Shifting Landscapes

Trends & Developments in the Alberta Energy Industry – May 17th, 2011

pwc

Contents

Introduction

Question:
What do these recent headlines have in common?

"Alberta's 'sunset' industry poised for growth"
-Nickles Daily Oil Bulletin, April 18, 2011

"The multibillion-dollar rush to scoop up land for natural gas exploration in British Columbia has come to a sudden halt, as energy companies almost completely abandon the province and turn back to Alberta in the hunt for future prospects"
-*The Globe and Mail*, April 8, 2011

"Canadian gas technology goes global"
-*The Financial Post*, March 18, 2011

"Deep Basin seeing another wave of investment"
-Nickles Daily Oil Bulletin, May 2, 2011

"Another big year expected for oilpatch financings"
-Nickles Daily Oil Bulletin, April 5, 2011

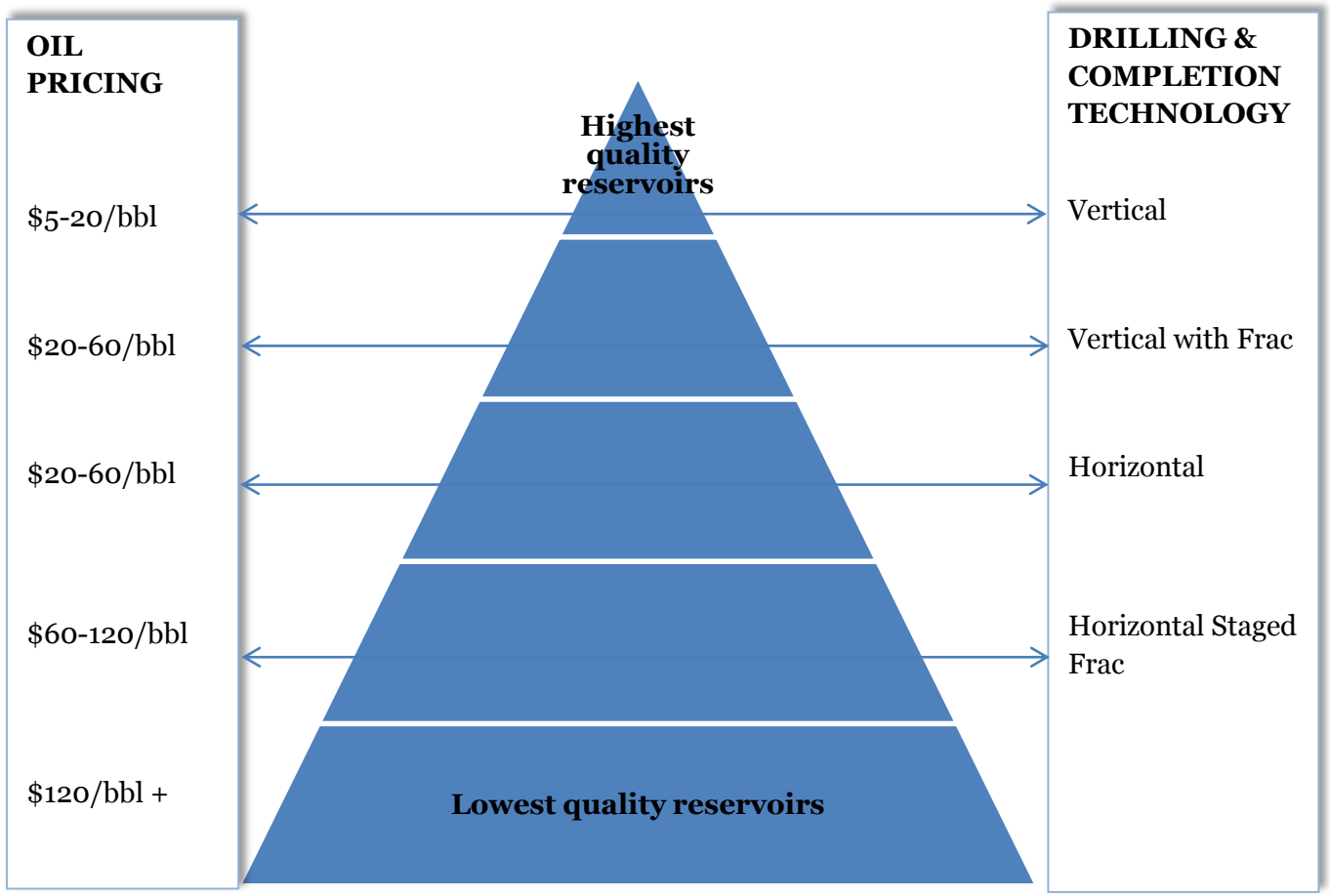
Answer:

Technology - now at the top of the oil and gas agenda

There is competitive pressure to innovate - below ground (location, depth, lateral length, recovery rates, steam oil ratios) & above ground (supply chain, modularization, sustainability)

- Resource plays, not exploration plays are the name of the game and technology is the key driver
- Market caps of new Canadian resource play companies challenging the traditional Canadian large caps
- IP protection is now a top of mind issue
- R&D spending rapidly increasing
- Future production growth potential is dramatic (e.g. 2 million boe/d in tight oil by 2016?)

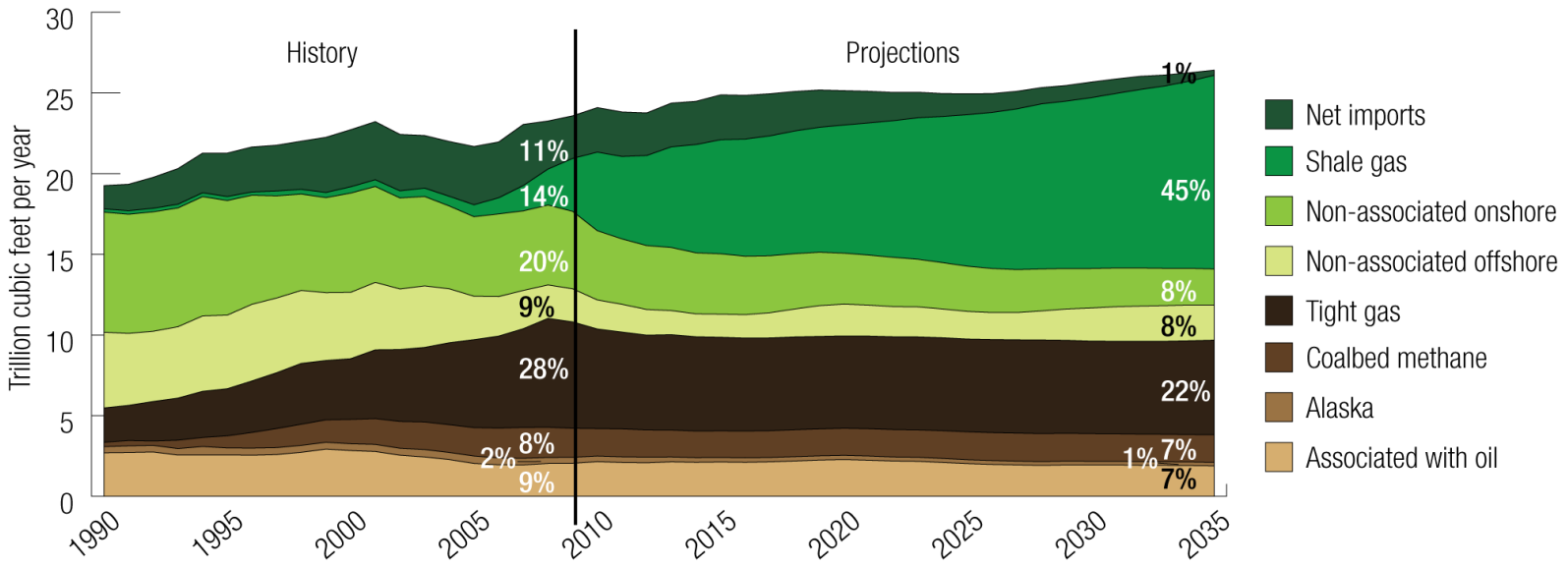
Technology is Unlocking "Difficult" or Unconventional Oil and Gas Supplies



Source: Penn West Energy Trust

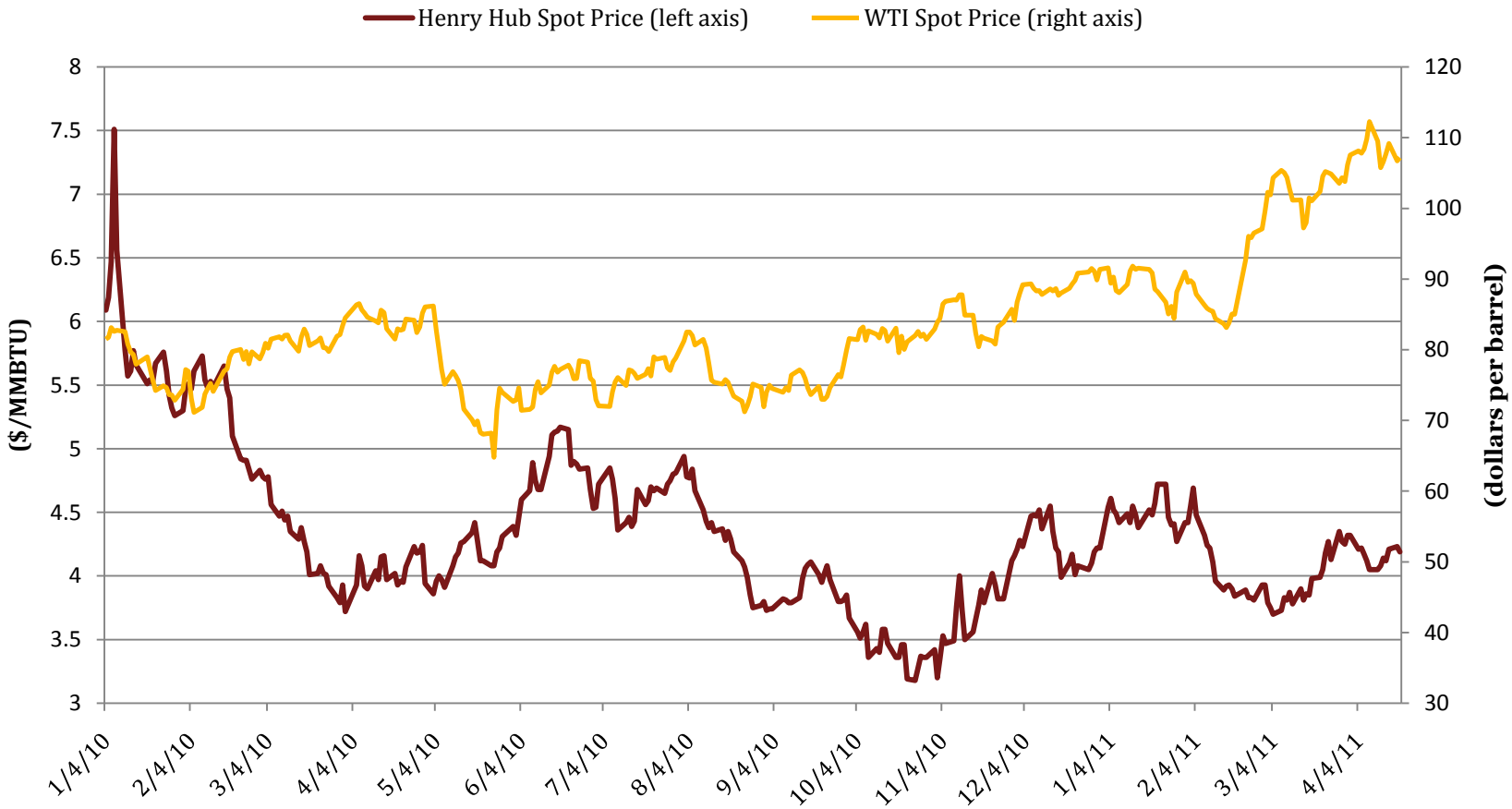
US Shift Toward Self-Sufficiency in Natural Gas

