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.

PTAC Technology Areas

Improve Oil and Gas Recovery
- CO₂ Enhanced Hydrocarbon Recovery
- Coalbed Methane, Shale Gas, Tight Gas, Gas Hydrates, and other Unconventional Gas
- Conventional Heavy Oil, Cold Heavy Oil Production with Sands
- Conventional Oil and Gas Recovery
- Development of Arctic Resources
- Development of Remote Resources
- Enhanced Heavy Oil Recovery
- Enhanced Oil and Gas 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

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

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

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

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

PTAC Networks
- Alberta Upstream Petroleum Research Fund
- Clean Bitumen Technology Action Plan
- Phoenix Network
- Pipeline Network
- Pipeline Technology Action Plan
- Remote Sensing Network
- Resource Emission Management Technology Action Plan
- Support for Small and Medium-sized Enterprises
- Technology for Emissions Reductions and Eco-Efficiency
- Tight Oil and Gas Innovation Network
Message from the Board

2015 was a monumental year for PTAC. We launched 59 new research and development projects, the most collaborative research projects launched in any year since our inception in 1996. Enthusiastic support for these new projects proves that our industry recognizes the critical need for collaborative innovation and technology development to tackle the challenges of today’s difficult Canadian oil and gas climate.

The PTAC collaborative model was developed during and for hard times in our industry, and has proven effective throughout twenty years of shifting markets. Our members and our industry have reaped the many benefits of pooling resources in pursuit of innovative R&D projects which have reduced costs, improved safety, mitigated environmental impact, increased production and reserves, created new value-added opportunities, and assisted in the maintenance of our industry’s social license to operate. Working together, we are overcoming current challenges and securing our industry’s future by developing technologies that reduce both cost and the environmental footprint.

PTAC’s longstanding Alberta Upstream Petroleum Research Fund (AUPRF) program and Technology for Emissions Reduction and Eco-Efficiency (TEREE) program both clearly demonstrate the successful combination of environmental responsibility and corporate financial success. The varied research and technology development projects made possible through AUPRF and TEREE have benefitted industry with an outstanding number of completed projects that deliver practical results. 300 AUPRF projects have been successfully completed since inception of the program in 1998. The results of these practical, science-based studies have helped drive best practices to the field and shape policy and regulations for the sustainable development of Alberta’s oil and gas resources.

In 2015, the AUPRF program launched 41 new projects that address high-priority environmental and social issues pertinent to Alberta’s oil and gas industry. The program itself received outstanding support from industry in 2015. More than 90% of Alberta producers opted to contribute their fair share of the voluntary fund collection for the AUPRF program, once again proving the critical value of this program to industry. The 2015 collection was the highest received to date, and would not have been possible without the endorsement of the boards of both the Canadian Association of Petroleum Producers (CAPP), and the Explorers and Producers Association of Canada (EPAC), as well as the Deputy Ministers of the Alberta Department of Energy and Alberta Environment and Parks.

PTAC’s TEREE committee was established in 2003 to address the growing issue of greenhouse gas (GHG) emissions in the Canadian hydrocarbon energy industry. Since that time, the international discourse on climate change and GHG emissions has continued to gain momentum in living rooms, board rooms, parliament, and social media. Since 2003, 28 projects have been funded through PTAC’s TEREE committee. The majority of PTAC’s TEREE projects have explored new techniques, technologies, and improvements to current procedures through field testing and pilot projects. This practical focus has led to the commercialization of several new technologies over the past twelve years. TEREE’s legacy continues with two new projects launched in 2015, and more planned for the coming year.

The increased recovery benefits from tight oil and shale gas deposits using combined horizontal drilling and multi-stage hydraulic fracturing are undeniable. However, application of the technology in formations throughout North America has raised significant concern over environmental impacts, and has triggered regulatory reviews in numerous international jurisdictions. PTAC formed the Tight Oil and Gas Innovation Network (TOGIN) in 2015 to articulate the challenges associated with multi-stage hydraulic fracturing, and identify technology solutions using the PTAC collaborative model. TOGIN’s vision is to create the lowest environmental footprint possible and minimize negative social impacts, all while establishing the best economic performance for Tight Oil and Shale Gas operations throughout Western Canada. Numerous organizations have already secured their spot in TOGIN, representing producers, federal and provincial governments, service and supply companies, academia, and research providers. The network’s primary project is the development of the Tight Oil and Shale Gas Innovation Roadmap to identify key challenges and opportunities related to this relatively new area of production. In addition to the roadmap, the network also launched several other projects in 2015 including mapping of the unconventional Duvernay and Bakken plays, development of a novel water treatment to remove pollutants from completions water in multi-stage hydraulic fracturing, and an evaluation of an innovative surface treatment and well stimulant for tight oil and shale gas operations.

Although the launch of new projects is always very exciting, their successful completion is even more so. PTAC completed twenty-seven collaborative research and development projects in 2015, providing industry with new information, recommendations, and technologies. These projects addressed diverse challenges in a variety of industry production areas, ranging from the evaluation of technologies to reduce methane venting in Cold Heavy Oil Production with Sands (CHOPS), to the exploration of the decomposition of pipe coating materials, to addressing venting from suspended and abandoned well sites. Although these projects spanned several of PTAC’s technology areas, they share many common goals, such as improved efficiency, cost reduction, increased recovery, and generating value-added opportunities, all while reducing industry’s environmental impact.

PTAC has facilitated numerous projects related to air quality and emissions reduction over the past two decades, but in 2015 we were recognized on the international stage with an unprecedented
partnership. The United Nations Environmental Programme’s (UNEP) Climate and Clean Air Coalition (CCAC) executed an agreement with PTAC, launching the ‘Accelerating Methane and Black Carbon Reductions from Oil and Natural Gas Production Project’, wherein PTAC is responsible for the component on ‘Technology Demonstration and Evaluation for the Recovery of Hydrocarbon Liquids’. This project is working to identify where venting and flaring of natural gas rich in volatile organic compounds (VOCs) occurs, and to identify cost-effective opportunities to reduce Short-Lived Climate Pollutant (SLCP) emissions. PTAC is honoured to be appointed as the lead implementer to facilitate this project with the United Nations (UN), and we look forward to a collaborative future not only with the UN, but other international organizations as well.

Global citizenship demands that environmental impact is a primary consideration for the oil and gas industry, and PTAC continues to learn, adapt, and respond to changing industry needs. PTAC firmly believes that by working together with all stakeholders, we can create a greener and more innovative energy industry for future generations. Among the activities planned for 2016 is a major initiative and three projects to reduce GHG emissions. The ‘Methane Venting and Flaring Initiative’ will combine existing activities and new initiatives under an overarching program to economically reduce methane venting and flaring from Western Canadian hydrocarbon activities by 80%. This collaborative initiative will conduct innovative applied research, and also develop, demonstrate, deploy, and commercialize technology to achieve substantial GHG reduction while improving profitability. Three new TEREE projects will examine opportunities to reduce emissions in field operations – two through changes to glycol dehydrators, and another exploring the use of solar power. In concert with improving environmental performance, improving operations while reducing costs remains central to all PTAC’s collaborative research projects. In 2016, PTAC will launch a network focused on ‘Optimization of Steam Oil Ratio for SAGD Operations’ that will aim to reduce both costs and GHG emissions in oil sands and heavy oil operations. This network developed out of a 2015 technology project measuring steam quality downhole in conjunction with cognitive computing technology and insulated tubing. As implemented and practiced in 2015, PTAC will also continue to provide industry with complimentary workshops and substantially reduced conference fees to increase the level of collaboration, articulate challenges, and identify technology solutions throughout industry, thus allowing all players to collaborate regardless of the economic climate.

Whatever economic climate lies ahead, PTAC remains committed to spurring the momentum of innovation and uniting stakeholders to address industry challenges and concerns. We will continue to facilitate projects and programs that demonstrate that environmental responsibility and corporate profits can thrive hand in hand. This past year was not an easy one for the Canadian oil and gas industry, and we stand beside our members as we weather this storm together. Collaboration is critical in times of adversity and innovation must continue, even when times are tough. We thank you, our members, for trusting in the PTAC model for the last two decades. Together, we can achieve our shared vision of seeing Canada become a global hydrocarbon energy technology leader through collaborative research and technology development, demonstration and deployment.

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

![Image: Award Recipient: Bryan Helfenbaum, Devon Canada, Award Recipient: Ken Mislan, Husky Energy, Award Presenter: Soheil Asgarpour, PTAC President, Award Recipient: Corrina Bryson, Nexen Energy ULC, Award Recipient: Hannah LaPlante, Statoil]
Key Accomplishments

Despite a challenging economic climate for the Canadian oil and gas industry, PTAC set a new record for launched projects in 2015. These projects aim to reduce both costs and the environmental footprint, while improving the financial performance of our industry.

