



# Energy and Regulatory Overview of Canada

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Government of Canada

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Natural Resources  
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Ressources naturelles  
Canada

Canada 

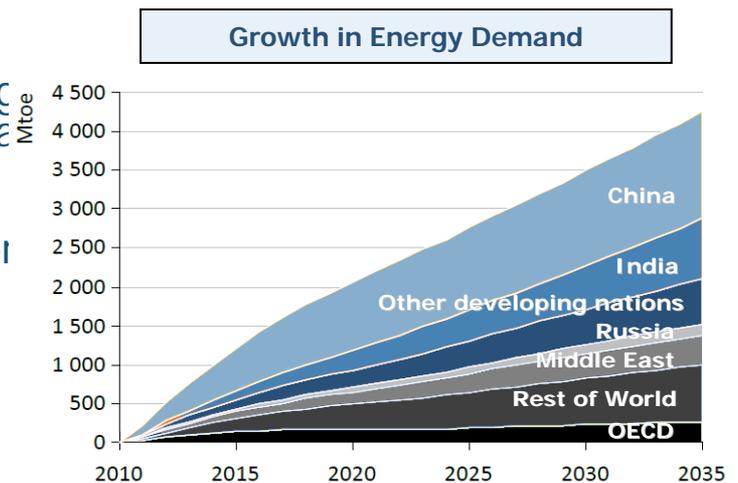
# Global energy demand is growing rapidly with a continued reliance on fossil fuels

- IEA projects global demand will rise by one third from 2010 to 2035

- Major role of emerging economies in energy markets and entering energy-intensive phase of growth
  - China and India to account for 50% of world growth

- Fossil fuels will remain important component of supply for decades

- 80% of global supply in 2035
  - Alternative supply and efficiency gains will not offset demand



Source: IEA 2011

- Global shift to lower-carbon future over longer term will put pressure on Canada to manage risks and capture market opportunities



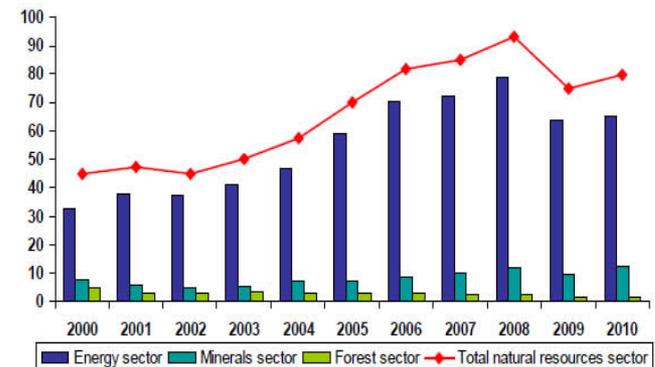
# Energy resources are important to Canada's current and future prosperity

- Canada has unique, diverse, large and secure energy resources
  - Export-oriented market-based producer of natural resources
  - Significant potential to expand oil production
  - Politically-stable with skilled workforce and strong economic fundamentals
- Significant customer for other industries such as construction, engineering and manufacturing
  - 23.9% of total capital expenditures in Canada (2010)
- About 25% of total Canadian exports and over 10% of total imports
  - 99% of exports destined for US

