The Keystone XL Project and the Climate Change Discussion

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September, 2013

TransCanada

In business to deliver

Overview

TransCanada Overview

- Asset base
- Keystone XL
- Greenhouse Gas Management Program

GHG Emissions and the KXL Project

- Pipeline emissions
- Oil sands GHG emissions in context
- Life cycle analysis
- Fundamental issues

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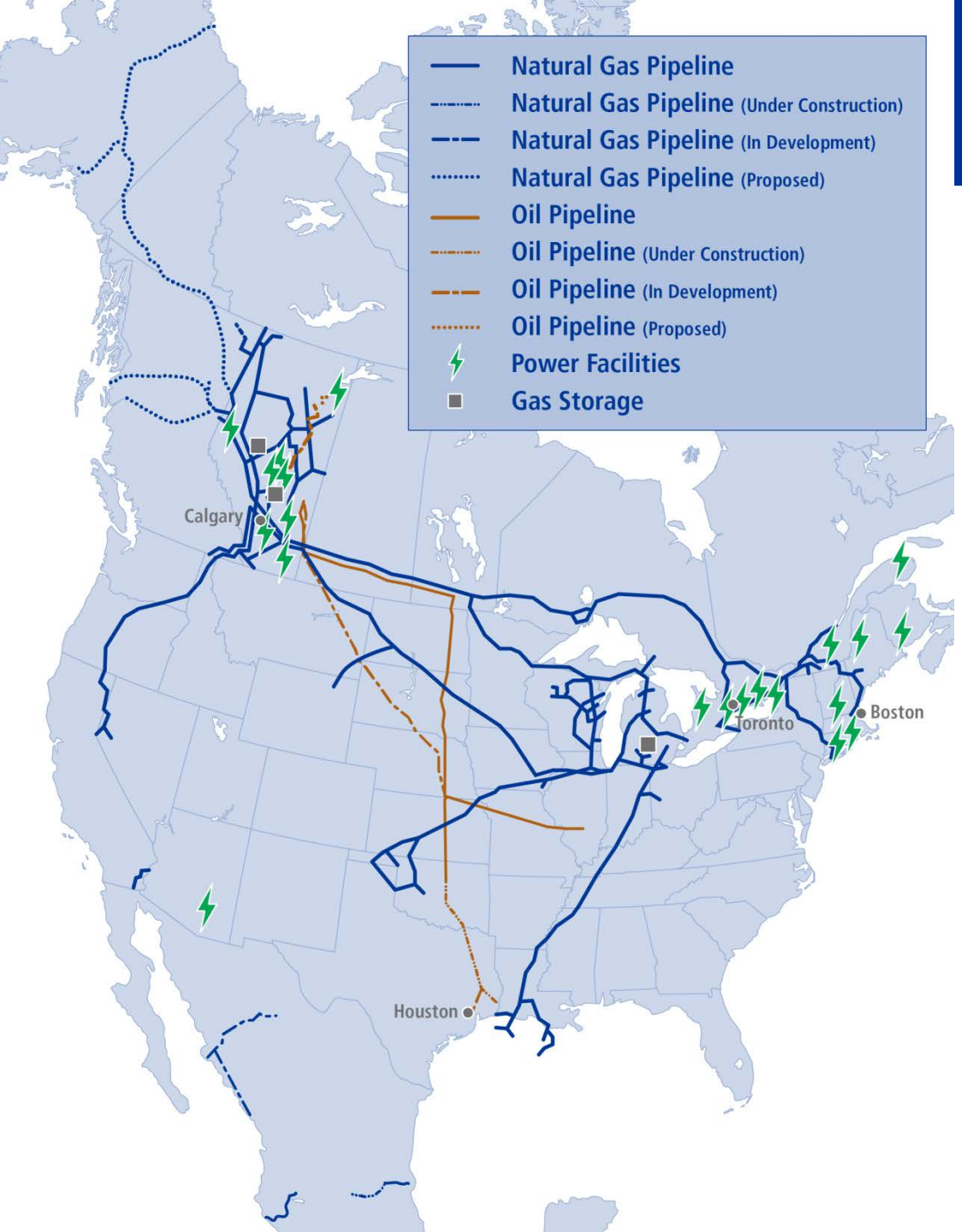

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One of North America's Largest Natural Gas Pipeline Networks

