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, Shale Oil, and other Unconventional Oil
- Development of Arctic Resources

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

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

PTAC Technical Areas
- Business
- Geosciences
- Health and Safety
- Instrumentation/Measurement Operations
- Production Engineering

PTAC Networks
- Phoenix Network Working Group
- Alberta Upstream Petroleum Research Fund
- Technology for Emissions Reductions and Eco-Efficiency
- Pipeline Network
- Tight Oil and Gas Technology Action Plan
- Clean Bitumen Technology Action Plan
- Resource Emissions Management Technology Action Plan
- Remote Sensing Network

Future Networks
- Heavy Oil
- Arctic Network

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

Our vision is to help Canada become a global hydrocarbon energy technology leader.
MESSAGE FROM THE BOARD

With low commodity prices a reality of the current Canadian economy, it is more critical than ever for the oil and gas industry to focus on innovative collaboration. Together, we can effectively minimize costs and increase production and reserves while reducing the environmental footprint.

The PTAC collaborative model was established during and for hard times in our industry. For over 19 years, our members have embraced this model and proven its many benefits throughout periods of both rapid growth and economic slowdown. During 2014 PTAC initiated the PTAC Project Performance Summary to independently evaluate the performance of a selection of the nearly 450 PTAC projects completed to date. This undertaking served to demonstrate the value created by past projects and also helped develop an effective template upon which to build future projects.

A significant number of the projects evaluated were launched under the Alberta Upstream Petroleum Research Fund, otherwise known as AUPRF. Managed by PTAC and led by the Canadian Association of Petroleum Producers (CAPP) and the Explorers and Producers Association of Canada (EPAC), AUPRF conducts practical science-based studies to address high priority environmental and social issues related to oil and gas exploration and development in Alberta. The findings of these studies inform the development of smart policies, regulations, and best practices for the sustainable development of Alberta’s world-class hydrocarbon resources. Since inception, AUPRF has launched 273 projects. 270 of these have been completed to date.

The AUPRF program has been instrumental in driving environmental best practices to the field and creating the datasets necessary for regulators to establish informed regulations. Over the past 14 years, producers have provided $19.2 million in funding to AUPRF. Combined with $99 million from other sources, such as NSERC and other beneficiary industries such as forestry, these funds have been leveraged into $119 million in total research dollars. Industry estimates a value creation thus far in the range of $90 million to $350 million. When compared to the industry cost of $19.2 million, this rate of return clearly demonstrates the value created by the program by simultaneously reducing costs and improving environmental outcomes. The AUPRF program, validated by the 2014 project evaluation, has proven that business can indeed make profit while addressing social and environmental concerns.

Another series of projects that exemplify the success of the PTAC model are the REMVue Slippstream technology projects. Slippstream technology was developed and commercialized through a series of projects and pilot validations under PTAC’s Technology for Emission Reduction and Eco-Efficiency (TEREE) Committee between 2004 and 2009. The Slippstream technology captures vented hydrocarbons from oil and condensate tanks, compressor packing and other instrumentation and uses it as fuel in the field process. Hundreds of Slippstream units are currently operational, generating $4.5 million per year from the engine fuel displaced. At the same time the carbon offset of the technology is equivalent to taking 40,000 cars off the road annually. Should these units be fully implemented across industry operations, the carbon offset would be equal to taking 1.6 million cars off the road annually while generating $160 million per year from engine fuel displacement.

Evaluating more than 400 of PTAC’s completed projects validated the considerable financial and environmental benefits of the PTAC collaborative model. The results of the cumulative project evaluation are posted on our website and testify that, through nearly two decades of projects, PTAC has created significant value for all stakeholders. Taking this objective look back at our past project successes and challenges will inform and guide our future course.

In addition to the evaluation of our historical performance, PTAC launched 11 new technology and innovation projects in 2014. Among these were projects addressing important industry issues such as responsible operation and development in the Canadian pipeline industry, well site abandonment technology, improved energy efficiency and emissions reduction, and the identification of new opportunities in the growing tight oil and shale gas sectors. Most of PTAC’s 2014 projects involve field trials or will lead to field trials in subsequent phases of R&D. Over the past several years, our continuing focus on helping projects reach this stage of development has led to the commercialization of multiple new technologies that provide a measureable value for industry far exceeding the original technology investment costs. By carefully selecting projects in line with industry needs, and involving multiple stakeholders through the collaborative model, PTAC continues to effectively leverage expertise and funding to rapidly move technology from research to implementation.

Throughout 2014, PTAC encouraged the steady progress of continuing projects and brought four others to successful completion. Completed projects developed three new pump technologies and brought them into the commercial market, gathered and analyzed important data for responsible pipeline abandonment, published the “Innovation Roadmap for Transmission Pipeline Transportation
of Petroleum Products”, and completed research that will help establish purity recommendations for carbon capture and storage practices not only in Alberta, but Canada as a whole and other jurisdictions across the globe.

A low-commodity-price environment is expected to persist for 2015, and it is a fact that over 99% of Canada’s hydrocarbon resources are unconventional, making the production and development of Canadian resources considerably more costly than other regions around the world. To address this reality, PTAC will focus on developing relevant cost-reduction projects in 2015 to help industry become more competitive with other hydrocarbon producers on the global stage. For example, PTAC is planning two projects to reduce drilling and completions costs related to production from tight oil/shale gas and oil sands. PTAC is currently seeking leveraged funds from both the federal and provincial governments to launch these initiatives.

Pipelines will be a major focus area for PTAC projects in the year ahead. The Pipeline Abandonment Research Steering Committee will release its first two project reports in 2015 while continuing to develop new projects. In addition, PTAC’s other technical steering committees are poised to launch several projects addressing a variety of industry concerns. 2015 projects will investigate emissions reduction and energy efficiency in heavy oil, evaluate the technical and economic benefits of steam and flue gas injection in SAGD wind down, conduct further work on a lightweight proppant for tight/shale oil and gas, assess a water treatment technology for application to hydraulic fracturing, and conduct a pilot scale demonstration of an online steam quality analyzer. The Phoenix Network, which is a group of seven senior oil sands producers, has also identified several projects to be launched in 2015.

We will also be stepping back into international partnerships in 2015. PTAC will be receiving funding from the United Nations Environmental Program to launch a project to accelerate Methane and Black Carbon Reductions from Oil and Natural Gas in support of the Climate and Clean Air Coalition (CCAC). The project will focus on measurement, mapping, and monitoring to identify where venting and flaring of natural gas rich in volatile organic compounds (VOCs) occurs. The project will identify economic opportunities to reduce Short-Lived Climate Pollutant (SLCP) emissions and develop related policy tools. The project will also target the development of demonstration projects to stimulate the commercial deployment of emerging Canadian technologies, largely from SME’s, that reduce SLCPs from venting and flaring.

PTAC stands upon a rich history of value-driven projects and a reputation for excellence and integrity. This success is due in no small part to the 277 industry volunteers who continue to serve on PTAC’s 24 technical steering committees and two subcommittees. For the past 19 years, as the oil and gas industry has faced both prosperity and adversity, PTAC has led the pursuit of innovation and technology development, demonstration, and deployment. As we enter 2015, we are prepared to take on the future just as we have done over the past two decades; with vigor and perseverance to create an ever-better hydrocarbon energy industry.

Soheil Asgarpour, Ph.D., P.Eng.
President

Dave Rushford
Chairperson
2014 was another year of developing programs, partnerships, projects, and events that promote innovation and research and development to benefit the Canadian hydrocarbon energy industry.

PROGRAMS

Working with our partners, PTAC continued to facilitate both the Alberta Upstream Petroleum Research Fund (AUPRF) and the SME Innovation Project in 2014. Both of these programs yielded significant benefits for participants, PTAC members, and the Canadian hydrocarbon energy industry.

AUPRF

AUPRF is led by the Canadian Association of Petroleum Producers (CAPP) and the Explorers and Producers Association of Canada (EPAC), and is managed by PTAC. The concept is based on the idea that collaborative research and development provides an economical means of minimizing the environmental impact of the oil and gas industry. Officially launched in 2001, the AUPRF program provides funding for practical, science-based environmental research on air, water, biodiversity, and surface impacts arising from both conventional and unconventional oil and gas activities. Projects address issues throughout the entire spectrum of oil and gas development, from early exploration through to production and retirements. These studies can also be used to inform the development of smart policies, regulations, and best practices for the sustainable development of Alberta’s world-class hydrocarbon resources.

