Submission to the Standing Senate Committee on Energy, the Environment, and Natural Resources

November 24, 2016 // John Zhou, Ph.D., P.Geol., Vice President Clean Energy, Alberta Innovates

INTRODUCTION

Alberta Innovates is dedicated to accelerating research and innovation to deliver social, environmental, and economic value to Alberta. Our vision is to be indisputably recognized as a leader – provincially, nationally and internationally – in catalyzing innovation to deliver a resilient and diversified economy, a sustainable environment, and a healthier population.

Clean Energy is one of Alberta Innovates’ three market-centric divisions that are supported by three platform technologies. The Clean Energy division has a proud legacy spanning four decades of innovation.

ENERGY RESOURCE DEVELOPMENT IN A LOW CARBON ECONOMY

The Standing Senate Committee on Energy, the Environment and Natural Resources is examining and reporting on the effects of transitioning to a low carbon economy, as required to meet the Government of Canada’s announced targets for greenhouse gas (GHG) emission reductions. Alberta Innovates’ submission today will focus on the role of energy resources (oil and gas) development in the transition to a low carbon economy.

The Canadian oil and gas sector has long been, and will continue to be a major contributor to the Canadian economy. Low-emission oil and gas production, processing, and consumption must be a priority for Canada in its pursuit of prosperity and global leadership in a low carbon world. The 2016 World Energy Outlook from the International Energy Agency predicts a slow growth in global oil demand, reaching a peak of 103 million barrels per day by 2040. Growth in natural gas demand will be greater. Canadian leadership in low-emission production, processing, and consumption of oil and gas will benefit not only Canada but also the world.
INNOVATION IS THE KEY

The Canadian oil and gas sector is undergoing transition at an unprecedented pace and scale to remain cost and carbon competitive. This transition includes adapting to intense competition for global market share and tackling the challenge to further reduce emissions. Innovation is the key to a successful transition.

Working with its government and private industry partners, Alberta Innovates has developed a portfolio of technologies to help the province achieve its economic development and climate leadership goals. Shown in this figure are those technologies related to the oil and gas industry with a focus on oil sands. All the opportunities are considered in terms of potential economic impact and GHG reduction potential. The potential economic impact and GHG reduction potential figures provide a sense of scale, and are not absolute.

- Advanced Hydrocarbon Recovery technologies include novel oil sands production technologies and methane reduction technologies. As a group, these technologies have the greatest economic value and GHG reduction potential.

- Value Added Processing refers primarily to bitumen partial upgrading (BPU) and natural gas to liquids and chemicals. BPU has a great economic potential and a modest GHG reduction potential.

- Clean Power includes solar, wind, and biomass power, and emerging energy storage and small modular nuclear reactors. Clean power has a great GHG reduction potential and could be an enabler for clean bitumen production.

- Enabling Clean Tech (including digital oilfield, sensor technologies, advanced materials, water treatment, etc.), and Waste to Energy (industry waste heat, municipal wastes, etc.) have modest economic and GHG reduction impacts.

- Bitumen Beyond Combustion (BBC) and CO₂ Utilization are two emerging innovations that can have significant impacts on lowering GHG emissions. BBC could also have significant economic impact. Both programs are at very early stages and success is not guaranteed.

Three specific examples will be used to illustrate how innovation in the oil and gas sector can contribute to a low carbon economy and the accompanying goal of meeting Canada’s emission targets.
**Low Carbon Bitumen Production.** Canada’s oil sands industry has experienced extraordinary growth. Total production has more than doubled from 2005, and reached 2.37 million barrels per day in 2015. While GHG intensity has decreased by 40 per cent from 2005 to 2015, total GHG emissions have increased to 72 Mt CO₂e. Furthermore, the cost of oil sands production is too high to be competitive. To simultaneously reduce production costs and GHG emissions, innovative technologies are required to significantly outperform the incumbent technologies: Clark Hot Water Process (CHWP) for surface mining and Steam Assisted Gravity Drainage (SAGD) for in situ recovery.

Alberta Innovates has been supporting the industry in developing such innovative technologies. Shown in the figure above are technologies that have been deployed, are being demonstrated, are in development, and have been conceived. In particular, a number of solvent-enhanced SAGD and solvent-based technologies promise to reduce GHG emissions by 40 to 80 per cent compared with the SAGD process used today. Using less or no steam, these technologies also promise to significantly reduce total production costs and water usage. Innovation in this area is critical for the oil sands industry to be cost and carbon competitive.

