Deloitte.

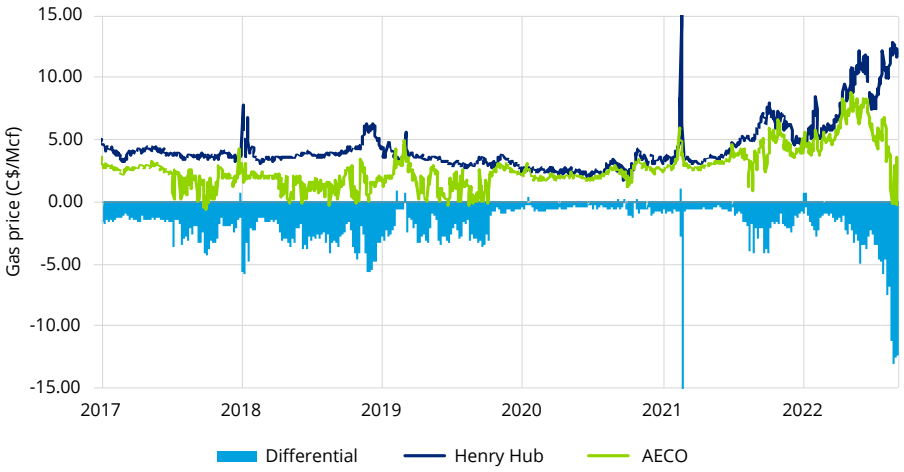
Oil and gas price forecast

Hydrogen pathways to net-zero: Charting a new course for industry

September 30, 2022

Forecast commentary

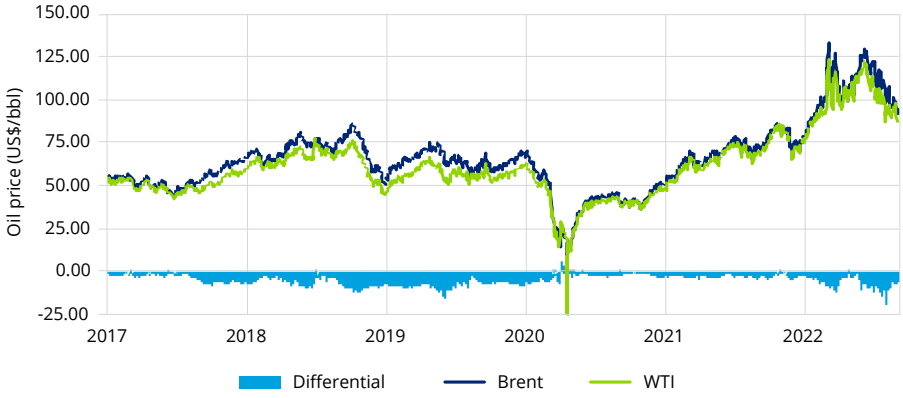
Natural gas prices around the world remain extremely elevated coming out of summer. Liquified natural gas (LNG) prices have risen consistently in the aftermath of the June explosion at the Freeport LNG facility, which exported approximately 20% of all US LNG. The facility is not expected to partially restart until October, and unlikely to be fully operational until early 2023. At the same time, the European Union (EU) has continued its efforts to replace Russian gas imports, which has resulted in increased LNG demand. European nations have raced to build up gas in storage before winter and under the threat of Russia cutting off their imports. At the end of August, Gazprom halted exports through Nord Stream 1 to Germany indefinitely, further exacerbating the energy issues faced by the EU. This energy crisis has the potential to impact economic growth in the region, as people attempt to budget for soaring heating costs and energy-intensive industries weigh decisions to shutter factories.



Sources: Energy Information Administration (EIA), Daily Oil Bulletin (DOB)

While natural gas prices have soared in most markets, those in Alberta saw extreme volatility throughout August, with negative closing prices on multiple days throughout the month and a significantly widening differential to Henry Hub. Similar volatility occurred in the summers of 2017 through 2019 due to maintenance outages along the Nova Gas Transmission Line (NGTL) system combined with rising production outpacing capacity upgrades. A temporary service protocol was put in place in September 2019 to help interruptible transmission and to curb the wide differentials and volatility that had been plaguing the system. AECO prices recovered, but the protocol was not extended in 2021. Throughout 2020 and 2021, as pandemic restrictions resulted in lowered demand, system capacity kept pace with production. However, the effects of no longer having the protocol became obvious, with supply beginning to rise at a faster pace in 2022 and the system under strain once again. This volatility may have less impact on company balance sheets than in the past since many companies have diversified away from AECO over the last five years and often have hedging in place to mitigate the expected Q3 volatility. However, some companies have announced production shut-ins in response to deeply discounted AECO prices.

Oil prices have fallen through much of the third quarter after reaching peak prices above $125/bbl. Ongoing interest rate hikes and lockdowns in China have fuelled fears of a possible recession and decline in oil demand. The United States also continues to release volumes from its strategic reserve in an effort to moderate prices, with a target release of approximately one million barrels per day over a six-month period. US oil production continues to grow but has not yet reached the peak seen in early 2020, while Canadian production continues to achieve all-time highs. These factors, along with the growing energy crisis in Europe and pressure to cut off Russian oil imports, have led to a higher differential between Brent and WTI as the North American market does not face the same supply concerns. Differentials reached a similar spread from 2018 through early 2020, when shale oil drilling led to record production in the United States.



Source: Energy Information Administration (EIA)

With these high prices, producers are generating record cash flows and companies are weighing decisions to increase investment or continue focusing on share buybacks, dividends, and debt repayments. Deloitte's *Striking the balance: How and where will oil and gas producers deploy their cash?* report delves into these decisions in detail. While Canadian companies are increasing development capital somewhat, large financial approvals or commitments to energy transition investments have been lacklustre so far. Most investments have been focused on optimization projects and fuel switching, which will contribute to emissions improvements but won't be significant enough to be the only investments that large companies make.

China spotlight: The evolution of an energy sector

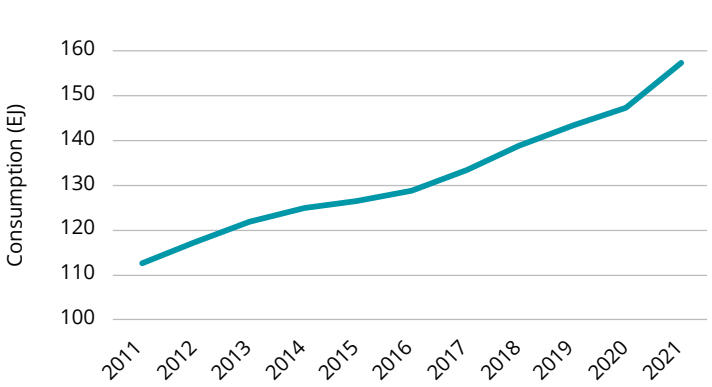
China is the largest energy consumer, crude oil importer, and LNG importer in the world. Its powerhouse nature in the global energy industry is likely to shape the coming decades in terms of energy demand and so it's important for the industry to pay attention to trends there. Its energy consumption has been growing at an average rate of 4% per year for the past five years (see chart below).

