Global Volatility and SAGD Long Range Planning

MBA Applied Project

APRJ 699

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April 30, 2012

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Abstract

The 2008 recession thrust global financial and commodity markets into turmoil. The US, the largest global consumer of oil, is troubled both politically and economically. As Canada's largest trading partner, the US balance of power is relatively paralyzed. Canada relies heavily on the US economy to generate domestic growth, a position that is becoming less dependable. Meanwhile, China and India's emerging economies and enormous populations possess vast economic opportunities. Abundant, affordable oil could play a key role in raising the standards of living in emerging economies and assert Canada's prominence as an energy super power. Canada's oil sands contain the second largest oil reserves in the world, and Canada is exploring new market opportunities beyond North America. This paper will provide insight into current global uncertainty and the pending consequences on oil sands investment and development. Analyzing macro and micro environmental factors, trends and deviations will evolve into forward looking scenarios.

The Canadian oil sands have a plethora of literature studying the economic, political, social and environmental impacts of mega projects. A new generation of globalism separates oil sand investment from earlier literature on the effects of market volatility on large capital ventures. Macro-environmental forces are pervasive with social media providing real time, raw information, communications channels on a global scale. A borderless socio-environmental culture has evolved to support clean, sustainable energy. However, global economic infrastructure and energy is oil based and lacks viable and sustainable alternatives. The current global environment is unsettling for expensive long term capital commitment, with the growing possibility of unintended economic, social and political consequences.

The Canadian oil sands are predominantly found in the province of Alberta's Athabasca region. Two techniques are used to remove bitumen oil from the oil sands; mining and in-situ. In-situ, or 'in place', allows for depletion of deeper oil sand pools through the drill bit; and applying a process of pressure and heat to melt bitumen into a mobile state. For the purpose of this paper we will focus on the in-situ SAGD method, which is currently the fastest growing commercial extraction process in the Canadian oil sands.

SAGD entrants and producers commit and invest billions of capital dollars over multiple years to research, acquire, develop and improve SAGD production and technology. With global macro-environmental uncertainty, achieving a realistic, comprehensive, long term strategic corporate plan is increasingly difficult. To understand the principles and costs of SAGD we need

to examine a multitude of macro to micro-variables comprising of: markets, political decisions, economy status, social impacts, technological innovation, legal rights, environmental protection, competitive capacity, peer analysis, rate of returns, capital efficiency comparison and available capacity. The micro variables are largely controllable by corporations, whereas the macros yield significant uncertainty.

Threats to economies have the power to start wars and the ability to paralyze nations. Oil ownership remains a fundamental economic power for any nation. Increasing oil production is unsustainable as populations and consumption increase. The world is presumed to be short on oil and this speculation is driving higher commodity prices. It is here that society finds itself on a precipice of decision to either maintain the current energy state, or build a new future that is sustainable for future generations. The Canadian oil sands appear to be the battleground that will set the stage for oils imminent destiny. SAGD operations which are currently deemed the 'best of the worst' oil sands extraction method is being heavily exploited to the dismay of environmentalists. There are many potential situations facing SAGD development and Canada is currently faced with two predominant scenarios, Anarchy and Utopia. These two oil sand industry scenarios will provide insight into future SAGD investment.

Investment in the Canadian oil sands has provoked a global rally to debate the exploitation of the world's second largest reserves. From the social impact to local stakeholders to global environmental outcry, the Canadian oil sands development is a contentious issue with real world ramifications. Development means a boon for Canada at the expense of global evolution towards sustainable energy sources. Without a legitimate exit strategy from oil, ongoing capital investment should receive sufficient financial returns to develop the Canadian oil sands. Alternatively, government intervention through policy making is required to transition away from oil. With respect to the oil sands, what concerns global citizens is the propensity of Canadian politicians and the oil industry to avoid long term accountability; passing off the cost of mistakes and miscalculations of decisions to future generations.

1. Introduction

The 2008 recession thrust global financial and commodity markets into turmoil. Today, nations and states are still struggling to stabilize economies crushed by overleveraged debt, greed and corruption (Carney, 2011). Developed western economies, like the United States (US) and the European Union (EU), continue to struggle while applying complex financial and economic instruments intended to mitigate market volatility (Taleb & Blyth, 2011) (Kirby, 2011). The US, the largest global consumer of oil, is troubled both politically and economically. As Canada's largest trading partner, the US balance of power is relatively paralyzed with Republicans controlling the House of Representatives and Democrats controlling the Senate. This partisan deadlock is unfavorable for healthy economic growth in the US. Canada relies heavily on the US economy to generate domestic growth, a position that is becoming less dependable. Meanwhile, China and India's emerging economies and enormous populations possess vast economic opportunities. Abundant, affordable oil could play a key role in raising the standards of living in emerging economies and assert Canada's prominence as an energy super power. Canada's oil sands contain the second largest oil reserves in the world, and Canada is exploring new market opportunities beyond North America. The impetus of this paper will provide insight into current global uncertainty and the pending consequences on oil sands investment and development. Analyzing macro and micro environmental factors, trends and deviations will evolve into scenarios. Scenario planning will develop contrasting global situations for the oil sands and provide valuable insight for industry adaptability and strategic direction (van der Heijden, 1997, p. 11).

The oil market is ambiguous and fluctuates wildly on speculation of global events. Middle East instability is contributing daily to global price volatility. Recessed economies of overleveraged developed nations offset any potential for growing oil demand. Global economic growth remains uncertain with the threat of a double dip recession. In 2008, the demand for oil dropped significantly from $147 per barrel to less than $40 per barrel within months. This brutal price adjustment shelved many large capital investments in growing oil production, most notably in the Canadian oil sands.

With emergent economies comes an insatiable appetite to increase quality of life similar to developed nations. This proclivity demands greater consumption of raw materials through manufacturing and industrialization. When voracious demand dwarfs supply, burgeoning

economies and untold opportunity emerge. World oil supply is forecast to peak early this century, while demand continues to increase with expanding global populations. The world is unprepared to transition towards alternative, sustainable energy and infrastructure (Graefe, 2009). The international economy remains vulnerable and future stability is largely dependent on the value and ownership of oil.

Peak oil has been debated since M. King Hubbert developed the theory in 1956 (Towler, 2011). The assumption is that finite oil will reach a tipping point when new supply discoveries fail to add incremental global production causing inevitable production declines. Peak oil's credence is deliberated by experts that it has transpired in prior years or will potentially occur in this decade (Aleklett, 2007). Speculation that oil is becoming scarce increases demand and prices, as nations scramble to secure energy for their future. Increasing prices and demand will spur industry to fund the exploitation of oil reserves historically deemed uneconomic. Rising energy costs will compel consumer conservation and the pursuit of sustainable energy substitutes. In the short run, the world is addicted to oil and the economic engine it fuels. Changing the consumption model will require global behavioral and cultural transitions to new energy supplies that lack the necessary and corresponding infrastructure at this time (Graefe, 2009).

Hubbert's Peak Oil Theory is impractical to determine because global reserves are difficult to quantify or qualify. Globally inconsistent measurement standards and accusations of manipulation on reserve estimate by the Organization of the Petroleum Exporting Countries (OPEC), creates speculation and pendulum shifts in global oil price (Graefe, 2009). Oil drives the world economy and is key indicator of global trade and industry health. The 2008 oil price spike and corresponding plunge propelled developed nations, like the US, into economic recession. Governments scrambled and responded with financial instruments and bail out packages to revive the global economy. High oil prices play a significant role in the global economy and pending recovery. Peak oil controversy will be pondered by theorists until price uncertainty shifts consumer demand to sustainable energy substitutes. Currently, the price of oil supports development in Canada's oil sands.

The Canadian oil sands have a plethora of literature studying the economic, political, social and environmental impacts of mega projects. Annually, the oil sands industry risks billions of dollars for potential, long term returns[1] (McLeod-Kilmurray & Smith, 2010). Arguably, the

[1] Discussion on cost benefit analysis

economic calculations of oil sands projects fail to fully account for the comprehensive political, social and environmental costs that are assigned to national reputation and image. The threat of political decisions to harmonize the economic calculation with balanced sustainability is a looming concern for the oil industry (Meadowcroft, 2009).

A new generation of globalism separates oil sand investment from earlier literature on the effects of market volatility on large capital ventures. Macro-environmental forces are pervasive with social media providing real time, raw information, communications channels on a global scale. International, national and regional information is communicated real time through the internet and social media. In this new era, instantaneous, unverified communication affects investment behavior and corporate decision making. National borders have been removed, in favor of globalism, increasing international judgment and accountability of corporations. A borderless socio-environmental culture has evolved to support clean, sustainable energy. However, global economic infrastructure and energy is oil based and lacks viable and sustainable alternatives. The primary issue, for present and new generations, is determining if society can transition to sustainable energy and away from carbon fuels. For oil sand projects, management decisions are complicated, by global messaging, when investing extensive capital resources to replace or supplement oil production. The current global environment is unsettling for expensive long term capital commitment, with the growing possibility of unintended economic, social and political consequences.

The development of the Canadian oil sands is no longer a national debate (Armstrong, 2010). Globally, environmentalists and activists are challenging the oil sands industry's compulsion to destroy a large tract of Canada's boreal forest. Vocally outraged, a growing faction of global citizens is condemning Canada's pursuit of political-economic fortunes at the expense of socio-environmental harms (McLeod-Kilmurray & Smith, 2010). This contentious issue is not easily resolved by choosing one position over the other; rather it requires balancing harm and benefit. For oil sand operators there are considerable identified risks being influenced by unpredictable international politics, global economies, environment and social costs.

McLeod-Kilmurray and Smith (2010) note that Canada's oil sands industry is a valuable contributor to economic stability in Canada. Oil sands projects must generate sufficient returns to attract investment based on project economics. Inherent social and environmental impacts are surfacing with unrealized costs that devalue oil sands projects. Global debate of environmental damage caused by the Canadian oil sands has focused attention on a developed

nation's declining priorities to support economic development above social and environmental protection. Canada, a developed nation and global leader, should hold a higher environmental and social threshold in comparison to developing and emerging countries. For oil sands development, politics and economics continue to dominate industry and government's agendas; with less consideration in fostering a holistic solution for the corresponding environmental and social harms. Global activism is aggressively attempting to influence politicians and the oil industry to assess and mitigate the long term, holistic impacts. In contrast, the government and industry's actions appear lopsided in favor of economic fortunes being created by the oil sands.

