Discussion paper on the Oil and Gas Sector Roundtable Meeting, November 3, 2009 Westin Hotel, Calgary, AB

1. Introduction

The National Round Table on the Environment and the Economy (NRTEE) is undertaking a major new research program on Water Sustainability and the Future of Canada's Natural Resource Sectors.

The NRTEE will examine the relationship between water and the forestry, mining, agriculture, and energy sectors (including oil and gas, hydro, nuclear, and thermal power). The Program seeks to evaluate what policies, approaches and mechanisms can be used by governments, industry and water management authorities so that water can be best-managed to foster both ecosystem health and the various resource sectors' economic sustainability. The NRTEE recognizes that water quality and quantity are interconnected, yet the focus for the initiative is water availability.

2. Water use and the oil and gas sector[1]

In 2005, the natural resources sectors accounted for approximately 22% of water consumption in Canada. By comparison, irrigation activities accounted for almost 60% of Canadian consumption. Relatively speaking the oil and gas sector uses small volumes of water in comparison with the other natural resource sectors and other energy sectors (thermal, nuclear and hydroelectric power generation), both in terms of total and consumptive water uses. The key difference with the other energy sectors is, however, that nearly all water use for oil and gas production could be considered to be consumptive, i.e. it is either injected into oil reservoirs or, in the case of the oil sands, held for years in tailings ponds (unlike the thermal power generation industry which is largely non-consumptive, withdrawing large volumes of water but then returning the majority back to the system).

There are three areas of unconventional oil and gas development that are of particular interest with respect to the *future* of the industry and sustainable use of water: oil sands, shale gas and coalbed methane, all having unique water uses and/or water management issues.

Oil sands
Surface-mining oil sands production uses 2.0 to 4.0 barrels of water (net) per barrel of bitumen produced. A mature mine will use about 80% recycle water. In-situ oil sands production, however, uses about one barrel of water (net) per barrel of bitumen produced. In some in-situ operations, saline groundwater replaces some or all of the freshwater requirements for extraction. Thus, for freshwater only, the average net value is 0.5 barrels of water per barrel of bitumen produced via in-situ extraction. All recent in situ projects are required to recycle a minimum of 90% of their produced water. CSS projects recycle produced water for steam at rates between 95% and 100%. The SAGD process requires higher quality steam so those projects recycle >90% (CAPP, pers. Comm.). Current efforts are underway in Alberta to develop dry tailings technologies that use little or no water for extraction.

Oil sands production is projected to increase two-fold by 2020 and therefore the industry may need to increase its current water needs to achieve the 2020 production targets, however, using more efficient technology. Recognizing their future water requirement in oil sands mining and production, some companies have committed to improving their water-use efficiency so they can expand their operations without increased water allocations.

[1] Most statistics from: *Water use by the natural resources sectors – Facts*. Natural Resources Canada, March 2009.

Shale gas

Shale gas merits some attention as a potential unique area of development for the oil and gas sector in Canada, both in terms of potential for expansion and the unique water requirements that are associated with the gas production. Shale gas resources in Canada are estimated to be in the order of 1500 Trillion cubic feet (Tcf) of gas in place, with the most significant play located in Horn River in NE British Columbia. The development of this gas requires multi-leg horizontal wells involving fracturing the shale beds which requires tens of thousands of cubic metres of water per well. In order for production to be commercial, thousands of wells will be required therefore requiring significant amounts of water. The water is not returned to source in the short-term and so is considered a consumptive use.

Coalbed methane[2]
Coalbed methane (CBM) in Alberta has significant potential for future production. The Alberta Geological Survey estimates the CBM resource at approximately 500 Tcf of natural gas in place. As of the end of 2007 Alberta had 9,339 wells with some CBM production. This unconventional natural gas could help supplement Alberta's recoverable conventional natural gas reserves; however there is not enough information at this time to provide a meaningful estimate of how much CBM is recoverable. Most of the CBM is attached to or "adsorbed" on the coal surfaces and it may also be trapped in the coal fractures, rather than being trapped in the pore space. Pressure from overlying rock and water within the natural fracture system of the coal seam keeps the methane gas bound to the coal. CBM is produced by reducing the pressure in the coal seam, sometimes by pumping groundwater out, so the natural gas flows through fractures in the coal into the well bore. The natural gas would then flow up to the surface. If few natural fractures exist, producers may use hydraulic fracturing to create channels in the coal.

The water issues related to CBM are related to water management of the water that is pumped out of the seams and management to minimize any contamination to surrounding groundwater sources. It is important to note that approximately 94% of the current Alberta development involves coals that produce little or no water. On the other end of the spectrum, there may be a need to fracture the rock hydraulically, introducing water into the formation, and then dewatering it to draw out the gas. In Alberta, the Energy Resources Conservation Board (ERCB) regulates produced water disposal to ensure the environment and farmland are protected. Saline water must be deep well injected, and the well must meet technical standards and testing requirements to ensure proper disposal. The volume of produced water from CBM is largely dependent upon the location, formation and associated water production characteristics.

