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## MASTER OF PUBLIC POLICY CAPSTONE PROJECT

Innovation Policies in Alberta's Oil Sands

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## Capstone Executive Summary

Alberta's oil sands are currently faced with economic and environmental challenges. The oil sands provide economic benefits both to Alberta and to the rest of Canada. However, environmental challenges and rising costs are putting the operation of the oil sands at risk. As this resource is publicly owned, coherent and focused public policies should be put in place to aid the further development of the oil sands.

Through examining current oil sands trends, it becomes apparent that innovation is a promising solution to many of the challenges posed to the oil sands today. Increased productivity is mainly the result of innovation. Further, technological innovation has also provided the oil sands with improved environmental records and has provided increased economic efficiencies. Based on the literature available, there is a strong consensus from key players that innovation has a significant role in creating solutions for challenges in the oil sands.

This paper describes governmental programs, and private institutions which promote and support innovation within the oil sands industry. As the oil sands and the significance of innovation, together, are relatively new, academic literature has not addressed this topic. My research indicates that, although there are efforts currently in place policies and programs to foster innovation in this industry, there is certainly room for expanding them. Also because of the lack of publically available evaluation and outcome reports for these policies and programs, it was difficult to determine the impact that each of these initiatives have had.

As this paper was being written, advancements were already being made to the promotion of innovation within Alberta. Earlier this summer, the Alberta Innovation Council was established. It is meant to play a guiding role in Alberta's innovation future and is expected to help create a healthy innovation ecosystem within Alberta. It is with optimism, that I believe this council will help facilitate additional innovation investment within the oil sands. The key recommendations stemming from my research include: increased focus on evaluation of all innovation policies and programs, continued collaboration amongst all key players in the oil sands industry, use regulation and legislation to increase innovation, and improved focus on ways to incentivize innovation. Lastly, increased financial support from the governments should be considered as a support mechanism.

## 1.0 Introduction

Alberta, and more broadly, Canada have both put forward their intention to become global energy ‘superpowers.’ However, much needs to be done to accomplish this audacious goal. Alberta’s energy challenge largely pertains to the competitiveness and social acceptance of its oil and gas industry. Especially in the last couple of years, innovation has received much deserved attention as a potential solution to the many challenges that the energy industry faces in securing a sustainable market for Alberta’s energy products. Improved environmental practices will promote public acceptance of conventional and unconventional oil and gas production in the province. A focus on innovation will also boost competitiveness.

Alberta’s oil sands play an important role in both provincial and national economies. Royalties received from oil sands production during 2012 – 2013 was \$3.56 billion and estimated to accumulate to approximately “\$350 billion in royalties and \$122 billion in provincial and municipal tax revenue in the next 25 years.”<sup>1</sup> Nationally, oil and gas operations employ over 200,000 people, and expected to increase to 500,000 in the next couple decades.<sup>2</sup> Evidently, the success of the oil sands will inevitably contribute and support stronger economies for both Alberta and the rest of Canada. For this reason, the governments of Alberta and Canada should adopt policies and programs to support innovation in the oil sands industry to ensure economic and environmental sustainability.

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<sup>1</sup> "Alberta's Oil Sands Economic Benefits." Alberta's Oil Sands Economic Benefits.  
<http://oilsands.alberta.ca/economicinvestment.html> Accessed July 14, 2014.

<sup>2</sup> Ibid.

This paper will focus on the innovation policies related to the oil sands development. It will provide a brief overview of the oil and gas sector in addition to the innovation landscape in Alberta and Canada. This includes analysis of current governmental policies which are geared towards achieving greater innovation performance in the oil and gas sector. Private sector institutions focused on supporting innovation in the oil sands will also be discussed. The oil sands industry is facing many challenges—industry and government must recognize the need to create strategies which place innovation as a priority. Public policy certainly has an opportunity to play a significant role in promoting innovation. There are several public policy tools which can be used to further innovation success. Some of the public policy instruments may include: regulatory functions, funding priorities, policy development and implementation, and legislative decisions. To conclude, recommendations and final thoughts will touch on the ways in which public policies can be leveraged to promote and incentivize innovation.

### **1.1 Overview of Innovation in Alberta and Canada**

Labour productivity is measured as output generated per hour worked.<sup>3</sup> Innovation has been often linked to productivity, the main long-run determinant of a country's living standards.<sup>4</sup> When productivity levels are high and growing, the citizens living in that particular country should experience an improved standard of living.<sup>5</sup> Innovation, as defined by Peter Nicholson, is a new and better way of doing something and creating better processes through gaining increased

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<sup>3</sup> "Labour Productivity Growth." Labour Productivity: Measuring Productivity in Canada. Accessed June 2014.

<sup>4</sup> Peter Nicholson, "Innovation and Business Strategy: Why Canada Falls Short," International Productivity Monitor (Spring 2009),

<sup>5</sup> "Labour Productivity Growth." Labour Productivity: Measuring Productivity in Canada. Accessed June 2014.

value from available resources.<sup>6</sup> Innovation promotes productivity growth because either processes are made more efficient, or new products are developed to open up new markets. With intense global competition, increasing labour productivity is paramount to maintaining a strong economy.

With Canada's aging population, innovation will be the key to resolving future labour market challenges by increasing productivity to help sustain our high standard levels of living. Much research and literature has indicated that Canada has lagged in terms of productivity level and growth.<sup>7</sup> Average productivity in Canada falls behind the USA, our biggest trading partner, by an astonishing 18%,<sup>8</sup> resulting in lower Canadian living standards.<sup>9</sup> Lack of innovation has been pegged as one of the main reasons why Canada has struggled to achieve high productivity levels. Internationally, Canada does not do much better. In regards to ability to innovate, Canada ranks below average beside other developed countries.<sup>10</sup> Much literature has focused on this issue. It has been found that R&D activity levels are strongly correlated innovation which results in increased productivity and growth of firms.<sup>11</sup> R&D engagement as a mean to innovation is

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<sup>6</sup> Peter Nicholson, "Innovation and Business Strategy: Why Canada Falls Short," International Productivity Monitor (Spring 2009), Page 51.

<sup>7</sup> Ibid.

<sup>8</sup> Dan Herman and Anthony D. Williams, "Driving Canadian Growth and Innovation – Five Challenges Holding Back Small and Medium- Sized Enterprises in Canada," Deep Centre – Centre for Digital Entrepreneurship + Economic Performance, (May 2013), Page 5.

<sup>9</sup> Richard Harris, "Canada's R&D Deficit – And How to Fix it: Removing the Roadblocks," C.D. Howe Institute, (C.D. Howe Institute Commentary No. 211, May 2005), Page 3.

<sup>10</sup> Mark Parsons, "Rewarding Innovation: Improving Federal Tax Support for Business R&D in Canada," C.D. Howe Institute, (C.D. Howe Institute Commentary No. 334, (September 2011)Page 1

<sup>11</sup> Herman and Williams, "Driving Canadian Growth," Page 9, AND Parsons, "Rewarding Innovation," Page 2 AND Harris, "Canada's R&D Deficit," Page 3.

significant, although there are various other factors that are crucial to the overall success of increasing productivity and overall innovation.

Alberta, based on 2012 numbers, boasts the highest productivity level in Canada with \$68.50 of output per hour of labour input, while the national average is \$47.50 per hour.<sup>12</sup> Statistics Canada numbers illustrate that Alberta's productivity levels were almost 50% higher than the Canadian average and Alberta was third highest in productivity growth.<sup>13</sup> Because of the investment that has occurred in the oil and gas industries, the general perception may be one that the industry has a high productivity growth rate. However, this is not the case; the industry has not performed well by the conventional productivity growth measure, multi-factor productivity (MFP) growth. Alberta's oil and gas industry ranks low, in terms of MFP growth, at -6.2% during 2007 – 2012<sup>14</sup>. Declining productivity has been a characteristic of the oil and gas industry for quite some time.<sup>15</sup> However, the traditional method of calculating productivity growth may not correctly reflect the unique nature of the oil and gas industry. For example, in the natural resource sector, inputs are not may not be reflected properly because the inventory of the non-renewable natural resource is continuously declining.<sup>16</sup>

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<sup>12</sup> Government of Alberta – “Trends in Labour Productivity” (June 2013)  
[https://www.albertacanada.com/files/albertacanada/SP\\_Trends\\_in\\_Productivity.pdf](https://www.albertacanada.com/files/albertacanada/SP_Trends_in_Productivity.pdf) accessed April 15, 2014; this statistic refers only to the business sector.

<sup>13</sup> Government of Alberta – “Trends in Labour Productivity” (June 2013)  
[https://www.albertacanada.com/files/albertacanada/SP\\_Trends\\_in\\_Productivity.pdf](https://www.albertacanada.com/files/albertacanada/SP_Trends_in_Productivity.pdf) accessed April 15, 2014

<sup>14</sup> Ibid.

<sup>15</sup> Ibid.

<sup>16</sup> Dahlby, Bev, “611 Innovation Policy Course Notes,” (February 2014)



## 1.2 Overview of Energy Innovation

Energy production, anywhere in the world, would not be where it is today, without one thing – innovation. In recent literature, technological and business innovations have dominated ideas surrounding solutions to the aforementioned challenges. However, there are concerns that Alberta’s oil industry is not truly innovative. For example, Ian Gates, a researcher with the University of Calgary asks the question, “why the oil sands is slower at innovating, [and] why technology that is over 20 years old is still being used?”<sup>17</sup> Others argue that if the oil and gas industry had completely neglected innovation, it is doubtful that it would be as successful as it has been, regardless of the presence of its immense resource endowment. Of course, innovation goals of today are not the same as those in the past. Innovation endeavors in the past were more focused on competitiveness and business feasibility, not that these are still not goals of today, but environmental challenges are now playing an imperative role in Alberta’s oil sands industry.

A good example of the latter view that the oil patch has always been innovative is shown by fact that the bitumen which lies in Alberta’s oil sands region is not an easily recoverable resource. Its production and refinement is energy intensive because it is “the most dense and viscous non-conventional oil in the world.”<sup>18</sup> Several decades ago, business needed governmental subsidies for technological development and commercialization in order to kick

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<sup>17</sup>“Researchers Ask: Why Is Oilsands Industry Slow to Innovate?” University of Calgary - UToday.

<http://www.ucalgary.ca/utoday/issue/2014-05-06/researchers-ask-why-oilsands-industry-slow-innovate>. Accessed July 08, 2014.

<sup>18</sup> Bloomer, Jagoda and Landry, “Canadian Oil Sands: How innovation and advanced technologies can support sustainable development,” *International Journal of Technology management & Sustainable Development* Vol 9 Number 2 (2010)

start oil sands production.<sup>19</sup> The establishment of the Alberta Oil Sands and Research Authority (AOSTRA) in the mid 1970's is an excellent example of public policy working efficiently to promote and support economic growth through innovation in the new business venture of what is now Alberta's prosperous oil sands. In the last couple of decades, innovation has helped boost oil sands production to become more cost effective and reduce environmental impacts.