Sustainable development is needed to mitigate the cumulative social and environmental consequences that are surfacing (McLeod-Kilmurray & Smith, 2010). McLeod-Kilmurray and Smith's article does not account for the relative immaturity of oil sands development or the continuously improving technological advancements that are reducing environmental impacts. The slant of the article is ubiquitous with the anti-oil sands movement and detracts from the real intent; influencing government policy making to regulate development in a sustainable manner. All levels of government, industry and citizens should promote national energy debate, strategy and policy in Canada. Unfortunately, oil sands participants are wary of federal and provincial government intervention and regulation. The unknown cost of carbon regulation is reminiscent of the Pierre Trudeau Liberal government where the creation of the National Energy Program, in the early 1980's, brought Alberta's economy to a standstill. A repeat performance is undesirable and could further divide Canada regionally.

Currently, Canada's environmental regulatory framework is primordially the provincial government's Environmental Impact Assessment requirement. This lengthy document, with input from provincial and federal regulatory agencies (Alberta Environment, Alberta Sustainable Resources, Fish & Wildlife, Energy Resources Conservation Board, National Energy Board, Department of Fisheries & Oceans, Transport Canada, etc.), is a very inefficient process. The multiagency approach is fragmented with disparate agendas, allowing the oil industry to largely self-regulate through the confusion.

Realizing environmental and social costs may have considerable impact on the economics of all oil sand projects. First Nations and local communities have witnessed the citizenry and social costs of oil sands boom economy. Known health and welfare issues consist of drug and alcohol abuse, housing shortages and public infrastructure deficiencies.

Additionally, changes in corporate decisions to add or drop projects burden local communities and Indian bands with employment and revenue concerns.

The Canadian oil sands are predominantly found in the province of Alberta's Athabasca region. The tar like viscosity of the oil sands (bitumen) requires unconventional methods to extract it from reservoir deposits. The oil sands huge reserves are located in a concentrated area. Ninety three percent of the 1.8 trillion barrels bitumen in place will be potentially recovered by in-situ methods. Currently 135.4 billion barrels are estimated recoverable reserves of which 3.1 billion are under active development. The reservoirs are thick channels of bitumen and sand that range from 5 to 50 meters in thickness. Unconventional extraction methods differentiate the oil sands from established sources of oil (Macquarie Equities Research, 2010). Two techniques are used to remove bitumen oil from the oil sands; mining and in-situ. Mining oil sands is accomplished through an open pit process and is constrained to ~20% of the total oil sands reserve. In-situ, or 'in place', allows for depletion of deeper oil sand pools through the drill bit; and applying a process of pressure and heat to melt bitumen into a mobile state. Methods of commercial in-situ extraction primarily consist of Cyclical Steam Circulation and predominantly Steam Assisted Gravity Drainage, better known as SAGD (Proveda & Lipsettt, 2011). For the purpose of this paper we will focus on the in-situ SAGD method, which is currently the fastest growing commercial extraction process in the Canadian oil sands. SAGD, like other oil sands extraction methods, has marginal economics at $60 per barrel (Financial Services, 2011, p. 55) (Macquarie Equities Research, 2010, p. 5) with a range of published capital efficiency costs between $20,000 and $42,000 per flowing barrel of production (Macquarie Equities Research, 2010, p. 3). In most instances, early commercial SAGD technology adopters have a competitive advantage over new entrants in achieving thermal economies of scale. SAGD operators gain valuable experience through reservoir modeling, simulation, well optimization and plant debottlenecking exercises to improve operating efficiencies at, or above, their facility's name plate production capacity (Atkins & MacFayden, 2008).

A reservoir thickness of 15 meters, or more, is necessary to employ the SAGD technology. Two horizontal wells are drilled, a lower well for oil production and an upper well for steam injection. A production well is drilled with an approximate 100 meters separation from parallel wells allowing for an estimated drainage and recovery factor of 70% of the oil in place. The injector and producer wells are parallel, spaced 5 meters apart, and cost approximately two million dollars a pair. Prior to production, steam is injected into both wells for months, increasing formation pressure and heating the reservoir. As the reservoir achieves operating parameters,

the lower well is completed by installing a submersible pump and cleaning out the well bore. Individual well production is prolific, yielding between 500 and 3000 barrels of oil a day. A production pad will initially have 8 well pairs that may drain a total of 64 hectares within a 10 year period.

Participants in the oil sands industry are committing billions of dollars, during periods of uncertainty, into multi-year SAGD projects with no assurances of a return on investment (ROI) (Macquarie Equities Research, 2010). Understanding and anticipating risks provide corporation's with an opportunity to learn, mitigate harms and champion a proactive outcome. Management selection and endorsement of a project must be differentiated from other projects on the higher value they bring the company. The planning, regulatory, engineering, procurement and construction phase commit corporate capital for multiple, annual budget cycles. Investment does not generate operating cash flow or ROI until first production is achieved, years after initial planning started. There is considerable risk in pledging large sums of capital to a multi-year project during turbulent economies, volatile commodity markets and pendulum shifting oil prices. With risks come rewards, and the organizations with the most astute strategic planning capabilities will reap the highest returns.

SAGD firms take multiple different approaches to technology and reservoir development. Companies are continuously searching for new technologies and operating opportunities. Two methods to SAGD commercialization, beyond a pilot stage, are full system capacity and the phased approach. The full system capacity is a big bang approach that plans, designs and constructs comprehensive infrastructure matched to the estimated reservoir production potential. Capacity is determined by reservoir modeling and project economic return. Planning and design is an engineering intensive exercise that is sanctioned through multiple management reviews. There is little opportunity for technology improvements to be incorporated cost effectively into design after sanctioning. The second method, a phased approach, starts with a smaller green field project that adds incremental stages of production. This method allows producers an opportunity to learn about SAGD behavior and apply greater flexibility in future designs phases by matching production with reservoir quality. Increasing knowledge, experience and technologies can be quickly applied as they become available. Entrepreneurial spirited organizations mitigate risk through phases and incur smaller capital commitments.

SAGD facilities have become modular as the industry moves to scalability and away from the inefficiencies of 'stick built'[2] plants. Most industry operators utilize full engineering, procurement and construction management (EPCM) companies to build their projects. EPCM's employ enhanced framework[3] project management in the oil sands, prompting increased scope, cost and schedule. Flexibility constraints while incorporating new technology paralyze organizations success. Others manage the construction internally, maintaining greater control over their projects. The in-house approach slows scope creep, strengthens productivity and advocates project cost control. Aggressive oil sands construction is recognized as creating hyper competitive markets for limited labor, equipment and materials (LEM) resources. Weak economies improve labour availability and productivity, as companies reduce investment, cancel projects and dedicate resources to projects with higher returns. Entrepreneurial organizations have better track records because they build flexibility into their design and construction models. Additionally, they are less constrained by the triple constraints[4] of formal project management.

The remoteness of the Canadian oil sands makes hypercompetitive site labour unattractive in comparison to modular fabrication yards near urban centers. Referred to as a 'manufacturing approach' the intent is to maintain repetitive design and construction. Giant industry players with deep pockets may build full capacity facilities in a 'big bang' approach to gain economies of scale. Smaller, risk adverse companies tend to construct incrementally, requiring less capital while increasing reservoir experience. Either approach normally generates an ROI between 15-20% after taxes.

Production facilities consist of a network of well pads, pipelines, water treatment and recycling plants, steam generation, oil storage and cogeneration units[5]. These facilities generate steam from treated brackish water that is pushed offsite to remote well pads and into the reservoir through injection wells. SAGD requires approximately a thousand cubic feet (mcf) of natural gas to produce three barrels of steam. Typically, three barrels of steam are needed to produce one barrel of oil referred to as the steam oil ratio (SOR). Emulsified water and oil mixture is returned to the production facility for processing. The water is stripped from the oil and recycled back through the steam generators to be reused. The oil is processed by adding diluent or synthetic oils to thin the bitumen for shipping. Few SAGD operators have onsite oil

[2] Facilities that are erected on site, piecemeal
[3] A process driven Project Management methodology
[4] Scope, Schedule and Cost
[5] Deregulated electricity prices have prompted SAGD operators to build natural gas cogeneration power plants to produce heat and electricity energy. Surplus electricity is sold to the Alberta grid.

upgrading facilities as the economics do not support the cost to construct. High differentials in crack spread[6] may improve the economics of upgrading, but with many US upgraders currently underutilized it is difficult for the oil sands industry to competitively justify an at home solution.

SAGD economics are very dependent on the SOR. Understanding the characteristics of the bitumen in the reservoir determines the SOR. A reservoir may contain steam thief robbing zones, mud clasts or natural shale impediments that cause steam inefficiencies. Other impediments such as natural gas over bitumen require repressurization of the zone to produce oil. Water above or below the bitumen can create issues with steam and production efficiency. Reservoir complexities add risk to the recovery factor of SAGD.

Facility design capacity is intended to operate at name plate volumes. Operating efficiency and plant run times are rarely consistent. Debottlenecking exercises and optimization projects are needed to continually improve production. Competitive advantage is gained by low cost operations and technologies that optimize operating efficiencies. Companies are frequently improving technologies to reduce capital costs, energy usage, water volumes and steam requirements.

SAGD entrants and producers invest billions of capital dollars over multiple years to research, acquire, develop and improve SAGD production and technology. With global macro-environmental uncertainty, achieving a realistic, comprehensive, long term strategic corporate plan is increasingly difficult. Strategic planning is often based on annual budget cycles which can be adversely affected by new economic and market information. It is debatable that SAGD long range corporate strategies can lead to efficient and effective management control during periods of global uncertainty. This problem provides a subset of questions:

- Is sustainability of oil industry specific capital intensive projects, during periods of geo-instability, a regional, national, or global issue?

- Does strategic planning provide value to SAGD participants in uncertain times?

- How are political, social and environmental costs being applied to SAGD project economic calculation?

- What strategic approaches and options are currently employed by SAGD operators?

[6] Crack spread – the differential between crude and refined petroleum

- Is there a fundamental problem in the formulation or the execution of SAGD strategy?

- Are SAGD capital investment principles in planning assumptions in today's macro-environment changing?

- What determines management control effectiveness and efficiency in volatile markets?

The primary methodology to answer the problem and subset questions is based on a comprehensive review of current events and relevant literature. Macro-environmental analyses of SAGD investment decisions will provide a high level understanding of global and corporate issues. Using SWOT analysis, micro-environmental factors will be examined for SAGD companies to moderate risk while attaining competitive advantages. The competitive environment will be assessed using Michael Porter's Five Competitive Forces framework (Grant, 2008). Using multiple literary sources and venues, primary research will explore real and implied costs of oil sands decisions that affect the triple bottom line[7]. Triple bottom line realization must account for volatile political and market risk in valuing long run SAGD projects. As noted earlier there is an abundance of literature; academic research, financial, industry, statistical and Non-Governmental Organization (NGO) publications available on the subject of the Canadian Oil Sands.