According to the latest Statistical Review of World Energy, China accounted for almost 60% of global LNG consumption growth in 2021 and increased its crude consumption by 1.3 MMbbl/d from 2020 volumes.[1] It's a net importer of crude oil and natural gas. In addition to growing oil and gas consumption, China increased coal demand by 3.7 exajoules (EJ) year over year in 2021 and led growth in coal production, primarily for domestic consumption. China continues to rely heavily on hydrocarbons as primary energy sources to meet growing demand within the country. Hydrocarbon-based fuels accounted for over 83% of primary energy sources in 2021.

China's overall crude oil demand has been reduced by its ongoing pandemic response and curbed fuel exports, importing only 8.79 MMbbl/d of crude oil in July 2022, a 9.5% reduction from a year earlier. Some refiners have also cut down run time due to low refining margins and high crude oil prices. However, the International Energy Agency (IEA) predicts that China will drive crude oil demand growth in 2023 as the country resurges from lockdowns and demand increases.

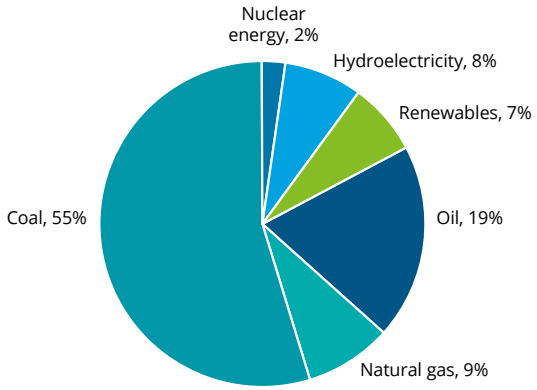
The reliance on crude oil and coal will continue to shape China's economy for years to come, but there has been significant investment in renewable energy sources, decarbonization efforts, and petrochemical processing

China's energy consumption



Source: BP Statistical Review of World Energy 2022

China's energy consumption by fuel type, 2021



Source: BP Statistical Review of World Energy 2022

[1] BP p.l.c., *bp Statistical Review of World Energy 2022*, June 2022.

over the last few years, indicating the country is committed to transitioning toward a greener economy. Investments by major producers in the country have shifted focus to renewable energy for domestic consumption, with China planning to reach net-zero by 2060.[2] The country has demonstrated support for innovation and technology growth and is internationally recognized as a primary manufacturing centre for energy technology.

China's latest five-year plan, released in 2021, indicated that the country intends to increase innovation in energy technology with a focus on making renewables more reliable and competitive, including hydrogen production and nuclear infrastructure. The plan also outlines expectations to grow domestic natural gas production to 8.1 trillion cubic feet (Tcf) annually by 2025[2] and to increase corresponding power generation from this source. To fill the gap between domestic natural gas production and consumption, China imports large volumes of natural gas by both pipeline and through LNG terminals. The imported volumes are expected to rise in the coming years as the country looks to switch from coal to natural gas. To increase supply, China struck a deal with Russia in 2022 to import an additional 0.35 Tcf per year from the East Siberian fields and plans for another 3.6 Tcf of LNG import capacity to be brought onstream by the end of 2024.[3]

The diversification of energy sources is supported by investment by Chinese national oil companies (NOCs) in their renewable and decarbonization mandate, including increased spending on petrochemical complexes in their portfolios. These NOCs are investing in the entire renewable supply chain, focusing on both asset development and technology maturation to provide solutions for domestic power generation and consumption. Some NOCs are moving faster than others, with their new energy investment platforms completing transactions in battery, hydrogen, wind, and photovoltaic value chains—not just to be a supplier of the energy, but also to have a hand in the entire ecosystem.

With the largest population in the world, China's energy consumption will continue to define demand trends. If current investments materialize into significant shifts in China's import behaviour, it will bend the global demand curve. While hydrocarbon fuel sources will still be needed in the coming years, China's commitment to innovation and its investment in alternative energy sources mean the future looks greener for the world superpower.

China's latest five-year plan, released in 2021, indicated that the country intends to increase innovation in energy technology with a focus on making renewables more reliable and competitive, including hydrogen production and nuclear infrastructure.

[2] International Energy Agency, *An energy sector roadmap to carbon neutrality in China*, September 2021.
[3] United States Energy Information Administration, *Country Analysis Executive Summary: China*, August 8, 2022.

Hydrogen pathways to net-zero: Charting a new course for industry

The race to net-zero is on, and Canada has an opportunity to pull to the front of the pack as global leaders in the hydrogen economy. How much progress we ultimately make—including the resulting range of benefits in terms of jobs and economic growth—will depend on how fast we can leap over current hurdles to achieve market development and secure the funding needed to develop both the supply and demand.

A national hydrogen ecosystem holds tremendous potential: to carve out new energy opportunities, shore up supply chains, strengthen our cleantech ecosystem, and reduce our carbon footprint as a country. The Government of Canada estimates Canada's hydrogen opportunity at $50 billion and 350,000 jobs in addition to reducing emissions by 90 megatonnes, or about 25%, of our current carbon footprint by 2050.[1]

Our strategic advantages are numerous and, as a resource-based economy, it's these raw materials/feedstocks that could allow Canada to lead the world in powering a hydrogen future.

Hydrogen feed stocks: Fast facts

Gas

Canada is sixth in the world for natural gas sources, with more than 1,382 trillion cubic feet as of 2019. Most of these reserves are found in Alberta,[2] which is home to 70% of Canada's marketable natural gas.

Renewable energy

- Solar: 2,399 MW of installed solar as of December 2021[3]
- Wind: 14,304 MW of installed capacity as of December 2021[3]
- Geothermal: abundant conditions for geothermal energy generation, with most potential noted in British Columbia, Alberta, Saskatchewan, Yukon, and the Northwest Territories

Water resources (including hydro)

Fourth-largest global hydropower producer by installed capacity, and home to 20% of the world's freshwater supplies, including 7% of renewable water supplies.[4]

Uranium

World's second-largest producer, accounting for 13% of the global total, and home to the largest high-grade deposits—100 times greater than the global average.[5]

[1] Natural Resources Canada, *Hydrogen Opportunities: Key Findings*, Government of Canada, December 2020.
[2] Canadian Gas Association, *Natural Gas Facts*, accessed September 2022.
[3] Canadian Renewable Energy Association, "*Canada installed almost 1 GW of wind and solar energy in 2021, driven by strong growth in Alberta*," accessed September 2022.
[4] Government of Canada, *Water in Canada*, July 2013.
[5] Natural Resources Canada, *About Uranium*, Government of Canada, September 2022.

