors Affecting Predation Risk to Boreal Caribou Calves: Implications for Management
- Evaluating the Ecological Risk of Oil and Gas Development on Ferruginous Hawks
- Grizzly Bears and Pipelines: Response to Unique Linear Features (Year 2)
- A Tool to Assess Cumulative Effects of Development on Biodiversity
- Long-term Revegetation Success of Industry Reclamation Techniques in the Northern Fescue Natural Subregion
- Removing the Wellsite Footprint, Phase Two: Wetland Reclamation
• White-tailed Deer Distribution and Density in Alberta’s Boreal Forest
• Peatland Restoration of Abandoned Oil and Gas Well Sites
• Evaluating the Revegetation Success of Foothills Fescue Grassland
• The Role of Predation by Wolves and Bears in Caribou Declines in West-Central Alberta
• We Have a Reclamation Certificate, but is it Good Enough? Long-term Reclamation Monitoring of Oil and Gas Footprints

SOIL and GROUNDWATER
• Proposed Third Party Review for PTAC SAR Subsoil Guidelines Project
• Vapour Emissions from Ex-Situ Remediation
• Updates and Upgrades to Alberta Environment Subsoil Salinity Tool (SST) Software and Manual
• Development of a Reduced Analytical Suite of Upstream Oilfield Metals for Groundwater Monitoring
• Development of Risk-Based Soil Quality Guidelines for Selected Trace Metals
• A rapid bioassay for predicting toxicity of PHC-contaminated soil (Phase 3) of 3
• Development of a Tier 2 SSRO Derivation Process Beyond the Pass/Fail Approach (Phase 2)
• Development of EcoContact Soil Selenium Guideline
• Using Laboratory Saturation Percentages to Estimate Soil Texture
• FWAL Chlorides

WATER
• Integrated Assessment of Water Resources for Unconventional Oil and Gas Plays, West-Central Alberta
• Understanding the Impact of Permafrost on the Prediction of Water Availability in the Horn River Basin
• Environmental Net Effects Assessment of Saline Water (Phase 3)
• Water Collaboration Assessment for Unconventional Gas Development
Technical Steering Committees

In 2013, PTAC facilitated 22 Technical Steering Committees, and 5 sub-committees.

Enhanced Environmental Management
- Air Research Planning Committee (ARPC)
- Soil and Groundwater Research Committee (SGRC)
  - Boron Working Group (BWG)
  - Background Metals and Salinity Database Group (BMSD)
- Ecological Research Planning Committee (ERPC)
- Water Innovation Planning Committee (WIPC)
- Technology for Emission Reduction and Eco-Efficiency Steering Committee (TEREE)
  - Energy Efficiency Forum Abstracts Selection Committee (EEFAS)
- Distributed Energy Efficiency Projects Platform Steering Committee (DEEPP)
- Petroleum Emissions Management Accelerator Committee (PEMA)
- Alberta \(\text{CO}_2\) Purity Project Steering Committee (ACP)
  - Alberta \(\text{CO}_2\) Purity Project Leaders Committee (ACPL)
- \(\text{CO}_2\) Forum Abstracts Selection Committee (CFAS)

Improved Oil and Gas Recovery
- Artificial Reservoir Project Steering Committee (ARPC)
- Altering Wettability Committee (AWC)
- Bitumen Production Fundamentals Research Group (BPFRG)
- Current Practices of Hydraulic Fracturing Steering Committee (CPHF)
- Froth Treatment Consortium (FTC)
- Hot Water Vapour Process Project Steering Committee (HWVP)
- Shallow Gas Well De-watering Pump Consortium Steering Committee (SGWPC)
- Ultra Lightweight Proppant Project Steering Committee (ULWP)
- Clean Bitumen Technology Action Plan Steering Committee (CBTAP)
  - CBTAP In Situ Recovery Committee (CBTAP ISR)

Reduce Capital, Operating, and G&A Costs
- Airborne Microseep Mapping Steering Committee (AMMSC)
- Innovative Applications of Electricity for Oil Sands Development Steering Committee (IAEOS)

Improve Value-Added Products
- CBTAP Upgrading and Value-Added Committee (CBTAP UVAC)
- Creating More Value from Asphaltenes Steering Committee (CVA)
- Pipeline Abandonment Research Steering Committee (PARSC)
- Nationally Appropriate Mitigation Actions (NAMA)
- Pipeline Innovation Roadmap Steering Committee (PIRSC)

Small and Medium Enterprises
- SME Innovation and Technology Commercialization in the Hydrocarbon Industry (SITC)
FACILITATING - Projects
PTAC provides industry with a neutral forum to work in collaboration, leveraging collective experience and expertise to identify opportunities, challenges, and potential solutions that require research 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.

