Presentation Outline

- Oil Sands Industry Public Image
- Greenhouse Gas Emissions
  - Present Situation
  - Outlook
  - Legislative Initiatives
- Carbon Capture and Storage
  - Overview
  - Supply, Demand and Costs
- Conclusions
- The Impact of Energy Conservation

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Sands Industry Public Image

- "Dirty Oil"/"Tar Sands"
- Reports of possible abnormally high cancer rates and possible fish deformities downstream of oil sands mining operations along the Athabasca River and at Fort Chipewyan
- Calls for a development moratorium by aboriginal leaders
- Calls for a slower and more orderly development of the industry by former Alberta Premier Peter Lougheed
- 1,600 ducks killed in the Syncrude tailings pond in April 2008 - subsequent charges
- Books/television and movie productions
- Actions by environmental lobby groups – Greenpeace and others
- Actions by US federal and state legislators

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Industry Response

- Canadian Association of Petroleum Producers
  - canadasoilsands.ca – "a Different Conversation"
  - Newspaper and Television Ads
  - Google Ads
  - Twitter Feeds
- Oil Sands Developers Group
  - "Setting the Record Straight" Presentations
  - "Oil Sands Facts" Publication
- Industry Studies (i.e., AERI-sponsored Life Cycle Analyses)
- Canadian Ambassador to the US
- Washington Lobbyists

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Is the Industry Doing Enough?

- "Wake up, people! It's no wonder what we are getting [out are] the wrong messages."
  - Pat Nelson, Former Alberta Energy Minister and Vice-Chair, In Situ Oil Sands Alliance
- "Consumers today are largely blind to the very real connection that exists between their light switch, thermostat or gas pedal, and the coal-fired generation stations, the nuclear power plants and the oilsands developments."
  - Pat Daniel, President & CEO, Enbridge Inc.

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Is the Industry Doing Enough?

- "Once seen as an engineering marvel, they [the oil sands] are now seen as an environmental challenge."
  - Eddy Issacs, Executive Director, Alberta Energy Research Institute
- "The world has changed. You have a big problem and it is going to get worse unless you get your story out there."
  - Richard Edelman, CEO, Edelman - the leading independent global PR firm
- "It is unfortunate that this is still being framed as a public relations battle. The statistics argument is not resonating with the public."
  - Simon Dyer, Oil Sands Program Director, Pembina Institute

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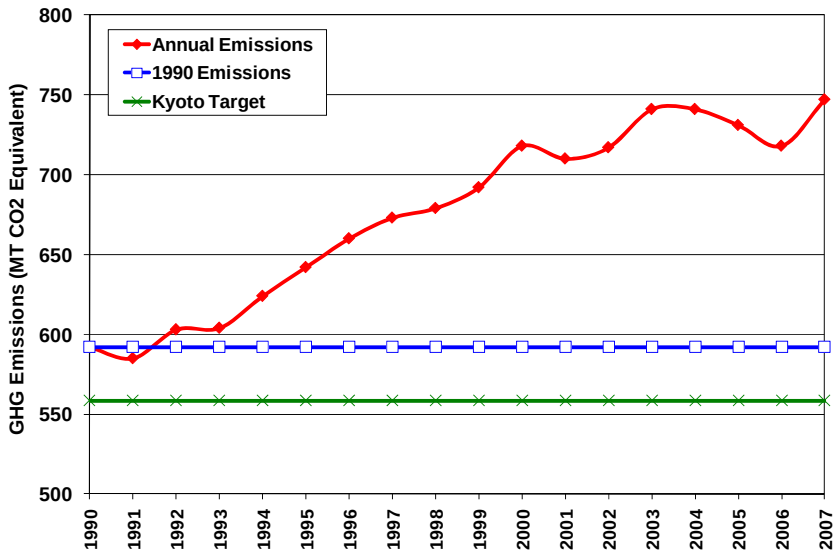
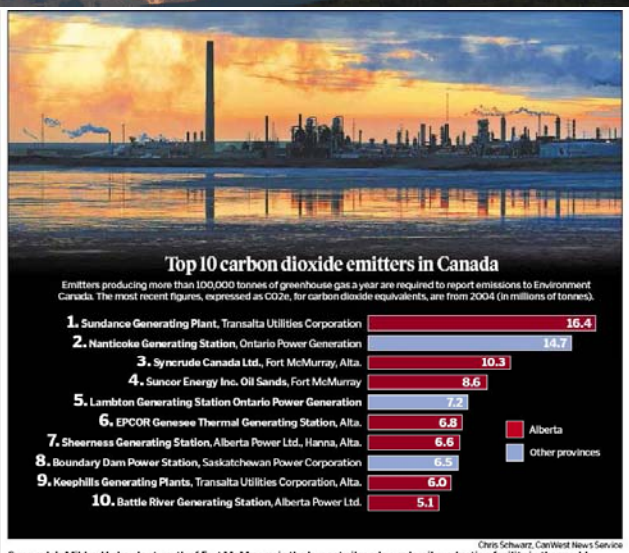
Canada's GHG Emissions