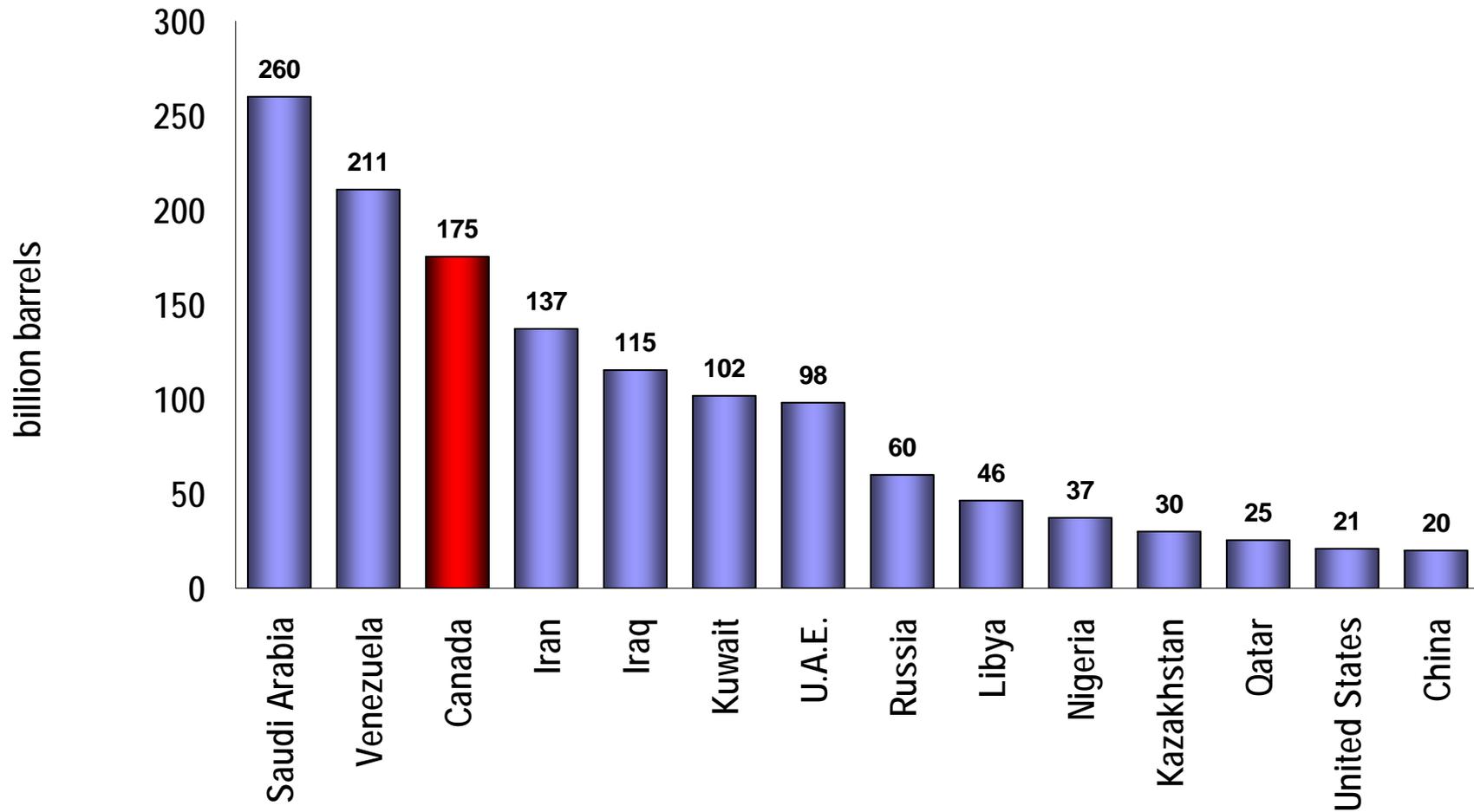
## Canada's Ranking in the World

- 3<sup>rd</sup> in oil reserves and 6<sup>th</sup> in production
- 3<sup>rd</sup> in natural gas production
- 3<sup>rd</sup> in hydroelectricity production,
- 2<sup>nd</sup> in uranium production and exports
- Significant potential in wind, biomass, solar, marine and geothermal

## Canadian Natural Resources New Capital Investment



# With the world's third-largest oil reserves . . .



Source: *Oil & Gas Journal*, data as of Jan. 2011



. . . and vast endowment stretching across the country

- CRUDE OIL
- NATURAL GAS
- OIL SANDS
- NATURAL GAS PIPELINE
- CRUDE OIL PIPELINE
- NUCLEAR
- TIDAL
- REFINERY
- HYDRO ELECTRIC PLANT
- COAL MINE
- WIND FARM
- THERMAL ELECTRIC FACILITY
- URANIUM MINES



Canada

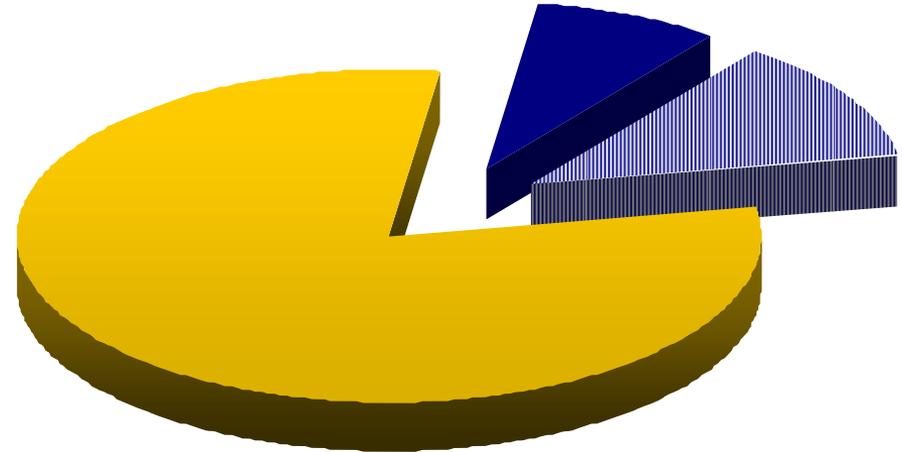
Shale Gas



Source: Centre for Energy Information, 2010

# Canada benefits from an open investment climate . . .

- ~80% of world oil reserves are controlled by states or national oil companies
- ~20% openly accessible to market based development
- Canada holds ~60% of world oil open to market development



## Oil sands alone: \$137 billion investment to date



## . . . and an effective and efficient regulatory system

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*Responsible Resource Development* is Government's plan to advance a system-wide approach for improved federal reviews of major natural resource projects

**One project, one review, over a defined timeline – stands out as a common goal**

It is based on four key themes:

- Making the review process for major projects more predictable and timely;
- Reducing duplication in the review process;
- Strengthening environmental protection; and
- Enhancing consultations with Aboriginal peoples.



