

# Spudding Collaboration

## *PTAC's Role in Canadian Natural Gas Resource Development*

*June 7, 2005*

For publication in the August 2005 edition of the  
*Journal of Canadian Petroleum Technology (JCPT)*

There is no doubting the need to make the development of Canada's natural gas resources more efficient. Once a resource that seemed practically limitless, Canada's conventional natural gas production is suddenly well beyond its peak. The easy gas is going, going, gone. Increasingly, our natural gas is found in difficult-to-produce rock formations requiring special completion, stimulation or production techniques to achieve economic production. On the demand side, gas is gas is gas: it all commands the same market price. But on the supply side, we're counting on economic recovery of natural gas from coal beds, tight sands and organic shales to supplement conventional reserves. Further, we'll be dependent on the viability of natural gas recovery in the harshest of environments: the Mackenzie Delta and the East Coast offshore to name just two.

This challenge lands on our lap at a moment in time when Canadian research, development and demonstration (RD&D) efforts cannot be described as auspicious. Over the years, technology has earned a stellar track record in oil and gas, and Canadians have shown leadership in the deployment of petroleum technology. Our successful development of Alberta's oil sands, and our progress in the Arctic prior to Justice Berger's recommendation of a moratorium on pipeline construction,<sup>i</sup> are two outstanding examples. But since the late 1980s, private and public sector R&D funding, particularly in conventional oil and gas exploration and production, has been in the doldrums. In a period when economic activity in the sector expanded threefold, R&D investment from private and public sources dropped by two-thirds, the victim of several factors including the Western Canada Sedimentary Basin's "harvest" mentality as well as merciless commodity price-driven activity cycles.<sup>ii</sup>

### **Vice-Presidents with a Mission**

Enter a group of industry vice-presidents on a mission. The Vice Presidents Breakfast Club, an informal Calgary-based organization of senior executives from two-dozen oil and gas companies, broached the R&D issue in 1994 and concluded that a new model was required in the Canadian industry.<sup>iii</sup> Believing that technology development would greatly benefit from collaboration, the VPs commissioned a study to examine the topic in detail. One of the day's most respected authorities on exploration and production, Murray Todd, took the pulse of industry and delivered a report highly supportive of collaborative technology development. Wrote Todd: "There is general agreement among the people involved in this study on the principal characteristics of a new collaborative research model. It seems they are looking for a clearing house – some mechanism to determine the needs of the stakeholders, match these with research providers and coordinate the collaboration."<sup>iv</sup>

The Todd Report (1995) engendered a series of events that culminated in the birth of PTAC Petroleum Technology Alliance Canada, whose purpose was "to provide a structure that will bring stakeholders together to identify industry problems and define research projects to deal with them. The objective is to leverage intellectual and financial resources, apply them to solving industry problems and improve industry

performance.”<sup>v</sup> PTAC would set out to replace, through collaboration, what the sector had lost through neglect.

## High Prices Mask Challenges

As far as the gas world is concerned, PTAC arrived in the nick of time. By the mid-1990s, Canada’s natural gas reserves were already in significant decline. Annual production was still rising, but the rate of increase was slowing and would turn negative at the end of the decade. Horizontal drilling and 3-D seismic, technologies arising from the 1980s, were enjoying their heyday with no radical or game-changing technologies in the pipe behind them. New well production rates were falling and first-year decline rates were rising, a teeter-totter effect that with natural gas’s steep price increase in this decade has generated record drilling activity in the basin. Gas, on the one hand, is increasingly valuable and, on the other, no longer nearly as accessible. Becoming more efficient in its development has become critical to sustaining Canadian natural gas production beyond the price-driven drilling derby we are experiencing today.

PTAC signed up 54 members in its first year of operation (1996).<sup>vi</sup> Its first ever collaborative research project (1996) concerned the water content and physical properties of acid gases, a project undertaken in partnership with the University of Calgary.<sup>vii</sup> Other R&D projects related to natural gas in those early years included a field pilot for water abatement in gas reservoirs, software development to improve borehole stability and reduce drilling and completion costs, mitigation of harmonic distortions in oilfield electrical systems, control of water coning in reservoirs, evaluation of coiled tubing serviceability, and optimization of steam generator performance.<sup>viii</sup>

Beyond the realm of natural gas, PTAC was also making a difference. VAPEX, a process involving the injection of vaporized solvents into heavy oil, was 20 years in the lab before entering pre-pilot phase through a series of projects facilitated by PTAC.<sup>ix</sup> Those projects ushered VAPEX into the field with four separate pilot projects. Success attracted rising support. By the turn of the decade, PTAC’s membership had swelled to 124.

