

Energy Briefing

Rory Johnston 1.416.862.3908
rory.johnston@scotiabank.com



CHINA

Coal

- China is the world's largest producer, consumer, and importer of coal, accounting for roughly half of global demand.
- The industry now faces headwinds amidst the government's "crack-down on pollution", structural shifts in demand, falling prices, and chronic overcapacity.

Oil

- China has become the world's largest net importer of crude oil and petroleum products on the back of its rapidly expanding middle class, booming vehicle sales, and limited production growth prospects.
- Consumption growth continues to slow as diesel demand remains flat, but consumer vehicle penetration and rising gasoline consumption should buttress crude demand over the coming years.

Natural Gas

- China's shifting economic landscape will provide a material boost to natural gas consumption, likely representing the country's largest energy growth market, albeit from a relatively small base.
- Domestic production will fail to keep pace with rising demand, putting upward pressure on imports.

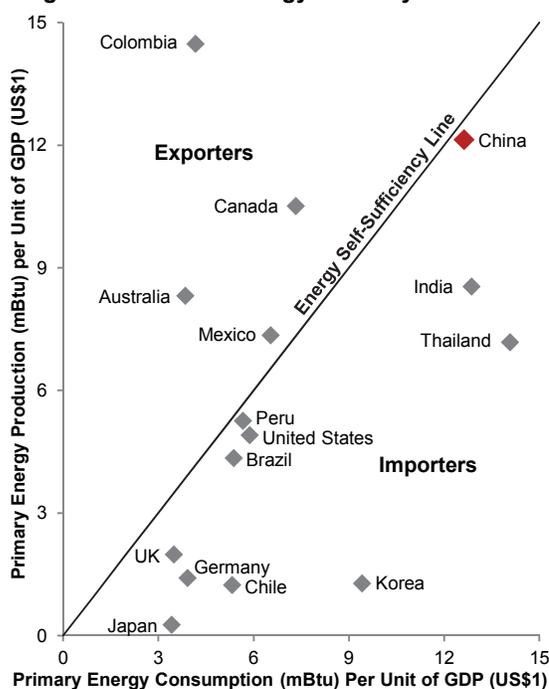
Primary Energy Mix

- China's primary energy mix remains heavily coal-dominated (66%), followed by petroleum (18%), natural gas (6%), and "non-fossil fuels" (10%) as of 2013.
- The State Council's "Energy Development Strategy Action Plan" has set primary energy targets for coal (less than 62%), natural gas (10%), and non-fossil fuels (15%) to be reached by 2020.

Energy Intensity

- The energy intensity of China's economy remains high relative to global peers (Figure 1), but significant progress has been made over the past few decades; energy consumption per unit of GDP (US\$1) has fallen from 77 mBtu (thousand British thermal units) in 1986 to 13 mBtu in 2012.

Figure 1: Chinese Energy Intensity in Context



Note: 2012 figures, the last year of reliable data availability.
 Source: IMF, EIA, Scotiabank Economics.

Figure 2: Key Energy Indicators

| | 2011 | 2012 | 2013 | 2014 |
|----------------------------------|-------|--------|--------|--------|
| Crude Oil (kbpd) | | | | |
| Production | 4,090 | 4,158 | 4,182 | 4,207 |
| Refinery Input | 8,956 | 9,340 | 9,652 | 9,992 |
| Imports | 5,098 | 5,449 | 5,665 | 6,193 |
| Exports | 51 | 49 | 32 | 12 |
| Petroleum Products (kbpd) | | | | |
| Refinery Output | 9,274 | 9,688 | 10,054 | 10,454 |
| Implied Consumption | 9,610 | 10,033 | 10,334 | 10,617 |
| Diesel | 3,418 | 3,468 | 3,472 | 3,502 |
| Gasoline | 1,794 | 2,017 | 2,187 | 2,433 |
| Imports | 895 | 877 | 903 | 814 |
| Exports | 559 | 532 | 624 | 651 |
| Natural Gas (bcm) | | | | |
| Production | 103 | 112 | 114 | 124 |
| Implied Consumption | 131 | 150 | 162 | 180 |
| Imports | 31 | 41 | 51 | 58 |
| LNG | 14 | 21 | 27 | 31 |
| Pipeline | 17 | 20 | 24 | 27 |
| Exports | 3 | 3 | 3 | 3 |
| Coal (Mt) | | | | |
| Production | 3,520 | 3,650 | 3,970 | 3,870 |
| Implied Consumption | 3,689 | 3,876 | 4,230 | 4,092 |
| Imports | 183 | 235 | 267 | 228 |
| Exports | 15 | 9 | 7 | 6 |

Note: China does not publish official consumption statistics; listed figures are implied estimates based on production and trade flows.