US natural gas production projections to 2035



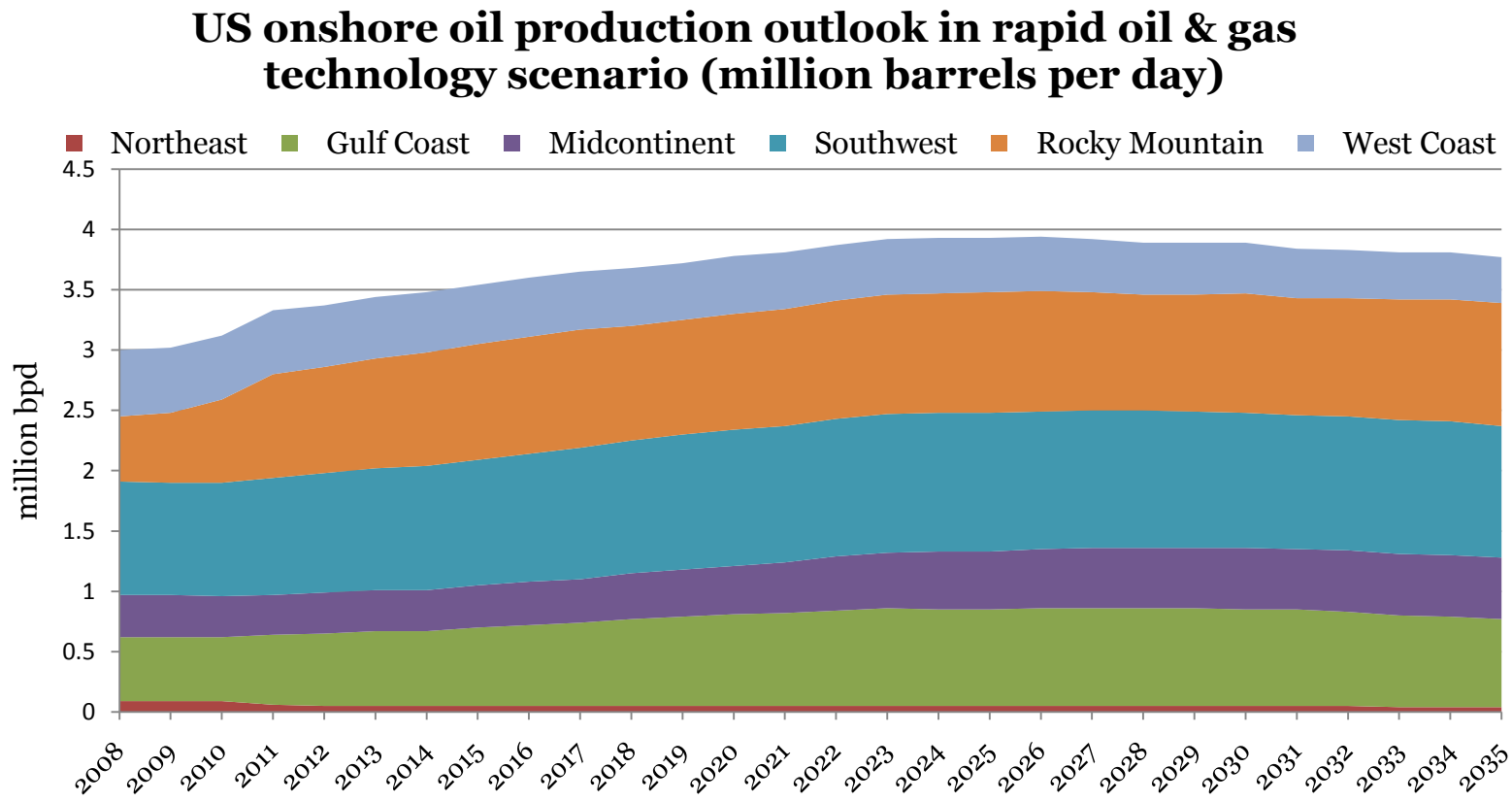
Sources: EIA, Annual Energy Outlook 2011

North American Natural Gas Prices Decoupling from Oil



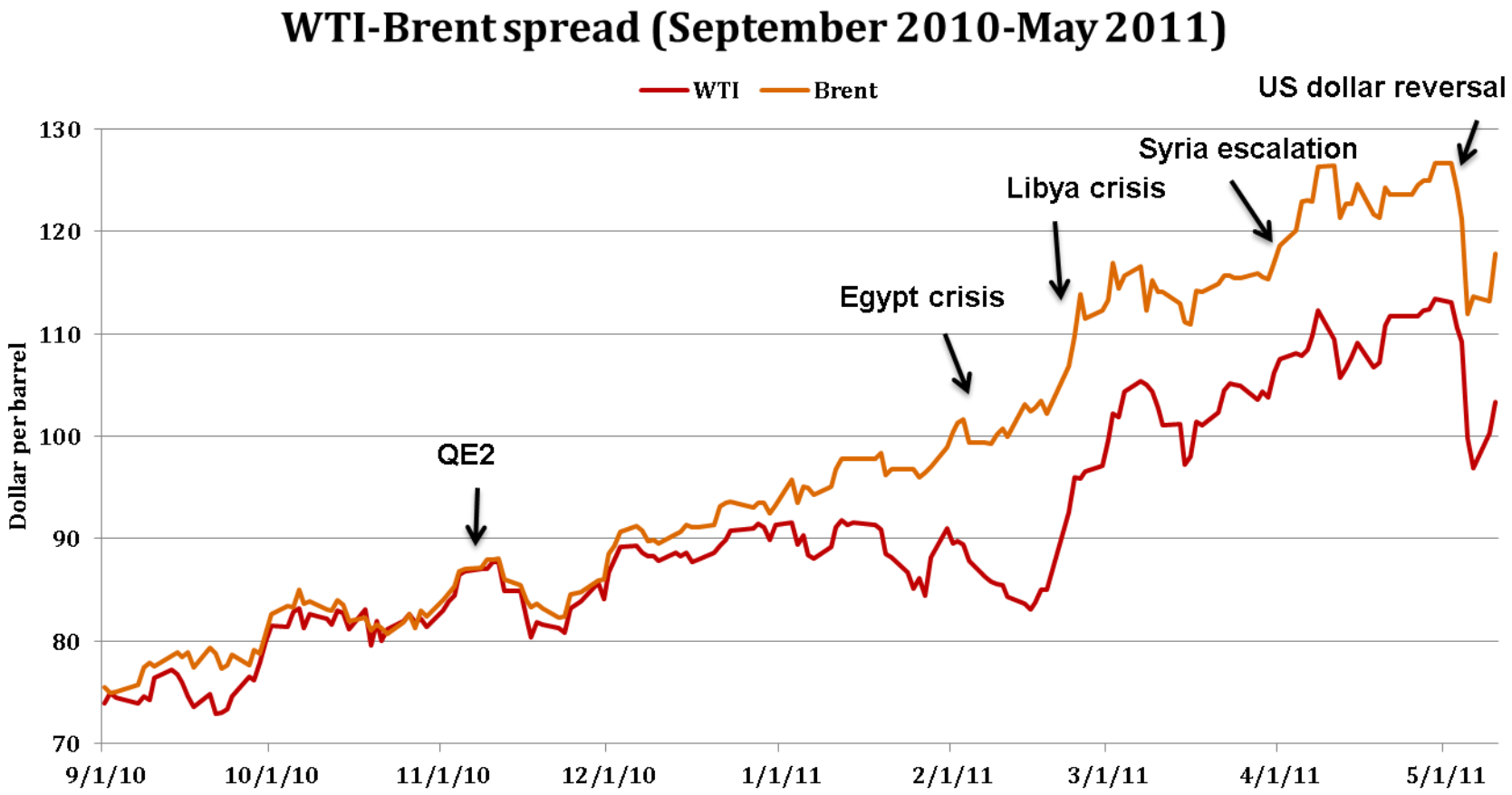
Source: EIA

US Crude Oil Production Looks Better



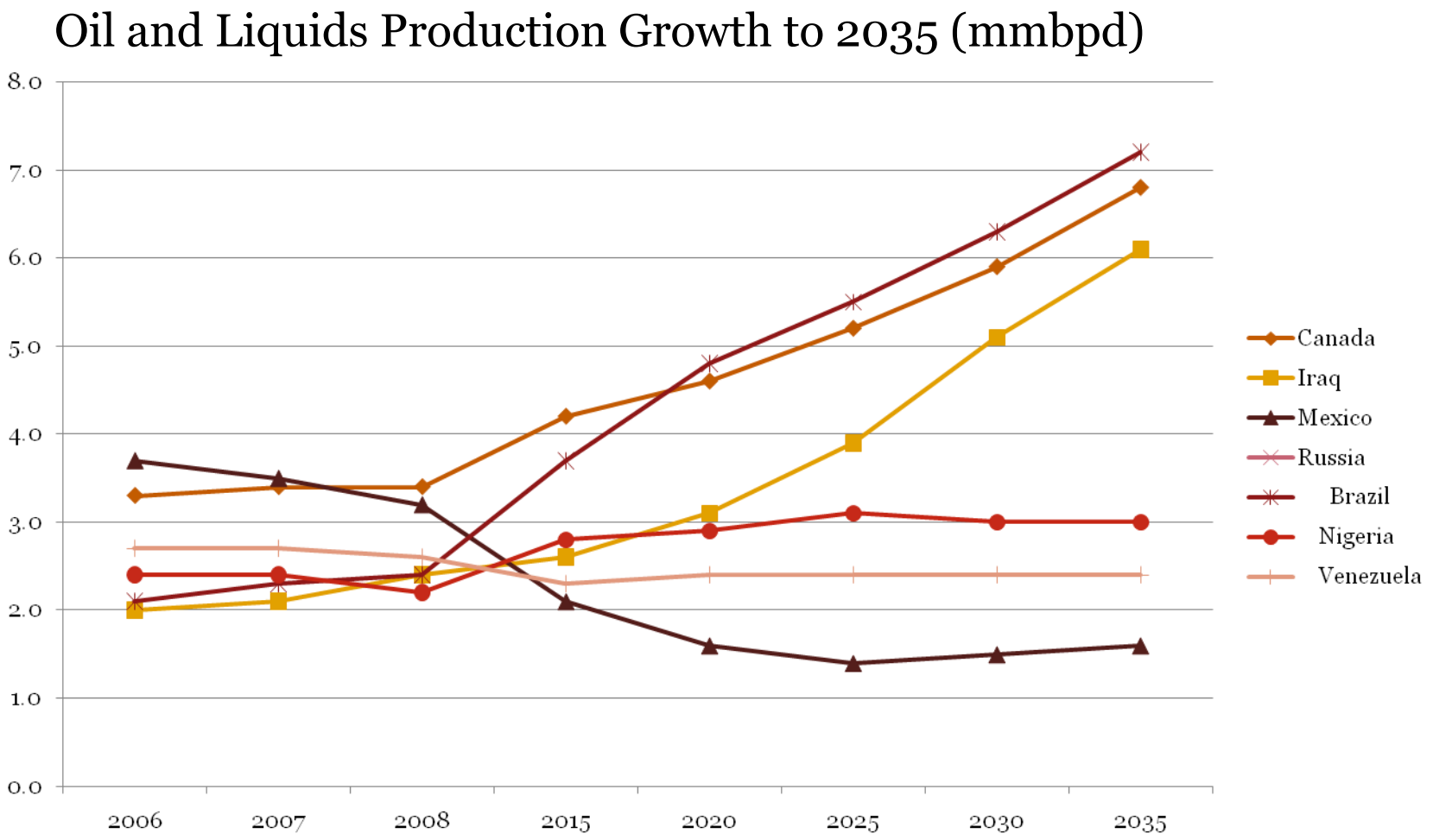
Source: EIA Annual Energy Outlook 2011

Global Oil Driven Higher and More Volatile by External Factors



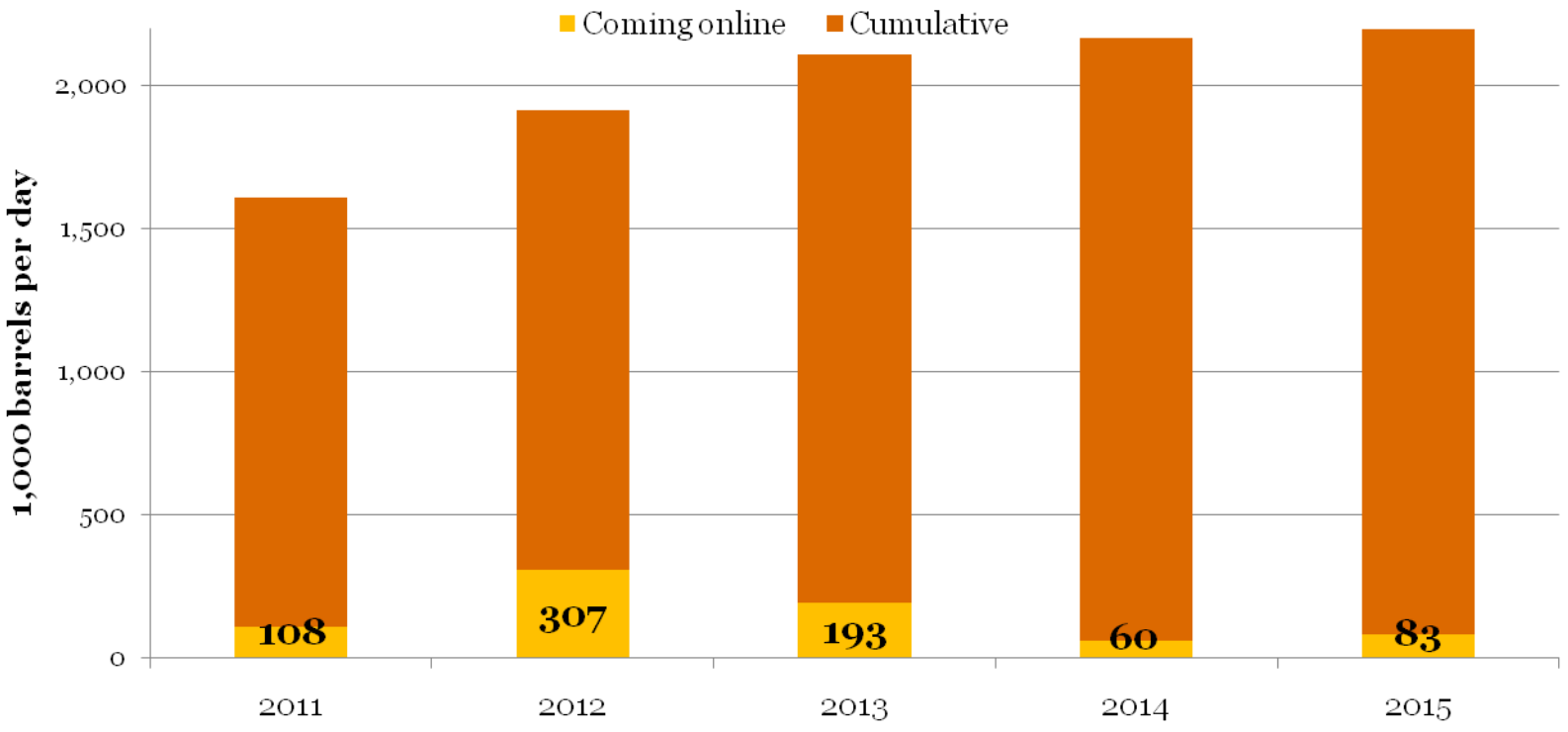
Source: EIA, EG Research

Canada Quietly Becomes an Energy Superpower



Source: EIA IEO 2010

Canadian Oil Sands Projects Under Construction:
2011-2015



Source: Oil Sands Review, April 2011

The Future is Unconventional

"Unconventional is now the key word in Western Canada, both in terms of future output growth and the marketing options producers must consider" PIW 31 January 2011

So our question is:

Beyond "play-specific" economics, geology, and technology what issues are out there for Western Canadian unconventional oil and gas?