Secondary research will compare the efficiency and effectiveness of management control through industry analysis of publicly traded SAGD peers. A subjective review of annual reports and investor presentations for the peer group will consist of publications from ConocoPhillips; Suncor Energy, Devon Energy, Cenovus Energy, and MEG Energy. This comparative analysis of the two different SAGD construction methods, full capacity systems and phased approaches, will conceptualize success during periods of geo-uncertainty.

Finally, scenario analysis will encourage critical and rational thought to achieve successful outcomes in volatile economies and markets. Scenario analysis will provide insight into the impacts that political, economic and social variables have on future SAGD investment. Scenario analysis' purpose is to understand and anticipate change through multiple combinations of influences by stimulating critical thought, evaluating alternatives, estimating performance and planning contingencies.

[7] Economic, social and environmental performance

2. Analysis

To understand the principles and costs of SAGD we need to first examine a multitude of macro to micro-variables comprising of: markets, political decisions, economy status, social impacts, technological innovation, legal rights, environmental protection, competitive capacity, peer analysis, rate of returns, capital efficiency comparison and available capacity. The micro variables are largely controllable by corporations, whereas the macros yield significant uncertainty.

2.1 Macro Environment

A market overview and PESTLE (political, economic, social, technology, legal and environmental) analysis will provide insight into macro environment trends and uncertainty that may assist an organization in their strategic direction.

2.1.1 Markets

Canada's domestic oil production increased 8% in the last four years and is expected to continue growing at ~2% per annum through the remainder of this decade (EIA, 2012, p. 1). Growth is supported by direct foreign oil sands investment. Oil and natural gas capital spend, in Canada, is forecasted at $18.5 billion in 2012, of which oil sands investment accounts for 27% (Hussain, 2012). Future oil availability and pricing uncertainty have Organization for Economic Cooperation and Development (OECD) countries and emerging nations securing supply by investing in the oil sands. Current oil demand is driven by OECD countries, whereas demand growth is looming with emerging nations. Developing countries can absorb high oil prices by factoring into their economic calculation, while developed countries economies are based on cheap oil. All importing nations need low oil prices to help stimulate their economies. Short term volatility does not support long term stability and growth.

Canada participates in the North American Free Trade Agreement with the US. The EIA (2012, p. 4) forecasts that the US will have the slowest economic recovery experienced in the last five decades. Oil imports to the US are declining with a sluggish economy and the discovery of a domestic oil solution. Unlocking the technological challenge of tight shale natural gas and oil has increased the potential for the US to become self-reliant. The US is optimistic that domestic production will provide sufficient energy until a holistic, sustainable solution is available.

New markets for Canadian oil are China, India, and ports in the US Petroleum Administration for Defense Districts (PADD) III and V. China is a carbon intensive economy searching for energy security. With 1.3 billion citizens the government has to balance social and economic needs to stave off political unrest. Canada currently supplies China with 10,000 barrels a day of oil (Cooper, 2011). Bilateral trade agreements with China will increase oil exports exponentially and provide Canada with higher global pricing. India, with over a billion citizens, imports ~80% of its oil and is another emerging opportunity for Canadian oil sales. The instability of India's current Middle Eastern suppliers, including Iran, will benefit Canada's marketability as a stable supplier. The US PADD III and V provide considerable refining capacity and access to international markets. These two coastal regions are among the largest global exporters of refined petroleum products to the rest of the world.

Alberta is land locked, Canada is not. Without significant access to Canadian ports, Alberta is constrained to sell crude oil continentally. Currently, a portion of Alberta's crude production can be upgraded and refined locally, with the majority exported to US refiners as feedstock. In Canada, upgrading and refining of bitumen is a contentious issue that lacks economic fundamentals to support it as a growth industry. For example, retrofitting coking capacity on existing infrastructure in the US is half the cost of building refineries in Alberta. Additionally, the labour, equipment and materials resource shortfall caused by oil sands development is unfavorable to building refiners. Zealous regulatory requirements and approval timelines are not supportive of national refining solutions, either. The altruistic nature of the 'at home' upgrading and refining ideology only holds merit theoretically.

The era of cheap conventional oil is ending and growth in unconventional sources is proving energy intensive. It is unlikely that oil price will drop below $60 per barrel for an extended period of time in the next decade (EIA, 2012, p. 4). OPEC target price of $75 per barrel in 2009 was managed through production cuts (Industry Taskforce on Peak Oil & Energy Security , 2010, p. 17). OPEC's intent is to optimize their profit potential while stimulating oil development projects in non OPEC countries. This floor price provides stability during repressed economies, enabling companies to complete existing projects and encourage incremental production. This strategy stabilizes erratic effects of 'Dutch Disease'[8] that is often associated with boom and bust cycles in the oil industry.

[8] Dutch Disease - boom and bust economies - high commodity prices promote capital investment, result in inflation, higher interest rates, high currency value, large debt, less borrowing, less economic growth and activity, leading to low exports & high unemployment

Demand price changes consumer behavior to buy more or consume less. Supply price adjusts investment behavior and is often unable to adequately match production with demand. Oil is the current energy source used for transportation of products around the world. Current business philosophies are based on minimizing inventories and just-in-time delivery through real time communication and transportation channels. Increasing oil prices have an ancillary effect on products and services pricing and delivery. The world's poor are the first to be negatively affected by high oil pricing impacts on agriculture and transportation. An ethical conundrum surfaces pitting environmental leadership against social morality.

Canada's population, according to Statistics Canada (2011) , exited 2011 at 34.6 million people with 3.8 million citizens in Alberta. In the Athabasca oil sands there are currently fourteen oil companies with SAGD operations, nine under construction (of which 4 are new entrants) and twenty two waiting on regulatory review and approval (of which 5 are new entrants) (Government of Alberta , 2011). All of the conceptual, construction, and operating projects require significant professional and trade labour. The projected labour demand forecasts a 77,000 shortfall in workers in the next decade (Cooper, 2011) due to attrition and replacement of the retiring baby boomer[9] generation, alone. To meet projected demand, companies are developing strategies to recruit people from all over Canada and the world. Industry is lobbying government to reform employment and immigration policy to have unemployed Canadians and foreign workers available to help construct mega projects (McCarthy, 2011). Unemployed Canadians in less opportune provinces, such as Newfoundland with 13.2% unemployment should have first right of refusal for any Canadian employment opportunities (McCarthy, 2011). For foreign worker programs to increase, industry must first exhaust employment opportunities for Canadians. The industry push in changing employment and immigration policy is based on easing future labour shortages and not fixing a flawed system.

The fastest growing ethnic group or minority in Canada is the aboriginal people (AANDC, 2010). This prolific resource pool is largely untapped by the oil sands producers. Government requires industry to consult First Nations on projects within their traditional lands, a requirement of the project approval process. Project consultation can take years as Canadian aboriginals push for employment and beneficial economic terms. To complicate the consultation process, traditional lands of several competing Bands may overlap a development area. Objections that hinder the approval process are based on environmental, social and political concern.

[9] Baby boomers are the largest post world war generation in the workforce

Opposition is generally resolved with financial mitigation. This legal extortion will continue unless the Canadian government engages and resolves treaty and traditional land issues.

Alberta experienced a 5% growth in wages in 2011, attributed to increasing oil sand development. The sheer number of competing SAGD projects awaiting approval, or in construction, is worrisome. Notable shortfalls in public infrastructure, labour availability and predictable cost escalation will agitate oil sand development. Unfortunately Alberta's lagging public infrastructure competes for the same labour pool as the hypercompetitive oil sands. The provincial government's lack of foresight finds Alberta in an infrastructure deficit. Without a holistic development strategy and supporting fiscal budget, the Alberta government's incompetence will eventually hinder the oil sands industry.

2.1.2 Political

Many countries around the world have created national oil companies (NOC) to provide domestic energy security. In Canada, federal and provincial governments avoid direct involvement in the oil business and entrust industry to quasi-laissez faire markets. In fact, the federal and provincial governments are unprepared for the oil sand industry. Canada is lacking a sustainable national energy strategy that benefits the entire nation. A Canadian made energy strategy is ultimately in the public's best interests (Kleiss, 2011). A collaborative energy policy would, ideally, increase provincial cooperation to access and develop the oil sands with national support.

In Canada, there are federal, provincial and regional struggles that have divided the country. Regional divisiveness is created through the disparity between have and have not provinces. The federal government considers the oil sands a key economic driver and recognizes the importance of market pipelines to Canadian ports. In this decade, oil production from the oil sands will outstrip US demand. Major oil market pipeline approvals are mired in an onerous regulatory debate and review process. Political game playing will increase regional conflict as bordering provinces adopt 'not in my backyard' mindsets. Without access to national sales pipelines and alternative international markets, oil sand development is geographically constrained. Accessing ports impact provincial boundaries, requiring federal approval. Provinces are positioning politically to maximize their individual economic and social benefit from the oil sands before cooperating with the federal government. Meanwhile, Canada is lacking a national solution for rising oil sands production. Billions of dollars in capital investment will perish and Canada's economy will falter. The federal government's active trade talks with

Asian markets appears ignorant to mounting provincial opposition. Selling oil to emerging Asia, at the expense of perceived environmental and social values, is considered to be in the nation's interest.

The federal and provincial governments primarily support sustainable long term development of the oil sand industry. The unstructured industry needs policy for strategic, moderate and sustainable growth. This requires both the federal and provincial governments implementing aligned, balanced and transparent regulations that support sensible development. The current regulatory process is convoluted with multiple agencies, unrelated agenda's and general uncertainty of oil sand project approvals. The federal government has devised a plan to simplify the regulatory process of 'one project, one review' (Bell, 2011).

Environmentalists and activists are gaining traction, both nationally and internationally, in holding Canada accountable through the national regulatory review process. Activism by NGO's is aimed to eliminate energy intensive carbon development. This ideology is perceived as a global pursuit for sustainable energy sources. The philosophy downside is that until sustainable energy sources are realized, constraining development will increase oil prices. The world's existing infrastructure supports oil energy and is unprepared for alternative energy solutions. In 2011, Canada's federal government opted out of Kyoto Accord. Many developed and emerging nations were dismayed by the backtracking on previous administrations environmental commitments (CBC News, 2011). The government declared the agreement unfair to Canadians, suggesting an international bias favoring emerging nations with large populations. Complementing this departure from environmental obligation, Canada's federal government is in the process of downsizing Environment Canada's climate change staff.