# Going forward, significant challenges will need to be met

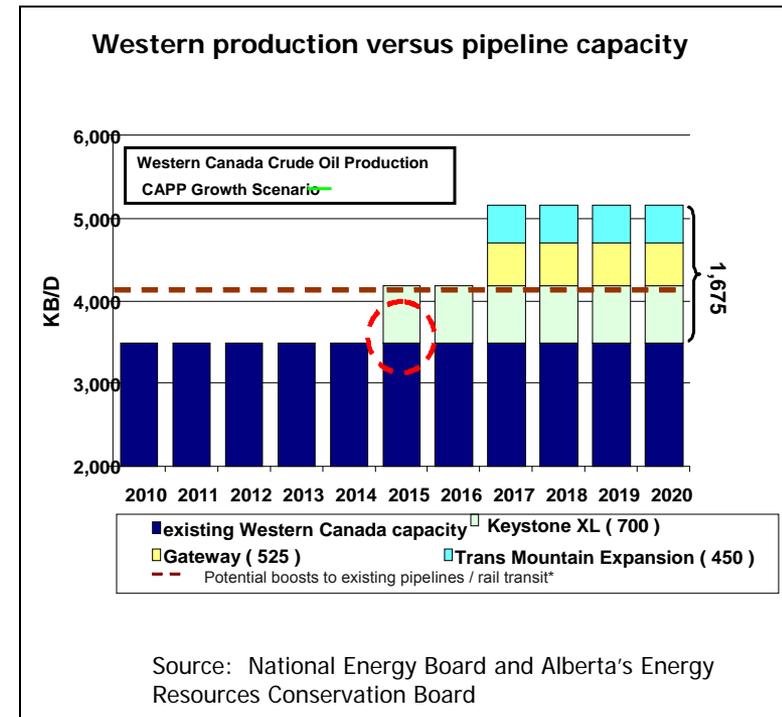
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- Barriers to unlocking Canada's unconventional energy resources
  - Regulatory processes
  - Environmental concerns
  - Social license
- Current markets may not provide sufficient demand over the medium-term
  - Infrastructure development not keeping pace with oil and gas production and demand
  - Slow uptake of clean energy technologies
- Meeting rising domestic energy demand
  - Per capita energy use among the highest in the world
- Massive investments required to replace and build new infrastructure
  - \$294 billion investment in electricity infrastructure alone from 2010 to 2030
- Addressing environmental concerns
  - Climate change and clean air objectives, including Canada's Copenhagen commitments



# Market diversification is a major priority

- About 98% of Canada's energy exports presently go to the US
  - Current markets may not provide sufficient demand over the medium-term
  - Canadian oil and gas have been trading at a discount to world markets
  - \$18B annual estimated loss to economy (CIBC/BMO)
- Market diversification is key
  - There is significant growth potential for Asia, particularly China
- Investments in infrastructure will be required in order to get energy to new markets – e.g., pipelines, LNG terminals



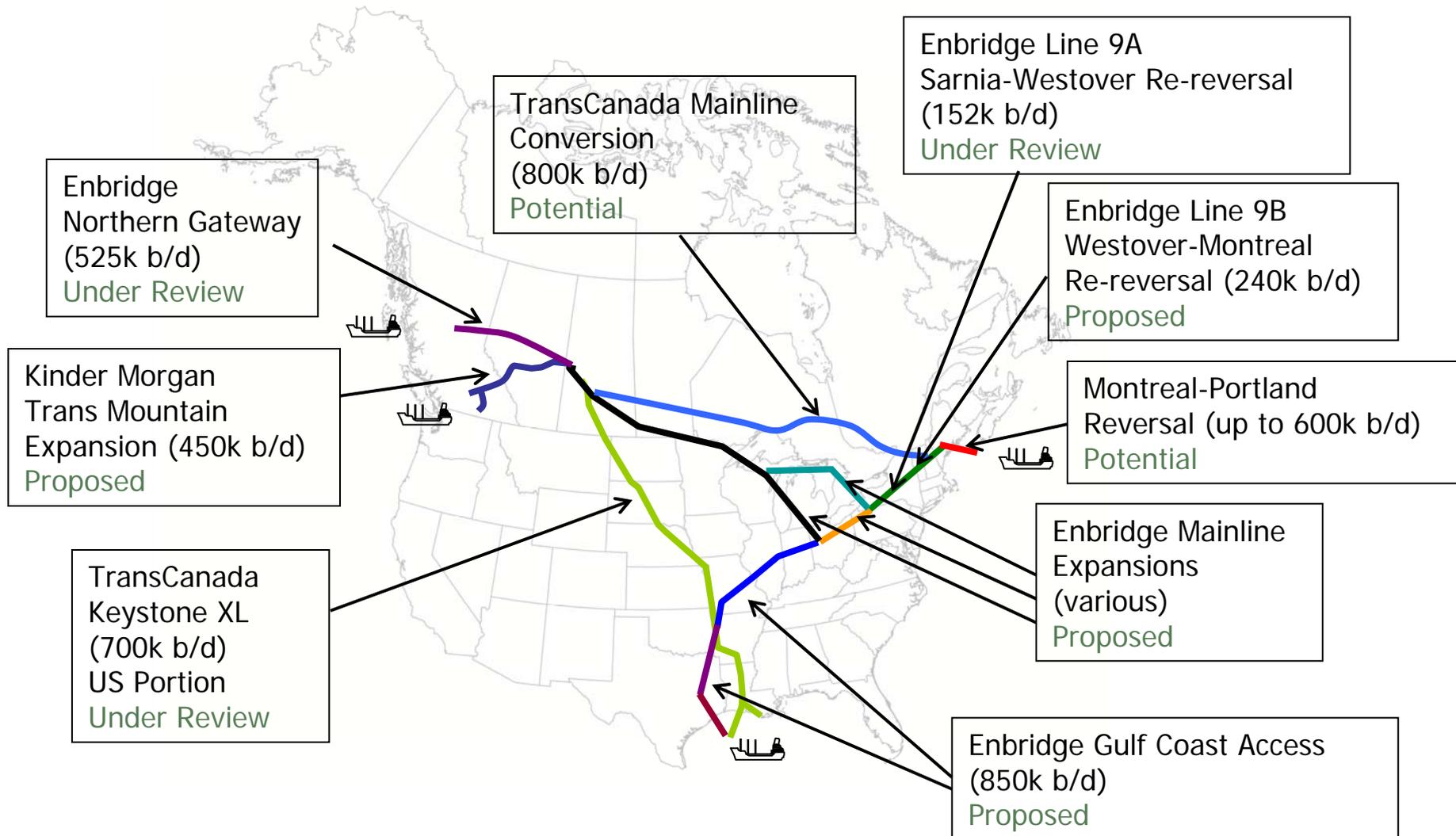
Source: CAPP Crude Oil Forecast 2011, NEB and Alberta Energy 2010