Canadian Energy Survey

PwC and Eurasia Group interviewed industry leaders, senior policy makers, and academic experts to get their perspective on the cumulative strategy and policy challenges stemming from the technology-driven “supply boom” in Western Canada and the US

Four Key Themes

I. Managing the transition from shale gas to tight oil

II. Finding new markets abroad- LNG & bitumen exports

III. Finding new markets at home- fuel-switching in the power & transport sectors

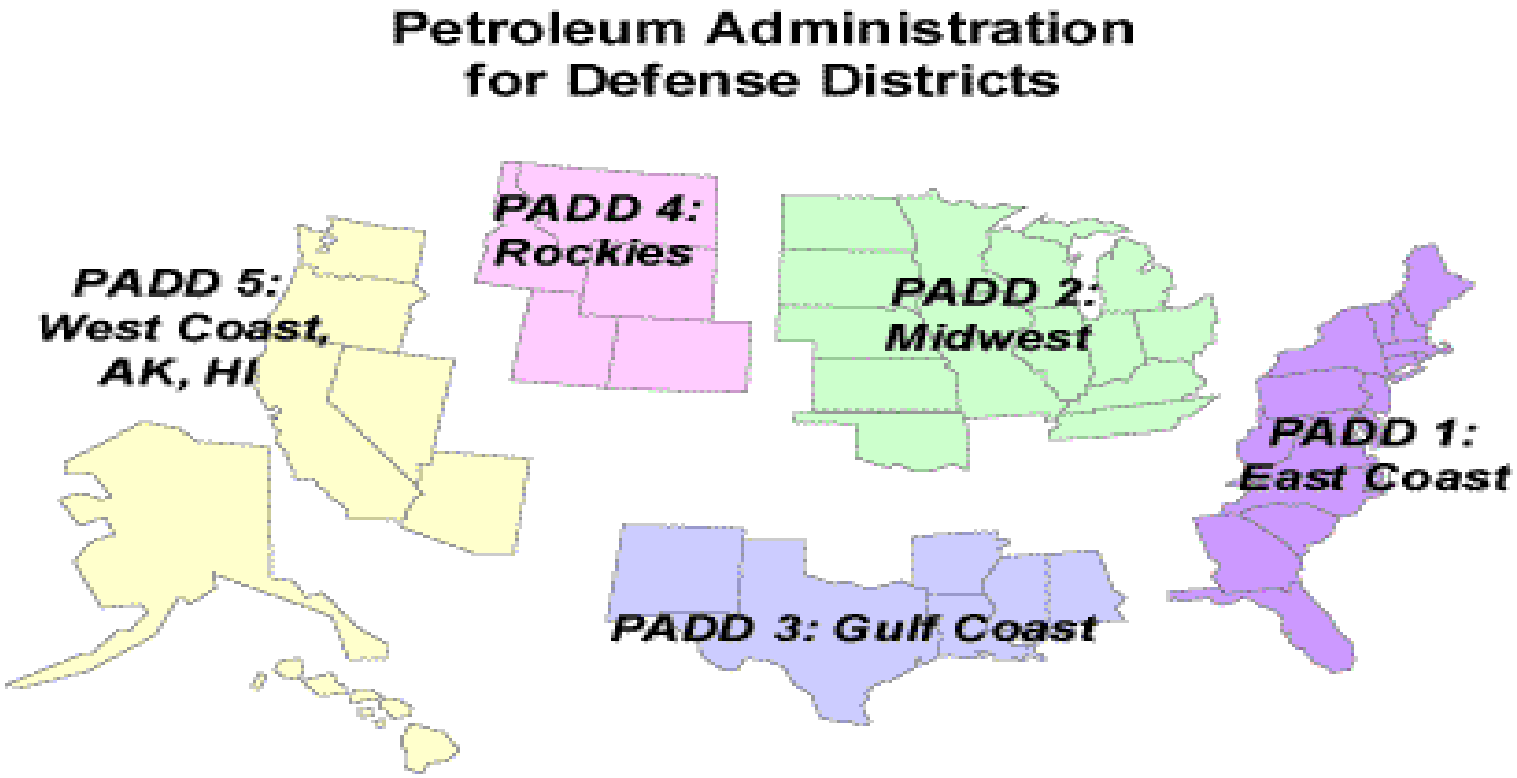
IV. Assessing outward investment opportunities for services and E&P

Theme I

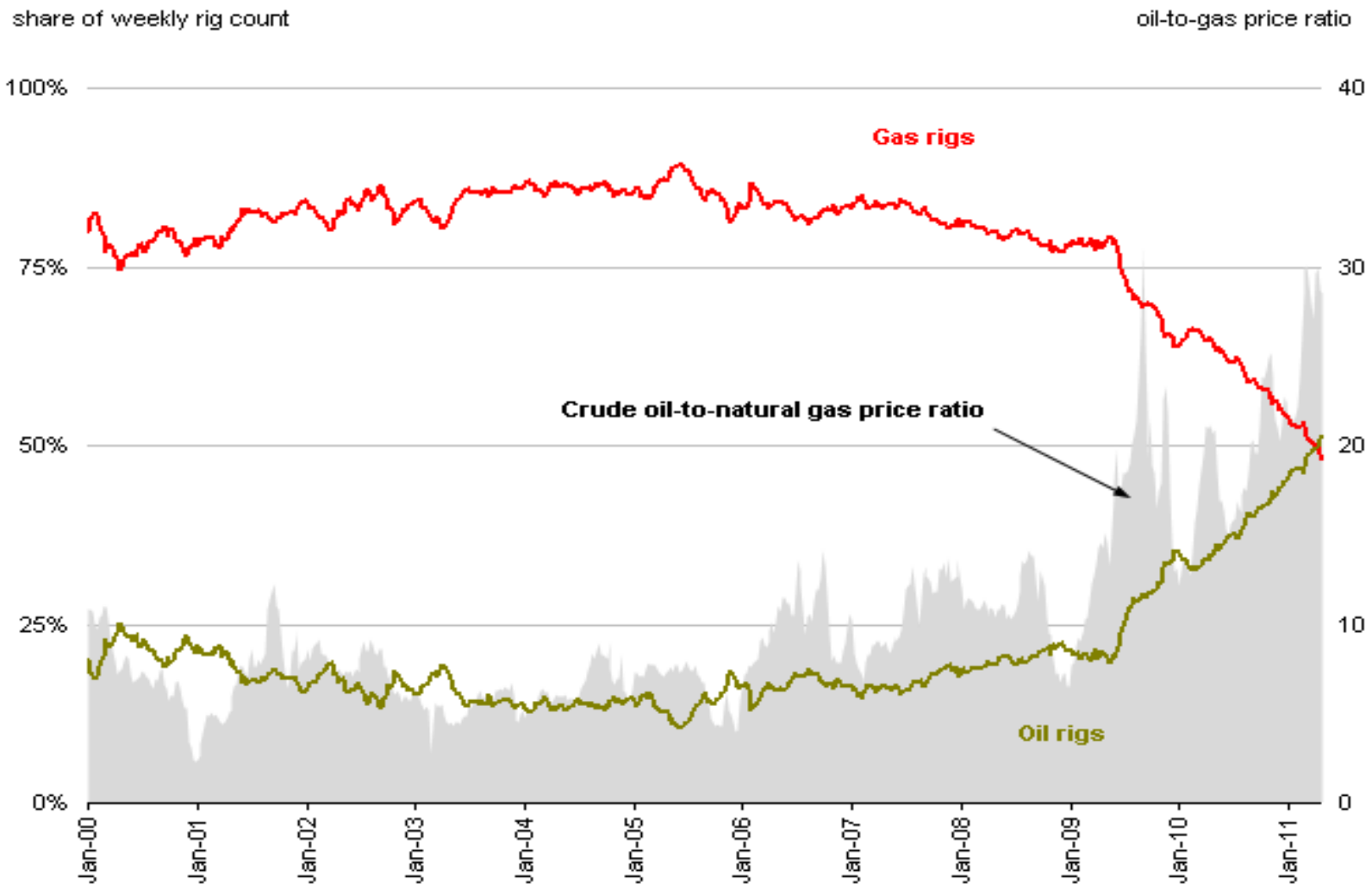
Drilling shifts to liquids & tight oil:

- Shift away from dry gas plays
- New opportunities/challenges in “light and tight oil growth
- Environmental concerns around fracking and surface impact must be addressed