A prime illustration of innovation in the oil sands is the invention of the Steam Assisted Gravity Drainage (SAGD) process by a Canadian engineer, Roger Butler with Imperial Oil.<sup>20</sup> This technological advancement not only increased production by creating the opportunity to extract where bitumen was previously inaccessible, but it also increased environmental stewardship in several ways. Governmental support and assistance was crucial in the success of this innovation – from development to deployment.<sup>21</sup> In the case of SAGD, AOSTRA invested heavily in Underground Test Facility (UTF), which ran SAGD's tests and pilots.<sup>22</sup> This is an excellent example of how innovation effectively 'killed two birds with one stone' – by exponentially increasing product production and providing environmental benefits (eliminating tailings ponds and 90% water recycling).<sup>23</sup>

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<sup>19</sup> Ibid.

<sup>20</sup> Gault, Sebastian, "An in-depth look at how in situ oil sands development has evolved" (February 2014) <http://www.albertaoilmagazine.com/2014/02/in-situ-bitumen-recovery/> (accessed April 2014)

<sup>21</sup> Ibid.

<sup>22</sup> Ibid.

<sup>23</sup> Government of Alberta, "Talk about SAGD" (November 2013) [http://www.energy.alberta.ca/OilSands/pdfs/FS\\_SAGD.pdf](http://www.energy.alberta.ca/OilSands/pdfs/FS_SAGD.pdf) (accessed March 2014)

### 1.3 Brief History of Alberta Oil Sands

Alberta's oil sands supply Canada with 42% of its crude oil demands.<sup>24</sup> In addition, the Canadian oil industry provides a quarter of US crude oil imports.<sup>25</sup> Global demand for oil and gas continues to increase. The International Energy Agency (IEA) forecasted in 2012, that by 2035, energy demands will increase by over 30% and fossil fuels are expected to be the main resource to satisfy the projected demand.<sup>26</sup> Alberta, being chief producer of these oil and petroleum products, must take the lead in setting goals to ensure sustainable growth and responsible development. Strategies employed to meet these demands must be comprehensive and include collaboration within sectors and stakeholders.

While the oil and gas industries in Alberta have flourished, they have been subject to criticisms and are continuously presented with challenges. These challenges are not independent. In fact – they are all interrelated and should be tackled holistically and not as individual silos. Alberta's energy challenges largely pertain to the competitiveness and social acceptance of its oil and gas industries. Energy markets are volatile and social license issues are now more pertinent than ever.

### 2.0 Environmental Concerns and Challenges in the Oil Sands

Some environmental challenges can certainly be coined as a market failure. Market failures occur when markets are unable to assign resources in an efficient manner. One cause for

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<sup>24</sup> Canadian Centre for Energy Information, "Energy By The Numbers - Alberta, Canada" (October 2013) <http://www.centreforenergy.com/Documents/AboutEnergy/ByTheNumbers/AB-bythenumbers.pdf> Accessed April 2014.

<sup>25</sup> US Energy Information Administration, "Canada Background" <http://www.eia.gov/countries/cab.cfm?fips=CA> Accessed April 2014.

<sup>26</sup> International Energy Agency, "World Energy Outlook 2012 Executive Summary," (November 2012) Accessed April 2014.

market failure can stem from externalities. Negative externalities are a result of unwanted consequences that are often not valued properly in the market. Activities pertaining to Alberta's oil sands certainly have produced a plethora of negative externalities that were not expected nor desired. Industry and government have a big opportunity to step up and find solutions to these challenges. There are many posed risks to the environment. Current problems should be fixed and handled promptly, and proactive action should constantly be taken to mitigate any future environmental problems. Government and industry certainly have a role to play in regards to the oil sands and the negative impacts it may have on the environment.

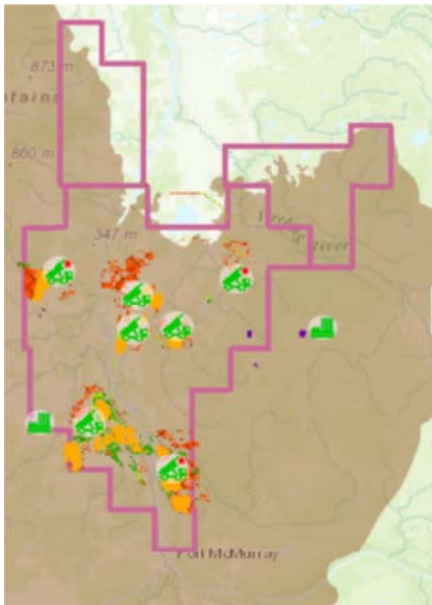
In Canada, the division of powers between the levels of government is set within the *1867 Constitution Act*. In the case of the oil sands, both provincial and federal governments have a role to play in creating effective solutions to these environmental problems. When the Constitution was written, environmental policy did not exist. According to Blake, Cassels & Graydon LLP, "the Supreme Court of Canada has determined that both levels of government may enact laws regarding the environment in respect of and ancillary to existing listed heads of power."<sup>27</sup> The complex nature of environmental issues requires both levels of government to cooperate and collaborate.

The demand for oil is only increasing and industries along with government are finding many challenges to keep up. Unfortunately, the Alberta oil sands pose many environmental concerns. Government and industry are continually pressed by environmental and other

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<sup>27</sup> Blake, Cassels and Graydon LLP, "Overview of Environmental Regulatory Regime Related to Alberta Oil Sands Activities," *Blakes Lawyers*, (Jan 2010): 2

organizations to find solutions to these problems. Finding sustainable solutions that are financially feasible, effective and rapid to employ is not easy. The main environmental issues relating to the oil sands can be categorized in three groups: Land, Water and Greenhouse Gases (GHG). The provinces and federal government have different responsibilities in finding and creating solutions to these problems. There have been innovations in each of these areas which have provided heightened levels of environmental responsibility and protection.



**Figure 1 – Snapshot of Tailings (solid bright orange)**

*Source – Oil Sands Information Portal Map*

### **Land**

Alberta's oil sands are home to over 160 billion barrels of crude oil reserves.<sup>28</sup> For bitumen to be recovered from the ground and processed into oil, the land may go through major disruptions. There are two main processes for extraction of bitumen: 1) Surface mining: wetlands are drained, rivers diverted, and all vegetation stripped from the surface and 2) In situ extraction: bitumen is heated underground and pumped to the surface through steam assisted gravity drainage (SAGD).<sup>29</sup> To date, 761 square kilometres have been disturbed in oil sands mining activities.<sup>30</sup> In a recent publication, the Canadian Association of Petroleum Producers (CAPP) forecast that both mining

<sup>28</sup> Government of Alberta, "Alberta's Oil Sands," <http://oilsands.alberta.ca/economicinvestment.html>, Accessed February 2014

<sup>29</sup> Wolynill, Dan, Marlo Raynolds, Chris Severson – Baker, "Oil Sands Fever: The Environmental Implications of Canada's Oil Sands Rush," *The Pembina Institute*, (Nov 2005): 12

and in situ operations will increase: “Looking ahead to 2030, mining production is forecast to increase to 1.6 million b/d and in situ production is forecast to grow to 3.2million b/d.”<sup>31</sup>

Presently, in situ procedures are used significantly more than surface mining operations.

Currently, based on proven recoverable oil, only about one fifth of oil sands will be recovered through mining, the remainder will be recovered using in situ procedures.<sup>32</sup>

With the SAGD technique, less harm is done to the surrounding environment compared to surface mining techniques, where environmental harm is much more evident. The Government of Alberta requires that companies operate under strict regulations and policies. Under the *Environmental Protection and Enhancement Act* they must remediate and reclaim land so it can be productive and provide “equal land capacity” prior to the land disturbance.<sup>33</sup> The Royal Society of Canada (RSC) has reviewed reclamation activities by the oil industry, and criticized the vague definition and standards of what it truly means to have land reclaimed.<sup>34</sup> Due to the extremely long time span it takes successfully reclaim disturbed land, the Government of Alberta has only issued one reclamation certificate to Syncrude Canada Ltd in 2008.<sup>35</sup>

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<sup>30</sup> Government of Canada, “Oil Sands - A strategic resource for Canada, North America and the global market,” <http://www.nrcan.gc.ca/sites/www.nrcan.gc.ca/files/energy/files/12-0608-Oil-Sands-Land-Use-and-Reclamation-eng.pdf> (Feb 2013) Accessed June 2014.

<sup>31</sup> Canadian Association of Petroleum Producers, “Crude Oil - Forecast, Markets & Transportation,” <http://www.capp.ca/getdoc.aspx?DocId=247759&DT=NTV> (June 2014) Accessed May 2014. pg ii

<sup>32</sup> Government of Alberta, “Alberta’s Oil Sands - Resourceful. Responsible.” <http://environment.gov.ab.ca/info/library/7925.pdf> (Sept 2008) Accessed May 2014.

<sup>33</sup> Government of Alberta – Environment, “Reclaiming Alberta’s Oil Sands,” <http://www.environment.alberta.ca/02012.html> (accessed April 2014)

<sup>34</sup> Dr. Gosselin, Pierre, Dr. Steve E. Hruddy, Dr. M. Anne Naeth, Dr. André Ploudre, Dr. René Therrien, Dr. Glen Van Der Kraak, Dr. Zhenghe Xu, “Executive Summary in Brief - Environmental and Health Impacts of Canada’s oil Sands Industry,” *The Royal Society of Canada Expert Panel*, (Dec 2010): 5

<sup>35</sup> Government of Alberta – Environment, “Reclaiming Alberta’s Oil Sands” (accessed April 2014)

From a land use perspective, surface mining is the least favourable as it requires the use of tailings ponds that will take a long time to reclaim. From a land use perspective, the largest concern when it comes to tailings ponds are the smaller particles that do not (or take decades to) settle, thus preventing the area from becoming solid and ‘trafficable’ ground.<sup>36</sup> The Pembina Institute released a few figures in 2013 to illustrate the land impacts of tailings ponds. Tailings ponds occupy 173 square kilometres of land. An estimated 25,000 cubic metres of waste is estimated to be produced daily, based on 2013 mining levels.<sup>37</sup> Although, there have been recent technological advances that should greatly improve reclamation rates of tailing ponds, an overarching solution has not been found. This will be further discussed in the following section.

## **Water**

Another major environmental concern with the oil sands is the issue of water, especially how much is used and the quality of the water that is left behind after oil sands activities. Large volumes of water are used for surface mining. The Pembina Institute estimates that extracting one barrel of bitumen requires between two and five barrels of fresh water.<sup>38</sup> In situ operations also affect both quality and quantity of water available for other uses. A positive aspect of the in situ process is that the water can be treated and reused again in the steam generator.<sup>39</sup> CAPP’s data indicates that mining operations used on average 3.1 barrels of water per barrel of oil. In the

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<sup>36</sup> Flanagan, Erin and Jennifer Grant, "Losing Ground – Why the problem of oil sands tailings waste keeps growing," (July 2013) <http://www.pembina.org/reports/losing-ground-oilsands-tailings-fs.pdf> Accessed August 2014.

<sup>37</sup> Ibid.