Source: National Bureau of Statistics of China, General Administration of Customs, Scotiabank Economics.

COAL

The Chinese coal industry faces headwinds amidst the government's "crack-down on pollution", structural shifts in coal demand, falling prices, and chronic overcapacity. Coal is arguably the single most important commodity in China, and the country is the world's largest producer and importer of coal, accounting for roughly half of global consumption.

Demand | Structural Shifts Amidst Beijing's Crack-Down On Pollution

China's implied coal consumption fell by more than 3% y/y to 4.1 billion tonnes in 2014, the first decrease since the late 1990s. Coal is the feedstock of choice for China's rapidly growing electricity grid (thermal coal), accounting for three-quarters of generation, and is an essential component of key industries such as steel and cement through the use of coke (derived primarily through coking coal). In 2012, roughly 55% of China's coal by weight was used in electricity production and 30% was used in industrial applications.

Localized air pollution in China's major cities — overwhelmingly located along the south and east coasts — has prompted the government to reorient the industry westward away from urban centres. As such, much of the changing character of the Chinese coal industry must be viewed in the context of the strategic shift toward the "harmonious development of human and nature" as outlined in the 3rd Plenum. Coal-fed industries (electricity, petrochemicals, etc.) will be incentivized to shift operations west and virtually all newly approved coal projects are located in interior provinces. Under this new vision, coal-fired power plants will generate electricity, and the accompanying emissions, in less densely populated areas and transport the electricity to the coast by way of ultra-high voltage transmission lines (Figure 3 illustrates the beginning of this trend). Similarly, the expanding coal-to-gas (CTG) industry is transforming a portion of China's coal resources into synthetic natural gas (SNG), used in power plants closer to cities or for residential heating.

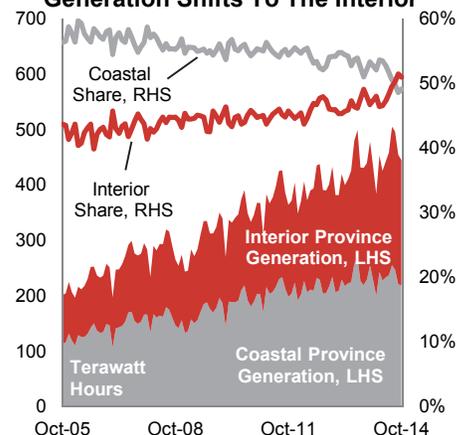
Supply | Government Moves To Cull Inefficient Producers, Stem Supply Glut

Chinese coal production fell by 2.5% y/y to 3.9 billion tonnes in 2014, likely a result of government initiatives aimed at cutting back inefficient production. Coal markets are experiencing a supply glut and prices have steadily fallen since the end of 2011 — shedding almost 40% over the past 3 years — as demand growth slowed and production continued unabated. In 2014, the head of the China National Coal Association indicated that more than 70% of Chinese coal companies are experiencing losses in the current price environment. The coal industry is facing government pressure to either close or consolidate smaller, less efficient mines into larger conglomerations. As these mines are brought into larger groups, their reserves are added to the coffers of larger national champions that enjoy higher operating efficiencies and benefit from vertically integrated transportation and marketing networks. Production will likely ease as the industry is restructured, but production growth may begin to pick up again after this consolidation process is complete.