In Europe, the EU is intent on penalizing energy intensive oil production from unconventional sources. The EU has proposed a fuel quality directive that would tax oil sands petroleum more heavily because of the copious energy required to extract and refine. The EU strategy may be an honest attempt at transitioning a carbon based society to sustainable energy development. If this is the desired outcome than the future of oil demand is at risk. The EU denies that the fuel directive is politically targeting future oil discounts. Although Canada exports very little oil to the EU, the ramifications are significant. This potential precedent will allow others to follow suit; discounting Canadian oil on the pretext of saving the environment. Ironically, a debt default by Greece, Ireland or Portugal is likely to spark a global recession and increase oil

affordability as prices plummet. Such a scenario repudiates transitioning from oil to sustainable energy sources.

In the US, TransCanada's Keystone XL pipeline is now a 2012 presidential election issue. Rejection of the Keystone XL pipeline will moderately impair the US and Canada's trade relationships. This US policy shift is largely based on reducing the reliance on imported oil. The US is aggressively drilling domestic tight shale deposits in the Bakken field, finding lucrative light oil production. For Canada, this is a warning sign that the US market is becoming less reliable as its major customer.

Ottawa immigration policy review to increase temporary foreign trade skills workers could benefit from the high unemployment in the US. Canada's major trade partner should be advocating cooperation to share unemployed resources that are willing to work in the oil sands. Arthur Okun (1962) founded Okun's Law illustrating that every one percent increase in unemployment detracts from national Gross Domestic Product (GDP by two percent. Alberta has the lowest unemployment rates in Canada with direct opportunities for an additional 400,000 workers, potentially Americans, in the next decade. The current Canadian national unemployment rate is close to 7.5% with ~17.3 million workers employed. This provides Canada with an opportunity to directly reduce national unemployment by 2% while increasing GDP by ~4%.The oil sands have unrealized positive economic potential that could benefit Canadians and Americans.

2.1.3 Economic

The Energy Information Administration (EIA) states that world oil demand will increase by 1.3 million in 2012 barrels a day and another 1.5 million barrels in 2013 (Oil & Gas Journal, 2012). In Canada, the International Monetary Fund (IMF) predicts the Canadian economy will expand a modest 1.9% in 2012 (CBC News Business, 2012). Growth will be supported by commodity pricing and capital investment in the oil sands, while the strength of the Canadian dollar will detract from manufacturing and agriculture gains in other regions of Canada. This fiscal imbalance may be marginally offset by lower cost of imports and living expense relative to the strength of the Canadian dollar.

Canadian oil sands production is set to double by 2020, based on lucrative oil price forecasts and project economics. Threatening economic growth are international events that could force another global recession. The European sovereign debt crisis, with Greece, Ireland and Portugal pending default, will have significant economic impacts through 2012. Europe's

dependence on cheap oil is at risk with the recent implementation of an embargo on Iran, a major supplier. Brent oil is forecasted to exit the year at $127.50 per barrel with an annual average of $120 per barrel (Onstad, 2012). Middle East instability is keeping oil commodity prices volatile.

Canada's largest trading partner, the United States, is sluggishly recovering from the 2008 recession. The US market has a relative monopoly on Canadian crude, consuming the majority of production. A transportation bottleneck at Cushing, Oklahoma is responsible for a buildup of oil sands crude inventories that lack market access to the prolific Gulf of Mexico coast refineries. This bottleneck requires Canada to sell oil at a steep discount due to wide 'crack spreads', whereas the opportunity to sell on world market would gain an incremental $10 – $20 per barrel (Pratt, 2012). The bitumen discount earns the US approximately $8.73 billion[10] a year benefit and a corresponding opportunity loss for Canada (Pratt, 2012). Alberta is hostage to US pricing with a Canadian made landlocked position. Access to world markets, through Canadian ports, is very important to the future success of the oil sands and Canada's social, economic and political welfare. The upside to an Asian market is an incremental ~$14 per barrel benefit to Canada (Krugel, 2011). Bitumen sales would realize comparative world market pricing and discounts for our primary customer would be reduced considerably.

In Canada, there is economic diversity across the nation with Alberta leading the provinces in prosperity. The Canadian oil sands are both a blessing and a curse with the opportunity to drive tremendous economic wealth, while potentially damaging Canada's reputation and image. Alberta's landlocked position isn't without national controversy. British Columbia's pristine environmental image should not be tarnished by the reputation of the oil sands. Currently small volumes of bitumen are shipped overseas through an existing oil pipeline[11] to the west coast. This precedence has gone unnoticed while activists oppose sanctioning of all new oil market pipeline construction outside of Alberta. Likewise, eastern Canada acrimony is visible with the region importing ninety percent of their oil from other nations. The existing Sarnia line to the East Coast reversal could provide Alberta crude to Canada's eastern provinces at a $10-15 barrel discount. Additionally, Alberta crude could be refined near existing Canadian ports, creating jobs and spurring regional economies. From Alberta's viewpoint, moving oil east makes less economic sense when access to ports on the west coast is geographically closer. Contrarily, the east sells electricity across the border to the

[10] University of Calgary study ($131 billion/ 15 years (2016-2030)
[11] Kinder Morgan Trans Mountain

US while the west is paying exorbitant prices on imported electricity from their southern neighbor. It is surreal that Canada and its provinces would rather sell oil and electricity at a discount to the United States than take advantage of a sustainable national energy strategy to benefit all Canadians.

Oil sands companies share prices are largely undervalued with most companies using operating cash flow to finance oil sand projects. Partnerships and joint ventures reduce risk through resource, technology and knowledge sharing. These alliances inspire investor confidence and corporate credibility. Canada attracts foreign investment because it is a politically stable nation with reasonable corporate taxation. Foreign investment is very strong in the oil sands as Canadian companies lack the financial fortitude to rapidly increase production on their own merit. Foreign oil majors and NOC's have deep pockets and massive resources available to exploit the oil sands. Early entrants with commercial SAGD operations experience are the best candidates for foreign partnership. SAGD industry players benefit by reducing the considerable capital risk. SAGD investment requires more than four years before returns are realized. Smart investors expect annual growth in their investments and the best economic return.

Oil price volatility is highly criticized as market speculation of questionable supply and emerging market demand. Excessive oil pricing produces negative economic consequences by reducing demand over the long run in all industries. This slows oil field development, creating pendulum shifts in supply and demand. Eventually, prohibitive pricing will fuel demand for alternative energy sources. For the oil sands industry, global economic performance impacts investment and development. If the economy slows and projects are delayed, operators lose their scalability. SAGD projects stoppages incur significant costs and inefficiencies that are realized when the project restarts. The impact affects the national economy as unemployment rises, investment falls and tax revenues shortfalls reduce transfer payments. Moderate, stable oil prices are needed to stimulate regional, national and global economies.

The oil sands are unique in the concentrated hyperactivity driven by high oil prices. The multi-year commitment in a SAGD project cannot stop and restart construction without incurring significant costs and penalties. Funding a SAGD project from cash flow, leveraged debt, or partnership investment can affect the outcome with short term fluctuations in oil prices. High levels of long term capital commitment in SAGD projects require a rate of return that will positively influence a large number of investors. Kalymon (1981) produced an astute article that

discusses the impact of the Oil Crisis of 1973 and capital investment in uncertain times. The Capital Asset Pricing Model (CAPM) is discussed in terms of smoothing erratic economic behavior on long term investments by determining a rate of return required to mitigate systematic and unsystematic risk. However, CAPM does not have the flexibility required to predict future variability caused by macro environmental influences. Understandably additional and unforeseen macro environmental influences exist today that were not relevant during the first oil crisis.

2.1.4 Social

The Canadian oil sands have raised the specter of social benefits and harms that have local and far reaching implications. The region produces economic benefits in wages, profits for industry and tax revenues for government. This windfall increases general prosperity that improves private and public infrastructure. Tax revenues help pay for health care, education, public services, transportation and transfer payments across Canada. General prosperity tends to increase standards of living through lucrative job opportunities and income. The downside to heavy industrialization in the oil sands is the potential association of increased health issues like cancer and respiratory impairments. Health of indigenous people and local communities are degraded by harsh lifestyles, callous work ethics, poor air quality, water and food chain contamination. The aggressive schedule of oil sands development promotes low unemployment in the area and inadequate work-life balance. Transient and highly mobile workforces are imported and housed in remote camps to make up for labor shortfalls. Drug and alcohol abuse is significant as permanent and temporary residents struggle with the stress of intrusion and abnormal lifestyles. Cost of housing in the Fort McMurray combined with the cost of living is hyper-inflated, undermining the lofty wages workers earn.

First Nations bear the brunt of the social impacts caused by boom economies. Fifty years ago in this region, Canada's indigenous people were living traditional lifestyles. Today local Indian bands and contractors are in business with many oil companies. On the reserves, blatant corruption creates vast income disparity between elected council and band members. Rapport and relationship building between industry and First Nations is necessary because federal and provincial governments have historically shirked their responsibility with Indian Bands across Canada. Government has delegated to the oil industry the responsibility to consult and self-monitor project acceptance within the Indian traditional lands. Avoiding political accountability perpetuates a growing resentment by First Nations towards the oil sands industry.

2.1.5 Technology

SAGD technology is evolving as companies learn more about steam characteristics in the oil reservoir. Operators are discovering new SAGD opportunities and complications daily. Technology is vital to improving industry operating efficiencies and environmental performance. Operating companies work independently with reservoir features that may be common, or specific, to the bitumen pool. Knowledge is not shared within industry, as each company strives for a competitive advantage. SAGD methods vary according to the oil sand quality and depth of the zone. Strategic partnering and joint ventures allow companies to gain SAGD knowledge and avoid collusion, while sharing risk. Intellectual property is highly valued and companies are protecting their competitive advantages through patents, trademarks and copyrights.

SAGD Technology is developing at a rapid pace as producers increase spending on research and development. Injection of solvents, gases or fractal infusion will develop game changing opportunities within the industry. Insulating technologies, optimization exercises and increasing operational throughput will reduce operating costs and environmental footprint. Engineering companies are continuously learning about the SAGD process as they develop and push the limits of technology. Government and academic institutions play a critical role in SAGD advancements, providing solutions for focused issues.

Outside of the oil sands, technology is developing competitive oil alternatives to the oil sands. Tight shale oil and deep ocean prospects are achieving large sustaining production. New technologies in well reservoir fracturing and directional drilling technologies have opened up new possibilities like the Bakken[12] play and deep water drilling along the South American coast. Shale oil could be a major substitute to oil sands providing a domestic solution for the US for many years. Both tight shale and deep water techniques have an attached environmental stigma that is not fully understood. Fracturing of tight shale may be responsible for contaminating potable ground water and creating small earth quakes. British Petroleum's Deep-water Horizon[13] tragedy personifies how regulators and industry underestimated the safety and environmental impacts their decisions had on society.