Source: Environment Canada; April 2009

Canada's Top GHG Emitters

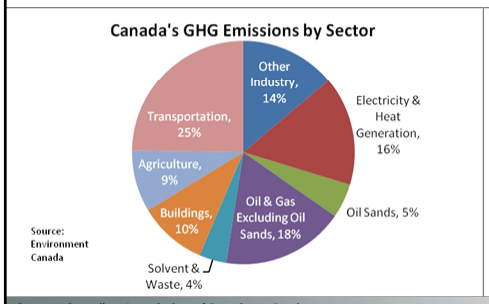


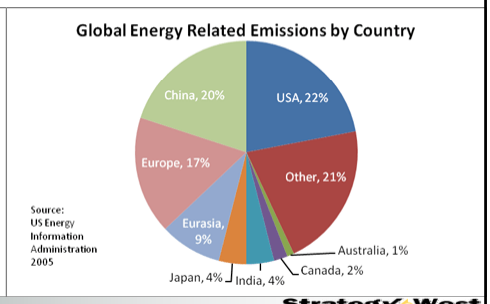
Syncrude's Mildred Lake plant north of Fort McMurray is the largest oilsands crude-oil production facility in the world.

Source: CanWest News Services

Oil Sands GHG Emissions

- Canada's oil sands industry emits about 30 Mt/a of GHGs accounting for:
  - Less than 5% of Canadian GHG emissions
  - Less than 0.1% of global GHG emissions

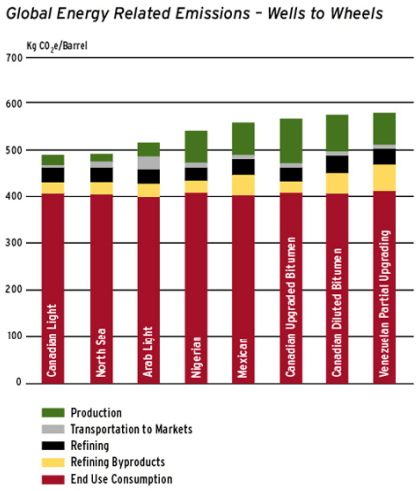




Source: Canadian Association of Petroleum Producers

GHG Emissions – Wells to Wheels

- Most GHG from fossil fuels come when the final product (such as gasoline) is burned
- A "wells to wheels" comparison gives a more complete picture.
- Full life cycle GHG emissions are about 5 to 15% higher from fuel derived from oil sands than they are from fuel derived from domestic onshore light crude oil



Source: Canadian Association of Petroleum Producers

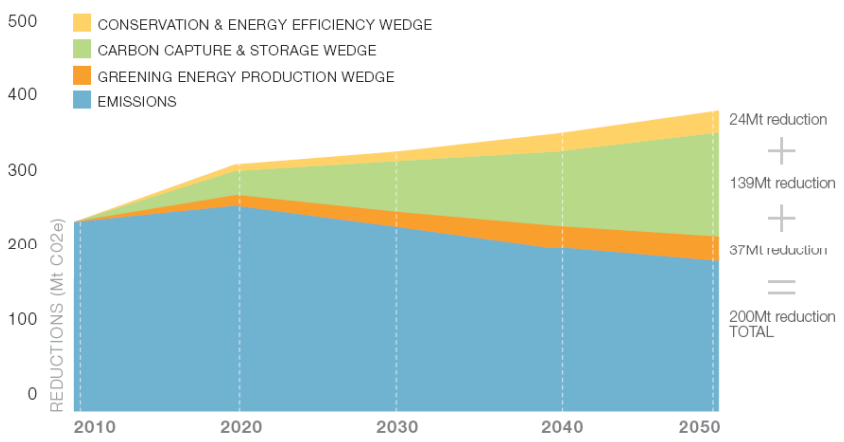
Alberta Climate Change and Emissions Management Amendment Act