Trade | Arbitrage (Not Unmet Demand) Fuels Rising Imports

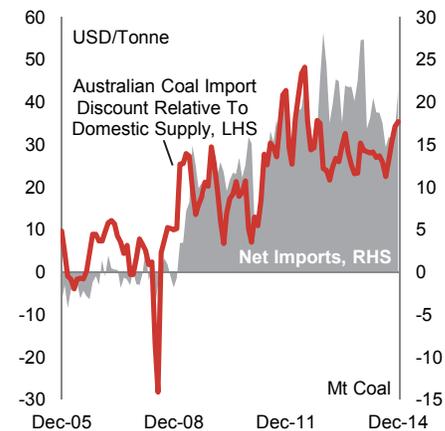
China is the world's largest importer of coal, surpassing Japan in 2011 despite having been a net exporter until 2008. While coal imports make up only 6% of implied Chinese consumption, they account for roughly one-quarter of total global coal imports. This import surge was incited not by unmet demand but by price arbitrage between domestic and international coal supplies. China has insufficient transportation infrastructure between coal-producing regions in the north-west and coal-consuming regions in the south-east, which makes it cheaper for domestic producers to ship their products to north-eastern ports and float coal supplies south. This puts domestically produced coal in direct competition with coal imports, particularly from Australia and Indonesia. High Chinese production costs resulted in these imports being cheaper relative to domestically produced coal in 2009, transforming China from a net exporter of 4.6 million tonnes (megatons, or Mt) in 2008 into a net importer of 222 Mt in 2014 (Figure 4). One of the tertiary benefits of the government's plan to reorient coal-intensive industries inland is that bases of demand will shift closer to sources of supply, lessening the impact of the infrastructural deficit.

Figure 3: Chinese Electricity Generation Shifts To The Interior



Source: National Bureau of Statistics of China, Scotiabank Economics.

Figure 4: Chinese Coal Import Arbitrage



Note: Spread = Qinhuangdao - Newcastle Spot.
Source: General Administration of Customs, Bloomberg, Scotiabank Economics.

PETROLEUM

China's rapidly expanding middle class, booming vehicle sales, and limited production growth prospects have made China the world's largest net importer of crude oil and petroleum products, recently supplanting the United States. The country has accounted for roughly one-third of global petroleum demand growth over the past decade and it is increasingly clear that the future of the global petroleum industry will be defined by decisions made by the Chinese state.

Demand | Gasoline Displaces Diesel As Growth Driver

China is the second-largest consumer of petroleum products in the world, demanding an average of 10.6 million barrels a day in 2014, up 3% y/y. This represents a slow-down in its demand growth rate, which has averaged almost 7% y/y over the past decade. The largest trend-shift in Chinese petroleum demand concerns the relative weight of diesel and gasoline. Historically, diesel has been the primary driver of Chinese petroleum demand growth due to the outsized importance of commercial freight traffic that coincided with the booming coal, steel, cement, and construction industries. Indeed, commercial vehicles accounted for 71% of the total Chinese vehicle fleet in 2005, falling to 53% in 2013 as consumer car sales accelerated. Accordingly, diesel demand has stagnated, growing at an average annual rate of less than 1% over the past three years, while gasoline demand growth has averaged 11% y/y over the same period (Figure 5).

While the Chinese vehicle stock has quadrupled from 30 million units in 2005 to 120 million units in 2013, both diesel and gasoline demand have grown far slower (up 62% over the same period). In 2005, the average Chinese vehicle consumed 42 barrels of fuel per year, but that number has fallen rapidly, reaching 17 barrels by the end of 2013 (Figure 6). This decline in vehicular fuel intensity is likely the result of two primary drivers: 1) the increasing penetration of consumer cars, which are driven far less frequently than commercial vehicles, and 2) rising fuel efficiency across vehicle segments.

China has been a major source of marginal demand since the late-2014 collapse in oil prices, with unseasonably large crude oil imports likely destined for state-controlled strategic reserves. However, this demand is likely to be temporary; China does not possess enough physical storage capacity to continue benefiting from lower prices for strategic stock-building indefinitely. The country is building more strategic storage capacity, but it is unlikely to be available for immediate demand relief.