- 68,500 km (42,500 mi) of pipeline
- Average volume of 14 Bcf/d or 20% of continental demand

North America's 3rd Largest Natural Gas Storage Operator

- 406 Bcf of capacity

Canada's Largest Private Sector Power Generator

- 21 power plants, 11,800 MW
- Diversified portfolio, including wind, hydro, nuclear, coal, solar and natural gas

North American Oil Pipeline System

- 1.4 million Bbl/d ultimate capacity*

***Keystone Wood River / Patoka and Cushing Extension sections in operation**
Gulf Coast pipeline project under construction
Keystone XL pipeline project in development
Houston Lateral pipeline project in development

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KXL - Project Overview

- **875 miles of 36” pipe**
- **830,000 barrels per day**
  - Up to 100,000 barrels per day of light crude and synthetic crude products from the Bakken
- **Includes 20 pump stations**
  - Pumps driven by electric motors

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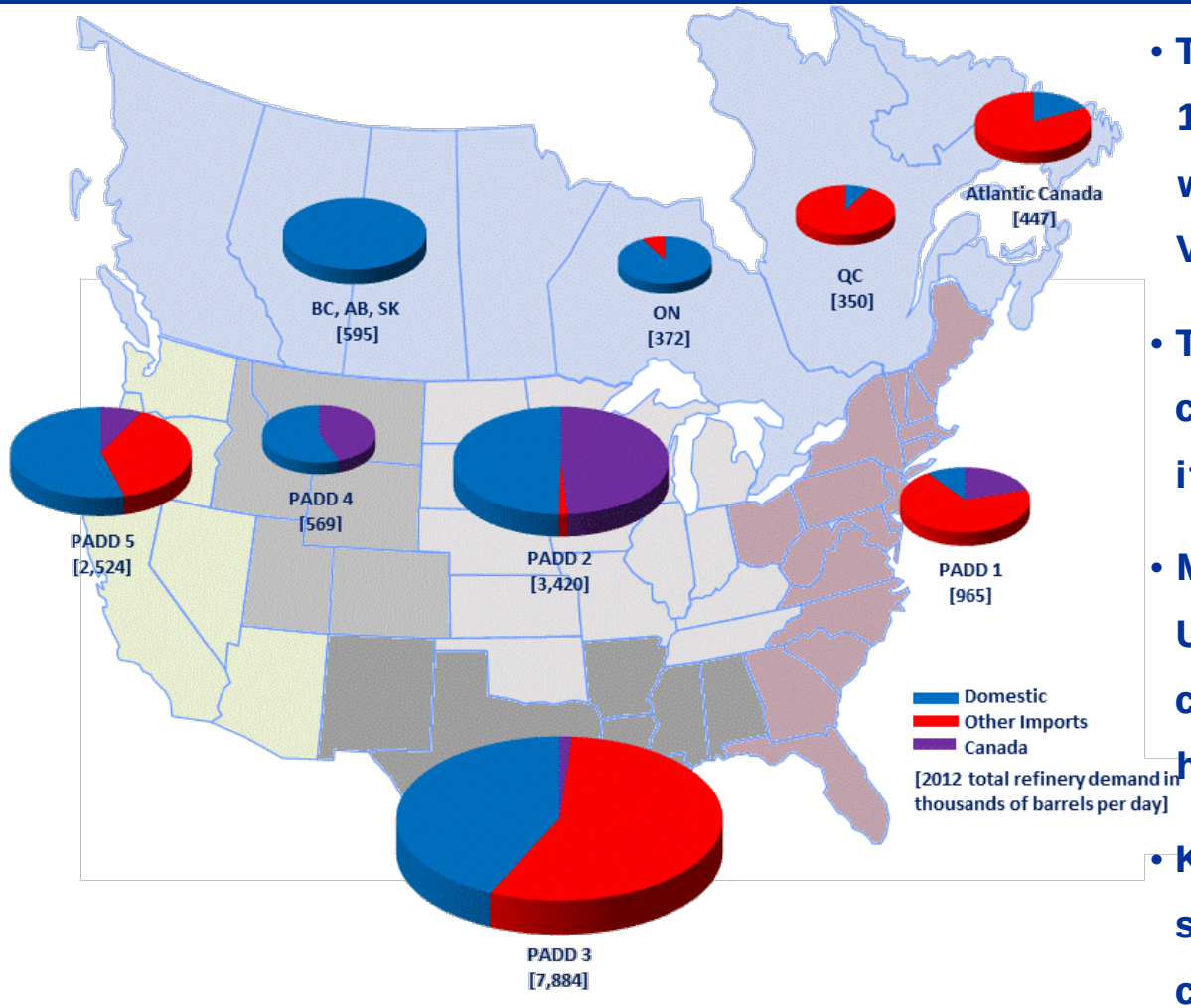
North America Crude Oil Demand