Investments desperately needed

While the runway to 2050 may appear a long way off, the reality is that there is less than a handful of investment cycles left. Couple that with regulatory, permitting, and processing timelines and Canada risks finishing last if we don't make serious headway in the near term. Investment is needed now to seize the hydrogen opportunity.

Adding to financial strain is pressure on organizations to make decarbonization investments to meet their 2030 and 2050 targets. Companies need to be supported so that the gap to a net-zero world can be bridged and a successful evolution achieved, but there is limited time to work through these challenges before the opportunity passes us by.

The challenge so far in many investment decisions has come down to cost. In five years, the municipality of Markham, Ontario, has been unsuccessful at delivering hydrogen to the neighbouring community of Mississauga, less than 60 kilometres away, thanks to costing. It also costs almost four times as much to run hydrogen-powered buses than their traditional diesel counterparts.

Successfully developing a domestic hydrogen economy demands we figure out how to drive down the cost of technologies and create the market demand. After all, we can't begin to target a national let alone an international hydrogen export development opportunity if we can't sort out our regional costing issues.

To solve this challenge, governments are opening their wallets. Canada has an opportunity to strengthen hydrogen investments by taking a page from the US Inflation Reduction Act, which will invest US$370 billion through various financing sources and tax credits in an effort to cut 42% of emissions (based on 2005 levels).[6]

Governments must take on a starring role in de-risking hydrogen investments to provide a path for private sector funds to flow in or we risk stalling.

While provincial and federal governments are making funding commitments, the sums are not enough to drive the private sector dollars needed to develop the hydrogen ecosystem. Governments must take on a starring role in de-risking hydrogen investments to provide a path for private sector funds to flow in or we risk stalling.

Money aside, there's another major component to the hydrogen economy that needs to be unravelled if we are to realize its full potential. It is one of the biggest risks that must be addressed, by any country pursuing hydrogen: water.

[6] The White House, "*By the Numbers: The Inflation Reduction Act*," Briefing Room, August 2022.

Unravel the water puzzle

Water supply is at the very foundation of hydrogen investments. While crucial to developing a hydrogen ecosystem, it is often overlooked in the investment and regulatory conversation.

Water and the future of energy systems are intrinsically linked. Canada's ability to develop a hydrogen-based economy will depend on water management, availability, and infrastructure. While requirements differ based on the hydrogen generation method, water plays a critical role in all forms of hydrogen production. Gas-based hydrogen requires less, but electrolytic hydrogen requires approximately nine litres of water for every kilogram produced.[7]

Water resources

We have a competitive advantage when it comes to water—Canada is home to more lakes than any other country and the Great Lakes contain 18% of the world's freshwater.[8] Yet we are not immune to water stressors. There are many arid and semi-arid climates, where water supplies are not as plentiful. In some regions, such as southern Ontario, aquifers are being depleted faster than they can be replenished, adding stress on water supplies. And of course, climate change and pollution are impacting the volume and quality of freshwater supplies. Climate shifts in our atmosphere and warming temperatures will continue to place added pressure on our water resources.

Water management

The availability of water could have a significant impact on the costs, liabilities, and feasibility of developing a domestic hydrogen industry, and underscores the need for better management policies in Canada.

Sustainable water management is an issue of economic stability and security. It requires principles and partnerships to manage global supplies, including regional and federal coordination. Right now, over a dozen federal governments and agencies have some responsibility for water as part of their mandate.

Delivering on the hydrogen opportunity will require systems-based thinking, analysis, and planning to ensure we don't inadvertently go down a path with unintended consequences such as exacerbating the risk of stranded assets across sectors and industries, including hydrogen feedstocks and the production of hydrogen itself. This is especially important as hydrogen production requires freshwater, which puts added strain on global drinking water supplies.

We have a competitive advantage when it comes to water—Canada is home to more lakes than any other country and the Great Lakes contain 18% of the world's freshwater.

[7] Naomi Bergman, "*Water access for hydrogen projects: don't let your options dry up*," Allens Linklaters, October 25, 2021.
[8] Government of Canada, *Water sources: lakes*, September 2013.

Planning and building
Freshwater resources must be managed as part of planning and infrastructure buildouts, otherwise we run the risk of more droughts. The United Nations predicts a 40% drop in global water supplies by 2030 if consumption and production patterns don't change.

The successful growth of a domestic hydrogen industry will require full life-cycle planning along with infrastructure upgrades and buildouts.

As a leading tech hub, Canada can work to address some of the challenges of major capital projects through AI and other innovative solutions. This will build on our scientific knowledge of freshwater and provide insights on sustainable water management principles by having real-time data on the health and volume of our water supplies.

Part of planning availability for hydrogen production should include a look at financing wastewater research and cost reductions for desalination to help protect freshwater supplies.

The idea may appear novel but it's already underway in Australia, where a pilot project is taking wastewater from a sewage treatment plant to create hydrogen and graphite. While still in its early stages, it demonstrates an opportunity that should be evaluated if we are to seriously consider growing our domestic hydrogen industry.

As climate change shifts precipitation patterns and warming temperatures place added demand on global water supplies for cooling, it is imperative that future economic investments, including for hydrogen, put water principles and management at the front and centre.

Investing in our resource economy today will help us ensure a sustainable tomorrow.

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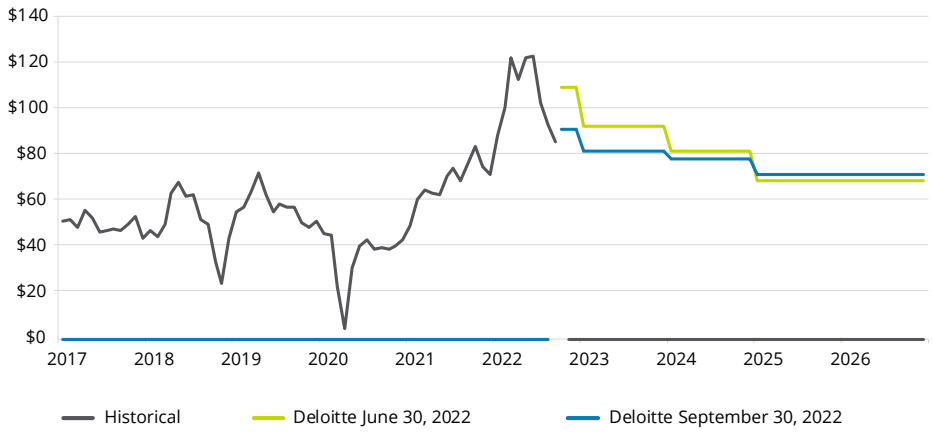
Canadian domestic price forecast

Crude oil price and market demand forecast

Hardisty WSC (real $)



