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The Geopolitical Implications of the North American Energy Revolution

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See Appendix A-1 for Analyst Certification, Important Disclosures and non-US research analyst disclosures
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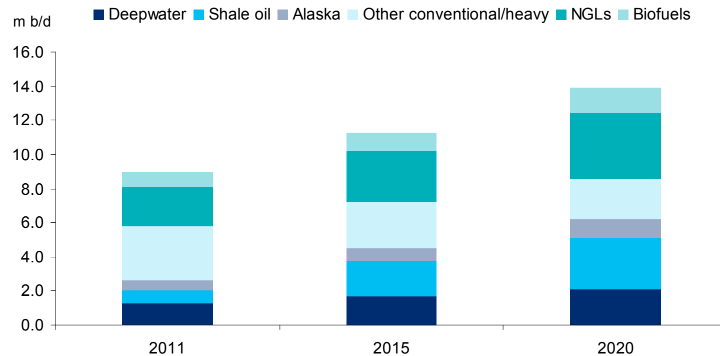
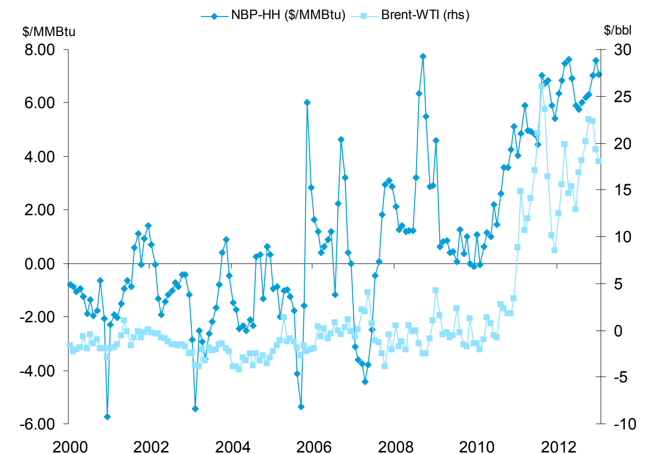
The unconventional revolution in North America has begun

The US increased total liquids production by almost 3-m b/d from 2007-12; combined with reduced consumption, net oil imports fell 5-m b/d, more than most countries' oil production except Russia, Saudi Arabia, the US itself

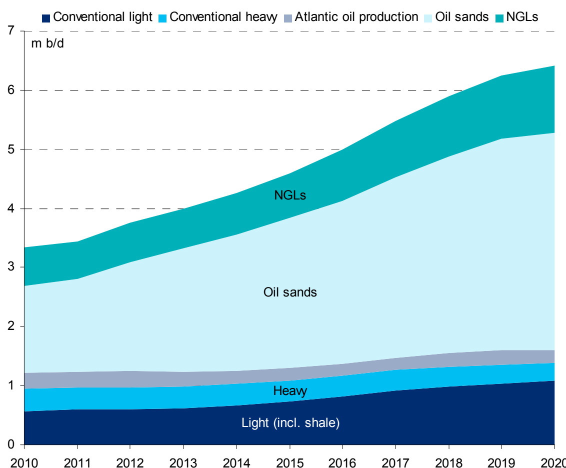
US production could grow over +4-m b/d to 2020, driven by shale and deepwater



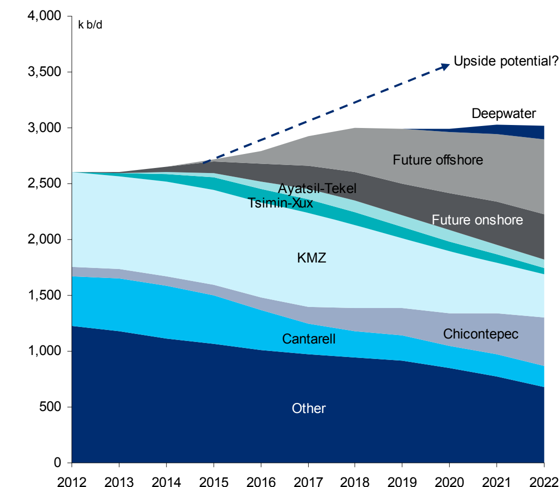
US oil and gas prices disconnect from the world



Canadian production could grow +3-m b/d by 2020, driven by oil sands, but also tight oil and NGLs



Mexico too could see growth of +1-m b/d by 2020



Source: Bloomberg, CAPP, Woodmac, Pemex, Citi Research

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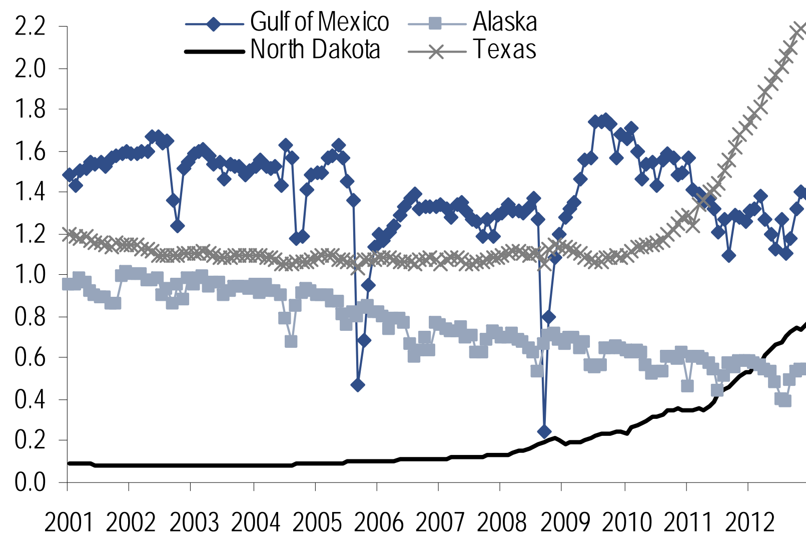
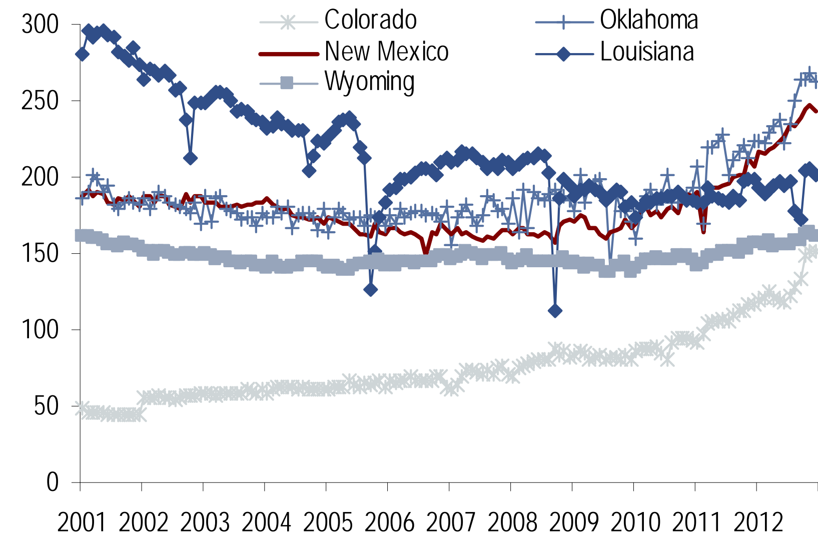
The shale oil story is gaining momentum

US oil production is surging despite Alaskan declines and the so-far limited rebound in the GOM, and now other shale plays are coming online too

North Dakota and Eagle Ford have been the key plays to date (production, m b/d, 2001-13)



But other plays are starting to show up (production, m b/d, 2001-13)



Source: EIA, Citi Research

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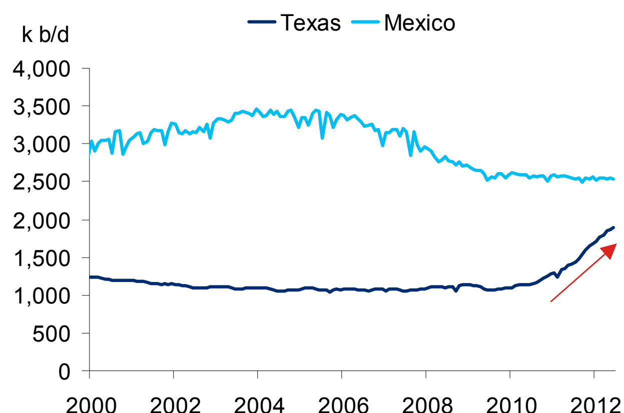
Domino effect: the global spread of the shale revolution?