- Applies to large GHG emitters (>100,000 t/a)
- 12% emission intensity reduction by March 31, 2008
- Alberta gave companies three options for meeting the reduction:
  - Improve the energy efficiency of their operations,
  - Buy carbon credits in the Alberta-based offset system, or
  - Pay $15 into the Climate Change and Emissions Management Fund for every tonne over their reduction target.
- Companies could also choose a combination of the options

Source: Alberta Environment

Alberta's January 2008 Climate Change Strategy

GREENHOUSE GAS REDUCTION WEDGE -- HIGHLIGHTING GREENER ENERGY PRODUCTION REDUCTIONS



Source: Alberta Environment

Proposed Federal GHG Emission Strategy

- Introduced April 2007
- GHG emission intensity reductions
  - Existing facilities
    - 6% annual reduction every year until 2010 (18% reduction in intensity by 2010)
    - 2% annual improvement thereafter
  - New facilities
    - 3-year grace period - 2% annual improvement thereafter
    - Clean fuel standard
- Alternative compliance options
  - Climate Change Technology Fund
  - Various trading mechanisms
- Credit for early action
- The expectation is to achieve a total reduction in GHG emissions of 20% by 2020 and 50-60% by 2050

Source: Environment Canada

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US Legislative Initiatives

- US Clean Energy and Security Act (Waxman-Markey Bill)
  - Passed by the House of Representatives in June 2009
  - Reduce GHG emissions from major sources by 17% by 2020 and 83% by 2050 relative to 2005 levels.
  - National cap-and-trade scheme
  - The bill would allow the President to impose tariffs on imports with a large carbon footprint
- Parallel bill now being considered by the Senate
- The Obama administration has served notice to opponents of the climate-change bill that, without legislation, the EPA will regulate emissions

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Industry Options

- Improve Existing Processes
  - Reduce energy use (i.e., SAP)
  - Reduce energy losses
  - Capture fugitive emissions
- Employ New Recovery Technologies
  - THAI
  - VAPEX, N-Solv (Nenniger)
  - Electric Heating
- Use Alternative Energy Sources (i.e., Nuclear)
- Carbon Capture and Storage

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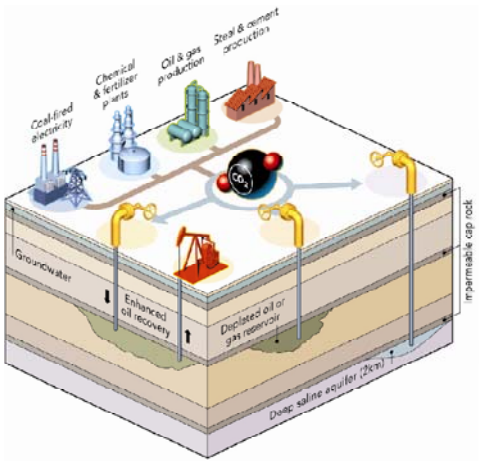
CO_2 Capture and Storage Overview

- Capture
  - At large industrial sources
- Transport
  - Through pipelines using existing technology
- Storage
  - In mature oil/gas reservoirs & deep geologic formations
  - Potential for enhanced oil recovery (EOR)
- Safety
  - Proven to be safe and effective over the long-term



Source: ICO2N

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Government Investment in Carbon Capture and Storage (CCS)