In 2014 PTAC worked with CAPP, EPAC, the ADOE, and ESRD to develop a sustainable long-term funding model for the AUPRF program. PTAC proposed changes to the existing model that address declining industry participation in the program and the resulting concern for the long-term sustainability of the program. This proposal was recently endorsed and approved by CAPP and EPAC and has the approval of the Government of Alberta. As part of the development process for the new funding model, PTAC completed a comprehensive evaluation of the AUPRF program. This report is available on PTAC’s website.

While funding was not secured for AUPRF in 2014, remaining funding from 2013 was utilized in 2014 to launch the “Assessing the Role of Grizzly Bears in the Decline of Woodland Caribou” project. The objective of this study is to determine the extent that grizzly bear predation is influencing caribou populations in west-central Alberta, and to develop new techniques to measure and monitor bear predation levels on caribou populations. PTAC is optimistic that the program will return to a full project roster in 2015.

Small and Medium Sized Enterprises (SMEs)

PTAC, with support from the National Research Council of Canada Industrial Research Assistance Program (NRC-IRAP), continued to develop its SME Innovation project in 2014, including the Virtual Centre for Commercialization which is focussed on facilitating, coordinating, and managing field tests to commercialize SME technologies.

Small and medium-sized enterprises (SMEs) play an important role in the Canadian hydrocarbon energy industry. Often, some of the industry’s most ground breaking innovations emerge from the SME sector, yet these small companies face significant barriers in bringing their ideas to market. Often the very strengths that allow SMEs to take risks in the first place end up hindering their progress, especially when trying to move their technology from prototype to commercialization. Oil and gas operations, particularly those undertaken on the scale of a major explorer or producer, are large, capital-intensive endeavours, often conducted under public scrutiny. As a result, these companies tend to take a very conservative approach to technology risk. By contrast, SMEs frequently build their business from limited technology development work and may offer products with uncertainties and risks beyond the tolerance of the operating companies they hope to connect with. Therefore, a large gap exists between the expectations of oil and gas exploration and producer companies and the typical offerings by SMEs. During 2014, PTAC worked alongside SMEs and operators to bridge this gap.

With support from NRC-IRAP, PTAC has directly helped SMEs by identifying industry needs and sharing this information so these companies might better align their products with the current market. Likewise, PTAC worked with operating companies and producers to raise awareness of emerging SME technologies and help them mitigate financial risk through the application of the PTAC collaborative model. Five new SME projects were launched in 2014, and PTAC introduced several SME technology solutions to 

KEY ACCOMPLISHMENTS
PTAC industry committees. In addition, PTAC facilitated several events with NRC-IRAP support. Among these were 22 Technology Information Sessions, and the PTAC “Showcase of SME Technologies” that highlighted SME technologies for an audience of exploration and production companies, as well as other stakeholders. More than 700 representatives from SME companies attended PTAC’s 2014 events.

A significant portion of PTAC’s 2014 projects were launched in conjunction with SMEs, assisting these companies to move their technologies from concept to implementation. These projects represent a variety of technical areas, and include such diverse projects as the “Vacuum Insulated Tubing” project, the “Distributed Energy Efficiency Projects Platform Phase 2” project, and the “Wellsite Abandonment with Eutectic Salts” project.

PARTNERSHIPS

PTAC’s Phoenix Network, composed of seven major oil sands operating companies, continued their work throughout 2014. The aim of the Phoenix Network is to launch Joint Industry Projects (JIPs) and Pay’n’Learn projects to address SAGD recovery challenges, mainly the challenge of reducing costs and increasing production and recovery. The network operates under the mandate to identify and articulate challenges, re-think and re-define problems, focus on the right challenges, identify appropriate solutions, stimulate the generation of ideas, import ideas from different jurisdictions and industries, and ultimately combine and create hybrid technology solutions. The Phoenix Network is focused on non-environmental technology development. Network members benefit from their involvement by increasing the breadth and depth of their knowledge, sharing learnings, building on ideas, reducing redundancy, accessing more technologies, increasing resources available for piloting and testing, and leveraging risk through collaboration. During 2014, the Phoenix Network identified 15 potential projects. Four of these have already been launched – two JIPs and two Pay’n’Learn projects.

PTAC also forged a new partnership through a Memorandum of Understanding with the Saskatchewan Research Council, which aims to collaboratively develop and launch high value projects, and proactively identify and define key industry challenges.

PROJECTS

Across the major technology portfolios, PTAC launched 11 new technology projects in 2014. By carefully selecting which new projects to launch, PTAC continued to effectively leverage collaborative expertise and funding to rapidly move technology from research to implementation. PTAC also concentrated resources on encouraging the steady progress of current projects and concluding projects, allowing the organization to remain agile and adapt to the ebb and flow of the current market.

Improve Oil and Gas Recovery

The “Improve Oil and Gas Recovery” technology area included projects at all phases of development in 2014, from new project launches through continued development and on to completion.

PTAC collaborated with several government departments and industry players in launching the “Mapping the Unconventional Resource Industry in the Cardium Play Region” project in 2014. The purpose of this project is to map the challenges and opportunities presented by new shale gas and tight oil technologies in the regions where these activities are currently taking place. This information will help evaluate appropriate hydraulic fracturing technologies to not only maximize recovery but also minimize the environmental footprint. Work on this project in 2014 included a workshop in Drayton Valley to highlight the benefits from Cardium operations and bring this information to the attention of the community.

The “Vacuum Insulated Tubing” (VIT) project, launched in 2014, seeks to help industry determine the economic values, energy savings, and efficiency values of VIT. In SAGD, near 100% quality steam is injected through an injector string. Usually, bare tubing is used, resulting in heat losses from the wellhead to the heel of the well. Therefore, less than 100% quality steam is delivered to the horizontal section. Vacuum Insulated Tubing (VIT) could replace the bare tubing and significantly reduce heat loss, resulting in higher quality steam and reduced GHG emissions. Although SAGD operators have experimented with VIT in recent years, adoption of the new technology has been uneven. This is due, in part, to the difficulty of precisely assessing the energy efficiency and economic benefits of VIT vs. bare tubing. Past computer modeling efforts have used basic simulation packages and simplistic geometries. The VIT project will use the sophisticated ANSYS CFD simulator to model eccentric and concentric 3D geometries, as well as the steam condensation process in steam injection to provide a realistic assessment of the economic and environmental benefits of VIT technology.

PTAC continued work on ongoing endeavours such as the “Ultra-Lightweight Proppant” project. Although the project committee considered undertaking additional trials to optimize the technology, operational and budget circumstances prevented these trials from proceeding in 2014. Therefore, the project team proceeded with results analysis and preparation of the draft results report.

PTAC also continued to facilitate both the Froth Treatment Consortium (FTC) and the Bitumen Production Fundamentals
Research Group (BPFGRG). Responsibility for the facilitation of these organizations was transferred to PTAC from CONRAD in 2013. After contributing to industry’s fundamental understanding of phase behavior, process chemistry, water-clay interactions, and tailings over the past several years, the BPFGRG came to a close at the end of 2014.

The multi-year “Shallow Gas Well Dewatering Pump Consortium” project was also successfully completed in 2014. Launched in 2010, the “Shallow Gas Well Dewatering Pump Consortium” project worked with SMEs to develop new low-cost reliable pumps to remove water from shallow gas wells. The SME pumps were in turn bench tested and subsequently field proven in a commercial natural gas well. As a result of this project, numerous pump technologies were tested at CFER and Enform sites over the past four years. Three of these technologies progressed from inception through to commercialization, and are currently available on the market. The final report for this project will be available to the public in 2016.

**Improve Value-Added Products**

Spanning such diverse technical areas as pipelines, geospatial data, and SAGD, the majority of PTAC’s new projects for 2014 were launched in the “Improve Value-Added Products” Technology Area.