<sup>38</sup> Wolynill, Dan, Marlo Reynolds, Chris Severson – Baker, "Oil Sands Fever: The Environmental Implications of Canada’s Oil Sands Rush," *The Pembina Institute*, (Nov 2005): 12

<sup>39</sup> Wolynill, Reynolds, Severson – Baker, "Oil Sands Fever": 33



case of in situ operations, just 0.4 barrels of fresh water is used per barrel of oil produced.<sup>40</sup>

These numbers show an overwhelming difference in water use intensity between mining and in situ oil sands processes. In this case, innovative technology has proven to drastically decrease water use where in situ can be applied.

Tailing ponds are another aspect to surface mining which poses water concerns. These tailings ponds are comprised of post-mining wastes which include bitumen, water, sand, silt and clay particles.<sup>41</sup> There is a fear that contaminants and pollutants may eventually seep through the groundwater system into surface water.<sup>42</sup> More recently, a report by Environment Canada confirmed tailings seepage into groundwater.<sup>43</sup> Mass media spotlighted this report, portraying it as a new development. However, industry and other stakeholders responded that these were not new findings and that finding solutions and supporting technologies to fix the tailings issue has been a priority for quite some time. Unfortunately, little is known about the long term effects of these tailings ponds and what harm they could possibly pose in the future.

### **Green House Gases**

Lastly, the oil sands are continuously criticized for its contribution to climate change through GHG emission during production. However, it should be noted, that the extreme negativity placed on the oil sands in regards to its influence on climate change is not completely accurate. Oil sands in-situ and mining activities accounted for 39.8% of Alberta's GHG

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<sup>40</sup> CAPP, "Water Use in Canada's Oil Sands," <http://www.capp.ca/getdoc.aspx?DocId=193756> (June 2012) Accessed July 2014.

<sup>41</sup> Wolynill, Reynolds, Severson – Baker, "Oil Sands Fever": 30

<sup>42</sup> Ibid.

<sup>43</sup> Alberta Innovates - Energy and Environment Solutions (AI-EES), "News - Committed to the reduction of oil sands tailings," (Spring 2014) [http://www.albertainnovates.ca/media/20456/2014\\_spring\\_ai-ees\\_newsletter\\_4web.pdf](http://www.albertainnovates.ca/media/20456/2014_spring_ai-ees_newsletter_4web.pdf) Accessed August 2014.



emissions at 49,037kt C02e in 2011, a slight increase from 38.2% in 2010.<sup>44</sup> By comparison, coal fired electricity generation accounted for 35.4% of GHG emissions in 2011. At the national level, oil sands activities account for approximately 8.0% of Canada's GHG emissions – and the oil sands contribute about 0.15% of GHG emissions globally.<sup>45</sup>

However, the growth of bitumen production has contributed to the dramatic increases in total GHG emissions from 589,000 kt in 1990 to 692,000 kt in 2010.<sup>46</sup> For the Mining & Oil and Gas Extraction sector, GHG emissions increased from 6,650 kt in 1990 to 38,200 in 2010, a 474 % increase. Environment Canada projections indicate GHG emissions from oil sands will account for 44% of the increase in Canada's total emissions between 2006 and 2020.<sup>47</sup> It is important to note that by 2020, in situ production is slated to be emitting four times the amount of GHG's as mining production.<sup>48</sup>

Both Alberta and Canada have made promises to decrease GHG emissions. A decade ago, the Canadian government ratified the Kyoto Protocol committing Canada to reduce its GHG

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<sup>44</sup> Government of Alberta, "Alberta Environment and Sustainable Resource Development: Report on 2010 Greenhouse Gas Emissions," <http://environment.gov.ab.ca/info/library/8616.pdf> (accessed April 2014) and <http://environment.gov.ab.ca/info/library/8849.pdf>

<sup>45</sup> Oil Sands Today, "GHG Emissions," <http://www.oilsandstoday.ca/topics/ghgemissions/Pages/default.aspx> Accessed August 2014.

<sup>46</sup> Environment Canada, "National Inventory Report - Greenhouse Gas Sources and Sinks in Canada 1990-2010 Part 3," (2012) [http://publications.gc.ca/collections/collection\\_2012/ec/En81-4-2010-3-eng.pdf](http://publications.gc.ca/collections/collection_2012/ec/En81-4-2010-3-eng.pdf) Accessed August 2014. PG 67. Note that total emissions peaked in 2006 at 726,000 kt.

<sup>47</sup> Stewart, Keith, Melina Laboucan – Massimo, "Deep Trouble: The Reality of In Situ Tar Sands Operations," *Greenpeace*, (April 2011): 4: 3

<sup>48</sup> Environment Canada, "Canada's Emissions Trends," [http://www.ec.gc.ca/ges-ghg/985F05FB-4744-4269-8C1A-D443F8A86814/1001-Canada%27s%20Emissions%20Trends%202013\\_e.pdf](http://www.ec.gc.ca/ges-ghg/985F05FB-4744-4269-8C1A-D443F8A86814/1001-Canada%27s%20Emissions%20Trends%202013_e.pdf) (October 2013) Accessed August 2014.

emissions. However, at the end of 2011, Canada officially withdrew out of the Kyoto Accord.<sup>49</sup> More recently, Canada has committed to the Copenhagen Accord in 2009 as a follow up to the Kyoto Protocol. Canada is now striving to achieve its promise under the Copenhagen Accord to reduce GHG emissions “17 percent from 2005 levels by 2020.”<sup>50</sup> To achieve this goal, Canada is under pressure to develop regulations pertaining to emissions reduction in the energy industry. Recently, Eric Newell, Chair of the CCEMC (Climate Change and Emissions Management Cooperation), expressed his view that actions needs to be taken swiftly and that a carbon levy, similar to Alberta’s carbon program, should be implemented.<sup>51</sup> The price that has been thrown around in the past year in regards to a federal carbon price has been \$40 per tonne.<sup>52</sup> There has been no evidence of any further developments on this matter.

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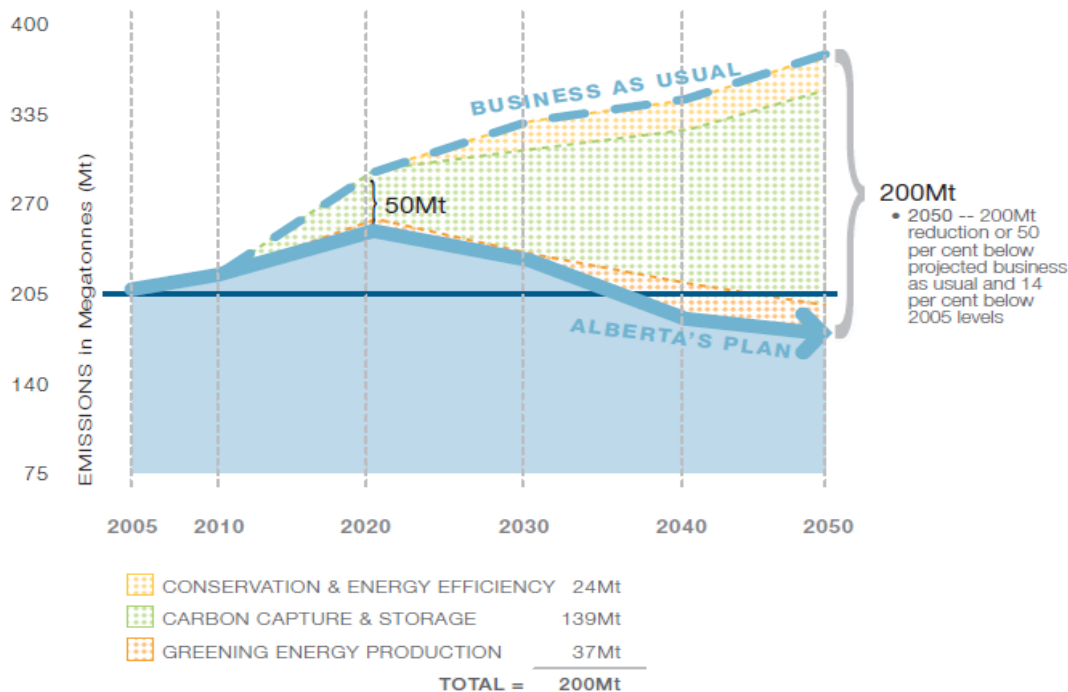
<sup>49</sup> Government of Canada, “Statement by Minister Kent,” (December 2011)  
<http://www.ec.gc.ca/default.asp?lang=En&n=FFE36B6D-1&news=6B04014B-54FC-4739-B22C-F9CD9A840800> (accessed April 2014)

<sup>50</sup> Government of Canada, “News Release – Canada half way to it Copenhagen Accord Emission Target,” (December 2012)  
<http://ec.gc.ca/default.asp?lang=En&n=976258C6-1&news=AFCE9B47-6579-4C2C-8CC3-F4E7D365DBDA> (accessed April 2014)

<sup>51</sup> Weber, Bob, “Federal government urged to hurry up on energy industry regulations,” *Calgary Herald* (May 2014)  
<http://www.calgaryherald.com/business/Federal+government+urged+hurry+energy+industry+regulations/9881501/story.html>  
Accessed August 2014.

<sup>52</sup> Ibid AND McCarthy, Shawn, “Shell calls for Ottawa to release carbon policy,” *The Globe and Mail* (December 2013)  
<http://www.theglobeandmail.com/report-on-business/industry-news/energy-and-resources/shell-calls-for-ottawa-to-release-carbon-policy/article15748420/> Accessed August 2014.

## ALBERTA'S REDUCTION COMMITMENTS



**Figure 2**  
**Alberta's Reduction Commitments**  
Source: Alberta's 2008 Climate Change Strategy

Alberta was one of the first “jurisdictions in North America to legislate GHG emissions reductions.”<sup>53</sup> Figure 2 illustrates the goals put forth by the Alberta government through its Climate Change Strategy. We can see here, that Carbon Capture and Storage (CCS) initiatives are responsible for an astounding 70% of total reductions. According to the Alberta government, the two CCS projects that have been approved are slated to reduce 2.76Mt annually, beginning in 2015.<sup>54</sup> This would work out to reductions of 96.6Mt by 2050 through CCS alone. This certainly does not come close to the 139Mt GHG reduction goal the government has set out for CCS.