A Reminder of the US PADD System

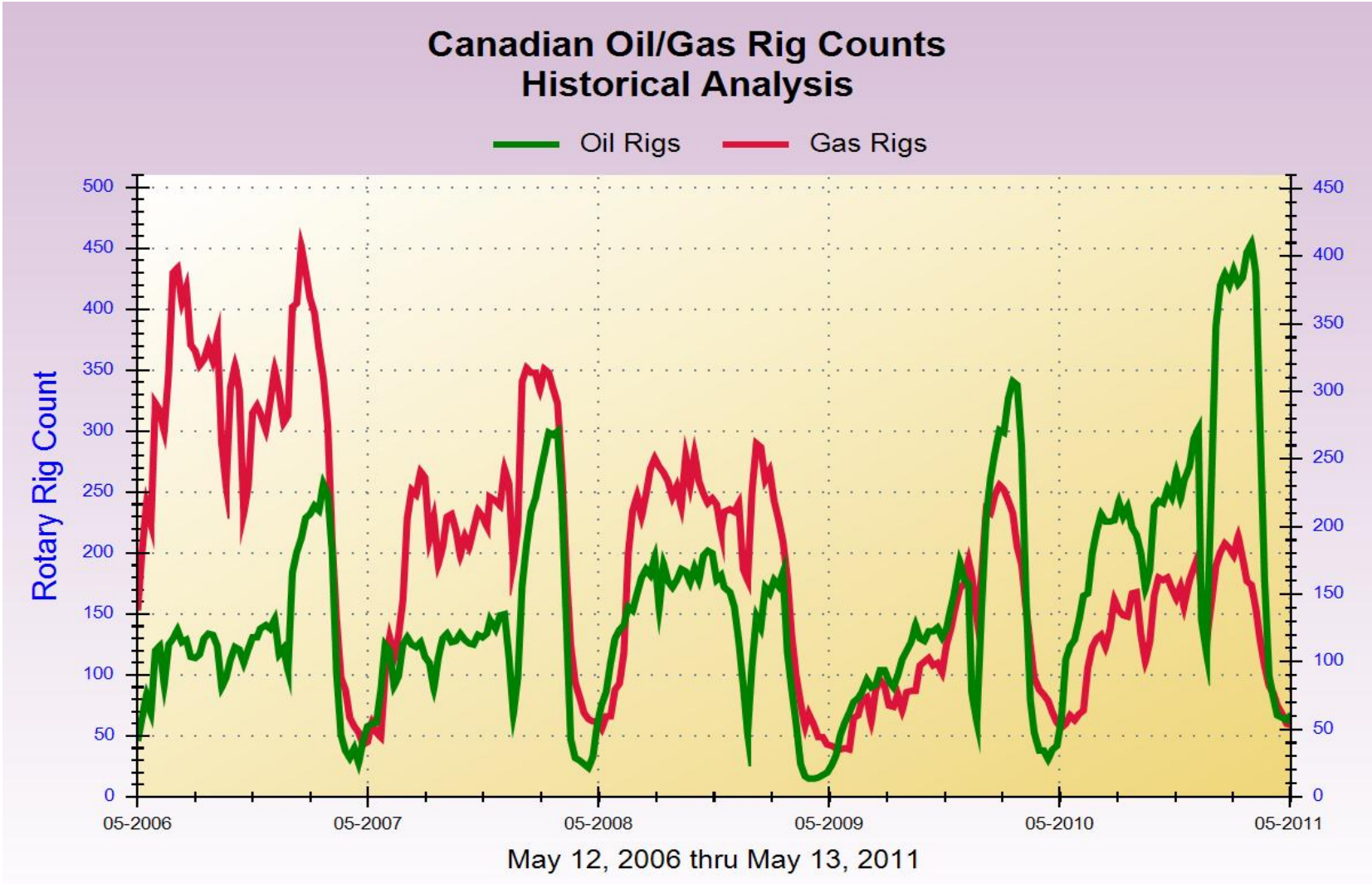


US Oil Rig Count Overtakes Natural Gas Rig Count



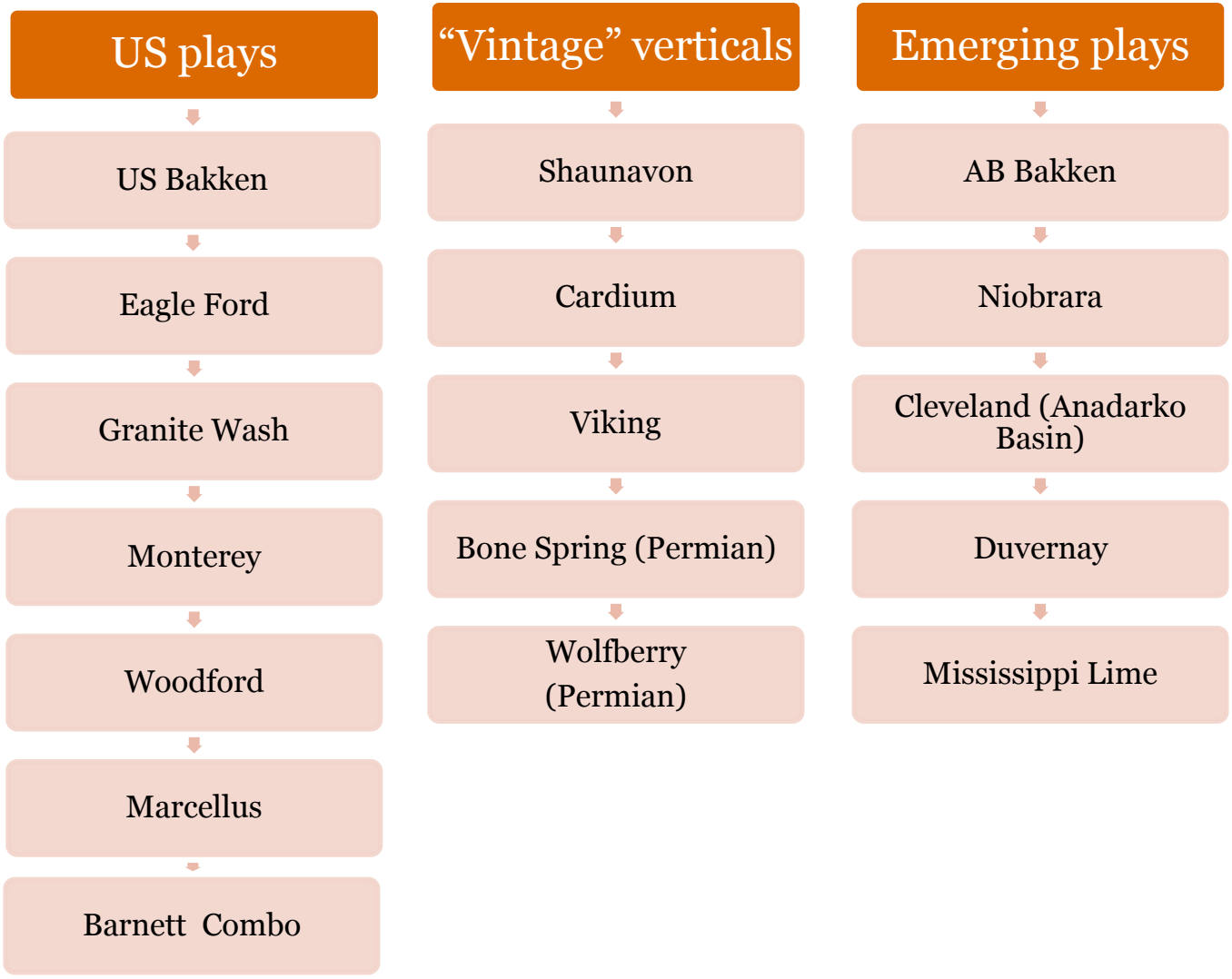
Source: EIA, May 9

Canadian Perspective



Source: http://www.energydigger.com/imageViewer/pub/graphs/rig-counts/ca/2011-05-13/ca-oilGas

Three Emerging Liquids-Focused Mega-Plays

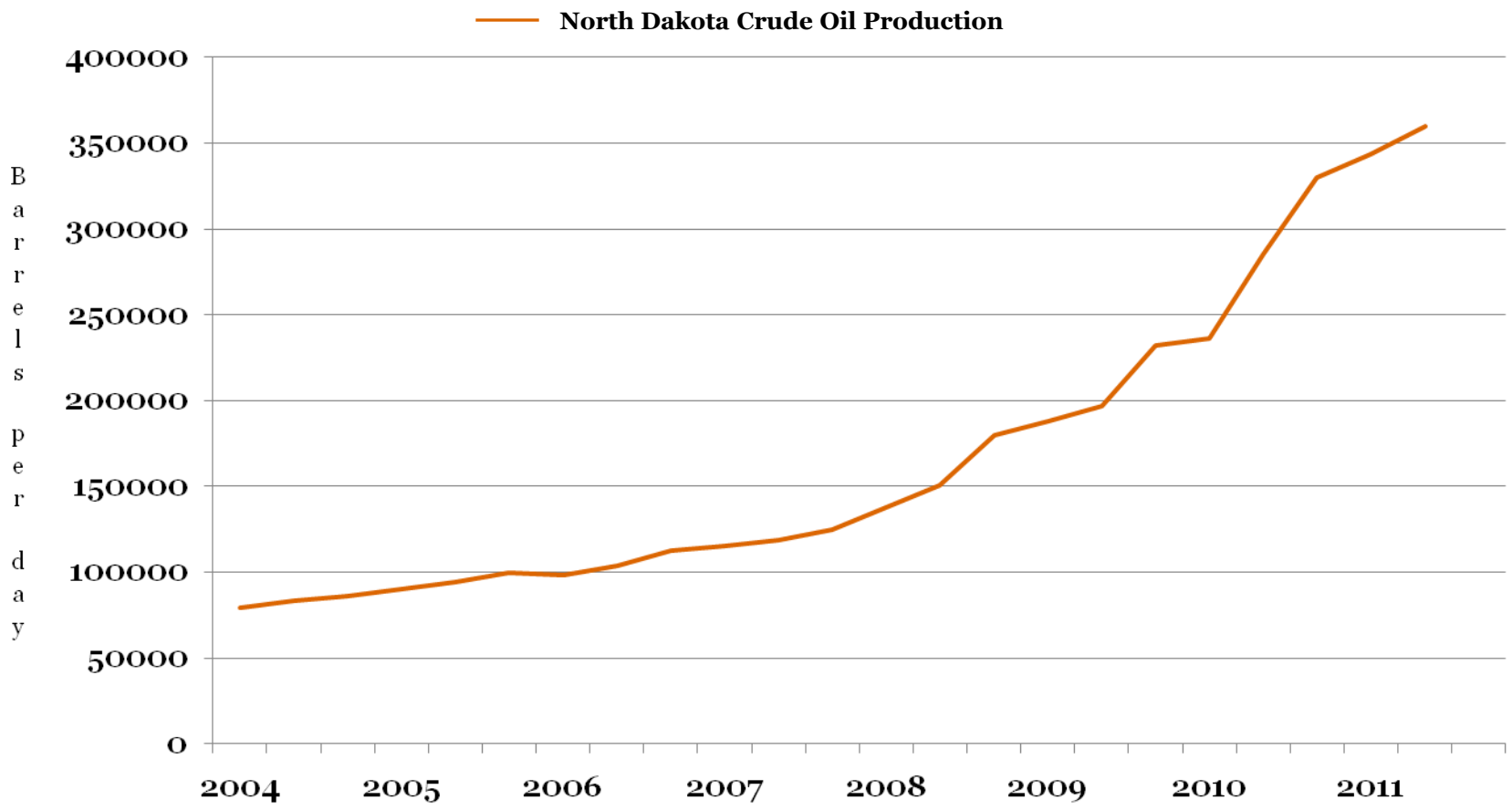


Technological Breakthrough

It's still early, but tight oil may be a "real game changer"

- Shale oil triggering revolution in NA onshore production: In Canada: Bakken Shale in Sask (AB next?), Cardium, Duvernay; In the US: Bakken shale in North Dakota, the Permian Basin and Eagle Ford in Texas
- Bakken producing ~350,000 bpd and could reach 700,000 bpd
- US shale/tight oil potential: between 1.5 to 2.5 million barrels per day
- M&A suggesting high confidence in the tight oil revolution
- Trend "in-fill drilling" - crews being deployed across Western Canada and US tapping into new formation and reworking old ones that were first brought on stream decades ago

North Dakota Crude Oil Production 04-11



Source: EIA Washington and State of North Dakota

Tight Oil Challenges
Differentials

- ***"Tight oil will have big implications for heavy oil producers. Parallel to shale gas- North America could be an oil island with wide differentials, same as gas."***
- "You could have 400kbpd from the Bakken and 200kbpd from the Niobrara- it will back out Canadian oil."
- "Heavy and light barrels are really two different markets in PADD II. Even if the tight oil/Bakken type barrels expand the complex refiners would still run heavy barrels."
- "As the North American light oil supply grows, the Saudis are getting heavier. Bakken-type barrels could be competitive in PADD I."
- "There is a lot of cyclicality and it's hard for the industry/province to position correctly or keep up. Now we have a risk of too many light barrels in PADD II when before we worried about too much heavy."

Tight Oil Challenges
Labor & service costs

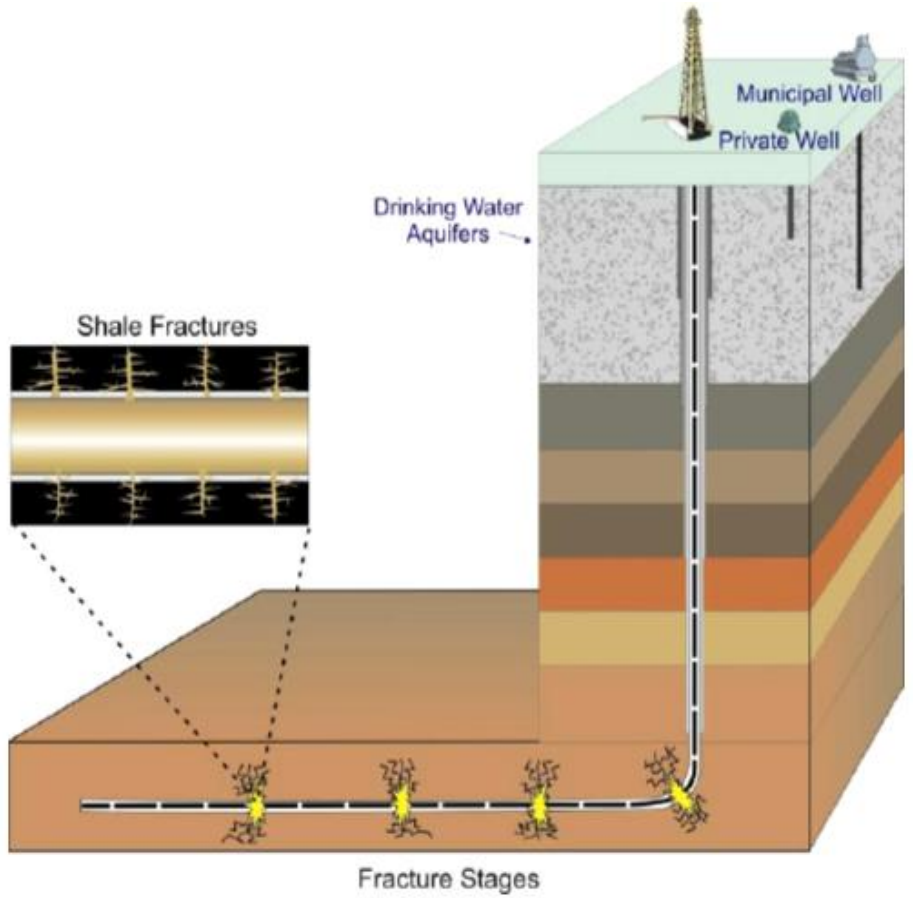
- "Skilled labor will also be a challenge- you have a generation of engineers who haven't worked light oil."
- ***"Tight oil adds to the labor and cost escalation pressures. The Alberta government needs a long-term plan."***
- "The Alberta tight oil plays are in established communities with housing, workers, and infrastructure. Easier to ramp up."
- "The tight oil plays are just drawing capacity from gas. It would be more difficult if you had gas come back too."
- "It will be tough for the province to absorb a tight oil boom and an oil sands boom at the same time. The risk is that you get back orders tying up too much cash. Eventually the E&P guys start saying no and the drilling stops."

Tight oil boom potential and continuation of "gas manufacturing" boom contingent on continued social license to operate

Source: http://www.treehugger.com/2010/09/12-week/

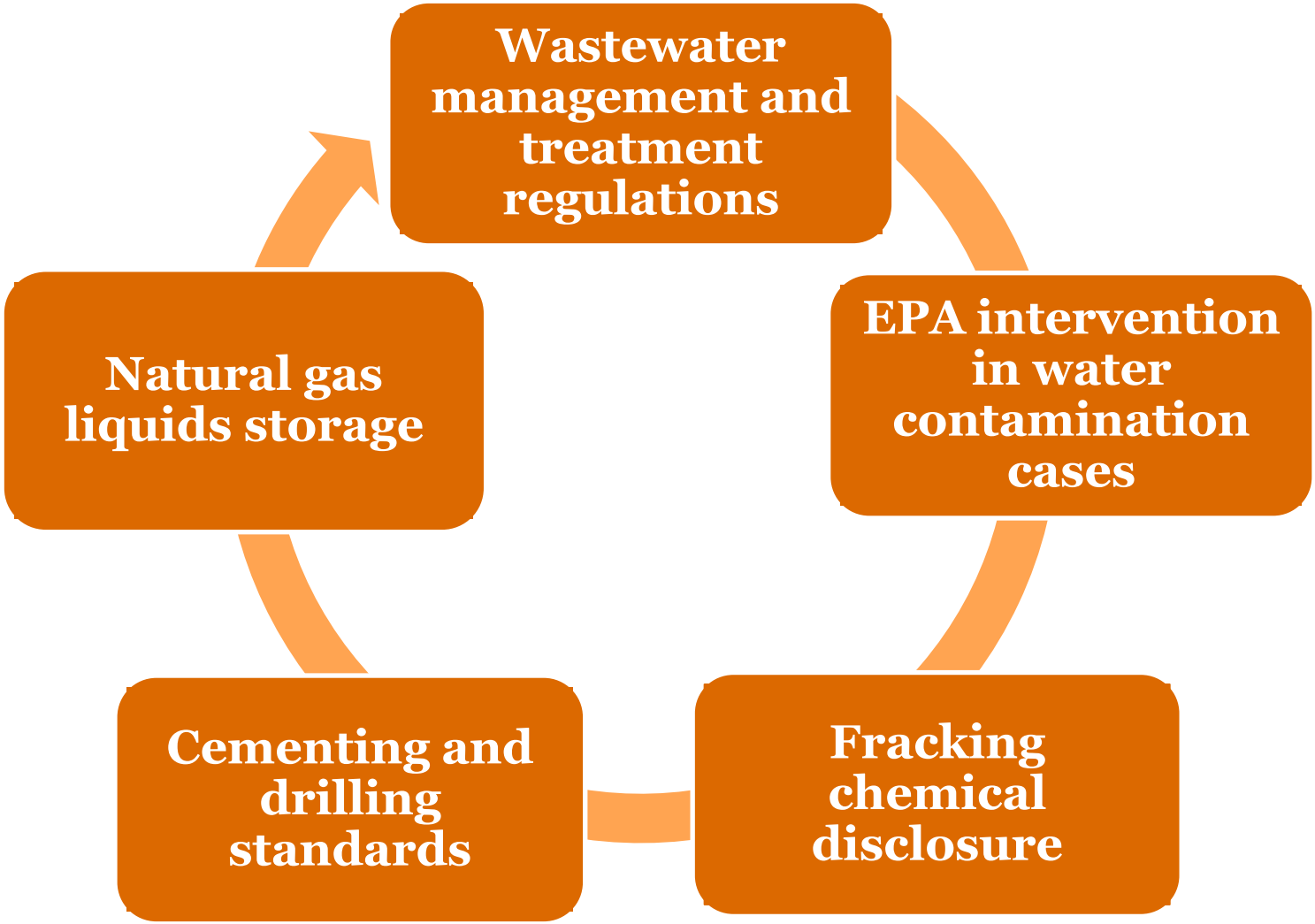
Environmental Concerns
Not just fracking

