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WaterTech 2008 Presentation

Water- Lubricating Investment in Alberta

April, 2008

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Alberta's Inventory of Major Projects

Inventory of Major Alberta Projects
Summary, February 2008

➢Source: Government of Alberta Website: www.alberta-canada.com

Sector	# Total Projects	Value of Projects($millions)
Agriculture & Related	7	$ 83.0
Biofuels	17	$ 2,415.0
Chemicals & Petrochemicals	5	$ 442.0
Commercial/Retail	105	$ 8,118.6
Commercial/Retail and Residential	15	$ 3,815.8
Forestry & Related	3	$ 360.0
Infrastructure	281	$ 17,169.9
Institutional	209	$ 13,132.3
Mining and Manufacturing	8	$ 2,957.4
Oil & Gas	15	$ 4,121.0
Oil Sands	50	$165,881.3
Other Industrial	12	$ 179.9
Pipelines and Power	77	$ 22,843.8
Residential	133	$ 6,044.2
Tourism/Recreation	112	$ 9,646.2
Total	1049	$257,210.4

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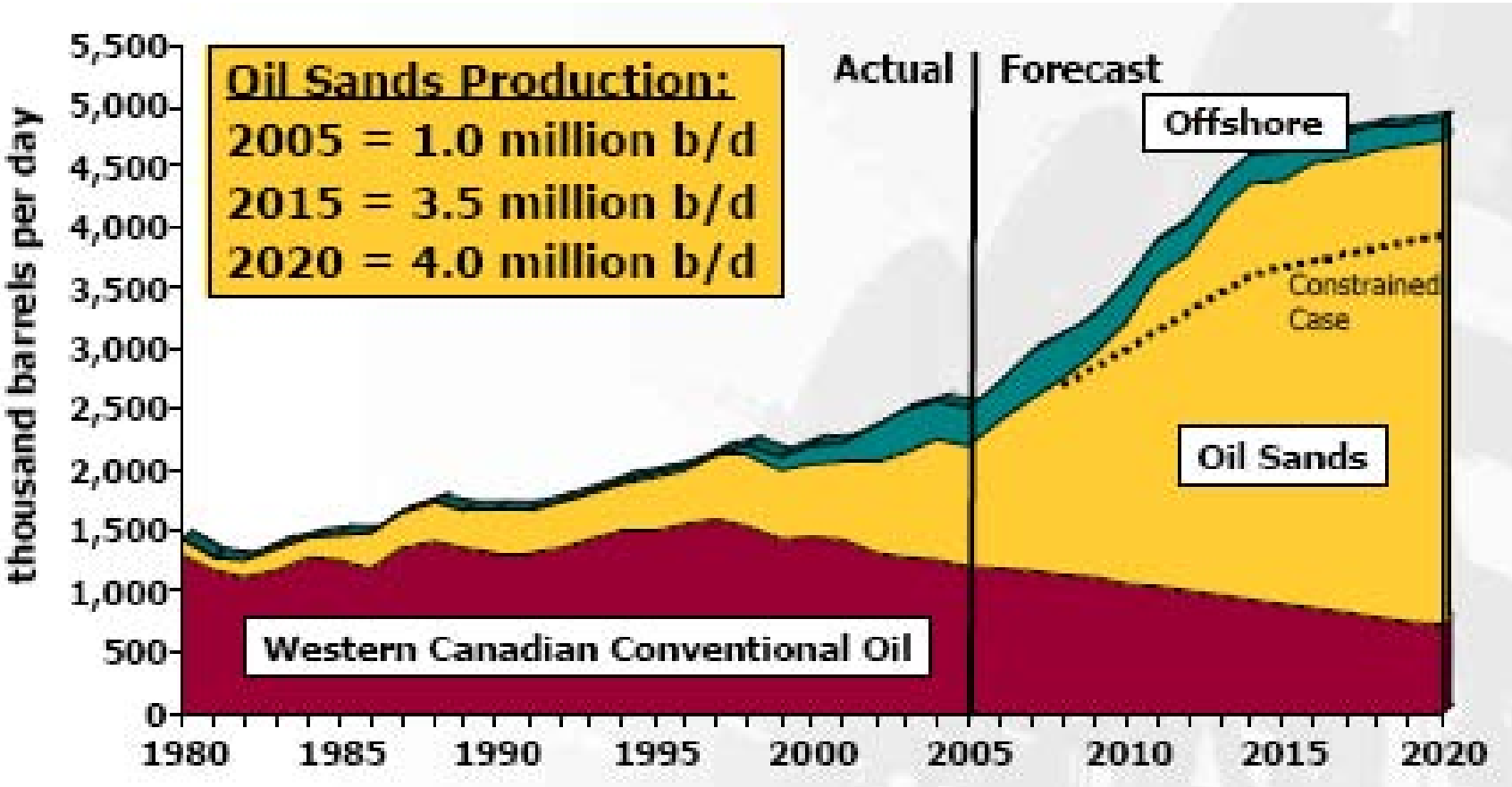
Alberta's Oil and Gas Industry