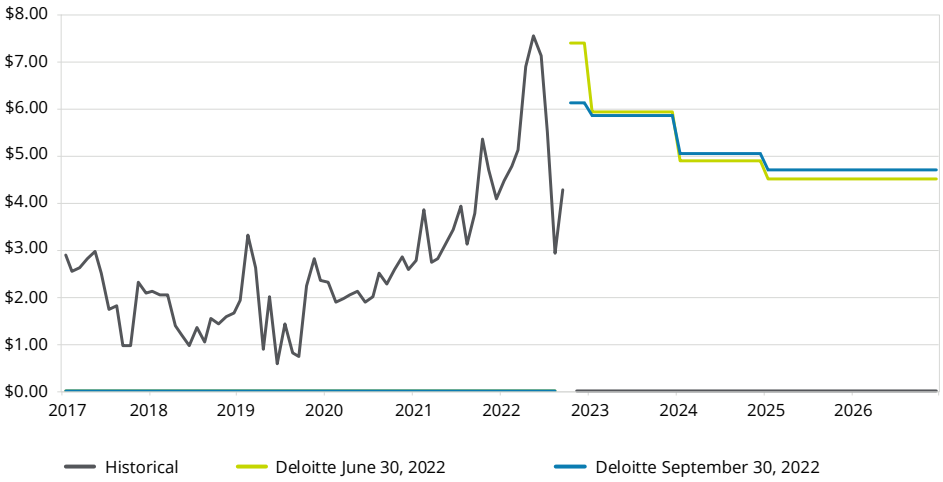
Forecast comments

WCS is forecast as a differential to WTI. This differential is based on Western Canadian Select Crude Oil Futures.

Year	WTI Cushing, OK (40 API)	WTI Cushing, OK (40 API)	Edmonton City Gate (40 API)	Edmonton City Gate (40 API)	WCS Hardisty (20.5 API)	Heavy Oil Hardisty (12 API)	Cost Inflation	CAD to USD Exchange
	US$/bbl Real	US$/bbl Current	C$/bbl Real	C$/bbl Current	C$/bbl Current	C$/bbl Current	Rate	Rate
Historical								
2019	$60.60	$56.98	$73.40	$69.02	$57.33	$55.11	1.9%	0.754
2020	$40.90	$39.23	$47.64	$45.69	$36.09	$31.48	0.7%	0.746
2021	$70.38	$67.99	$83.27	$80.44	$68.21	$63.82	3.4%	0.798
2022								
9 Mths H	$99.01	$99.01	$123.48	$123.48	$105.23	$103.13	6.7%	0.781
3 Mths F	$90.00	$90.00	$110.40	$110.40	$90.90	$86.40	0.0%	0.770
Avg.	$96.76	$96.76	$120.21	$120.21	$101.64	$98.95	-	0.778
Forecast								
2022	$90.00	$90.00	$110.40	$110.40	$90.90	$86.40	0.0%	0.770
2023	$80.00	$83.20	$97.40	$101.30	$84.40	$79.70	4.0%	0.770
2024	$75.00	$79.55	$90.90	$96.45	$82.65	$77.85	2.0%	0.770
2025	$70.00	$75.75	$84.40	$91.30	$77.30	$72.45	2.0%	0.770
2026	$70.00	$77.25	$84.40	$93.15	$78.85	$73.90	2.0%	0.770
2027	$70.00	$78.80	$84.40	$95.00	$80.45	$75.35	2.0%	0.770
2028	$70.00	$80.40	$84.40	$96.90	$82.05	$76.85	2.0%	0.770
2029	$70.00	$82.00	$84.40	$98.85	$83.70	$78.40	2.0%	0.770

Natural gas price and market demand forecast

AECO natural gas (real $)



Forecast comments

The AECO natural gas price is forecast based on historical differentials to Henry Hub and future contracts traded on the NGX based in Calgary.

Year	AB Ref. Avg. Price	AB AECO Avg. Price	AB AECO Avg. Price	BC Direct Station 2 Sales	NYMEX Henry Hub	NYMEX Henry Hub
	C$/Mcf	C$/Mcf	C$/Mcf	C$/Mcf	US$/Mcf	US$/Mcf
	Current	Real	Current	Current	Real	Current
Historical						
2019	$1.48	$1.93	$1.81	$1.02	$2.73	$2.57
2020	$2.00	$2.35	$2.25	$2.20	$2.12	$2.04
2021	$3.27	$3.77	$3.64	$3.34	$4.05	$3.91
2022						
9 Mths H	$5.02	$5.41	$5.41	$5.12	$6.78	$6.78
3 Mths F	$5.75	$6.15	$6.15	$6.00	$8.50	$8.50
Avg.	$5.20	$5.60	$5.60	$5.34	$7.21	$7.21
Forecast						
2022	$5.75	$6.15	$6.15	$6.00	$8.50	$8.50
2023	$5.65	$5.85	$6.10	$5.95	$6.25	$6.50
2024	$4.95	$5.05	$5.35	$5.20	$5.00	$5.30
2025	$4.65	$4.70	$5.10	$4.90	$4.50	$4.85
2026	$4.75	$4.70	$5.20	$5.00	$4.50	$4.95
2027	$4.85	$4.70	$5.30	$5.10	$4.50	$5.05
2028	$4.95	$4.70	$5.40	$5.20	$4.50	$5.15
2029	$5.05	$4.70	$5.50	$5.35	$4.50	$5.25

International price forecast

Crude oil price and market demand forecast

Year	Av. WTI Spot	Brent Spot (38.3 API with 0.37% sulphur content)	Gulf Coast ASCI/MARS	Avg. OPEC Basket	Nigerian Bonny Light (33.4 API FOB)	Mexico Maya (21.8 API FOB)	Russia Urals (31.7 API FOB)
	US$/bbl	US$/bbl	US$/bbl	US$/bbl	US$/bbl	US$/bbl	US$/bbl
	Current	Current	Current	Current	Current	Current	Current
Forecast							
2022	$90.00	$95.00	$87.50	$94.00	$97.00	$85.00	$70.00
2023	$83.20	$87.35	$80.60	$86.30	$88.40	$79.80	$72.80
2024	$79.55	$82.75	$76.90	$81.70	$83.80	$75.05	$74.25
2025	$75.75	$79.00	$73.05	$77.90	$80.05	$71.15	$75.75
2026	$77.25	$80.55	$74.50	$79.45	$81.65	$72.55	$77.25
2027	$78.80	$82.20	$76.00	$81.05	$83.30	$74.00	$78.80
2028	$80.40	$83.80	$77.50	$82.65	$84.95	$75.50	$80.40
2029	$82.00	$85.50	$79.05	$84.35	$86.65	$77.00	$82.00

- International crude quality reference points for OPEC Basket, Venezuelan, Nigerian, UAE, Mexican, Chinese, Russian, and Indonesian crudes are now based on Brent in US dollars. For the purposes of this forecast Brent is receiving a premium to WTI on the world markets.
- Current forecasts for other crude oil reference points are based on historical trends to the WTI price.
- Brent, United Kingdom crude, is based on 38.3°API with 0.37% Sulphur content. Brent blend is a light sweet North Sea crude oil that serves as an international benchmark grade.
- United States Gulf Coast Argus Sour Crude Index (ASCI) is a blend of offshore Gulf Coast oil from Mars, Poseidon, and Southern Green Canyon.
- OPEC Basket represents the current grouping of crude oil prices from the OPEC member countries.
- Russia Urals 31.7°API is the FOB delivered price to the Mediterranean destinations.

