

## WRITTEN STATEMENT

### Submission to the Subcommittee on Energy and Power

### Hearing titled “The American Energy Initiative”

For the March 20, 2012 Hearing on

### The Future of Energy Technology with an Emphasis on Canadian Oil Sands

Eddy Isaacs, Ph.D.

Chief Executive Officer

Alberta Innovates – Energy and Environment Solutions

[Eddy.Isaacs@albertainnovates.ca](mailto:Eddy.Isaacs@albertainnovates.ca)

#### Summary of Major Points

- The global endowment of heavy oil and bitumen is vast and easy to produce conventional sources are declining. The majority of oil producing countries having reached their peak of oil production. Globally, reserves are being replaced by the more difficult to produce resources such as deep offshore, highly waterflooded reservoirs, tight oil and heavy crudes.
- Heavy oil and bituminous resources, bring a unique set of environmental and social challenges: they are hard to extract and sensitive to market and input costs; the sophisticated technologies used to produce these crudes require a skilled labor force; and careful management of environmental issues especially land disturbance, high water use and greenhouse gas emissions is essential.
- Innovation and technology development have been key to reducing costs of commercial deployment of oil sands and in making “**technology oil**”<sup>1</sup> competitive against

---

<sup>1</sup> We have coined the term “technology oil” to describe the products derived from oil sands because technology development has been the key to allow bitumen to be produced at competitive costs.

conventional crudes in world markets. Current oil sand production of about 1.7 million barrels per day is a direct result of sustained investments in technological innovation and decades of “learning by doing.”

- An increasing focus is now devoted to addressing environmental performance - land reclamation, water recycle and reuse, air emissions, increasing the efficiency of operations, reducing the energy intensity of existing processes, carbon capture and storage and switching to next generation technologies.
- Examples of progress made on environmental issues include:
  - Reduced energy demand in many operations, which is resulting in greenhouse gas emissions of bitumen that are approaching those of US domestic and imported crudes; and,
  - Reduced water consumption with high water recycle rates (>90%) being routinely achieved.
- The Alberta government strategies guide the sustainable development of the oil sand resources with innovation and technology as a strategic driver.
- As a provincial government corporation, the mandate of Alberta Innovates – Energy and Environment Solutions (AI-EES) is to reach sustainable goals in delivering the best available energy and environmental solutions to ensure Alberta remains competitive in a low carbon clean energy and clean water economy.
- AI-EES’ balanced portfolio focuses on the key technical, environmental and economic challenges with significant advancements being made through industry-government collaboration and work with international partners.

## **The U.S. and Canada: A History of Innovation without Borders**

The technology used to produce the bitumen from surface mined oil sands was already well understood when J. Howard Pew, the American industrialist and co-founder of Sun Oil Company (Sunoco), drove the development of the first commercial oil sands project. At the

opening ceremonies for the oil sands plant in 1967, Pew told his audience, “No nation can be secure in this atomic age unless it is amply supplied with petroleum... It is the considered opinion of our group that if the North American continent is to produce the oil to meet its requirements in the years ahead, oil from the Athabasca area must of necessity play an important role.”<sup>2</sup> The first years of commercial operations involved overcoming large technological challenges, especially in equipment reliability and process efficiency. But the company persisted despite the hardships and initial failures. Today, Suncor Energy, the successor to the Sun Oil’s oil sands venture, is the largest oil sands producer – currently producing some 300,000 barrels/ day from surface mining and *in situ* operations. Suncor is also the leading Canadian producer of renewable fuels such as ethanol and biodiesel.

**Cyclic steam stimulation** technology to develop *in situ* production in the Cold Lake oil sands region was adapted in the 1980’s and 1990’s from California’s heavy oil production expertise. Today Imperial Oil Ltd. (70% owned by US based ExxonMobil) is one of the largest *in situ* oil sands producers using cyclic steam stimulation. Imperial Oil is also a major partner in Syncrude, the second largest producer of synthetic crude from the oil sands.

The drilling of **horizontal wells** was perfected in Canada and today is used to produce oil in the US and in many operations around the world. On the US side, hydraulic fracturing technology, the ability to initiate multiple fractures from horizontal wells, has provided tremendous advances in our ability to develop natural gas and oil from lower-permeability resources. This technology is responsible for more than a 30% increase in conventional oil production in Alberta in the past year alone.