A lot of opportunities, but a lot of challenges; the shale revolution can extend elsewhere quicker than expected, due to strong political imperatives in major resource-holding countries, and low costs of entry for shale

- The US, and to some extent Australia, Canada and the UK, enjoys several advantages that have facilitated the head-turning growth of shale gas and oil production
  - Only US geology has been explored and delineated so widely
  - Only the US has state government management of land policy
  - Only the US and Australia, Canada and the UK have:
    - Independent entrepreneurial companies
    - Favorable capital markets
  - Only the US and Canada have private land ownership rights, enabling "fiscal" returns to be determined by market forces
  - Independents have demonstrated a strong ability to experiment, which is harder to replicate by majors and large companies
- Therefore the shale revolution can extend elsewhere, but could face headwinds… but two key factors could push it along faster than anticipated:
  - Political imperative
  - Lower costs of entry for shale than conventional hydrocarbons
- China has huge resources and potential, but major problems with lack of water, little technological experience, limited mapping of resources, lack of infrastructure. Government price controls on natural gas are a major disincentive, so company strategy may be first to gain acreage, learn from abroad and wait for price control changes
- Saudi Arabia needs gas to accommodate growing power consumption, free up oil being used for power generation, but like China, suffers from lack of water and the need for price reform. However, it has started major new drilling programs to develop shale. +6-Bcf/d of shale gas production could more than replace the ~900-k b/d summer peak direct crude burn for power generation
- Russia is developing its Bazhenov shale, and could add perhaps +500-k b/d over the next half-decade
- Mexico has great potential too, and could perhaps see +250-k b/d over the next half-decade

US and Mexico both have significant shale resources

…but while crude production is surging north of the border (Texas is up ~800-k b/d since the mid-2000s to 1.9-m b/d in June 2012), Mexican production remains flat – for now



Source: EIA, Citi Research

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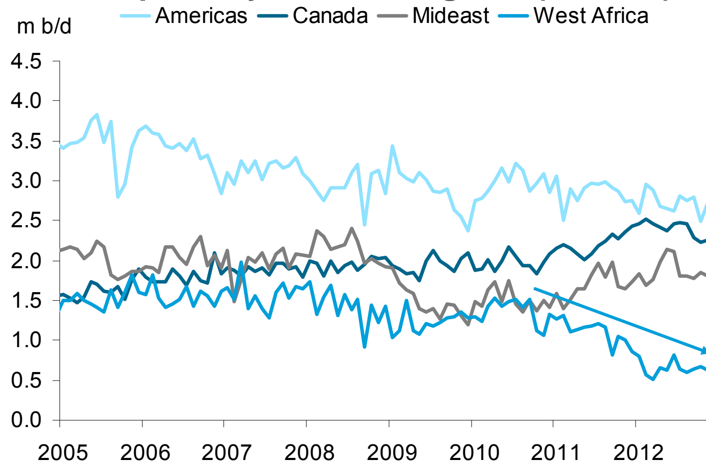
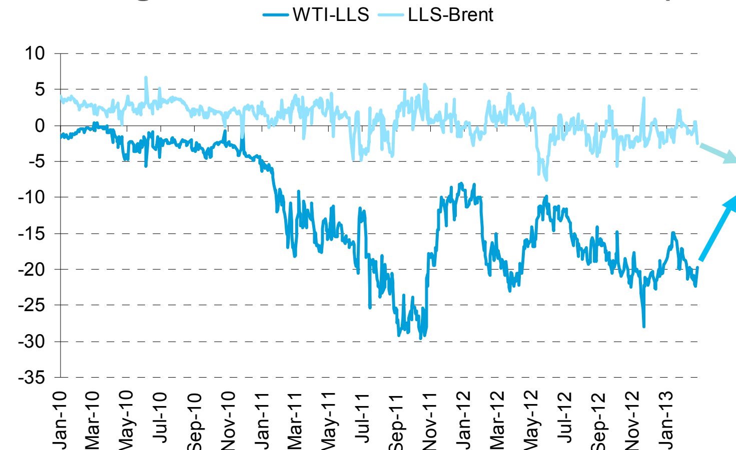
Phase I: Light sweet crude imports are pushed out

West Africa stands to lose US market share. As USGC light sweet imports fall to zero – by summer 2013? – LLS moves to $2-5 below Brent, and becomes the effective Atlantic Basin benchmark. Local USGC bottlenecks could hinder the narrowing of WTI-LLS to pipeline costs until 3Q'13 or later.

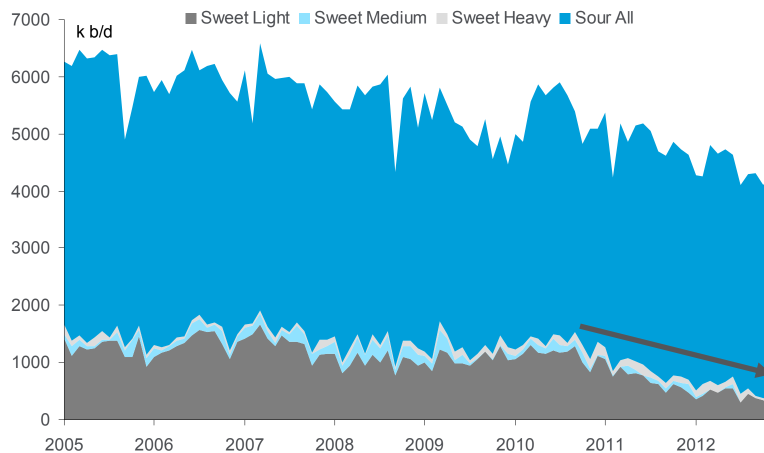
US crude imports by selected regions (2005-12)



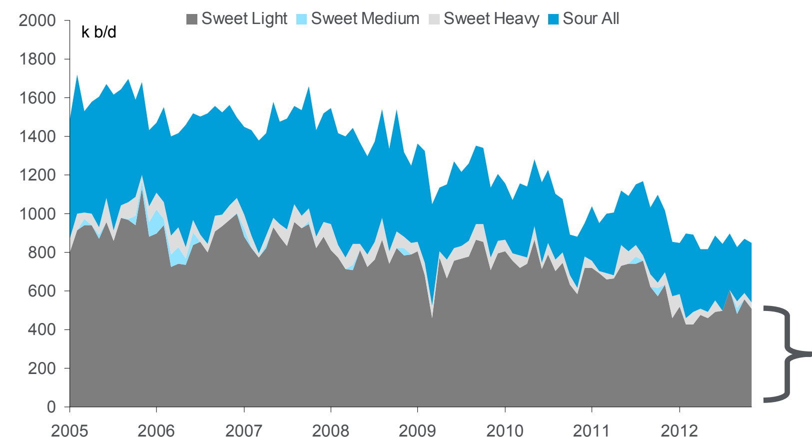
LLS moving to a structural discount to Brent ($/bbl)