- **In 2008, Alberta announced a $2B investment in Carbon Capture and Storage**
- **Three projects were selected by Alberta Energy:**
  - **Shell/Chevron/Marathon**
    - Integrated carbon capture and storage project at the Scotford Upgrader in the Alberta Industrial Heartland
  - **Capital Power/Enbridge**
    - Integrated gasification combined-cycle (IGCC) carbon capture power generation facility adjacent to Capital Power's existing Genesee power plant, west of Edmonton
  - **Enhance/Northwest:** The Alberta Carbon Trunk Line
    - Gasification, CO_2 capture, transportation, enhanced oil recovery and storage in the Alberta Industrial Heartland and central Alberta
    - CO_2 capture from the Agrium fertilizer plant and the Northwest upgrader
- **Funding for the first two has been announced**

Source: Alberta Energy

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Other CCS Initiatives

- Integrated CO_2 Network (ICO_2N)
- Alberta Saline Aquifer Project (ASAP)
- CO_2 Sequestration Projects
  - Heartland Area Redwater Project (HARP)
  - Boundary Dam Integrated Carbon Capture and Sequestration Demonstration
- CO_2 Enhanced Oil Recovery (EOR) Projects
  - EnCana Weyburn (Saskatchewan)
  - Anadarko Enchant Arcs (southern Alberta)
  - Apache Zama Keg River (northwest Alberta)
  - Devon Swan Hills (central Alberta)
  - Penn West Pembina Cardium (central Alberta)