Programs

Working with their partners, PTAC continued to facilitate both the Alberta Upstream Petroleum Research Fund (AUPRF) and the Small and Medium-sized Enterprises (SME) Innovation Project in 2015. Both of these programs yielded significant benefits for participants, PTAC members, and the Canadian hydrocarbon energy industry.

AUPRF

The Alberta Upstream Petroleum Research Fund (AUPRF) is one of the most successful programs originating from PTAC’s collaborative model. Managed and administered through PTAC, this program is a unique collaborative platform between industry, the Government of Alberta, and the Alberta Energy Regulator. AUPRF is led by the Canadian Association of Petroleum Producers (CAPP) and the Explorers and Producers Association of Canada (EPAC). AUPRF research is driven by the core belief that the long-term success of the Canadian oil and gas industry depends upon the collective advancement of environmental research by all stakeholders. Between 1998 when the program began and the beginning of 2015, 314 AUPRF projects have been launched, 300 of which have been completed. Each of these projects provides market-driven, 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. The results of AUPRF’s independent, peer-reviewed research inform the development of policies, regulations, and best practices for the sustainable development of Alberta’s natural hydrocarbon resources. The AUPRF program has contributed to cost reduction, ease of operations, and improved social license for industry. At the same time, the program has helped foster an understanding between industry and regulators by sharing objective information that has helped fast-track development activities, avoiding unnecessary costs and adversarial hearings, and helping both parties understand the environmental impact of hydrocarbon development.

In 2015, the AUPRF program awarded 41 new projects $2.2M in funding. The leveraging of additional funding resulted in $11.4M in 2015 total projects. The value-creation and return on investment of AUPRF projects clearly demonstrates that environmental responsibility and corporate profits can indeed thrive hand in hand.

Small and Medium Sized Enterprises (SMEs)

PTAC, in collaboration with the National Research Council of Canada Industrial Research Assistance Program (NRC-IRAP), continued to develop the SME program in 2015. Small and medium-sized enterprises (SMEs) are prevalent in the Canadian hydrocarbon energy sector. Agile and adaptable, these small companies are often at the forefront of innovation and technology solutions. Their small size allows them to take greater risks to accomplish initial goals, but a large gap exists between the SME entrepreneur and the oil and gas exploration and production companies with whom they hope to connect. SMEs frequently build their business from limited technology development work and may offer products with acknowledged uncertainties and risks. The large-scale oil and gas operations of major producers and explorers are capital-intensive endeavors regularly scrutinized by shareholders and the public, so these companies often take a very conservative approach to technology risk.

PTAC’s SME program continued to bridge the gap between SMEs and their potential customers in 2015. PTAC worked with their membership base to identify industry needs and share this information with SMEs so that they could better align their products with consumer demand. Likewise, PTAC worked with operating companies and producers to raise awareness of emerging SME technologies and help them mitigate financial risk through the PTAC collaborative model. SMEs often face significant barriers moving their technology from the prototype phase into commercial application. Deployment and field testing is a necessary step in this process, but SMEs often struggle to secure funding and sites for field pilot testing. In 2015, the economic downturn further limited available funds for producers and explorers to invest in testing SME technologies. However, PTAC helped SMEs secure alternative funding for testing from Venture Capital firms. PTAC was able to advocate for such investment based on their record facilitating the SME program. PTAC’s position that SMEs who work with PTAC have a much higher chance of success than the average SME firm is buoyed by the historical willingness of producers and explorers to accept operational risks in order to work with PTAC SMEs.

Seven collaborative projects were launched with SMEs in 2015, most of which evolved organically through dialogue rather than resulting from a specific program initiative. PTAC also facilitated several events with support through NRC-IRAP, including 12 Technology Information Sessions where SMEs had an opportunity to showcase their technology and share project opportunities with PTAC members throughout the industry. PTAC also hosted a forum specifically aimed at SMEs that highlighted the support, services, and funding available through the SME program. This event also provided guidance on the best ways to access these services.

PTAC’s work with SMEs, investors, producers and explorers continued to gain momentum, and is effectively shifting prevailing attitudes. There is a growing atmosphere of trust in which explorers and producers feel comfortable discussing challenges and collaborating with SMEs on solutions.
In 2015, PTAC formed the new Tight Oil and Gas Innovation Network (TOGIN) to address growing concerns around multi-stage hydraulic fracturing. The recent combination of horizontal drilling technology and multi-stage hydraulic fracturing has undoubtedly changed the future of North American tight oil and gas reserves. Using this technology, the United States has secured over 100 years of gas supply and positioned itself to surpass Saudi Arabia as the world’s largest oil producer. Prolific production of shale gas using this technology in British Columbia has created new opportunities for the export of Liquefied Natural Gas (LNG), and in Alberta, light oil production has increased as a result of new contributions from tight zones in formations such as the Cardium and Viking plays. Moving east, previously inaccessible tight oil resources have been recovered in Saskatchewan’s Bakken formation. However, alongside the successful production achieved through multi-stage hydraulic fracturing, this technology is raising concern around its environmental impact. Major sources of concern are the high volume of water injected into the well, the long-term effects of chemical additives, and the safe handling of the returned water. Additional concerns have been raised over the possibility of seismic disruption, high GHG emissions, and the impact of vehicular traffic and industrial activity on nearby communities.

The purpose of PTAC’s TOGIN Network is three-fold; to articulate the specific challenges associated with multi-stage hydraulic fracturing, to identify technology solutions, and to develop a technology roadmap showing the best way forward for both industry growth and environmental protection. TOGIN’s vision is to create the lowest environmental footprint possible and minimize negative social impacts while establishing the best economic performance for Tight Oil and Shale Gas operations throughout Western Canada. Numerous organizations have already secured their spot in TOGIN, helping industry by articulating challenges, identifying priorities, and searching for potential solutions. Network participants range from producers and government bodies representing both federal and provincial governments, to service and supply companies, research organizations, and academic institutions.

PTAC’s Phoenix Network continued to grow in 2015. Canadian Natural Resources Ltd. joined the Phoenix Network as an Associate Member. This expanded the Network’s membership to encompass a total of eight senior oil sands members, four of whom are the original founding members Devon Canada, Statoil Canada, Nexen Energy ULC, and Husky Energy, as well as three other current Associate Members, Cenovus Energy, ConocoPhillips Canada and Suncor Energy. In addition, five workshops were held to articulate challenges and identify technology solutions for SAGD Wind Down Strategy, Drilling Accuracy, Sub-Cool Management, Electric Heating, and Non-Condensable Gas Wind Down.

Despite the ebb in the 2015 market, the PTAC collaborative model continued to effectively leverage varied expertise and funding to rapidly move innovative technologies from research to implementation. PTAC launched a record 59 projects in 2015 to address industry challenges in a variety of technology areas. These projects exemplify PTAC’s unique ability to marry the historically competing goals of mitigating environmental impacts and pursuing increased recovery. Ongoing research also continued undeterred, with several in-progress projects reaching exciting milestones. The twenty-seven projects concluded in 2015 provide foundational discoveries from which further research and pilot projects may grow.

**Improve Oil and Gas Recovery**

Although the financial benefits of increased recovery have always been the ultimate goal for industry, the pursuit of such success must be in concert with sound environmental stewardship. Each of the ten projects launched under PTAC’s ‘Improve Oil and Gas Recovery’ Technology Area paid substantial attention to sustainability and reduced environmental impact.

Four ‘Improve Oil and Gas Recovery’ projects were launched in 2015 under the leadership of the newly-formed TOGIN. The ‘Tight Oil and Shale Gas Innovation Roadmap’ project will identify key areas for research and development in tight oil and shale gas, such as methods for reducing the cost of drilling and completions, solutions to high rates of production decline and low resource recovery, water management strategies, mitigation of GHG emissions, and improved market access. In addition to the roadmap, the network also launched the ‘Technology Opportunities in the Unconventional Duvernay Play’ and the ‘Technology Opportunities in the Unconventional Bakken Play’ which will respectively map the present and historical situation of these two unconventional...
plays, identify the challenges and opportunities inherent in potential development scenarios, and propose potential technology solutions. Finally, TOGIN launched the ‘Proppant Surface Treatment and Well Stimulation for Tight Oil and Shale Gas Development’ project that will provide innovative new fracturing techniques for shale gas and tight oil. In this project, the Proppant Surface Treatment and Well Stimulation Treatment are based on a technology developed by 3M Canada. The 3M chemical treatment modifies the surface of sand particles to make them neutral wet, resulting in increased production from the same well and lower environmental intensity. The project builds on previous field tests conducted by 3M partners outside of Canada and two limited western Canadian trials. The objectives of this project are to understand how best to apply and to measure the performance of the 3M chemical treatment technology in PST and WS technologies used for fracturing in shale gas and tight oil. The project will provide a better understanding of the production and environmental benefits of this application in western Canada.