PADD III imports by crude quality – 300-k b/d of imports can be pushed out before pressure to export



PADD I imports by crude quality – 500-k b/d of imports can be pushed out as railed volumes grow



Source: EIA, Bloomberg, Citi Research

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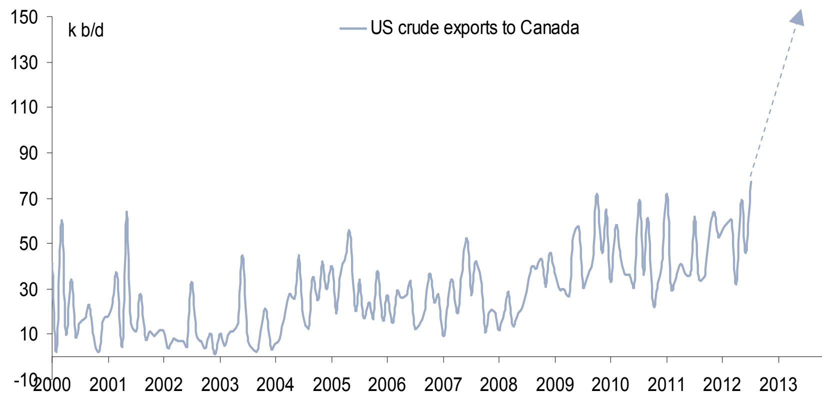
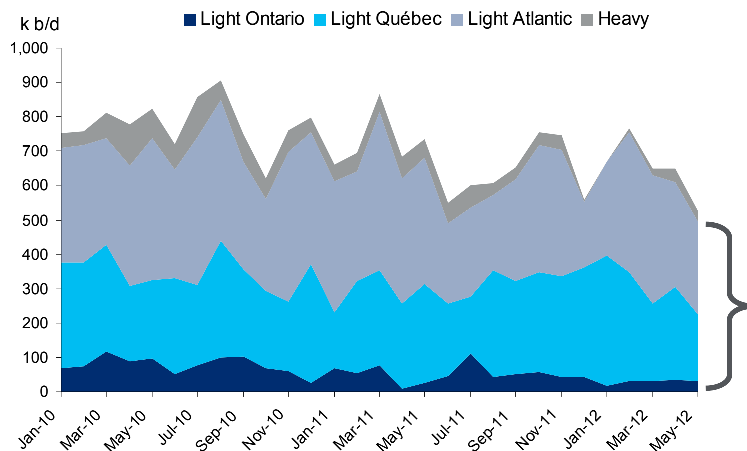
Light sweet crude could be exported to eastern Canada

Pressures should grow to export surplus light sweet coming from the Bakken, Permian Basin and Eagle Ford, with eastern Canada as a major market. Jones Act waivers to the East Coast could provide further outlets.

The US already exports small volumes to Canada, but this could rise to perhaps 200-k b/d or more



Eastern Canada imports 600-k b/d of light, sweet crude, some of which could be met by US shale



- **Export controls currently provide limited ability to export crude:**
  - **The Department of Commerce currently imposes export controls** of domestically produced US crude oil with a license being required for crude exports to all destinations
  - **A Presidential waiver would be needed for the DOC to grant licenses for crude exports of US origin** – this includes US Gulf of Mexico oil, which resides in Federal waters, and US-produced crude transported on Federal right-of-way/interstate pipelines
  - **Canadian oil, as crude of foreign origin, is allowed to be re-exported under current rules** with a DOC issued license and without a Presidential waiver, but could face political opposition
  - **Domestically produced US crude oil transported by rail is not currently covered by the rules,** and new rules would have to be written. Domestically produced US crude transported on intra-state pipelines could be another area of contention.
  - **Exports to Canada are already allowed, albeit only small quantities have been seen to date.** BP, Shell and Vitol look like they have obtained licenses to export to Canada. Statoil rails Bakken crude to the Irving Saint John refinery in eastern Canada. **Exports to Korea** – another FTA country – could conceivably be written into future rules.
  - **The categorization of condensates** may allow them to be exportable, but this remains unconfirmed and may end up being resolved by a ruling on the first export license application that tests this. Some have considered condensates above 50 API as products, and thus not subject to crude export controls.
- **The Jones Act** limits shipping of petroleum between US ports
  - Shipping oil between US ports falls under the Jones Act, which requires that the goods be carried on US flag vessels, constructed in the US, owned by US citizens and crewed by US citizens. There are practically no US flag vessels available for these purposes.

Source: EIA, Citi Research

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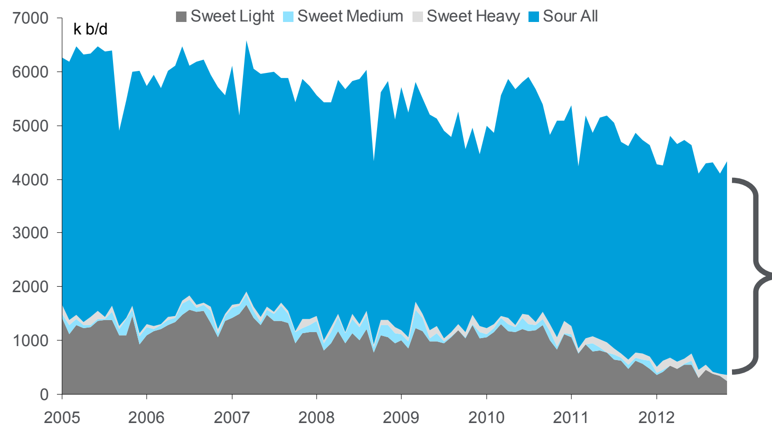
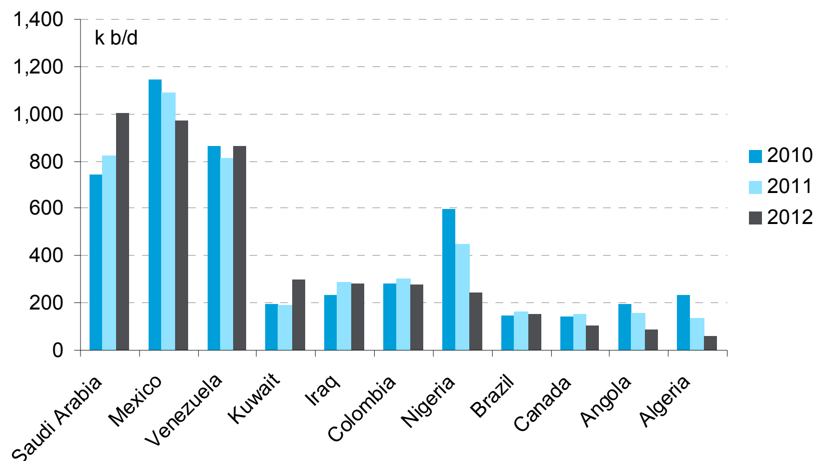
Phase II: Canadian crudes push out heavier crude imports

Massive pipeline build-out helps evacuate Western Canadian crude south and east, and could become exportable from the Gulf Coast. Rail could play a major role too. Westward pipelines remain problematic.