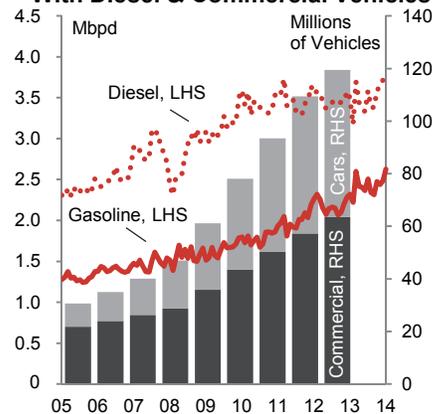
Supply | Monopoly, Geology Challenge for Potential Growth

China is the world's fourth-largest petroleum producer, but production grew by a mere 0.6% y/y in 2014 to 4.2 million barrels per day, less than 40% of the country's consumption. Annual production has expanded by an average rate of 2% y/y over the past two decades but future growth prospects are hampered by the state-owned enterprise (SOE) monopoly on upstream activities. Three large fields (Daqing, Shengli, and Changqing) account for almost half of China's crude oil production, but these fields are increasingly mature — discovered in 1959, 1961, and 1971, respectively — and past their peak. Enhanced oil recovery techniques have slowed production losses in legacy fields but future production gains will likely need to come from peripheral or unconventional resource bases. China holds the world's third-largest shale oil resources, but these formations are typically deeper than similar shales in the United States, making them far more expensive to produce.

Trade | Central Role for World's Largest Importer and Growing Regional Exporter

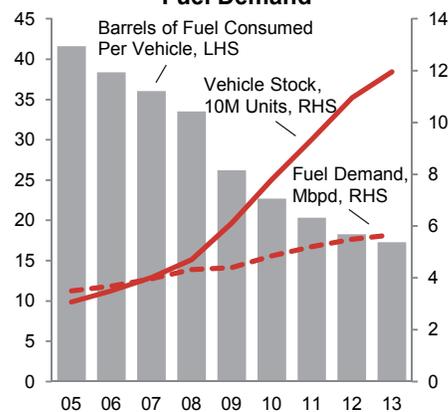
China is now the world's largest net importer of crude oil and petroleum products, surpassing the United States in 2014. Despite this dependence, Beijing has placed little emphasis on supply diversification, importing half of its crude oil from just four countries in 2014: Saudi Arabia (16%), Angola (13%), Russia (11%), and Oman (10%). However, China's growing refining capacity has also allowed it to emerge as a large regional exporter of refined products, selling roughly 650 thousand barrels a day of mainly gasoline, kerosene, and fuel oil through 2014.

Figure 5: Cars & Gasoline Catch Up With Diesel & Commercial Vehicles



Source: Ward's Automotive, National Bureau of Statistics of China, Scotiabank Economics.

Figure 6: Chinese Vehicle Stock and Fuel Demand



Note: Fuel = Gasoline & Diesel Aggregate.
Source: Ward's Automotive, EIA, National Bureau of Statistics of China, Scotiabank Economics.

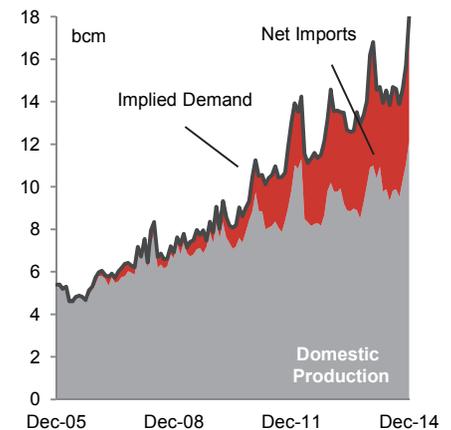
NATURAL GAS

China's natural gas industry is still in the early stages of development and accounts for less than 6% of the country's total energy consumption. However, natural gas demand is rapidly growing on the back of China's emerging middle-class, the increasing importance of the country's service sector, and the government's emphasis on environmentally sustainable development. Natural gas will likely be the energy growth story in China over the coming decade.

Demand | Consumption Will Rise As China Reorients Toward Cleaner, Flexible Energy Mix