- Watershed contamination
- Land-use footprint
- Proximity to urban areas
- Increase in CO_2 emissions
- Water use



Source: NEB; The Economist; US Environmental Protection Agency

Regulatory Risks to Shale Drilling



Regulatory Considerations

United States

- Growing involvement of EPA in shale gas state level regulations
- Two year EPA study on impact of fracking on water resources
- States will tighten their regulations in the coming year

Canada

- ERCB's Unconventional Gas Regulatory Framework Project
- Alberta's existing regulatory framework will likely translate to well to shale gas drilling regulations
- Alberta Energy's *Energizing Investment* report
- Quebec has halted shale gas development pending further study of environmental impact
- Federal-provincial relations & regional politics

Source: Alberta Energy; ERCB

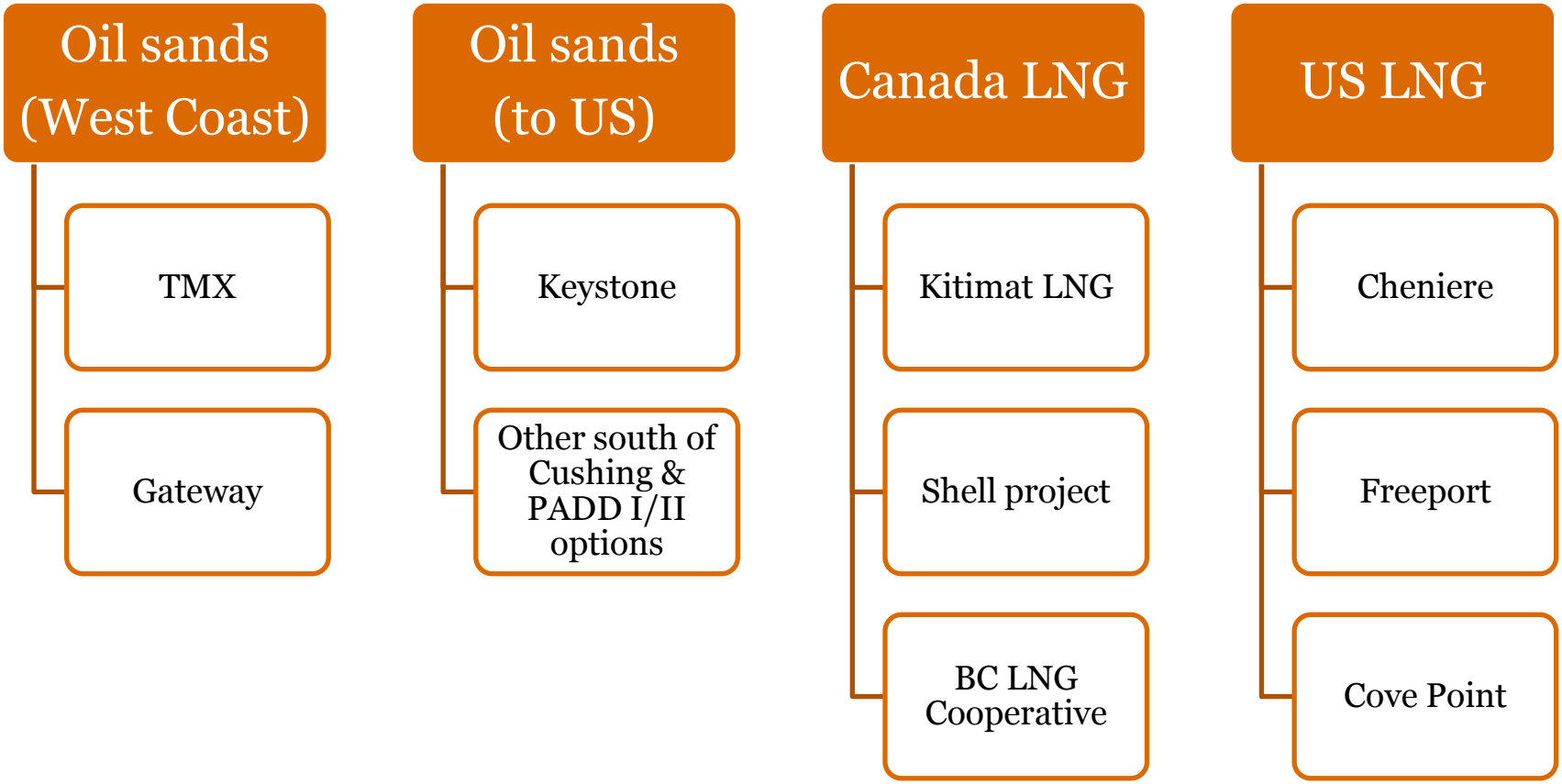
Environmental Challenges
Social license to operate

- ***"The fracking technology may be old but it is being applied on a massive scale, in new jurisdictions. The scale is massive- bigger locations, more equipment."***
- "You have to separate the true regulatory challenges from the media fabrications."
- "Fracking has become a big issue because the 'green agenda' is threatened."
- "One thing that complicates this is that the produced waters from the wells are the responsibility of the E&P companies not the services- we manage what's going in not what is going out."
- "There are social issues too between neighbors where some people are getting the direct benefits of production through royalties and other people just get the frack trucks, noise, and water issues."

Theme II

New export routes for bitumen and natural gas

New Export Plays



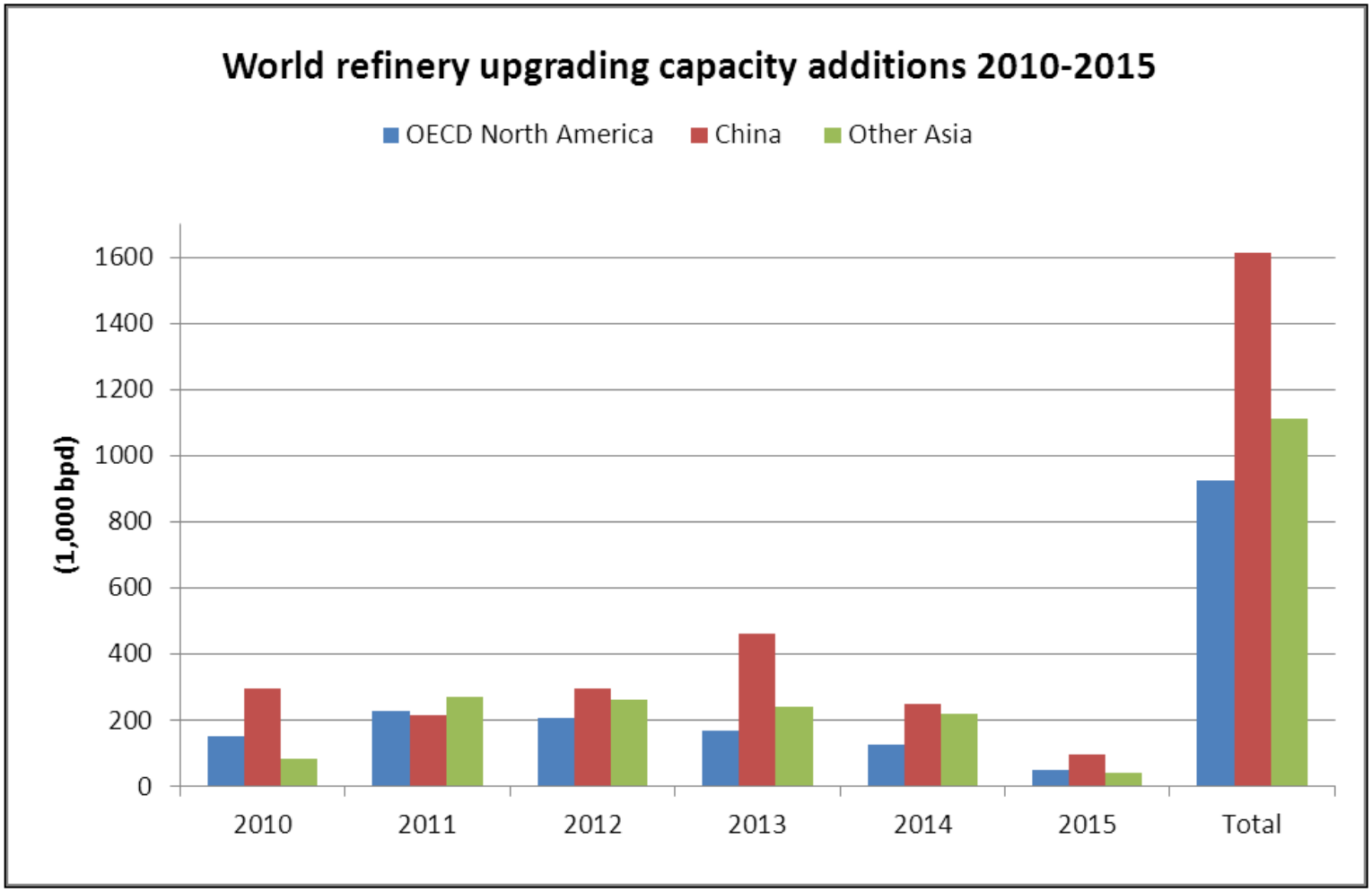
Key Policy Questions

- Permitting challenges (especially for Keystone XL and Gateway)
- Foreign policy implications (US-China)
- Objections from competing gas users
- Provincial royalty revenues
- Environmental concerns

Asia-Pacific Market Ready for Oil Sands

- Diversion of Canadian supply to West Coast could ease pressure on Cushing in long-term
- Western Premiers uniting to promote Canadian commodity exports to China- growing industry & "petro-nerd" support
- China slowing down refinery construction amid uncertain product market and domestic pricing- but China's appetite for diversified oil supply and competitively priced heavy barrels will surge in the years ahead.
- Shift in Saudi toward heavy barrels (27 API) as Manifa field comes online will bolster China's appetite for medium & heavy sour barrels
- PADD V could come back for Canada in longer-run depending on Alaskan barrels, LCFS-type policies
- Need to manage US relationship on multiple fronts

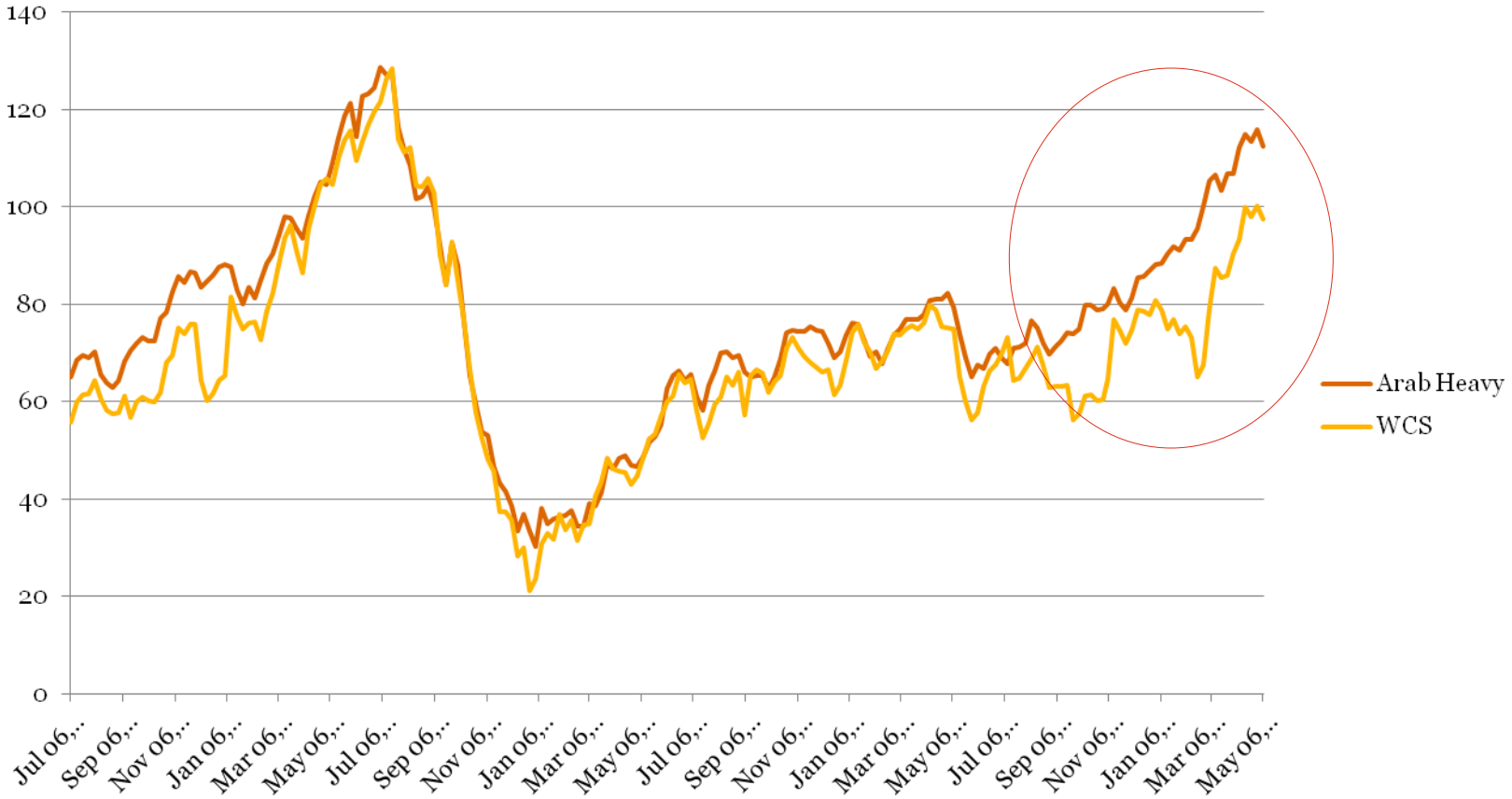
Available Upgrading Capacity in Asia for Oil Sands



Source: IEA Medium-Term Oil & Gas Market Outlook June 2010

Arab Heavy Barrels Will Flow to China

Asia-Pacific Differential of the Future- Arab Heavy and WCS?