CONNECTING - Technology Information Sessions
As a service to members, PTAC facilitates Technology Information Sessions (TIS) for interested companies, providing benefits to both the presenting company and all those in attendance. The company presenting is provided a forum to solicit interest, gather feedback, invite participation or seek potential funding for new research and development projects. TISs may also serve to help a member company 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 service and supply members, a PTAC TIS can also be an excellent method of marketing new technology to the Canadian oil and gas industry. Attending a PTAC TIS provides industry stakeholders with the opportunity to learn about new projects and ideas through a targeted, facilitated presentation.

ENGAGING - Forums and Workshops
Focusing on broader needs or larger technical areas, PTAC forums are comprised of presentations detailing new technologies, case studies, and objectives and results of current research. Presentations always provide opportunities for questions and answers. 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 Manager 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 display in the 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 associations. These technical steering committees help 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.

COMMUNICATING - Member Communications
PTAC is committed to ensuring effective communication with members. The PTAC website, with a fresh new look and simplified interface, provides members with access to the most up-to-date information on PTAC projects, events, and activities as well as an extensive archive. For more information on the many benefits of PTAC membership please visit www.ptac.org.
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**  
Nexen Inc.

**Chairman's Award**  
Ken Putt, Independent

**President's Award**  
Mike Layer, Natural Resources Canada

**Air Issues Research Leadership Award**  
Gerald Palanca, ERCB

**Ecological Research Leadership Award**  
Bruce Greenfield, ERCB

**Soil and Groundwater Research Leadership Award**  
Ole Mrkas, ConocoPhillips Canada

**Water Innovation Leadership Award**  
James Armstrong, Encana

**Eco-Efficiency Leadership Award**  
Paul Slobodnik, ConocoPhillips Canada

**Greenhouse Gas Reduction Leadership Award**  
Sean Hiebert, ConocoPhillips Canada  
Kurt Uhrich, BP Canada

**Resource Emissions Management Leadership Award**  
James Callendar, Encana  
John Harvey, Encana

**Commercializing Technology Award**  
Robert Faulder, NRC-IRAP  
Karl Miller, NRC-IRAP  
Chris Holly, Alberta Department of Energy

**Completion Innovation Leadership Award**  
Donna Garbutt, Schlumberger Canada  
Dave Braun, Shell  
Jeanne Phene, Penn West Exploration

**Distinguished Service Award**  
David Layzell, ISEEE University of Calgary

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**VOLUNTEER Recognition Awards**

<table>
<thead>
<tr>
<th>Category</th>
<th>Nominee</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corporate Leadership Award</td>
<td>Nexen Inc.</td>
</tr>
<tr>
<td>Chairman’s Award</td>
<td>Ken Putt, Independent</td>
</tr>
<tr>
<td>President’s Award</td>
<td>Mike Layer, Natural Resources Canada</td>
</tr>
<tr>
<td>Air Issues Research Leadership</td>
<td>Gerald Palanca, ERCB</td>
</tr>
<tr>
<td>Ecological Research Leadership</td>
<td>Bruce Greenfield, ERCB</td>
</tr>
<tr>
<td>Soil and Groundwater Research</td>
<td>Ole Mrkas, ConocoPhillips Canada</td>
</tr>
<tr>
<td>Water Innovation Leadership</td>
<td>James Armstrong, Encana</td>
</tr>
<tr>
<td>Eco-Efficiency Leadership</td>
<td>Paul Slobodnik, ConocoPhillips Canada</td>
</tr>
</tbody>
</table>
| Greenhouse Gas Reduction        | Sean Hiebert, ConocoPhillips Canada  
                                  | Kurt Uhrich, BP Canada                                                 |
| Resource Emissions Management   | James Callendar, Encana  
                                  | John Harvey, Encana                                                   |
| Commercializing Technology      | Robert Faulder, NRC-IRAP  
                                  | Karl Miller, NRC-IRAP  
                                  | Chris Holly, Alberta Department of Energy                             |
| Completion Innovation           | Donna Garbutt, Schlumberger Canada  
                                  | Dave Braun, Shell  
                                  | Jeanne Phene, Penn West Exploration                                  |
| Distinguished Service Award     | David Layzell, ISEEE University of Calgary                              |