<sup>53</sup> Government of Alberta, “Facts and Statistics,” <http://www.energy.alberta.ca/oilsands/791.asp> (accessed April 2014)

<sup>54</sup> Government of Alberta, “Carbon Capture and Storage,” <http://www.energy.alberta.ca/Initiatives/1438.asp> (Accessed July 2014)

British Columbia and Quebec also have introduced emission reduction systems and both provinces have established carbon taxes, although their carbon tax regimes are much different than Alberta's emissions program. Alberta's policy works on the idea of a 'carbon price' and is not guided by taxation methods as BC and Quebec's emissions policies. Alberta's 'carbon price' provides companies different options to achieve reductions at the least cost to them, and one of the options being a \$15 per tonne price to be paid into a technology fund. On the other hand, BC's and Quebec's carbon taxes:

Put a price on each tonne of GHG emitted, sending a price signal that will, over time, elicit a powerful market response across the entire economy, resulting in reduced emissions. It has the advantage of providing an incentive without favouring any one way of reducing emissions over another. By reducing fuel consumption, increasing fuel efficiency, using cleaner fuels and adopting new technology, businesses and individuals can reduce the amount they pay in carbon tax, or even offset it altogether.<sup>55</sup>

The province's most significant step in reducing emissions was in 2008 when it officially released its *Climate Change Strategy*. This strategy comprised of three main components: Conservation & Energy Efficiency (goal to reduce 24 Megatonnes by 2050), Carbon Capture & Storage (goal to reduce 139 Megatonnes by 2050), and Greening Energy Production (goal to reduce 37 Megatonnes by 2050).<sup>56</sup> Alberta's more pressing commitment is to achieve an absolute reduction of 50 Megatonnes by the year 2020 below projected business as usual levels based in

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<sup>55</sup> Government of British Columbia, Ministry of Finance, "What is a Carbon Tax?," <http://www.fin.gov.bc.ca/tbs/tp/climate/A1.htm>, Accessed August 2014.

<sup>56</sup> Government of Alberta, "Alberta's 2008 Climate Change Strategy," (Jan 2008) Government of Alberta, "Facts and Statistics," <http://www.energy.alberta.ca/oilsands/791.asp> (accessed April 2014) PG 23

2005.<sup>57</sup> Emissions reduction from the oil sands are part of the aforementioned strategies, although the most contentious of the three is the Conservation & Energy Efficiency component which includes the province's most prominent emissions reduction program, the *Specified Gas Emitters Regulation (SGER)*.

This regulation "requires all facilities emitting over 100,000 tonnes of CO<sub>2</sub> equivalent per year to reduce their annual emissions intensity by 12 per cent below their approved Baseline Emissions Intensity (BEI)."<sup>58</sup> These reductions are measured on an annual basis. Under SGER, those facilities which do not meet the requirements under the specified reduction targets have a couple of options to choose from to satisfy the regulations. One option is to purchase emissions offsets, and a second is to purchase/use emissions performance credits.<sup>59</sup> For every tonne of CO<sub>2</sub>e (carbon dioxide equivalent) that a company exceeds its reduction target, it pays \$15 into to the Climate Change and Emissions Management Fund (CCEMF) which funds projects aimed at reducing GHG emissions.<sup>60</sup> The CCEMF is still relatively new, but it is a positive step forward in creating a model which will hopefully act as a catalyst in oil sands innovation. SGER is set for renewal at the end of this year.

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<sup>57</sup> Government of Alberta, "Alberta's 2008 Climate Change Strategy," (Jan 2008) Government of Alberta, "Facts and Statistics," <http://www.energy.alberta.ca/oilsands/791.asp> (accessed April 2014) PG 24

<sup>58</sup> Government of Alberta, "Specified Gas Emitters Regulation – Technical Guide," [http://environment.alberta.ca/documents/2008\\_CR\\_Tech\\_Guide.pdf](http://environment.alberta.ca/documents/2008_CR_Tech_Guide.pdf) (2009) Accessed August 2014

<sup>59</sup> Mansell, Anthony, Clayton Munnings, Peter Sopher, "Alberta - The world's carbon markets: A case study guide to emissions trading," Environmental Defense Fund and International Emissions Trading Association, (May 2013) pg 3 AND Read, Andrew, "Climate Change policy in Alberta," Backgrounder, Pembina Institute. (July 2014) <http://www.pembina.org/docs/oil-sands/sger-climate-policy-backgrounder.pdf> Accessed August 2014.pg 3

<sup>60</sup> The Climate Change and Emissions Management Corporation, <http://ccemc.ca/> Accessed June 2013.

The Pembina Institute, very recently, released a backgrounder on Alberta's Climate Change Strategy. Andrew Read suggests that although Alberta's carbon regulation scheme may seem promising, there have been no significant results and that the programs is quite complex and it is difficult to measure outcomes.<sup>61</sup> Further, he explains that in order to achieve large carbon reductions, the 'price' of the carbon levy needs to be high enough to deter companies from emitting and to be costly enough to encourage and incentivize few emissions. 51% of compliance from industry was through payment into the CCEMF. This, explains Read, is showing "too high reliance on the technology fund for compliance indicates that the technology fund price is likely insufficient to motivate internal reductions."<sup>62</sup> The 51% figure illustrates that instead of finding innovative ways to decrease emissions, industry is choosing to pay into the fund instead. This may suggest that the 'carbon price' is too low and instead of spurring innovation through the price, companies would rather just pay into the fund.

As mentioned above, SGER is set for renewal by the end of 2014. The Alberta government has in fact confirmed that it will be currently unable to reach its goal of reducing emissions of 50 megatonnes by 2020.<sup>63</sup> There has been a lot of conversation around increasing the carbon price. So far, a price of \$30 per tonne has been rumored which would theoretically

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<sup>61</sup> Read, Andrew, "Climate Change policy in Alberta," Backgrounder, Pembina Institute

<sup>62</sup> Ibid pg 4

<sup>63</sup> Varcoe, Chris, "Alberta revising climate change plan, no changes in works on emissions," Calgary Herald (June 2014) <http://www.calgaryherald.com/business/Alberta+revising+climate+change+plan+changes+works+emissions/9934252/story.html> Accessed August 2014.



result in a 24 percent of reduction.<sup>64</sup> This new carbon price has been under speculation for over a year and there have been no official proposals or governmental notice confirming this.<sup>65</sup> Though, with the current political instability in the province, it is difficult to foresee what changes or lack of changes are in store for Alberta's climate change strategy.

## 2.1 Innovative Solutions to Environmental Concerns

One of biggest issues with oil sands mining could be said to be the tailings ponds. Tailings comprise of a combination of excess bitumen, clay, sand and water. It is the particles that do not sink to the bottom that cause concern. Suncor Energy has found a way to expedite the time it takes to reduce tailings ponds into reclaimed land.

They do this by “mix[ing] a polymer flocculent with the mature fine tailings and then deposits them into thin layers over sand beaches with shallow slopes.”<sup>66</sup> Typically, the reclamation of tailings is an extremely slow process; it can take years to decades – fortunately, with these new innovations these advancements are said to speed up the drying process to a mere

**Figure 3**

*Results of the TRO™ tailings reclamation technology*  
*Source: Suncor Website*



<sup>64</sup> Kleiss, Karen and Erika Stark, "Climate change plan due in September: Hancock," Edmonton Journal (May 2014) <http://www.edmontonjournal.com/Climate+change+plan+September+Hancock/9864749/story.html>, Accessed August 2014.

<sup>65</sup> Further reading: <http://www.theglobeandmail.com/report-on-business/industry-news/energy-and-resources/alberta-industry-face-wide-gap-on-carbon-tax/article10911280/> AND <http://www.calgaryherald.com/business/Energy+industry+cool+reports+federal+provincial+plan+double+double+hike+carbon+levy/9802309/story.html>

<sup>66</sup> PricewaterhouseCoopers LLP, "Innovation surge sparks oil sands opportunities," (2013) [http://www.pwc.com/en\\_CA/ca/energy-utilities/publications/pwc-technology-oil-sands-report-2013-11-en.pdf](http://www.pwc.com/en_CA/ca/energy-utilities/publications/pwc-technology-oil-sands-report-2013-11-en.pdf), Accessed June 2014. pg 14

number of weeks. Further, this innovation effectively decreases the company's tailings ponds by 80 percent.<sup>67</sup> This is an innovation which will exponentially assist in tailings reclamation.

CANMETEnergy, through the National Research Council (NRC), was instrumental in providing the research to support the commercialization of Suncor's TRO™ tailings reclamation technology. CANMETEnergy explains that, "work in the early 1990's at the University of Alberta on consolidated tailings showed that geotechnically, this process might produce a trafficable deposit ... from a portion of the fluid fine tailings that are accumulating as a result of surface mined oil sands development." In 2010, approval was given to Suncor to implement their tailings management using this technology.<sup>68</sup> This process illustrates that game-changing, technological innovations do not occur quickly. In fact, it often is a long-term process which unavoidably requires significant investment over time.

Government funded institutions such as Alberta Innovates – Energy and Environment Solutions (AI-EES) and Institute for Oil Sands Innovation (IOSI) continue to invest in resources to research and support tailings management solutions. In AI-EES, tailings research and projects fall into their Water and Environmental Management strategic area, where 28% of its funds were invested in the time period of 2012 – 2013.<sup>69</sup> IOSI also places tailings research as one of their priority research themes. CANMETEnergy continues to invest in studies regarding to tailings ponds management.

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<sup>67</sup> ibid

<sup>68</sup> Suncor, "Tailings Management," <http://www.suncor.com/en/responsible/3229.aspx>, Accessed July 2014.

<sup>69</sup> AI - EES, "Report on Outcomes 2012-2013 - Growing an Innovation Support Network," [http://www.ai-ees.ca/media/11453/ai-ees\\_report\\_on\\_outcomes\\_2012-2013\\_final\\_web.pdf](http://www.ai-ees.ca/media/11453/ai-ees_report_on_outcomes_2012-2013_final_web.pdf) (August 2013) Accessed July 2013.



Water use intensity, in oil sands operations are also a large concern. Athabasca Oil Corporation has invented the Thermal Assisted Gravity Drainage (TAGD) process which uses “down hole electrical resistance heaters installed in horizontal wells to heat the reservoir via thermal conduction.”<sup>70</sup> TAGD operates at a lower temperature than current SAGD processes, thus creating energy efficiencies. In addition, TAGD does not require any water use throughout its process. Considering SAGD’s significant water usage, TAGD is certainly a technological breakthrough that will reduce the oil sands’ environmental footprint. Currently, there is only one Athabasca Oil operation that is using this technology, and not yet at its full scale.<sup>71</sup> There are also concerns about the impacts oil sands operations on the quality of water. Mainly the concerns pertain to leakage from tailings ponds into ground and surface water. AI-EES invested \$10 million into research focusing on water resources and uses in 2013. CANMETEnergy is focusing on three core areas in regards to water: Chemicals in Oil Sands Process Water, Oil Sands Water Chemistry Modelling, and Oil Sands Water Treatment.<sup>72</sup>

Third, greenhouse gas emissions from oil sands production are a highly contested issue. GHG emissions stemming from the oil sands have garnered world-wide attention. One way of managing GHG’s is the relatively new technique, carbon capture and storage (CCS). The CCS method captures the carbon dioxide then “transported by pipeline to a well site where it will be

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<sup>70</sup> Athabasca Oil Corporation, "Thermal Assisted Gravity Drainage," <http://www.atha.com/operations/technology/tagd.html>, Accessed August 2014.

<sup>71</sup> Ibid.

