SUMMARY

Climate Change Impacts to the Oil and Gas Sector in Western Canada - How are we Preparing?

Summary of Results by Sector

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INTRODUCTION

Many scientists agree that a changing climate will likely manifest itself in increased frequency and severity of extreme weather events, such as floods, storms, droughts, and natural disturbances such as forest fires, landslides and insect outbreaks, as well as changes in temperature (average highs and lows), and precipitation patterns (timing, amounts and types [rain vs. snow]). These changes are expected to have a significant impact on the full range of upstream oil and gas sector activities including exploration, infrastructure development and production, and transmission, especially in western Canada. Potential climate change impacts that are expected to affect the oil and gas sector include physical damage to infrastructure and access structures, changes to operational activity schedules and timing, and reduced effectiveness of current sector strategies and activities to meet government regulations, policies and standards. Adaptation strategies will become increasingly important to ensure that the sector continues to meet its environmental obligations and adequately protects its infrastructure and operations into the future. The extent of the oil and gas sector leaders’ awareness of the full range of possible climate change impacts to the industry, and their level of preparedness to address these impacts has been relatively unknown and was identified as a priority information need by the Energy Working Group of the Adaptation Platform.

An online survey and follow-up interviews of sector leaders in both the upstream and transmission oil and gas industries in British Columbia, Alberta and Saskatchewan were conducted in the spring and summer of 2014 to;

1) Assess the corporate culture and policy regarding climate change,
2) Determine the current state of awareness of the potential climate change impacts on the sector’s operations and infrastructure,
3) Ascertained whether there are any perceived barriers to climate change adaptation,
4) Determine if any climate change strategies have been or are being developed,
5) Identify any information needs, and
6) Determine the best methods for information sharing within the oil and gas sector.

Twenty-eight people completed the on-line survey and another six were interviewed. All survey respondents were oil and gas company employees with approximately equal numbers representing small (<100 employees), medium (100-500 employees), and large (>500 employees) sized companies. All three western Canadian provinces, all sector business areas (e.g., production, transmission, and
exploration) with the exception of conventional gas production and all company roles (e.g., management, operations, and environment) were represented in the survey responses.

Five of the six people interviewed were oil and gas company employees while the sixth was a consultant. All three provinces were represented as were all business areas with the exception of oil pipelines and oil and gas exploration. Four interviewees worked for large companies and two worked for medium-sized companies.

SUMMARY OF RESULTS

Oil and Gas Producers

The following is a summary of the survey responses from respondents working for oil or gas production companies. These results include responses from survey participants who identified their company’s primary business area as conventional or unconventional oil production, or unconventional gas production. No survey respondents identified their company’s primary business area as conventional gas production.

**Extreme Weather and Climate**

- 39% of survey respondents indicated that they had observed extreme weather events within their company’s geographic operating area within the last two years.
  - Respondents listed “abnormally high snow pack, the 2013 flood in Calgary and 2011 flood in SE Saskatchewan, and colder temperatures” as examples.
- 71% of respondents expressed uncertainty as to whether the extreme weather events they had observed were a result of a changing climate.
- 29% of respondents indicated that they did not think that the extreme weather events they had observed were a result of a changing climate.

**Changing Climate**

- 41% of respondents agreed or strongly agreed that global climate change is occurring while 64% of respondents were neutral and 7% strongly disagreed.
• 35% of respondents agreed or strongly agreed that their company’s operations and/or infrastructure could be affected while 23% said that their company’s operations and/or infrastructure would not be affected.

• 35% of respondents had observed their company participating in planning activities to prepare for potential climate change impacts on their company’s operations and/or infrastructure while 47% of respondents had not.

• 12% of respondents had observed their company implementing changes to operations and/or infrastructure to prepare for a changing climate, while 65% of respondents had not observed such activities.

• Extreme weather events and decision making

Percent respondents indicating that their company incorporated current or predicted changes to the frequency and severity of extreme weather when making management decisions.

<table>
<thead>
<tr>
<th>Management Decision</th>
<th>Yes</th>
<th>No</th>
<th>Not sure</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. When making operational decisions</td>
<td>18%</td>
<td>76%</td>
<td>6%</td>
</tr>
<tr>
<td>b. When doing long-term forecasting/planning</td>
<td>35%</td>
<td>53%</td>
<td>12%</td>
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<tr>
<td>c. When doing risk management planning</td>
<td>35%</td>
<td>47%</td>
<td>18%</td>
</tr>
<tr>
<td>d. When designing infrastructure</td>
<td>41%</td>
<td>47%</td>
<td>12%</td>
</tr>
<tr>
<td>e. When developing long-term strategic plans</td>
<td>23%</td>
<td>53%</td>
<td>24%</td>
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**Risk Factors**

• Cost increases were the most frequently mentioned risks associated with climate change, followed by worker health and safety and environmental damage.