---

**BOARD OF DIRECTORS**  
(As at December 31, 2013)

<table>
<thead>
<tr>
<th>Name</th>
<th>Position and Company</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dave Rushford</td>
<td>Chair, Senior Vice-President and Chief Operating Officer, Quicksilver Resources Canada Inc.</td>
</tr>
<tr>
<td>Donna Garbutt</td>
<td>Vice-Chair, President, Schlumberger Canada Ltd.</td>
</tr>
<tr>
<td>Soheil Asgarpour</td>
<td>President, PTAC Petroleum Technology Alliance Canada</td>
</tr>
<tr>
<td>Doug Boyler</td>
<td>Chief Operations Engineer, Alberta Energy Regulator</td>
</tr>
<tr>
<td>Gary Bunio</td>
<td>General Manager of Technology Development, Suncor Energy Inc.</td>
</tr>
<tr>
<td>Randy Cormier</td>
<td>General Manager, Research and Development, Nexen, Inc.</td>
</tr>
<tr>
<td>Mike W. Ekelund</td>
<td>Assistant Deputy Minister, Strategic Initiatives Division, Alberta Department of Energy</td>
</tr>
<tr>
<td>Eddy Isaacs</td>
<td>Chief Executive Officer, Alberta Innovates – Energy and Environment Solutions</td>
</tr>
<tr>
<td>Paul Jeakins</td>
<td>Commissioner and CEO, British Columbia Oil and Gas Commission</td>
</tr>
<tr>
<td>Mark Johnstone</td>
<td>Independent Director</td>
</tr>
<tr>
<td>Jonathan Matthews</td>
<td>VP of Heavy Oil Technology Centre, Statoil Canada Ltd.</td>
</tr>
<tr>
<td>Dan McFadyen</td>
<td>Independent Director</td>
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<tr>
<td>Ken Putt</td>
<td>Independent Director</td>
</tr>
<tr>
<td>Joy Romero</td>
<td>VP Technology Development – Horizon Canadian Natural Resources Ltd.</td>
</tr>
<tr>
<td>Randy Rudolph</td>
<td>Principal, Millennium EMS Solutions Ltd.</td>
</tr>
<tr>
<td>Mike Scribner</td>
<td>Manager, Technology &amp; Optimization, ConocoPhillips Canada</td>
</tr>
<tr>
<td>Earle Shirley, Past Chair</td>
<td>Independent Director</td>
</tr>
<tr>
<td>Kevin Stashin</td>
<td>President and CEO, NAL Resources Management Limited</td>
</tr>
<tr>
<td>Chuck J. Szmurlo</td>
<td>Vice President of Emerging Technologies, Enbridge Inc.</td>
</tr>
<tr>
<td>Murray Todd</td>
<td>President and CEO, Todd Resources</td>
</tr>
</tbody>
</table>
COMMITTEE VOLUNTEERS