KB/D = Thousand Barrels Per Day

• Various existing pipelines (Keystone original, Alberta Clipper) could be expanded for a total of 475,000 barrels per day;  
 • CN Rail indicates that up to 200,000 barrels per day could be moved by rail; industry has yet to proposed specific options.

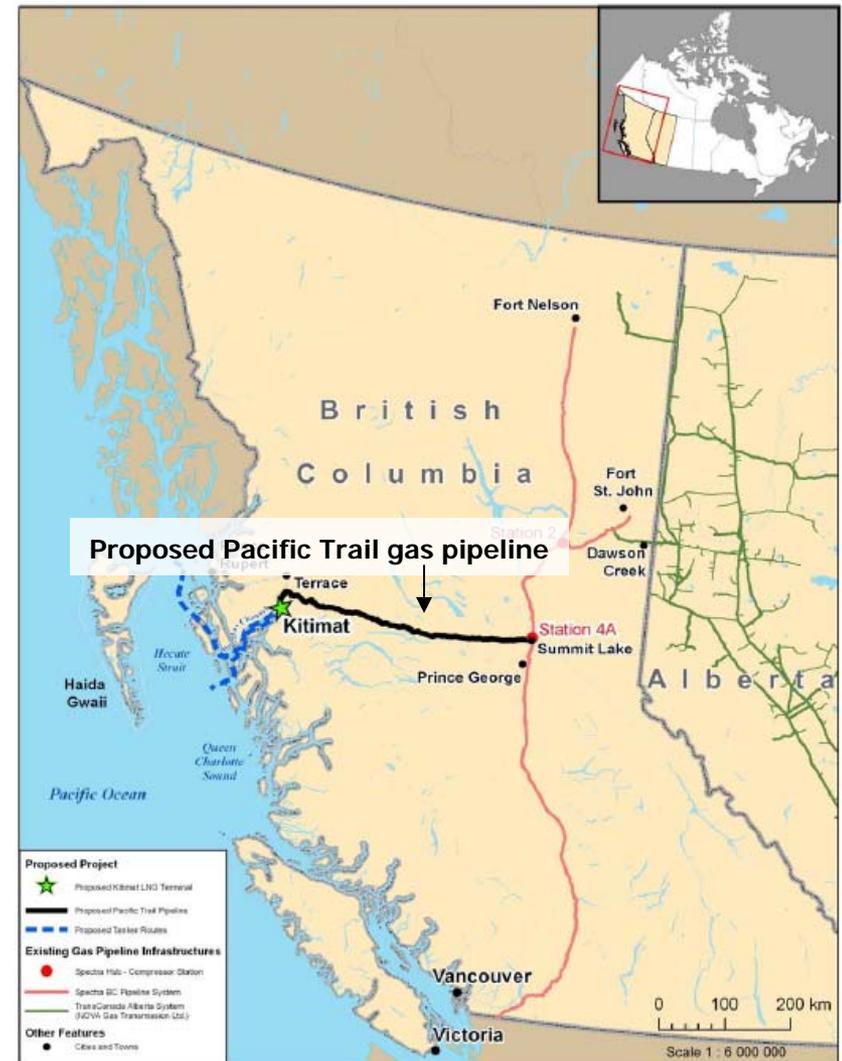


# Where Canada-US energy market is opportunity to grow and diversify



## . . . including LNG export capacity

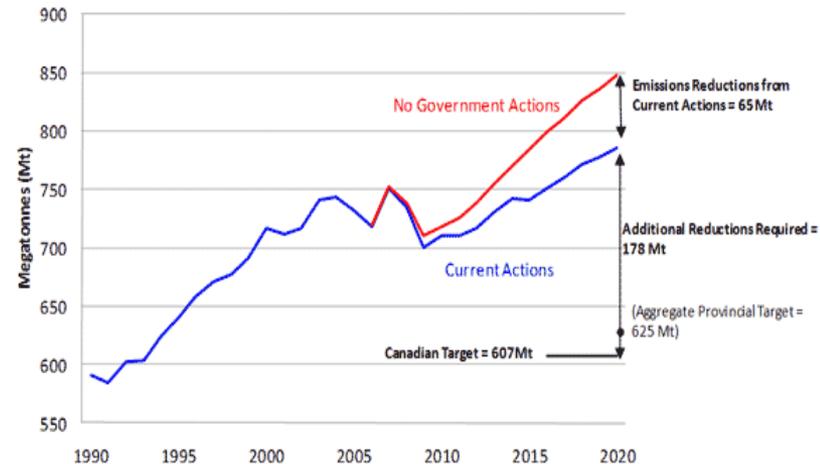
- Three export terminals are under consideration for Kitimat, BC
- Earliest in-service date for first project is late 2013 (capacity of 250 million cubic feet/day – equivalent to about 45,000 barrels of oil per day)
- Second is expected to be in-service in 2015 (capacity of 1.4 billion cubic feet/day – 250,000 barrels of oil/day) supplied by the Pacific Trail gas pipeline
- Third is in planning stages (capacity could be as much as 3.4 billion cubic feet/day – 585,000 barrels of oil/day)
- No projects are yet planned for Canada's East coast