<sup>72</sup> National Resources Canada, "Water Management in Oil Sands," <http://www.nrcan.gc.ca/energy/oil-sands/water-management/5865>, Accessed August 2014.

injected more than two kilometres underground into the deepest saline formation in Alberta...”<sup>73</sup>

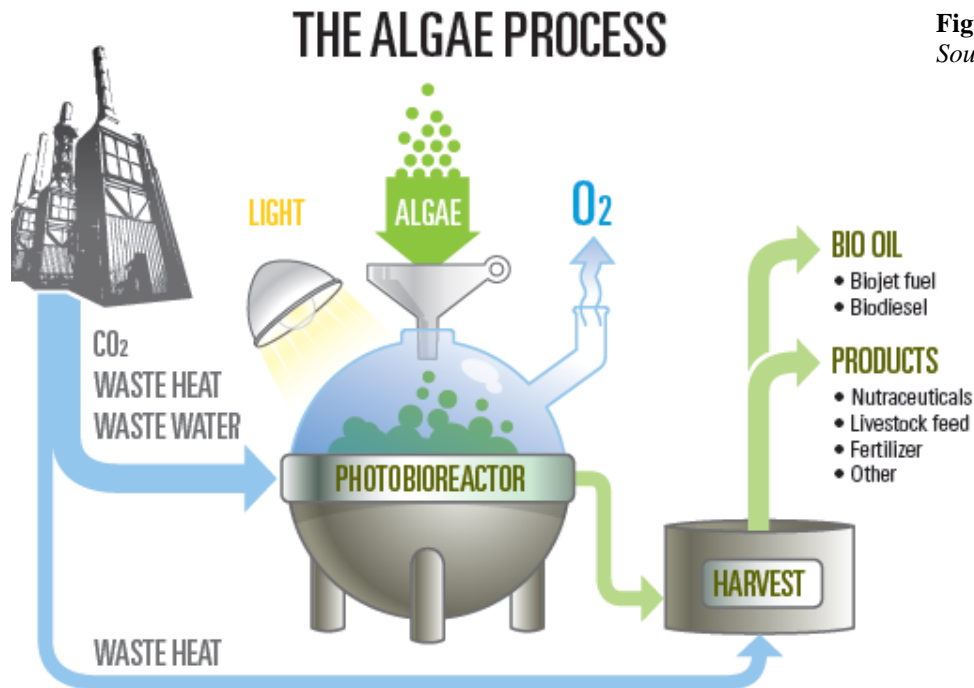
In 2011, Alberta approved two large CCS projects. The Alberta Carbon Trunk Line has \$495 million of funding over 15 years by the Alberta government and the Quest project has \$745 million worth of funding provided by the Alberta government over 15 years.<sup>74</sup> The Quest project alone is forecasted to capture over one million tonnes of CO<sub>2</sub> a year. Originally there were four proposed CCS projects, but the other two were cancelled. It is forecasted that these two projects, when implemented in 2015, will reduce 2.76 million tonnes a year.<sup>75</sup> These CCS projects will assist in the objective of reducing emissions. Of course, this alone will not be enough and other technological or process advances will be needed to fill the gap. To date, the Alberta government has not shared an updated strategy on how it will achieve its reduction goals with only two CCS projects set to operate in 2015.

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<sup>73</sup> PricewaterhouseCoopers LLP, "Innovation surge sparks oil sands opportunities," Accessed June 2014.pg 8

<sup>74</sup> Solutions Start Here, "Carbon Capture and Storage," <http://www.solutionsstarthere.ca/71.asp> AND <http://www.solutionsstarthere.ca/70.asp>, Accessed August 2014.

<sup>75</sup> <http://www.energy.alberta.ca/Initiatives/1438.asp>



**Figure 4 – CNRL's Algae Biorefinery**  
Source – COSIA Website

Canadian Natural Resources Limited (CNRL) has developed a technology that would produce algae products by using CO<sub>2</sub> emissions. The Algal Biorefinery, illustrated in Figure 4, is largely funded by the National Research Council (NRC), with a contribution of approximately \$9.5 million. The algae produced can be used for a variety of purposes such as fertilizer and fuel. CNRL is hoping that this refinery will help cut down their emissions by 15% - 30%.<sup>76</sup> This technological advancement is truly and innovative breakthrough which not only improves GHG emissions, it also produces additional commercial products.

<sup>76</sup> PricewaterhouseCoopers LLP, "Innovation surge sparks oil sands opportunities," Accessed June 2014. pg 12.

### **3.0 Concerns and Challenges in the Oil Sands**

Environmental concerns are not the only worry oil sands producers have on their minds. Oil sands production costs are rising steadily and putting more pressure on an already resource intensive operation. In this year's Canada Energy Research Institute (CERI) annual report, costs for a "SAGD producer has risen by 4.4 percent, 1.6 percent for a standalone mine and 5.9 percent for an integrated mining and upgrading project" compared to 2013 costs.<sup>77</sup> In 2013 there were predictions that oil sands projects would be delayed or cancelled completely because of rising production costs. One year later and that prediction came true – Total SA, decided to axe its \$11 billion projects because financial returns did not seem promising.<sup>78</sup> Projects are evaluated constantly on a financial basis and as costs are rising, companies are hard pressed to either find ways to produce cheaper, or not at all.

#### **3.1 Innovation to Increase Economic Benefits**

As mentioned earlier, Alberta's oil sands are not the most economical to produce compared to other oil resources around the world. Major oil sands companies, such as Suncor and Canadian Natural Resources Limited (CNRL) have suggested that innovation is a priority in maintaining the competitiveness of the oil sands industry. For example, in a speech delivered in 2011 by former President and CEO of Suncor, Rick George stated "innovation and technological

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<sup>77</sup> Canadian Energy Research Institute (CERI), "Canadian Oil Sands Supply Costs and Development Projects (2014-2048)," Study No. 141 (July 2014) [http://www.ceri.ca/images/stories/2014-07-17\\_CERI\\_Study\\_141\\_Oil\\_Sands\\_Supply\\_Cost\\_Update\\_2014-2048.pdf](http://www.ceri.ca/images/stories/2014-07-17_CERI_Study_141_Oil_Sands_Supply_Cost_Update_2014-2048.pdf), Accessed July 2014.

<sup>78</sup> Tait, Carrie, "Total shelves \$11 billion Alberta oil sands mine," The Globe and Mail (May 2014) <http://www.theglobeandmail.com/report-on-business/joslyn/article18914681/>, Accessed August 2014.

advances [are] required to more effectively bring [these] resources to market.”<sup>79</sup> Similarly, CNRL is one of the largest proponents in innovation to improve operations and performances, It wants to make continuous innovation a priority in achieving heightened competitiveness as well as ensuring costs are effectively managed.<sup>80</sup> Industry certainly appreciates the value in innovation for not only its improved environmental performance and benefits but also for its ability to reduce economic costs.

In 2010 the Government of Alberta released *Energizing Investment – A Framework to Improve Alberta’s Natural Gas and Conventional Oil Competitiveness*. In that report, the Government of Alberta acknowledges the importance of innovation in these industries and recognizes that with such volatile markets, Alberta’s oil and gas industries must innovate to remain competitive to garner investments into these industries.<sup>81</sup> It is clear that innovation is critical in the oil sands to help it adapt to the volatile market pressures in which the oil sands operates in.

#### **4.0 Role of Public Policy in Oil Sands Innovation**

In Alberta, 81% of mineral rights, including the oil sands, are crown owned. The Department of Energy manages the mineral rights owned by the crown on behalf of Albertans. Thus, making

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<sup>79</sup> Suncor, "Charting a course for our energy future," Speech by Rick George (June 2011), <http://www.suncor.com/en/newsroom/2470.aspx?id=4047>, Accessed July 2014.

<sup>80</sup> Canadian Natural Resources Limited (CNRL), "Working Together to Create Value - Innovation," <http://www.cnrl.com/corporate-responsibility/our-people/living-our-mission-statement/working-together-to-create-value---innovation.html>, Accessed August 2014.

<sup>81</sup> Government of Alberta, "Energizing Investment - A Framework to Improve Alberta's Natural Gas and Conventional Oil Competitiveness," (2010), <http://www.energy.gov.ab.ca/Org/pdfs/EnergizingInvestment.pdf>, Accessed June 2014.

the citizens ‘owners’ of the resource. So, it is Albertans’ interest to ensure that the tenants of the oil sands are serving public interests while serving their private interests. It is apparent that innovation is extremely important in achieving environmental and economic goals. Public policy certainly has a role to play in facilitating and supporting innovation efforts in the oil sands.

When tackling onerous environmental and economic issues connected with oil sands operations, policy options must be evaluated for appropriateness. As oil sands challenges are multi-dimensional, there is no simple solution. Public policy can influence innovation through several avenues including (but not limited to): legislation, regulatory systems, direct and indirect policies, programs, etc. Below we will review an inventory of the significant policies and programs (both provincial and national) that are in place in attempts to promote and encourage innovation within the oil sands. There are currently a handful of programs which the provincial and federal governments are currently supporting which may directly or indirectly benefit oil and gas innovation. I will briefly examine what current programs and policies are in place which may support directly or indirectly innovation in the oil and gas industries.

#### **4.1 Regulatory**

Energy regulation in Alberta has been around for over 75 years.<sup>82</sup> Alberta’s oil sands are subjected to regulation both provincially and federally. In 2010, a Regulatory Task Force (RTF) was set up by the Government of Alberta to head up the Regulatory Enhancement Project (REP).

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<sup>82</sup> Alberta Energy Regulator, [www.aer.ca](http://www.aer.ca), Accessed July 2014.

This project had been established to address chronic negative feedback in regards to regulatory processes for energy development projects. Criticisms were expressed by varying stakeholder groups.<sup>83</sup> An additional impetus in the formation of this task force was to meet the objectives of the *Alberta Competitiveness Act*.<sup>84</sup> REP reports suggested that actionable items that could be taken to improve Alberta's oil and gas competitiveness, all the while upholding health, environmental and public safety measures.<sup>85</sup> The result was the *Responsible Energy Development Act* in 2012 which established the Alberta Energy Regulator (AER) as the sole regulator for all hydrocarbon resources. The AER is a "full life-cycle regulator, from development applications to closure"<sup>86</sup> which amalgamated several governing bodies pertaining to energy regulation.

The most obvious regulation to impact innovation has so far been Directive 074 – Tailings Performance Criteria and Requirements for Oil Sands Mining Schemes created in 2009. This directive requires "oil sands companies to capture and dry a minimum proportion of their new tailings waste, and to continue to reduce the rate of liquid tailings stored on the landscape each

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<sup>83</sup> Government of Alberta, "Regulatory Enhancement Project: Stakeholder & First Nations Engagement Summary." (December 2013), Accessed March 26, 2014. <http://www.energy.alberta.ca/Org/pdfs/FirstNationsEngagementSummary.pdf>. Page 2. AND Government of Alberta, "Enhancing Assurance: Developing an integrated energy resource regulator." (May 2011), Accessed March 18, 2014. <http://www.energy.alberta.ca/Org/pdfs/REPEnhancingAssuranceIntegratedRegulator.pdf>. Page 3.

<sup>84</sup> Government of Alberta, "Enhancing Assurance: Developing an integrated energy resource regulator." <http://www.energy.alberta.ca/Org/pdfs/REPEnhancingAssuranceIntegratedRegulator.pdf>. Page 3.

<sup>85</sup> Ibid.