- Salim Abboud, Alberta Innovates – Technology Futures (BMSD)
- James Agate, Canadian Natural Resources Limited (SGRC)
- Tamer Al-Ramahi, NRC IRAP (SITC)
- Mark Anderson, Husky Energy Inc. (ARPC)
- James Armstrong, Encana (WIPC)
- Victoria Bachmann, Alberta Department of Energy (TEREE)
- Stefan Bachu, Alberta Innovates – Technology Futures (ACPP)
- Jamie Bagan, Stantec Consulting Inc. (ACPP)
- Stephanie Bailey, Husky Energy Inc. (ARPC)
- James Beck, Suncor Energy (ARPC)
- Matt Beck, Husky Energy (DEEPP, PEMA)
- Astaw Bekele, Imperial Oil Resources (SGRC, BWG)
- Rodger Bernar, Husky Energy (CBTAP, UVAC)
- Tara Bernat, Encana (ERPC)
- Luis Betancourt, PEMex (NAMA)
- Jeff Bezanson, ARC Resources (AWC)
- Elise Beche, CAPP (ARPC)
- Robert Birkholtz, Shell Canada (FTC)
- Fauve Blanchard, Devon Canada Corporation (ERPC)
- Javier Bocanegra, PEMex (NAMA)
- Mark Bohm, Suncor Energy Inc. (TEREE)
- Daniel Booy, C-FER Technologies (SGWPC)
- Isabelle Bouffard, Union of Agricultural Producers of Quebec (PARSC)
- Ken Bradley, Sley Hunter (AMMSC)
- David Braun, Shell Canada Resources Ltd. (ULWP, AWC)
- Don Brick, Spartan Controls (TEREE, DEEPP, PEMA)
- Stephen Bromley, Husky Energy Inc. (SGRC, BWG)
- Ken Brown, Petroleum Technology Research Centre (ARPC, CBTAP ISR, CBTAP)
- Richard Brown, Fort Hills Energy L.P. by Suncor Energy Operating Inc. (BPFRG, FTC)
- Frank Brunner, IHS (ULWP)
- Michael Buckley, Worley Parsons (ACPP)
- Cesar Buitrago, Ecopetrol (NAMA)
- Dan Butt, Suncor Energy (PEMA)
- Victoriano Calderon, PEMex (NAMA)
- James Callbeck, Husky Energy Inc. (HWVP)
- James Callendar, Encana Corporation (TEREE, PEMA, EEFS)
- Kelly Campbell, Devon Canada Corporation (TEREE, DEEPP, PEMA)
- Scott Cantwell, Maxxam Analytics (BWG, BMSD)
- Pierre-Yves Caux, Environment Canada (TEREE)
- Ayan Chakraborty, Imperial Oil Resources Ltd. (SGRC)
- Jose Luis Chavarria, Shell Canada (ULWP)
- Mikhail Cazacu, Husky Energy Inc. (ULWP)
- Chi Chen, Alberta Environment Sustainable Resource Development (BMSD)
- Frank Cheng, University of Calgary (PIRSC)
- David Chittick, TransCanada Pipelines (PARSC)
- Bill Clay, Enerplus Corp. (SGWPC)
- Jason Close, CMG Ltd. (ACPP)
- Todd Cole, MEG Energy Corp. (TEREE)
- Bob Corbet, Access Analytical Laboratory Inc. (BWG, BMSD)
- Randy Cormier, Nexen Inc. (IAEOS, CBTAP ISR, CBTAP)
- Gokhan Coskuner, Husky Energy Inc. (CFAS, HWVP)
- Cal Coulter, Suncor Energy (AMMSC)
- Kathy Cox, Enerplus Corporation (SGRC)
- Robert Craig, Integrated CO2 Network (ACPP, ACPL)
- Cathy Crawford, Devon Canada (DEEPP, PEMA)
- David Cuthrell, Laricina Energy Ltd. (ARPC)
- Ted Cyr, Alberta Department of Energy (TEREE)
- Gauthier Demouelaere, Northern Lights Partnership, by managing partner Total E&P Canada and Total E&P Canada (BPFRG, FTC)
- Gur Dhalwal, Alberta Department of Energy (TEREE)
- Alex Dickson, CETAC West (TEREE)
- Gordon Dinwoodie, Alberta Environment Sustainable Resource Development (SGRC, BWG)
- Randy Dobko, Alberta Environment and Sustainable Resource Development (ARPC)
- Cam Dowler, Spartan Controls (TEREE, DEEPP, PEMA)
- Keith Driver, The Prasino Group (DEEPP, PEMA)
- Bonnie Drozdowski, Alberta Innovates – Technology Futures (BMSD)
- Bruce Duong, Alberta Innovates – Technology Futures (IAEOS)
- Russ Duncan, Sley Hunter (AMMSC)
- Joe Dusseault, Cenovus Energy Inc. (TEREE)
- Kelly Edwards, Harvest Operations (ACPP, ACPL)
- Goel Edworthy, Nexen Inc. (IAEOS)
• Curtis Eickhoff, Maxxam Analytics (BWG, BMSD)
• Vince Elenko, Encana (PEMA)
• Russell Engelman, Suncor Energy (ARPC)
• Carol Engstrom, Husky Energy Inc. (ERPC)
• R.D. Evans, Upside Engineering (ACPP)
• Henry Ewa, AER (ARPC)
• Craig Fairbridge, Natural Resources Canada (TEREE)
• Mark Fawcett, Sky Hunter (AMMSC)
• Allison Fisher, Shell Canada (ARPC)
• Natalia Fomina, NRC IRAP (SITC)
• Glyn Fox, BC Oil and Gas Commission (BWG)
• Geoff Frazer, Devon Canada Corporation (TEREE)
• Larry Frederick, Husky Energy Inc. (AMMSC, CBTAP ISR)
• Ian Freeland, Devon Canada Corporation (HWVP)
• Gavin Freeman, Shell Canada Resources (BBFRC)
• Rob Fulton, Canyon Technical Services (ULWP)
• Chris Gatfield, 3M Canada – Oil and Gas Division (ULWP, AWC)
• Genaro Gelves, 3M Canada – Oil and Gas Division (ULWP, AWC)
• Bob Gervang, Athabasca Oil Corporation (TEREE)
• Greg Gill, Kinder Morgan (PARSC)
• Marc Godin, Portfire Associates (TEREE)
• Shirley Graham, AGAT Laboratories Ltd. (BWG, BMSD)
• Pierangelo Grande, Alberta Energy (CPHF)
• Christ Grant, Suncor Energy (FTC)
• Bruce Greenfield, Alberta Energy Regulator (ERPC)
• Scott Grindal, ConocoPhillips Canada (ERPC)
• Rodney Guest, Suncor Energy (WIPC)
• Karin Guiguer, Franz Environmental Inc. (BWG, BMSD)
• Subodh Gupta, Cenovus Energy Inc. (ARPC, IAEOS, CBTAP ISR, CBTAP)
• Dennis Hahn, Talisman Energy (AWC)
• Susan Halla, Alberta Energy Regulators (SGRC, BWG)
• Hassan Hamza, CANMET (FTC)
• Maggie Hanna, Suncor Energy Inc. (TEREE)
• Khalid Hansraj, Innovate Calgary (TEREE)
• Brian Harshchinitz, JACOS - Japan Canada Oil Sands Limited (CBTAP)
• Michael Harrass, Borax (BMSD)