Addressing issues critical to the responsible operation and development of the Canadian pipeline industry, PTAC’s Pipeline Abandonment Research Committee (PARSC) launched two new projects in 2014. The “Decomposition of Pipe Coating Materials in Abandoned Pipelines” project will review the leachability of various products from pipe coating materials, examine their solubility in water, analyze their soil sorption coefficients, and determine how these factors affect the transport of such products in groundwater. The project will summarize the potential effects of these products on humans and wildlife and determine their relative toxicity ranking. The “Cleaning Methods, Standard Pipeline Products List, and Detections of Residual Contamination in Abandoned Pipelines” project seeks to determine the effectiveness of pipeline cleaning methods in practice, and compare them to the regulatory authorities’ recommended standards for cleanliness of abandoned pipelines. It will also determine and catalog the types of products that flow through pipelines, the expected contaminants that can be found when transporting each product, and the appropriate tests needed to determine if and how much of these contaminants are actually present when line abandonment occurs.

Also focused on pipelines, work continued on PTAC’s ongoing “Frost Heave Effects on Pipeline Exposure Rates” project. The objective of this project is to understand the mechanisms of heaving of abandoned pipelines, especially in relation to agricultural land and roadway and railway crossings. This project is expected to conclude in 2015.

PTAC’s PARSC completed their “Understanding the Mechanisms of Corrosion and their Effects on Abandoned Pipelines” project in 2014. This study validated corrosion models for abandoned pipelines, carried out a structural integrity study, and researched the collapse of soil under different void sizes, soil types, and depth of pipeline cover. The final report for this project will be released to the public in 2015.

In collaboration with the Canadian Energy Pipeline Association (CEPA) and the Pipeline Engineering Centre at the University of Calgary, PTAC completed and published the “Innovation Roadmap for Transmission Pipeline Transportation of Petroleum Products” in 2014. 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 both 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 will benefit the sector as a whole.

Under the same technology area, but a very different technical stream, PTAC launched the “Geospatial Data Visualization” project. This project will allow for the simultaneous visualization and analysis of multiple 2-D geospatial data layers through intuitive interaction and inter-layer correlative analysis. This new system hopes to benefit the many users of geospatial data by providing them with a collaborative environment where teams of people can come together to make decisions. Oversight for this project is being managed by the Geospatial Data Visualization Project Technical Steering Committee.

In yet another technical stream, the “Low Cost InSAR for Oil Sands Steam Chambers Monitoring” project is being launched by the project committee. InSAR technology has proven effective for SAGD steam chamber monitoring, but its use has been limited by the prohibitive expense of the technology. This project hopes to help overcome these financial barriers by investigating the potential cost reduction achieved by tailoring an InSAR service specifically for steam chamber monitoring.

**Manage Environmental Impacts**

PTAC’s TEREE committee launched the “Conceptual Engineering Study of Technologies for Reducing Methane Venting in Cold Heavy Oil Production” project to address the startling statistic that despite declining in previous years, methane venting actually increased by more than 20% from 2011 to 2012 (Alberta ST-60B 2013 report). In Alberta, 80% of vented volumes are related to cold heavy oil production. Venting of methane to the atmosphere is a reality for oil and gas operations, usually venting as fugitive emissions and occurring in circumstances where conservation would be prohibitively expensive. However, technologies currently exist that enable companies to avoid methane venting in circumstances where it is prohibitively expensive to capture vented volumes, compress them, and deliver them to pipelines. Therefore, this study will examine the technologies currently available, investigate the technical and economic reasons why these technologies are not widely used, and determine how they might be improved to justify greater utilization. This study will also focus on the ability
of each technology to reduce GHG emissions, with an eye to informing further studies related to carbon offset protocols.

The overall purpose of the “Distributed Energy Efficiency Projects Platform” (DEEPP) project is to create a streamlined technology solution to overcome 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 reporting transparency to government. Given its large scale, the project was stage-gated to control costs and risk. Building upon the results of Phase 1, PTAC launched Phase 2a in 2014. This phase extended the DEEPP database to include a quantification module for pneumatic instruments, the study of methane venting, and the capability for sophisticated analytics. These enhancements improve source data quality and identify trends for operational excellence including asset tracking, document management activities, reports, dashboarding, and alerts.

In partnership with the Integrated CO₂ Network (ICO₂N) and 32 industry experts, PTAC completed the groundbreaking “Alberta CO₂ Purity” project in 2014. This final phase of the project developed a detailed techno-economic model populated with derived data. This model can analyze system scenarios to determine the effects of impurities and optimize purity levels across an integrated CCS infrastructure. Purity specifications have never before been evaluated across the entire chain, and more importantly across a spectrum of impurities in combination. This project will help establish purity recommendations that can be utilized by regulators, academia, and industry in Alberta, Canada and jurisdictions across the globe. Determining optimal CO₂ Purity will lead to lower costs in CCS implementation, and ultimately contribute to the overall reduction of GHG emissions through increased knowledge, safety, and practicality of CCS technology. Thirty-two organizations participated in this project, including producers, transporters, service companies, CO₂ emitters, federal and provincial governments, research providers, and members of academia. Overall, this project clearly demonstrates the broad benefits of PTAC’s collaborative model, including the outstanding leveraging of financial resources and expertise.

Reduce Capital, Operating and G&A Costs
PTAC’s “Airborne Microseep Mapping” project continued in 2014. Although this project was originally concluded in 2013, the steering committee determined that the project should continue with additional surveys to validate the initial results. During 2014, more data form airborne surveys of oil sands projects was analyzed and appears to support early conclusions that the cost of this technology is significantly lower than existing seismic survey methods, and that there is no environmental disturbance. Further survey work is planned for 2015.

Small and Medium Enterprises
Straddling the “Reduce Capital, Operating and G&A Costs” and the “Manage Environmental Impacts” Technology Areas, the 2014 launch of PTAC’s “Wellsite Abandonment with Eutectic Salts” project grew out of the SME program. The objective of this laboratory project is to validate the performance of a new technology for well abandonment that forms a plug using eutectic salts rather than traditional cement. Eutectic salts expand slightly upon setting, making for a tighter seal and an abandonment method with improved integrity and potentially lower costs than existing cement-based methods. The laboratory work undertaken in 2014 resulted in significant changes to the technology, and plans are being made to take it to a field trial in 2015. This technology may also result in lower fugitive emissions of methane gas from leaking wells.

EVENTS

PTAC is committed to communicating project results in a timely manner, and PTAC’s collaborative approach includes a commitment to clearly disseminate project outcomes. This communication is often achieved through workshops, forums, and technology information sessions. PTAC’s 2014 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 2014 PTAC facilitated:
• 23 Technology Information Sessions (TISs) attended by 567 participants
• 8 forums that attracted over 642 participants
• 5 workshops that engaged 139 stakeholders in meaningful discussion
With the current economic forecast predicting a challenging year for Alberta’s oil and gas industry in 2015, PTAC will focus on projects, partnerships, and programs that align with shifting industry needs. PTAC will put significant emphasis on the development and commercialization of cost-reduction technologies to help industry compete more economically with other hydrocarbon-producing regions around the world. For example, PTAC has launched two initiatives to reduce the cost of drilling and completions for both tight oil and shale gas production and oil sands. PTAC is currently seeking funds from federal and provincial governments to support the development of further cost-cutting technologies. At the same time, PTAC’s commitment to reduce environmental impact remains. PTAC is working with the United Nations Environmental Program to launch a project to help implement mitigation options for short-lived climate pollutants.

The PTAC collaborative model is itself a product of tough times, and PTAC is committed to remaining industry’s best choice for innovation and collaborative research in 2015.

**PROJECTS**

Project management will remain at the forefront of PTAC’s 2015 activities. However, in keeping with the challenges industry is expected to be facing, there will be an increased focus on projects that seek to reduce costs and improve recovery. PTAC will pursue creative approaches to collaborative funding that encourage continued industry participation, while projects will focus on technology areas with a high return on investment.