2015 also saw the launch of several projects focussed on technical innovations to improve recovery from Alberta’s oil sands and heavy oil reservoirs. Phase 1 of the ‘Technical and Economic Benefits of Steam and Flue Gas Injection in SAGD Wind Down’ project seeks to minimize the negative impact of a depleted SAGD reservoir on adjacent producing SAGD well pairs. The project will compare alternatives such as gas injection and flue gas to determine the most cost-effective and energy-efficient method of filling in depleted reservoirs. The ‘Oil Sands Drilling and Completions Needs Identification and Technology Scan’ project targets the development of new technologies to extract the significant in situ resources currently left in the ground by existing SAGD technologies. The ‘Enhancements to an Online Steam Analyzer for Thermally Enhanced Heavy Oil Recovery’ project will pilot test a new steam quality meter under development by Luxmux Technology. Finally, the ‘Numerical Modelling of Submerged Combustion Vaporizer Process Application’ project will test a mobile system to convert produced water into high-quality steam and flue gas.

After two years of study, PTAC also successfully completed the ‘Vacuum Insulated Tubing (VIT) Simulation’ project. By using the ANSYS CFD simulator to model eccentric and concentric 3D geometries, this study was able to determine the economic efficiency values of replacing bare tubing with VIT. This study has given industry the most realistic assessment of the economic and environmental benefits of VIT technology to date.

The Phoenix Network wrapped up four projects in 2015. The ‘SAGD Multilateral Junction Project – Phase 1’, and the ‘Non-Condensable Gas SAGD Wind Down Project’ were both launched and completed within the same year. In addition, the ‘Establishing Thermal Communication’ Project and the ‘Jet Drilling Reservoir Barriers Pay’N’Learn’ were also successfully completed.

**Manage Environmental Impacts**

PTAC’s 2015 projects in the ‘Manage Environmental Impacts’ Technology Area clearly reflect a longstanding commitment to mitigating the environmental impact of the Canadian hydrocarbon energy industry. Foremost among these was a project launched in partnership with the United Nations Environmental Programme’s (UNEP) Climate and Clean Air Coalition (CCAC) to accelerate the reduction of methane and black carbon from oil and natural gas. The project measures, maps, and monitors the circumstances of venting and flaring of natural gas rich in volatile organic compounds to identify opportunities to reduce Short-Lived Climate Pollutant (SLCP) emissions and develop related policy tools. A major aspect of this project is the development, demonstration and deployment of emerging Canadian technologies that reduce SLCPs from venting and flaring.
of both combustion emissions and the direct release of methane gas. The second project, ‘Distributed Energy Efficiency Project Platform (DEEPP) Phase 2b’, builds upon the cloud database that was developed in Phase 1 and validated in Phase 2a, and uses the GHG credit and offset expertise of Cap-Op Energy to extend the DEEPP platform and technology to other energy-efficiency technologies selected by industry sponsors.

The ‘Methane Venting Reduction Technologies Study’ was successfully completed in 2015. This project thoroughly evaluated the potential for and feasibility of technologies to reduce methane venting and tank odours from Cold Heavy Oil Production with Sand (CHOPS) sites. Numerous technologies were investigated, but only the Hexa-Cover solution proved a candidate for immediate implementation. However, even this solution provides minimal emission reduction and involves site-specific challenges. Therefore, the study determined that combustion solutions currently remain the best alternative.

Also completed in 2015, PTAC’s ‘Wellsite Abandonment with Eutectic Salt’ Project with Winterhawk Technologies sought to determine if eutectic salt would be a suitable replacement for cement in well abandonment. The study determined that the salt did not demonstrate the necessary properties to be used independently for oil-and-gas-well abandonment applications. However, the salt did demonstrate remarkable properties related to the thermal effects of the high temperature liquid phase that, coupled with a mechanical retainer, demonstrated high potential for use as an effective inner and outer seal system for well abandonment. Therefore, even though the initial trial did not provide the anticipated results, other significant discoveries were made that will inform future pilot projects building on these results.

Improve Value-Added Products

Continuing their multi-year research program for the sustainable development of the Canadian pipeline industry, PTAC’s Pipeline Abandonment Research Steering Committee launched the ‘Cleaning Methods, Standard Pipeline Products List and Detection of Residual Contamination in Abandoned Pipelines’ project. Focused on oil and gas transmission pipelines, this study seeks to determine the effectiveness of mechanical and chemical cleaning methods for pipeline abandonment, and examine methods to detect potential residual contaminants. In addition, the study will review existing federal and provincial abandonment regulations and current industry guidelines.

2015 saw the completion of four projects under the ‘Improve Value-Added Products’ Technology Area. PTAC’s Pipeline Abandonment Research Steering Committee completed both the ‘Frost Heave Effects on Pipeline Exposure Rates’, and the ‘Decomposition of Pipe Coating Materials in Abandoned Pipelines’ Projects in 2015. The former was the first study ever undertaken examining the potential for frost heave to expose abandoned pipeline segments, especially abandoned transmission pipelines in the southern Canadian croplands. The latter study provided analytical models useful to estimate the time to collapse and resulting soil subsidence for abandoned pipelines. The ‘Heavy Metals Extraction Study’ project was both launched and completed within 2015. This project studied the opportunity to recover vanadium and nickel from oil sands gasifier waste. Information about extraction yield and quality, operating costs, and capital investment were obtained, and a preliminary business plan was prepared. The project clearly identified the environmental and value added manufacturing opportunity, as well as the likely path forward for its development, and a list of next steps for possible implementation. Also under the Improve Value-Added Products technology area, PTAC completed the ‘Low Cost InSAR for Oil Sands Steam Chambers Monitoring’ project. This project investigated the potential savings achieved by developing an InSAR service specifically for steam chamber monitoring.

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 2015 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 2015 PTAC facilitated:

- 14 Technology Information Sessions (TISs) attended by more than 500 participants
- 6 forums that attracted more than 450 participants
- 10 workshops that engaged 284 stakeholders in meaningful discussion

[Image of award recipients]
The contemporary Canadian oil and gas sector is driven by technology, and the conventional resource-management mindset informed by the resource-driven economies of the past must evolve to meet today’s challenges. A significant percentage of the world’s unconventional hydrocarbon resources are deposited in Canada, but the reality of low commodity prices, limited market access, and growing emphasis on environmental and social responsibility mean that the successful development and production of these deposits is not an easy task. In 2016 PTAC will launch two major initiatives and several projects to address these challenges.

The ‘Methane Venting and Flaring Initiative’ will combine PTAC’s existing activities with new initiatives into a new overarching program. Through innovation, applied research, and technology development, demonstration, and deployment, this program will aim to economically reduce methane venting and flaring from Western Canadian hydrocarbon activities. The majority of methane emissions in the Alberta hydrocarbon energy sector results from methane venting from crude oil solution gas, methane venting from routine equipment releases and fugitive emissions, methane flaring, and gas migration and surface casing vent flows. The reduction of methane venting and flaring from Western Canadian hydrocarbon development and production activities is critical to the environment, but finding better ways to manage methane emissions will also improve profitability and increase industry’s social license to operate.

PTAC’s ‘Methane Venting and Flaring Initiative’ offers significant environmental, economic, and social benefits to industry and government participants. Foremost, the initiative will significantly reduce air pollutants and GHG emissions through the development and commercialization of existing and emerging technologies. Many of these technologies will be provided by SMEs, and their involvement in PTAC’s ‘Methane Venting and Flaring Initiative’ will strengthen these companies’ financial position, and help create jobs in difficult economic times. Adoption of the newly commercialized technologies by producers will improve efficiency, reduce operating costs, and increase profitability. The initiative will also help producers to develop best practices that economically reduce their environmental footprint. This visible investment in emissions reduction will help maintain oil and gas producers’ social license to operate. The ‘Methane Venting and Flaring Initiative’ will foster connections between industry and government throughout the development process, sharing science and knowledge that provides governments and regulators with the information they need to develop smart policies and regulations for environmental management in the hydrocarbon industry.