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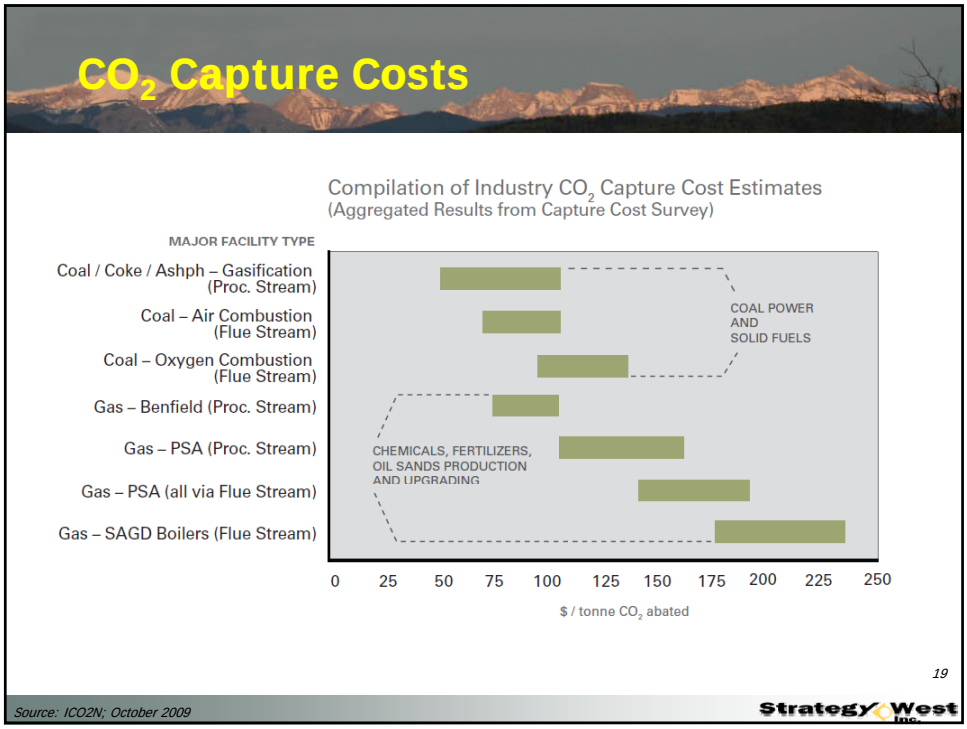
CO2 Capture Costs
Compilation of Industry CO2 Capture Cost Estimates
(Aggregated Results from Capture Cost Survey)
MAJOR FACILITY TYPE
Coal / Coke / Ashph – Gasification (Proc. Stream)
Coal – Air Combustion (Flue Stream)
Coal – Oxygen Combustion (Flue Stream)
Gas – Benfield (Proc. Stream)
Gas – PSA (Proc. Stream)
Gas – PSA (all via Flue Stream)
Gas – SAGD Boilers (Flue Stream)
COAL POWER AND SOLID FUELS
CHEMICALS, FERTILIZERS, OIL SANDS PRODUCTION AND UPGRADING
0 25 50 75 100 125 150 175 200 225 250
$ / tonne CO2 abated
19
Source: ICO2N; October 2009
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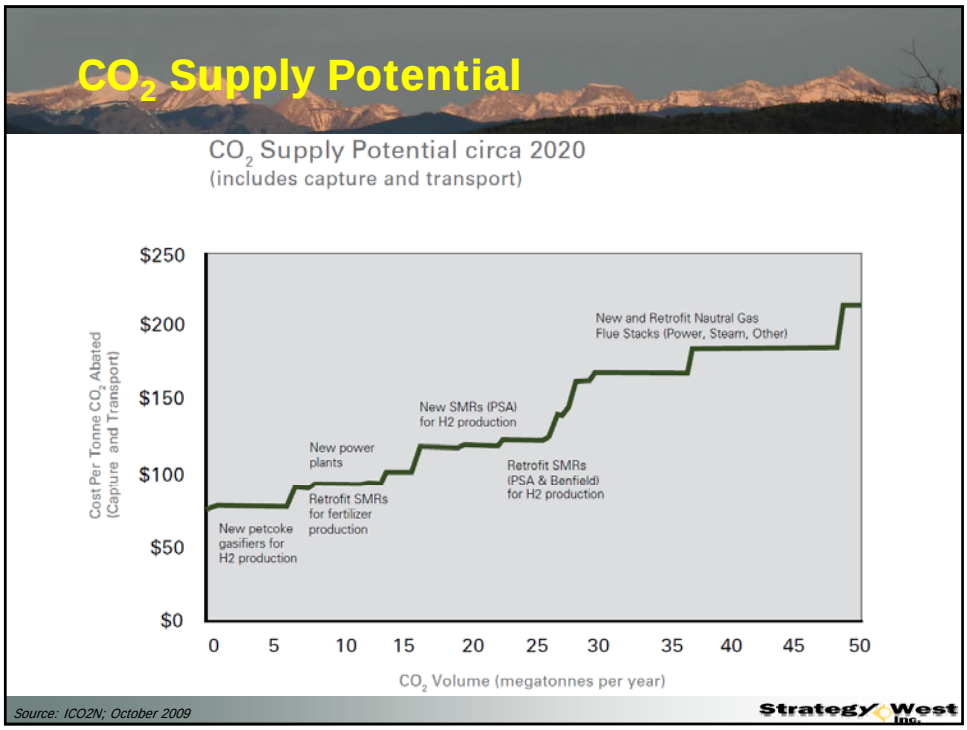
CO2 Supply Potential
CO2 Supply Potential circa 2020
(includes capture and transport)
Cost Per Tonne CO2 Abated (Capture and Transport)
$250
$200
$150
$100
$50
$0
New petcoke gasifiers for H2 production
Retrofit SMRs for fertilizer production
New power plants
New SMRs (PSA) for H2 production
Retrofit SMRs (PSA & Benfield) for H2 production
New and Retrofit Nautral Gas Flue Stacks (Power, Steam, Other)
0 5 10 15 20 25 30 35 40 45 50
CO2 Volume (megatonnes per year)
Source: ICO2N; October 2009
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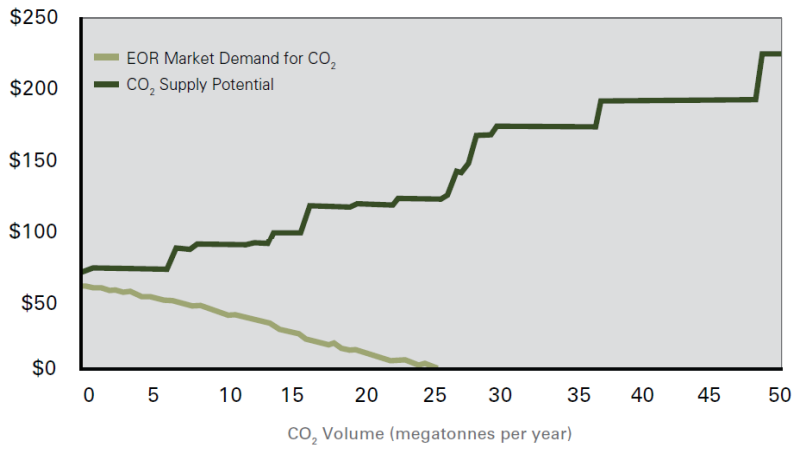
CO_2 Supply & EOR Demand Potential