One of the technical areas PTAC will explore more fully in 2015 is non-environmental oil sands initiatives. The Phoenix Network plans to launch four new projects related to oil sands in 2015, and PTAC will also be launching the “Oil Sands Drilling and Completions” project, which will primarily target cost reductions and productivity improvements in SAGD. PTAC’s stage-gated “Oil Sands Drilling and Completions” project will identify needs, provide a gap analysis and prioritize opportunities in Phase 1 before launching additional innovation projects. New drilling and completion technologies identified through the project will not only offer opportunities for cost reduction, but the benefits from improved drilling and completions technologies could extend to all types of oil and gas extraction, such as hydraulic fracturing, shale gas, tight oil, and conventional oil and gas.

PTAC’s Tight Oil and Gas Technology Action Plan (TOGTAP) Network is actively engaged in launching the Tight Oil and Shale Gas Roadmap in 2015. Additional projects related to drilling and completions, water supply and disposal, reservoir and geoscience, and environmental impact will also be considered on an individual basis. These upcoming projects themselves are not substantially different from previous years, but PTAC’s approach to funding them in 2015 is. For these two projects, PTAC is seeking only in-kind support from industry, while project funding is being secured from other sources. This creative and flexible funding model points to an organization in sync with the industry they serve.

Pipeline initiatives will also be a major focus for PTAC projects in 2015. The Pipeline Abandonment Research Steering Committee will release its first two project reports in 2015 - “Understanding the Mechanisms of Corrosion and their Effects on Abandoned Pipelines” and “Frost Heave Effects on Pipeline Exposure Rates”. The committee will also continue work on the “Decomposition of Pipe Coating Materials in Abandoned Pipelines Project” and the “Cleaning Methods, Standard Pipeline Products List, and Detections of Residual Contamination in Abandoned Pipelines”, both launched in 2014. In addition, the committee is looking forward to launching two new projects in 2015.

The Artificial Reservoir Steering Committee, which completed Phase One of the “Artificial Reservoir” Project in 2013, is examining options to launch Phase Two in 2015, including the possibility of working in partnership with post-secondary students and their institutions. The overall objective of this project is 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.
PTAC is in discussion with the United Nations Environmental Program (UNEP) to launch a project to accelerate Methane and Black Carbon Reductions from Oil and Natural Gas in support of the Climate and Clean Air coalition (CCAC). UNEP and PTAC is planning to enter into an agreement to provide technical support for the implementation of options to mitigate Short-Lived Climate Pollutants (SLCP) specifically related to the recovery of readily-condensable hydrocarbon liquids. PTAC’s engagement will be two-fold. First, PTAC will support measurement, mapping and monitoring to identify where venting and flaring of natural gas rich in volatile organic compounds (VOCs) occurs, with a view to identifying economic opportunities to reduce SLCP emissions as well as the development of related policy tools. Second, PTAC will support targeted demonstration projects to stimulate the commercial deployment of emerging technologies to reduce SLCPs from venting and flaring.

PTAC will continue to move ongoing projects forward across all technology areas as existing initiatives continue to develop in 2015. Further survey work will continue on the “Airborne Microseep Mapping” project, PTAC’s DEEPP project will launch phases 2b and 2c, and several projects to reduce GHG emissions are being considered by the TEREE Steering Committee. In addition, the revitalized AUPRF program will add significant project work and value in 2015.

PARTNERS

In times of economic downturn, partnerships become increasingly important. By working together, goals that neither could reach on their own can be accomplished in an affordable and timely manner. PTAC has many established partnerships, and in 2015 the organization will strengthen collaboration with industry associations such as Innovate Calgary, the technology-transfer and business-incubation center for the University of Calgary, and with inter-provincial research partners such as the Saskatchewan Research Council. In addition, PTAC is currently working towards a potential new collaboration between the AUPRF program and British Columbia’s Science and Community Environmental Knowledge (SCEK) program, which plays a similar role in that province. At the same time, PTAC will continue to promote and encourage existing partnerships such as the Phoenix Network and TOGTAP Network.

PROGRAMS

PTAC spent much of 2014 working with industry and government partners to demonstrate the value of the AUPRF Program and the need for a sustainable funding model. CAPP, EPAC, and the Government of Alberta chose to continue with the program, supporting a voluntary funding model with measures to increase industry participation. Now that the funding model has been developed and approved, PTAC will focus strongly on building up the AUPRF program in 2015. This program is based on the belief that through innovation and collaborative R&D, industry can minimize their environmental impact economically. This founding principle will be as important as ever in 2015, with commodity values shifting but no change in the pressure for enhanced environmental responsibility.

EVENTS

PTAC is committed to ensuring its events will continue to be aligned with industry needs in 2015. With the ramping up of the program projects, PTAC’s AUPRF forums are expected to communicate new research progress. The Phoenix Network plans to host four workshops related to oil sands innovation, research, and development. PTAC Members will continue to benefit from targeted TISs. In addition to several upcoming TISs, Forums, and Workshops, PTAC will partner with COSIA in 2015 to host the Oil Sands Clay Workshop and Conference (previously hosted by CONRAD) at the University of Alberta.
In 2014, PTAC facilitated the launch of eleven new research projects and project phases to address industry challenges.

**Improve Oil and Gas Recovery**
- Mapping Unconventional Resource Industry in the Cardium Play Region
- Vacuum-Insulated Tubing Simulation

**Improve Value-Added Products**
- Decomposition of Pipe Coating Materials in Abandoned Pipelines Project
- Cleaning Methods, Standard Pipeline Products List and Detection of Residual Contamination in Abandoned Pipelines
- Geospatial Data Visualization
- Low-Cost InSAR for SAGD Steam Chamber Monitoring

**Manage Environmental Impacts**
- Conceptual Engineering Study of Technologies for Reducing Methane Venting in Cold Heavy Oil Production
- Distributed Energy Efficiency Projects Platform Phase 2a

**Small and Medium Enterprises**
- Demonstration and Deployment of SME Innovation and Technology in the Hydrocarbon Energy Industry
- Wellsite Abandonment with Eutectic Salts

**AUPRF**
- Assessing the Role of Grizzly Bears in the Decline of Woodland Caribou
In 2014, PTAC facilitated 24 Technical Steering Committees, and two sub-committees.

**Manage Environmental Impacts**
- Air Research Planning Committee (ARPC)
- Soil and Groundwater Research Committee (SGRC)
- Ecological Research Planning Committee (ERPC)
- Water Innovation Planning Committee (WIPC)
- Technology for Emission Reduction and Eco-Efficiency Steering Committee (TEREE)
- Methane Venting Project Committee (MVPC)
- Distributed Energy Efficiency Projects Platform Steering Committee (DEEPP)
- Alberta CO₂ Purity Project Committee (ACPP)
- Alberta CO₂ Purity Project Leaders Committee (ACPL)

**Improved Oil and Gas Recovery**
- Artificial Reservoir Project Steering Committee (ARPC)
- Bitumen Production Fundamentals Research Group (BPFRG)
- Current Practices of Hydraulic Fracturing Steering Committee (CPHF)
- Froth Treatment Consortium (FTC)
- Shallow Gas Well De-Watering Pump Consortium Steering Committee (SGWPC)
- Ultra-Lightweight Proppant Project Steering Committee (ULWP)
- Mapping Unconventional Resource Industry in the Cardium Play Region Project Committee (MUCP)
- Vacuum-Insulated Tubing Project Committee (VITC)

**Reduce Capital, Operating, and G&A Costs**
- Airborne Microseep Mapping Steering Committee (AMMSC)

**Improve Value-Added Products**
- CBTAP Upgrading and Value-Added Committee (CBTAP UVAC)
- Creating More Value from Asphaltenes Steering Committee (CVA)
- Geospatial Data Visualization Project Committee (GDVC)
- Pipeline Abandonment Research Steering Committee (PARSC)
- Pipeline Innovation Roadmap Steering Committee (PIRSC)
- Low Cost InSAR Project Committee (LCIC)

**Small and Medium Enterprises**
- SME Innovation and Technology Commercialization in the Hydrocarbon Industry (SITC)
- Wellsite Abandonment with Eutectic Salts Project Committee (WAESC)
PTAC offers members a variety of opportunities to become involved in innovation, research, and development, demonstration, and deployment (IRD3) initiatives that further the Canadian hydrocarbon energy industry.

**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. Recently, a motion was passed that allows PTAC to provide up to 15% seed money to help move projects forward.