## Ideas, Information, People

The year 2000 was seminal for PTAC: in a single year, it almost doubled the number of R&D projects launched in the previous four years.<sup>x</sup> In 2001, PTAC teamed with the Gas Technology Institute (GTI) from Des Plaines, Illinois to create the Calgary-based Technology Centre for Natural Gas, initiated a pilot project on technology transfer to assist producers to find new natural gas technologies, and hosted, in conjunction with the Canadian Coalbed Methane Forum, the world’s largest coalbed methane conference to date.<sup>xi</sup> The partnership with GTI was short-lived (GTI pulled the plug on its Canadian commitment in 2002) but PTAC was spurred to even greater progress: in October 2002, PTAC, in conjunction with the newly constituted Canadian Society for Unconventional Gas (CSUG), hosted the world’s largest unconventional gas and coalbed methane conference and tradeshow.

By 2003, total PTAC-facilitated investment in R&D had surpassed \$100 million, membership had risen to 170 and the collaborative theme was beginning to pay off. Commercial extraction of Canadian natural gas from coal (NGC) was almost non-existent before 2003 but, thanks in part to the interest engendered and information shared at these early conferences, production is expected to be beyond 250 MMcf/day by the end of 2005.<sup>xii</sup> This rapid progress is partly attributable to the experience base previously established south of the border. The aggressive, entrepreneurial business behaviour of several basin producers responding to gas price increases also played a role – not to mention customized solutions generated by the Canadian service sector to facilitate improved recovery of NGC. Underlying the headline winners, however, was the

collaborative groundwork, information exchange and research commitments fostered years earlier. A multitude of incremental advancements had generated a step change.

“With the ever-growing need for these ‘unconventional’ reservoirs, R&D needs to be front and centre for continued growth and prosperity,” says Derek Krivak, VP Operations for Stealth Ventures Ltd., a Calgary-based developer of NGC and shale gas prospects. “There can be no mistaking that PTAC and organizations like PTAC are part of the reason that the NGC industry has moved as fast as it has. They will absolutely play a key role in advancing the shale gas industry.”

## Unlocking the Potential

Canadian production of NGC is now well on its way. Canadian production of tight formation gas – not recognized as unconventional due to definitional differences – may already account for up to one-quarter of the Western Canada Sedimentary Basin’s natural gas production. With the right technology – some of it yet to come – the sky is the limit: Canada’s estimated natural gas resources include more than 700 Tcf in tight sands, more than 860 Tcf in organic shales, and more than 700 Tcf in coals – not to mention gas hydrates which, once unlocked, could dwarf all the rest.<sup>xiii</sup>

In the “Lower 48” states, unconventional gas already accounts for one third of total annual natural gas production, and it is expected by the U.S. National Petroleum Council to be the source of at least half of production by 2025.<sup>xiv</sup> The size of the task of meeting rising demand is not lost on the Americans, who have collaborated over the development of a “technology roadmap for unconventional gas resource exploration and production.<sup>xv</sup> “Every year, the average depth of a well increases, more low-permeability (tight) formations need to be explored, and, overall, wells are smaller in size,” says the GTI’s Kent Perry.<sup>xvi</sup> “All these factors combine to make new technology requirements a strategic component of the gas industry’s future.”

Canada is counting on the bump provided by its own unconventional natural gas resources to offset the inexorable reductions in its conventional gas production, and to help to meet demand that both domestically and internationally only continues to escalate. Challenges lay ahead. Most of Canada’s NGC resource, for example, occurs in the Mannville coals, which to date have defied attempts to generate significant commercial production. New techniques will be required to boost flow rates as well as efficiently manage the production and disposal of saline water. Existing horizontal drilling and completion technologies may need adaptation in order to best fit the characteristics of the coals. Enhanced gas recovery through injection of substances including CO<sub>2</sub> is a compelling prospect with much work remaining to complete. Gas hydrates by best estimates are still at least two decades away from practical reality.

## Marching Down the Collaborative Path

PTAC has been sticking to the collaborative path in an effort to keep the road to the future open. In 2003, on contract to the Alberta Energy Research Institute, PTAC facilitated an investigation into the need for R&D, technology demonstration and accelerated deployment in the industry. Government and industry listened to the resulting recommendations, contained in a report called *Spudding Innovation*; subsequent to the report, royalty reductions for technology investment were announced provincially and a business case focusing on recoverability of the vast amounts of oil and gas in place in the basin was launched, with funding through industry and government.<sup>xvii</sup> *Spudding* provided a badly needed focal point for what is potentially attainable through improved recovery. With more than 100 Tcf of conventional natural gas still in Alberta ground and “unrecoverable” given current economics, technology and geology, the prize is large indeed.<sup>xviii</sup>

Now that society's focus is again sharpening around environmental issues, PTAC has launched a project called Technology for Emission Reduction and Eco-efficiency (TEREE). TEREE aims to facilitate the increased adoption of sustainable, eco-efficient and economical greenhouse gas-reducing technologies in the hydrocarbon energy industry. The project, financially supported by Western Economic Diversification, has already led to several potential advances in "eco-efficiency" technologies and generated a report examining ways to overcome the barriers to greater deployment of environmental technologies in oil and gas. TEREE will point the way for industry to improving the efficiency of oil and gas facilities and, now that Canada is a Kyoto signatory, it may ultimately help the industry profitably meet its carbon-reduction commitments.