Despite making up a small share of China's overall energy consumption, natural gas demand stood at 180 billion cubic meters per annum (bcm) in 2014 (up 11% y/y and a four-fold increase since 2005), making China the third-largest consumer of the fuel behind the US and Russia. In 2012, industry consumed roughly 21% of the country's natural gas supply, with other major sources of demand being the electricity sector (18%), residential and commercial sectors (26%), and the transportation sector (9%). China's 12th Five-Year Plan (FYP) for the natural gas industry (2012) estimated that consumption would reach 230 bcm by 2015, but it will likely fall short of this goal. Demand grew by an average of 15% annually over the past decade, which, if the trend holds, will put Chinese natural gas consumption at around 210 bcm by year-end. In the long run, however, natural gas demand has the potential to grow substantially. Natural gas makes up only 2% of installed electricity generation capacity — far below the 22% global average — and the majority of China's power plant fleet is utilized for base-load supply (which remains relatively static throughout the day). As the service industry grows and heavy industry begins to shrink as a share of China's economy, flexible "peaker" plants will be needed to meet shifting daily demand and natural gas is the feedstock best suited for this role (coal, nuclear, and hydroelectric generation are unable to efficiently ramp up or cycle down supply). These peak demand periods are typical in advanced economies, but are relatively muted in present day China due to the outsized share of industrial demand.

Figure 7: Chinese Natural Gas Balance



Source: General Administration of Customs, Scotiabank Economics.

Supply | Significant Potential Runs Up Against Regulatory, Pricing, & Governance Hurdles

Natural gas production stood at 124 bcm in 2014 (up 10% y/y) and the 12th FYP estimated that production would reach 176 bcm (138.5 conventional and 37.5 unconventional) by 2015. This goal, too, is unlikely to be reached. Production is divided into conventional and unconventional sources; the former is subjected to tighter government pricing controls, while the latter is market-determined to incentivize production and technological innovation. Unconventional natural gas typically comes from one of three sources: coal bed methane (CBM), shale, or coal-to-gas (CTG) transformation. CBM is naturally occurring gas located in coal seams and is currently a victim of mineral rights jurisdictional issues; coal rights are administered by local authorities while gas resources are regulated by the central government, despite the fact that mining the former releases the latter. China also boasts the world's largest shale gas resources, but difficult geology, lackluster private property rights, water scarcity, and little in the way of publicly available subsurface data will make large-scale near-term production difficult. (CTG developments are covered on page 2.) In addition to pricing and regulatory hurdles, China suffers from a lack of natural gas transmission pipelines, with about 50,000 km (2013) compared to the United States' 500,000 km (transmission only; does not include city-level distribution networks). Moreover, pipelines are exclusively owned and operated by one of China's three oil and gas giants: PetroChina, Sinopec, and CNOOC. Even if smaller private players are able to economically produce natural gas from unconventional resources, there are concerns that they will not be able to secure fair market access to pipelines in the absence of an independent operator.

Trade | Gas-Thirsty China To Increase Imports From Central Asia, Russia, & Seaborne LNG

Natural Gas imports rose 13% y/y in 2014 to 58 bcm (54% from LNG and 46% from pipelines), equal to one-third of Chinese consumption. China imports 80% of this gas from just five countries — Turkmenistan, Qatar, Australia, Malaysia, and Myanmar — but Turkmenistan stands out with a 44% (25.5 bcm) share of the Chinese natural gas import market in 2014 due to a large central Asian pipeline completed in early 2010 and there are plans to increase that volume to 65 bcm by 2020. Russia is also likely to emerge as a major supplier of pipeline gas after signing a 38 bcm supply deal in early 2014 (to begin exports after 2018); another 30 bcm non-binding agreement in late 2014 indicates that this volume has upside potential. LNG infrastructure is also growing, with 11 LNG import terminals (46.8 bcm capacity) operating at the end of 2014 and another 8 planned to come on-stream by 2020 (roughly 40 bcm additional capacity).

INTERNATIONAL ECONOMICS GROUP**Pablo F.G. Bréard, Head**

1.416.862.3876

pablo.breard@scotiabank.com**Erika Cain**

1.416.866.4205

erika.cain@scotiabank.com**Rory Johnston**

1.416.862.3908

rory.johnston@scotiabank.com**Tuuli McCully**

1.416.863.2859

tuuli.mccully@scotiabank.com**Estela Molina**

1.416.862.3199

estela.molina@scotiabank.com**Neil Shankar**

1.416.866.6781

neil.shankar@scotiabank.com**Scotiabank Economics**

Scotiabank Plaza 40 King Street West, 63rd Floor

Toronto, Ontario Canada M5H 1H1

Tel: 416.866.6253 Fax: 416.866.2829

Email: scotia.economics@scotiabank.com

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