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

**ENGAGING Forums and Workshops**
Focusing on broader needs or larger technical areas, PTAC forums are comprised of presentations detailing new technologies, case studies, and the objectives and results of current research. 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 are made up of PTAC members representing various industry sectors, governments, and non-governmental organizations. These technical steering committees work to identify opportunities for collaborative research and technology development, raise awareness of existing research and technology through planning events, find solutions to challenges through the process of soliciting proposals and launching new projects, and promote involvement by informing appropriate colleagues of Technical Steering Committee activities. In 2014, PTAC facilitated 24 Technical Steering Committees.

**COMMUNICATING Streamlined Communications**
In 2014, PTAC developed a new streamlined communications strategy to more efficiently share information with our membership, including their employees and affiliates. As of January 2015, an opt-in monthly newsletter has replaced individual event communications. This electronic publication highlights current PTAC project opportunities, new technologies, member news, upcoming events, and other initiatives addressing current industry current trends and needs. In an effort to reduce email correspondence, PTAC’s goal is to issue just two communications per month to our members.
BOARD OF DIRECTORS

(As at December 31, 2014)

Dave Rushford, Chair
Senior Vice-President and Chief Operating Officer, Quicksilver Resources Canada Inc.

Soheil Asgarpour
President, PTAC Petroleum Technology Alliance Canada

Doug Boyler
Chief Operations Engineer, Alberta Energy Regulator

Randy Cormier
Vice President - Technology, Nexen Energy ULC

Mike Ekelund
Assistant Deputy Minister, Strategic Initiatives Division, Alberta Department of Energy

Eddy Isaacs
Chief Executive Officer, Alberta Innovates – Energy and Environment Solutions

Paul Jeakins
Commissioner and CEO, British Columbia Oil and Gas Commission

Mark Johnstone
Independent Director

Laurier Schramm
President and Chief Executive Officer, Saskatchewan Research Council

Jonathan Matthews
Director, Tailings EPA, COSIA

Dan McFadyen
Independent Director

Ken Putt
Independent Director

Joy Romero
VP Technology Development – Horizon, Canadian Natural Resources Ltd.

William Rosehart
Dean, Schulich School of Engineering, University of Calgary

Randy Rudolph
Principal, Millennium EMS Solutions Ltd.

Mike Scribner
Manager, Technology & Optimization, ConocoPhillips

Kevin Stashin
President and CEO, NAL Resources Management Limited

Murray Todd
President and CEO, Todd Resources

VOLUNTEER RECOGNITION AWARDS

Volunteer Recognition Awards 2013
Service Awards (Presented at 2014 Annual General Meeting)

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

Corporate Leadership Award
Statoil Canada Ltd.

Chairperson’s Award
Larry Frederick, Husky Energy Inc.

President’s Award
Joy Romero, Canadian Natural Resources Limited

Air Quality R&D Leadership Award
Filiz Onder, Encana

Ecological Research Leadership Award
Mark Sherrington, Shell Canada Ltd.

Soil and Groundwater Research Leadership Award
Stephen Bromley, Husky Energy Inc.

Water Innovation Leadership Award
Lindsay Stephens, Encana

Eco-Efficiency Leadership Award
Jerry Scoular, Husky Energy Inc.

Commercializing of SME Technology Award
Sky Hunter Corporation

Distinguished Service Award
Donna Garbutt, Schlumberger Canada
Earle Shirley
COMMITTEE VOLUNTEERS