<sup>86</sup> ibid



year.”<sup>87</sup> Critics, such as the Pembina Institutes acknowledge that this regulation has encouraged industry to find solutions collaboratively. For example, tailings are a priority issue for the Canadian Oil Sands Innovation Alliance (COSIA). Unfortunately, the lack of enforcement of Directive 074 has not encouraged faster technological innovation in the tailings challenge. In this case, regulation has the potential to push innovation by forcing industry to find solutions or suffer penalties. Companies currently have the flexibility to negotiate terms under Directive 074 and even then, the goals are not being achieved.<sup>88</sup>

**Figure 5 - Underachieved goals under Directive 74**

Source – Pembina Institute - *Losing Ground: Why the problem of oil sands tailings waste keeps growing*

Project	Capture rate (% of fine particles captured in oilsands feed)		
	Rate established in Directive 074	Rate negotiated by company	Rate achieved* (2011–2012)
Suncor	30.0	30.0	8.5
Syncrude (Mildred Lake)		12.0	8.8
Shell (Muskeg River)		23.5	8.8
Shell (Jackpine)		15.0	0.0

\* "Rate achieved" denotes the amount of fine tailings each company has captured according to the Directive 074 standards, based on the ERCB's assessment of the companies' reported performance.

Federal regulations are not as pertinent for the oil sands industry as natural resources fall under the responsibility of the provinces under the Constitutional Act. However, there are a

<sup>87</sup> Flanagan, Erin and Jennifer Grant, "Losing Ground – Why the problem of oil sands tailings waste keeps growing," (July 2013) <http://www.pembina.org/reports/losing-ground-oilsands-tailings-fs.pdf> Accessed August 2014.

<sup>88</sup> Ibid.



couple of important federal provisions which are of importance to oil sands development. First, the National Energy Board (NEB) is Canada's international and interprovincial energy regulator which approves projects which span through several jurisdictions.<sup>89</sup> For example, pipelines crossing multiple jurisdictions (internationally or interprovincial) are approved and regulated by the NEB. Second, federal environmental legislation—*Canadian Environmental Protection Act*, *Canadian Environmental Assessment Act* and the *Fisheries Act*—may impact projects depending on their nature.

#### **4.2 Direct Provincial Policies**

In 2004, the Alberta Energy department announced a \$200 million *Innovative Energy Technologies Regulation* (IETP). Successful applicants can receive up to 30 percent of project costs through royalty adjustments; the remainder 70 percent is left for industry to cover.<sup>90</sup> Generally speaking, the program supported innovative technologies which will improve processes which could potentially reduce costs and enhance environmental stewardship. The \$200 million investment introduced about a decade ago is a total amount with no renewal or additional investment set for the future. To date, forty projects have been funded under this program. Some notable achievements of this program included a couple of firsts: a field wide

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<sup>89</sup> National Energy Board, "Who we are," <http://www.neb-one.gc.ca/clf-nsi/rthnb/whwrndrgvrnnc/whwrndrgvrnnc-eng.html>, Accessed March 2014.

<sup>90</sup> Alberta Energy, "Innovative energy Technologies Programs," <http://www.energy.alberta.ca/oil/768.asp>, Accessed February 2014.

polymer flood and a SAGD project in a carbonate rock formation in Alberta.<sup>91</sup> The IETP only supports oil sands and natural gas innovation projects and does not support other energy technology initiatives that do not fall in this category. It is unclear how much of the \$200 million is left and if there are plans to extend this program.

Another direct support program is the Climate Change and Emissions Management Fund (CCEMF). It operates through the Climate Change and Emissions Management Corporation (CCEMC) under the project management of Alberta Innovates – Energy and Environment Solutions (AI-EES). This program uses the funds from Alberta’s *Specified Gas Emissions Regulation* (SGER). Companies which emit over their limit of 100,000 tonnes of carbon dioxide may choose to comply through contributing to this fund. The ‘penalty’ is applied at 15 dollars per extra tonne emitted.

The objective of the CCEMF is to provide financial support to projects which span the innovation pipeline from early stages to commercialization.<sup>92</sup> CCEMC’s current priority areas include: carbon capture and storage, energy efficiency, greening fossil fuels, renewable energy, biological and adaptation. CCEMC funds projects which show significant potential in reducing greenhouse gas emissions. Unlike the IETP program, CCEMC funding streams encompasses more than just oil and gas initiatives. CCEMC supports projects that are reflective of the province’s climate changes strategies. To date, the CCEMF has invested \$213 out of the received

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<sup>91</sup> Ibid.

<sup>92</sup> The Climate Change and Emissions Management Corporation, “Funding,” <http://ccemc.ca/funding/>, Accessed February 2014.

\$316 million dollars through SGER since inception. Further, CCEMC estimates that CCEMC projects account for \$1.56 billion including contributions from industry.<sup>93</sup>

The following tables outline CCEMC's funding by innovation stage and strategic areas since inception (accounts for 4 years of funding):<sup>94</sup>

**Funding by Innovation Stage**

	<b>Investment Amount (millions)</b>
Basic Research and Development	\$4.7
Project Technology Design and Development	\$11.5
Market Demonstration	\$88.5
Commercialization	\$108.2

**Funding by Strategic Area**

	<b>Investment Amount (millions)</b>
Carbon Capture and Storage	\$21.4
Energy Efficiency	\$38.7
Greening of Fossil Fuels	\$54.7
Renewables	\$98.0

Lastly, Alberta established its most formal energy and environmental innovation program through the creation of Alberta Innovates – Energy and Environment Solutions (AI-EES) in 2010. AI-EES' predecessors include the Alberta Energy Research Institute (AERI) and the Alberta Oil Sands Technology and Research Authority (AOSTRA). AOSTRA is often applauded for its significant contribution to the oil sands industry. In 1974, AOSTRA was founded as a provincial crown corporation. Its mandate was focused on the commercialization of the oil sands

<sup>93</sup> Climate Change and Emissions Management Corporation, "2012/2013 Annual Report," <http://ccemc.ca/wp-content/uploads/2013/12/CCEMC-2013-AnnualReport-web-R1.pdf>, Accessed February 2014.

<sup>94</sup> Ibid.

and the end goal was to turn the oil sands into a profitable business. AOSTRA's efforts have made an immense impact on the success of the oil sands industry.

AOSTRA operated as a quasi-operating company and ran about 19 pilot projects. It engaged in joint agreements and profited from the sale of bitumen from these projects. This crown corporation was not created or used as a funding body.<sup>95</sup> In 1986, Alberta's Energy department assumed AOSTRA's role in oil sand technology development and was officially changed to a different operating body known as AERI, which was transformed into a funding organization. A significant portion of AERI efforts were oil sands related.<sup>96</sup>

At the time AOSTRA was introduced, environmental issues were not quite yet on the radar. Consequently, environmental matters were not of priority. However, the goal at hand – commercializing the oil sands – was achieved with great success. Now with growing capital costs and environmental issues, as well as challenging transport options (among other things) – Alberta must engage in a similar effort such as AOSTRA to foster maximum collaboration and facilitate ongoing innovative breakthroughs.

AI-EES' goals are to support industry and partners not only through project funding, but also through research and advisory services. The AI-EES mandate is to encourage solutions to energy and environmental challenges, by providing the technical and financial support where applicable. AI-EES is not solely dedicated to oil sands and heavy oil projects. Their three

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<sup>95</sup> Eddy Isaacs, CEO AI-EES, June 19 2014

<sup>96</sup> *ibid*

program initiatives fall under the following categories: Energy Technologies, Renewable and Emerging Resources, and Water and Environmental Management.

AI-EES' contributions can be looked at through an innovation lens and a strategy area based lens. It is important to acknowledge the importance of supporting innovation in all its various stages. In AI-EES' most current *Report on Outcomes*, it provides the following figures of funding throughout differing innovation levels and also provides a breakdown of funding by strategic area<sup>97</sup>:

#### **Funding by Innovation Stage (2010-2013)**

	<b>Investment Amount (millions)</b>
Concept and Applied Research	\$47.6
Development	\$10.6
Field Pilot and Demonstration Projects	\$39.5
Commercial	\$29.1

#### **Funding by Strategic Area (2010-2013)**

	<b>Investment Amount (millions)</b>
Energy Technologies	\$61.3
Renewable and Emerging Technologies	\$35.5
Water and Environmental Management	\$31.2

### **4.3 Indirect Provincial Policies**

Alberta introduced its research and development tax credit in 2009. This tax credit fosters innovation by supporting “all sectors that conduct research and development that will lead to new, improved or technologically advanced products or processes.”<sup>98</sup> For a maximum credit for

<sup>97</sup> AI - EES, "Report on Outcomes 2012-2013 - Growing an Innovation Support Network," Pg 4

<sup>98</sup> Government of Alberta, "Alberta Scientific Research and Experimental Development Tax Credit," <http://eae.alberta.ca/economic-development/technology/support/taxcredit.aspx> (accessed April 2014)

\$400,000, it is valued at 10 percent of the business' eligible expenditures to a maximum of \$4 million.<sup>99</sup> Oil and gas companies are certainly one of the sectors which can benefit from this tax credit.

#### 4.4 Direct Federal Policies

Canada's largest direct contribution to oil sands innovation is research funding by Canada's Natural Sciences and Engineering Research Council of Canada (NSERC). During the time period from 2012 – 2013, NSERC invested \$11.1 million towards oil sands and heavy oil research.<sup>100</sup> This money is distributed through several different academic and industry programs. NSERC's funding is intended to encourage technological innovation to "improve industry's process efficiencies and reduce its environmental footprint."<sup>101</sup> NSERC's funding has produced exciting research in many areas that are relevant for the oil sands and heavy oil industries from emissions reductions to tailings research.

Natural Resources Canada (NRC) takes a different approach in supporting innovation in Alberta's oil sands.<sup>102</sup> CanmetEnergy, is a program within the NRC which is dedicated to research and technological development to promote clean energy. When speaking of innovation in the oil sands, the idea of clean energy plays a role when looking at technological advances and

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<sup>99</sup> Ibid.

<sup>100</sup> Government of Canada, National Sciences and Engineering Research Council of Canada, <http://www.nserc-crsng.gc.ca/db-tb/index-eng.asp?province=0&category=11> (accessed April 2014)

<sup>101</sup> Ibid.

<sup>102</sup> Government of Canada, Natural Resources Canada, "Oil Sands," <http://www.nrcan.gc.ca/energy/oil-sands/5849> (accessed March 2014)

process improvements which may ‘green’ oil sands productions. Thus, making innovation in the oil sands an important part of the clean energy mix. CanmetEnergy, also works to influence sound policy and regulation in Canada’s natural resource sectors. CanmetEnergy supports the research centre in Devon, Alberta, which employs technical and managerial staff to generate research and knowledge to their partners in government, academia and industry.<sup>103</sup>

#### **4.5 Indirect Federal Policies**

The Scientific Research and Experimental Development (SR&ED) Tax Incentive Program provides approximately \$3.5 billion to 18,000 businesses for SR&ED assistance according to the Canadian Chamber of Commerce.<sup>104</sup> The majority of claimants are small and medium sized businesses and just under half are in the manufacturing sector.<sup>105</sup> Provincial or territorial R&D tax incentives are meant to work in conjunction with this federal program. Canada’s SR&ED tax incentives have been coined one of the most generous in the world. Qualifying activities which qualify for SR&ED include: basic and applied research, experimental development and limited support activities.<sup>106</sup> Eligible expenditures are current expenditures in use for SR&ED performed in Canada by a taxpayer, or on behalf of the taxpayer.<sup>107</sup>

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<sup>103</sup> Government of Canada, Natural Resources Canada, “Devon (AB) Research Centre,” <http://www.nrcan.gc.ca/energy/offices-labs/canmet/devon/5743> (accessed April 2014)

<sup>104</sup> Kremmidas, Tina. “The Scientific Research and Experimental Development (SR&ED) Tax Incentive Program.” The Canadian Chamber of Commerce. *Policy Brief: Economic Policy Series - April 2011*. : 1-11.