2.1.6 Legal

The Oil sands industry is both provincially and federally regulated through the respective Alberta Energy Resources Conservation Board and the Canadian National Energy

[12] Bakken tight oil is located in the Williston Basin in southern Saskatchewan North Dakota, and Montana
[13] A well blow out in deep water in the Gulf of Mexico that resulted in 11 fatalities and three months of uncontrolled oil spillage

Board. This method supposedly acts as a governor on development. It is neither strategic, nor holistic, rather electing industry to satisfy each agency individually. The regulatory approach is piecemeal. The lack of internal cohesiveness in governments and industry invites environmental groups and activists to continually assault the system. Both government and industry should fear an internationally influenced energy solution through activism. Objectors to the Canadian oil sands are intent on persistent intervention to increase capital costs and eventually stop development.

Resource development is the legal responsibility of the provinces. Oil sands fall under the jurisdiction of the Alberta provincial government's *Mines and Minerals Act*. The federal government provides input through national agencies and provides approvals for projects that cross provincial or national borders. SAGD uses oil well drilling technology regulated through the *Mines and Minerals Act* and not the *Oil & Gas Act*. The *Mines and Minerals Act* requires cradle to grave planning and a stringent regulatory process. Environmental Impact Assessments (EIA's) are developed by project applicants prior to regulatory review and approval. Final endorsement of a SAGD project can take two years depending on the quality of the submission and the number of supplemental information requests (SIR) from regulators. Each operator submits their application in isolation, depending on economics and urgency to grow production. Companies may acquiesce prematurely, setting precedents for increasingly higher standards at the regulator's request. This creates industry problems adding to approval delays as SAGD applicants scramble to meet new and changing requirements. This lack of clear regulatory policy generates uncertainty for the oil industry and investors. To counteract this uncertainty, SAGD companies are proactively incorporating higher environmental standards and protocols, increasing corporate responsibility.

Industry has a legal obligation to consult with First Nations. Smart industry players are building relationships for long term oil sands development. Consultation is generally a lengthy and burdensome process that often deviates from fact based discussion to mitigating rumor and conjecture. Most companies suffer angst and confusion in consulting with Indian Bands. Even the best relationships are contradicted by First Nation objections as local Bands ante up revenue generating opportunities with each new project in their traditional areas. The consultation and intervening process has become known as legal extortion whereby First Nation objectors can game play the process to the point of making a project uneconomic. Oil companies have billions of dollars to invest and execute, while Indian councils know that project delays cost money and are great bargaining points.

2.1.7 Environment

Environmentalists and activists perceive Canada's oil sands as detrimental to global environmental health. The massive destruction of the boreal forest from open pit mining can be seen from outer space, whereas the less visible impact of in-situ operations is best described as 'death by a thousand cuts'[14] (Dyer, 2006). The oil sands have large, concentrated environmental impacts on surrounding and downstream ecologies, specifically noise, land, water and air. The active construction and operational noise is contained to the immediate vicinity of the best known reservoirs. These areas contain clusters of SAGD activity. Each oil company is reducing physical environmental footprints to lower future obligations in reclamation costs. New technologies in drilling, construction and stimulation are increasing operating efficiencies and effectiveness that lower environmental impacts. Environmental and waste management is focused on reduce, reuse and recycle principles. Meanwhile, oil sands reclamation criteria for site disturbances are among the strictest in the mining industry throughout Canada and abroad. The intent is to return disturbed lands to its original state. Locally endangered and 'at risk' species receive special consideration through legislation and the *Lower Athabasca Regional Plan* (LARP). LARP requires setting aside crown lands that will not be accessed or disturbed for resource production. The Federal government has introduced advanced fresh water monitoring program to scrutinize downstream effects on the Athabasca River and surrounding ecosystems. There are potential contaminant impacts with siltation from construction, chemical spills and toxic leeching that can adversely affect the local biology. SAGD water sources are deep brackish water reservoirs treated and maintained in a closed loop system. Fresh water usage has been reduced to less than ten percent of the volumes need to generate steam. Provincially, the government is assessing water usage from a total industry perspective. The volume of water required to process steam for SAGD is staggering. Typically it takes three barrels of steam to produce one barrel of oil, known as the steam to oil ratio (SOR). Total water recycle ratios are monitored carefully to sustain over 90% efficiency. Steam, in addition to water, requires heat sources like natural gas and electricity. An abundance of unconventional tight shale gas has lowered supply prices considerably. Global emissions monitoring are a numbers game to reduce greenhouse gas emissions (GHG). Oil sands GHG increased 2% per produced barrel between 2009 and 2010, which is largely related to increased development of new SAGD production. Alternatively, as SAGD construction starts to decline and oil production grows, GHG's per flowing barrel will decrease through economies of scale. Commercial production using SAGD technology and methodology is new and relatively undeveloped. Operators are

[14] Pembina Institute publication on in-situ environmental impacts

continuously discovering new opportunities to reduce emissions. SAGD operations currently have four opportunities to reduce GHG emissions by:

1. Adding incremental production in producing reservoirs[15];
2. Employing operational efficiencies,
3. Reduced steaming as wells move to blow-down[16];
4. Introducing new technologies.

The oil sands industry is waiting on government to mandate policy on emissions control. Currently, there is no visible plan or agreement forthcoming that can be built into the economics of a SAGD project. Most companies leave this cost out as they focus on future technologies to reduce operating costs, energy intensity and emissions output. A producing SAGD facility, rule of thumb, produces 0.05 tonnes carbon dioxide (CO_2) emissions per barrel of energy produced. A mature facility will be 15 to 20% more efficient through economies of scale and sound operating practices. Cost range for CO_2 emissions are forecasted between $15 and $60 per tonne which translates to $0.75 and $3.00 per flowing barrel of oil produced. A barrel of oil contains 159 liters which suggest that potentially two cents could be passed on to the consumer per liter.

Oil companies struggle with long lead times to initiate, plan and execute SAGD projects. Regulatory changes, midstream, can potentially increase project economics by 25%. Additionally, environmental activism now has the potential to stop future development by keeping Alberta's oil sand production landlocked. A contingent of malevolent conditions is merging to keep oil sands bitumen from entering the world market. International NGO's are hijacking Canada's regulatory review process through stakeholder objections. US refining and global transportation, agriculture, manufacturing have a vested interest in discounted Canadian oil. The EU is vocal that the Canadian oil sands are dirtier (carbon intensive) than conventional oil and require a penalizing carbon based tax. Using supply and demand theory this will make conventional oil imports more expensive, while illogically, Canada will receive lower prices to market their oil. Access to emerging markets improves Canada's options, minimizing the effects of the EU impairment and increasing economic power. Meanwhile, NGO's, environmentalists and activists will continue to lobby against pipeline expansions because they believe industry is lacking transparency.

[15] Through techniques such as down spacing distance between production wells, or adding additional wells to accelerate drainage
[16] Depressurizing the well by removing steam at the end of the production lifecycle

2.2 Micro Environment

The oil sand industry's micro-environmental factors are analyzed using Porter's five forces of competitive, SWOT evaluation and an established SAGD competitor review.

2.2.1 Porters Five Forces

Porter's five forces of competition is a framework that is useful in examining competition and profitability in the SAGD industry. The five competitive forces discussed are: threat of new entrants, threat of substitutes, bargaining power of buyers, bargaining power of suppliers and competitive rivalry.

Threat of New Entrants

The SAGD industry is rapidly growing in north eastern Alberta as oil companies seek long term returns and opportunity to replace declining production from conventional sources. Entry into the industry is capital intensive and requires substantial risk taking. Initial investment is very high in knowledge, time and money to build a successful SAGD competitive advantage through economies of scale. The regulatory review process and facility construction process requires four to six years to achieve production, costing billions of dollars depending on facility size. With only three percent of the available in situ reservoir accessed there is plenty of opportunity for new entrants with deep pockets.

Threat of Substitutes

The 2012 price of light crude oil on the world market is well over $100 per barrel. This high pricing stimulates oil industry exploration and development of less economical sources. New prolific sources of oil from tight shale plays and deep offshore wells could have a significant impact on world oil supply and pricing. Coal, natural gas and natural gas liquids are readily available, overly abundant and very cheap sources of energy. The high price of oil threatens global economic growth and by extension petroleum demand.

Bargaining Power of Buyers

With the current global culture poised to eliminate the use of oil, consumption patterns and behaviors are changing as more environmentally sustainable sources are being considered. Activism and political game playing are driving discounts on SAGD production by constricting access to market. International tariffs, like the proposed EU fuel directive, penalize the carbon intensity of oil sand production. At the same time, the world infrastructure for transportation, agriculture and manufacturing continue relying on oil. Emerging nation's demand will continue to rise, easily offsetting any decline in developed nations. Considerable time is required to convert

the world's principles to alternative sources of energy, suggesting demand for oil will remain high for at least the next generation.

Bargaining Power of Suppliers

The hypercompetitive labor market and uncontrolled project sanctioning by the Alberta provincial government give substantial power to suppliers. Acquiring and controlling contractor labor and equipment resources and supplier materials are a significant competitive advantage for an oil company. Alliances and relationship building are prudent strategies in keeping resources committed through the entirety of a project. Maximizing productivity is crucial to maintain project economics. Contingency and escalation factors need to be generous to accommodate the lengthy timelines required to execute planning and construction.

Competitive Rivalry

Industry rivalry is largely focused on capturing the resources necessary to design, build, operate and maintain SAGD projects. A proven recipe for success is hard to replicate without insider knowledge, as the successful companies already have developed their 'in-house' expertise. This allows companies to gain distinctive competencies over rivals by being early movers. For, example, over-nomination of sales pipelines has increased competition to lock up market access for produced oil. These market conditions will dictate the speed of SAGD development, allowing early movers and low cost operators to gain considerable competitive advantage and profitability over new entrants.

2.2.2 SWOT Evaluation

Examining the SAGD industries strengths, weaknesses, opportunities and threats will weigh the potential for success or failure. Strengths and weaknesses study the internal factors influencing the organization while opportunities and threats provide insight into the external factors.

The oil sands present lucrative opportunities for corporate capital investment noted in Table 1. Balancing the triple bottom line will give a company and the industry greater credibility and access to new markets. A national energy strategy with industry and NGO support would benefit Canada's reputation and image. First, government and the oil sand industry must understand the reasoning behind public outcry and act diligently. This will stabilize oil sand development and focus technologies that benefit social and environmental aspirations.