- Tamer Al-Ramahi, NRC IRAP (SITC)
- Mark Anderson, Husky Energy Inc. (ARPC)
- Sue Anderson, Fort Hills Energy L.P. (BPFRG)
- Joshua Anhalt, Green Path Energy (TEREE)
- Renato Araujo, Enerplus Corporation (TEREE)
- James Armstrong, Encana (WIPC)
- Stefan Bachu, Alberta Innovates – Energy and Environment Solutions (ACPP)
- Jamie Bagan, Stantec Consulting Inc. (ACPP)
- Caroline Bamfylde, ESRD (ERPC)
- James Beck, Suncor Energy (ARPC)
- Matt Beck, Husky Energy Inc. (DEEPP)
- Asfaw Bekele, Imperial Oil Resources (SGRC)
- Rodger Bernar, Husky Energy Inc. (CBTAP UVAC)
- Michael Bevan, Alberta Energy Regulator (WIPC)
- Robert Birkholz, Shell Canada (FTC)
- Mark Bohm, Suncor Energy (TEREE)
- Daniel Booy, C-FER Technologies (SGWPC)
- Greg Boser, zEroCor Tubulars Inc. (VITC)
- Isabelle Bouffard, Union of Agricultural Producers of Quebec (PARSC)
- Mark Boulton, Suncor Energy (ERPC)
- Ken Bradley, Sky Hunter (AMMSC, GDVC)
- Don Brick, Spartan Controls (TEREE, DEEPP)
- Imad Brohi, Pengrowth (TEREE)
- Stephen Bromley, Husky Energy Inc. (SGRC)
- George Brosseau, Alberta Innovation and Advanced Education (MUCP)
- Colin Brown, ConocoPhillips Canada (TEREE)
- Frank Brunner, IHS (ULWP)
- Michael Buckley, Worley Parsons (ACPP)
- Gary Bunio, Suncor Energy (TEREE)
- Ann Byers, ANSYS Inc. (VITC)
- James Callendar, Encana (TEREE)
- Kelly Campbell, Devon Canada Corporation (TEREE, DEEPP)
- Pierre-Yves Caux, Environment Canada (TEREE)
- Ayan Chakraborty, Imperial Oil Resources Ltd. (SGRC)
- Jose Luis Chavarría, Shell Canada (ULWP)
- Mikhail Cazacu, Husky Energy Inc. (ULWP)
- Yvan Champagne, Blue Source Canada (TEREE)
- Frank Cheng, University of Calgary (MUCP)
- Bill Clay, Enerplus Corporation (SGWPC)
- Jason Close, CMG Ltd. (ACPP)
- Kathleen Coffey, Sentio Engineering (MVPC)
- Todd Cole, MEG Energy Corp. (TEREE)
- Kathy Cox, Enerplus Corporation (SGRC)
- Robert Craig, Integrated CO2 Network (ACPP, ACPL)
- Cathy Crawford, Devon Canada Corporation (DEEPP)
- Beverley DeSantis, Imaginea Energy (TEREE)
- Aleena Dewji, Blue Source Canada (TEREE)
- Gur Dhaliwal, Alberta Department of Energy (ARPC, TEREE)
- Gordon Dinwoodie, Alberta Environment Sustainable Resource Development (SGRC)
- Luong Doan, Japan Canada Oil Sands Ltd. (ARPC)
- Randy Dobko, Alberta Environment and Sustainable Resource Development (ARPC)
- Tim Doerksen, Enerplus Corporation (SGWPC)
- Richard Dollighan, Natural Resources Canada (NRC) (TEREE)
- Cam Dowler, REM Technology (TEREE, DEEPP)
- Keith Driver, The Prasino Group (DEEPP)
- Russ Duncan, Sky Hunter (AMMSC, GDVC)
- Steve Dunk, Progress Energy (WIPC)
- Joe Dusseault, Cenovus Energy Inc. (TEREE)
- Kelly Edwards, Harvest Operations (ACPP, ACPL)
- Carol Engstrom, Husky Energy Inc. (ERPC)
- R.D. Evans, Upside Engineering (ACPP)
- Henry Ewa, Alberta Energy Regulator (ARPC)
- Jennifer Ezekiel, Encana (TEREE)
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- Hilary Falkner, Alberta Department of Energy (MUCP)
- Hamid Farid, Devon Canada Corporation (VITC)
- Mark Fawcett, Sky Hunter (AMMSC, GDVC)
- Allison Fisher, Shell Canada (ARPC)
- Natalia Fomina, NRC IRAP (SITC)
- Gary Foulds, Suncor Energy (FTC)
- Terry Frank, Greatario Covers (TEREE)
- Geoff Frazer, Devon Canada Corporation (TEREE)
- Gavin Freeman, Shell Canada Resources (BPFRG)
- Sarah Fulton, Husky Energy Inc. (WIPC)
- Rob Fulton, Canyon Technical Services (ULWP)
- Chris Gatfield, 3M Canada – Oil and Gas Division (ULWP)
- Genaro Gelves, 3M Canada – Oil and Gas Division (ULWP)
- Mark Giesbrecht, Devon Canada Corporation (GDVC)
- Greg Gill, Kinder Morgan (PARSC)
- Marc Godin, Portfire Associates (TEREE)
- Bob Golding, NRC IRAP (SITC)
- Geoff Gorrie, ANSYS Inc. (VITC)
- Chris Grant, Fort Hills Energy L.P. by its operator Suncor Energy (FTC)
• Roy Graves, TransCanada Corporation (PARSC)
• Bruce Greenfield, Alberta Energy Regulator (ERPC)
• Scott Grindal, ConocoPhillips Canada (ERPC)
• Rodney Guest, Suncor Energy (WIPC)
• Anil Gupta, ESRD (WIPC)
• Subodh Gupta, Cenovus Energy Inc. (ARPC)
• Susan Halla, Alberta Energy Regulator (SGRC)
• Todd Halladay, CNRL Canadian Natural Resources Limited (TEREE, MVPC)
• Gerry Hampshire, Cavalier Energy (VITC)
• Khalid Hansraj, Innovate Calgary (TEREE)
• John Harvey, Encana (TEREE)
• Kevin Heal, EnviroVault (TEREE)
• Jackson Hegland, ARC Resources Ltd. (TEREE)
• Phil Henderson, Athabasca Oil (VITC)
• Sean Hiebert, ConocoPhillips Canada (TEREE, DEEPP)
• Shannon Hiebert, Husky Energy Inc. (DEEPP)
• Scott Hillier, ConocoPhillips Canada (WIPC)
• Lars Hinrichs, Devon Canada Corporation (CBTAP UVAC, VITC, AMMSC, GDVC, LCIC)
• Trina Hoffarth, Enerplus Corporation (TEREE)
• David Hoffman, Enbridge Inc. (PARSC)
• Cliff Hogstead, Encana (SGWPC)
• Scott Hoiland, Devon Canada Corporation (TEREE, MVPC, DEEPP)
• Christopher Holly, Alberta Department of Energy (TEREE)
• David Horsley, Horsley Consulting (PIRSC)
• Becky Horvath, Talisman Energy Inc. (WIPC)
• Ron Hugo, University of Calgary (TEREE)
• Scott Imbus, Chevron Canada Ltd. (ACPP, ACPL)
• Eddy Isaacs, CANMET and Alberta Innovates – Energy and Environment Solutions (BPFRG, TEREE)
• Alex Isings, 3M Canada – Oil and Gas Division (ULWP)
• Bill Jeffries, LOOKNorth (AMMSC, GDVC, LCIC)
• Justin Jia, Husky Energy Inc. (CBTAP UVAC)
• Paul Jiapizian, Environment Canada (TEREE)
• Barry Jessup, Enhance Energy (ACPP)
• Scott Johnston, Husky Energy Inc. (ERPC)
• Mark Kapfer, LOOKNorth (AMMSC, GDVC, LCIC)
• Shashank Karra, ANSYS Inc. (VITC)
• Jerry Keller, Alberta Environment (TEREE)
• Erin Kempin, Husky Energy Inc. (WIPC)
• Tara Koomen, Encana (ERPC)
• Prit Kotecha, Suncor Energy (SGRC)
• Jim Kresta, Syncrude Canada (BPFRG, FTC)
• Milos Krnjaja, Cenovus Energy Inc. (TEREE, DEEPP)
• Steve Kullman, Husky Energy Inc. (SGRC)
• Dale Kunz, Winterhawk (WAESC)
• Amrita Lall, Integrated CO₂ Network (ACPP, ACPL)
• Andrea Lamond, Encana (TEREE)
• David Lamont, ConocoPhillips Canada Ltd. (ACPP, ACPL)
• Michael Lawson, ConocoPhillips Canada (TEREE)
• Michael Layer, CANMET Energy Technology Centre (TEREE)
• Logan Leduc, Environment Canada (TEREE)
• Jaelin Lee, Husky Energy Inc. (GDVC)
• Guiqin Li, Husky Energy Inc. (ARPC)
• Vicki Lightbown, Alberta Innovates – Energy and Environment Solutions (PIRSC)
• Shunlan Liu, Alberta Innovates – Energy and Environment Solutions (CVA, CBTAP UVAC)
• Ian Lockley, ANSYS Inc. (VITC)
• Jackson Luong, Devon Canada Corporation (GDVC)
• Fern Maas, Enerplus Corporation (TEREE)
• Waseem Mahmood, Alberta Department of Energy (TEREE)
• Monty Malik, 3M Canada – Oil and Gas Division (ULWP)
• Margaret Mara, Shell Canada Limited (ERPC)
• Sandra Marken, ConocoPhillips Canada (ERPC, WIPC)
• Robert Martens, Taqa North (DEEPP)
• Paul Martin, ConocoPhillips Canada (WIPC)
• Adam Martinson, Cenovus Energy Inc. (ERPC)
• Magdalena Mateuszczyn, Alberta Innovation and Advanced Education (MUCP)
• Barb McCarthy, Husky Energy Inc. (AMMSC, GDVC)
• Mikaela McQuade, CAPP (ARPC)
• Duncan Meade, Enbridge Inc. (ACPL)
• Chris Meloche, Husky Energy Inc. (SGRC)
• Karl Miller, NRC-IRAP (SITC)
• Raheleh Salehi Mojarad, BP Canada Energy Group ULC (ARPC)
• Ole Mrklas, ConocoPhillips Canada (SGRC)
• Anamika Mukherjee, Cenovus (ARPC)
• Michael Mund, ConocoPhillips Canada (TEREE, PEMA)
• Alan Murray, Principia Consulting (PIRSC)
• Tony Nakamura, Japan Canada Oil Sands Limited (JACOS)(TEREE)
• Rekha Nambiar, Suncor Energy (ARPC)
• Rick Nelson, Alberta Innovates – Energy and Environment Solutions (BPFRG)
• JP Nicot, University of Texas – Austin (ACPP, ACPL)
• Greg Northey, Canadian Federation of Agriculture (PARSC)
• Egide Nzojibwami, Technosol Engineering (ACPP)
• Devin Ollenberger, Suncor Energy (AMMSC)
• Garnet Olson, Canyon Technical Services Ltd. (ULWP)
• Filiz Onder, Encana (ARPC)
• Koray Onder, ConocoPhillips Canada (ARPC)
• Jim Ontko, Upside Engineering (ACPP)
• Elaine Pacheko, Canadian Energy Pipeline Association (CEPA) (PARSC)
• Gerald Palanca, Alberta Energy Regulator (ARPC, TEREE)
• Thomas Palmer, Imperial Oil Ltd. (FTC)
• Eusebio Palmisano, ConocoPhillips Canada (CVA, CBTAP UVAC)
• Shane Patterson, Innovation and Advanced Education (ERPC)
• Tara Payment, Canadian Association of Petroleum Producers (SGRC)
• Pat Payne, Alberta Energy Regulator (SGRC)
• Bruce Peachey, New Paradigm Engineering (MUCP)
• Teresa Penafiel-Bastidas, 3M Canada – Oil and Gas Division (ULWP)
• Alan Pentney, National Energy Board (PARSC)
• Rick Phaneuf, Alberta Environment (TEREE)
• Kelly Piers, C-FER Technologies (SGWPC)
• Elizabeth Pin, Alberta Innovation and Advanced Education (MUCP)
• Silviu Potlog, Husky Energy Inc. (ULWP)
• Jessica Poupore, Environment Canada (TEREE)
• Rob Power, Alliance Pipeline (PARSC)
• Ron Quick, NRC-IRAP (STC)
• Karsten Radtke, UHDE (ACPP)
• Aileen Raphael, Taqa North (DEEPP)
• Al Rasmussen, Nexen Energy ULC (TEREE)
• John Remmer, Encana (TEREE)
• Kate Reynolds, Alberta Innovation and Advanced Education (MUCP)
• Brian Ross, Nexen Energy ULC (ARPC)
• Thomas Robinson, TransCanada Corporation (ACPP, ACPL)
• Mark Roblin, ARC Resources Ltd. (WIPC)
• Joy Romero, Canadian Natural Resources Ltd. (BPFRG, FTC)
• Brian Ross, Nexen Energy ULC (TEREE)
• Paul Rutherford, Athabasca Oil Corporation (TEREE)
• Ziad Saad, Canadian Energy Pipeline Association (ACPP, PIRSC)
• Unwala Sadiq, Government of Alberta (TEREE)
• Ronnie Sador, Nexen Energy ULC (CVA)
• Pooja Saini, Suncor Energy (TEREE, CVA, CBtap Uvac)
• Jennifer Saldana, Husky Energy Inc. (WIPC)
• Mahendra Samaroo, Alberta Department of Energy (WAESC)
• Reea Sangha, Environment Canada (TEREE)
• Daljinder Sanghera, Encana (TEREE)
• Gary Sargent, Canadian Association of Petroleum Producers (ERPC)
• Dave Sask, Encana (SGWPC)
• William Sawchuck, ARC Resources Ltd. (ACPP)
• Adam Schink, ConocoPhillips Canada (DEEPP)
• Jerry Scoolars, Husky Energy Inc. (TEREE, MVP, DEEPP)
• Andrea Sedgewick, Northern Lights Partnership, by its managing partner Total E&P Canada (BPFRG) and Total E&P Canada (FTC)
• Gordon Severin, IHS (ULWP)
• Jerry Shaw, Devon Canada Corporation (TEREE)