<sup>105</sup> Ibid.

<sup>106</sup> Ibid.

<sup>107</sup> Ibid.

**Figure 6 - Business Enterprise Research and Development (BERD)**

Source – Data retrieved from Statistics Canada

(CANSIM, table 358-0024 and Catalogue no. 88-202-XIE)

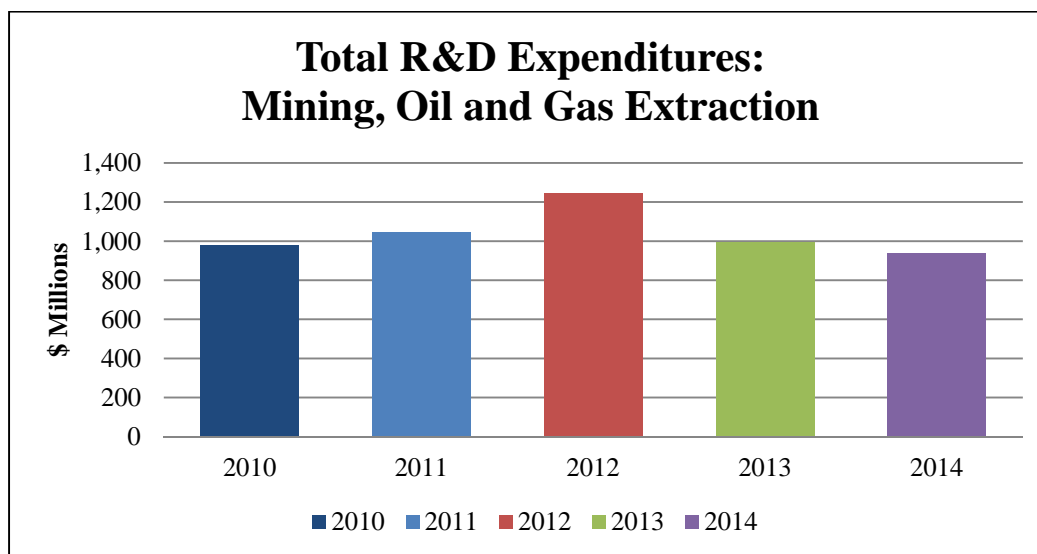


Figure 6 shows the varying amounts of R&D performed by the business enterprise sector in the mining, oil and gas sector. As 2014 numbers are not yet fully confirmed, here is the breakdown of 2013 expenditures: wages and salaries accounted for 174M, other expenditures of \$473M and capital expenditures were calculated at \$374M.<sup>108</sup>

The majority of SR&ED claimants are small and medium sized businesses and just under half are in the manufacturing sector.<sup>109</sup> Canada's SR&ED tax incentives have been coined one of the most generous in the world. Unfortunately, Canada's performance seems lagging when judged beside other OECD (Organization for Economic Cooperation and Development)

<sup>108</sup> Statistics Canada, "Research and development performed by the business enterprise sector (Mining, oil and gas extraction)," <http://www.statcan.gc.ca/tables-tableaux/sum-som/101/cst01/econ151c-eng.htm>, Accessed August 2014.

<sup>109</sup> Ibid.



countries<sup>110</sup> Therefore, it has been constantly stated that Canada's SR&ED program must improve to reach its full potential.

There are two main components to the federal SR&ED tax incentive program. First, it provides an income tax deduction where current qualified SR&ED expenditures are eligible to be immediately expensed.<sup>111</sup> Secondly, an investment tax credit (ITC) is applied to income taxes otherwise payable for SR&ED activities.<sup>112</sup> Two different rates are associated with SR&ED ITCs: "a general rate of 15% and an enhanced rate of 35% is available to smaller CCPCs and unused ITCs may be carried back three years or forward 20 years."<sup>113</sup> Cash refunds are paid to CCPCs and so provide a reliable contribution to their expected cash-flows.<sup>114</sup> In addition, for large CCPCs and public or foreign-controlled corporations, the 15% SR&ED ITC is non-refundable.<sup>115</sup> Canadian federal taxes payable can be offset using the tax credits.<sup>116</sup> Qualifying activities include: basic and applied research, experimental development and limited support activities.<sup>117</sup> Eligible expenditures are current expenditures in use for SR&ED performed in Canada by a taxpayer, or on behalf of the taxpayer.<sup>118</sup>

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<sup>110</sup> Ibid. Page 2.

<sup>111</sup> Ibid. Page 3.

<sup>112</sup> Ibid.

<sup>113</sup> Ibid.

<sup>114</sup> Ibid.

<sup>115</sup> Ibid.

<sup>116</sup> Ibid.

<sup>117</sup> Ibid.

<sup>118</sup> Ibid.

It is important to note, direct operations pertaining to oil and gas such as “prospecting, exploring or drilling for, or producing, minerals, petroleum or natural gas” are not eligible for the SR&ED credit exempt”<sup>119</sup> Despite this restriction, there are significant opportunities for businesses in this sector to take advantage of the SR&ED program. For example, improvements to processes through new technology or software related innovations could potentially qualify for SR&ED.

When looking at the oil sands industry, larger companies with access to more resources may find it easier to obtain SR&ED credits. Applying for SR&ED is not a simple process and has its challenges. If SR&ED requirements and forms are embedded into company processes, it makes the application and reporting procedures for SR&ED much easier. Having said that, small and medium sized firms may not have the resources to embed SR&ED into their systems so larger firms are more capable of claiming SR&ED credits.

## **5.0 Private Sector Institutions**

In 2012, twelve oil and gas companies came together to develop a unique collaboration, Canada’s Oil Sands Innovation Alliance (COSIA). There are now a total of fourteen companies that are a part of this alliance. COSIA aims to enhance innovation in the oil sands through unprecedented collaboration amongst government, academia and most importantly, industry. Since COSIA’s inception, over \$900 million has been spent to develop over 500 technologies

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<sup>119</sup> Government of Canada, Canada Revenue Agency, <http://www.cra-arc.gc.ca/txcrdt/sred-rsde/clmng/whtwrkqlfssrd-eng.html> (accessed April 2014)

and innovations which are shared between alliance members.<sup>120</sup> As this alliance continues to grow in members and resources, it is expected to promote innovations which will not only solve environmental challenges, but which also give the oil sands a competitive boost in this industry with intense market demands. Innovations will increase productivity and may provide economic benefits which such as reduced operational costs.

There are four key Environmental Priority Areas (EPA) which guide COSIA's projects: tailings, water, land, and greenhouse gases. COSIA is a true collaborative body which relies on sharing of ideas and technologies. Often, some member companies will lead certain projects, with others supporting the effort. That being said, a budget of \$2 million is allocated for each of the EPAs. The exception is the tailings EPA. Tailings receives well over \$2 million in the COSIA budget with an extra couple million that is put into a research group dedicated to tailings.<sup>121</sup>

COSIA is an amalgamation of two other institutions the Oil Sands Leadership Initiative (OSLI) and Canadian Oil Sands Network for Research and Development (CONRAD). OSLI was more of a mini-version of COSIA and consisted of 6 member companies. The one difference in objectives between OSLI and COSIA, is the goal of sustainable communities. COSIA has not kept this as a strategic priority as OSLI has dedicated its own Sustainable Communities Working Group to further this endeavor.<sup>122</sup> CONRAD was described as "a network of companies,

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<sup>120</sup> Canada's Oil Sands Innovation Alliance – <http://www.cosia.ca/about-cosia>, Accessed March 2014.

<sup>121</sup> Joy Romero, Vice-President, Technology Development CNRL, July 10, 2014

<sup>122</sup> Oil Sands Leadership Initiative - <http://www.osli.ca/>, Accessed April 2014.

universities and government agencies organized to facilitate collaborative research in science and technology for Alberta Oil Sands.”<sup>123</sup>

## 6.0 Findings and Recommendations

Through examining the above policies and programs, we can see that there are, a number of resources dedicated to the promotion of innovation in the oil sands industry. As with any government initiative, outcomes are not always guaranteed and successes or failures cannot always be accurately foreseen. This section will evaluate the major categories of government policies that have impacted innovation in the oil sands and acknowledge any potential gaps which may be hindering innovation efforts. Policy recommendations will follow each section which will address gaps which may be present in current public policies and programs.

### *Regulatory*

The biggest regulatory piece, having potential in influencing innovation in the oil sands, is *Directive 074 – Tailings Performance Criteria and Requirements for Oil Sands Mining Schemes*. This regulation shows that it is possible leverage in encouraging innovation to promote faster and more efficient tailings ponds reclamation processes. However, there has been immense criticism on this front, as shown in previous sections, that the regulation has not been upheld by the regulator and oil sands operators are negotiating longer time frames for completion of tailings sites. To many, the Directive has not been a successful way of pushing innovation since companies are not being penalized for non-compliance.

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<sup>123</sup> Alberta Water Portal - <http://www.albertawater.com/work/alberta-water-community/industry-organizations/1436-canadian-oil-sands-network-for-research-and-development> (accessed April 2014)

*Policy Recommendation* – It is recommended that the AER, revisit this regulation and assess whether or not current practices are achieving what this specific regulation was set out to accomplish. Tailings are certainly one of the most challenging environmental dilemmas in the oil sands and it would be beneficial to both the environment and industry to use this regulation to apply additional pressure to the operators to hasten the innovative process.

### ***Provincial and Federal Policies***

The most significant provincial policy affecting innovation in the oil sands, should be its climate change policy. However, both provincial and federal governments are lagging in their strategies to reduce absolute GHG emissions. Yes, Alberta may have been one of the front runners in establishing a carbon price program for its emissions, but the program has proved unsuccessful as provincial targets are not expected to be met and there is a lot of speculation of how SGER will evolve as the renewal period is up and provincial politics are unstable. A couple months ago, July 2014, the *Report of the Auditor General of Alberta* outlines criticisms of Alberta's climate change strategy. One of the concerns was the non-existence of monitoring of the program. Also there was lack of tracking outcomes to measure performance to the goals of the climate change strategies.<sup>124</sup> The Auditor General recommends improved planning and improved monitoring processing for Alberta's climate change strategy.