Table 1 SWOT Analysis of SAGD Projects

Strengths	Weaknesses
• Diversified operating portfolios • Prolific reservoir and production • Development potential • Focus on high return, long term projects • Capital discipline • Scalability through improved execution • Multiple construction methodologies • Optimization of existing infrastructure • Operating experience • Strong operating cash flow • Cogeneration • Low natural gas cost • Brackish water treatment • Evolving and new technologies • Continuous improvements • Reducing environmental footprint • Emissions reduction • Manufacturing approach • Relationship building	• Large capital commitments • Natural gas revenue • High electricity pricing • LEM escalation • Trade labor shortage • Contractor availability • Knowledge drain with attrition • Wide crack spreads • Lengthy regulatory process • Shifting approval process • Approval precedent setting • Long lead times to production • Energy intense production • Environmental constraints • First Nation consultation • Upgrading and refining • Reputation and image
Opportunities	**Threats**
• Balanced national energy strategy – electricity & oil • Federal policy on SAGD development, regulatory & emission • Canadian port strategy • Develop trade with emerging markets • Access US Gulf Coast refining • Refining & upgrading throughout Canada • Foreign investment – JV/partnerships • Technology sharing	• Recession • Political policy uncertainty • Regional divisiveness • Unbalanced national energy strategy • Significant industry growth • Canadian port access uncertainty • Over nominated sales pipelines • Unmanaged SAGD competition • Limited resources

• Long term profit potential • Employment and immigration policy • Employ First Nation and idle Canadians • US unemployment opportunity • Foreign trades workers	• Energy commodity prices • US oil market monopoly • Commodity discounts • Lack of supporting public infrastructure • EU fuel directive • High electricity rates

2.2.3 SAGD Competitor Review

An industry analysis of five peer companies in the oil sands offers interesting distinctions in the approach and success of their capital employment. Conoco Phillips (2012), Suncor (2012), Devon (2012), Cenovus (2012) and MEG Energy (2012) are all established commercial SAGD producers. Suncor SAGD operations are not clustered in the same reservoir area as the other four competitors, having their steam production facilities on the eastern edge of their oil sand mining operations.

Table 2 Competitor Financial Summary

	EBITDA Multiple	ROE	Debt to Capital Ratio 2011	ROCE	SOR	Capital Efficiency / flowing barrel
Conoco	5.0	18.8%	26%	14%	n/a	~$55-65K
Suncor	4.9	11.3%	22%	14%	2.5	$ 38,000
Devon	3.7	22.1%	31%	11%	2.6	$ 30,000
Cenovus	7.7	15.8%	27%	13%	2.2	$ 25,000
MEG	392.4	1.6%	31%	5%	2.4	$ 40,000

(ConocoPhillips, 2012) (Suncor Energy, Inc., 2012) (Devon Energy, 2012)(Cenovus, 2012) (MEG Energy, 2012)

Conoco Phillips is a multi-national, fully integrated oil and natural gas company with a current market capitalization of $94 billion. Publicly posted financial information on their oil sands projects is high level and very vague in comparison to their peers. The company's cash flow multiple is 5x, noted in Table 2, with a return on equity (ROE) of almost 19%. In 2011, the company debt to capital ratio was 26% with return on capital employed (ROCE) at 14% (ConocoPhillips, 2012). Conoco has two significant commercial SAGD projects: Surmont a

partnership with French Energy giant Total where Conoco is the principal; and a successful joint venture with Cenovus Energy as the upstream operator. The initial Surmont One project began production in 2007 with a capacity of 27,000 barrels per day. Surmont Two is a sanctioned 'full capacity' project that may produce between 83,000 and 120,000 barrels a day, at a capital efficiency range between $55,000 and $65,000 per flowing barrel[17]. Production is expected to last 40 years.

Suncor Energy, Canada's largest energy producer, current market capitalization is almost $49 billion. Suncor is a diversified, integrated company with conventional oil, natural gas, oil sands mining and in situ production, along with upgrading and refining capacity across North America. The company's cash flow multiple is just below 5x with a ROE over 11%. In 2011, the company debt to capital ratio was 22% with ROCE at 14% (Suncor Energy, Inc., 2012). Suncor's commercial Firebag SAGD production, 100% ownership, started in 2003 with current production capacity of 70,000 barrels per day. Suncor's Firebag SAGD has two new stages of production being constructed that will produce 62,500 barrels each, at a capital efficiency of approximately $38,000 per flowing barrel. The cost from the initial stages of production has grown by more than $20,000 per flowing barrel as safety enhancements, process improvements, environmental considerations and SAGD learning increase, contributing to facility longevity. Suncor's SOR is the highest in the peer group (excluding Conoco) at 2.6.

Devon Energy is a midsize North American independent oil and natural gas producer with a current market capitalization over $26 billion. Devon is based out of the US and has a diversified portfolio with strong position in natural gas and a growing interest in SAGD production. The company's cash flow multiple is less than 4x, largely due to depressed natural gas prices, with a ROE over 22%. In 2011, the company debt to capital ratio was 31% with ROCE at 11% (Devon Energy, 2012). Devon's commercial Jackfish SAGD production, 100% ownership, started in 2007 with current combined production capacity from two facilities of 70,000 barrels per day. Devon is working on a third facility that will produce an additional 35,000 barrels with a predicted capital efficiency of $37,000 per flowing barrel. Like Suncor, the cost of developing the first production in Jackfish One and Two has grown by approximately $20,000 per flowing barrel as safety enhancements, process improvements, environmental considerations and SAGD learning increased, contributing to facility longevity.

[17] Information ranges are a guide and provided informally by Conoco representative

Cenovus Energy, a Canadian company, is the first commercial SAGD producer in the oil sands. A midsize integrated oil (both upstream production and downstream refining capacity) and natural gas company with a current market capitalization over $26 billion. Cenovus has a diversified portfolio in oil, refining, and natural gas. The company's cash flow multiple is almost 8x, with ROE just under 16%. In 2011, the company debt to capital ratio was 27% with ROCE at 13% (Cenovus, 2012). Cenovus first commercial SAGD production in Foster Creek started in 2001. In 2007 the company partnered with Conoco to share risk and gain refining capacity. The resulting FCCL partnership provides gross production capacity from the two facilities of 178,000 barrels per day. Cenovus increases production incrementally through phases with the expectation to generate over 200,000 barrels a day each facility. Phase increments range from 30,000 to 40,000 barrels per day with a predicted capital efficiency of approximately $25,000 per flowing barrel. The cost of new production development, as compared to the initial production at Foster Creek, has grown by approximately $10,000 per flowing barrel. Notably, Cenovus has the lowest cumulative SOR at 2.2 suggesting the most efficient operations and effective environmental stewardship.

MEG Energy, a new arrival, is fully positioned in the oil sands as an in situ producer with commercial SAGD production. MEG's current market capitalization is just over $7 billion. MEG converted from a private to public company in 2010. The company's cash flow multiple is negative at this time as MEG's initial production is starting to generate returns. MEG's ROE is less than 2% with huge upside potential. In 2011, the company's debt to capital ratio was 27% with ROCE at 5% (MEG Energy, 2012). MEG's first commercial SAGD production in Christina Lake started in 2009 and is supported by CNOOC, from China, who owns a limited ~17% interest. Current production capacity is 25,000 barrels per day operating at well over 100% operating efficiency. MEG increases production through incremental phases, forecasting 260,000 barrels a day by 2020. Phase increments of 35,000 barrels per day have a capital efficiency of approximately $40,000 per flowing barrel. MEG has aggressively and extensively delineated their field, holding the most proven and probable reserves of all the peer companies discussed.

Conoco, Suncor, Devon and MEG utilize the EPCM model of planning, designing and constructing their facilities with the help of a single firm managing the project for them. Project management and control is largely an enhanced framework on project scope, cost and schedule. Cenovus segregates engineering and procurement from construction management. Taking on the role of prime contractor, the company hires multiple small contractors, develops

module fabrication yards and maintains small, focused project management teams in house. Cenovus project management is entrepreneurial and outcome[18] based, focusing on achieving production. Cenovus enjoys cost leadership and is successful in delivering on their commitments through flexible management. Through analysis, it is apparent that large full capacity production projects are less desirable and multiple smaller stage projects increase capital efficiency.

3. Scenario Planning

Chermack (2011) explains that scenario planning evolved from military strategizing. The originator of scenario planning was Kahn in 1967 of RAND Corporation (Chermack, 2011, p. 43). Royal Dutch Shell's, Wack and Newland, in the early 1970's, became early movers and supporters in scenario planning in the oil and natural gas industry. During this period, the Stanford Research Institute was developing another school of thought: long range planning. Both methods create a forum for participants to discuss and debate the future. Organizations may gain competitive advantage over their rivals by developing scenarios that influence strategies and long range planning.

Scenario planning is a process of understanding macro to micro environmental influences and the consequential decision on a firm's behavior. An organization's leaders must participate, engage and support stakeholders in critical thinking and discussion. The interaction will enhance future corporate performance and support sustained investment decisions. "Deeply ingrained perceptions" of the organization and the external environment must be challenged to stimulate the implications of scenarios (Chermack, 2011, p. 104). Once the external and internal environments are examined they are catergorized by their impact to the organization. "Scenario building generates options and opens up thinking while scenario deployment is making decision and creating focus" that will benefit organization planning (Chermack, 2011, p. 122). Scenario planning provides four major outcomes (Chermack, 2011, p. 51):

1. Changed thinking
2. Informed narratives about futures
3. Improved decision making
4. Enhanced learning and imagination

[18] An outcome based Project Management Methodology that focuses participants on a goal

If successful, scenario outcomes will change and enhance a firm's behavior to competitively adapt to new environments. Companies that successfully exercise this tool will gain a competitive advantage over their peers.

World events, since 2008, have created uncertainty and instability. Economic and political matters are changing rapidly, making annual corporate budgeting and forecasting less reliable. Companies investing in the oil sands are generally diversified to hedge against price volatility, with holdings in conventional oil and natural gas. In this century, crude oil production through traditional methods is declining. Discovering and developing new sources of oil is difficult and commodity prices are increasing. The market over supply in natural gas has adversely affected diversified corporate balance sheets with less operating cash flow and profitability. This dilemma affects most diversified company's ability to fund, through cash flow, the required long term commitments required to build SAGD projects.

OPEC's establishment of oil floor pricing is keeping oil prices higher, stimulating investment in unconventional oil production. The broad minded strategy is based in myopic thinking by protecting their resource from being fully depleted by western societies. This insular view is moving the world forward to conventional oil alternatives and sustainable energy solutions. However, the floor price is sufficient to encourage investment, fund existing projects, and continue developing SAGD projects. The risk is that OPEC could shift back to low cost production and cripple current and future western projects.