- The USGC imported more than 1.6 billion barrels in 2012, of which 320 million barrels were Venezuelan crude
- The US remains a net importer of crude oil beyond 2040 to meet its energy demand
- Majority of the imports in the USGC have been and will continue to be medium and heavy crude oil
- Keystone XL will safely and securely bring Canadian heavy crude to the USGC to displace heavy imports from Venezuela

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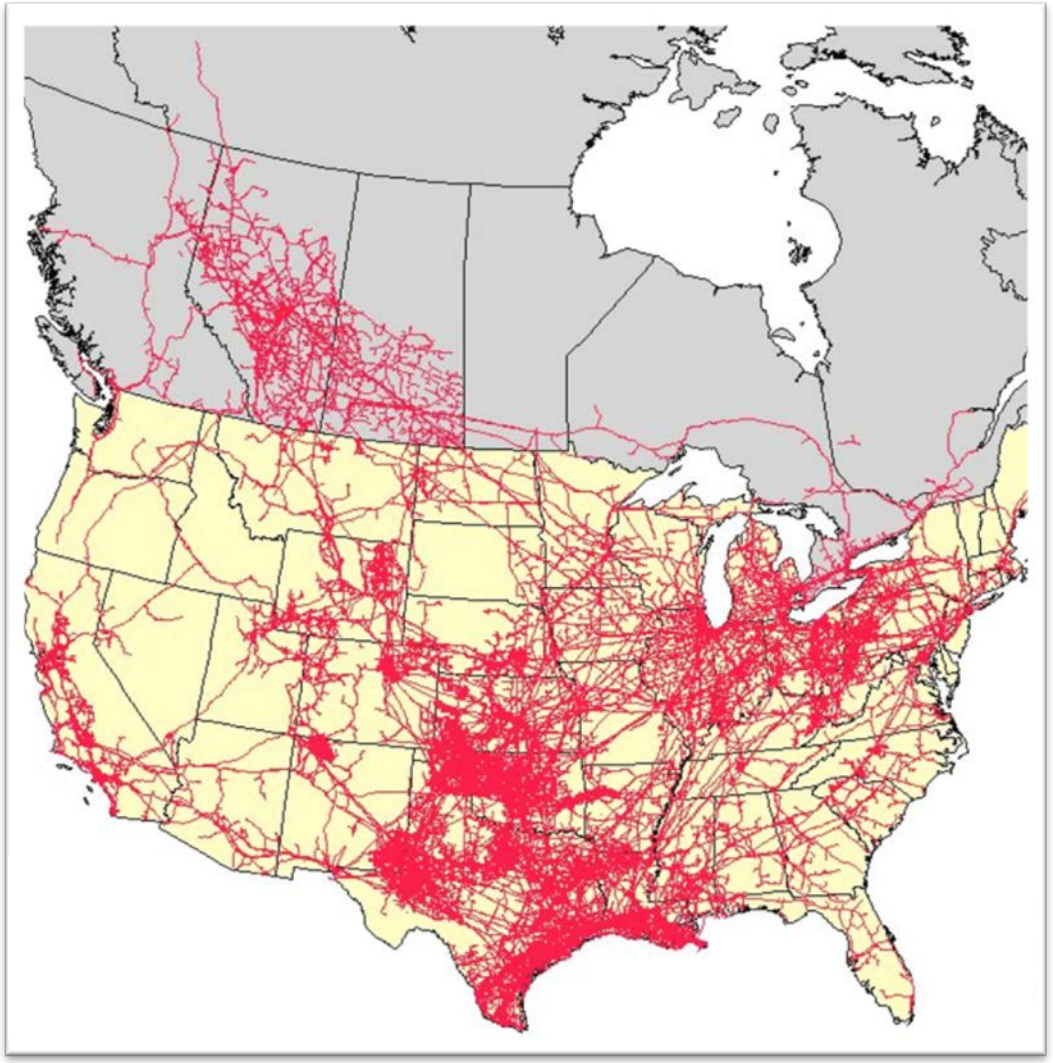
North American Pipeline Systems