• Mark Sherrington, Shell Canada Ltd. (ERPC)
• Harry Siewert, Teck Resources (FTC)
• Arvinder Singh, NRC IRAP (SITC)
• Surindar Singh, Alberta Innovates – Energy and Environment Solutions (TEREE)
• Apoorv Sinha, zEroCor Tubulars Inc. (VITC)
• Song Sit, Cenovus Energy Inc. (CVA)
• Scott Smith, Cenovus Energy Inc. (TEREE)
• Jonathan Smith, Blue Source Canada (TEREE)
• Mark Sombach, Cenovus Energy (AMMSc, GDVC, LCIC)
• Clementina Sosa, Cenovus Energy (CBTAP Uvac)
• Lindsay Stephens, Encana (TEREE, ARPC, WIPC)
• Michael St. James, Praxair Canada Inc. (ACPP)
• Dale Struksnes, IHS (ULWP)
• Mark Summers, Alberta Innovates – Energy and Environment Solutions (TEREE)
• Rudy Tamayo, Chevron Canada Ltd. (WIPC)
• Betty Seto Tang, Encana (ARPC)
• Kristian Tange, Penn West (ACPP)
• Blair Temple, Imperial Oil (VITC)
• Jonathon Theaker, Alberta Jobs, Skills, Training and Labour (MUCP)
• Zoe Thomas, CAPP (WIPC)
• Greg Unrau, Talisman Energy Inc. (ARPC)
• Carolyn Ussher, Nexen (ARPC)
• Brian Van Vliet, Spartan Controls (TEREE, DEEPP)
• Nick Veriotes, Canadian Natural (TEREE, MVP)
• Andrew Vink, Devon Canada Corporation (LCIC)
• Goran Vlajnic, Devon Canada Corporation (CBTAP Uvac)
• Trystan Wall, Athabasca Oil (VITC)
• Stella Wang, Suncor Energy (ARPC)
• Bill Way, Encana (TEREE)
• Doris Weiss, Devon Canada Corporation (TEREE)
• Shawn Willette, ConocoPhillips Canada (SGRC)
• Brad Wilson, Murphy Oil Company (ULWP)
• Adam Winter, Cap-Op Energy (DEEPP)
• Cindy Wolfe, Cenovus Energy Inc. (SGWPC)
• Nancy Wu, Alberta Innovation and Advanced Education (MUCP)
• Michelle Young, Imperial Oil Resources (SGRC)
• Alice Yu, Cenovus Energy Inc. (TEREE)
• Frank Zahner, Accurata (MVPC)
• Kourosh Zanganeh, Natural Resources Canada (NRCan) (TEREE)
• Lori Zaparniuk, Alberta Jobs, Skills, Training and Labour (MUCP)
• Nestor Zerpa, Nexen Energy ULC (CBTAP Uvac, CVA)
• John Zhou, Alberta Innovates – Energy and Environment (ACPP, PIRSC)
• Tom Zimmerman, Enbridge Inc. (PIRSC)
To the Members of Petroleum Technology Alliance Canada

We have audited the accompanying financial statements of Petroleum Technology Alliance Canada, which comprise the statement of financial position as at December 31, 2014 and the statements of revenues and expenditures, changes in net assets and cash flows for the year then ended, and a summary of significant accounting policies and other explanatory information.

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

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

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

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

Opinion
In our opinion, the financial statements present fairly, in all material respects, the financial position of Petroleum Technology Alliance Canada as at December 31, 2014 and the results of its operations and its cash flows for the year then ended in accordance with Canadian accounting standards for not-for-profit organizations.

Calgary, Alberta
March 25, 2015

Professional Accountants
### PTAC Petroleum Technology Alliance Canada

**Statements of Financial Position As at December 31, 2014**

<table>
<thead>
<tr>
<th>ASSETS</th>
<th>2014</th>
<th>2013</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cash and cash equivalents</td>
<td>$4,135,500</td>
<td>$4,238,562</td>
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<tr>
<td>Restricted cash</td>
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<td>2,449,118</td>
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<td>Short term investments</td>
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<td>709,263</td>
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<td>Goods and services tax recoverable</td>
<td>-</td>
<td>8,263</td>
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<td>Accounts receivable and accrued receivables</td>
<td>1,408,895</td>
<td>1,490,827</td>
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<tr>
<td>Prepaid expenses</td>
<td>27,517</td>
<td>25,477</td>
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<tr>
<td>Property and equipment</td>
<td>17,143</td>
<td>35,128</td>
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<tr>
<td><strong>Total Assets</strong></td>
<td><strong>$7,955,691</strong></td>
<td><strong>$8,964,638</strong></td>
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<table>
<thead>
<tr>
<th>LIABILITIES</th>
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</thead>
<tbody>
<tr>
<td>Current</td>
<td></td>
<td></td>
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<tr>
<td>Accounts payable and accrued liabilities</td>
<td>$617,000</td>
<td>$729,320</td>
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<tr>
<td>Good and services tax payable</td>
<td>25,739</td>
<td>-</td>
</tr>
<tr>
<td>Unearned membership revenue</td>
<td>522,949</td>
<td>571,618</td>
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<tr>
<td><strong>Total Current Liabilities</strong></td>
<td><strong>1,165,688</strong></td>
<td><strong>1,300,938</strong></td>
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<tr>
<td>Deferred contributions</td>
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<td>4,624,420</td>
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<tr>
<td><strong>Total Liabilities</strong></td>
<td><strong>4,592,404</strong></td>
<td><strong>5,925,358</strong></td>
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<table>
<thead>
<tr>
<th>NET ASSETS</th>
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</thead>
<tbody>
<tr>
<td>Invested in property and equipment</td>
<td>17,143</td>
<td>35,128</td>
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<tr>
<td>Internally restricted funds</td>
<td>1,946,144</td>
<td>1,694,152</td>
</tr>
<tr>
<td>Unrestricted</td>
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<td>1,400,000</td>
</tr>
<tr>
<td><strong>Total Net Assets</strong></td>
<td><strong>3,363,287</strong></td>
<td><strong>3,039,280</strong></td>
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</tbody>
</table>