• John Harvey, Encana Corporation (TEREE)
• Chris O’Brien, Shell Canada (AWC)
• Devin Ollenberger, Suncor Energy (AMMSC)
• Garnet Olson, Canyon Technical Services Ltd. (ULWP)
• Filiz Onder, Encana (ARPC)
• Koray Onder, ConocoPhillips Canada (ARPC)
• Jim Onisko, Upside Engineering (ACPP)
• Gerald Palanca, AER (ARPC, TEREE)
• Thomas Palmer, Imperial Oil Ltd. (FTC)
• Shane Patterson, Alberta Environment Sustainable Resource Development (ERPC)
• Pat Payne, Alberta Energy Regulator (BWG)
• Bruce Peachey, New Paradigm Engineering (CPHF)
• Bill Peclch, Alberta Environment Sustainable Resource Development (BWG)
• Teresa Pena-Bastidas, 3M Canada – Oil and Gas Division (ULWP, AWG)
• Alan Pentney, National Energy Board (PARS)
• Jeanne Phené, Penn West Exploration (ULWP)
• David Picard, Clearstone Engineering (NAMA)
• Kelly Piers, C-FER Technologies (SGWPC)
• Jorge Plaucu (NAMA)
• Silviu Potlog, Husky Energy Inc. (ULWP)
• Murray Pow, Husky Energy (AWC)
• Rob Power, Alliance Pipeline (PARS)
• John Prediger, Husky Energy (AWC)
• Ron Quick, NRC-IRAP (TEREE, STG)
• Karsten Radtke, UHDE (ACPP)
• Aileen Raphael, Taqa North (DEEPP)
• Al Rasmussen, Nexen Inc. (TEREE)
• James Rau, ConocoPhillips Canada (AWC)
• Sharla Rauschning, Alberta Energy (CPHF)
• John Remmer, Encana Corporation (TEREE)
• Andy Ridge, Alberta Environment (CPHF)
• Gerardo Rivera, Talisman Energy (AWC)
• Blair Rogers, Talisman Energy (AWC)
• Dan Rozzoli, Alberta Innovation and Advanced Education (CPHF)
• Thomas Robinson, TransCanada Pipelines (ACPP, ACPL)
• Joy Romero, Canadian Natural Resources Ltd. (BPFRG, FTC)
• Brian Ross, Nexen Inc. (ARPC, TEREE)
• Glenn Rovang, Syncrude Canada (BPFRG, CBTP)
• Jesse Row, Alberta Energy Efficiency Alliance (PEMA)
• Ziad Saad, Canadian Energy Pipeline Association CEPA (PARSC, ACPP, PIRSC)
• Ronnie Sadorna, Nexen Inc. (CVA, CBTP UVAC)
• Pooja Saini, Suncor Energy Inc. (TEREE, CVA, CBTP UVAC)
• Roger Saint Fort, Mount Royal University (BWG)
• Court Sandau, Chemistry Matters (BMSD)
• Gary Sargent, CAPP (ERPC)
• Dave Sash, Encana Corporation (SGWPC)
• Patrick Sauve, Cenovus Energy (AMMSC)
• William Sawchuck, ARC Resources Ltd. (ACPP)
• Adam Schink, ConocoPhillips Canada (DEEPP, PEMA)
• Scott Schmidt, ConocoPhillips Canada (AWC)
• Dennis Schmitt, Encana Corporation (TEREE)
• Jerry Scourai, Husky Energy Inc (TEREE, DEEPP, PEMA, EEFAS)
• Gordon Severin, IHS (ULWP)
• Jerry Shaw, Devon Canada Corporation (TEREE)
• William Shotyk, University of Alberta (BMSD)
• Harry Siewert, Teck Resources (FTC)
• Hannah Simmons, Cap-OP Energy (PEMA)
• Surindar Singh, Alberta Innovates – Energy and Environment Solutions (TEREE, CPHF, IAEOS)
• Mark Sombach, Cenovus Energy (AMMSC)
• Song Sit, Cenovus Energy Inc. (CFAS, CBTP UVAC, CVA, IAEO, CBTP ISR, CBTP)
• Paul Slobodnik, ConocoPhillips Canada (TEREE, PEMA, EEFAS, DEEPP)
• Al Smandych, Alberta Energy Regulators (TEREE)
• Scott Smith, Cenovus Energy Inc. (TEREE, AMMSC, CBTP ISR)
• Sandeep Solanki, Larcina Energy Ltd. (ARPC)
• Kevin Sonnenberg, EPCOR (WIPC)
• Jim Spangello, Alberta Energy Regulators (TEREE)
• Lindsay Stephens, Encana (ARPC)
• Michael St. James, Praxair Canada Inc. (ACPP)
• Dale Struknes, IHS (ULWP)
• Jack Suquet, Athabasca Oil Sands Corp. (CBTP ISR, CBTP)
• Rudy Tamayo, Chevron Canada Limited (WIPC)
• Kristian Tange, Penn West (ACPP)
• Alberta Telfer, Innovation and Advanced Education (CPHF)
• Zoe Thomas, CAPP (WIPC)
• Jerry Tyler, Enmax (IAEOS)
• Kurt Uhrich, BP Canada Energy Company (IAEOS)
• Greg Unrau, Talisman Energy Inc. (ARPC)
• Edith Vanderpuye, Alberta Environment (CPHF)
• Chris Vander Pyl, Canadian Natural Resources Canada (PEMA)
• Brian Van Vliet, Spartan Controls (TEREE, DEEPP, PEMA)
• Shane Viste, ARC Resources (AWC)
• Sanjay Vitthal, Shell Canada Resources Ltd. (ULWP, AWG)
• Scott Wagner, Nexen Inc. (ERPC)
• Steve Wallace, Alberta Environment (CPHF)
• Stella Wang, Suncor Energy (AMMSC)
• Dors Weiss, Devon Canada Corporation (TEREE, PEMA, EEFAS, DEEPP)
• Jill Weiss, Alberta Energy Regulator (BMSD)
• Aaron White, Murphy Oil (ULWP, AWG)
• Neil Wildgust, Petroleum Technology Research Centre (HWVP)
• Bob Willard, Alberta Energy Regulator (CPHF)
• Ryan Williams, Enmax (IAEOS)
• Stephen Wills, Alberta Energy (CPHF)
• Brad Wilson, Murphy Oil Corporation (ULWP, AWP)
• Malcolm Wilson, Petroleum Technology Research Centre (HWVP)
• Adam Winter, Cap-OP Energy (DEEPP, PEMA)
• Cody Wollen, Husky Energy (AMMSC)
• Cindy Wolfe, Cenovus Energy Inc. (SGWPC)
• Michelle Wright, Cenovus Energy Inc. (BWG)
• Nancy Wu, Alberta Innovation and Advanced Education (CPHF)
• Edgar Yanez, Ecopetrol (NAMA)
• Stephen Yeung, Alberta Environment Sustainable Resource Development (WIPC, CBTP)
• Michelle Young, Imperial Oil Resources (SGRC)
• Alice Yu, Cenovus Energy (PEMA)
• Nestor Zerpa, Nexen Inc. (CBTP UVAC, CVA, IAEO)
• John Zhou, Alberta Innovates – Energy and Environment (ACPP, CFAS, CPHF, PIRSC)
• Tom Zimmerman, Enbridge (PIRSC)
To the Board of Directors of PTAC
Petroleum Technology Alliance Canada:

Report on the financial statements
We have audited the accompanying financial statements of PTAC Petroleum Technology Alliance Canada, which comprise the statement of financial position as at December 31, 2013, and the statements of operations, changes in net assets and cash flows for the year then ended December 31, 2013, and a summary of significant accounting policies and other explanatory information.

Management’s responsibility for 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 PTAC Petroleum Technology Alliance Canada as at December 31, 2013 and the results of its operations and its cash flows for the year then ended December 31, 2013 in accordance with Canadian accounting standards for not-for-profit organizations.

Thompson, Penner & Lo LLP  May 6, 2014
Certified General Accountants
Calgary, Alberta, Canada
PTAC Petroleum Technology Alliance Canada
Statements of Financial Position As at December 31, 2013 and 2012

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<thead>
<tr>
<th>ASSETS</th>
<th>2013</th>
<th>2012</th>
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</thead>
<tbody>
<tr>
<td>Current</td>
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<tr>
<td>Cash and cash equivalents</td>
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<tr>
<td>Restricted cash</td>
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<td>-</td>
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<tr>
<td>Short term investments</td>
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<td>Accounts receivable and accrued receivables</td>
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<td>Goods and services tax recoverable</td>
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<td>Prepaid expenses</td>
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<td>Property and equipment</td>
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<td>$8,964,639</td>
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<tr>
<th>LIABILITIES</th>
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<tbody>
<tr>
<td>Current</td>
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<tr>
<td>Accounts payable and accrued liabilities</td>
<td>$729,321</td>
<td>$1,719,773</td>
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<tr>
<td>Unearned membership revenue</td>
<td>$571,618</td>
<td>$573,159</td>
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<td></td>
<td>1,300,939</td>
<td>2,292,932</td>
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</tbody>
</table>

| Deferred contributions                   | $4,624,420 | $1,978,738 |
|                                        | $5,925,359  | 4,271,670  |

<table>
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<tr>
<th>NET ASSETS</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Invested in property and equipment</td>
<td>$35,128</td>
<td>50,841</td>
</tr>
<tr>
<td>Internally restricted funds</td>
<td>$1,604,152</td>
<td>1,222,347</td>
</tr>
<tr>
<td>Unrestricted</td>
<td>$1,400,000</td>
<td>1,400,000</td>
</tr>
<tr>
<td></td>
<td>3,039,280</td>
<td>2,673,188</td>
</tr>
<tr>
<td></td>
<td>$8,964,639</td>
<td>$6,944,838</td>
</tr>
</tbody>
</table>