Over 3.6-m b/d of sour imports on the USGC at risk



Largest imports by country into the US Gulf Coast (PADD III), 2010-12



- It looks even with Keystone XL and other delays, Canadian crude could flood the USGC before westward pipeline options arrive.
  - PADD III sour crude imports are ~3.6-m b/d, which could be cut into by US GoM (+0.7-m b/d from 1.3-m b/d levels to 2-m b/d by 2015/16) and Canadian crude (+1.9-m b/d to 3.7-m b/d by 2020)
- Upgraded refining provides US Gulf Coast and Midcontinent refiners a choice, with light-heavy spreads fluctuating between parity and $7/bbl. US Gulf Coast refiners should opt for heavy sour crudes if they are priced $4-7 below light sweet crudes.
  - BP Whiting is the third of the major PADD II refinery upgrade projects, but is delayed; though the new converted sour CDU could be ready by summer 2013, the associated coker is not expected to be commissioned until perhaps late 1Q'14.
- Over time, Canadian imports can push out sour imports in largest upgrading refining sector in world
  - Only NOC term relationships (Mexico, Venezuela, Saudi Arabia) should remain in US market to supply their own refineries
  - As exportable crude under current US rules, Canadian sours could find an export market against Urals in Europe, priced at a discount to Urals (~$2) minus transatlantic transportation (~$1), minus pipeline tariffs (~$7-8), or a netback to Alberta of Urals minus ~$10
  - Only eventual pipeline outlets to the Pacific could generate potentially higher netbacks.

Source: CAPP, EIA, Citi Research

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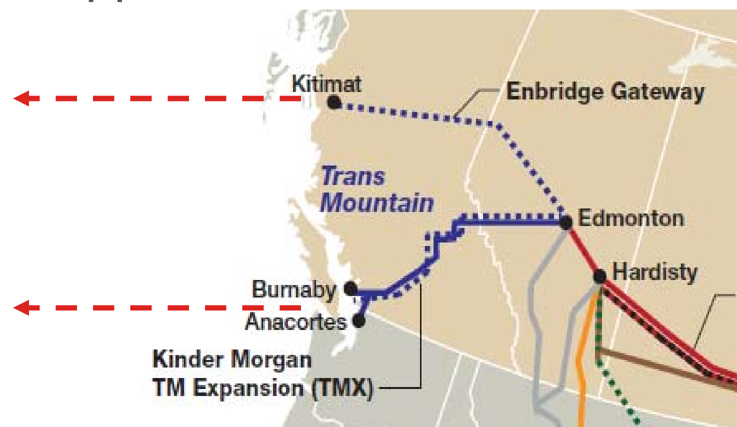
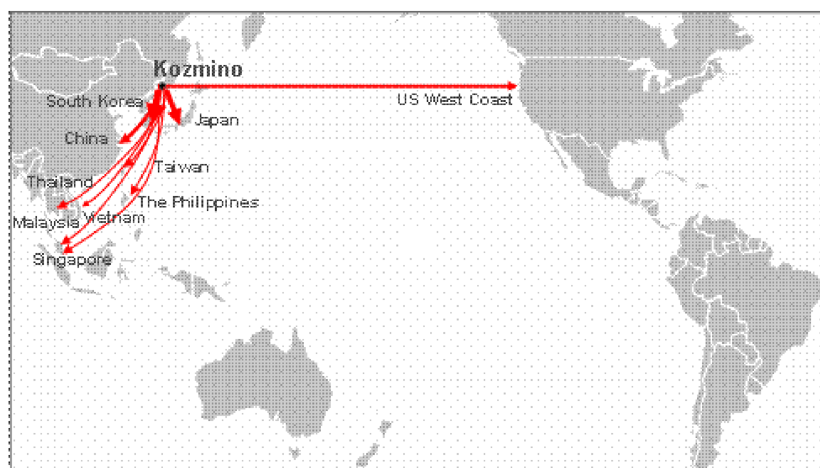
Phase III: Canada takes on the Pacific Basin market

The competition is not from the higher volume contract sellers in the Middle East and West Africa, but Russia.

Westward pipelines for Albertan oil sands



ESPO destinations



- **Roll forward to two West Coast pipelines, with combined capacity – and export potential – of an additional 975-k b/d.** Kinder Morgan Trans Mountain expansion (+450-k b/d to existing 300-k b/d to reach 750-k b/d, potentially ready by 2017-18?) from Edmonton, AB to Burnaby, BC; Enbridge Northern Gateway (new +525-k b/d, potentially ready by 2017-18, could ramp-up to 830-k b/d) from Bruderheim, AB to Kitimat, BC. These volumes could be all sold spot, fob Canada West Coast.
- **Who's the competition? Not the higher volume contract sellers (Middle East, West Africa) - the main competitor would be Russia.** The Russian government is pushing a new contract traded on the St. Petersburg Exchange. But Canada – without government support – could be a natural new benchmark provider with WCS becoming the price setting grade for Middle East crudes – a role ANS once played.
- **ESPO and Canadian crudes (probably mostly syncrude or WCS/synbit, but eventually mostly syncrude) should become the largest suppliers to the Pacific Basin market.** For both ESPO and syncrude, the Pacific Basin market, as the fastest growing market in the world, provides enormous market optionality. ESPO is already mainstreaming - it started as a discount to Middle East crudes; now is at a premium and effectively sets the benchmark for Asia; what's missing for complete transition to a benchmark is a formal traded contract on an exchange, which Russia are pursuing.
- **But although the optionality of the Pacific Basin is attractive, crude sales are still dependent on refinery configurations.** ESPO can make it in the Pacific Basin now; WCS can make it on the US Gulf Coast now, but would need more refinery upgrading in Asia (it won't work in the Japanese market). Big questions – will China, India, other new refining in Asia have ample coking capacity to provide competitive bidding for WCS?
- **If all works as might, Middle East crude to the Pacific Basin could be priced off of Pacific benchmarks, not Oman/Dubai, causing loss of a $1-2/bbl premium.**