Considering the potential for oil sands production, production from tight shale oil, unconventional gas and inclusion of Mexico’s petroleum endowment, North American energy self-sufficiency is no longer just a theoretical possibility.

---

<sup>2</sup> Peter McKenzie-Brown, Gordon Jaremko and David Finch, “The great oil age: the petroleum industry in Canada” (1993)

## AI-EES -- Continuing the Collaboration on Innovation

AI-EES was formed as a Provincial Corporation January 1, 2010. AI-EES builds on the successes of the former Alberta Energy Research Institute (operated between 2000 and 2009) and the Alberta Oil Sands Technology and Research Authority (operated between 1975 and 1999). In 2011, the Alberta Water Research Institute was incorporated into AI-EES' operations. Today, AI-EES serves as the research, innovation and technology implementation arm for the Government of Alberta in energy and environment, applying world-class research and innovation management strategies to preserve and enhance Alberta's economic, environmental and social well-being. AI-EES also serves as the technical arm of the Climate Change and Emissions Management Corporation (CCEMC)<sup>3</sup> in providing strategic advice, technology adjudication and project management.

Alberta has a history of great success in achieving 'breakthroughs' in energy research and technology. In all cases these have come about from **strong government/industry partnerships**, based on clear business cases and with well-developed and articulated implementation strategies. The development of Steam Assisted Gravity Drainage that, in the past ten years, has become the leading commercial technology for producing bitumen from the oil sands, serves as an important example of a technology breakthrough based on government-industry collaboration.

In close collaboration with US organizations, AI-EES is working to develop next generation technologies in several areas of oil sands production, upgrading and carbon capture including:

- Harris Corporation - a pilot project to evaluate electromagnetic heating with and without solvent injection to produce oil with a potential for an over 50% reduction in

---

<sup>3</sup> The Climate Change & Emissions Management Corporation is a not-for-profit, independent organization with the mandate to achieve actual and sustainable reductions in greenhouse gas emissions and to assist in adapting to climate change. It is funded through carbon penalties from large emitters.

greenhouse gas emissions. The project involves three oil sand producers and the CCEMC.

- Honeywell UOP - development of a slurry phase upgrading technology based on a process developed by Natural Resources Canada that provides a 25% higher liquid yield than the conventional coking process. The project has involved Statoil Canada, and since November 2011, is available for licensing from Honeywell UOP.
- Pratt & Whitney Rocketdyne - pilot testing of Alberta coal and petroleum coke (a by-product from oil sand upgrading) on a novel compact gasifier, leading to reduced equipment costs, increased fuel production and potential for lower cost carbon capture.
- Air Products - pressure swing absorption technology to purify hydrogen and capture CO<sub>2</sub> from a sour gas stream, replacing the need for solvents in carbon capture from a gasification process.
- Initiating work with the Pacific Northwest National Lab on a study to be jointly conducted with the University of Ottawa on CO<sub>2</sub> capture from flue gas in a micro-structured bed.

In addition to new and transformative technologies needed to ensure long-term sustainable development of the oil sands resources, there is a critical need to focus on emerging innovations to decrease the impact of current technologies on the environment. Examples of environmentally focused projects that showcase collaboration between oil sands producers, academia, AI-EES and other Government of Alberta and Canadian ministries include:

- A technology deployment roadmap and action plan for “end-to-end” solutions for oil sands tailings. With about 100 technologies being evaluated, the study is identifying near term deployment technologies as well promising pathways and gaps for future deployment. The project is significant in achieving knowledge sharing and deployment practices in managing oil sands tailings.
- A study evaluating new and emerging water treating processes to conserve fresh water in oil sands operations. The study involves assessing the impact of increasing thermal *in*

*situ* water recycle and moving toward zero liquid discharge on energy usage, greenhouse gas emissions and waste generation.