PTAC’s second major initiative, the ‘Optimization of Steam Oil Ratio for SAGD Operations’, focusses on increased recovery from Canada’s oil sands and heavy oil resources. The vast oil sands reserves in Northern Alberta and Saskatchewan, and the heavy oil reservoirs shared by both provinces, are among the world’s largest petroleum deposits, but current recovery technologies are unable to extract the majority of the resources. PTAC’s ‘Optimization of Steam Oil Ratio for SAGD Operations’ project aims to improve steam technologies in these two areas, including measuring and optimizing the Steam to oil ratio (SOR). Although cold production of heavy oil is an important segment of the hydrocarbon industry in Western Canada, existing production technologies only achieve 5 to 15 % recovery. The ‘Optimization of Steam Oil Ratio for SAGD Operations’ will explore injecting thermal fluid, such as steam, into heavy oil reservoirs to improve recovery. In the oil sands, the project will investigate the benefits and improved SOR achieved through steam additives such as solvents, surfactants, and others during Steam Assisted Gravity Drainage (SAGD) and Cyclic Steam Stimulation (CSS). In both heavy oil and oil sands production, these new methods will minimize heat losses and improve steam generation efficiency, which may in turn significantly reduce GHG emissions.

Two PTAC projects planned for launch in 2016 under the TEREE committee will investigate the GHG emission reduction and energy efficiency achieved by optimizing Glycol Dehydrators. Glycol dehydrators are used in oil and gas operations as part of the gas treatment process to remove water from natural gas. Removing this water reduces pipeline corrosion, controls hydrate formation, and ensures companies meet pipeline water-content specifications. Most dehydrators are of a standard skid mounted package design, which includes a contactor where the glycol and gas mix, glycol pumps to circulate glycol, a regenerator (boiler) to remove water from the glycol, and an accumulator to store glycol for later use and provide some surge capacity.

The first project, ‘Evaluation of Right Sizing Pumps in Glycol Dehydration Units’, will pilot the use of smaller pumps and evaluate their benefits. Most dehydrators in use today are still gas-driven, as many sites lack affordable access to electricity. The natural gas released from these pumps is either vented, flared, or combusted, giving rise to GHG emissions on site. Optimizing the size of the pumps would reduce the use of natural gas and its environmental impact. In addition, this savings will make more gas available for sale. At locations within central Alberta, participating operators will switch out a 210-15 Kimray gas-driven glycol pump for a smaller 90-15 or 40-15 Kimray pump. Pre- and post-installation metrics for both pumps will be examined. A third party report will summarize the project specifics and metrics analysis of emissions reductions and energy efficiency.

The second project, ‘Analysis and Reporting of a Trial of an Auxiliary Burner System in Glycol Dehydration Units’, will partner with Canadian SME REM Technology to conduct an independent analysis of a pilot project for their Slipstream Dehydrator Technology. The regenerators in current glycol dehydrators emit methane and other hydrocarbons into the atmosphere. The Slipstream Dehydrator
technology uses an auxiliary burner and sophisticated process control to combust the gas and greatly reduce harmful GHG emissions. The analysis will also explore further opportunities for heat recovery and energy efficiency.

PTAC’s TEREE committee will also launch the ‘Near-Zero Emissions Well Site Demonstration Project using Calscan Electric Controls Technology (Calscan by Encana)’ in 2016. This pilot project will field test the Bear Solar Electric Control System, which replaces pneumatic instrumentation and controllers, thereby virtually eliminating the need to use fuel gas or propane. In this project, Encana will install the Calscan equipment at an Alberta well site in its Montney resource play to evaluate performance and costs, and determine the potential for future deployment. Pre and post installation metrics will be examined, and a report summarizing the project results and the performance of the technology will be produced by Encana and shared with industry through PTAC’s TEREE Committee.

2016 will also see the continuation of PTAC’s Artificial Reservoir project. An engineering study completed as Phase 1 in 2014 investigated the value and cost of a physical model facility for heavy oil and bitumen recovery technologies. ‘Artificial Reservoir Phase 2’ will examine the value and cost of an intermediate-scale physical model facility for evaluation of heavy oil and oil sands recovery processes.

In 2016, PTAC’s Phoenix Network is set to create a clearing house encompassing nearly 100 R&D and field test projects that have been completed by Network members. This collection will facilitate sharing technologies and innovation amongst Network collaborators. By sharing innovative projects and the application of new technologies, members will be able to accelerate the pace of improvements both internally and externally across industry operations. Moreover, the Network will launch Phase 2 of both the Multi-Lateral Junction Project, and the SAGD Wind Down project, and will hold workshops that focus on ICD/Liner/DAS/DTS, NCG tests/Foam, Reducing SOR, Pad Design, and “Leaky” Reservoir Options.

Although the economic forecast for 2016 continues to suggest a challenging future for the oil and gas sector, PTAC will continue to learn and adapt to changing industry needs. The initiatives and projects slated for deployment in 2016 underscore the growing importance of minimizing environmental impacts while simultaneously pushing forward with new technologies to increase recovery. Working together with all stakeholders, a more sustainable, more environmentally responsible, more innovative energy industry is within reach, and PTAC is on the leading edge of that transformation. Whatever the future holds, PTAC remains committed to helping Canada become a global hydrocarbon energy technology leader in the most responsible and cost-effective way possible.
Projects or New Project Phases Launched in 2015

PTAC facilitated the launch of 59 new research projects and project phases to address industry challenges. Eleven of these projects were launched in collaboration with SME partners. Forty-one of these projects were launched under the direction of PTAC’s AUPRF Management Committee.

**Improve Oil and Gas Recovery**
- Proppant Surface Treatment and Well Stimulation for Tight Oil and Shale Gas Development
- Oil Sands Drilling and Completions Needs Identification and Technology Scan
- Enhancements to an Online Steam Analyzer for Thermally Enhanced Heavy Oil Recovery
- Numerical Modelling of Submerged Combustion Vaporizer Process Application
- Technical and Economic Benefits of Steam and Flue Gas Injection in SAGD Wind Down Phase 1
- Tight Oil and Shale Gas Innovation Roadmap
- Technology Opportunities in the Unconventional Duvernay Play
- Technology Opportunities in the Unconventional Bakken Play
- Vertical Upracks Pay’N’Learn
- SAGD Multilateral Junction Project Phase 1
- Non-Condensible Gas SAGD Wind Down Project

**Manage Environmental Impacts**
- United Nations Environment Programme Accelerating Methane and Black Carbon Reductions from Oil and Natural Gas Production Project - Component on Technology Demonstration and Evaluation for the Recovery of Hydrocarbon Liquids
- Emissions Reductions and Energy Efficiency in Crude Bitumen and Heavy Oil
- Distributed Energy Efficiency Project Platform Phase 2b
- Novel Water Treatment Technology for Application to Hydraulic Fracturing

**Improve Value-Added Products**
- Cleaning Methods, and Standard Pipeline Products List and Detection of Residual Contamination in Abandoned Pipelines Project
- Heavy Metals Extraction Study

**Small and Medium Enterprises**
- PTAC - National Research Council of Canada Industrial Research Assistance Program for SMEs SME