**Bitumen Partial Upgrading (BPU).** Over 60 per cent of Alberta’s bitumen is shipped as diluted bitumen and sold to U.S. refineries at a large discount. The heavy-light differential is as high as $20 Cdn/bbl which shifts profits to refiners. The diluent cost is $10 Cdn/bbl with much of this an unrecoverable cost. Shipping diluent also requires much needed pipeline capacity. For the 40 per cent of bitumen that is converted to synthetic sweet crude (SCO), the production cost and life cycle GHG emissions are high. BPU is the happy medium that can:
• Provide a significant value uplift
• Reduce or eliminate diluent
• Free up pipeline capacity
• Increase market access
• Reduce GHG emissions on life cycle basis.

Alberta Innovates and NRCan have been supporting the industry in developing a number of BPU technologies. A number of technologies are at pilot and field demonstration stages. According to a recent study by the University of Calgary’s School of Public Policy, a 100,000 barrel per day bitumen partial upgrader can generate: $3.54 billion labor income; $13.37 billion GDP; and contribute $2.77 billion in revenue to the federal government and $1.85 billion in revenue to the provincial government - over 20 years (7.5 years construction, and 12.5 years production). BPU can also reduce GHG emissions by up to 20 per cent on a wheel-to-tank (WTT) life cycle basis.

**Bitumen Beyond Combustion (BBC).**

BBC is a new concept for the Canadian energy resources industry. It is a long term strategy for Canadian oil sands. Many believe that oil will hit its peak before or by the middle of this century. Bitumen as a fuel commodity will face even more challenges by then. Through BBC, innovative technologies are sought to make value added materials from bitumen. BBC takes the advantages of the large molecules in bitumen. Hydrogen in bitumen may provide the energy required for the conversion, making the entire value-add process emission free. Alberta Innovates has been working with the Bowman Centre, Cenovus, Shell, and Suncor on this new initiative. The Bowman Centre is working on a plan to build a high performance asphalt plant. Alberta Innovates is also working with the University of Alberta on a technology to make highly valued carbon fiber from asphaltene.

**COLLABORATION AS A STRATEGY**

Alberta Innovates considers collaboration as critical to build a sustainable resource industry in a low carbon economy. In particular, we would like to acknowledge important partnerships with:

• Emissions Reduction Alberta (ERA)
Canada’s Oil Sands Innovation Alliance (COSIA) and its member companies

- Natural Resources Canada (NRCan)
- Sustainable Development Technology Canada (SDTC)
- Universities and entrepreneurs across the country

The transition to a low carbon economy is a national challenge and requires a national effort. Building a low emission, clean energy sector is part of this collaborative national effort. Alberta Innovates is supporting an industry-led Energy Innovation Supercluster submission to Innovation, Science and Economic Development Canada.

RECOMMENDATIONS

To achieve GHG emission targets in a manner that is sustainable, affordable, efficient, equitable and achievable, Alberta Innovates recommends the following:

- Recognize the oil and gas sector as a solution for building a low carbon economy. Canada can neither abandon the largest export industry nor achieve its GHG emission targets without transformation in this sector. The industry is a willing partner and has invested heavily in innovation as noted in the most recent federal Science, Technology and Innovation Council findings. Growing the industry under an emission cap is not only possible but essential.

- Support targeted innovation, investing in areas where it can make the greatest impacts in the short, medium, and long term. In the short term, the Government of Canada should support the industry to demonstrate and deploy new technologies to lower GHG emissions and enhance its competitiveness. For the medium and long term, the Government of Canada should support the development of transformational innovations such as BBC.

- The Government of Canada should continue to encourage collaboration between government institutions, academic institutions, and private companies, and among industry players. The GoC should support on-going collaboration between NRCan and Alberta Innovates, in particular their national programs in Bitumen Partial Upgrading, Non-aqueous Extraction, and Oil Sands Tailings.

- Intellectual property (IP) ownership has been a major barrier to innovation in universities, federal and provincial laboratories, and industry. The GoC should make all its major funding conditional on IP sharing within Canada.

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