Natural gas price and market demand forecast

Year	USD to GBP Exchange	USD to EUR Exchange	NYMEX Henry Hub	Permian Waha	San Juan Ignacio	Rocky Mountain Opal	UK NBP	India Domestic Gas
			US$/Mcf	US$/Mcf	US$/Mcf	US$/Mcf	US$/Mcf	US$/Mcf
	Rate	Rate	Current	Current	Current	Current	Current	Current
Forecast								
2022	1.15	1.00	$8.50	$7.90	$8.10	$8.20	$53.50	$10.00
2023	1.20	1.05	$6.50	$5.90	$6.10	$6.20	$50.70	$21.70
2024	1.20	1.05	$5.30	$4.65	$4.90	$5.00	$34.50	$19.45
2025	1.20	1.05	$4.85	$4.20	$4.45	$4.55	$26.50	$13.65
2026	1.20	1.05	$4.95	$4.30	$4.50	$4.65	$18.75	$10.85
2027	1.20	1.05	$5.05	$4.40	$4.60	$4.75	$19.15	$8.40
2028	1.20	1.05	$5.15	$4.50	$4.70	$4.80	$19.50	$8.55
2029	1.20	1.05	$5.25	$4.55	$4.80	$4.90	$19.90	$8.75

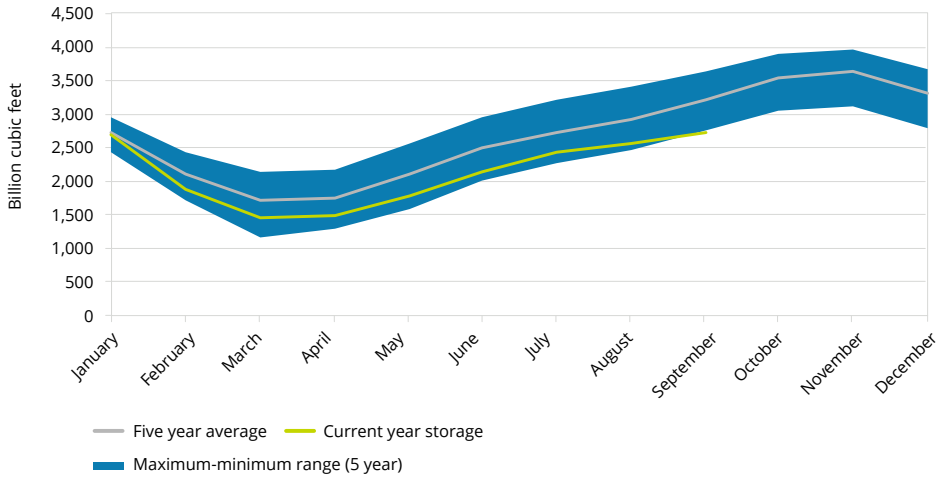
Global trends

Storage

United States

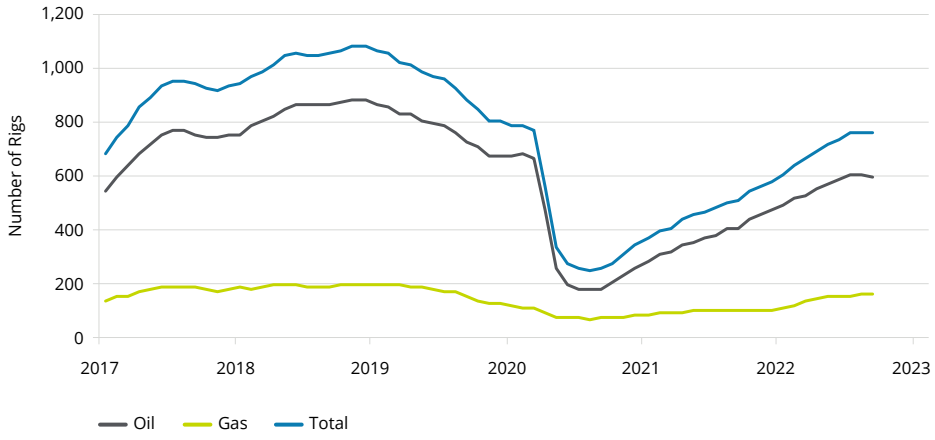
Natural gas storage in the United States continues to trend near the five-year low after the summer season.