Canadian Oil Production Conventional, Oilsands and Offshore:



Source: CAPP

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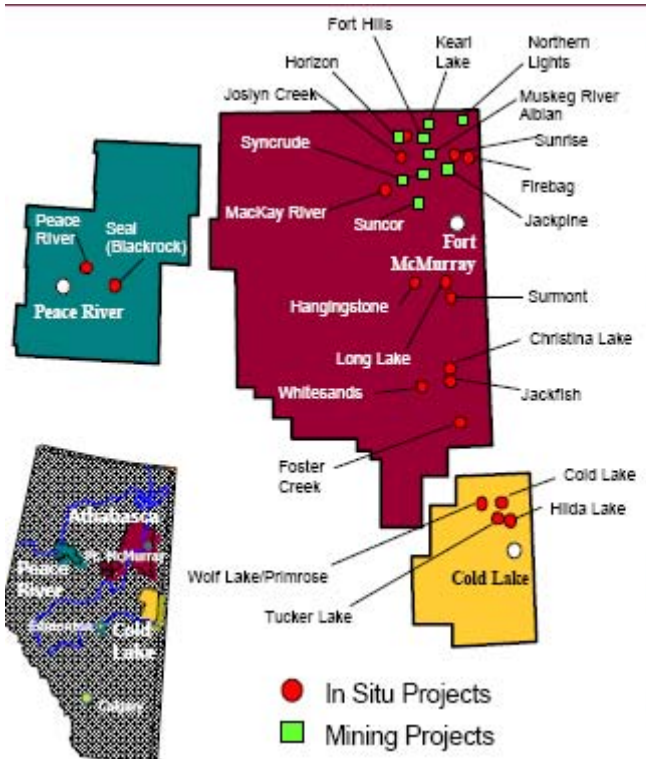
Alberta Oilsands Industry

Oil Sands Projects in Three Deposits



Athabasca – Mining		Barrels per day	
Operator	**Project**	**Initial**	**Potential**
Albian/Shell	Muskeg/Jackpine	155,000	560,000
Suncor	Base Plant	280,000	550,000
Syncrude	Base Plant	300,000	600,000
CNRL	Horizon (2008)	135,000	577,000
Imperial	Kearl (2010)	100,000	300,000
Petro-Canada	Fort Hills (2011)	100,000	190,000
Total E&P	Joslyn Creek Mine (2013)	50,000	200,000
Athabasca – In Situ Thermal			
ConocoPhillips	Surmont	25,000	110,000
Encana	Christina/Foster	42,000	400,000
JACOS	Hangingstone (pilot)	10,000	30,000
Suncor	Firebag	68,000	375,000
Total E&P	Joslyn Creek	10,000	40,000
Devon	Jackfish (2008)	35,000	70,000
Husky	Sunrise (2012)	50,000	200,000
OPTI/Nexen	Long Lake (2007)	72,000	288,000
Petro-Canada	MacKay River (2009)	22,000	70,000
Cold Lake – In Situ Thermal			
Shell	Hilda Lake (pilot)	600	20,000
CNRL	Primrose	50,000	110,000
Imperial	Cold Lake	150,000	170,000
Husky	Tucker (2007)	18,000	40,000
Peace River – In Situ Thermal			
Shell	Peace River	12,000	100,000