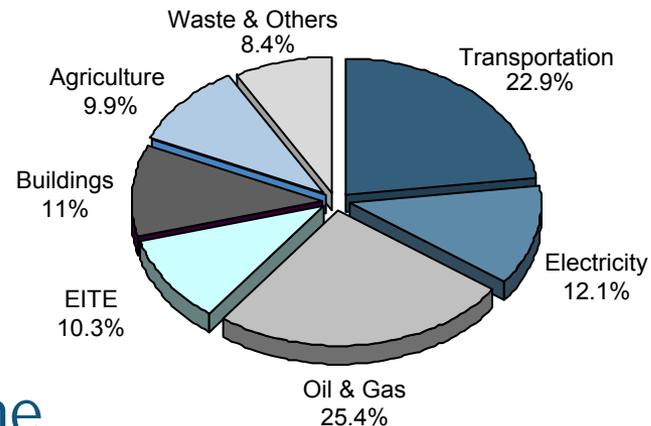
# Important progress being made on improving environmental performance . . .

- Progress being made in reducing Canada's emissions by 17% from 2005 by 2020
- The correlation between economic growth and rising emissions continues to weaken
  - In 2010 economic growth (3.2%) outpaced emissions growth (0.25%)
- As the economy grows, however, emissions are also expected to increase, and additional reductions will be required
- Oil and gas and transportation sectors account for about 50% of projected emissions growth to 2020

Scenarios of Canadian Emissions to 2020 9Mt CO<sub>2</sub>e



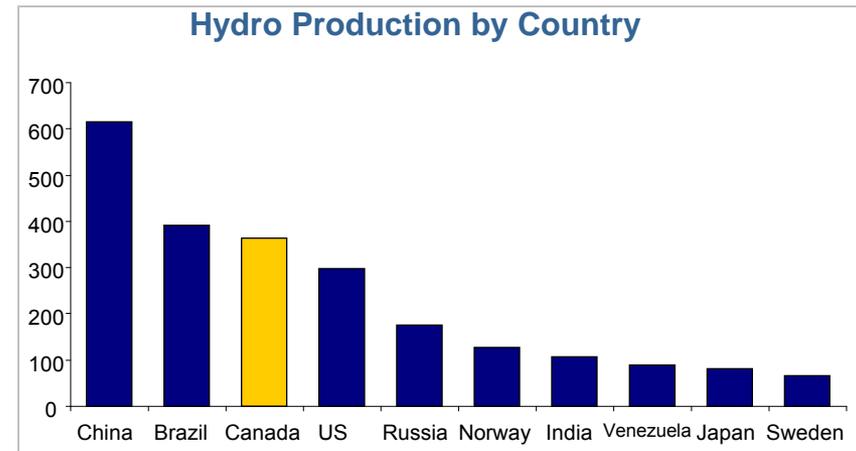
2020 GHG Emissions by Economic Sector



. . . and more needs to be done

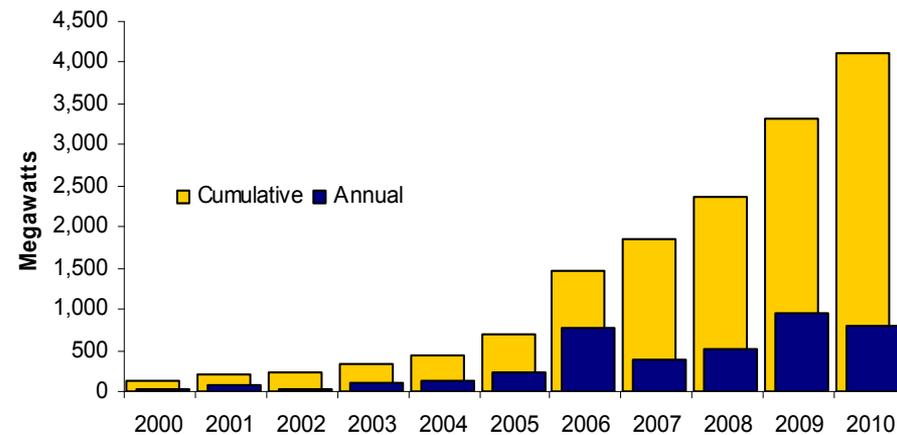
# Canada is also growing its clean energy . . .