- More than 2 million miles of pipeline in the US enable safe movement of energy products
- Majority of pipelines operate underground, so their role is unnoticed
- Safest and most efficient form of transportation for petroleum products

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Keystone Right-of-Way Before & After

Near David City, Nebraska • Spread 5B Construction
Photo above taken June 15, 2009 Photo below taken August 25, 2010

North of Yankton, South Dakota • Spread 4B Construction
Photo above taken May 27, 2009 Photo below taken August 26, 2010

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TransCanada's GHG Management Programs

Improving energy efficiency

- Engine/system efficiencies
- Waste heat recovery

Implementing methane management programs

- LDAR
- Pulldowns
- System outage decision model

Funding research and development projects

- Compressor station blowdown capture
- Oxy fuel combustion

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Research and Development Program

Four technology focus areas, one of which is focused on environmental research (air, GHG, soil, animals, water)

Projects areas include:

- **Methane management**
  - Recovery of CS blowdowns
  - Supersonic ejectors
- **Combustion processes and energy systems**
  - Oxy Combustion
  - Fuel cell applications

Proceedings of IPC 2010
8th International Pipeline Conference
September 27-October 1, 2010, Calgary, Alberta, Canada

IPC2010-31015

Thermodynamic and Economic Assessment of an Oxy-Combustion CCS System Applied to Gas Turbine-Driven Compressor Stations

C.J. Ennis *and* K.K. Botros

NOVA Research & Technology Centre
Calgary, Alberta, Canada

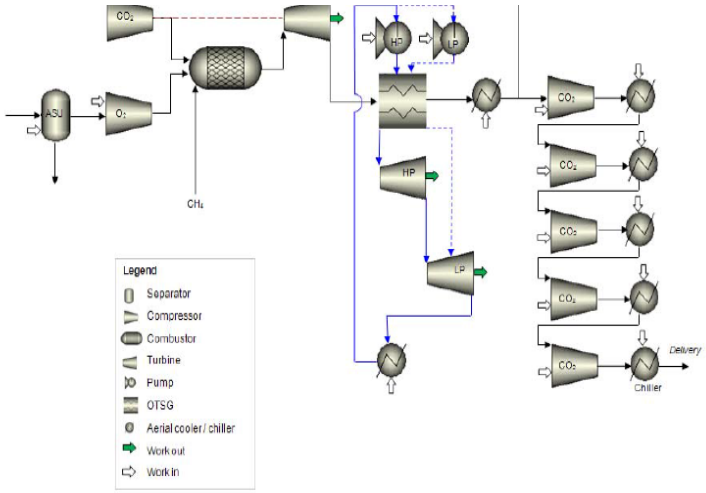

Figure 4: Process flow diagram of an O_2-blown semi-closed CO_2 cycle with two steam pressure stages

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KXL and the Climate Change Debate

The KXL climate change debate is centered around the "incremental" GHG emissions arising from heavy crude products from Canadian Oil Sands and transported by KXL.

Fundamentally three issues:

- **What are the upstream emissions?**
- **What is being displaced by products carried by KXL?**
- **Will Oil Sands production grow without KXL?**