Source: EIA

Oil Sands Exports Challenges
Is China ready?

- "The Asian offtakers want government to government facilitation and commercial diplomacy. They want certainty that the Canadian government is behind these export initiatives."

- "China is ready for bitumen right now. They can take dilbit or synbit and blend it in to their feedstocks."

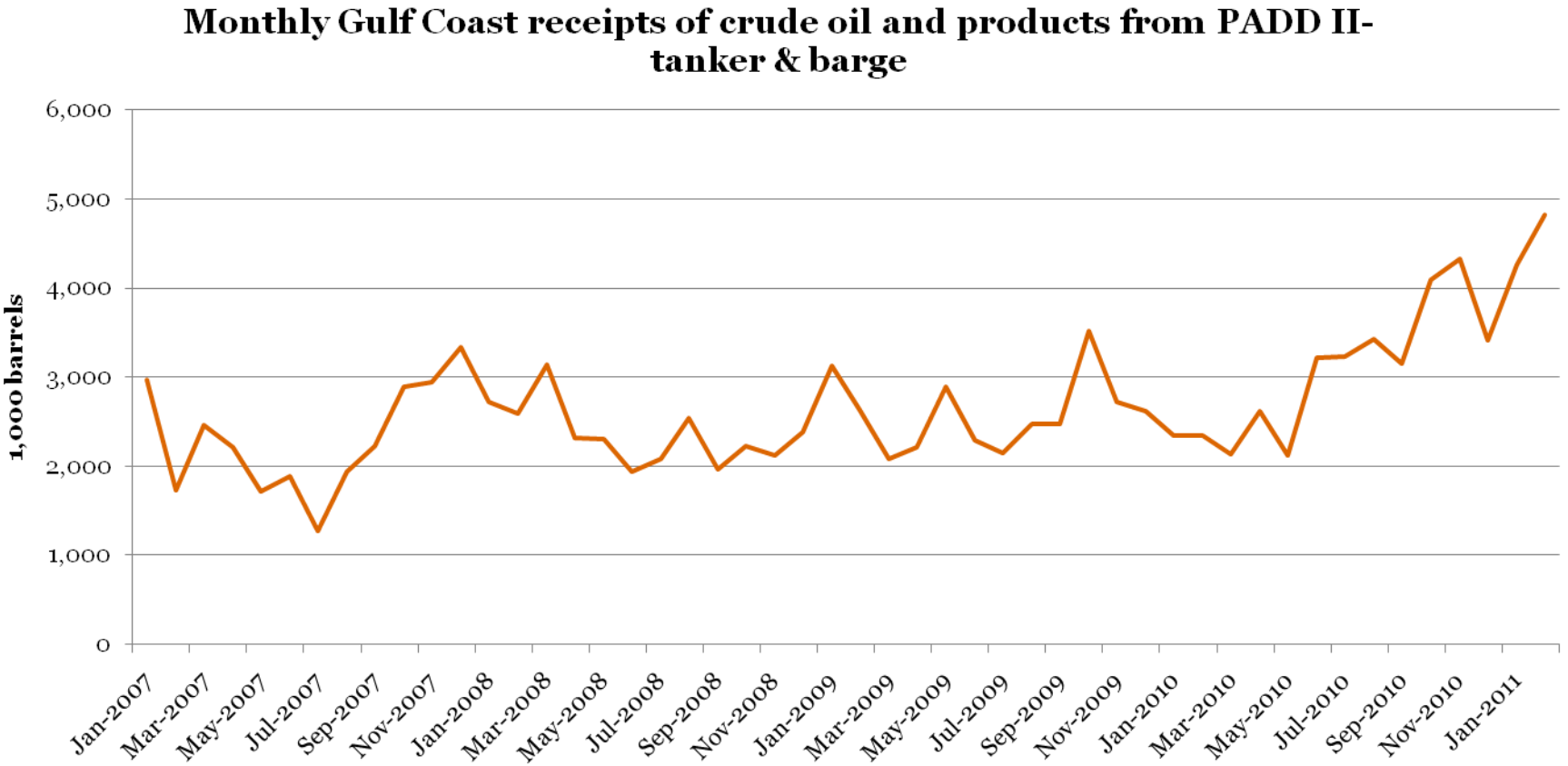
- ***"China will build 600,000bpd of heavy conversion to account for Gateway and Venezuelan barrels. They can blend heavier barrels into their feedstock."***

- "SCO exports would be optimal- China could use the SCO and you get upgraders and value creation in Alberta."

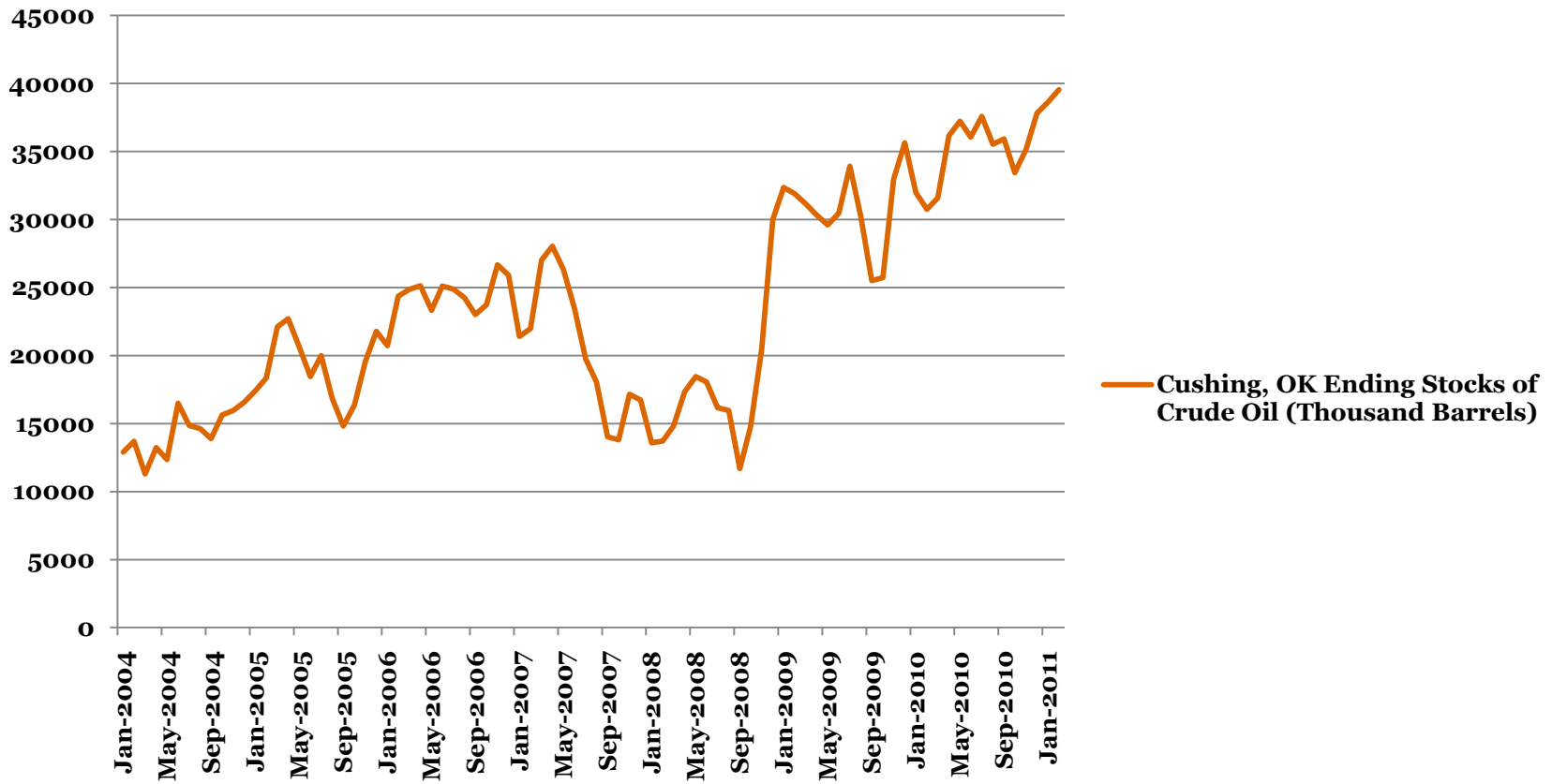
Looking South
KXL and beyond

- "Window" for PADD III oil sands access has narrowed and become more urgent as Bakken barrels fill Cushing
- Market confusion around role of "standalone" pipeline south of Cushing option- without Keystone northern leg
- DOE study on KXL – will oil sands developers approve FIDs without guaranteed PADD III access- not clear that "oil sands volumes will grow regardless" of KXL approval
- Role of Latin American heavy barrels will remain strategic in medium-term- especially Mexico and Colombia
- Outlook for approval by State Department by 4Q2011 looking good– but EPA could refer to White House

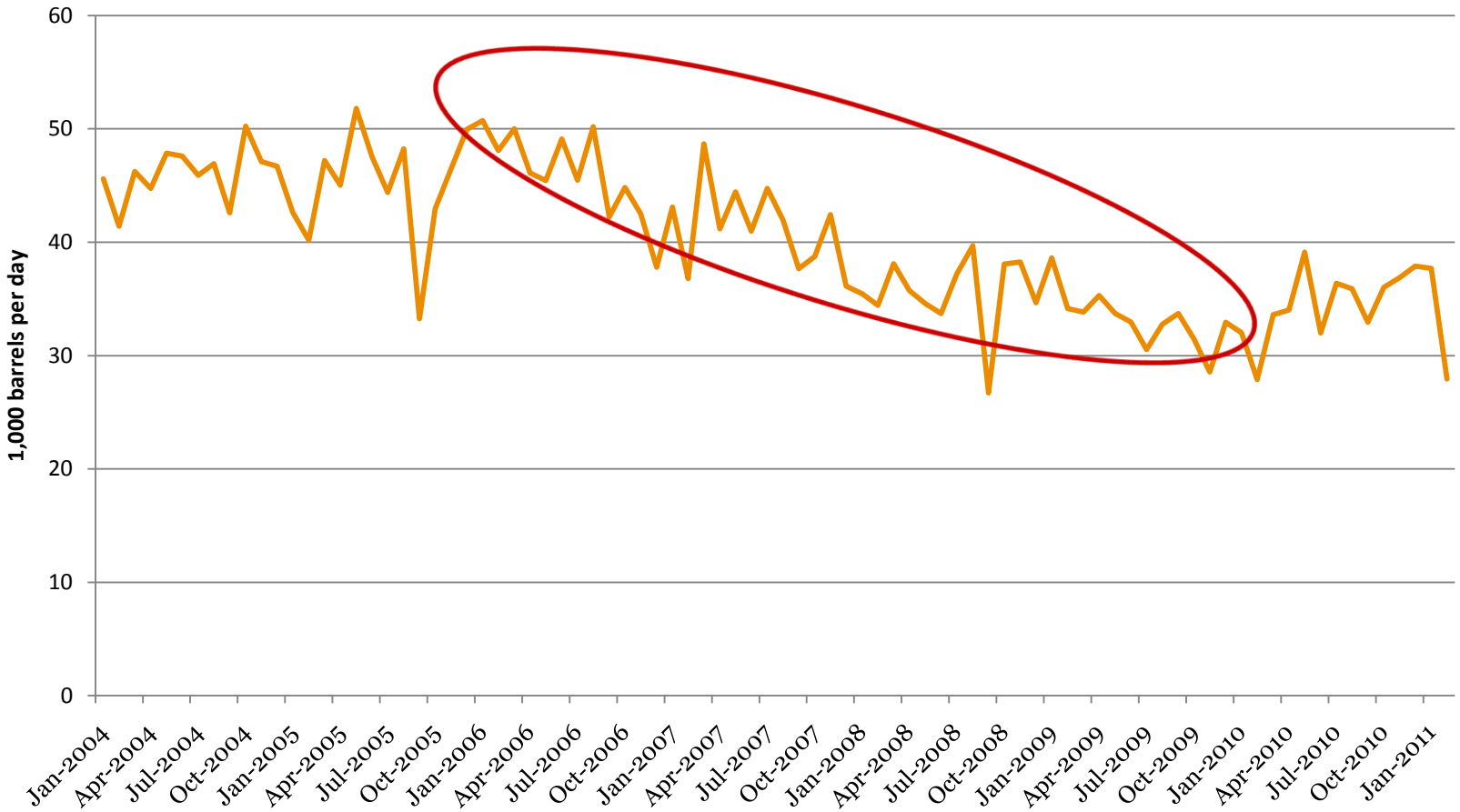
"North of Cushing" Bakken barrels finding way to the Gulf Coast