- 3<sup>rd</sup> largest producer of hydro electricity  
- 75% coming from non-GHG emitting sources
- 7<sup>th</sup> largest producer of renewable energy, including hydro
- Access to abundant emerging renewable energy sources including large and small hydro, biomass, wind power, geothermal, ocean, tidal and solar
- Growth driven by federal and provincial government policies
- Wind energy is the fastest growing source of electricity



Source: IEA, 2010

## Canadian Wind Power Capacity - 4,105 MW (2010)



Source: StatCan, 2011



. . . and provinces play an important role

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### Northern Canada

- Focus on technology development for renewable deployment in cold climates
- Pioneers in small-scale renewables for off-grid communities and cold climates

### Atlantic Canada

- Pursuing regional integration to increase share of renewable electricity to 40% by 2020
- First commercial tidal power station located in the Bay of Fundy, NS

### Western Canada

- Supporting bioenergy production and expanded wind power capacity
- BC and MB have significant hydro production
- BC and AB have established a price on carbon

### Ontario

- Feed-In-Tariff program guarantees rates for renewable electricity
- Home to world's largest PV farm

### Quebec

- 97% of electricity currently from hydro
- Committed to support development of 4,000MW of wind by 2015

# Canada is making investments in technology and innovation . . .

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- NRCan is the major Government of Canada investor and has the largest public science capacity supporting clean energy research, development and demonstration (RD&D) in the country
- Public and private investment in innovation increasing energy efficiency and improving environmental performance
  - Carbon Capture and Storage – Canada a test bed
  - Smart grids – e.g., load management, smart meters
  - Renewable energy sources – e.g., biomass, tidal

## Canada's energy RD&D priority areas:

- ✓ Energy efficiency
  - Buildings and Communities – Integration of Energy Systems
- ✓ Clean electricity and renewables
  - integration of renewables into the grid and the built environment
  - clean coal and carbon capture and storage
- ✓ Bioenergy
  - Integrated bio-refinery concepts
- ✓ Electrification of transportation
  - Electric vehicles and systems
- ✓ Unconventional oil and gas
  - Reduce water use and process water contaminants; air emissions



. . .with a focus on large CCS demonstration projects

**\$3 billion in public funding, \$7 billion total investment**

**Spectra – Fort Nelson**

→ Shale gas processing plant

**Shell – Quest**

→ Oil sands upgrader

**Enhance – Alberta Carbon Trunk Line**

→ 240-km CO<sub>2</sub> pipeline for EOR

**Weyburn-Midale CCS Project**

→ Commercial CO<sub>2</sub>-enhanced oil recovery  
→ IEA CO<sub>2</sub> Monitoring & Storage project

**Swan Hills**

→ Underground coal gasification and syngas production

**SaskPower – Boundary Dam**

→ Coal power: new installation will integrate CO<sub>2</sub> capture technology

# Canada has an integrated suite of energy efficiency programs . . .

- Energy efficiency improvements have slowed the rate of growth in energy use
- Without this, energy use would have increased by 46% between 1990 and 2010 (instead of the observed 23%)

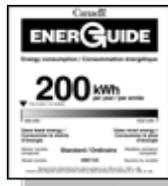
## Making Canada's Building Stock More Efficient

- Building codes
- Housing codes – home energy rating system
- Equipment regulations



## Making Energy Performance More Visible

- Building benchmarking
- Home labelling
- Vehicle and tire labelling
- Product labelling



... generating \$26.8 billion in annual savings for  
Canadians

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## Making Operations More Efficient

- Fleet certification
- ISO energy management standard



## Making Efficiency More Affordable

- Home retrofits



## In Summary, Canada is . . .

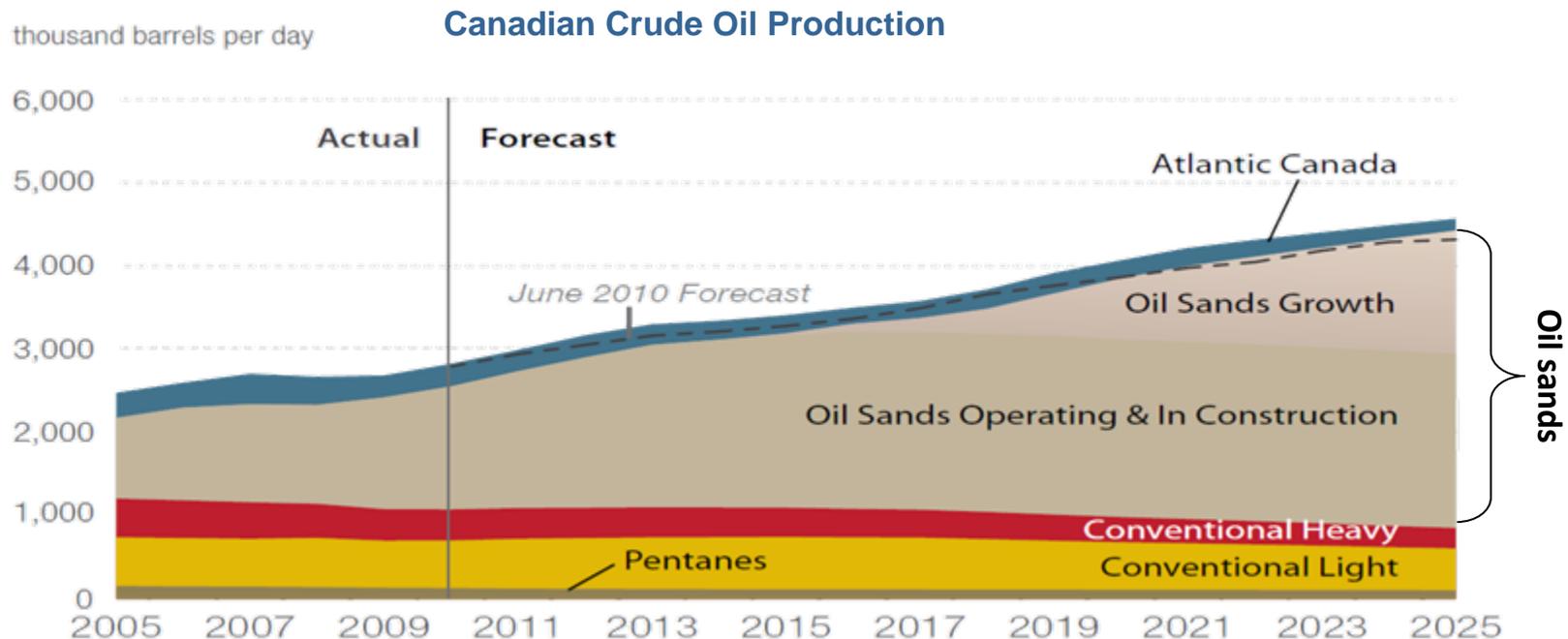
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- A competitive, reliable and responsible global energy supplier
- Committed to a market-oriented approach, with an open and competitive investment environment
- Focussed on diversifying its energy export markets
- Governed by effective, efficient and transparent regulation
- Investing in clean energy innovation to enhance economic and environmental performance