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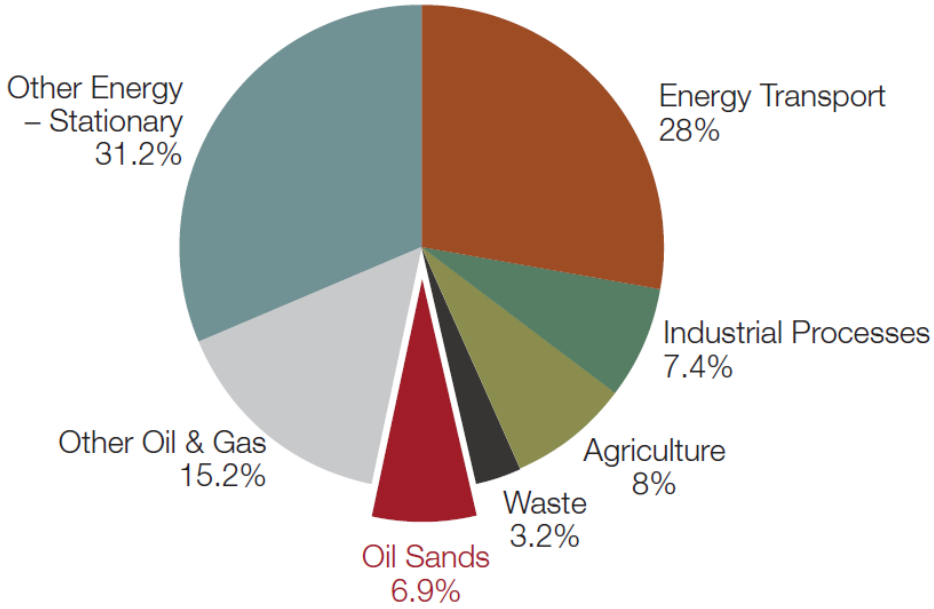
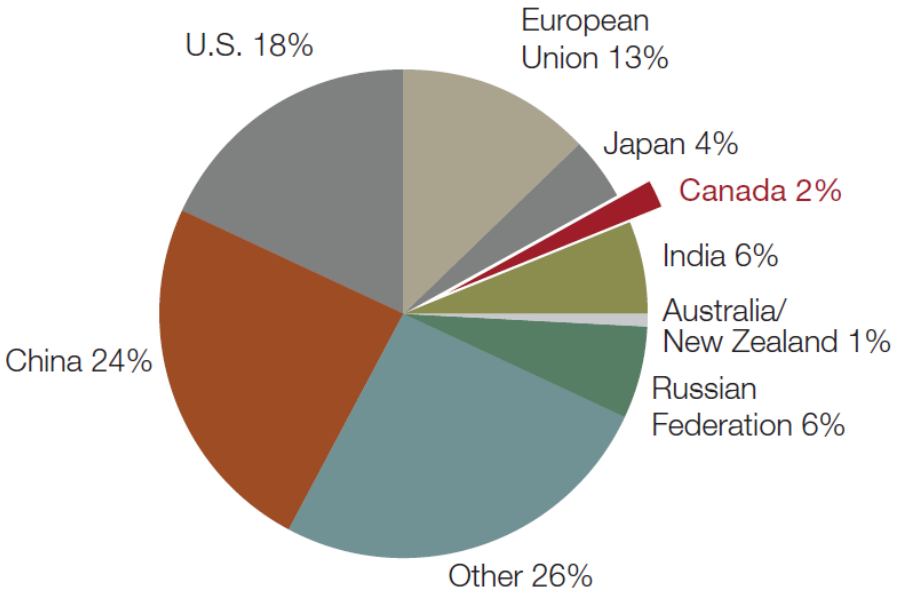
Oil Sands Emissions

Canada's GHG Emissions by Sector – 2010



Source: Environment Canada 2012

Global Energy Related Emissions by Region – 2008*



Source: United Nations Statistics Division (2008 Data)
*data released 2011

Oil Sands contribute less than 0.2% of global emissions

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Oil Sands Emissions - Context

- Total oil sands GHG emissions in 2011 were 55 million tonnes

Source: Environment Canada 2012

- Equivalent to 3.2 per cent of the emissions from the U.S. coal-fired power generation sector in 2011

- Natural gas-fired electricity generated in the U.S. produces 409 million tonnes/year in 2011

- U.S. emissions from transport and for generating electricity from coal total over 3.4 billion tonnes/year