US natural gas storage



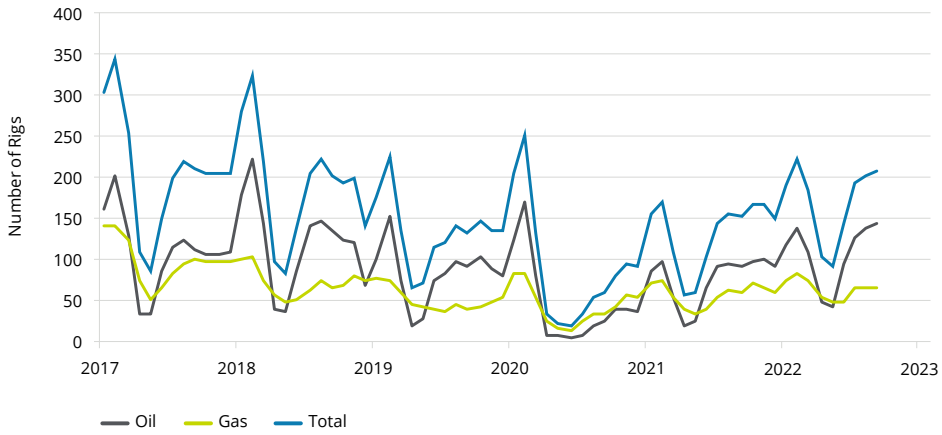
Source: Baker Hughes

US rig counts



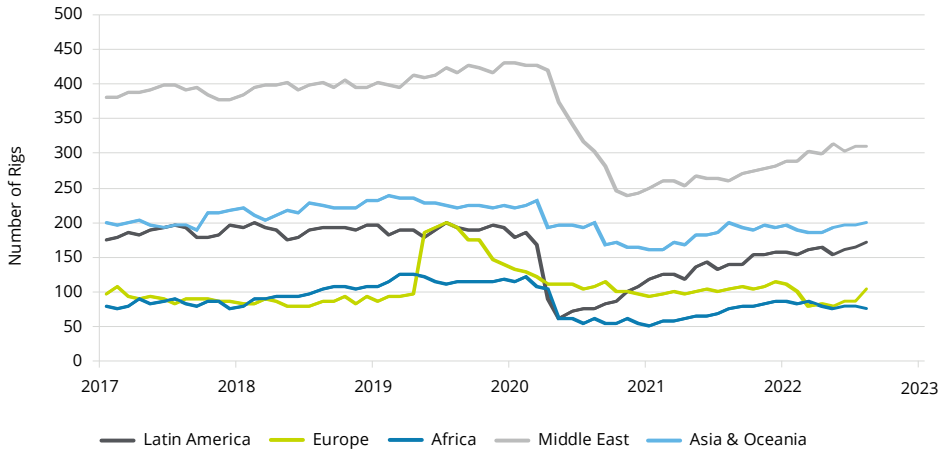
Source: Baker Hughes

Canada rig counts



Source: Baker Hughes

International rig counts



Source: Baker Hughes

Rigs

United States

Oil rig count growth has slowed along with softening prices, while the number of active gas rigs continues to increase.

Canada

Oil and gas rig counts are at a similar level to those seen in 2017 and 2018, primarily as a result of increased oil drilling. Gas drilling has not increased compared to last year as AECO prices disconnected from elevated Henry Hub prices over the summer.

International

Strength in both oil and gas markets has led to rig counts increasing across much of the globe. European rig counts dropped throughout much of 2022, largely due to sidelined rigs in Ukraine, but have recently begun to see an increase.

Canadian domestic price tables

Year	Price Inflation	Cost Inflation	CAD to USD Exchange	Crude Oil Pricing: WTI at Cushing Oklahoma	WTI at Cushing Oklahoma	Edmonton City Gate	Edmonton City Gate	WCS 20.5 Deg. API Hardisty
				US$/bbl	US$/bbl	C$/bbl	C$/bbl	C$/bbl
	Rate	Rate	Rate	Real	Current	Real	Current	Current
Historical								
2012	1.5%	1.5%	1.001	$111.59	$94.11	$102.65	$86.57	$73.10
2013	0.9%	0.9%	0.972	$114.33	$97.91	$109.02	$93.36	$74.97
2014	1.9%	1.9%	0.906	$107.88	$93.26	$108.73	$94.00	$81.06
2015	1.1%	1.1%	0.783	$55.25	$48.69	$64.68	$57.00	$44.80
2016	1.4%	1.4%	0.755	$48.42	$43.15	$58.59	$52.22	$38.90
2017	1.6%	1.6%	0.771	$56.27	$50.88	$68.69	$62.12	$49.51
2018	2.3%	2.3%	0.772	$70.66	$64.94	$75.18	$69.10	$49.89
2019	1.9%	1.9%	0.754	$60.60	$56.98	$73.40	$69.02	$57.33
2020	0.7%	0.7%	0.746	$40.90	$39.23	$47.64	$45.69	$36.09
2021	3.4%	3.4%	0.798	$70.38	$67.99	$83.27	$80.44	$68.21
2022								
9 Mths H	6.7%	6.7%	0.781	$99.01	$99.01	$123.48	$123.48	$105.23
3 Mths F	0.0%	0.0%	0.770	$90.00	$90.00	$110.40	$110.40	$90.90
Avg.	N/A	N/A	0.778	$96.76	$96.76	$120.21	$120.21	$101.64
Forecast								
2022	0.0%	0.0%	0.770	$90.00	$90.00	$110.40	$110.40	$90.90
2023	4.0%	4.0%	0.770	$80.00	$83.20	$97.40	$101.30	$84.40
2024	2.0%	2.0%	0.770	$75.00	$79.55	$90.90	$96.45	$82.65
2025	2.0%	2.0%	0.770	$70.00	$75.75	$84.40	$91.30	$77.30
2026	2.0%	2.0%	0.770	$70.00	$77.25	$84.40	$93.15	$78.85
2027	2.0%	2.0%	0.770	$70.00	$78.80	$84.40	$95.00	$80.45
2028	2.0%	2.0%	0.770	$70.00	$80.40	$84.40	$96.90	$82.05
2029	2.0%	2.0%	0.770	$70.00	$82.00	$84.40	$98.85	$83.70
2030	2.0%	2.0%	0.770	$70.00	$83.60	$84.40	$100.85	$85.35
2031	2.0%	2.0%	0.770	$70.00	$85.30	$84.40	$102.85	$87.05
2032	2.0%	2.0%	0.770	$70.00	$87.00	$84.40	$104.90	$88.80
2033	2.0%	2.0%	0.770	$70.00	$88.75	$84.40	$107.00	$90.60
2034	2.0%	2.0%	0.770	$70.00	$90.50	$84.40	$109.15	$92.40
2035	2.0%	2.0%	0.770	$70.00	$92.35	$84.40	$111.30	$94.25
2036	2.0%	2.0%	0.770	$70.00	$94.15	$84.40	$113.55	$96.15
2037	2.0%	2.0%	0.770	$70.00	$96.05	$84.40	$115.80	$98.05
2038	2.0%	2.0%	0.770	$70.00	$98.00	$84.40	$118.15	$100.00
2039	2.0%	2.0%	0.770	$70.00	$99.95	$84.40	$120.50	$102.00
2040	2.0%	2.0%	0.770	$70.00	$101.95	$84.40	$122.90	$104.05
2041	2.0%	2.0%	0.770	$70.00	$104.00	$84.40	$125.35	$106.15
2041+	2.0%	2.0%	0.770	0.0%	2.0%	0.0%	2.0%	2.0%

Notes:

- All prices are in Canadian dollars except WTI and NYMEX gas which are in U.S. dollars
- Edmonton city gate prices based on historical light oil par prices posted by the government of Alberta and Net Energy differential futures (40 Deg. API < 0.5% Sulphur)
- Real prices listed in 2022 dollars with no escalation considered