Source: CAPP, Dec. 2007

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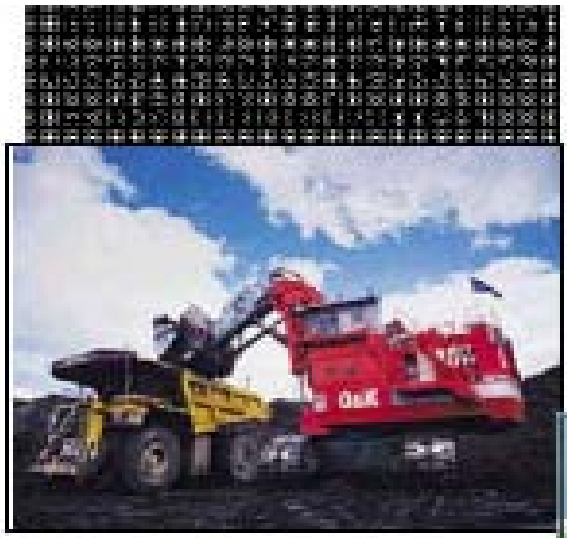
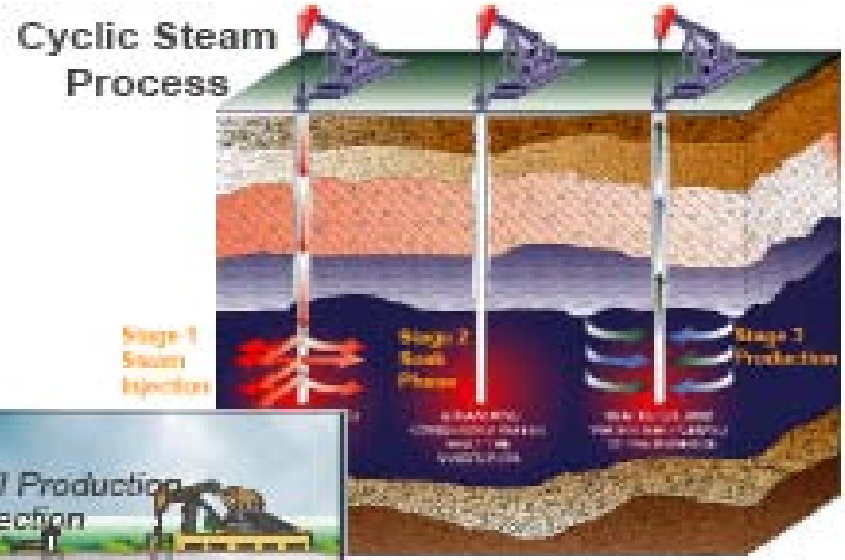
Alberta Oilsands Industry

Alberta Oilsands Production Technologies:

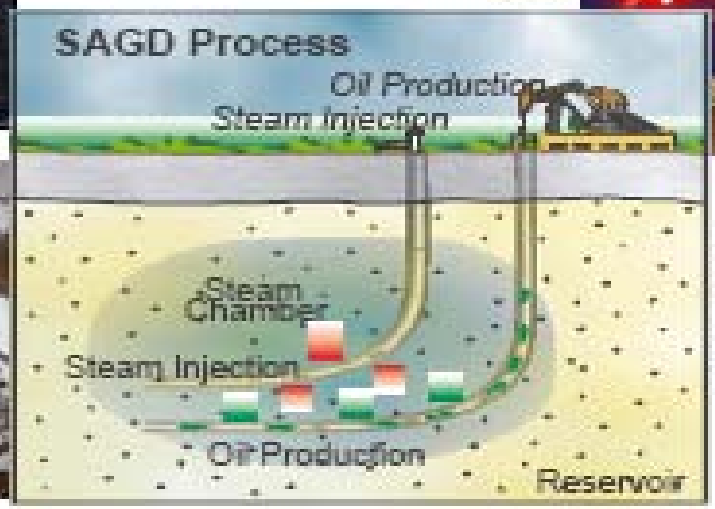


Source: Syncrude

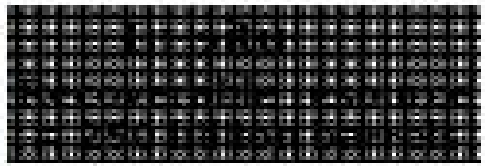
Source: Shell Canada



Source: Imperial Oil



Source: Petro-Canada



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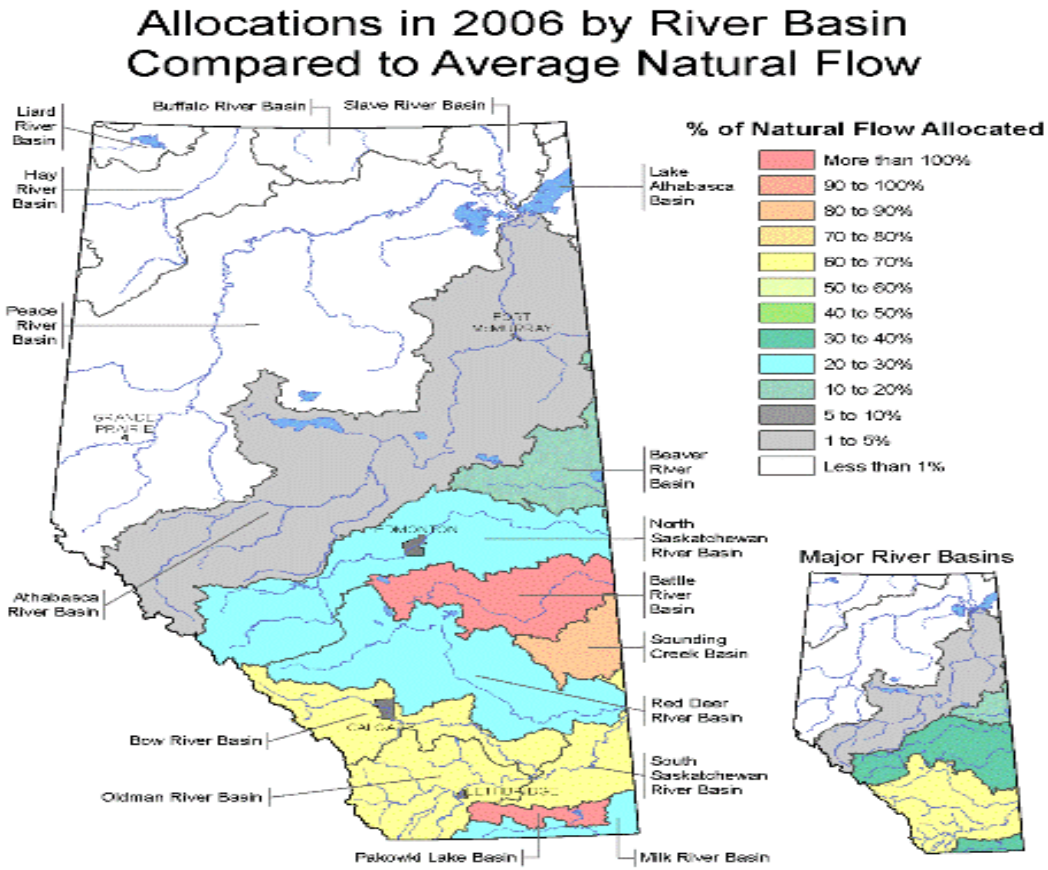
Alberta Oilsands Industry

Alberta oilsands mining, extraction and upgrading – Suncor and Syncrude Sites.