# Substantial oil reserves, including oil sands

- In 2010, oil sands production exceeded conventional production for the first time
- Over 97% of Canada's remaining known reserves are crude bitumen in oil sands
- 170 billion barrels of oil sands reserves are currently known to exist and are recoverable under current technological and economic conditions
- Oil is the most important energy source for Canadian consumers ahead of natural gas and electricity



Source: CAPP, 2011



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# Oil Sands: Improving Environmental Performance

- Federal and Alberta governments are collaborating on a new, science-based environmental monitoring plan
  - Will bring comprehensive and transparent monitoring of water, air and biodiversity
- Canadian Oil Sands Innovation Alliance puts in place an information sharing agreement
  - Group of 12 oil sands companies will share information in areas including intellectual property rights, research and technology development, air emissions, and management of tailings

## Water

- Most of the water used in oil sands development is recycled – up to 90% for *in situ* projects
- Federal and provincial regulations limit withdrawals of water – less than 1% of the Athabasca River's annual flow is used by the oil sands

## Tailings

- Regulations require tailings ponds to be ready for reclamation within 5 years after they cease to be in service
- NRCAN has helped to develop new techniques that significantly reduce tailings and accelerate reclamation

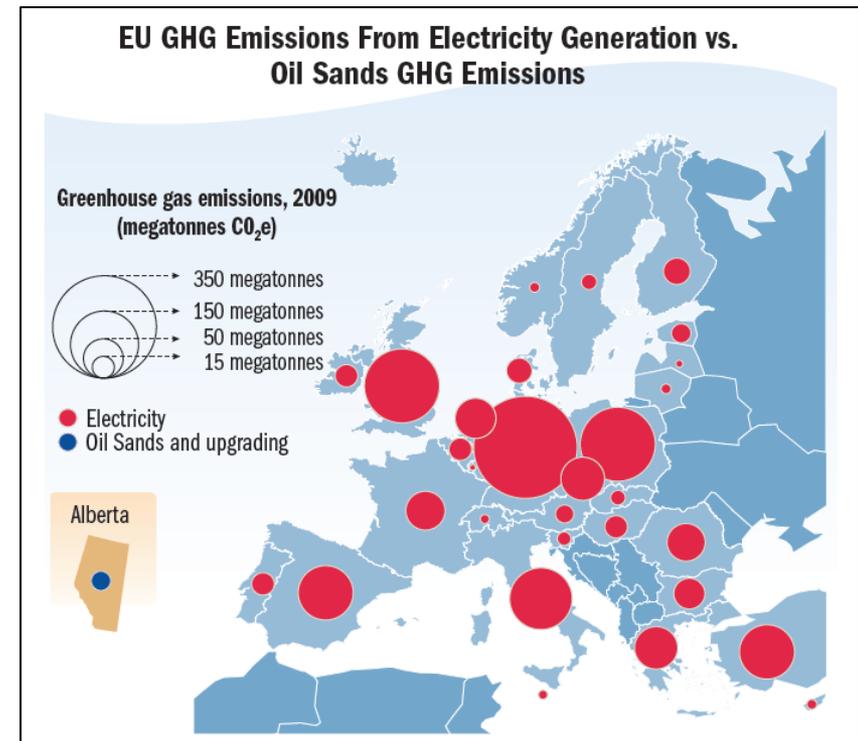
## Air

- Oil sands GHG emissions per barrel decreased by 29% between 1990 and 2009
- Oil sands have a long history of innovation – this has led to improved energy efficiency and reduced emissions
- For example, oil sands cogeneration operations produce ~15,000 GW of power per year as a by-product of oil sands production



# Oil Sands: Emissions Impact

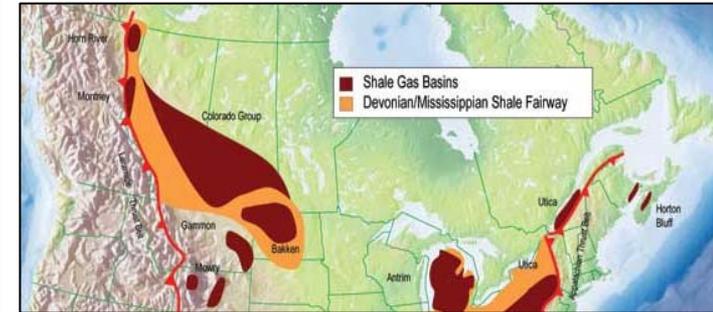
- Oil sands contributed about 6.5% of Canada's total GHG emissions in 2009 – this is equal to 0.1% of global emissions
- By comparison, GHG emissions from European electricity generation were nearly 30 times greater
- A recent *Nature* article shows that coal is a much worse threat than the oil sands – burning all commercially viable oil sands could increase global temperatures by 0.03°C compared with 15°C for coal
- An Environment Canada researcher, using a NASA satellite, recently found that air pollution from the entire oil sands area was comparable to a large power plant or a medium-sized city