Alberta has to do much more to adopt the right policy to not only reach emissions targets, but also to act as an innovation push. Industry is innovating, but there must be a catalyst to

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<sup>124</sup> Auditor General Report

hasten these innovations that are needed for the economic and environmental health of the province and country. Canada has made firm commitments under the Copenhagen Accord, but has only weak strategies and has not adopted a carbon program.

*Policy Recommendation* – Alberta must place the renewal of SGER as a priority item and heed the Auditor General’s recommendations. Its planning should recognize the current efforts in place and ensure that all resources are taken advantage of. Canada cannot afford to take small steps with climate change; it must begin to craft policies which will protect the environment all the while promoting economic competitiveness within its industries.

***Tax Incentives – Provincial and Federal SR&ED***

As mentioned earlier, Canada’s SR&ED program is one of the most generous in the world. Alberta’s oil sands companies are one of the many industries which benefit from this tax incentive. Although data for sector specific allocation of SR&ED is unavailable, it can be assumed that oil sands operators are making use of this tax incentive when investing in their R&D efforts. Alberta’s SR&ED credit is available on a much smaller scale, but can still help contribute to the oil sands’ innovation efforts.

*Policy Recommendation* – Federal SR&ED has gone through numerous review processes which have already considered recommendations such as simplified processes and increasing support for firms to become more competitive. Those are also very important in supporting continuous SR&ED in the oil sands innovation chain. An additional recommendation would be to ensure that the outcomes from SR&ED activities are measured as best as they can be. It is,

indeed, difficult to measure innovation and what impacts SR&ED may have. So, creating a process to enable performance measurement would be highly valuable. This process could have the means of capturing successes and also discover problem areas within the program.

### ***Public Funding and Programs – Provincial***

Alberta has a couple of programs which are aimed directly at promoting innovation in the oil sands. These include: IETP, IOSI, and AI-EES. IETP's \$200 million commitment in 2004 has dwindled and there is very little public information available in regards to IOSI's projects. However, IOSI indicates that it had approximately two dozen publications in regards to oil sands research in the year 2013.<sup>126</sup> IOSI is also funded by Imperial Oil. AI-EES, has invested \$126 million since 2010 but all of the funds are not directed to the oil sands, a portion of this money also goes towards renewable energy initiatives. Because AI-EES is still relatively new, many projects are in progress and not yet completed. In addition, CCEMC also provides some limited support for oil sands innovation.. Like AI-EES, CCEMC is a young organization with a significant portion of their projects still in progress.

*Policy Recommendation* – With IETP's program expiring soon, IOSI and AI-EES will be the only organizations left directly supporting innovation in the oil sands. IOSI's funding structure is unknown, and AI-EES is limited to governmental funding. Compared to the \$900 million industry has committed through COSIA since 2012, these governmental programs are small. Alberta should seriously look at oil sands innovation as a priority and commit more

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<sup>126</sup> <http://www.iosi.ualberta.ca/Resources/Publications/PublishedPapers/2013.aspx>



resources to motivate innovation. AI-EES has shown a strong track record of collaboration with other public program and private institutions. It is recommended that these collaborative efforts continue to strengthen and grow. Lastly, outcome measurement should also be a priority to enable a realistic evaluation of governmental programs.

### ***Public Funding and Programs – Federal***

On the federal level, there are also a handful of government programs which allocate resources to directly support innovation in the oil sands. These programs include: NSERC, CanmetENERGY and SDTC. All three programs have shown to work on collaborative project with provincial government initiatives and industry. NSERC covers the academic/research portion of the innovation chain; CanmetENERGY's priorities are research and technological development and SDTC supports 'clean tech' that improves efficiency and environmental outcomes of the oil sands. Through examining these programs, it seems that the Canadian government is recognizing the importance of facilitating innovation in the oil sands. However, just like provincial programming, there should be increased resources as the problems in the oil sands are very real and need immediate action.

### ***Innovation Chain and Process in Alberta***

An Expert Panel Report was commissioned, the Fall of 2013 to examine the innovation ecosystem in Alberta. In December 2013, the report was released. The report included several overarching recommendations provided by the panel. These recommendations included the following: creation of a top-level government Advisory Body and a central innovation portfolio

Management Body, establish a defined implementation process in a timely fashion, develop a long-term strategic vision for the innovation system – one that is coherent and has a defined sense of direction, ensure a collaborative environment with all key players in existing innovation system, invigorate policies that are more than just science policy, and provide complementary top-down directions with bottom-up initiatives.<sup>127</sup>

This report attempted to cover a wide range of innovation challenges and acknowledged gaps and problems within Alberta's current innovation ecosystem. This system evaluation was necessary to facilitate action from the government. It is important that the province recognizes the significance of innovation in maintaining and growing a strong and healthy economy. Fortunately, the province did not waste time in adopting the first recommendation – on July 17, 2014, the Alberta Innovation Council was created. The purpose of this Council is to “advise the Premier and Cabinet on innovation policies, strategies and initiatives with a view to creating greater strategic alignment, coordination and integration among the organizations within Alberta's research and innovation system.”<sup>128</sup> The council includes a mix of key innovation players from different industries and institutions.

What does the establishment of this council mean for innovation in the oil sands? The aspirations of the panel of now of the council are large. But if the recommendations are taken

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<sup>127</sup> University Ventures International, "Sustainable prosperity through innovation – Expert Panel report on transforming Alberta's innovation system"(December 2013) Table of Contents.

<sup>128</sup> Government of Alberta, “Alberta Innovation Council – Terms of Reference,” <http://eae.alberta.ca/media/421252/innovationcouncil-termsreference.pdf> Pg 1

seriously and action is taken, hopefully there will be a realization of how important it is that we prioritize innovation in the oil sands for the sake of Alberta's economy and environment.

## **7.0 Conclusion**

Undoubtedly, the oil sands are a significant asset for Albertans. It is the responsibility of the government to ensure it is doing all it can to maximize economic profits and ensure environmental stewardship simultaneously – they are certainly complementary. Both provincial and federal governments do show efforts in supporting innovation in the oil sands, but with the number of challenges the oil sands still face, there is much room for improvement and appropriate actions and initiatives must be taken swiftly. There are abundant public policy tools to promote innovation; it can be challenging, but rewarding, figuring out the proper balance and effectiveness of each policy. Optimistically, with all the awareness and consideration given to innovation and its importance, we will see policy gaps closing and increased program efficiency. Hopefully, in the very near future, more innovations will be adopted that will make Alberta's oil sands economically viable, with a significantly improved environmental track record.

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## Appendix – Table of Oil Sands Innovation Programs

	Program/Policy	Funding	Inception Date
<b>PROVINCIAL DIRECT</b>			
	<b>Innovative Energy Technologies Program (IETP)</b>		2004
	The IETP provides royalty adjustments to pilot and demonstration projects that use innovative technologies to increase recoveries from existing reserves and encourage responsible development of oil, natural gas and in situ oil sands reserves.	Over time, \$2 million commitment	
	<b>Alberta Innovates - Energy and Environment Solutions (AI-EES)</b>		2010
	AI-EES goal is to help Alberta become a global leader in sustainable energy production and exceptional waste management. We work with our partners to identify critical technology gaps and apply world-class innovation management strategies and research to develop solutions for the biggest challenges facing Alberta's energy and environment sector. From identifying a model to value our waste to solving energy issues to working with industry to map tailing solutions – we are working to enhance Alberta's economic, environmental and social well-being.	AI-EES has invested \$126 million, since inception, 2010. \$138 million invested between 2012 - 2013	
	<b>Institute for Oil Sands Innovation (IOSI)</b> University of Alberta	IOSI continues that tradition by combining several innovative approaches to research driven by the Institute's Vision that will achieve "Oil sands operations with a reduced environmental footprint by minimizing water use, consuming less energy, lowering greenhouse gas and other emissions, yielding high quality products at lower cost."	Imperial, AI-EES, Faculty of Engineering 2005
	<b>Climate Change and Emissions Management Corporation/ Climate Change and Emission Management Fund</b>	CCMEC is a not-for-profit organization with a mandate to establish or participate in funding initiatives that reduce greenhouse gas emissions and improve the ability to adapt to climate change. Their mission is to achieve actual and sustainable reductions in greenhouse gas emissions and facilitate climate change adaptation by stimulating transformative change through investments in innovative projects. These projects are in the areas of carbon capture and storage, renewable energy, clean energy production, energy efficiency, adaptation, and biological.	CCMEC funds projects across the innovation scale, from early stages to commercialization. All projects must support CCMEC's mandate of supporting Alberta's Climate Change Strategic. CCMEC's funding comes from the CCMEF which receives contributions via a SGER compliance option. \$16 million has been received through SGER and to date \$213 million has been invested into projects. SGER was passed in 2007 CCMEC established in 2009
<b>PROVINCIAL INDIRECT</b>			
	<b>Alberta Scientific Research and Experimental Development (SRAED)</b>	The Alberta Scientific Research and Experimental Development (SRAED) tax credit benefits businesses of all sizes and in all sectors that conduct research and development that will lead to new, improved or technologically advanced products or processes.	N/A 2009
<b>FEDERAL DIRECT</b>			
	<b>Natural Science and Engineering Research Council (NSERC) Oil Sands and Heavy Oil</b>	NSERC aims to make Canada a country of discoverers and innovators for the benefit of all Canadians. The agency supports university students in their advanced studies, promotes and supports discovery research, and fosters innovation by encouraging Canadian companies to participate and invest in post-secondary research projects. NSERC researchers are on the vanguard of science, building on Canada's long tradition of scientific excellence.	\$144 million invested in Oil Sands and Heavy Oil from 2011 - 2012. \$11.1 million invested in Oil Sands and Heavy Oil from 2012 - 2013 1978
	<b>CANMETEnergy - National Research Council Devon (AB) Research Centre</b>	CANMET/ENERGY supports Natural Resources Canada's priorities to promote the sustainable and economic development of our natural resources, while improving the quality of life of Canadians.	N/A 1975
	<b>Sustainable Development Technology Canada</b>	Sustainable Development Technology Canada (SDTC) is a not-for-profit foundation that finances and supports the development and demonstration of clean technologies which provide solutions to issues of climate change, clean air, water quality and soil, and which deliver economic, environmental and health benefits to Canadians.	Approximately 15 oil sands related projects 2001
<b>FEDERAL INDIRECT</b>			
	<b>Federal Scientific Research &amp; Experimental Development (SRAED)</b>	The Scientific Research and Experimental Development (SRAED) Program is a federal tax incentive program, administered by the Canada Revenue Agency (CRA), that encourages Canadian businesses of all sizes, and in all sectors to conduct research and development (R&D) in Canada. It is the largest single source of federal government support for industrial R&D. The SRAED Program gives claimants cash refunds and / or tax credits for their expenditures on eligible R&D work done in Canada.	N/A 1944
<b>PRIVATE INSTITUTIONS</b>			
	<b>Canada's Oil Sands Innovation Alliance (COSIA)</b>	Canada's Oil Sands Innovation Alliance (COSIA) is an alliance of oil sands producers focused on accelerating the pace of improvement in environmental performance in Canada's oil sands through collaborative action and innovation.	To date, COSIA member companies have shared 560 distinct technologies and innovations that cost over \$900 million to develop. 2012