

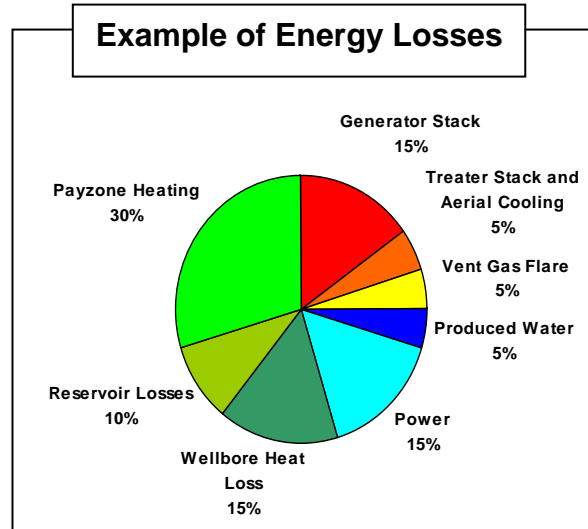


**PTAC Knowledge Centre
Upstream Oil and Gas Energy Efficiency**

Thermal Heavy Oil = Minimize Energy Inputs

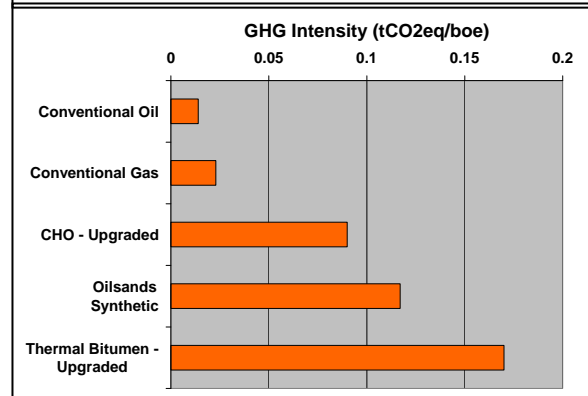
1. Quick Facts:

- Total Alberta Thermal Bitumen Production = over 23 million m³/yr (2005)
- Average Ratio of Energy Output vs. Energy Input = 4:1 (before upgrading)
- Average Ratio of Value of Energy Output to Value of Energy Input = 2:1 (before upgrading)
- Assumed Energy Values used:
 - a. Electrical Power @ \$20/GJ = 15% of energy input
 - b. Gas for steam @ \$6/GJ = 85% of energy input
 - c. Bitumen @ \$30/bbl = \$4.4/GJ



2. Key General Documents on Thermal Heavy Oil and Energy Technology Issues

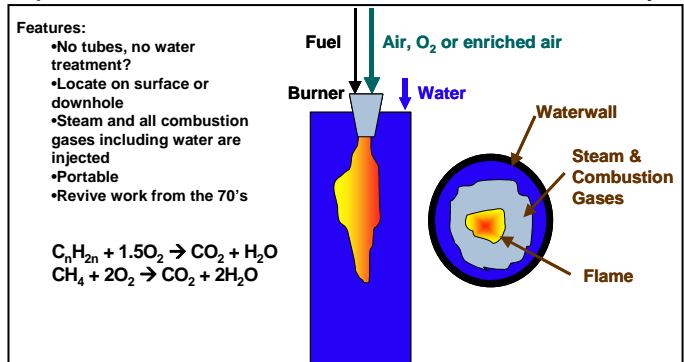
- a. **“Thermal Heavy Oil Energy Conservation Options”** New Paradigm 2001. This document discusses options to assess and reduce energy use in thermal heavy oil operations, mainly focused on cyclic injection or continuous flooding; however, many options also apply to SAG-D operations. This document is available on the PTAC website at: <http://www.ptac.org/links/EnergyEfficiencyKC/eekc0503.pdf>



3. Information on New Energy Options for Thermal Heavy Oil

- a. **Cogeneration of Heat and Power for Thermal Heavy Oil** – The thermal efficiency of power generation is about 30% at a stand-alone coal fired plant or 45% with a gas turbine generator with steam cycle power generation on the exhaust gas stream. Generally cogeneration of heat and power can reach efficiencies of 80%. Since deregulation in 1999 over 1500 MW of cogeneration capacity has been installed in Alberta mainly in large oil sands, gas transmission and petrochemical facilities. This has significantly changed operating costs for oilsands as purchased power, the highest cost energy used has been virtually replaced by regional cogeneration. Cogeneration information is available on the PTAC website at: <http://www.ptac.org/links/EnergyEfficiencyKC/CoGeneration.pdf>

- b. **Fuel Switching for Oil Sands** – With the increasing costs and declining supplies of natural gas thermal heavy oil producers will have to begin considering alternate fuel sources. Bitumen gasification can be used to upgrade bitumen, by generating hydrogen, generate power for cogen, and provide gas for steam generation. This lowers costs by avoiding purchasing out side energy, and is also more energy efficient as there is less energy lost in production and transmission of the external energy.
- c. **Downhole or Direct Contact Steam Generation (A Product Development Opportunity)** – Downhole or direct contact steam generation could be considered for steam generation instead of once through steam generation. This technology was developed in the 1970’s for deep thermal wells, but could be more easily applied to shallow, continuous injection projects using SAG-D. CO₂ in the produced stream can improve recovery over steam alone, there is a 20% increase in thermal efficiency (HHV), potentially water treatment could be avoided and the combustion water is collected instead of being emitted with the stack gases.



4. Financial Support for Change

- a. Alberta
- Royalty Incentives – Capital risk on new oil sands projects is reduced through reduced royalties on oil sands projects until they reach payout.
- b. Federal
- Financial Assistance for Industry <http://oee.nrcan.gc.ca/industrial/financial-assistance.cfm?attr=24>
 - Tax Incentives – New programs may allow for accelerated write off of capital on energy efficiency projects. Check with the Office of Energy Efficiency <http://oee.nrcan.gc.ca/industrial/cipec.cfm>
 - Innovative Financial Approaches – A number of large energy efficiency projects have utilized innovative financing to reduce up front capital costs. See <http://oee.nrcan.gc.ca/industrial/financial-assistance.cfm?attr=24>

5. Key Reports on Volumes, Trends, R&D Needs and Environmental Impacts

- “Alberta Chamber of Resources Oil Sands Technology Roadmap”**
http://www.acr-alberta.com/Projects/Oil_Sands_Technology_Roadmap/OSTR_report.pdf
- “Conventional Heavy Oil R&D Needs Including GHG Intensity Reduction”**
NRCan/PTAC Sept 2005 - <http://www.ptac.org/cho/dl/chop0501fr.pdf>
- “Expanding Heavy Oil and Bitumen Resources”** NRCan/PTAC May, 2006 - <http://www.ptac.org/osd/dl/osdp0601r.pdf>
- “Oilsands Fever the Environmental Implications of Canada’s Oil Sands Rush”** Pembina Institute, November 2005
<http://www.pembina.org/pdf/publications/OilSands72.pdf>