What are the key/priority water use issues facing the sector (now/future; and real/perceived)?

3. Sector roundtables

The NRTEE is undertaking a series of expert sector roundtables in the fall 2009, recognizing that each sector has different water needs and experiences. The purpose of these meetings is to gain information and facilitate a dialogue amongst practitioners and researchers about the water use in each sector. The meetings will identify water-related risks for sectors and ecosystems, opportunities to improve efficient water use, barriers to innovation, as well as views on Integrated Water Management (IWM).

[2] Most information taken from: Coalbed Methane/Natural Gas in Coal Final Report. Prepared by: The CBM/NGC Multi-Stakeholder Advisory Committee, Government of Alberta. January 2006.

More specifically, the objectives of the meeting are to:

1. *Identify the key current and emerging freshwater use and availability issues within the oil and gas sector.*
2. *Identify data sources and characterize the state of freshwater use information in the oil and gas sector.*

The oil and gas water sector roundtable is co-hosted by the NRTEE and the Canadian Association of Petroleum Producers (CAPP). The event will occur on November 3, 2009, at the Westin Hotel in Calgary.

4. Water use information

Why is water use data important?

Just as monitoring debits, credits, and savings is crucial to financial success, water accounting is critical in informing the effective and efficient allocation of water for its sustainability. An understanding of how much water is accessible and when; where it's located; who uses it; and what services it provides are basic necessities of effective water management. Ideal management is therefore based on comprehensive, reliable, and frequent primary data. Yet, this type of data infrastructure, management, and reporting can be very costly.

While several provinces have demonstrated efforts to improve their monitoring and allocation schemes, several of these processes are impinged by a general lack of primary data to inform policies. In water-rich regions, there is little political incentive to monitor and regulate water use. However, international experience shows us that, unless carefully managed, the legacy of prior licensing decisions can result in over-allocation problems or misappropriate use that significantly impair the health of aquatic ecosystems, and ultimately the economic health of the industry.

Looking to the future sustainability of Canada's natural resources water demands will continue to vary regionally because of changes in climate, urban growth patterns, and growth of industry. These factors will have implications for allocation, trade, investments and infrastructure. The NRTEE seeks to understand what information is needed and how it can be better managed to improve the management of water to sustain aquifers and baseflow in streams while supporting the economy.

How is water use data collected in Canada?

Information and data collection for the oil and gas sector activities varies by jurisdiction, by sub-sector and likely varies among companies; and there are a number of different sources of water data. In Alberta the *Water Act* places requirements upon licensees to collect and report on water use within the licenses. Licenses or approvals are issued under the *Water Act* to grant licensees or approval holders the right to divert a specific amount of water. The specific use of this water is indicated in the water diversion permit approved by Alberta Environment. Under the *Energy Resources Conservation Act,* there are requirements for drilling and disposal of wastes from drilling activities for all oil and natural gas activities. At the federal level Statistics Canada conducts a regular (biennial) survey of Industrial Water Use. The NRTEE seeks to understand the different water data requirements across the oil and gas sector, and develop a complete and comprehensive picture of what the state of the information and data is for the sector.

- Types and sources of water information: what information is collected by companies? What is required by regulators vs. what is voluntary (e.g., corporate sustainability reporting)?
- How is water use information in the oil and gas sector characterized with respect to: reliability (quality, availability, accessibility), coverage (national, basin, regional, site) and usefulness of information

5. Water availability and climate change

Climate change is one of many challenges that are expected to change the way in which we must manage water resources. Although water availability is not a problem in most regions of Canada at this time, large-scale changes to water regimes are occurring. For the oil and gas sector, vulnerability to climate change is a legitimate concern. As many operations exists in regions of Canada that are anticipated to become warmer and drier, access to additional freshwater supply could be a limitation for future development.

From a water management perspective, decisions must be made using the best available information on climatic scenarios. In some cases, data limitations create uncertainty about whether those decisions are indeed accurate and will support the sustainability of the resource. For example, data on the historic river fluctuations of the Athabasca only date back 50 years, and therefore may be insufficient to predict decal and century scale hydrological cycles (even in the absence of climate change). Research examining the accuracy of future trend analysis of hydrological cycles has demonstrated our limitations to predict future water availability in a meaningful way. While this uncertainty poses significant challenges in a business paradigm, from the water manager's perspective, it supports the need for adaptive policies and decision making grounded in the precautionary principal.