• Loss of social license to operate was of least concern across all respondents.

**Temperature**

• Compressed time available to conduct field operations and develop and build infrastructure due to changes in the timing of winter freeze and/or spring melt was the most frequently mentioned concern related to climate change-induced changes to temperatures.

• Cost increases due to required upgrades to access roads and increased difficulty of summer operations due to melting permafrost were also noted.

• Most respondents felt that temperature changes would not impact infrastructure.
**Precipitation**

- Impacts on access availability and the access structures themselves were the most frequently noted operational concern related to potential changes in precipitation patterns as a result of a changing climate.
- Ensuring adequate storm water drainage and construction of facilities above the flood plain were the two most cited concerns related to infrastructure.

**Ecological Processes**

- 18% of respondents expect changes to natural disturbance patterns (e.g., forest fires, floods, landslides) in their company’s operating areas as a result of a changing climate, while 35% of respondents don’t expect changes and 47% of respondents were unsure.
- 94% of respondents were at least somewhat aware of the impact that changes to the extent and diversity of plant and tree species occurring in the ecosystems in which they operate as a result of changing temperatures, precipitation patterns and ecological processes may have on site reclamation and restoration efforts.
- 82% of respondents were at least somewhat aware of the potential impacts of a changing climate on the presence of invasive plants, while 18% of respondents were not aware.

**Company Strategies**

- 41% of respondents indicated that their company had a strategy or strategies to prepare for a changing climate.
- 35% of respondents indicated that their company did not have a strategy
- 24% of respondents didn’t know if their company had a climate change strategy.

**Government Policies**

- 31% of respondents indicated that it was ‘not easy’ to modify management practices to adapt to a changing climate due to existing government policies and standards.
• 23% of respondents indicated that a changing climate would have an effect on their company’s ability to meet government regulations.
• 13% respondents indicated that existing government policies and standards create barriers to climate change adaptation, while 69% of respondents were neutral.

**Information Needs and Sources**

• Monitoring data and predictive models, both at a local/regional level were the two types of information most often mentioned by both survey respondents and interviewees as being needed to help them make operational or environmental decisions regarding adaptation to a changing climate.
• Industry Associations preferred current source of information on climate change followed by colleagues/peers outside of their own company.
• Industry Association electronic newsletters best method for distributing information on climate change to the sector.

**Oil and Gas Pipelines**

The following is a summary of the survey responses from respondents working for oil or gas pipeline companies. These results include responses from survey participants who identified their company’s primary business area as oil transmission pipelines or gas transmission pipelines.

**Extreme Weather and Climate**

• 67% of survey respondents indicated that they had observed extreme weather events within their company’s geographic operating area within the last two years.
  o Respondents listed “abnormally high snow pack, the 2013 flood in Calgary and 2011 flood in SE Saskatchewan, and colder temperatures” as examples.
• 75% of respondents expressed uncertainty as to whether the extreme weather events they had observed were a result of a changing climate.
• 25% of respondents indicated that they thought that the extreme weather events they had observed were a result of a changing climate.
Changing Climate

- All respondents agreed or strongly agreed that global climate change is occurring.
- 67% of respondents agreed or strongly agreed that their company’s operations and/or infrastructure could be affected while 33% were neutral.
- 50% of respondents had observed their company participating in planning activities to prepare for potential climate change impacts on their company’s operations and/or infrastructure while 17% of respondents had not.
- 50% of respondents had observed their company implementing changes to operations and/or infrastructure to prepare for a changing climate, while 33% of respondents had not observed such activities.
- Extreme weather events and decision making

Percent respondents indicating that their company incorporated current or predicted changes to the frequency and severity of extreme weather when making management decisions.

<table>
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<th>Management Decision</th>
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<tbody>
<tr>
<td>a. When making operational decisions</td>
<td>50%</td>
<td>17%</td>
<td>33%</td>
</tr>
<tr>
<td>b. When doing long-term forecasting/planning</td>
<td>50%</td>
<td>33%</td>
<td>17%</td>
</tr>
<tr>
<td>c. When doing risk management planning</td>
<td>83%</td>
<td>0%</td>
<td>17%</td>
</tr>
<tr>
<td>d. When designing infrastructure</td>
<td>33%</td>
<td>33%</td>
<td>33%</td>
</tr>
<tr>
<td>e. When developing long-term strategic plans</td>
<td>33%</td>
<td>33%</td>
<td>33%</td>
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Risk Factors

- Cost increases were the most frequently mentioned risks associated with climate change, followed by worker health and safety and environmental damage.
- Loss of social license to operate was of least concern across all respondents.