	Natural Gas Liquids Pricing Edmonton Par Prices				Natural Gas Pricing						Sulphur
Year	**Ethane**	**Propane**	**Butane**	**Pentanes + Condensate**	**Alberta Reference Avg. Price**	**Alberta AECO Avg. Price**	**Alberta AECO Avg. Price**	**B.C. Direct Stn. 2 Sales**	**NYMEX Henry Hub**	**NYMEX Henry Hub**	**Alberta Plant Gate**
	C$/bbl	C$/bbl	C$/bbl	C$/bbl	C$/mcf	C$/mcf	C$/mcf	C$/mcf	US$/Mcf	US$/Mcf	C$/lt
	Current	Current	Current	Current	Current	Real	Current	Current	Real	Current	Current
Historical											
2012	$6.73	$30.80	$75.47	$99.67	$2.25	$2.83	$2.39	$2.29	$3.26	$2.75	$126.81
2013	$8.68	$38.54	$77.44	$103.52	$2.98	$3.71	$3.17	$3.11	$4.35	$3.73	$62.17
2014	$12.46	$42.93	$59.43	$101.47	$4.22	$5.21	$4.50	$4.16	$5.08	$4.39	$88.99
2015	$7.49	$5.35	$33.70	$55.15	$2.56	$3.05	$2.69	$1.81	$2.98	$2.63	$107.45
2016	$6.04	$8.71	$31.45	$52.43	$1.93	$2.42	$2.16	$1.75	$2.82	$2.52	$45.40
2017	$6.11	$27.92	$40.98	$63.65	$2.13	$2.42	$2.19	$1.56	$3.30	$2.99	$41.85
2018	$6.90	$29.76	$46.17	$75.74	$1.36	$1.67	$1.54	$1.26	$3.45	$3.17	$89.25
2019	$5.00	$15.82	$21.40	$67.57	$1.48	$1.93	$1.81	$1.02	$2.73	$2.57	$37.54
2020	$6.20	$16.11	$20.93	$47.14	$2.00	$2.35	$2.25	$2.20	$2.12	$2.04	$2.60
2021	$10.08	$45.46	$40.28	$82.91	$3.27	$3.77	$3.64	$3.34	$4.05	$3.91	$69.73
2022											
9 Mths H	$15.06	$54.72	$66.61	$120.62	$5.02	$5.41	$5.41	$5.12	$6.78	$6.78	$166.49
3 Mths F	$17.20	$49.70	$60.70	$110.40	$5.75	$6.15	$6.15	$6.00	$8.50	$8.50	$100.00
Avg.	$15.59	$53.47	$65.13	$118.06	$5.20	$5.60	$5.60	$5.34	$7.21	$7.21	$149.87
Forecast											
2022	$17.20	$49.70	$60.70	$110.40	$5.75	$6.15	$6.15	$6.00	$8.50	$8.50	$100.00
2023	$17.05	$45.60	$55.70	$101.30	$5.65	$5.85	$6.10	$5.95	$6.25	$6.50	$104.00
2024	$15.00	$43.40	$53.05	$96.45	$4.95	$5.05	$5.35	$5.20	$5.00	$5.30	$106.10
2025	$14.25	$41.10	$50.20	$91.30	$4.65	$4.70	$5.10	$4.90	$4.50	$4.85	$108.20
2026	$14.50	$41.95	$51.20	$93.15	$4.75	$4.70	$5.20	$5.00	$4.50	$4.95	$110.35
2027	$14.80	$42.80	$52.25	$95.00	$4.85	$4.70	$5.30	$5.10	$4.50	$5.05	$112.55
2028	$15.10	$43.65	$53.30	$96.90	$4.95	$4.70	$5.40	$5.20	$4.50	$5.15	$114.80
2029	$15.40	$44.50	$54.35	$98.85	$5.05	$4.70	$5.50	$5.35	$4.50	$5.25	$117.10
2030	$15.70	$45.40	$55.45	$100.85	$5.15	$4.70	$5.60	$5.45	$4.50	$5.40	$119.45
2031	$16.00	$46.30	$56.55	$102.85	$5.25	$4.70	$5.75	$5.55	$4.50	$5.50	$121.85
2032	$16.35	$47.25	$57.65	$104.90	$5.35	$4.70	$5.85	$5.65	$4.50	$5.60	$124.30
2033	$16.65	$48.15	$58.80	$107.00	$5.45	$4.70	$5.95	$5.75	$4.50	$5.70	$126.80
2034	$17.00	$49.15	$60.00	$109.15	$5.55	$4.70	$6.10	$5.90	$4.50	$5.80	$129.30
2035	$17.35	$50.10	$61.20	$111.30	$5.65	$4.70	$6.20	$6.00	$4.50	$5.95	$131.90
2036	$17.70	$51.10	$62.40	$113.55	$5.80	$4.70	$6.30	$6.10	$4.50	$6.05	$134.55
2037	$18.05	$52.15	$63.65	$115.80	$5.90	$4.70	$6.45	$6.25	$4.50	$6.20	$137.25
2038	$18.40	$53.20	$64.95	$118.15	$6.00	$4.70	$6.60	$6.35	$4.50	$6.30	$139.95
2039	$18.75	$54.25	$66.25	$120.50	$6.15	$4.70	$6.70	$6.50	$4.50	$6.40	$142.75
2040	$19.15	$55.35	$67.55	$122.90	$6.25	$4.70	$6.85	$6.65	$4.50	$6.55	$145.65
2041	$19.55	$56.45	$68.90	$125.35	$6.40	$4.70	$7.00	$6.75	$4.50	$6.70	$148.55
2041+	2.0%	2.0%	2.0%	2.0%	2.0%	0.0%	2.0%	2.0%	0.0%	2.0%	2.0%

Notes:

- Data sources include: EIA, DOB, NRC, Flint Hills Resources, Alberta Government
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- Edmonton city gate prices based on historical light oil par prices posted by the government of Alberta and Net Energy differential futures (40 Deg. API < 0.5% Sulphur)
- Natural Gas Liquid prices are forecasted at Edmonton therefore an additional transportation cost must be included to plant gate sales point
- 1 Mcf is equivalent to 1 mmbtu
- Real prices listed in 2022 dollars with no escalation considered
- Alberta gas prices, except AECO, include an average cost of service to the plant gate
- NGL prices have been switched from a mix reference to a spec reference

Additional crude reference prices

	Crude oil pricing			Natural gas pricing
Year	Lt. Sour 35 Deg. API Cromer, SK	MSO 31 Deg. API Hardisty	Syncrude Sweet Premium 32.5 Deg. API	Ontario Dawn Reference Point
	C$/bbl	C$/bbl	C$/bbl	C$/mcf
	Current	Current	Current	Current
Historical				
2012	$84.27	$77.53		$3.11
2013	$91.76	$82.65		$4.13
2014	$92.91	$89.39		$5.76
2015	$55.46	$54.70		$3.72
2016	$51.37	$48.29		$3.46
2017	$62.06	$58.16		$3.97
2018	$73.06	$62.82		$4.07
2019	$69.68	$65.72		$3.22
2020	$45.41	$43.55	$36.18	$2.51
2021	$80.08	$76.58	$69.55	$4.55
2022				
9 Mths H	$122.15	$118.94	$133.13	$8.34
3 Mths F	$109.40	$106.40	$115.90	$10.75
Avg.	$118.96	$115.81	$128.82	$8.94
Forecast				
2022	$109.40	$106.40	$115.90	$10.75
2023	$100.25	$97.15	$105.20	$8.10
2024	$95.35	$92.20	$98.55	$6.60
2025	$90.25	$87.00	$93.55	$6.00
2026	$92.05	$88.75	$95.40	$6.15
2027	$93.90	$90.50	$97.30	$6.25
2028	$95.75	$92.30	$99.25	$6.35
2029	$97.70	$94.15	$101.25	$6.50
2030	$99.65	$96.05	$103.30	$6.65
2031	$101.65	$97.95	$105.35	$6.75
2032	$103.65	$99.95	$107.45	$6.90
2033	$105.75	$101.95	$109.60	$7.05
2034	$107.85	$103.95	$111.80	$7.20
2035	$110.00	$106.05	$114.05	$7.30
2036	$112.20	$108.15	$116.30	$7.45
2037	$114.45	$110.35	$118.65	$7.60
2038	$116.75	$112.55	$121.00	$7.75
2039	$119.05	$114.80	$123.40	$7.90
2040	$121.45	$117.10	$125.90	$8.10
2041	$123.90	$119.40	$128.40	$8.25
2041+	2.0%	2.0%	2.0%	2.0%