Cushing, OK Ending Stocks of Crude Oil (Thousand Barrels)

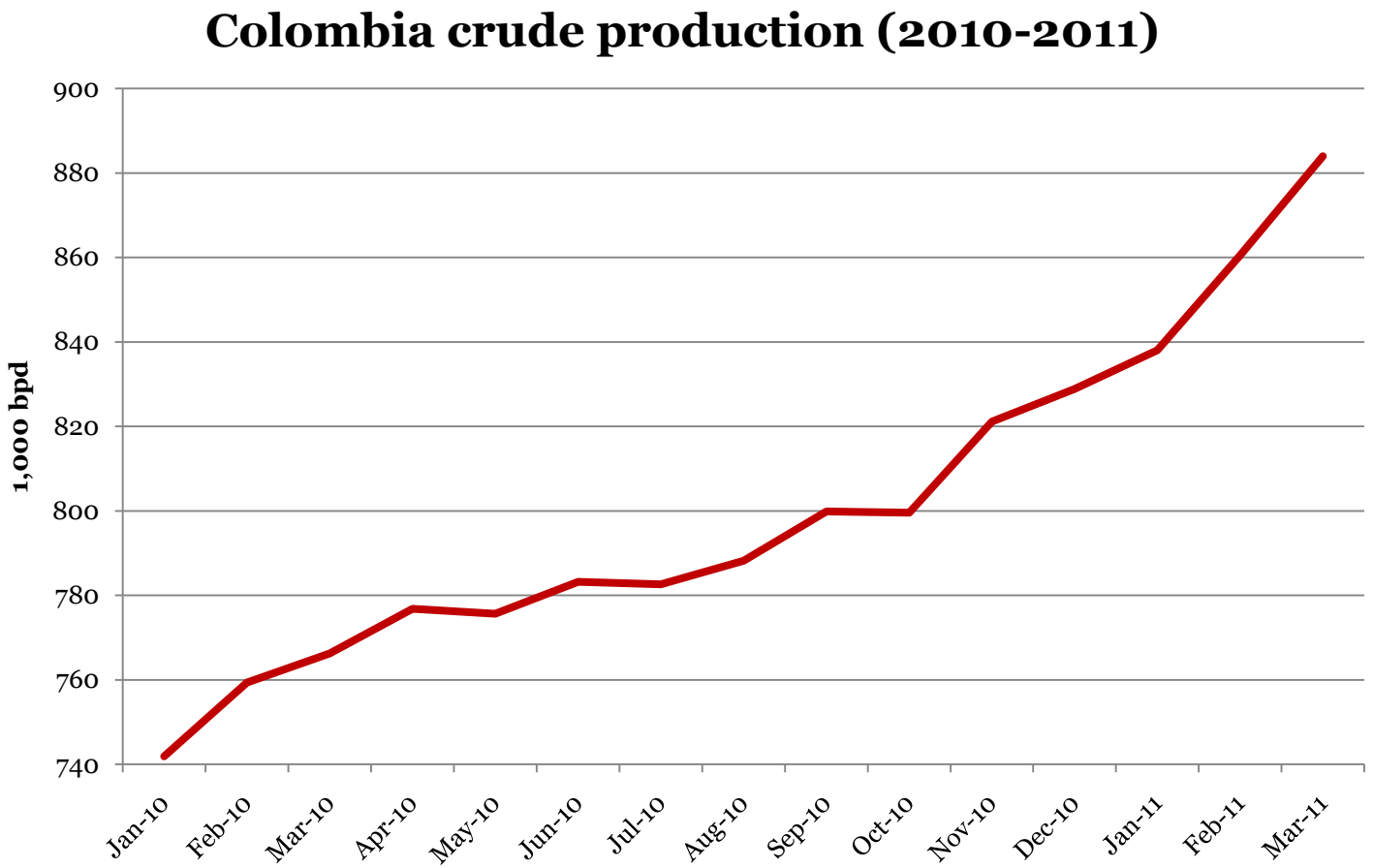


Mexico exports to PADD III recover in 2010



Source: EIA

Colombia: EOR and heavy oil driving growth



Source: Colombia National Hydrocarbons Agency

Oil Sands Exports Challenges
Role of public policy

- "We will play a more active role if the market doesn't provide what the government wants. Bitumen royalty-in-kind is an option that is available."

- ***"The KXL project is urgent- we need to see that it develops at a sufficient enough pace. The differentials have underscored the need for an outlet to the USGC."***

- "Lack of export outlets means we are leaving money on the table. There are enough people in the know in government and industry who get that."

- "Government involvement, backstopping Gateway with in-kind royalty barrels or even direct equity is interesting. But the AB government has conflicting objectives- exports or upgraders?"

US market access tied to GHG and ever-expanding list of environmental challenges

KXL opportunity tied up in GHG & "off-oil" debate

- Industry success on GHG issues, particularly on well-to-wheels
- LARP plan also sends positive signals to Washington on boreal forest
- Alberta is in year 4 of a 5 year greenhouse gas plan and BC just launched theirs about 6 months ago
- Pipeline safety message of growing significance
- No clear endgame on messaging- may need to be persistent for years into the future
- European issues are real as well- Fuel Quality Directive; shareholder activism

Business Case and Market Implications
New markets for natural gas/LNG exports

- Absence of markets in Eastern Canada and the US makes new markets for Northern BC crucial
- Strong political support from Canadian political leaders– Premiers of Alberta and BC
- Growing market in interest in size of potential “net” US and Canadian LNG exports
- Asia obvious market because size and rapid growth, China in particular because demand expected to jump from 100bcm/year in 2010 to 260bcm /year by 2015
- Nuclear challenge in Japan further bolstering demand- Chubu/Mitsubishi deal in BC
- Key question is potential long-term competition from unconventional gas production in China

LNG Export Challenges
Competition

- "The cost of BC gas is still high. The freight advantage alone won't be enough. The Asian governments want diversification which will help."

- "It will be tough to compete with Qatar. There is better value in trying to promote domestic markets."

- ***"Horn River gas can compete with Australia. We don't need to be the #1 supplier and compete with Qatar- don't need to be the cheapest."***

LNG Export Challenges
Role of public policy

- "Government role should be to facilitate and fast-track exports of Western hydrocarbons. There is broad support for Kitimat."

- "Don't need any help from the federal government to make Kitimat happen- just don't need any obstacles."

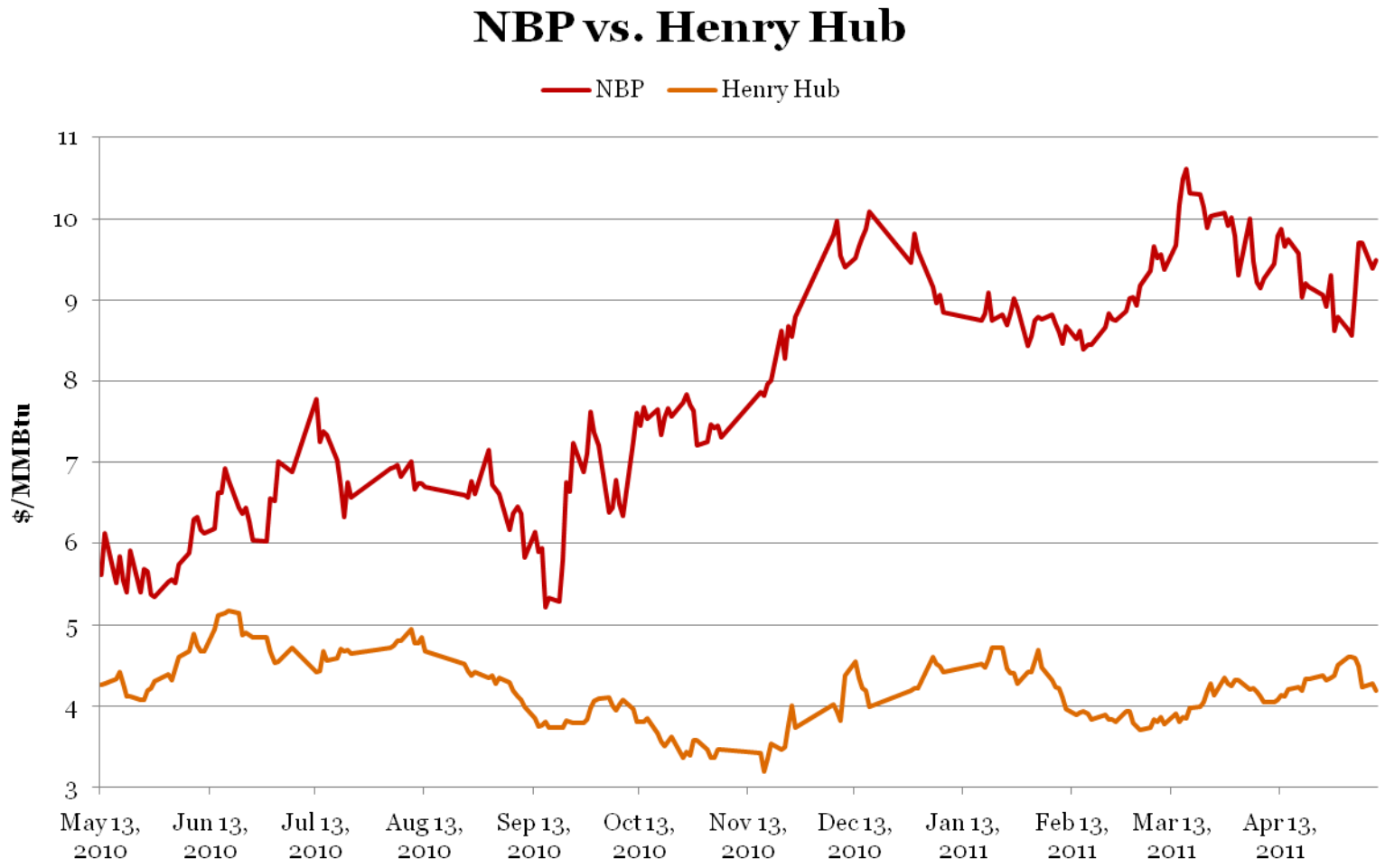
- ***"We do think that coal gasification through in-situ could be another great resource and backstop for LNG exports, underpinning the resource security."***

United States: Shale Gas Boom Shifts Focus on LNG Exports

Once key LNG market, US now eyeing exports thanks to shale gas boom

- Must be sensitive to "China" concerns in Washington
- Industrial and consumer advocates protesting LNG export plans– cheap natural gas key
- Cheniere and Freeport highlighting flexible nature of their projects, which will allow shippers to pay for export and import
- Companies will position the project as seasonal outlet for US gas during periods of peak storage and/or weak demand
- **Henry Hub-NBP arbitrage will become critical to Alberta & BC price realization- key question is how "open" will LNG export arbitrage be and how much US gas will be exported?**

NBP-HH Differential: Linking Alberta to "Global Gas"



Source: Bloomberg

Theme III

New Domestic Markets: Increasing Gas Demand

US Fuel Switching

Positive impact on natural gas market and on environment

- New non-carbon EPA and state level environmental regulations are driving 30-70GW of coal power plant retirements
- State environmental laws like California's AB32, Oregon's Utility Mercury Rule, North Carolina's Clean Smokestacks Act, and Colorado's Clean Air-Clean Jobs law are an additional catalyst
- Short-term switching driven by economics-regulation will play bigger role longer-term
- Fuel-switching could drive 10bcf/day of new gas demand by 2020- but will be intermittent growth benefitting longer-term players like international oil companies
- Natural gas vehicle legislation under consideration has bipartisan appeal, but mainly targets long-haul trucking fleets

Recent Coal Plant Closure Announcements

Utility	*State*	*Coal capacity (MW)*	*Regulatory drivers*	*Scheduled date*
Southern Company	Georgia	540	EPA, Georgia Multipollutant Rule	2012
Georgia Power (Southern Company)	Georgia	569	EPA, Georgia Multipollutant Rule	2013
Calpine	Delaware	83	EPA	2010
Calpine	New Jersey	25	EPA	2010
APS	New Mexico	560	EPA	2017
Xcel	Colorado	342	EPA, Colorado Clean Jobs Act, state incentives	2013-2017
Exelon	Pennsylvania	732	EPA, economics	2011
Duke	South Carolina	1,193	EPA	2011-2015
Progress Energy	North Carolina	1,086	EPA, N.C. Clean Smokestacks Act	2013-2017
Portland General Electric	Oregon	585	EPA, Oregon Utility Mercury Rule	2020
TransAlta	Washington	1,376	EPA, Washington SB 5769	2020, 2025
Tennessee Valley Authority	Virginia, Indiana, Massachusetts	1,000	EPA, economics	2015
Dominion		1,327	EPA	2017
Total coal retirements		*9,418*		***2020***

Source: Eurasia Group research

US: Power Sector Key to Medium Term Natural Gas Demand Growth

US Power Generation: 2010 & 2020 Fuel-Switching Scenarios	
2010 total installed capacity- natural gas (GW)	414.4
2010 US gas consumption by electric power sector (bcf/day)	**20.3**
2010 US electricity generated from natural gas (billion kwh)	906.4
2010 estimated US natural gas capacity factor	25%
2020 total installed capacity- natural gas (GW)	450
Expected 2020 capacity factor	35%
Expected 2020 US electricity generated from natural gas (billion kwh)	1379
EIA 2020 baseline forecast (billion kwh)	767
2020 US gas consumption by electric power sector (bcf/day)	**28.3**
2020 EIA AEO 2011 baseline forecast (bcf/day)	**18.3**

Canadian Fuel Switching

Ontario has a political commitment to close remaining coal plants by 2014

Less impetus in Canada due to:

- Relatively smaller supply of shale gas so far
- Harper 80% CES plan lacks legislative backing
- Quebec and BC lack meaningful fuel-switching opportunity
- Ontario's original political commitment was to exit coal by 2007 which changed to 2009. The most recent target is 2014 with a plan to close the four remaining plants:
  1. Nanticoke (3920MW);
  2. Lambton (1975MW);
  3. Atikokan (215MW); and
  4. Thunder Bay (310MW).