Temperature

- Compressed time available to conduct field operations and develop and build infrastructure due to changes in the timing of winter freeze and/or spring melt was the most frequently mentioned concern related to climate change-induced changes to temperatures.
- Cost increases due to required upgrades to access roads and increased difficulty of summer operations due to melting permafrost were also noted.
Most respondents felt that temperature changes would not impact infrastructure.

**Precipitation**

- Impacts on access availability and the access structures themselves were the most frequently noted operational concern related to potential changes in precipitation patterns as a result of a changing climate.
- Ensuring adequate storm water drainage and construction of facilities above the flood plain were the two most cited concerns related to infrastructure.

**Ecological Processes**

- 60% of respondents expect changes to natural disturbance patterns (e.g., forest fires, floods, landslides) in their company’s operating areas as a result of a changing climate, while 40% of respondents were unsure.
- All respondents were at least somewhat aware of the impact that changes to the extent and diversity of plant and tree species occurring in the ecosystems in which they operate as a result of changing temperatures, precipitation patterns and ecological processes may have on site reclamation and restoration efforts.
- All respondents were at least somewhat aware of the potential impacts of a changing climate on the presence of invasive plants.

**Company Strategies**

- 50% of respondents indicated that their company had a strategy or strategies to prepare for a changing climate.
- 50% of respondents didn’t know if their company had a climate change strategy.

**Government Policies**

- 50% of respondents indicated that it was ‘not easy’ to modify management practices to adapt to a changing climate due to existing government policies and standards.
• 25% of respondents indicated that a changing climate would have an effect on their company’s ability to meet government regulations.

• 50% respondents indicated that existing government policies and standards create barriers to climate change adaptation, while the remaining 50% of respondents were neutral.

**Information Needs and Sources**

• Monitoring data and predictive models, both at a local/regional level were the two types of information most often mentioned by both survey respondents and interviewees as being needed to help them make operational or environmental decisions regarding adaptation to a changing climate.

• Industry Associations were the preferred current source of information on climate change followed by colleagues/peers outside of their own company and Independent private contractors or consultants.

• Industry Association electronic newsletters best method for distributing information on climate change to the sector.

**Oil and Gas Exploration**

The following is a summary of the survey responses from respondents working for oil and gas exploration companies.

**Extreme Weather and Climate**

• 50% of survey respondents indicated that they had observed extreme weather events within their company’s geographic operating area within the last two years.
  • Respondents listed “the 2013 flood in Calgary and colder temperatures” as examples.

• 50% of respondents indicated that they thought that the extreme weather events they had observed were a result of a changing climate while the remaining 50% thought that they were not.
Changing Climate

- 50% of respondents agreed or strongly agreed that global climate change is occurring while the remaining 50% were neutral.
- 25% of respondents agreed or strongly agreed that their company’s operations and/or infrastructure could be affected by a changing climate, 50% were neutral, and the remaining 25% did not think that their operations and/or infrastructure would be affected.
- 50% of respondents had observed their company participating in planning activities to prepare for potential climate change impacts on their company’s operations and/or infrastructure while 50% of respondents had not.
- 50% of respondents had observed their company implementing changes to operations and/or infrastructure to prepare for a changing climate, while 50% of respondents had not observed such activities.
- Extreme weather events and decision making

Percent respondents indicating that their company incorporated current or predicted changes to the frequency and severity of extreme weather when making management decisions.

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<tbody>
<tr>
<td>a. When making operational decisions</td>
<td>25%</td>
<td>75%</td>
<td>0%</td>
</tr>
<tr>
<td>b. When doing long-term forecasting/planning</td>
<td>25%</td>
<td>75%</td>
<td>0%</td>
</tr>
<tr>
<td>c. When doing risk management planning</td>
<td>25%</td>
<td>75%</td>
<td>0%</td>
</tr>
<tr>
<td>d. When designing infrastructure</td>
<td>25%</td>
<td>75%</td>
<td>0%</td>
</tr>
<tr>
<td>e. When developing long-term strategic plans</td>
<td>25%</td>
<td>75%</td>
<td>0%</td>
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Risk Factors

- Cost increases were the most frequently mentioned risks associated with climate change, followed by worker health and safety and environmental damage.
- Loss of social license to operate was of least concern across all respondents.

Temperature

- Compressed time available to conduct field operations and develop and build infrastructure due to changes in the timing of winter freeze and/or spring melt was the most frequently mentioned concern related to climate change-induced changes to temperatures.
• Increased difficulty of summer operations due to melting permafrost were also noted.
• Most respondents felt that temperature changes would not impact infrastructure.