Source: CAPP

Water Allocations



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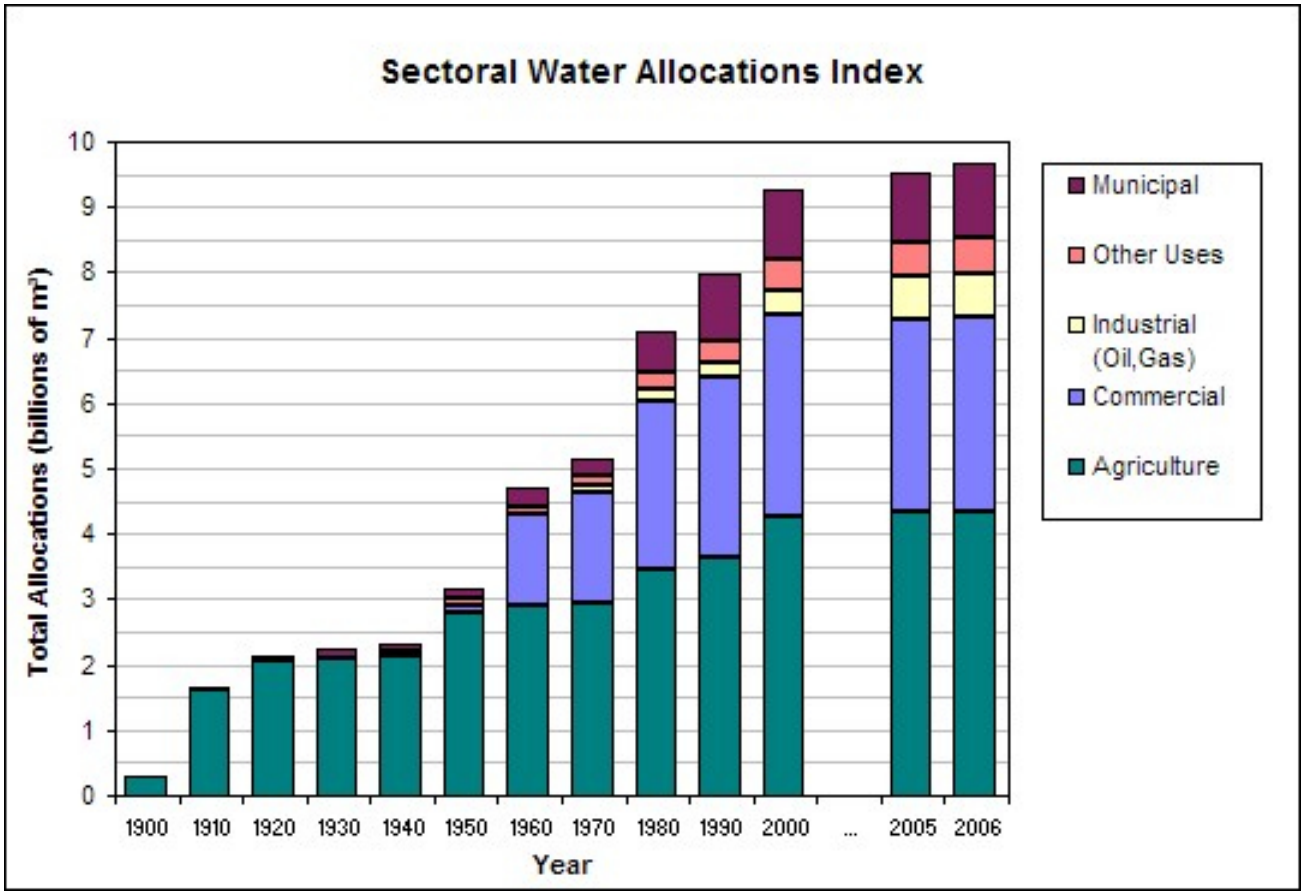
Water Allocations