**AUPRF**
- Development of a Model to Predict Benzene Emissions from Glycol Dehydrators with Condensation Tanks: Project Continuation
- Potential Release into the Atmosphere of Additives used in the Hydraulic Fracturing Process
- Literature Review: Use & Environmental Impact of Amines
- Developing a Stand-Off (Non-Intrusive) Stack Testing Technology
- Investigation of Potential Emission Trade-Offs among Flare Efficiency, NOx, and Particulate Matter Emissions
- Pneumatic Pump Alternatives for Cold Weather
- Flaring Cost-Benefit Analysis
- Heavy Oil Odour Management Technology and Best Practices
- PM2.5 Emissions Test Program and Emission Factor Development
- Does Recovering Linear Features Increase Functional Habitat for Caribou?
- Assessing the Role of Grizzly Bears in the Decline of Woodland Caribou
- White-tailed Deer in Alberta’s Boreal Forest: Population Density, Resource Selection, and Occupancy in Relation to Industrial Landscape Features
- Efficient Monitoring of Wildlife Responses to Seismic Line Restoration in the Algar Habitat Restoration Program
- Removing the Wellsite Footprint Phase II: Wetland Reclamation
- Caribou Behaviour and Calving Success in Relation to Oil and Gas Development: Are all Disturbances Created Equal?
- Caribou Range Restoration Project Treatment Sites: 9 to 13 Year Follow-up Monitoring in the Little Smoky Caribou Range
- Assessing Disease Prevalence and Caribou Health in West-Central and Northwestern Alberta
- Moose and Predator Numerical Response to Anthropogenic Features
- Do Oil and Gas Activities and Access Control Measures Affect the Distribution, Abundance and Movements of Grizzly Bears?
- Assessing Peatland Restoration Success to Meet Alberta’s Peatland Reclamation Criteria
- Background Metals Database
- Regulatory Follow-up for Subsoil SAR SST Implementation
- Soil Quality Guidelines for Selected Trace Metals
- Development of a Chloride Water Quality Guideline Based on Hardness and Consideration for Cation Toxicity
- Development of EcoContact Soil Selenium Guidelines
- Field Validations of the F2:F3b Ratio and BOC-adjusted PHC F3 Calculation for Resolving False Detections of Crude Oil and Diesel Petroleum Hydrocarbons in Clean Soils
- Salt-Affected Wellsite Closure
- Salt-Affected Wellsite Closure (Part B)
- Regulatory Follow-up for Boron Guideline Finalization
- Soil & Groundwater Project Review and Categorization
- Consolidation of Existing Groundwater Quality Data Collected in Western Canadian Sedimentary Basin
- Develop Tool to Complete Environmental Net Effects (ENE) Assessment of Water Source Alternatives for Unconventional Gas
- Developing Scope for Treatment technology pilot.
- Set Protocols for Sustainable Withdrawal from Lakes.
- Identify Regulatory Challenges for Re-Using Produced Water and Flowback in Albertas.
- Catalog and Reconcile Water Usage Information from the Available Sources in Western Canada
- Performance analysis of Engineered Liner Systems Used to Store Saline Fluids in the Canadian Oil and Gas Industry: Physical and Environmental Influences
- Consortium for Permafrost Ecosystems in Transition
- Western Canada Forum and Select Projects
- Investigate the Potential for Surface Casing Vent Flow/ Groundwater Migration Issues
- Surface Casing Vent Flow Impacts on Groundwater
Technical Steering Committees

In 2015, PTAC facilitated 25 Technical Steering Committees

Manage Environmental Impacts

- Air Research Planning Committee (ARPC)
- Soil and Groundwater Research Committee (SGRC)
- Ecological Research Planning Committee (ERPC)
- Well Abandonment Research Initiative Committee (WARI)
- Water Innovation Planning Committee (WIPC)
- Tight Oil and Gas Innovation Network Water Management (TOGIN-WM)
- Tight Oil and Gas Innovation Network Greenhouse Gas and Air Emissions (TOGIN-GGAE)
- Technology Opportunities in the Unconventional Duvernay Play Steering Committee (DSSC)
- Technology Opportunities in the Unconventional Bakken Play Steering Committee (BSSC)
- Methane Venting Reductions Study Committee (MVRC)
- Technology for Emission Reduction and Eco-Efficiency Steering Committee (TEREE)
- Distributed Energy Efficiency Projects Platform Steering Committee (DEEPP)
- AUPRF Management Committee (AUPRF)
- Wellsite Abandonment with Eutectic Salts Project Committee (WAESC)

Improve Oil and Gas Recovery

- Tight Oil and Gas Innovation Network Steering Committee (TOGIN)
- Tight Oil and Gas Innovation Network Sustainable Production (TOGIN-SP)
- Artificial Reservoir Project Steering Committee (ARPSC)
- Froth Treatment Consortium (FTC)
- Vacuum-Insulated Tubing Project Committee (VITC)
- Phoenix Network (PHN)

Reduce Capital, Operating, and G&A Costs

- Airborne Microseep Mapping Steering Committee (AMMSC)

Improve Value-Added Products

- Geospatial Data Visualization Project Committee (GDVC)
- Pipeline Abandonment Research Steering Committee (PARSC)
- Low Cost InSAR Project Committee (LCIC)

Small and Medium Enterprises

- SME Innovation and Technology Commercialization in the Hydrocarbon Industry (SITC)
Member Services

PTAC offers members a variety of opportunities to become involved in innovation, research, and development, demonstration, and deployment initiatives that 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. PTAC may also provide up to 15% seed money to help move projects forward.

Connecting Technology Information Sessions
As a service to members, PTAC facilitates Technology Information Sessions (TISs) for interested companies. TISs offer member companies an opportunity to present new 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 consist of PTAC members representing various industry sectors, governments, and non-governmental organizations. These technical steering committees work to identify opportunities for collaborative research and technology development, raise awareness of existing research and technology through planning events, find solutions to challenges through the process of soliciting proposals and launching new projects, and promote involvement by informing appropriate colleagues of Technical Steering Committee activities.

Communicating Streamlined Communications
PTAC’s streamlined communications strategy has reduced the number of broad email blasts being sent to our members by replacing individual event notifications with an opt-in bi-monthly newsletter. This electronic publication highlights current PTAC project opportunities, new technologies, member news, upcoming events, and other initiatives addressing current industry current trends and needs.
Board of Directors (As at December 31, 2015)

David 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
Brian Doucette, Director - Environmental Excellence, Suncor
Mike Ekelund, ADM and Strategic Initiatives / Resource Revenue and Operations Division, Alberta Energy
Jim Ellis, President and CEO, Alberta Energy Regulator
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
Jonathan Matthews, Director - Tailings EPA, COSIA
Dan McFadyen, Independent Director
Ken Putt, Independent Director
Joy Romero, Vice President, Technology & Innovation, Canadian Natural Resources Ltd.
William Rosehart, Dean - Schulich School of Engineering, University of Calgary
Randy Rudolph, Principal, Millennium EMS Solutions Ltd.
Laurier Schramm, President and Chief Executive Officer, Saskatchewan Research Council
Kevin Stashin, President and CEO, NAL Resources Management Ltd.
Murray Todd, President and CEO, Todd Resources

Volunteer Recognition Awards

2014 Service Awards (Presented at 2015 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
Devon Canada Corporation

President’s Award for Leadership in Collaborative Research and Development
The Phoenix Network
• Nexen Energy ULC
• Statoil Canada Ltd.
• Devon Canada Corporation
• Husky Energy Inc.

Collaborative Spirit
The Phoenix Network Working Group
• Lars Hinrichs, Devon Canada Corporation
• Larry Frederick, Husky Energy Inc.
• Serene Cheung, Statoil Canada Ltd.
• Aurelie Lagisquet, Statoil Canada Ltd.
• Dan Giesbrecht, Nexen Energy ULC

Chairperson’s Award
• Mike Ekelund, Alberta Energy
• Kevin Stashin, NAL Resources Management Ltd.

Air Quality R&D Leadership Award
Koray Onder, ConocoPhillips Canada

Ecological Research Leadership Award
Shane Patterson, Alberta Innovation and Advanced Education

Soil and Groundwater Research Leadership Award
Tony Knafla, Equilibrium Environmental

Water Innovation Leadership Award
Bill Berzins, K’nowbe

Eco-Efficiency Leadership Award
Scott Hoiland, Devon Canada Corporation

Commercializing of SME Technology Award
Cap-Op Energy Inc.

Outstanding Service Award
Ole Mrklas, ConocoPhillips Canada

Distinguished Service Award
• Chuck Szmurlo, Enbridge
• Mike Scribner, ConocoPhillips Canada
• Jerry Keller, Alberta Environment and Parks
• Mark Sombach, Cenovus Energy Inc.
Committee Volunteers