- A study to evaluate and understand the effectiveness of silvicultural treatments to speed forest recovery from industrial disturbances caused by, for example, seismic lines in oil sands exploration. This will also involve developing decision-support tools to predict the expected recovery rates of corridors and specifying recommended management actions for each corridor based on restoration needs.
- A study of terrestrial and wetland reclamation of dried fine tailings designed to understand the landform, hydrology and soil placement requirements to support boreal forest ecosystem development.
- A study on nutrient retention requirements in reconstructed soils for reclamation of oil sands mining effected areas. The project is quantifying the nutrient levels in soils in comparison with natural analogs and investigating the impact of fertilization on plant root development to improve landscape design.

## Innovation and Energy Security

Canada and the US are the only developed countries that can dramatically increase oil production – not only from oil sands but from tight shale oil reservoirs (Bakken type) found in North Dakota, Montana, Texas, California and the Canadian provinces of Manitoba, Saskatchewan and Alberta. Energy security for North America, however, implies that energy development and economic competitiveness cannot be separated from environmental protection and social responsibility. To put it in the form of a simple equation:

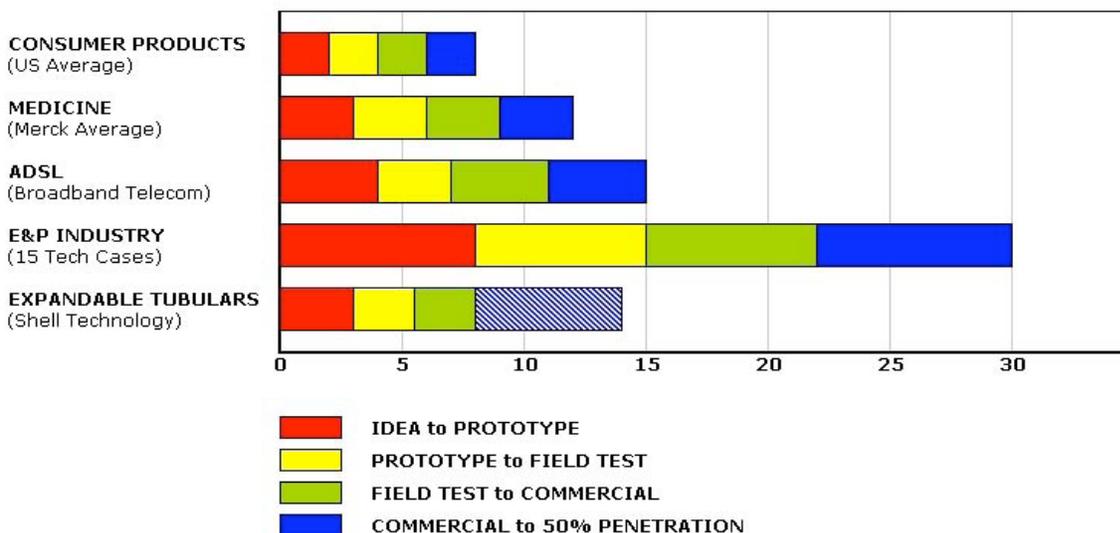
$$\text{Energy Security} = \text{Energy} + \text{Economy} + \text{Environment} + \text{Societal Values}$$

North American energy resources are vast; our economies are heavily dependent on a competitive energy supply; our industry's environmental performance provides the social

license to operate and grow; and societal values determine the cleanliness of our energy system. Technology and innovation is the glue to ensure that energy is “available”, “accessible” “acceptable” and “affordable” or in other words “secure”. Technology development, however, is costly and needs a long lead time to develop, adapt, and implement. Sustained long term investments are, therefore, required for research and innovation.

It takes 20 to 30 years to take an idea from the lab to commercialization (see attached Graph). AI-EES’ raison d’être is to significantly reduce the time lag for innovation. The organizations’ role is to work with industry to reduce the risk of adapting technology, so investments need to be focused and sustained over long periods due to the length of time it takes to bring new technology to market. In the end it is technology that got us here and technology that is the key to achieving environmental targets, “changing the game” and taking us into a more sustainable future.

Figure on time-to-market in years for various industries showing the comparatively longer period for technology commercialization in the oil and gas industry<sup>4</sup>.



<sup>4</sup> Graph developed for Shell by McKinsey, provided courtesy of Petroleum Technology Alliance of Canada (PTAC)