Billion dollar SAGD capital commitments are significant to corporate image and reputation. There is a certain amount of managerial bravado and ego in making large risk decisions that appeal to investors. Establishing a successful track record of management control in delivering on scope, cost and schedule is far more important. SAGD technology requires a larger than normal risk appetite with conceivably higher expected returns. The lengthy timelines for a SAGD project allow macro-environmental influences to shift many times prompting managerial action and decision making. Scenario planning helps expose unforeseen perils and mitigate risk through proactive management. Initiating, delaying or accelerating projects have consequences that effect the original economic calculation. Constructing a SAGD project is not accomplished in a vacuum and is affected by world events meeting with corporate decisions. How each company manages unexpected events is benefited through scenario planning and analysis. Van der Heijdan (1997, p. 3) suggests firms can approach uncertainty three ways; ignore, assign a margin of error, or create multiple futures to understand it.

Scenario planning is used by proactive companies to ease management “uncertainty paralysis” (van der Heijden, 1997, p. 1). The uncertainty of global events and commodity pricing provokes microcosm decisions to maintain, delay or accelerate SAGD projects. Companies and their investors dislike shelving projects, and exhibit preference of weathering cyclical booms and busts. Scenario planning provides ‘strategic conversations that makes an organization’s behavior more rational’ in determining how it will adapt to rapidly changing environmental factors (van der Heijden, 1997, p. 5).

There is a battle brewing globally between economic growth and environmental protectionism. With the advent of social media there is a growing behavioral movement with energy shifting potential. For centuries the principle foundation of the current global state has been the economy. Nations measure their prosperity and power by their own economic condition. Threats to economies have the power to start wars and the ability to paralyze nations. Oil ownership remains a fundamental economic power for any nation. Increasing oil production is unsustainable as populations and consumption increase. The world is presumed to be short on oil and this speculation is driving higher commodity prices. It is here that society finds itself on a precipice of decision to either maintain the current energy state, or build a new future that is sustainable for future generations. The Canadian oil sands appear to be the battleground that will set the stage for oils imminent destiny. SAGD operations which are currently deemed the ‘best of the worst’ oil sands extraction method is being heavily exploited to the dismay of environmentalists. There are many potential situations facing SAGD development and Canada is currently faced with two predominant scenarios, Anarchy and Utopia. These two oil sand industry scenarios will provide insight into future SAGD investment.

3.1 Anarchy

An economy driven future has governments and financial systems struggling to improve their domestic fiscal situation. Developed nations success requires trade agreements with emerging nations to capture new opportunities. Canada’s oil sands remain energy intensive in their unconventional methods of extraction. Capital intensive SAGD projects require significant labor, equipment and materials resources that benefit a vibrant, growing economy. Crude oil, upgraded and refined petroleum global demand is rising, which is an economic boon for Canada. Oil prices and demand bolster investment in search of new supply and national prosperity. Canada’s key trading partner, the US, possess underutilized upgrading and refining capacity. Recessionary forces have slowed growth in the US and demand for imported oil is declining. Reduced oil consumption combined with a potential domestic solution in tight shale oil

has the US optimistic about less reliance on foreign oil imports, including Canada. Political game playing pushes Canada to continually increase oil discounts to the US market. Without viable alternative oil markets Canada's economy will struggle to grow. This strategy is what will trigger global anarchy.

With the US mired in a punishing recession and high unemployment rates, the American political game playing forces Canada to pursue emerging economies in Asia. The federal government is compelled to intervene in the lengthy project regulatory review process under the pretense of national interests. 'One review for one project' is mandated with aboriginal and environmentalist concerns ignored. Militant activism increases as these groups refuse being disregarded. Martial law is imposed by the federal government to protect the 'golden goose' as economic greed triumphs democracy. The federal and provincial governments' ongoing lack of energy planning and transparency increases overall economic prosperity while incurring high social and environmental costs. A legacy of Canadian passivism and political irresponsibility will enable anarchy.

The opportunity loss from discounted Canadian oil and the US wager on tight shale production has propelled Canada to attract 'world pricing' for their oil. Trade agreements with Asia replace US market demand and consume Canadian supply. This requires that Canada mandate a national energy strategy that provides market access to ports in British Columbia and the Maritimes. British Columbia is attractive for Asian markets and eastern Canada replaces foreign oil imports with domestic. Refining benefits from the new, efficient review process and Canadian ports set up refining capacity to compete with US refinery capacity. The discounts enjoyed by the US have driven Canadian oil producers to achieve greater efficiencies, increasing profits and investment. The efficiencies push the limits of safety and environment, doing more with less. Industry's actions perpetuates as world pricing and low cost producer profits converge, accelerating the development of the oil sands. Even more pressure is placed on society, infrastructure and the environment. Meanwhile, US tight shale oil production proves to be less prolific than originally estimated, requiring renewed reliance on oil imports from Canada. As the largest oil exporter to the US, Canada is, once again, in a unique position to influence the revival of the American economy. Specifically, gasoline prices at the pump for the American consumer.

The US paying world price for all imported oil is the proverbial 'straw that breaks the camel's back' and the ensuing ramifications are catastrophic. High gasoline prices and rising

transportation costs in the US ignite American consumer outrage and discontent. Quality of living decreases and citizens battered by high unemployment and seesaw recessions dissent. National debt levels become unmanageable and the US defaults on their credit, triggering global anarchy. Everyone had expected it to be Greece, Ireland or Portugal. The asset backed US dollar, known as reserve currency, exercised in the majority of international transactions is then devalued. The deflation of this dominant currency reduces the quality of global credit and collapses most economies. Europe falls, unable to manage its own debt crisis, is torpedoed by the downward spiral of the American dollar. China, Japan and OPEC nations are adversely affected with destabilized economies and little recourse on foreign securities investment. Global chaos ensues, oil prices crash and once powerful nations erupt in world war. Oil prices gain traction as nations battle, scrambling to protect their interests and grow global influence. High oil prices lead to government rationing to fund and support war efforts. Labour, equipment and materials are seized, leaving few resources to sustain oil production. Polarization overtakes globalization as the harms of war segregate the powerful from the weak. The balance of natural resources shift through the spoils of war, and trade barriers increase as trust is lost. Canada, resource rich and military weak, finds itself vulnerable and without US protection.

Global economic instability and international reliance on the US dollar does little to inspire confidence. Investing billions of dollars in the oil sands stimulates the Canadian economy, political capital and capitalist greed. Investment in SAGD production in this scenario will provide near term fiscal benefits with continuing violent price shifts, ultimately ending in the nationalization of the oil sands. If prolonged negative demand ensues with a depressed economy, it is reasonable to assume that conventional sources and those closer to key markets will out-compete high cost production from the oil sands. Meanwhile, SAGD technology has a limited window to reduce capital and operating costs; otherwise the billions invested under Anarchy will not provide the long term returns shareholders expect.

3.2 Utopia

An environmentally focused future literally changes the landscape of the oil sands. In this scenario environmental stewardship combined with energy sustainability is the platform for global political, social and economic responsibility. Emerging economies massive consumption of energy pushes the world to pursue alternative sources such as thorium, deuterium, hydrogen, bio fuels, geo thermal, wind, and solar energy. Global nations pool scientific, environmental, and social engineering resources to create new industries in sustainable energy. Carbon based fuels are no longer the primordial energy solution, conviction is broadened with the evolving

environment. Governments commit to exchange domestic reliance on oil for natural, sustainable energy sources. GHG emissions are negligible lowering taxation. This stimulates the need for massive economic restructuring in a world of sustainable energy leaving the oil industry paralyzed. Shareholders pull investment from the oil sands in favor of environmentally sound projects. Morally bankrupt oil industry purveyors shift their capital resources from the rapidly declining industry to new energy source technologies that are both sustainable and ecologically friendly. Reclamation of oil sands disturbances and environmental commitments are abandoned. Government assumes responsibility and passes the cost to Canadian citizens through higher taxes. Passive Canadian consumers, with less disposable income, change consumption patterns in favor of energy conservation. Social media plays a dominant role in communicating idealism, as younger generations decline the opportunity of progress if it harms the earth.

Regulatory reform is clearly accomplished with the development of a national energy strategy benefiting all Canadians. Nationalism through social media activism drives policy and democracy becomes emboldened. International anxiety shifts to restored confidence in Canada. Investment surges and opportunity to shape the future is boundless without creating imminent harms. What was once uncertain generates volumes of excitement with opportunities to shape a new future. Oil is no longer needed.

Utopia's sustainable sources such as wind, solar, thermal and nuclear energy do not have the negative stigma associated with carbon intense resources. Commonly viewed as clean forms of energy, these sources have less obvious and transparent environmental tradeoffs. All require carbon based fuels during construction phase and ongoing maintenance. As power generation from wind mill density increase so will the number of bird deaths associated to man-made structures. Solar panels have health related disposal concerns. Nuclear power has the greatest potential for catastrophic failure as witnessed by the tsunami event on Japan's Fukushima plant in 2011. Long term sustainability requires tradeoffs and have unexpected effects on the environment, society and economy.

Alberta's landlocked position, in Utopia, remains intact as activism makes access to foreign markets untenable. The US shift in energy policy away from carbon based fuels to sustainable solutions reduces the demand of imported oil from Canada. The EU's fuel directive is adopted by nations creating a domino effect, making investment in energy intensive fuels unattractive for economic, political and environmental reasons. The environmental activism

campaign is such a success that it appears the 'cart got ahead of the horse' as massive global consumption of energy has no quick, remedial solution to replace carbon based fuels. Transportation, agriculture, and manufacturing infrastructure all rely on cheap carbon based energy. Altering the energy solution from a limited resource pool to sustainable is ideological. Transitioning global infrastructure to accommodate different energy sources requires behavior and culture changes. The best strategy stands little chance of success if human behavior and culture are not fully engaged. This becomes even less achievable with disparity between nations, race and religion.

3.3 Outcome

Van der Heijdan (1997, p. 4) noted that the "outcome of action is unpredictable". The intent of scenario planning, as noted by Chermack (Scenario Planning in Organizations, 2011, p. 277) is to develop "signals and signposts" that alert organizations of pending change and the need for adaptability. In Anarchy, national interests in economic prosperity outweigh global activism. The short term Canadian success leads to international chaos, violence, market and political fragmentation. Such a scenario would be catastrophic as the world would further regress into resource nationalism over global sustainability. Utopia poses a polar view that places greater environmental burden on all citizens who accept their responsibility for past harms. Growth ensues through the advent of new technologies achieved through global collaboration and continued relationship building. Society is integrated and prosperity is shared to eliminate poverty. Utopia provides a holistic solution that provides global credibility and security as social, environmental and economic factors are balanced. In either scenario, significant events happen within this decade that force change during the next generation. The oil sands industry will need to ready itself to maximize shareholder value while balancing social and environmental responsibility.