- David Acton, Husky Energy Inc. (TOGIN, TOGIN-WM)
- Joshua Anhalt, Green Path Energy (TEREE)
- Jarred Anstett, Progress Energy (WIPC)
- Darren Anweiler, Saskatchewan Research Council (TOGIN-WM)
- Renato Araujo, Enerplus Corporation (TEREE)
- James Armstrong, Encana Corporation (TOGIN, TOGIN-WM, WIPC)
- Caroline Bamphylde, Alberta Environment and Parks (ERPC)
- Carol Barsky, Canadian Association of Petroleum Producers (CAPP) (ERPC)
- Marek Barthomowicz, Husky Energy Inc. (TOGIN, TOGIN-WM, TOGIN-SP)
- James Beck, Suncor Energy Inc. (ARPC)
- Matt Beck, Husky Energy Inc. (TEREE, DEEPP)
- Asfaw Belele, Imperial Oil Resources (SGRC)
- Bill Berzins, Fossil Water/Knowbe (TOGIN-WM)
- Michael Bevan, Alberta Energy Regulator (WARD, WIPC)
- Drew Black, Canadian Federation of Agriculture (PARSC)
- Mark Bohm, Suncor Energy Inc. (TEREE)
- Greg Boser, zEroCor Tubulars (VITC)
- Isabelle Boulfard, Union of Agricultural Producers of Quebec (PARSC)
- Mark Boulton, Suncor Energy Inc. (ERPC)
- Ken Bradley, Sky Hunter (AMMSC, GDVC)
- Don Brick, Spartan Controls (DEEPP)
- Stephen Bromley, Husky Energy Inc. (AUPRF, SGRC, WARD)
- Juliana Buenidua, Ferus (TEREE, TOGIN-WM)
- Andy Byers, ANSYS, Inc. (VITC)
- James Callendar, Encana Corporation (TEREE)
- Jessica Campbell, Blue Source Canada ULC (TEREE)
- Kelly Campbell, Devon Canada Corporation (DEEPP)
- Ayan Chakraborty, Imperial Oil Resources Ltd. (SGRC, WARD)
- Yvan Champagne, Blue Source Canada ULC (TEREE)
- Serene Cheung, Statoil Canada Ltd. (PHN)
- Todd Cole, MEG Energy Corp. (TEREE)
- Deanna Cottrell, Shell Canada (WARI, WIPC)
- Mike Crabtree, Saskatchewan Research Council (TOGIN-SP, BSSC)
- Cathy Crawford, Devon Canada Corporation (DEEPP)
- Hans Custers, Alberta Department of Energy (TOGIN, TOGIN-WM)
- Burt Daniels, Suncor Energy Inc. (TEREE)
- Kumud Deka, Independent (TOGIN-WM)
- Sasha Desjardins, Alberta Energy Regulator (SGRC)
- Aleena Dewji, Blue Source Canada ULC (TEREE)
- Gur Dhaliwal, Alberta Department of Energy (ARPC, TEREE)
- Nadine Diner, British Columbia Innovation Council (TOGIN-WM)
- Gordon Dinwoodie, Alberta Environment and Parks (SGRC)
- Tomica Divic, British Columbia Innovation Council (TOGIN-WM)
- Mike Dixon, Alberta WaterSMART (TOGIN-WM)
- Luong Doan, Japan Canada Oil Sands Ltd. (ARPC)
- Randy Dobloko, Alberta Environment and Parks (ARPC)
- Richard Dollighan, Natural Resources Canada (TEREE)
- Cam Dowler, Spartan Controls (TEREE, DEEPP)
- Keith Driver, The Prasino Group (DEEPP)
- Russ Duncan, Sky Hunter (AMMSC, GDVC)
- Carol Engstrom, Husky Energy Inc. (ERPC)
- Matthew Fallen, Devon Canada Corporation (PHN)
- Monireh Faramarzi, University of Alberta (TOGIN-WM)
- Hamid Farid, Devon Canada Corporation (VITC)
- Mark Fawcett, Sky Hunter (AMMSC, GDVC)
- Jon Fennell, Integrated Sustainability (TOGIN-WM)
- Allison Fisher, Shell Canada (ARPC)
- Natalia Fomina, National Research Council Industrial Research Assistance Program (SITC)
- Terry Frank, Greatario Covers Inc. (TEREE)
- Glen Fraser, Penn West (TOGIN, TOGIN-WM)
- Larry Frederick, Husky Energy Inc. (PHN)
- Neil Fricke, Worley Parsons (TOGIN-WM)
- Sarah Fulton, Husky Energy Inc. (TOGIN, TOGIN-WM, ERPC, WIPC)
- Mike Gatens, UGR Blair Creek Ltd. (TOGIN, TOGIN-WM)
- Dan Giesbrecht, Nexen Energy ULC (PHN)
- Mark Giesbrecht, Devon Canada Corporation (GDVC)
- Geoff Gorrie, ANSYS, Inc. (VITC)
- Greg Goss, University of Alberta (TOGIN-WM)
- Chris Grant, Fort Hills Energy L P by its operator Suncor Energy Operating Inc. (FTC)
- Roy Graves, TransCanada Pipelines (PARSC)
- Bruce Greenfield, Alberta Energy Regulator (ERPC)
- Scott Grimdal, ConocoPhillips Canada (AUPRF, ERPC)
- Rodney Guest, Suncor Energy Inc. (WIPC)
- Anil Gupta, Alberta Environment and Parks (WIPC)
- Subodh Gupta, Cenovus Energy Inc. (ARPC)
- Todd Halladay, Canadian Natural Resources Limited (TEREE)
- Gerry Hampshire, Cavalier Energy Inc. (VITC)
- Tim Hazlett, Alberta Economic Development and Trade (TOGIN, TOGIN-WM)
- Jackson Hegland, ARC Resources Ltd. (TEREE)
- Gregory Henderson, Encana Corporation (TOGIN, TOGIN-WM)
- Phil Henderson, Athabasca Oil Corporation (VITC)
- Owen Henshaw, Husky Energy Inc. (TEREE, MVRSC)
- Sean Hiebert, ConocoPhillips Canada (TEREE, DEEPP)
- Shannon Hiebert, Husky Energy Inc. (DEEPP)
- Scott Hillier, ConocoPhillips Canada (TOGIN, TOGIN-WM, AUPRF, WIPC)
- Lars Hinniks, Devon Canada Corporation (VITC, AMMSC, GDVC, LCIC)
• Trina Hoffarth, Enerplus Corporation (TEREE)
• Scott Hoiland, Devon Canada Corporation (TEREE, DEEPP)
• Christopher Holly, Alberta Department of Energy (TEREE, TOGIN, TOGIN-WM)
• Beckly Horvath, Talisman Energy/Repsol (TOGIN, TOGIN-WM, WIPC)
• Jane Humberstone, Alberta Economic Development and Trade (TOGIN, TOGIN-WM, TOGIN-SP)
• Eddy Isaacs, Alberta Innovates – Energy and Environment Solutions (TOGIN, TOGIN-WM)
• Sreelumar Janardhan, Suez North America (TOGIN-WEM)
• Paul Jiapizian, Environment Canada (TEREE)
• John Jochen, UGR Blair Creek Ltd. (TOGIN, TOGIN-WM)
• Marie Johnson, Progress Energy (WIPC)
• Arvinder Kainth, National Research Council Industrial Research Assistance Program (SITC)
• Mark Kapfer, LOOKNorth (AMMSC, GDVC, LCIC)
• Kim Kasperski, CANMET (FTC)
• Oksana Kielbasinski, Integrated Sustainability (TOGIN, TOGIN-WM)
• Erin Kempin, Husky Energy Inc. (WARI, WIPC)
• Nathan King, Devon Canada Corporation (TEREE, MVRC)
• Brad Komishke, TECK Resources (FTC)
• Tara Koomen, Encana Corporation (AUPRF)
• Prit Kotecha, Suncor Energy Inc. (SGRC)
• Jim Kresta, Syncrude Canada (FTC)
• Milos Krnjaja, Cenovus Energy Inc. (DEEPP)
• Steve Kullman, Husky Energy Inc. (SGRC)
• Dale Kunz, Winterhawk Technologies Ltd. (WAESC)
• Aurelie Lagisquet, Statoil Canada Ltd. (PHN)
• Rajan Lall, Kinder Morgan (PARSC)
• Logan Leduc, Environment Canada (TEREE)
• Jaelin Lee, Husky Energy Inc. (GDVC)
• Brian Lemoine, Imperial Oil Ltd (WARI)
• Shengan Li, Cenovus Energy Inc. (TEREE)
• Vicki Lightbown, Alberta Innovates – Energy and Environment Solutions (MVRC)
• Ian Lockley, ANSYS, Inc. (VITC)
• Stuart Lunn, Imperial Oil Ltd. (SGRC)
• Peng Luo, Saskatchewan Research Council (TOGIN-SP)
• Jiacson Luong, Devon Canada Corporation (GDVC)
• Lily Ma, ATCO Energy Solutions (TOGIN, TOGIN-WM)
• Fern Maas, Enerplus Corporation (TEREE, TOGIN, TOGIN-WM)
• Richard MacDonald, Higher Ground Consulting (TOGIN-WM)
• Lucyna Mackay, Statoil Canada Ltd. (WIPC)
• Martin Mader, Alberta Department of Energy (TOGIN, TOGIN-WM, DSSC, MVRC)
• Waseem Mahmood, Alberta Department of Energy (TEREE)