| PTAC Petroleum Technology Alliance Canada |        |              |

**Statements of Operations For the Years Ended December 31, 2014**

<table>
<thead>
<tr>
<th>REVENUE</th>
<th>2014</th>
<th>2013</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project and service revenue</td>
<td>$3,149,688</td>
<td>$5,445,216</td>
</tr>
<tr>
<td>Membership revenue</td>
<td>533,882</td>
<td>540,289</td>
</tr>
<tr>
<td>Project participation fee</td>
<td>57,233</td>
<td>57,233</td>
</tr>
<tr>
<td>Event Revenue</td>
<td>240,587</td>
<td>222,586</td>
</tr>
<tr>
<td>Rental income</td>
<td>62,974</td>
<td>71,763</td>
</tr>
<tr>
<td>Interest income</td>
<td>44,350</td>
<td>45,668</td>
</tr>
<tr>
<td>Miscellaneous income</td>
<td>6,883</td>
<td>20,668</td>
</tr>
<tr>
<td><strong>Total Revenue</strong></td>
<td><strong>4,097,597</strong></td>
<td><strong>6,403,423</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>EXPENSES</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Salaries and benefits</td>
<td>724,482</td>
<td>745,085</td>
</tr>
<tr>
<td>Direct project and service costs</td>
<td>2,689,293</td>
<td>4,664,827</td>
</tr>
<tr>
<td>Rent</td>
<td>122,317</td>
<td>190,628</td>
</tr>
<tr>
<td>Direct event costs</td>
<td>61,927</td>
<td>65,859</td>
</tr>
<tr>
<td>Office and equipment leases</td>
<td>23,253</td>
<td>26,950</td>
</tr>
<tr>
<td>Marketing</td>
<td>19,865</td>
<td>16,120</td>
</tr>
<tr>
<td>Amortization</td>
<td>20,092</td>
<td>22,652</td>
</tr>
<tr>
<td>Consulting and professional fees</td>
<td>33,846</td>
<td>47,152</td>
</tr>
<tr>
<td>Training</td>
<td>8,712</td>
<td>13,276</td>
</tr>
<tr>
<td>Printing and publications</td>
<td>6,317</td>
<td>4,043</td>
</tr>
<tr>
<td>Volunteer recognition</td>
<td>6,075</td>
<td>5,809</td>
</tr>
<tr>
<td>Computer and website</td>
<td>4,750</td>
<td>8,131</td>
</tr>
<tr>
<td>Insurance</td>
<td>13,489</td>
<td>11,548</td>
</tr>
<tr>
<td>Bad debt</td>
<td>33,354</td>
<td>-</td>
</tr>
<tr>
<td>Bank charges and credit card discounts</td>
<td>12,813</td>
<td>15,451</td>
</tr>
<tr>
<td><strong>Total Expenses</strong></td>
<td><strong>3,780,587</strong></td>
<td><strong>6,037,331</strong></td>
</tr>
</tbody>
</table>

**Excess of revenue over expenses** | **$317,010** | **366,092** |
PTAC’s membership was comprised of 189 active members at year-end 2014

**Producers (27)**
- ARC Resources Ltd.
- ArthaBasca Oil Corp.
- BP Canada Energy Group ULC
- Brion Energy
- Cavalier Energy
- Cenovus Energy Inc.
- Chevron Canada Ltd.
- CNRL Canadian Natural Resources Limited
- ConocoPhillips Canada
- Devon Canada Corporation
- Encana
- Enerplus Corporation
- Husky Energy Inc.
- ImagineX Energy
- Japan Canada Oil Sands Limited (JACOS)
- Laricina Energy Ltd.
- Murphy Oil Company
- NAL Resources
- Nexen Energy ULC
- Penn West
- Petrobank Energy and Resources
- Quicksilver Resources Canada Inc.
- Statoil Canada Ltd.
- Suncor Energy
- Sunshine Oilsands
- 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

**Research Providers (12)**
- Alberta Innovates – Energy and Environment Solutions
- Alberta Innovates – Technology Futures
- Alberta Sulphur Research Ltd.
- ANSYS Inc.
- Canada-Israel Industrial R&D Foundation
- CIFI – Canadian Institute for Photonics Innovations
- Innovation Support at the National Institute for Nanotechnology
- MBM Intellectual Property Law
- Pure Elements Environmental Solutions
- Saskatchewan Research Council
- TRENCH
- zEnCor Tubulars Inc.

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

**Service and Supply (131)**
- 2020 Power Generation
- 3M Canada - Oil and Gas Division
- Abandonite Enviro Services Corp.
- Absolute Combustion International
- Absolute Gemini Ltd.
- Accelware Ltd.
- Advanced Flow Technology Inc.
- Advanced Measurements Inc. - Oil and Gas Division
- AGAR Canada Corporation
- AGAT Laboratories
- AgniPower Inc.
- AMEC Earth and Environmental Ltd. – Calgary, Environmental Services Unit
- Amolite Strategies Inc.
- ARCADIS Canada Inc.
- Ark Platforms Inc.
- Atlantic Hydrogen
- Benchmark Instrumentation & Analytical Services Inc.
- Bennett Jones LLP IP & Climate Change
- Black Gold Rush Industries
- Blair Air Systems Inc.
- Blue Source Canada ULC
- Boreal Laser Inc.
- Branch Corner Supply
- Calscen Energy Ltd.
- Canadian Chemical Corporation
- Canadian Fertilizers Limited
- Canyon Technical Services Ltd.
- Cap-Op Energy
- CW Energy Systems
- Clearpath Robotics Inc.
- Clearstone Engineering Ltd.
- CO2 Solutions Inc.
- ComplyWorks Ltd.
- Computer Modelling Group Ltd.
- Core Laboratories Canada Ltd.
- Cortex Business Solutions
- Dassault Systems
- Deloitte – Research and Development, Tax
- Enersoft Inc.
- ENFRAC Inc.
- Enhanced Recovery Services Inc.
- Enviro Vault Canada Ltd.
- Envirotech Engineering
- Ernst & Young LLP
- Extreme Telematics Corp.
- Fekete Associates Inc.
- First Base Solutions Inc.
- Fulcrum Environmental Services
- Gas Liquids Engineering Ltd.
- GEM Services
- geoLOGIC Systems Ltd.
- GEOSEIS Inc.
- GHG Solutions Corp.
- Global Analyzer Systems Ltd.
- Global New Petro Ltd.
- Gowlings
- Greatano Covers
- GreenPath Energy Ltd.
- GuildOne, Inc.
- H2O Systems Inc.
- Halliburton – Production Enhancement
- HiFi Engineering Inc.
- HTCO2 Systems Corp
- Hydro Pacifics Pumps Inc.
- IBM Canada – Energy Branch
- IFP Technologies (Canada) Inc.
- IMDC Consulting Inc.
- INCAS’ Solutions BV
- INO
- Intelliview Technologies
- Intalog Inc.
- Intermap Technologies
- Inventys Thermal Technologies Inc.
- Katch Kan Limited
- Kenilworth Combustion Ltd.
- KMPG High Technology Practice Group
- Lakes Environmental Software
- LiDar Services International Inc.
- LIFTECK inc.
- LuxLux Technology Corporation
- McCarthy Tetrault LLP – Technology Group
- ME Resource Corp
- Micralayne Inc.
- Micro Engineering Tech Inc.
- Millennium EMS Solutions Ltd.
- Mundle Anchors
- Mycelx Technologies
- Nalpeyian Environmental Consulting Inc.
- National Silicates
- Nelson Environmental Remediation, Ltd.
- New Paradigm Engineering Ltd.
- Newalta
- Nine Sigma
- Norton Rose Canada LLP
- N-Solv Corporation
- Omega Well Monitoring
- P&G Optica Inc.
- Pason Systems Inc.
- PetroJet Canada Inc.
- Portfire Associates
- Process Ecology Inc.
- PSAC - Petroleum Services Association of Canada
- PTRC – Petroleum Technology Research Centre
- Remediation Consulting Group Inc.
- Resource Energy Solutions
- RJ Oil Sands Inc.
- Rosen Canada Ltd.
- RWDI Air
- Samson Pump LLC
- Scanimetrics
- Schlumberger Canada Ltd.
- Sky Hunter Corporation
- SNC Lavalin - Studies and Developmental Projects
- SNC Lavalin Environment and Water
- Spartan Controls Ltd – Efficiency Group
- Stanton Consulting Ltd.
- Tangent Design Engineering Ltd.
- Technosol Engineering Ltd.
- Terra Water Systems LP
- Terrapro Group
- Terra Tech EBA Inc.
- Total Combustion Inc.
- Trido Industries Inc.
- TSGI-Chartered Accountants
- Tundra Process Solutions Ltd.
- Veolia Water Solutions & Technologies
- Weatherford Canada Partnerships
- Winterhawk Technologies Ltd.