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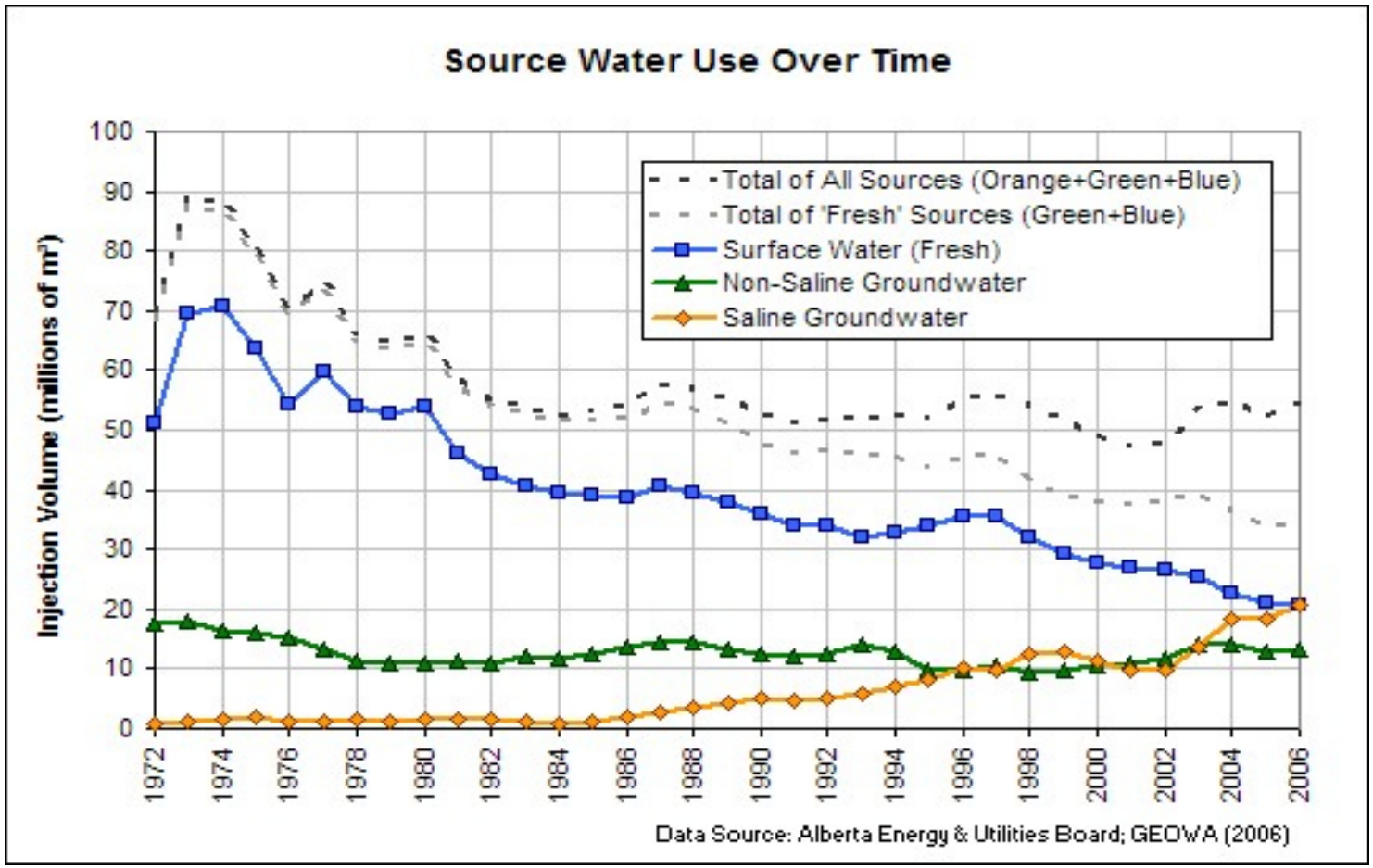
Water Use in Alberta Enhanced Oil Recovery



Total fresh & saline groundwater and surface water use for conventional EOR in Alberta

Source: EUB

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Water Use in Alberta Oil and Gas Industry

Water Use in the Upstream Industry:

- The upstream industry uses water in various ways:
  - Drilling muds.
  - Oilsands development (to transport and process bitumen, and for cooling).
  - In-situ oilsands projects (to generate steam).
  - Enhancement of oilfield reservoirs (water injection).

- More than half of the oil produced in Alberta is developed by using enhanced recovery (injecting water to increase flows or to push out oil) or by using water for processing (oilsands).

- This use of water (saline, recycled, or fresh) allows industry to produce more oil, increasing Canada's supply of this resource.

Source: Centre for Energy

Water Use in Alberta Oilsands

Water Use in Extraction of Bitumen from Oilsands:

- Oil sand mining uses 2 - 4.5 barrels water/barrel SCO.
- Many mining projects located close to Athabasca River.
- 66% water allocated in Athabasca basin is for oil sands mining
- The 2005 allocation for oil sands mining & production was 359 million m3.
- Land that was once boreal forest and wetlands is now covered by 50 km2 of tailings.
- 10% of water taken from the Athabasca for mining return to the river; the rest is used/diverted to tailings ponds.

Source: Alberta Energy

Water Treatment Requirements in Oilsands

Water Treatment Requirements in Oilsands Mining:

- Mine development & maintenance:
  - Muskeg drainage
  - Overburden dewatering
  - Basal aquifer depressurization (affects groundwater volumes, aquifers, & surface water levels)
- Bitumen extraction
- Steam production
- Hydrogen production
- Process Cooling

Source: Alberta Energy

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Wastewater in Oilsands Operations

- **Types of Operational Wastewater:**
  - Consolidating tailings release water
  - Mine drainage
  - Basal aquifer water (often saline)
  - Coker and upgrader wastewaters
  - Sewage treatment system (domestic and industrial)
  - Cooling tower blowdown waters

- **Types of Reclamation Wastewater:**
  - Fine tailing settling pond release water
  - Rain & snow melt runoff from in-pit tailings cells, fine tailings deposits, dykes, composite tailings deposits, and various sulphur, coke, topsoil & overburden stockpiles.