Source: Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2011, April 12, 2013

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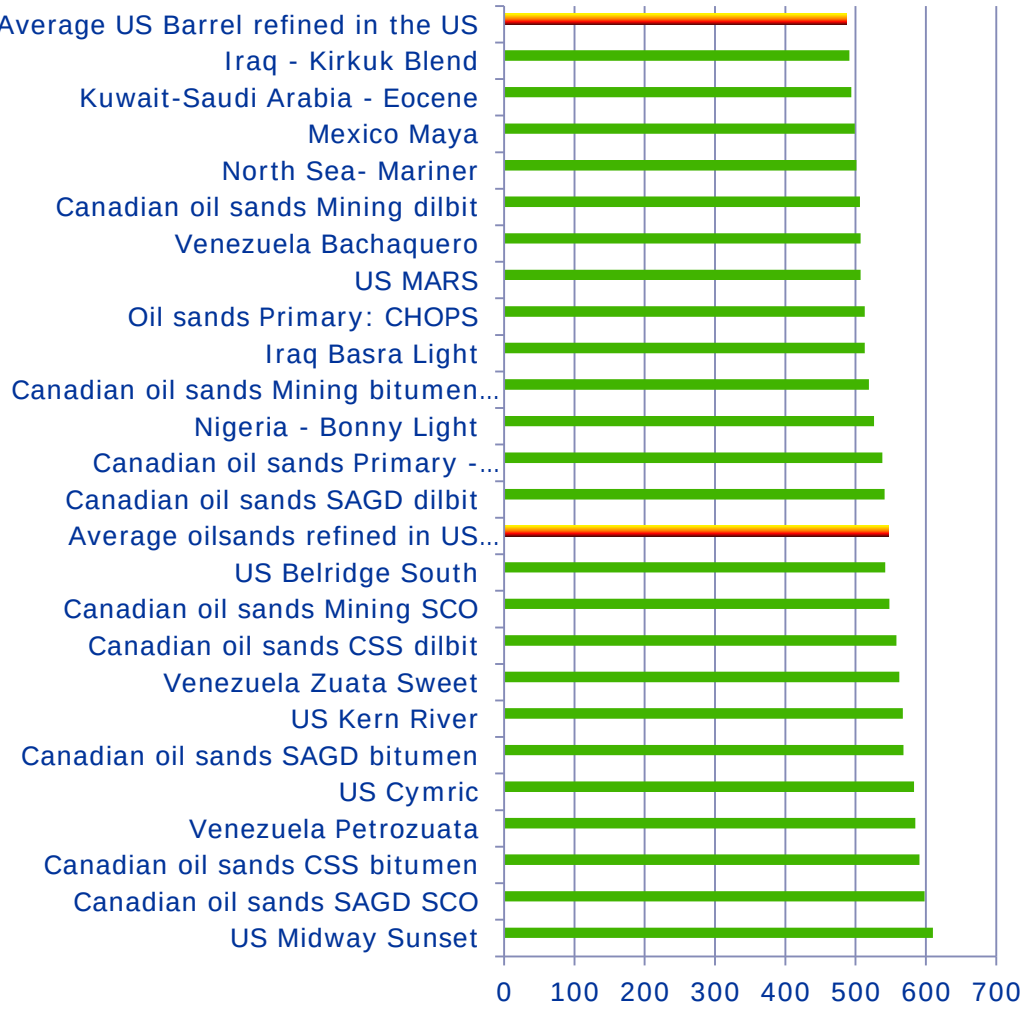
CERA Wells to Wheels GHG Emissions
(kg CO2e / barrel of refined product)

Average wells to wheels for oil sands 14% higher than average crude refined in US (wide boundary basis)*

BUT

The most likely alternative heavy oil supply to Gulf Coast is Venezuelan crude "***which is in the same GHG emissions range as oil sands.***"**



* IHS CERA, Getting the Numbers Right, November 8, 2012

** IHS CERA Insight, August 5, 2013

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KXL: No Material Impact on US GHG Emissions

US Department of State, Draft Supplemental EIS, March 2013:

- Approval or denial of the Project is "*unlikely to have a substantial impact on the rate of development of oilsands….The incremental indirect life-cycle emissions associated with those decreases in oil sands production are estimated to be in the range of 0.07 million to 0.83 million metric tonnes CO2 equivalent..annually*"

IHS CERA Report, August 5, 2013:

- Incremental GHG emissions from the pipeline would not be substantial as the most likely alternative heavy oil supply to the Gulf Coast is Venezuelan crude "*which is in the same GHG emissions range as oil sands. Consequently, if oil sands were not consumed in the Gulf Coast, there would be little to no change in the overall GHG intensity of the US crude slate."*