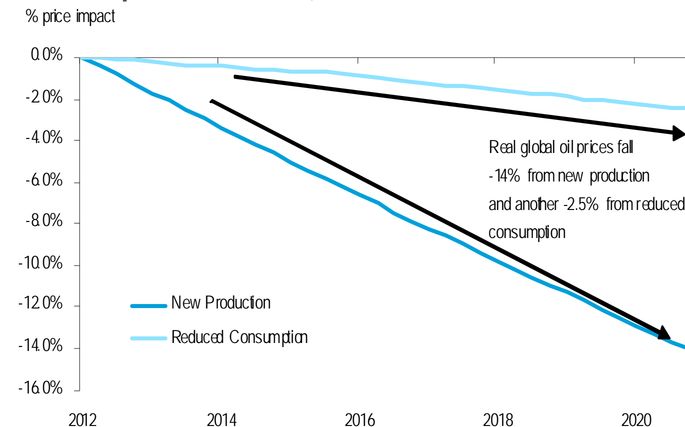
Source: CAPP, Citi Research

A lower oil price environment: a $90 floor becomes a $90 ceiling

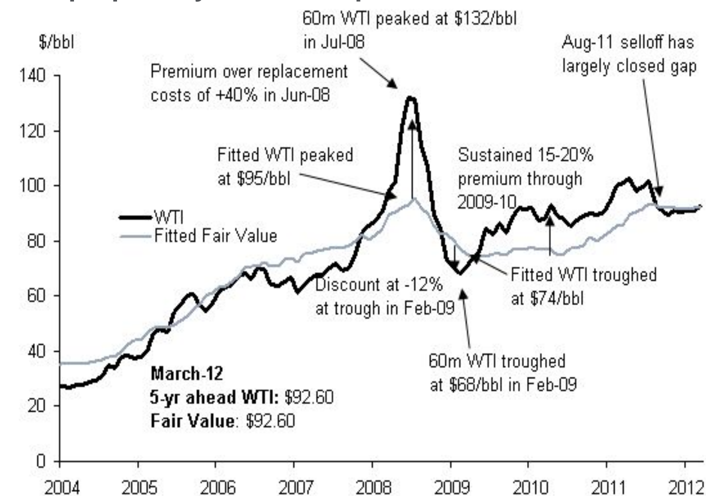
…a $90 floor becomes a $90 ceiling

- **Citi approaches short-term (2012-13) and medium-term (2012-17) price outlooks by projecting out supply-demand balances, while zeroing-in on longer-term oil prices to 2020 or beyond is approached differently.**
- Four different methodologies point to long-term oil prices in the $72-95/bbl range (real, not nominal basis 2012). Currently, three methods - **(1) long-dated forward curves, (2) marginal project economics,** and **(3) Citi's proprietary cost index -** point to long-term prices at the $85-95/bbl range.
  - The forward curves for Brent and WTI converge on the 60-month deferred price, mean-reverting in the low-$90s, while the spread should settle in at $6-7/bbl.
- A fourth methodology looking at **(4) Average finding and development (F&D) costs** point to oil prices in a lower band in the $65 range.
  - Markets have a tendency to over- and under-shoot, suggesting prices could fall to $50 or potentially lower, below the $65-90 range.
  - But at $70-72/bbl, capex would fall, making **$72-95/bbl** a more realistic range.
- And in our first Energy 2020 report, we modeled the implications of the surge of oil and gas production in North America combined with a fall in North American oil consumption, and estimated that real global oil prices could be 15-30% lower than they would otherwise be. With a long-term price outlook of ~$90-95/bbl, this would imply prices between $60 and $75/bbl.
- **Downside scenarios:**
  - Global recession hits GDP and, in turn, oil demand growth
  - Saudi Arabia has a stronger market share orientation
  - Persistent Iraqi supply growth along with Saudi Arabia looking to protect its market share
  - Non-OPEC supply growth surprises further to the upside, although prices below ~$72 would likely mean that non-conventionals (shale, deepwater, oil sands) see capex fall, decline curves accelerate.
- **Upside scenarios:** struggling non-OPEC and OPEC supply, stronger demand growth

Real oil price impact from new production and reduced consumption in the US, 2012E-2020E



Citi's proprietary cost index points to $85-95/bbl



Source: EIA, Citi Research

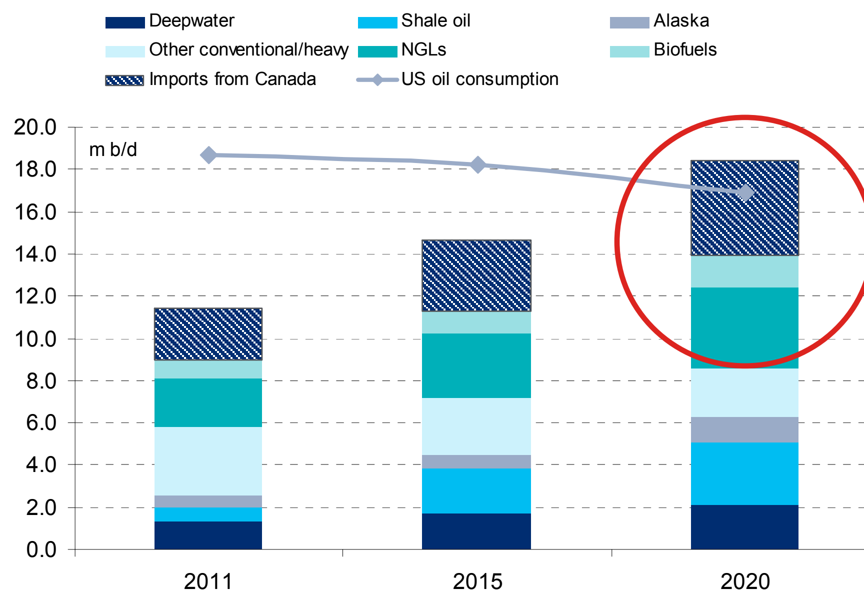
Source: US BLS, Citi Research

Impacts on the US, OPEC and the international energy order

The US will need to reflect deeply on its resurgent ability – but waning willingness – to play its traditional, major role at the center of the global energy order. What does this mean for global stability?

- As North America becomes the new Middle East, this poses a challenge to the future role of OPEC
- After near-term supply tightness, the end of the decade sees investments coalescing in offshore output in the Gulf of Mexico, offshore West and East Africa, India, the Caspian and various places in Asia, turning markets looser – US energy independence is likely to come to fruition at a time of weakening prices
- What are the political consequences of changing American attitudes towards playing the various roles it has adopted since World War II – guarantor of supply lanes globally, protector of main producer countries in the Middle East and elsewhere?
- A US economy that is less vulnerable to oil disruptions, less dependent on oil imports and supportive of a stronger currency should inevitably play a central role globally but with such a turnaround in its energy dependence, it is questionable how arduously the US government might want to play those very roles

The US could see a surplus of crude supply over consumption, putting on the pressure to export crude out of the US Gulf Coast



Source: Citi Research

In geopolitics, there are always winners and losers

While the US could be freer to pursue a more values-based foreign policy, and maintain its clout and superpower status, geopolitical tensions could shift but not go away; isolationism not an option as US “borders” remain global

- The economic consequences strengthen the US, with positive effects on GDP and employment. And the current account could strengthen from lower oil imports as well as a renaissance in domestic petrochemical, steel and energy-intensive industries
- Dollar vulnerability and physical oil vulnerability could end, benefits no other country shares (not China nor Russia)
- Potential impacts on foreign policy:
  - Elimination of the current account deficit
  - Ability to conduct foreign policy freer from shackles to despotic regimes
  - But it does not mean isolation – for all practical purposes, in an age of cyber warfare, biological warfare and terrorism, US borders are global
  - But no other country has reduced vulnerabilities like US is able to
- But geopolitical impacts remain:
  - Lower prices a crimp on revenue of oil/gas producers
  - Means the US has the chance to retain superpower status vs. others
  - This does not necessarily mean a more peaceful or less resentful world
  - There are increased opportunities for failed states and the uncertainties and insecurities associated with these

Fiscal breakeven oil prices for selected oil producer countries ($/bbl)

Country	Fiscal breakeven oil price
Algeria	$105
Bahrain	$119
Iran	$117
Iraq	$112
Kuwait	$44
Libya	$117
Oman	$77
Qatar	$42
Saudi Arabia	$71
United Arab Emirates	$84
Yemen	$237
Russia*	$117