Market intervention through political and economic reform in Utopia is double edged and highly debatable. Dirigiste intervention versus laissez faire markets success will be highly contested over the coming years. Without market intervention, as in Anarchy, through the period of 2008 – 09 it is conceivable that the economy would have severely declined to the chagrin of all concerned. Arguably, the interference has resulted in a slow motion fall that holds most developed countries captive. The economic instruments that prop up the current economy may continue creating new and unforeseen issues that either help or hinder economic recovery. The world silently anticipates a domino effect of spiraling economies into a double dip recession.

The unintended consequences of global government interventions remain to be seen as valuable or increasingly harmful.

The current state of the world is confusing the hierarchical placement of national and global interests. Arguably Utopian, global protection should dominate national interests. The lack of global alignment on political, social and economic beliefs denotes support for national interest before global. Developed nations are required to take on a global view whereas emerging and third world countries remain immersed in nationalism. During periods of geo-instability, as in Anarchy, regional and national protectionism requires cleaning up one's own backyard before broader interests, irrespective of hierarchy. Once stability and prosperity resume, it is easier for nations to advance global well-being. For capital intensive projects, like SAGD, sustainability is dependent on a corporation's ability to make decisions that adapt to changing conditions.

A constricting economy has less credit available to stimulate or finance a reversal of past mistakes. Vibrant economies can catapult society forward to improve futures and correct past harms. Fiscal policy making through complex financial instruments has created opportunities as well as imbalances through emerging and unforeseen issues in Anarchy. Market bubbles simmering below the surface have the power to cripple economies. Likewise, similar issues in society and the environment are festering with equal power as noted in Utopia. Without a groundswell to balance the global triple bottom line, Canada is lacking global policy and commitment to shift to a new state. Instead, a mixed bag of government interventions in the economies implies greater financial, social and environmental cost and risk for the SAGD industry. Political, social and environmental costs must be explored and assigned a value in project calculation and selection. This charge may challenge the future viability of SAGD and the oil sands as a whole. This lack of foresight in capturing high environmental and social costs may eventually lead to a day of reckoning where investors mistrust the economic calculations of oil sands projects. Investors, today, may not have a clear understanding that the expected rate of return may exclude long term, unknown obligations. Both government and industry require fiscal restraint. Ongoing volatility makes the market place less efficient and significantly more difficult for industry to focus on their core competencies. Together, government, activists and industry should focus on investing in social and environmental fortitude to gain investment confidence.

Environmental and regulatory legislation, by policymakers, change with each election or public opinion poll. In scenario planning and SAGD projects, policy making can shift significantly with each election. Companies that steward toward exceeding standards become competitively disadvantaged in the short term. Companies that meet the lowest requirements are poorly prepared to meet changes in the long run. Predicting future policies may prove very difficult without a strategic framework agreed upon by both the federal and provincial government. This is not an easy task as the federal government balances the wants and needs of all provinces.

Determining a SAGD strategy and approach is dependent on corporate risk appetite and project analysis. More operators are moving to phased approaches to reduce risk and the impact of erratic market fluctuations, caused by either Anarchy or Utopia. A credible coalition of environmental groups, government and industry should be developed to understand and mitigate their differences. This holistic relationship would address escalation and inflation through sustainable development. Strategic partnerships in the oil sands would allow operators to work together and share ideas and technologies, gaining competitive advantage on a world scale.

Fabrication yards near metropolitan centers reduce the cost of attracting and housing large workforces at remote sites, reducing environmental footprint. Many firms use of large EPCM contractors to build their facilities should review the trend to manage construction ‘in house’ using smaller engineering outfits and multiple contractors. This methodology reduces labor risk and proposes increased productivity. Smaller professional and contractor workforces are easier to ‘plug and play’ than large EPCM models, allowing firm’s greater flexibility. The downside is increased home office management of the project. The phased approach with joint venturing may result in the optimal risk mitigation scenario in either Anarchy or Utopia. Alternatively, constructing full capacity plants may be necessary to arouse investor ego and confidence, a flaw within the SAGD execution strategy. In any event, decentralization may reduce the time lag to react to macro-environmental influences. The advantage and peril of decentralization is in communication. In large SAGD projects, communication breakdowns are not perceptible until an incident occurs. Without challenging imbedded perceptions; organizational complacency and comfort in daily activities keep a good company from becoming a great one.

Management controls effectiveness during volatility can be applied to the peer group of companies analyzed earlier. Publicly available information of proposed compounded annual

growth for each peer company, (CAGR) in Table 3, provides additional insights. With the exception of Conoco, whose information was unavailable, the following assumptions for the remaining four peer companies are as follows:

- Reservoir recovery is 70%
- 90% operational efficiency
- Proven and contingent reserve estimates are accurate
- Investor presentation proven and probable reserve growth CAGR remains constant through to 2010,
- Contingent reserve growth is 50% the proposed proven and probable CAGR out to 2020

Table 3 Reservoir and production potential

	2020 Forecast SAGD Production bbls/day	Compound Annual Production Growth	Years to Produce Proven (After 2020)	Years to Produce Contingent (After 2020)	Total Years of Production
Suncor	400,000	15%	8.4	44.1	52.4
Devon	175,000	18%	19.1	0.0	19.1
Cenovus	500,000	14%	34.8	40.6	75.5
MEG	260,000	22%	54.2	0.0	54.2

(Suncor Energy, Inc., 2012) (MEG Energy, 2012) (Devon Energy, 2012) (Cenovus, 2012)

Applying the assumptions, Table 4 denotes that Devon's current reservoir delineation program of proven, probable and contingent reserves will exhaust production within the next generation. Based on current technology, Suncor and MEG have over 50 years of production, while Cenovus has the greatest longevity at 75 years. All the peer companies combined will produce almost 50% of Canada's total oil production in 2020. Adding an additional 140,000 barrels a day production after 2020, with a CAGR of 10% over five years, allows MEG to maximize future production without overbuilding. Suncor's vast reserves are optimized at 700,000 barrels a day in a stable market, matching reservoir growth with sustainable SAGD production for almost 50 years. Suncor can grow production to over 1,000,000 barrels a day, but their replacement reserves are not increasing at a sustainable rate. Cenovus has more reserve potential than 'realistic' development capacity. The company has the potential to increase

production another 1.5 million barrels a day from 2020 to 2030. Increasing production capacity to the optimal number is not realistic in the proposed timeline after 2020. Interestingly, optimization of SAGD production potential is between the years 2025 and 2030, with production ending within two generations. Long range planning, investment and management stewardship needs to start today to minimize SAGD reservoir inventories in the time it takes the world to transition to sustainable energy. For SAGD companies to be efficient, they need to maximize their capital investment prior to 2030.

Table 4 Competitor Production Opportunity

	Proposed Production Increment after 2020 (bbls)	Proposed Total Production (bbls)	CAGR	2020 plus number of years to get to optimal production	Total Years of Remaining Production
Suncor	300,000	700,000	15%	2025	49
Devon	-	175,000	0%	n/a	16
Cenovus	1,500,000	2,000,000	17%	2030	31
MEG	140,000	400,000	10%	2025	21

4. Conclusion

A successful transition from carbon based fuels is, at minimum, a full future generation away. Younger and new generations are effecting change, refusing to accept the status quo. They are driving global society to discover and market universally sustainable energy solutions. Feasible alternatives may be accomplished within the next two decades, but the accompanying infrastructure and cultural acceptance will take far longer. Canada does not want to be holding a huge inventory of a primary resource with no economic benefit. This does not mean that all hope is lost; contrarily the optimal time for a sustainable energy solution is required now more than ever. Opposition to the oil sands and the irreparable environmental harm to the boreal forest have highlighted undesirable political and industrial decision making by advanced economies. Activism and social media is providing an astute warning to developed nations that they are accountable for their actions.

It is in Canada’s best interest to diversify our oil export markets to ensure we are maximizing values, including higher social and environmental standards. Balanced stakeholders and improving technologies are necessary to progress SAGD production sustainability. Innovation in reducing energy intensity and increase input efficiencies will only lend credibility to

SAGD production and investment. Increasing efficiency and effectiveness in depleting resources at the lowest environmental cost will require sharing technologies between industry players. Disclosing technology lessens the overall environmental footprint, also. To avoid industry collusion from occurring, the federal and Alberta government must act to ensure the entire industry portfolio of SAGD projects lead to sustainable growth. Year over year industry improvements are necessary to mitigate activists' concerns. Reengineering the regulatory system is needed to improve predictability for industry, while improving the overall resource management of the oil sands. Unmanaged, the SAGD industry continuing competition for future development resources will escalate costs, impede development and reduce project viability. Ad hoc sanctioning is no longer feasible. The best outcome would be to balance economic development with sound social and environmental management. Environmental concerns should not stop progress. Instead they should safeguard against potential harms to the environment and public. Canada needs to build sustainability into their energy development. Remarkably industry and government have stepped up through media campaigns to tell the oil sands story.

A carbon free, sustainable global energy solution is currently unavailable. Government intervention and high oil prices will force a solution to be developed. Carbon emission regulation and taxation will burden the cost of oil production, stimulating interest in sustainable energy sources, also. If the free market is allowed to operate, a solution will be developed. As the price per barrel of oil increases so will the desire to find viable energy alternatives and sustainability. Until government rolls out a long term comprehensive emissions policy, the oil sands industry will remain in a state of flux. Without a national energy and regulatory policy, credibility is lacking and impairs investor confidence. Both industry and consumers will incur higher product and service costs, creating a divide in confidence over the transparency of 'big oil' industry profits. Meanwhile, short term focused governments will fill their coffers, advocating job creation and economic vitality.

Investment in the Canadian oil sands has provoked a global rally to debate the exploitation of the world's second largest reserves. From the social impact to local stakeholders to global environmental outcry, the Canadian oil sands development is a contentious issue with real world ramifications. Development means a boon for Canada at the expense of global evolution towards sustainable energy sources. Without a legitimate exit strategy from oil, ongoing capital investment should receive sufficient financial returns to develop the Canadian oil sands. Alternatively, government intervention through policy making is required to transition

away from oil. With respect to the oil sands, what concerns global citizens is the propensity of Canadian politicians and the oil industry to avoid long term accountability; passing off the cost of mistakes and miscalculations of decisions to future generations.

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