• Robert Martens, Taqa North (DEEPP)
• Paul Martin, ConocoPhillips Canada (WIPC)
• Todd Martin, Encana Corporation (ERPC)
• Magdalena Mateuszczyk, Alberta Economic Development and Trade (TOGIN, TOGIN-WM, DSSC)
• Barb McCarthy, Husky Energy Inc. (AMMSC, GDVC)
• Adam McConnell, Progress Energy (TOGIN-WM)
• Darin McCollum, Kentowbe (TOGIN-WM)
• Dusty McKinnon, Easwara (TOGIN-WM)
• Mikaela McQuade, Canadian Association of Petroleum Producers (ARPC)
• Aaron Miller, Canadian Association of Petroleum Producers (SGRC)
• Jessica Mitchell, Blue Source Canada ULC (TEREE)
• Agata Nowak, MEG Energy (WIPC)
• Devin Ollenberger, Suncor Energy Inc. (AMMSC)
• Filiz Onder, Encana Corporation (ARPC)
• Koray Onder, ConocoPhillips Canada (ARPC)
• Elaine Pacheco, Canadian Energy Pipeline Association (CEPA) (PARSC)
• Gerald Palanca, Alberta Energy Regulator (ARPC)
• Shane Patterson, Alberta Environment and Parks (TOGIN, TOGIN-WM, TOGIN-SP, ERPC)
• Tara Paynter, Saskatchewan Research Council (TOGIN-WM, TOGIN-SP, BSSC)
• Bruce Peachey, New Paradigm Engineering Ltd. (TOGIN-WM, TOGIN-SP, DSSC)
• Erin Peachey, Encana Corporation (ERPC)
• Maureen Pelletier, Suncor Energy Inc. (TEREE)
• Alan Pentney, National Energy Board (PARSC)
• Rick Phaneuf, Alberta Environment and Parks (TEREE)
• Oleg Podporin, Alberta Environment and Parks (TOGIN, TOGIN-WM, WIPC)
• Daniel Pollard, Alberta Energy Regulator (SGRC)
• Jessica Poupore, Environment Canada (TEREE)
• Rob Power, Alliance Pipeline (PARS)
• Ron Quick, NRC-IRAP (SITC)
• Aileen Raphael, Taqa North (DEEPP)
• Murray Reynolds, Ferus (TEREE)
• Alan Roberts, Husky Energy Inc. (TOGIN, TOGIN-WM)
• Mark Robin, ARC Resources Ltd. (WIPC)
• Joy Romero, Canadian Natural Resources Ltd. (FTC)
• Brian Ross, Nexen Energy ULC (ARPC, TEREE)
• Paul Rutherford, Athabasca Oil Corporation (TEREE)
• David Ryan, Natural Resources Canada (TOGIN, TOGIN-WM)
• Reea Sangha, Environment Canada (TEREE)
• Jennifer Saldana, Husky Energy Inc. (WIPC)
• Mahendra Samaroo, Alberta Department of Energy (TOGIN, TOGIN-WM, DSSC, MVR, WAESC)
• Reea Sangha, Environment Canada (TEREE)
• Adam Schink, ConocoPhillips Canada (DEEPP)
• Jerry Scoular (TEREE, DEEPP)
• Jennifer Shalagan, Husky Energy (ERPC)
• Tera Shandro, Imperial Oil (FTC)
• Sherry Sian, Canadian Association of Petroleum Producers (AUPRF)
• Surindar Singh, Alberta Innovates – Energy and Environment Solutions (TEREE)
• Apoorv Sinha, zEnCor Tubulars (VITC)
• Dale Smith, Blue Source Canada ULC (TEREE)
• Jonathan Smith, Blue Source Canada ULC (TEREE)
• Scott Smith, Cenovus Energy Inc. (TEREE)
• Mark Sombach, Cenovus Energy Inc. (AMMSC, GDVC, LCIC)
• Mick Somerwil, Quicksilver Resources Canada Inc. (TOGIN, TOGIN-WM)
• Jim Spangelo, Alberta Energy Regulator (TEREE)
• Peter Stapleton, Shell Canada (FTC)
• Hilary Steinbach, Canadian Natural Resources Limited (TOGIN, TOGIN-WM)
• Lindsay Stephens, Encana Corporation (TOGIN, TOGIN-WM, ARPC, AUPRF, WIPC)
• Craig Strand, Suncor Energy Inc. (FTC)
• Mark Summers, Alberta Innovates – Energy and Environment Solutions (TEREE)
• Debbie Tainton, Canadian Natural Resources Limited (SGRC)
• Andrews Takyi, Matrix Solutions (TOGIN-WM)
• Giani Talinga, Penn West (TOGIN, TOGIN-WM, WIPC)
• Blair Temple, Imperial Oil (VITC)
• Subhayan Guha Thakurta, General Electric (TOGIN-WM)
• Jonathan Toews, Independent (TOGIN-WM)
• Mike Truzak, Enerplus Corporation (SGRC)
• Bill Tubbs, ICF Canada (TEREE)
• Greg Unrava, Repsol Oil & Gas Canada Inc. (ARPC)
• Sadiq Unwala, Alberta Environment and Parks (TEREE)
• Brian Van Vliet, Spartan Controls (TEREE, DEEPP)
• James Vaughn, Alberta Energy Regulator (ARPC)
• Nick Verinotes, Canadian Natural Resources Ltd. (TEREE, MVRC)
• Shirley Vickers, British Columbia Innovation Council (TOGIN-WM)
• Andrew Vink, Devon Canada Corporation (LCIC)
• Paul Walker, Ground Effects Environmental (TOGIN-WM)
• Trystan Wall, Athabasca Oil Corporation (VITC)
• Steve Wallace, Alberta Environment and Parks (WIPC)
• Stella Wang, Suncor Energy Inc. (ARPC)
• Bill Way, Encana Corporation (TEREE)
• Shawn Williams, Nexen Energy ULC (WIPC)
• Shawn Willerets, ConocoPhillips Canada (SGRC)
• Kate Wilson, Alberta Innovates – Energy and Environment Solutions (TOGIN, TOGIN-WM, DSSC)
• Adam Winter, Cap-Op Energy Inc. (DEEPP)
• Michelle Young, Imperial Oil Ltd. (SGRC)
• Alice Yu, Cenovus Energy Inc. (TEREE)
• Kourosh Zanganeh, Natural Resources Canada (TEREE)
• Emily Zevenhuizen, Integrated Sustainability (TOGIN-WM)
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, 2015 and the statements of operations, changes in net assets and cash flows for the year then ended, and a summary of significant accounting policies and other explanatory information.

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

Auditor’s Responsibility
Our responsibility is to express an opinion on these financial statements based on our audit. We conducted our audit in accordance with Canadian generally accepted auditing standards.

Those standards require that we comply with ethical requirements and plan and perform the audit to obtain reasonable assurance about the preparation of financial statements that are free from material misstatement, whether due to fraud or error.

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, 2015 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
Calvista LLP Professional Accountants

Petroleum Technology Alliance Canada

<p>| Statements of Financial Position (As at December 31, 2015) |</p>
<table>
<thead>
<tr>
<th>ASSETS</th>
<th>2015</th>
<th>2014</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cash &amp; cash equivalents</td>
<td>$4,483,191</td>
<td>$4,133,500</td>
</tr>
<tr>
<td>Restricted cash</td>
<td>4,126,896</td>
<td>1,651,740</td>
</tr>
<tr>
<td>Short term investments</td>
<td>714,936</td>
<td>-</td>
</tr>
<tr>
<td>Goods &amp; services tax recoverable</td>
<td>92,389</td>
<td>-</td>
</tr>
<tr>
<td>Accounts receivable &amp; accrued receivables</td>
<td>2,888,190</td>
<td>1,408,855</td>
</tr>
<tr>
<td>Prepaid expenses</td>
<td>36,915</td>
<td>27,517</td>
</tr>
<tr>
<td><strong>Total Current</strong></td>
<td>$11,629,381</td>
<td>7,938,548</td>
</tr>
<tr>
<td>Property and equipment</td>
<td>8,880</td>
<td>17,143</td>
</tr>
<tr>
<td><strong>Total Assets</strong></td>
<td>$11,638,461</td>
<td>$7,955,691</td>
</tr>
<tr>
<td>LIABILITIES</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Current</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Accounts payable &amp; accrued liabilities</td>
<td>$2,932,358</td>
<td>$1,671,000</td>
</tr>
<tr>
<td>Deferred revenue</td>
<td>8,707</td>
<td>-</td>
</tr>
<tr>
<td>Goods &amp; services tax payable</td>
<td>-</td>
<td>25,739</td>
</tr>
<tr>
<td>Deferred membership revenue</td>
<td>427,812</td>
<td>522,949</td>
</tr>
<tr>
<td><strong>Total Current</strong></td>
<td>3,368,877</td>
<td>1,165,688</td>
</tr>
<tr>
<td>Deferred contributions</td>
<td>4,554,445</td>
<td>3,426,716</td>
</tr>
<tr>
<td><strong>NET ASSETS</strong></td>
<td><strong>4,554,445</strong></td>
<td><strong>3,426,716</strong></td>
</tr>
<tr>
<td>Invested in property &amp; equipment</td>
<td>8,880</td>
<td>17,143</td>
</tr>
<tr>
<td>Internally restricted</td>
<td>2,306,259</td>
<td>1,946,144</td>
</tr>
<tr>
<td>Reserve</td>
<td>1,400,000</td>
<td>1,400,000</td>
</tr>
<tr>
<td><strong>Total NET ASSETS</strong></td>
<td><strong>3,715,139</strong></td>
<td><strong>3,363,287</strong></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>$11,638,461</strong></td>
<td><strong>$7,955,691</strong></td>
</tr>
</tbody>
</table>