6. Risks for the Sector

Water allocation to the oil and gas industry in Alberta grew by 54% from 2001 to 2005 and accounted for approximately 8% Alberta's total water allocations in 2008. In many cases, however, oil and gas companies use much less than the amount they are allocated. In the southern part of Alberta where the water resource is now fully allocated there are no longer licenses for new developments. This situation, while somewhat unique in Canada, may be a sign of future situations in other parts of the country. Are there any risks facing the oil and gas sector, now and in the future as a result of competing use for water? What are the potential impacts as a result of competing uses of water, and the potential scarcity in the future? Is the industry planning for potential reductions in water availability and possible cost implications, and if so how?

7. Opportunities

Demands on the oil and gas sector to continually improve environmental performance have led to multiple initiatives, partnerships, and investment to improve water use from both the quality and quantity perspectives. Provincial regulations, such as those employed in Alberta, have also pressed the need to employ effective water conservation and protection measures. Added to this, recent research that demonstrates the economic benefits of reducing water use have strengthened the business case for innovation.

While the NRTEE recognizes the evolving nature of this field, a number of areas in which the sector has identified and in many cases ceased opportunities to improve water use are noted. These include: recycling or reuse of process water, use of brackish or saline water from aquifers as an alternative to freshwater, recapture and reuse of mining tailings water, research into extraction and tailing technologies that would serve to reduce water use, research into in situ bitumen recovery methods that alternative substances, research into cooperative withdrawal arrangements and mechanisms such as water permit trading.

As water availability is sometimes linked to water quality issues, those activities by the sector that compromise water quality have also been the focus of research, as required by regulations and conditions of approvals related to environmental assessments. Examples include tailing thickening, and water capping among others. The NRTEE is interested in learning about which services and

water uses are being examined by the sector and what areas of water use could be the focus of future innovation from technological, policy, or management perspectives. Additionally, the NRTEE is interested in gaining information through the Program about opportunities and technologies that could benefit other sectors.

What opportunities exist to improve the sector's water uses, and perhaps its competiveness through innovation (or other means) in water use?

8. Integrated Water Management

Integrated Water Management (IWM) is a term that refers to the development of a strategy for water management that incorporates management of land, water, and living resources and promotes conservation of water resources as well as use of water in a sustainable way. This form of management typically takes place at the river basin or sub-basin scale, given that all activities that impact water quality, quantity or rate of flow at locations upstream, create impacts downstream. In an effort to minimize current or potential conflict between individual water and larger scale users IWM involves participation from a range of water users in balance with experts whom can speak to the ecological and social needs of the area. As an example, there are Watershed Planning Advisory Councils in each of Alberta's water basins.

As a starting point, most strategies require participants to define the values and services that they wish to obtain, maintain or preserve. The subsequent actions required are then defined based on both shared and self interest. As water resources are part of an evolving hydrological cycle and are in constant flux, water users are required to assess and re-assess demands and goals on an adaptive basis.

The oil and gas sector has a strong history of participating in collaborative water management processes. In Alberta, for example, the Water for Life provincial policy has taken a sectoral approach towards developing its land management decisions and build flexibility, such as trading water permits, into its water allocation scheme. The Water for Life process has been criticized by some in terms of its effectiveness, but has been heralded by many as a good model for water governance. It has also led to public-private investment in technology research related to water conservation for the sector.

This paper was produced to assist the NRTEE and sector roundtable participants to identify the key current and emerging freshwater use and availability issues within the oil and gas sector, and to identify data sources and characterize the state of freshwater use information in the oil and gas sector. However, the information as it is presented is not intended to be all inclusive and comprehensive, and therefore may contain gaps or highlight themes that are more or less relevant to the broader discussion of water issues in Canada.

Comments on the paper are welcome in writing to the NRTEE and may be sent to Jill Baker at bakerj@nrtee-trnee.ca.

The NRTEE is conducting a series of sector roundtables to further advance its work on water and resource sectors in Canada. Specifically, the oil and gas sector meeting will address the following questions:

9. Questions

1. What are the key/priority water use issues facing the sector (now/future; and real/perceived)?

2. What opportunities exist to improve the sector's water uses, and perhaps its competiveness through innovation (or other means) in water use?
3. Types and sources of water information: what information is collected by companies? What is required by regulators vs. what is voluntary (e.g., corporate sustainability reporting)?
4. How is water use information in the oil and gas sector characterized with respect to:
    - Reliability (quality, availability, accessibility)
    - Coverage (national, basin, regional, site)
    - Usefulness of information
5. What are the key issues that NRTEE should focus on in its Water Program?
6. What are the key information needs that NRTEE should study further?
7. What are some initial ideas on potential solutions to these priority issues that the NRTEE could investigate (policy options for example)?
8. What are some initial ideas on examples of particularly effective governance processes?