Finally, PTAC is spearheading the creation of an "unconventional gas technology roadmap" for Canada, intended to delineate the current state, development challenges and best avenues for technology advancement in NGC, tight gas, share gas and gas hydrates. The effort will complement the technology roadmap developed by New Mexico Tech University and GTI south of the border. The Canadian roadmap, scheduled for completion in 2006, is expected to "galvanize a coordinated and cooperative approach to technology development."<sup>xix</sup> The initiative will afford industry the opportunity to gain consensus on the technical challenges, offer the R&D community support, focus and coordination, and provide, for government, the understanding and context for any decisions it may take to encourage appropriate development of the unconventional resource.

## Backstopping Our Future

Efficiency can be described as the comparison of *production* to associated *cost* – "efficient" natural gas development, as a case in point, results in more of the former, with comparatively less of the latter. Production of Canada's immense gas resources offers huge potential – but only if the technologies, the processes and the policies can be put in place to facilitate economic and sustainable extraction. The future envisioned by PTAC is one of heightened technology development, demonstration and deployment activities accretive to the economics of gas production in the mature basin – a future fueled by entrepreneurial initiative but ably backstopped by the collaborative ethos.

For Canadian natural gas resource development, it's the efficient path.

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<sup>i</sup> An excellent read on our technological advances in the North three decades ago is *Breaking Ice with Finesse: Oil & Gas Exploration in the Canadian Arctic* by Karin Clarke, Cory Hetherington, Chris O'Neil and Jana Zavitz, published by the Arctic Institute of North America, University of Calgary, 1997.

<sup>ii</sup> Deep Blue Associates, *Spudding Innovation: Accelerating Technology Deployment in Natural Gas and Conventional Oil*, PTAC Petroleum Technology Alliance Canada, Calgary, 2003, p 30.

<sup>iii</sup> Todd Resources and Pallister Management, *Petroleum Technology Alliance Canada: The Road to Collaborative Research & Technology Development*, Calgary, April 3, 1996, p 1.

<sup>iv</sup> Todd Resources, *Collaborative Technology Development: Pooling Resources in the Conventional Oil and Gas Industry*, Calgary, March 1995, p 4.

<sup>v</sup> Todd Resources and Pallister Management, 1996, p 2.

<sup>vi</sup> PTAC 1996 Annual Report, Calgary, 1997, p 2.

<sup>vii</sup> PTAC, 1997, p 2.

<sup>viii</sup> PTAC 1997, 1998, 1999 and 2000 Annual Reports.

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<sup>ix</sup> "PTAC VAPEX Pre-Pilots Enable \$30 Million Heavy Oil Pilot Project – DOVAP Technology to Reduce Emissions," PTAC newsletter, Calgary, November 2002. VAPEX is now the subject of a long-term demonstration project undertaken at Dover near Fort McMurray by a multi-company consortium led by Devon Canada.

<sup>x</sup> PTAC 2000 Annual Report, Calgary, 2001, p 2.

<sup>xi</sup> PTAC 2001 Annual Report, Calgary, 2002, p 2.

<sup>xii</sup> Michael Gatens, "Coalbed Methane Development: Practices and Progress in Canada," *Journal of Canadian Petroleum Technology*, Calgary, August 2005.

<sup>xiii</sup> Kin Chow, "Unconventional Gas in Canada: Past, Present, Future, Canadian Society for Unconventional Gas," Presentation at CPANS Conference, Canmore, Alberta, April 12, 2005, p 8.

<sup>xiv</sup> Chow, 2005, p 6.

<sup>xv</sup> Tom Engler and Kent Perry, "Creating a Roadmap for Unconventional Gas R&D," *GasTIPS*, Fall 2002, p 16.

<sup>xvi</sup> "New Mexico Tech University and Gas Technology Institute to Collaborate on Technology Roadmap for Unconventional Gas Resource Exploration and Production," Gas Technology Institute, [www.gastechnology.org](http://www.gastechnology.org), Des Plaines, May 10 2002.

<sup>xvii</sup> Work on the EnergyNet Increased Recovery of Oil and Gas Business Case Project commenced in 2004; it is under preparation through PTAC by Richard Baker of Epic Consulting, Calgary.

<sup>xviii</sup> Deep Blue Associates, 2003, p 22.

<sup>xix</sup> "Unconventional Gas Technology Roadmap Proposal," PTAC Petroleum Technology Alliance Canada, Calgary, April 19, 2005, p 1.