| Statements of Operations (As at December 31, 2015) |
|---|---|---|
| REVENUE | 2015 | 2014 |
| Project & service revenue | $6,786,945 | $3,149,688 |
| Membership revenue | 464,608 | 333,882 |
| Event revenue | 311,718 | 240,587 |
| Rental income | 98,631 | 62,974 |
| Interest income | 32,258 | 44,350 |
| Project participation fee | - | 57,233 |
| Miscellaneous income | - | 6,883 |
| **Total REVENUE** | $7,694,160 | $4,097,597 |
| EXPENSES | | |
| Direct project & service costs | 6,249,272 | 2,889,293 |
| Salaries & benefits | 729,152 | 724,482 |
| Rent | 194,478 | 122,317 |
| Direct event costs | 45,900 | 61,927 |
| Office & equipment leases | 24,181 | 23,255 |
| Consulting & professional fees | 20,060 | 33,846 |
| Bad debts | 12,749 | 33,354 |
| Marketing | 11,078 | 19,863 |
| Insurance | 10,149 | 13,489 |
| Training | 9,814 | 8,712 |
| Amortization | 8,263 | 20,092 |
| Printing & publications | 6,468 | 6,317 |
| Volunteer recognition | 6,405 | 6,075 |
| Computer & website | 6,365 | 4,750 |
| Bank charges & credit card discounts | 6,144 | 12,813 |
| Realized/unrealized exchange loss | - | - |
| **Total EXPENSES** | 7,342,308 | 3,780,387 |
| **Excess of revenue over expenses** | $351,852 | $317,010 |
PTAC’s membership was comprised of 184 active members at year-end 2015.

**Producers (22)**
- ARC Resources Ltd.
- Athabasca Oil Corporation
- Brion Energy
- Canadian Natural Resources Ltd.
- Cavalier Energy Inc.
- Cenovus Energy Inc.
- Chevron Canada Resources
- ConocoPhillips Canada
- Devon Canada Corporation
- Encana Corporation
- Enersus Corporation
- Husky Energy Inc.
- Imaginea Energy
- Japan Canada Oil Sands Ltd.
- NAL Resources
- Nexen Energy ULC
- Quicksilver Resources Canada Inc.
- Repsol Oil & Gas Canada Inc. (Formerly Talisman Energy Inc.)
- Statoil Canada Ltd.
- Suncor Energy Inc.
- Sunshine Oilsands Ltd.
- UGR Blair Creek Ltd.

**Government (4)**
- Alberta Innovates – Energy and Environment Solutions
- British Columbia Oil and Gas Commission
- CRA Canada Revenue Agency - Calgary CTSO SR & ED Section
- Saskatchewan Ministry of Energy and Resources

**Individuals (10)**
- Bernard Dumanowski
- Gordon Jolly
- Dwayne Hooper
- Kent Kearns
- Eric Lloyd
- Jerry Melanson
- Ken Putt
- George Rhodey
- Earle Shirley
- Murray Todd

**Learning Institutions (4)**
- Innovation Support at the National Institute for Nanotechnology
- SAIT
- University of Alberta
- University of Calgary

**Research Providers (15)**
- Alberta Innovates – Technology Futures
- Alberta Sulphur Research Ltd.
- ANSYS, Inc.
- BC Research Inc.
- Canada Chemical Corporation
- Canada-Israel Industrial R&D Foundation
- CPI C (PhotonsCanada)
- Foothills Research Institute
- Innovcorps Research Corporation
- Natural Resources Canada
- Priddis Environmental Solutions Ltd.
- PTRC – Petroleum Technology Research Centre
- Saskatchewan Research Council
- TRTech
- zEroCor Tubulars Inc.

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

**Service and Supply (126)**
- 2020 Power Generation
- 3M Canada - Oil and Gas Division
- Abandonrite Enviro Services Corp.
- Absolute Combustion International
- Accenture Ltd.
- Accurata Inc.
- Advanced Flow Technology Inc.
- Advion – Environment
- Agar Canada Corporation Ltd.
- AgriPower Inc.
- Amec Foster Wheeler Environment & Infrastructure
- AMGAS Services Inc.
- ARCADIS Canada Inc.
- ASL Environmental Sciences Inc.
- Aware 360 Ltd.
- Bayshore Petroleum Corp.
- Benchmark Instrumentation & Analytical Services Inc.
- Black Gold Rush Industries
- Blair Air Systems Inc.
- Blue Source Canada ULC
- Boreal Laser Inc.
- Calabria Energy & Environment Ltd.
- Calscan Energy Ltd.
- Canyon Technical Services Ltd.
- Cap-Op Energy Inc.
- Clearstone Engineering Ltd.
- CO₂ Solutions Inc.
- Computer Modelling Group Ltd.
- Core Laboratories Canada Ltd.
- C-Sinc Technologies Ltd.
- Deloitte – Research and Development, Tax
- Easwarra Origins Corp.
- Endeavour Technologies Inc.
- Ensonsoft Technology Corp.
- Ensoft Inc.
- Enertech Environmental, Inc.
- Enviro Vault Canada Ltd.
- Environsoft Products Inc.
- Envirotech Engineering
- Equilibrium Environmental Inc.
- Extreme Telematics Corp.
- Ferus Inc.
- FieldCap
- Foundry Spatial Ltd.
- Fulcrum Environmental Solutions Inc.
- Gas Liquids Engineering Ltd.
- GEM Services
- geoLOGIC Systems Ltd.
- GEOSEIS Inc.
- GHG Solutions Corp.
- Global Analyzer Systems Ltd.
- Globotics Industries Inc.
- Golder Associates
- Gowlings
- Groatario Covers Inc.
- GreenPath Energy Ltd.
- Halliburton – Production Enhancement
- Higher Ground Consulting
- Hydro Pacifics Pumps Inc.
- IBM Canada – Energy Branch
- IFP Technologies (Canada) Inc.
- IHS Global Canada Ltd.
- Ingu Solutions Inc.
- INO
- Integrated Sustainability Consultants Ltd.
- Intelliview Technologies Inc.
- Intelllog Inc.
- Intermap Technologies
- I-Open Technologies Inc.
- ISIT International
- KaiZentLAB Inc.
- Katch Kan Ltd.
- Kenilworth Combustion Ltd.
- Kinetic Ventures
- KPMG High Technology Practice Group
- LiDar Services International Inc.
- LuxMux Technology Corporation
- Matrix Solutions Inc.
- MaxFleet Solutions Ltd.
- MBM Intellectual Property Law
- McCarthy Tetraault LLP – Technology Group
- ME Resource Corp
- M-Flow Technologies Ltd.
- Millennium EMS Solutions Ltd.
- Millennium Stimulation Services
- Nakeyan Environmental Consulting Inc.
- New Paradigm Engineering Ltd.
- Newalta
- Nine Sigma
- Norton Rose Fulbright Canada LLP
- Novus Environmental Inc.
- N-Solv Corporation
- Paradox Access Solutions
- Petrel Robertson Consulting Ltd.
- PetroJet Canada Inc.
- Portfire Associates
- Process Ecology Inc.
- Petroleum Services Association of Canada
- RJ Oil Inc.
- ROSEN Canada Ltd.
- RWDI Air Inc.
- SABZ Consulting Group
- Schlumberger Canada Ltd.
- Silvacom
- Sky Hunter Corporation
- SNC Lavalin – Environment and Water
- SNC Lavalin - Studies and Developmental Projects
- Solstice Canada Corp.
- Spartan Controls Ltd – Efficiency Group
- Star-Ting Incorporated
- Suez North America
- Tangent Design Engineering Ltd.
- Terra Water Systems LP
- Terrapco Group Inc.
- Tetra Tech Inc.
- The Delphi Group
- Total Combustion Inc.
- TSGI – Chartered Accountants
- Tundra Process Solutions Ltd.
- Veolia Water Solutions & Technologies
- Waterline Resources Inc.
- Wave Control Systems Ltd.
- Winterhaw Technologies Ltd.
- Wison Offshore and Marine (Canada)
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