Source: Bryne Purchase, Queen's University, Energy & Environmental Policy

Canadian Fuel Switching

Natural Gas Vehicles :

- 5-6 bcf/day of demand if you convert the entire Canadian road vehicle fleet over to natural gas use tomorrow- will be lucky to get 5% of that number in the next decade

Power Generation:

- Canada is much less coal-centric than the US so less opportunity for incremental natural gas demand from a coal phaseout
- Canada currently uses about 1 bcf/day on natural gas for power generation (updated to reflect Ontario's off-coal effort)
- Switching entire coal fleet would add just over 1.5-2 bcf/day to gas demand

Takeaway:

- Canadian market of about 16 bcf/day of current demand (9 bcf/day of which are exports to the US). Going off coal and replacing gasoline and diesel in transport has potential to add 6.5 -8 bcf/day to demand

Fuel Switching Challenges
Building confidence

- "The choice for gas producers is to develop opportunities in oil-linked markets or promote fuel-switching for power & NGVs at home. The 20:1 oil/gas price ratio can't last forever."
- **"We are trying to build comfort with gas through advocacy. Need to overcome past hurdles and legacy problems- build comfort with the size of the resource."**
- "It is critical to enter into long-term contracts for baseload supply. Short-term contracts are ok for peakers not for baseload. We need to be creative with merchants and IPPs."
- "The key to fuel-switching is long-term contracts, more utility-type deals."
- "BC and Quebec will be interesting markets. They don't have coal-fired generation so will have to meet GHG targets through the transport sector."

Theme IV

Diversifying Markets: Services Export Opportunities

Eyeing New Markets

Global interest in Canadian services and technology is on the rise

- Companies sending services, technology overseas alongside traditional E&P plays
- International companies and sovereign wealth funds from a wide range of countries investing in technology-intensive oil and gas upstream plays - far from just a China story
- China nonetheless is controversial in terms of relationship with the US, role of state ownership/control, environment, and intellectual property
- These investments are driven by export strategy, technology transfer or both
- Reciprocal access to the home markets of inbound investors to the Canadian oil and gas sector will be critical

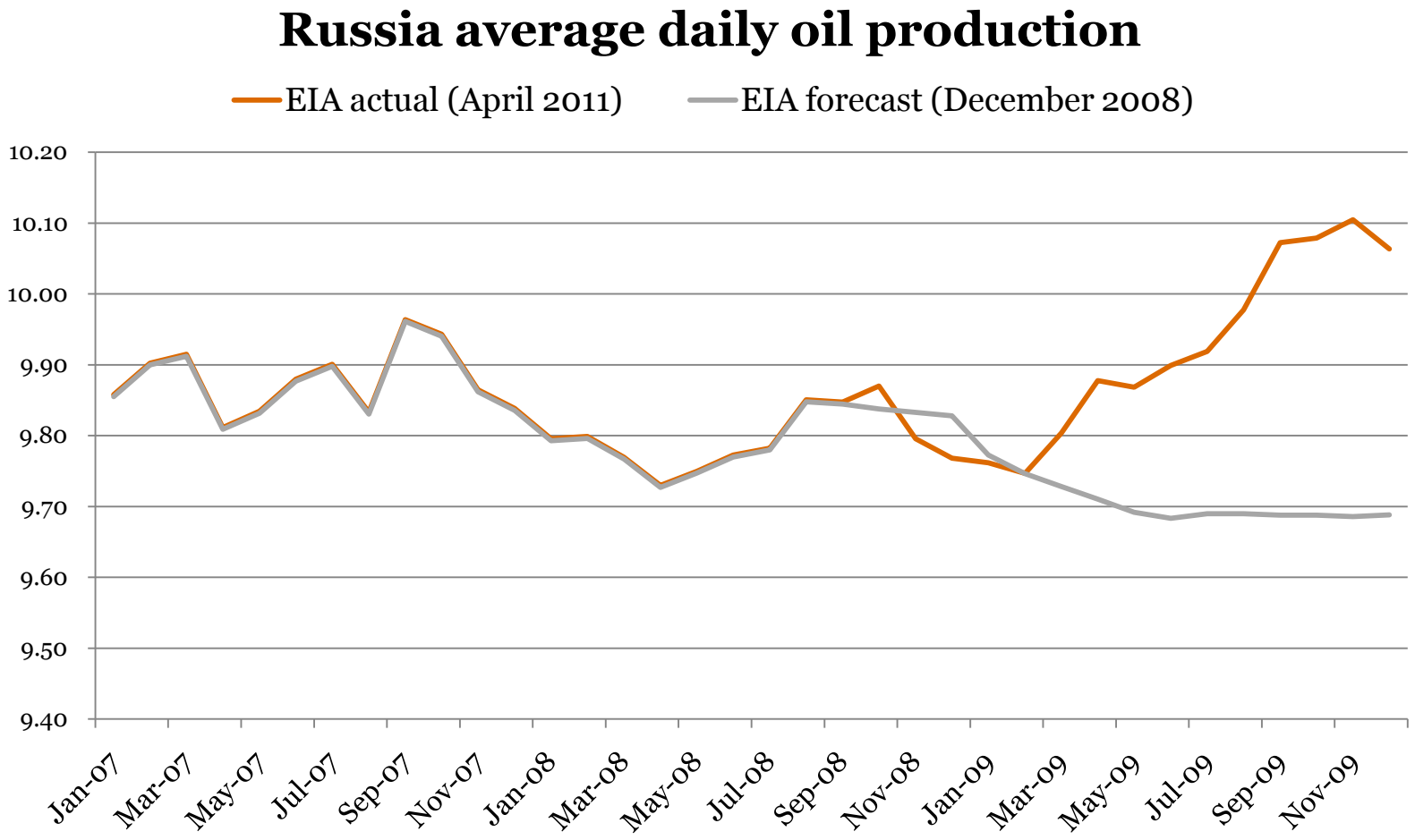
Key Technologies and Capabilities in Demand

- Pressure pumping
- Hydraulic fracturing
- Enhanced steam flooding
- Infill drilling
- Cementing
- Coil tubing
- Multi-lateral horizontal drilling
- THAI
- HTL
- Upgrading

International Opportunities

EIA April 2011 report: Estimated shale gas technically recoverable resources					
	2009 natural gas production (tcf)	**Proved natural gas reserves (tcf)**	**Technically recoverable shale gas resources (tcf)**	**Canadian services companies**	**Canadian E&P companies**
China	2.93	107	1275	✸	
United States	20.6	272.5	862	✸	✸
Argentina	1.46	13.4	774	✸	✸
Mexico	1.77	12	681		
South Africa	0.07	-	485	✸	✸
Australia	1.67	110	396	✸	✸
Canada	5.63	62	388	✸	✸
Libya	0.56	54.7	290		✸
Algeria	2.88	159	231	✸	✸
Brazil	0.36	12.9	226		
Poland	0.21	5.8	187	✸	✸
France	0.03	0.2	180	✸	✸

Services Exports can Also be a "Macro" Game Changer



Source: EIA

Service Exports Challenges
IP Protection

- "IP is a big issue for us. We won't go to China for that reason."
- "China could reverse engineer- but US competitors are trying to reverse engineer and do knockoffs too."
- "There is a need for IP protection in China. Key data is kept under lock and key. Key technology is installed directly in wells."
- "China has the hardware- rigs and equipment. They need the intellectual and operating expertise – critical expert capability for optimization."
- ***"The IP can ultimately be commoditized. The optimization and expertise are much harder to duplicate."***
- "The real key is identifying the right resource. The mechanical stuff gets around. The real competitive advantage is putting the pieces together – project execution is the key. That's what the North American companies bring to the table."

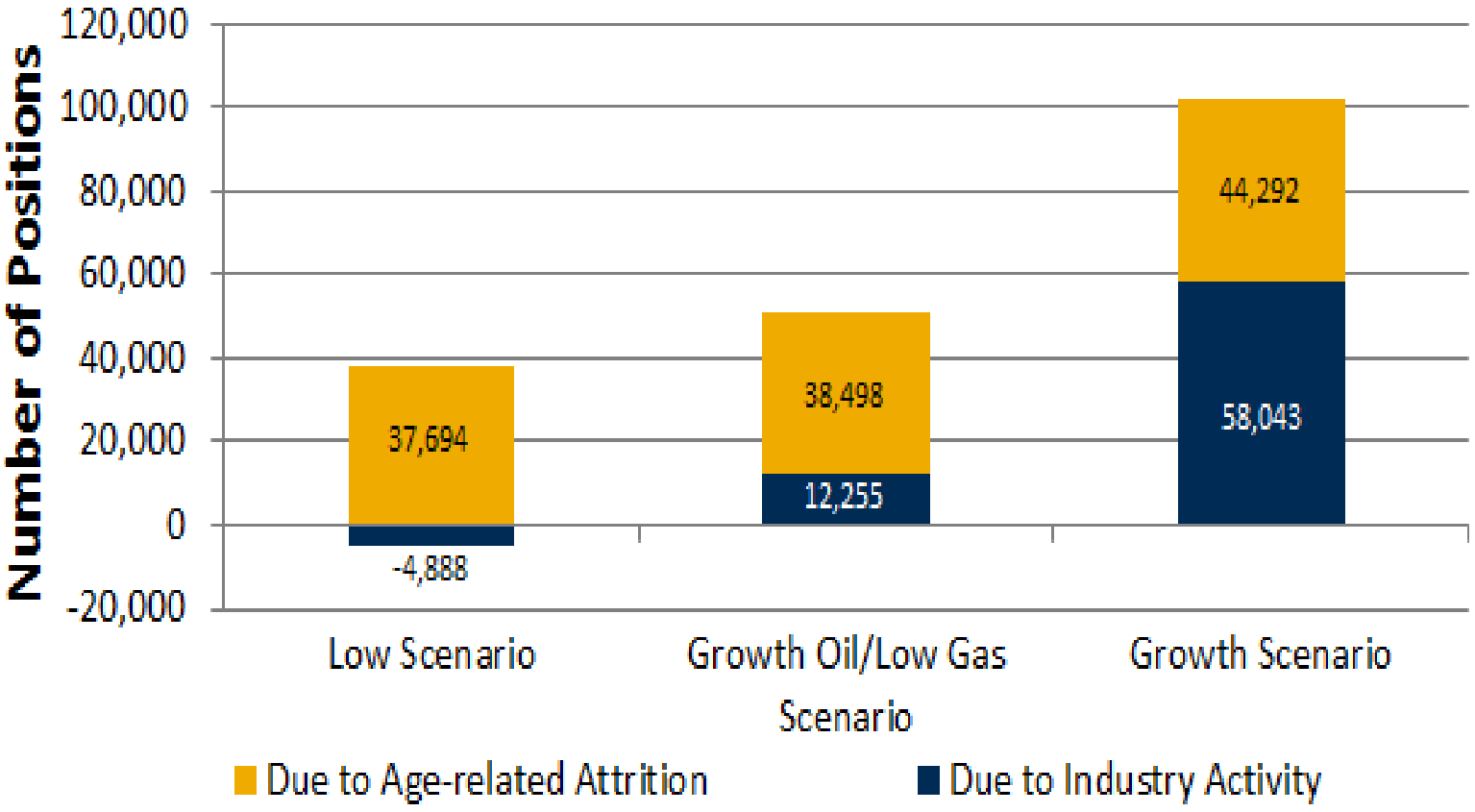
Service Export Challenges
Trade promotion

- "You can do technology trade missions but there are differences between the provinces, and between the provinces and the feds."
- "It's all about relationships and trust. The Canadian and Alberta governments can't help with that. EDC is helpful after the fact for financing but the trade missions do nothing ."
- ***"The Alberta International Relations team is leading trade missions to China, Japan, and Korea. Their efforts are very useful for the smaller companies."***
- "Global outreach along the lines of a "Global Bitumen Initiative" may be tough for a provincial government or even Ottawa - too many other priorities besides export development. But Calgary has something to offer because it's a melting pot of energy expertise- you have 98% of the industry within 6 blocks."

Services Exports Challenges
Labor overstretch

- "There is a need for a Canadian energy strategy to address the graying of the industry. It's hard to send your best people overseas."
- ***"There is a shortage of internationally-experienced managers. They need a global perspective when they become multi-service, multi-jurisdiction companies."***
- "People are a big challenge to overseas expansion. How many frac crews are out there? There are more frac crews in Red Deer than in all of Europe."
- "The industry and government are not doing enough to take advantage of the opportunities abroad. It's not clear that the industry wants any more international support or industrial policy. The problem is that the service companies are going flat out in North America."

Can Alberta Handle Tight Oil Boom & Oil Sands Boom and Overseas Opportunities?



Source: Petroleum Human Resources Council of Canada

Conclusions & Key Takeaways

Key Takeaways

At the company level:

- Diversification strategy – international services play- IP challenges, geopolitical risk, different utilization model- but worth it
- Labor a barrier to tight oil boom and international services play – and, what happens if gas prices come back
- Differentials face further uncertainty- light/heavy & Brent/WTI & sweet/sour etc.- tough for companies (and province) to hedge

For industry and policy-makers:

- Reputation management & social license to operate is critical (fracking, KXL, pipeline safety)
- More aggressive thinking on public policy innovation- lessons from Brazil and other international producers, sovereign wealth funds, reciprocity, fuel-switching
- Don't forget about the US as we turn to China

Thank you

pwc