CO_2 Supply & EOR Demand Potential circa 2020 / 2025
with $75 Oil Price (WTI)
(Supply cost includes capture and transport costs)



Source: ICO2N; October 2009

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The CCS Challenge

- Closing the Funding Gap
- Reducing Energy Consumption
- Addressing Public Safety Concerns
- Resolving Legal and Liability Issues

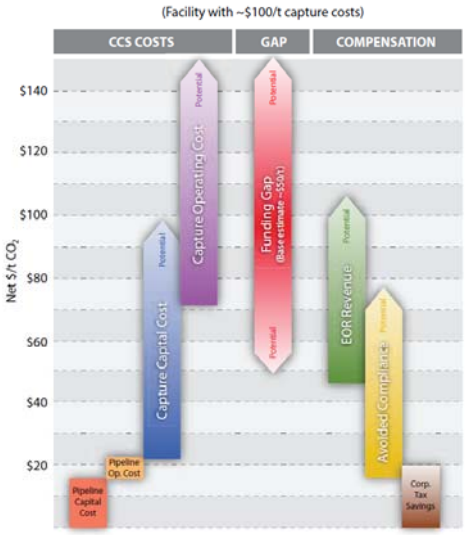

Image Source: Alberta Carbon Capture and Storage Development Council; March 2009

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Conclusions

- CCS will not create **"Green Bitumen"** but has potential to reduce the carbon footprint of the oil sands industry
- CCS is very costly
  - Gasification of bitumen residues provides the best opportunity for CO_2 capture in the oil sands
  - CO_2 capture from new and retrofitted SMRs may also be feasible
  - CO_2 capture from flue gases is more expensive
- EOR requires low-cost CO_2
- The economic gap to produce significant capture volumes must be addressed
- Governments have an important role

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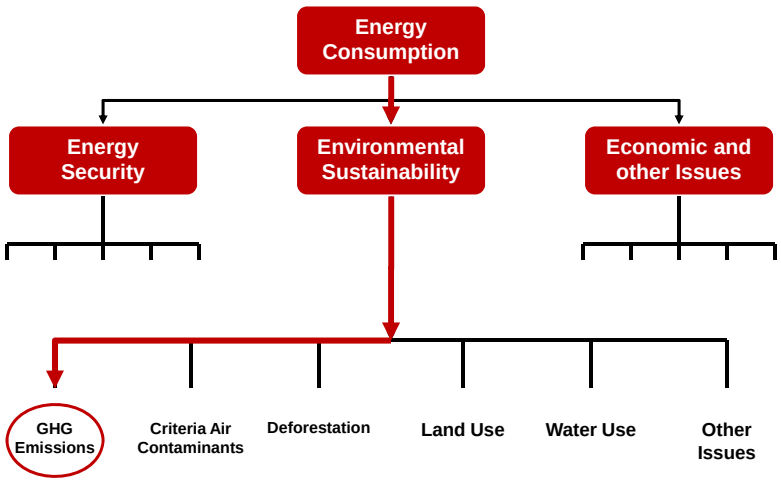
The Impact of Energy Conservation



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Adapted from "The End of Energy Obesity"; Peter Tertzakian; 2009

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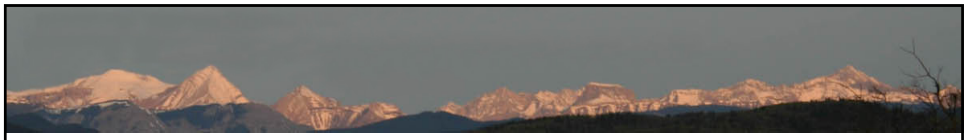

Thank You

Presentation is available for download at www.strategywest.com

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