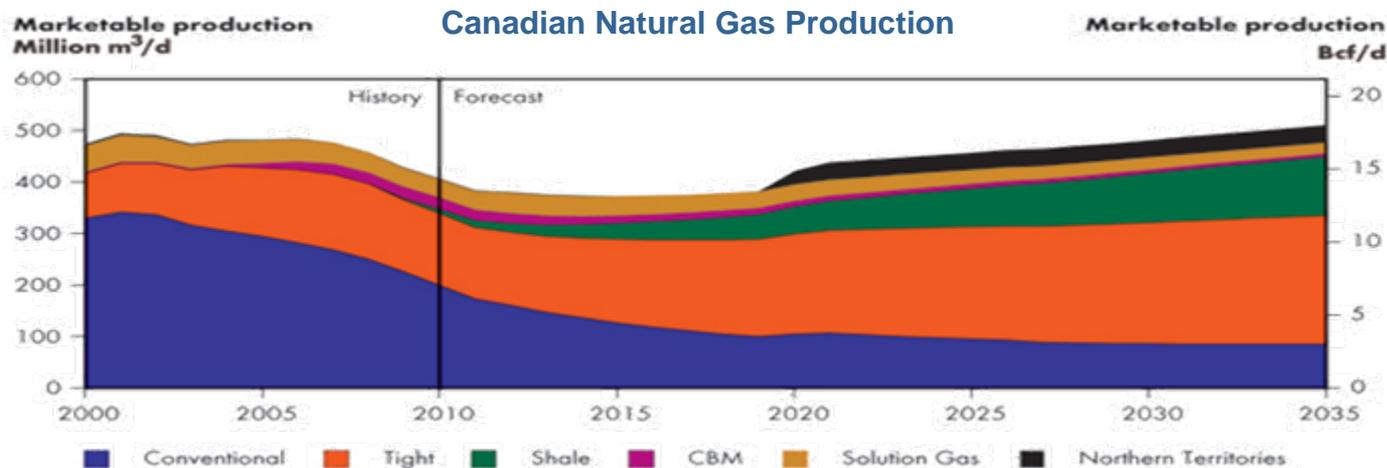
Sources: Environment Canada; European Environment Agency

# Abundant supply of natural gas, including shale gas

- Canadian production declining as Western Canadian Sedimentary Basin matures, however Canada remains the world's 3<sup>rd</sup> largest producer of natural gas
- New sources of supply will maintain Canada's natural gas production capacity, including shale gas, coal bed methane, and potentially Mackenzie Valley gas
- In Canada, potential and producing shale gas resources are found in British Columbia, Alberta, Saskatchewan, Manitoba, Ontario, Quebec, New Brunswick, and Nova Scotia.



Source: NEB, 2009

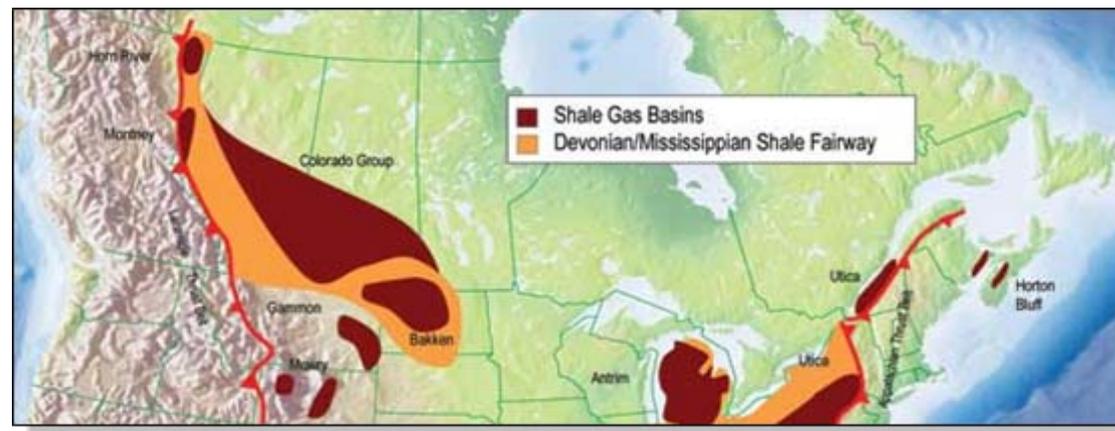


Source: NEB, 2011



# Shale Gas: Responsible Development

- Shale gas activity provincially regulated and regulations vary by jurisdiction
- Focus on safety, environmental protection, and resource conservation
- Drilling permits required and must follow approved procedures at each stage of drilling, through to decommissioning and reclamation
- NRCan's Geological Survey of Canada (GSC) contributes scientific information used in making exploration, resource management and environmental protection decisions by the provinces
- Council of Canadian Academies undertaking an assessment of environmental impacts of shale gas development, to report in 2013



Source: NEB, 2009