**Precipitation**

• Ensuring adequate storm water drainage and construction of facilities above the flood plain were the two most cited concerns related to infrastructure.
• Most respondents felt that precipitation changes would not impact infrastructure.

**Ecological Processes**

• 25% of respondents expect changes to natural disturbance patterns (e.g., forest fires, floods, landslides) in their company’s operating areas as a result of a changing climate, while 50% of respondents don’t expect changes and 25% of respondents were unsure.
• 75% of respondents were at least somewhat aware of the impact that changes to the extent and diversity of plant and tree species occurring in the ecosystems in which they operate as a result of changing temperatures, precipitation patterns and ecological processes may have on site reclamation and restoration efforts, while 25% of respondents were not aware.
• 67% of respondents were at least somewhat aware of the potential impacts of a changing climate on the presence of invasive plants, while 33% of respondents were not aware.

**Company Strategies**

• 25% of respondents indicated that their company had a strategy or strategies to prepare for a changing climate.
• 75% of respondents indicated that their company did not have a climate change strategy.

**Government Policies**

• 50% of respondents indicated that it was ‘not easy’ to modify management practices to adapt to a changing climate due to existing government policies and standards.
• All respondents indicated that a changing climate would have no effect on their company’s ability to meet government regulations.
• 50% respondents indicated that existing government policies and standards do not create barriers to climate change adaptation, while the remaining 50% of respondents were neutral.

**Information Needs and Sources**

• Monitoring data and predictive models, both at a local/regional level were the two types of information most often mentioned by both survey respondents and interviewees as being needed to help them make operational or environmental decisions regarding adaptation to a changing climate.
• Industry Associations were the preferred current source of information on climate change followed by independent private contractors or consultants.
• Industry Association electronic newsletters best method for distributing information on climate change to the sector.

**RECOMMENDATIONS**

• Given the variability of the opinions and experiences among respondents about climate change, a multi-faceted and comprehensive outreach approach utilizing a variety of extension methods and techniques will be required to increase the sector’s knowledge about the predicted impacts changes to the frequency of extreme weather events and natural disturbances, as a result of a changing climate, may have on the sector’s operations and/or infrastructure. For example, preparing for climate change is good practice for risk management in general; even those in the energy sector who don’t agree with climate change do agree with good risk management. And so, for example, an outreach program aimed at risk management in general could include climate change adaptation as one of the topics.

• Due to the complex nature of projecting climate change impacts on the sector, it is recommended that companies implement collaborative internal approaches that engage experts, technicians and specialists to develop adaptation strategies.
• Small companies could be more vulnerable to the impacts of a changing climate depending on the extent and diversity of their operations and may not have the necessary resources to focus on climate change adaptation. Companies operating in a small area or with a small number of facilities could be severely impacted should an extreme weather event or natural disturbance cause a shutdown/suspension of their operations at either a critical time or for an extended period. Outreach activities targeted specifically at small oil and gas companies are required to help them prepare for the potential impacts of a changing climate on their operations and/or infrastructure.

• An analysis of government policies that further examines which policies are considered hindrances and what policy changes could help provide incentives and remove barriers for energy sector companies to address climate change through modification of management practices would be important as a start in eliminating barriers to adaptation in the sector.

• Increased efforts to gather local/regional climate change monitoring data and develop local/regional models and forecasting tools is recommended. Or, if such tools do already exist, then increased efforts are required to increase the awareness of these tools and to increase the sector’s knowledge on how to use them in decision making.

• Many survey respondents and interviewees stated that extreme weather events would have minimal impact on the sector’s infrastructure as the current engineering design standards and criteria already take these events into account. However, given that the frequency and severity of extreme weather events as well as natural disturbance processes are expected to increase over the next few decades, it is imperative that design standards and criteria continue to be monitored to ensure that they remain adequate to ensure the continued safe operation of the sector’s infrastructure. This may also require continued research on the risks and potential impacts of a changing climate on the sector’s operations and infrastructure as well as on the associated costs of adaptation.

• Oil and gas sector industry associations should take a lead role in fostering the dialogue on climate change within their sector and in identifying opportunities for coordinated climate
change adaptation strategies given their role as a trusted and representative body that addresses relevant issues across their membership.

- Future studies designed to gather information about the sector’s preparedness for climate change would be best accomplished through engagement such as focus groups or workshops rather than surveys of individuals. It is also recommended that future discussions on the potential impacts of a changing climate on the sector should use more neutral terms such as ‘extreme weather events’ and ‘climate variability’ instead of ‘climate change’ and should be framed in a risk and cost reduction context.