PTAC Petroleum Technology Alliance Canada
Statements of Operations
For the Years Ended December 31, 2013 and 2012

<table>
<thead>
<tr>
<th>REVENUE</th>
<th>2013</th>
<th>2012</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project and service revenue</td>
<td>$5,445,216</td>
<td>$4,822,269</td>
</tr>
<tr>
<td>Membership revenue</td>
<td>$540,289</td>
<td>563,256</td>
</tr>
<tr>
<td>Event revenue</td>
<td>$222,586</td>
<td>229,548</td>
</tr>
<tr>
<td>Rental revenue</td>
<td>$71,763</td>
<td>63,824</td>
</tr>
<tr>
<td>Project participation fee</td>
<td>$57,233</td>
<td>-</td>
</tr>
<tr>
<td>Interest income</td>
<td>$45,668</td>
<td>54,307</td>
</tr>
<tr>
<td>Miscellaneous income</td>
<td>$20,068</td>
<td>2,146</td>
</tr>
<tr>
<td></td>
<td>$6,403,423</td>
<td>5,735,350</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>EXPENSES</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct project and service costs</td>
<td>$4,864,736</td>
<td>4,113,428</td>
</tr>
<tr>
<td>Salaries and benefits</td>
<td>$745,085</td>
<td>924,619</td>
</tr>
<tr>
<td>Rent</td>
<td>$190,628</td>
<td>176,660</td>
</tr>
<tr>
<td>Direct event costs</td>
<td>$65,950</td>
<td>50,384</td>
</tr>
<tr>
<td>Consulting and professional fees</td>
<td>$47,132</td>
<td>45,409</td>
</tr>
<tr>
<td>Office and equipment leases</td>
<td>$26,950</td>
<td>29,001</td>
</tr>
<tr>
<td>Amortization</td>
<td>$22,652</td>
<td>17,942</td>
</tr>
<tr>
<td>Marketing</td>
<td>$16,120</td>
<td>16,932</td>
</tr>
<tr>
<td>Bank charges and credit card discounts</td>
<td>$15,451</td>
<td>15,617</td>
</tr>
<tr>
<td>Training</td>
<td>$13,276</td>
<td>4,501</td>
</tr>
<tr>
<td>Insurance</td>
<td>$11,548</td>
<td>8,066</td>
</tr>
<tr>
<td>Computer and website maintenance</td>
<td>$8,131</td>
<td>11,841</td>
</tr>
<tr>
<td>Volunteer recognition</td>
<td>$5,609</td>
<td>4,887</td>
</tr>
<tr>
<td>Printing and publications</td>
<td>$4,043</td>
<td>5,054</td>
</tr>
<tr>
<td></td>
<td>6,037,331</td>
<td>5,424,341</td>
</tr>
</tbody>
</table>

| Excess of revenue over expenses        | $366,092  | $311,009 |

Project and Service Revenue
PTAC’s membership was comprised of 191 active members at year-end 2013

Producers (26)
• ARC Resources Ltd.
• Athabasca Oil Corp.
• BP Canada Energy Company
• Brion Energy
• Cenovus Energy Inc.
• Chevron Canada Ltd.
• CNRL Canadian Natural Resources Limited
• ConocoPhillips Canada
• Devon Canada Corporation
• Encana Corporation
• Enerplus Corporation
• Husky Energy Inc.
• Imperial Oil Resources Ltd.
• Japan Canada Oil Sands Limited (JACOS)
• Murphy Oil Company
• NAL Resources
• Nexen Inc.
• Penn West
• Petrobank Energy and Resources
• Quicksilver Resources Canada Inc.
• Statoil Canada Ltd.
• Suncor Energy
• Sunshine Oilsands
• Syncrude Canada Ltd.
• Talisman Energy Inc.
• Unconventional Gas Resources Canada Operating Inc.

Government (4)
• British Columbia Oil and Gas Commission
• CRA Canada Revenue Agency - Calgary CTSO SR & ED Section
• Natural Resources Canada
• Saskatchewan Ministry of Energy and Resources

Individuals (9)
• Bernard Dumanowski
• Glen Anhorn
• Derry Eddy
• Eric Lloyd
• Ken Pett
• Geordie Rhodey
• Earle Shirley
• Robert Tasker
• Murray Todd

Learning Institutions (3)
• SAIT
• University of Alberta
• University of Calgary (ISEEE)

Research Providers (13)
• Alberta Innovates – Energy and Environment Solutions
• Alberta Sulphur Research Ltd.
• ANSYS, Inc.
• Canada-Israel Industrial R&D Foundation
• CPI – Canadian Institute for Photonic Innovations
• CIPI – Canadian Institute for Photonic Innovations
• E I DuPont Canada
• MBM Intellectual Property Law
• Pure Elements Environmental Solutions
• Saskatchewan Research Council
• TIPM Laboratory (Perm Inc.)
• TRAech
• zEroCor Tubulars Inc.