Source: IMF
* Citi Research

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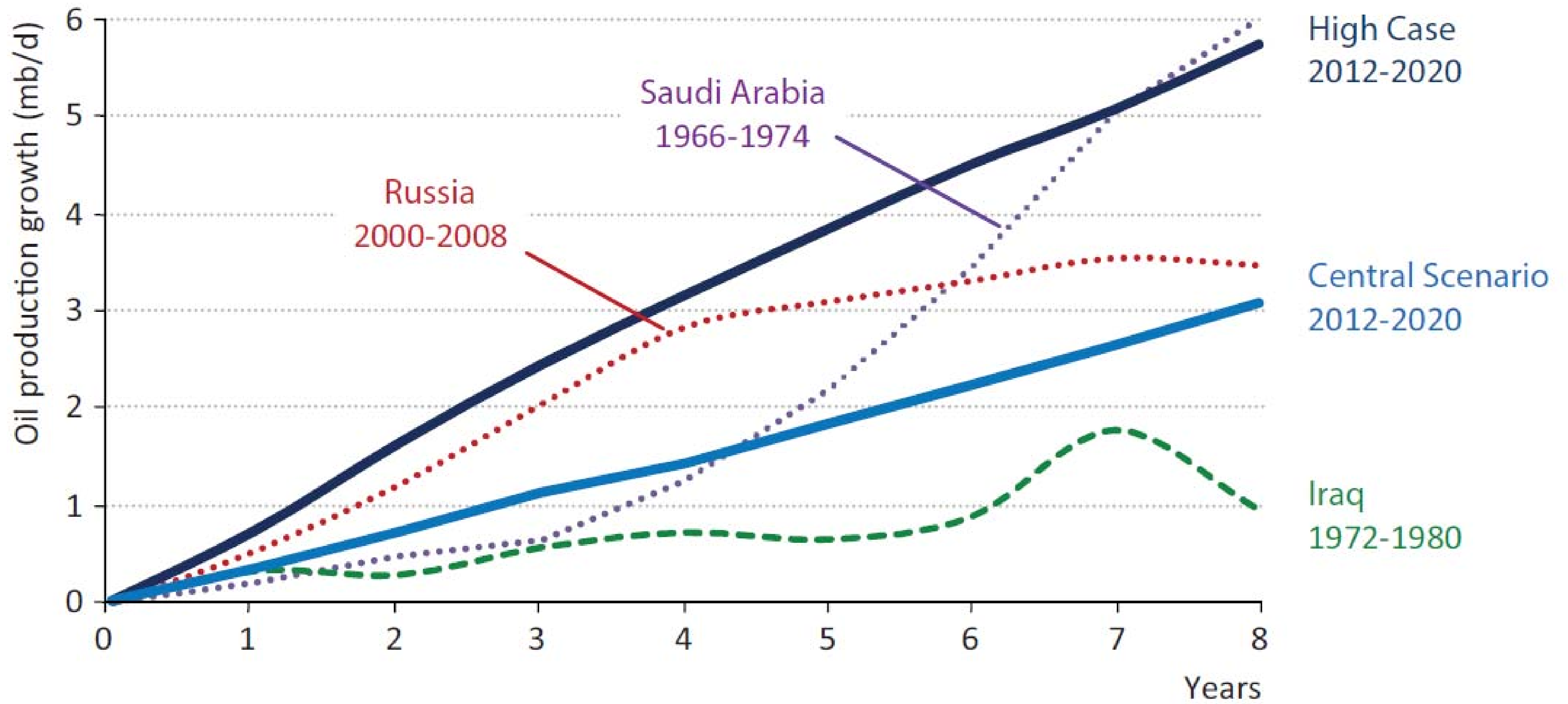
OPEC needs to make room for Iraq



Source: IEA

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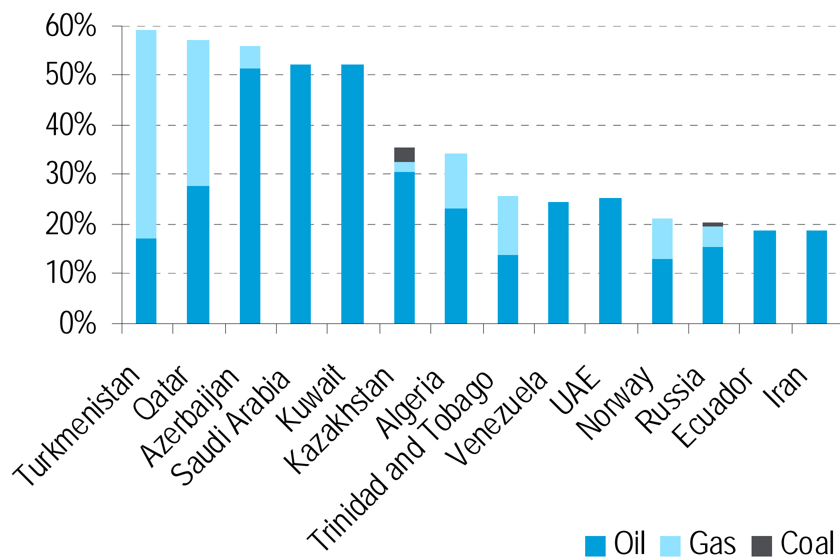
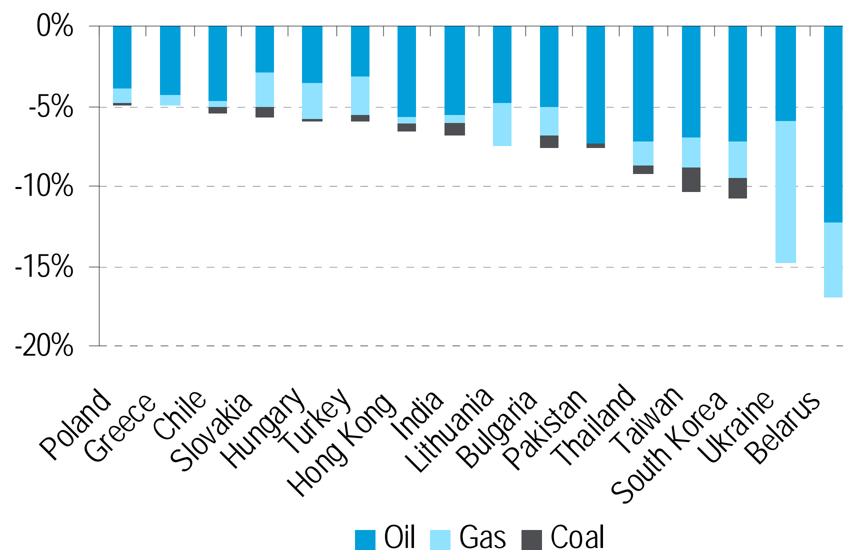
Petrostates stand to lose, energy importers stand to gain

Petrostates' net energy exports, %GDP, stand to lose from easing oil and gas prices...



Source: Citi Research

...while energy importers stand to gain



Source: Citi Research

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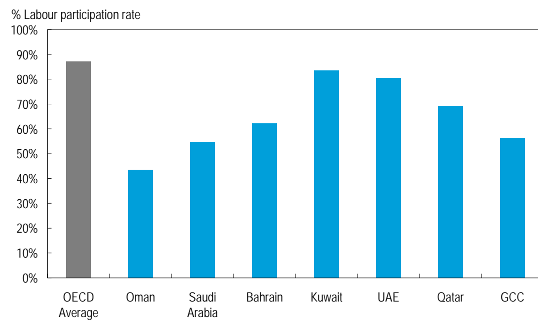
Between a rock and a hard place in the aftermath of the Arab Spring

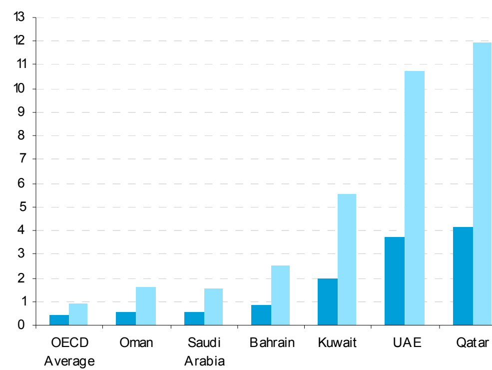
Young, unemployed populations demanding a greater political voice may be partially assuaged by higher social spending, but when this is based on dwindling fiscal budgets as oil revenues shrink, then what?