Water Treatment Technologies in Oilsands Mining

Technologies to Reduce Water Demand in Oilsands Mining:

1. Dry Tailings Technologies
2. Further develop tailings consolidation technologies
3. Promoting accelerated fine solids settling in the tailings ponds
4. Reduce requirements for process cooling
5. Other technologies: _____

Source: The Pembina Institute, 2006

Water Use in Alberta Oilsands

Water Use in In-situ Enhance Recovery:

- In-Situ production uses less than does oilsands mining (usually < 1 barrel water/barrel of synthetic crude oil.
- Many projects use some fresh groundwater, with over one-third of total water supply expected to come from this source.
- For in-situ production, it's better to use deep saline water than fresh shallow groundwater.
- Saline water must first be treated, to create steam.
- The wastes from treating saline and recycled water are either put into deep wells or sent to landfill, where there is a risk that may eventually leach into fresh groundwater.

Source: Alberta Energy

Water Treatment Requirements in Oilsands

Water Treatment Requirements in Steam Assisted Gravity Drainage (SAGD):

- Steam Generation
  - Filtering solids (sand & bitumen)
  - Softening (remove magnesium & calcium hardness)
  - Treatment of Saline feed water

- Bitumen Removal from Process Water:
  - Skim tanks
  - Induced gas flotation
  - Granular media filtration

Source: Alberta Energy

Water Treatment Technologies in In-situ Recovery

- **Technologies to reduce water use in in-situ recovery[2]:**
  - Solvents
  - Solvents and heat
  - In-situ combustion or gasification of the bitumen
  - Electrical heaters to warm bitumen
  - Electro-magnetic stimulation
  - Other technologies: _____

[2] *Source: The Pembina Institute, 2006*

Water Treatment Technology Trends

North American Business Trends:

- The merging of water and wastewater utilities.
- Public/private partnerships for the operation and maintenance of water and wastewater treatment facilities.
- Subcontracting of water and wastewater treatment by industrial accounts.
- Move towards development of regional centres for treatment and distribution.

Water Treatment Technology Trends

Technology Trends:

- more widely used techniques such as *reverse osmosis, membrane filtration, UV radiation, chlorination, ion exchange, chemical treatment, flocculation and settling*,
- some of these new water technologies include: *electro-coagulation, sonication, cavitation, demineralization, ozonation, electro-deionization, biocidal disinfection, electrodialysis reversal, multi-stage bubble aeration, and various alternative chemical treatments using nanoparticles*,

Alberta Initiatives

Industrial Heartland- A new Cumulative Effects Management Framework for both air emissions and water

Athabasca River Water Management Framework- a new framework that sets maximum water withdrawals system

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Alberta Initiatives

Water For Life

- The *Water For Life* strategy is based on three key goals, or outcomes:
- Safe, secure drinking water supply
- Healthy aquatic ecosystems
- Reliable, quality water supplies for a sustainable economy

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Opportunities in Alberta

Planned investment in water and wastewater treatment facilities by The Government of Alberta

Year 2007/08	$209 million
Year 2008/09 (Forecast)	$222 million
Year 2008/09 (Forecast)	$243 million
Total	$674 million

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Opportunities in Alberta

Alberta Energy Research Institute

- is working with industry to finalize the terms for the construction of a Mobile Data Aquisition System (MODAC)
- The MODAC would consist of 2 mobile trailers that could be placed on location at a SAGD operation
- Will do testing pre-commercial scale "next generation" produced water treatment technologies
- A typical "project" would involve (and be sponsored by) one or more thermal in situ bitumen operators (eg. SAGD operations) and one or more technology vendors.

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Opportunities in Alberta

Conclusions

- Significant amount of investment by the private sector in the resource industry will drive innovation and investment in water treatment
- Province is committed to development in an environmentally sustainable manner
- Our water resources are for the most part in good shape and it the goal to keep it that way

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www.alberta-canada.com

www.gov.ab.ca

www.hre.gov.ab.ca

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Questions?

Thank you.

We are pleased to answer any questions you may have.

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