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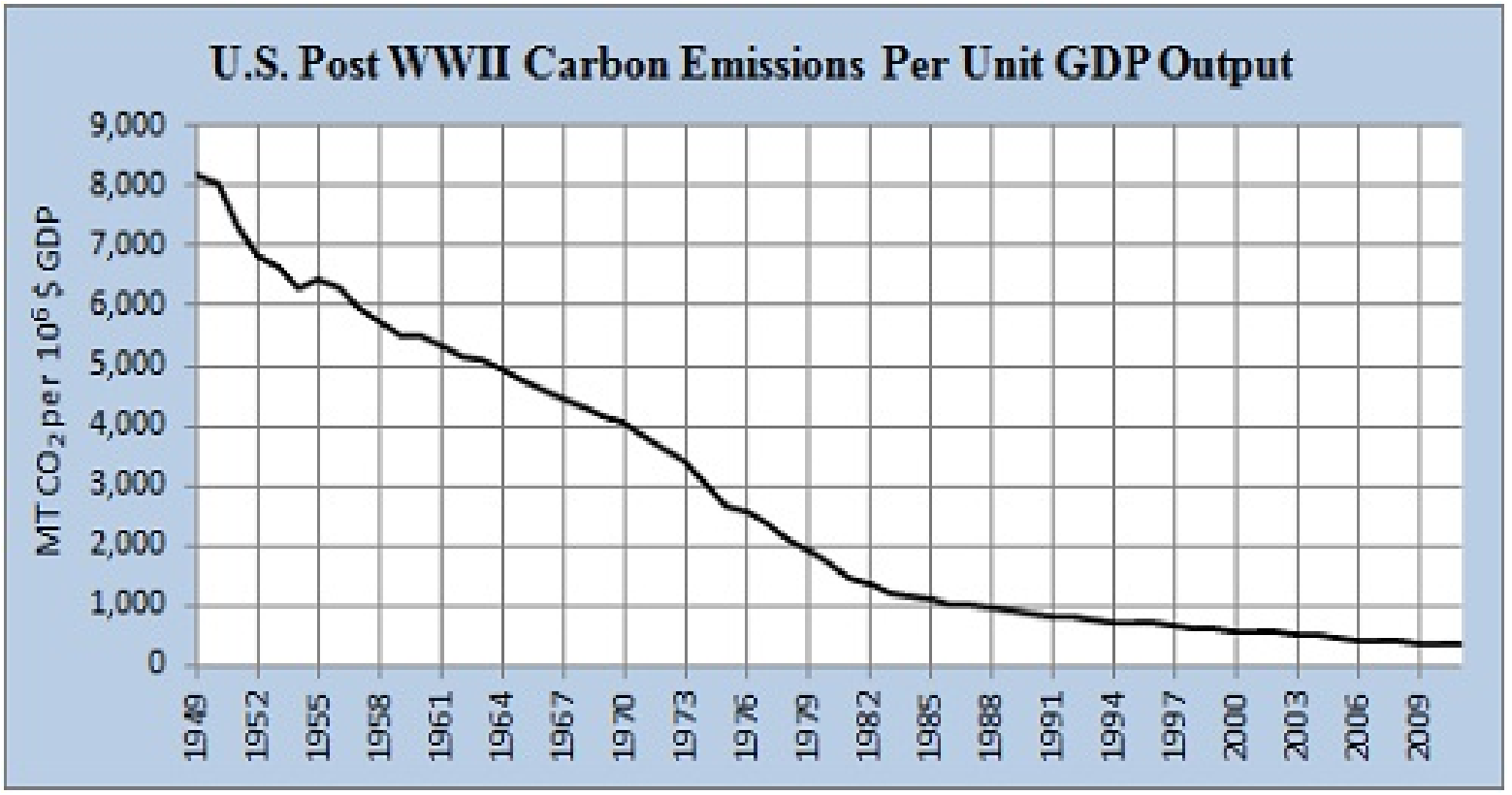
Realities

- **Energy infrastructure always poses stakeholder trade-offs**
  - Critical infrastructure for some, inconvenient and unnecessary for others
- **Global crude demand is static**
  - Theoretic life-cycle analysis is academically interesting, but likely not predictive of the future
  - Global emissions from oil sands are relatively small in any case

Extra Slides

Discussion topics…


U.S. Post WWII Carbon Emissions Per Unit GDP Output
MT CO_2 per 10^6 $ GDP
9,000
8,000
7,000
6,000
5,000
4,000
3,000
2,000
1,000
0
1949
1952
1955
1958
1961
1964
1967
1970
1973
1976
1979
1982
1985
1988
1991
1994
1997
2000
2003
2006
2009

Where are we?