Transport/Midstream (3)
• Keyera Energy Ltd.
• Enbridge Inc.
• TransCanada Corporation

Service and Supply (132)
• 3M Canada - Oil and Gas Division
• Abandonite Enviro Services Corp.
• Advanced Flow Technology Inc.
• Advanced Measurements Inc. - Oil and Gas Division
• AGAR Canada Corporation
• AGAT Laboratories
• AMEC Earth and Environmental Ltd. – Calgary, Environmental Services Unit.
• ARCADIS Canada Inc.
• Ark Platforms Inc.
• Atlantic Hydrogen
• Au-Zone Technologies
• Benchmark Instrumentation & Analytical Services Inc.
• Blair Air Systems Inc.
• Blue Source Canada ULC.
• Brocal Laser Inc.
• Calscan Energy Ltd.
• Canadian Fertilizers Limited
• Canyon Technical Services Ltd.
• Cap-Op Energy
• Cataflow Technologies Inc.
• CCW Energy Systems
• CH2M Hill Energy and Chemicals
• Clearstone Engineering Ltd.
• CO Solutions Inc.
• ComplyWorks Ltd.
• Computer Modelling Group Ltd.
• Core Laboratories Canada Ltd.
• Cortex Business Solutions
• Dassault Systems
• Deloitte – Research and Development, Tax
• Delta C Technologies Inc.
• ESP Technologies Inc.
• Eawara Origins Corp.
• EBA Engineering Consultants Ltd. – Research Department
• ENFRAC Inc.
• Engenium Chemicals Corporation
• Ensol Systems
• Enviro Vault Canada Ltd.
• Envirosoft Products Inc.
• Envirotech Engineering
• Epcore
• Ernst & Young LLP
• ETX Systems Inc.
• Exponent Inc.
• Explo Group Canada Inc.
• Extreme Telematics Corp.
• Fekete Associates Inc.
• First Base Solutions Inc.
• Fracturing Horizontal Well Completions Inc.
• Gas Liquids Engineering Ltd.
• geoLOGIC Systems Ltd.
• GEOSEIS Inc.
• GHG Solutions Corp.
• Global New Petro Tec Ltd.
• Gowlings
• Granetech Engineering International Inc.
• GreenPath Energy Ltd.
• Ground Effects Environmental Services Inc.
• GuildOne, Inc.
• Gushor Inc.
• H2O Systems Inc.
• Harber Coatings Inc.
• Hatch Ltd.
• HiFi Engineering Inc.
• IBM Canada – Energy Branch
• IFP Technologies (Canada) Inc.
• Innovative Energy Solution
• INO
• Insight Emissions Management Inc.
• Integrated Environments (2006) Ltd.
• Intelliview Technologies
• Intellox Inc.
• Internet Technologies
• Jaktek Systems Inc.
• Katch Kan Limited
• Kenilworth Combustion Ltd.
• KMPG High Technology Practice Group
• Lakes Environmental Software
• LiDar Services International Inc.
• LIFFECK inc.
• LuxMux Technology Corporation
• McCarthy TetraLPP – Technology Group
• ME Resource Corp
• Microlyne Inc.
• Micro Engineering Tech Inc.
• Millenium EMS Solutions Ltd.
• Mundle Anchors
• MWH Canada Inc.
• Mycelx Technologies
• National Silicates
• Nelson Environmental Remediation, Ltd.
• New Paradigm Engineering Ltd.
• Newalta
• Norton Rose Canada LLP
• N-Solv Corporation
• Oilflow Solutions Inc.
• Omega Well Monitoring
• Pason Systems Corporation
• Portfire Associates
• Process Ecology Inc.
• PSAC
• PTCR – Petroleum Technology Research Centre
• R.I. North America Inc.
• RDANA Technology
• REM Technology Inc.
• Remediation Consulting Group Inc.
• Resource Energy Solutions
• RJ Oil Sands Inc.
• RWDI Air
• Safenergy
• Scanamics
• Schlumberger Canada Ltd.
• Siemens Industry Software Ltd.
• Sky Hunter Corporation
• SNC Lavalin – Studies and Developmental Projects
• SNC Lavalin Environment and Water
• Stanton Consulting Ltd.
• Steeper Energy
• Synodin Inc.
• Tangent Design Engineering Ltd.
• Technosyl Engineering Ltd.
• Terra water Systems LP
• Terrapro Group
• Total Combustion Inc.
• Trican Well Service Ltd.
• Trido Industries Inc.
• Tri-Pac Engineering and Machine Company
• TSGL-Chartered Accountants
• Tundra Process Solutions Ltd.
• Turbo Trac USA, Inc.
• Weatherford Canada Partnership
• Winterhawk Technologies Ltd.