Job participation rates lower in Oman, Saudi Arabia, Bahrain



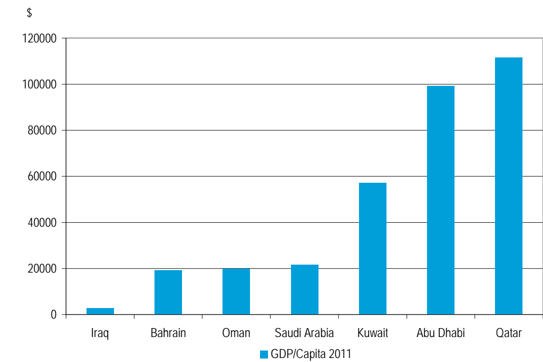
Source: National sources, Citi Research

As are jobs available per national of working age



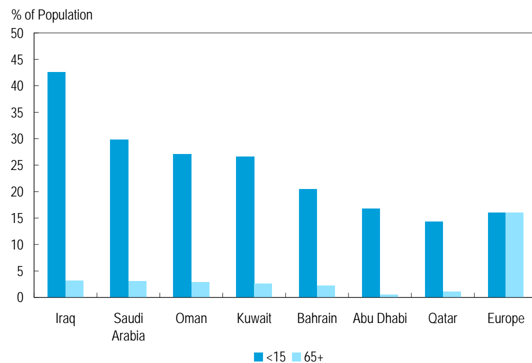
Source: National sources, Citi Research

Personal wealth is higher in Abu Dhabi, Kuwait, Qatar



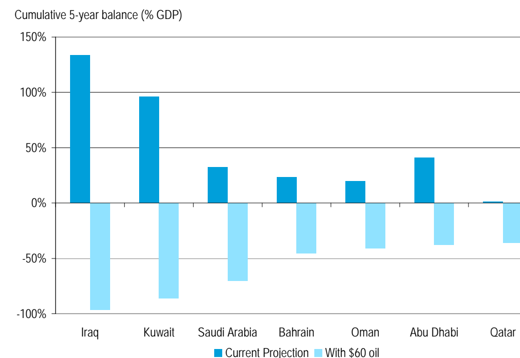
Source: Haver, Citi Research

The youth bulge is visible across the region



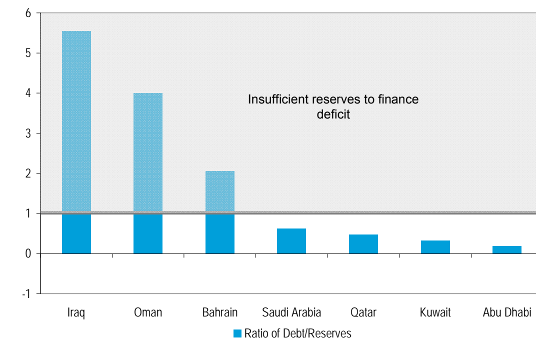
Source: Population Reference Bureau, Citi Research

Illustrative $60 oil price scenario hits fiscal balances severely



Source: Citi Research

Bahrain, Iraq, Oman would have insufficient fiscal reserves to weather $60/bbl



Source: Citi Research

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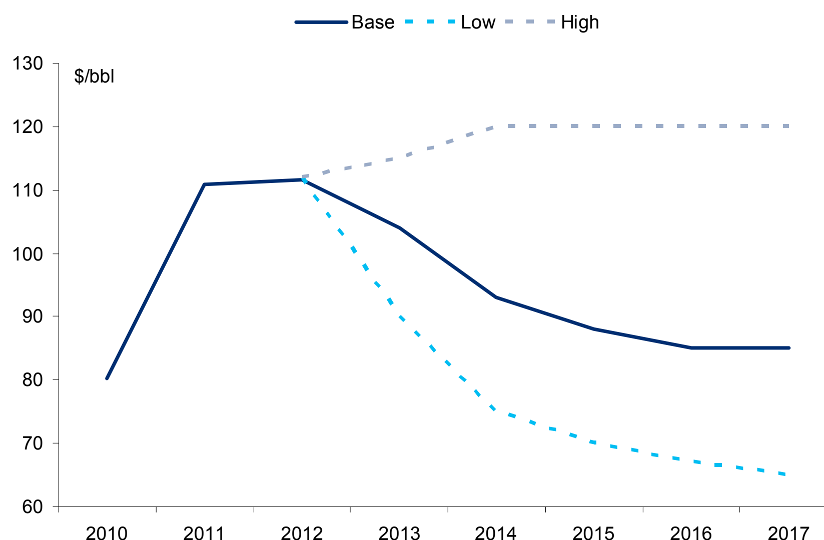
Citi medium-term oil outlook (2012-17) – low and high case



Brent ($/bbl)	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**
Base	80.3	110.9	112	104	93	88	85	85
Low			112	90	75	70	67	65
High			112	115	120	120	120	120

- **Low case** – demand slowdown and faster substitution to natural gas, continued Saudi overproduction, market overshooting to the downside on robust non-OPEC supply growth:
  - Brent prices could fall as low as $50-60 at times before recovering to ~$90, particularly at times of Saudi overproduction combined with lower demand (which could come earlier as in 2013-14), or as markets overshoot to the downside as robust non-OPEC supply growth stimulated by recent high capex comes online, combined with moderating services sector costs (more likely later in the period, in 2015-16)
  - This downside case could be balanced by cuts in OPEC production, at the risk of losing market share, although shale and oil sands production could also see some reining-in below ~$70-72/bbl
  - The oil-to-gas substitution case is discussed in more detail in the following section "Natural gas challenges petroleum demand"
  - The shale revolution could begin to spread globally at a faster pace than anticipated, in Mexico, Canada, Russia, Saudi Arabia, Argentina, China and elsewhere
- **High case** – OPEC production pulls back to the call on OPEC, non-OPEC supply is challenged, faster demand growth, obstacles to oil-to-gas substitution:
  - Higher demand growth combined with a more pessimistic supply outlook keeps spare capacity roughly flat, and still somewhat tight by historical standards. OPEC production pulls back towards the call on OPEC in the short-term. Rising OPEC capacity is put to the test as more robust demand growth (particularly 2014-15 onwards) outpaces non-OPEC supply growth, with high prices needed to ration demand; if there is a failure of OPEC production consistently high prices could persist.
  - A supply disruption in any year could cause sharp short-term spikes; a year of multiple and diverse supply problems as in 2011 and 2012 could see prices above $120 for a period. Prices persistently at these levels would be balanced by demand destruction; Citi sees this past year's $125 Brent level as a reasonable analog for where the economic consequences of too-high prices are seen.
  - Falling oil prices at the same time as rising fiscal breakeven oil prices could tip vulnerable countries into political instability and persistent supply disruptions

Source: Citi Research

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Natural gas challenges petroleum demand

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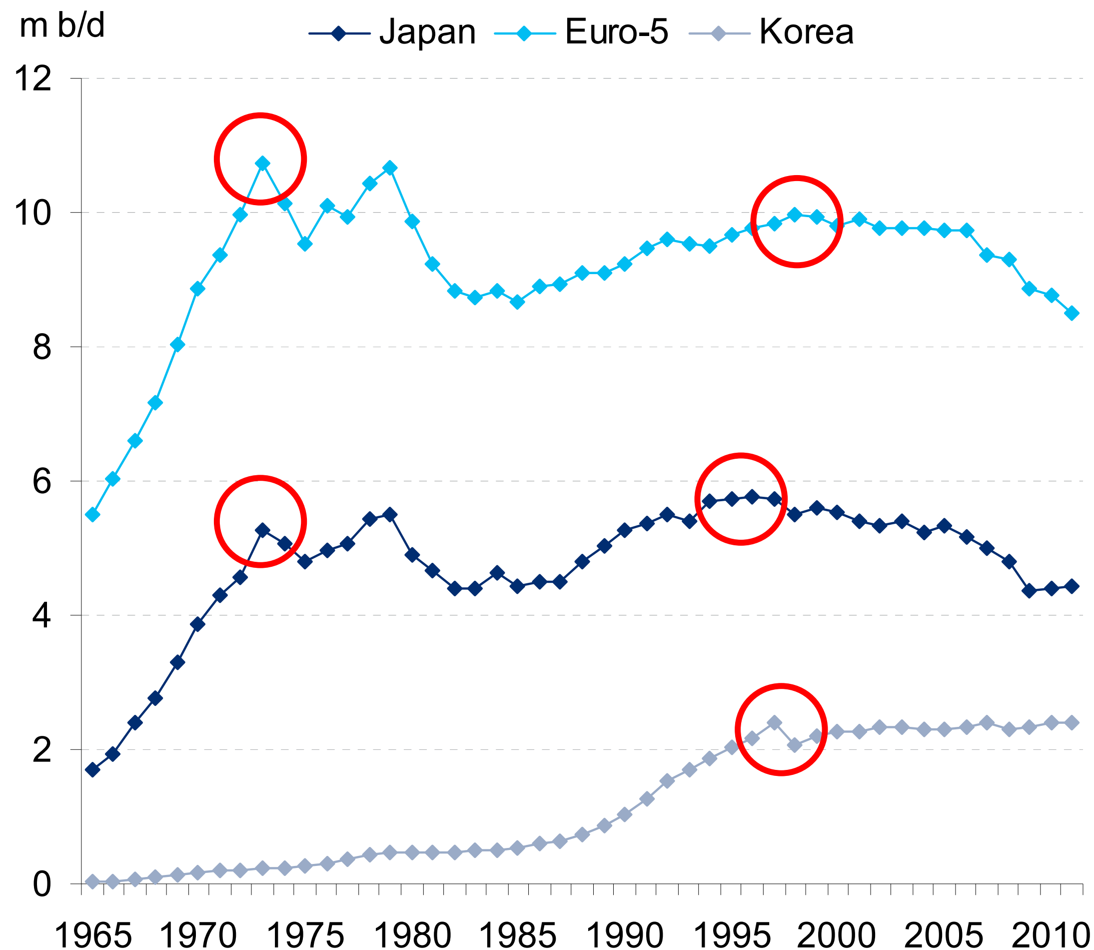
Oil demand has tipping points, putting sudden ends to robust growth

Japan and the Euro-5 (UK, France, Germany, Italy and Spain) and then later South Korea saw periods of robust growth ending or reversing very suddenly. FAI and IP in emerging markets could see similar patterns.



 Source: BP Statistical Review of World Energy 2012, Citi Research

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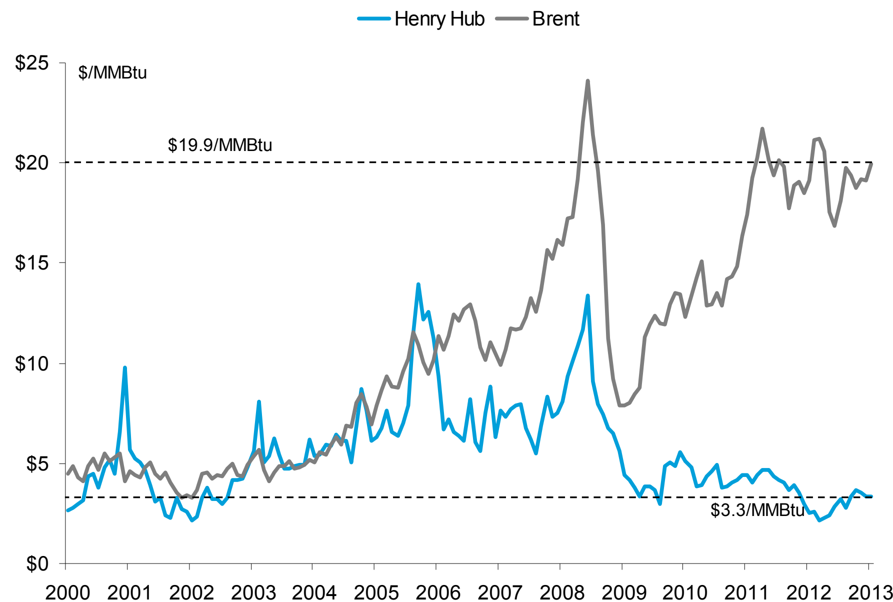
Oil demand of 20-m b/d is a near-term target for natural gas substitution

Brent and Henry Hub natural gas prices were around $5/MMBtu levels until the mid-2000s, but in 2012, Henry Hub prices fell to below $2 while Brent was above $20/MMBtu at times



- **In the US, natural gas supply grew over 20% from 2009 to 2012, pushing out gas imports and coal use.** Supply has stalled-out waiting for higher demand, which can come in five sectors: power generation, residential/commercial space heating, industrial demand, LNG exports, and passenger and delivery transportation.
- **Even if natural gas prices rise, the economics are compelling for snowballing demand growth,** eroding King Coal's reign in power generation and King Oil's domination of transportation.
- **What's at stake: 20 million barrels per day of oil demand (of 90-m b/d global market) and, combined with renewables, another 150mtpa of coal.**
  - 9-m b/d of trucking diesel demand
  - 3-m b/d of marine bunker fuel oil demand
  - 2-m b/d of oil-fired power generation
  - 5-m b/d of petrochemical demand for naphtha
  - Rail transport use, drilling equipment and oil use for space heating
  - …and this does not include gasoline demand that could be eroded in light vehicles.

Source: Bloomberg, Citi Research

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Gas displaces 12-m b/d of oil in global transport, not including gasoline

Global trucking demand for diesel is some 9-m b/d, with bunker demand for residual fuel oil at some 3-m b/d. US railroad demand for diesel is some 200-k b/d.

- **Natural gas use in transportation could displace over 12-m b/d of today's oil demand (and an even larger slice of the growing pie going forward) within a decade**
- **Trucking:** Global diesel demand from trucking is some 9-m b/d, and could rise to 13-m b/d by 2035
  - US diesel on-highway use (including trucking) is some 2-m b/d
  - Worldwide, the number of NGVs have grown from just 1.2 million in 2000 to about 15 million in 2011. The main obstacle in the past was the lack of infrastructure due to the lower number of NGVs, but infrastructure is now being developed.
- **Marine bunker:** global marine transportation use of residual fuel oil is some 3-m b/d
  - US marine use of residual fuel oil is 300-k b/d, as well as marine use of another 100-k b/d of diesel
- **Rail:** US rail diesel uses 200-k b/d
- The European Union recently announced a clean fuels initiative (the **Clean Power for Transport** package) which includes plans to roll-out natural gas-based facilities for cars, trucks and ships. This would include CNG fueling outlets across the EU every 150 km by 2020; LNG truck fueling stations every 400 km on "core" trans-European routes; fueling stations for 139 core EU maritime and inland ports (by 2020 and 2025, respectively)

Source: IEA, EIA, Citi Research

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Appendix A-1

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