Notes:

- Data sources include: EIA, DOB, NRC, Flint Hills Resources, Alberta Government
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International price tables

Year	Crude Oil Pricing														
	Average WTI Spot	Alaskan North Slope	California Midway-Sunset	Louisiana Light Sweet	Gulf Coast ASCI/ MARS	Wyoming Sweet	Brent Spot	Average OPEC Basket	Venezuelan Merey	Nigerian Bonny Light	Arabia UAE Dubai Feteh	UAE Murban	Mexico Maya	Russia Urals	Indonesia Minas
	US$/bbl	US$/bbl	US$/bbl	US$/bbl	US$/bbl	US$/bbl	US$/bbl	US$/bbl	US$/bbl	US$/bbl	US$/bbl	US$/bbl	US$/bbl	US$/bbl	US$/bbl
	Current	Current	Current	Current	Current	Current	Current	Current	Current	Current	Current	Current	Current	Current	Current
Forecast															
2022	$90.00	$85.00	$89.00	$91.00	$87.50	$88.50	$95.00	$94.00	$72.00	$97.00	$91.00	$92.50	$85.00	$70.00	$90.00
2023	$83.20	$78.00	$82.15	$84.25	$80.60	$80.35	$87.35	$86.30	$67.60	$88.40	$84.75	$86.05	$79.80	$72.80	$85.00
2024	$79.55	$74.25	$78.50	$80.60	$76.90	$76.65	$82.75	$81.70	$62.60	$83.80	$80.10	$81.40	$75.05	$74.25	$80.35
2025	$75.75	$70.35	$74.65	$76.80	$73.05	$72.75	$79.00	$77.90	$58.45	$80.05	$76.30	$77.65	$71.15	$75.75	$76.55
2026	$77.25	$71.75	$76.15	$78.35	$74.50	$74.20	$80.55	$79.45	$59.60	$81.65	$77.80	$79.20	$72.55	$77.25	$78.10
2027	$78.80	$73.15	$77.70	$79.95	$76.00	$75.70	$82.20	$81.05	$60.80	$83.30	$79.35	$80.75	$74.00	$78.80	$79.65
2028	$80.40	$74.65	$79.25	$81.55	$77.50	$77.20	$83.80	$82.65	$62.00	$84.95	$80.95	$82.40	$75.50	$80.40	$81.25
2029	$82.00	$76.15	$80.80	$83.15	$79.05	$78.75	$85.50	$84.35	$63.25	$86.65	$82.55	$84.05	$77.00	$82.00	$82.85
2030	$83.60	$77.65	$82.45	$84.80	$80.65	$80.35	$87.20	$86.00	$64.50	$88.40	$84.20	$85.70	$78.55	$83.60	$84.50
2031	$85.30	$79.20	$84.10	$86.50	$82.25	$81.95	$88.95	$87.75	$65.80	$90.15	$85.90	$87.45	$80.10	$85.30	$86.20
2032	$87.00	$80.80	$85.75	$88.25	$83.90	$83.60	$90.75	$89.50	$67.10	$91.95	$87.60	$89.20	$81.70	$87.00	$87.95
2033	$88.75	$82.40	$87.50	$90.00	$85.55	$85.25	$92.55	$91.30	$68.45	$93.80	$89.40	$90.95	$83.35	$88.75	$89.70
2034	$90.50	$84.05	$89.20	$91.80	$87.30	$86.95	$94.40	$93.10	$69.85	$95.70	$91.15	$92.80	$85.00	$90.50	$91.50
2035	$92.35	$85.75	$91.00	$93.65	$89.05	$88.70	$96.30	$94.95	$71.20	$97.60	$93.00	$94.65	$86.70	$92.35	$93.30
2036	$94.15	$87.45	$92.85	$95.50	$90.80	$90.45	$98.20	$96.85	$72.65	$99.55	$94.85	$96.55	$88.45	$94.15	$95.20
2037	$96.05	$89.20	$94.70	$97.45	$92.65	$92.30	$100.15	$98.80	$74.10	$101.55	$96.75	$98.45	$90.25	$96.05	$97.10
2038	$98.00	$91.00	$96.60	$99.40	$94.50	$94.15	$102.20	$100.80	$75.60	$103.60	$98.70	$100.45	$92.05	$98.00	$99.05
2039	$99.95	$92.80	$98.50	$101.35	$96.35	$96.00	$104.20	$102.80	$77.10	$105.65	$100.65	$102.45	$93.85	$99.95	$101.00
2040	$101.95	$94.65	$100.50	$103.40	$98.30	$97.95	$106.30	$104.85	$78.65	$107.75	$102.65	$104.50	$95.75	$101.95	$103.05
2041	$104.00	$96.55	$102.50	$105.45	$100.25	$99.90	$108.45	$106.95	$80.20	$109.90	$104.70	$106.60	$97.65	$104.00	$105.10
2041+	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%

Notes:

- Data sources include: EIA, OPEC, ARC Energy, Marex Spectron.
- Venezuelan Merey replaced BCF-17 in the OPEC basket March 1, 2009.

Year	USD to GBP	USD to EUR	Natural Gas pricing					
			NYMEX Henry Hub	Permian Waha	San Juan Ignacio	Rocky Mtn. Opal	UK NBP	India Domestic Gas
	Exchange rate	Exchange rate	US$/Mcf Current	US$/Mcf Current	US$/Mcf Current	US$/Mcf Current	US$/Mcf Current	US$/Mcf Current
Forecast								
2022	1.150	1.000	$8.50	$7.90	$8.10	$8.20	$53.50	$10.00
2023	1.200	1.050	$6.50	$5.90	$6.10	$6.20	$50.70	$21.70
2024	1.200	1.050	$5.30	$4.65	$4.90	$5.00	$34.50	$19.45
2025	1.200	1.050	$4.85	$4.20	$4.45	$4.55	$26.50	$13.65
2026	1.200	1.050	$4.95	$4.30	$4.50	$4.65	$18.75	$10.85
2027	1.200	1.050	$5.05	$4.40	$4.60	$4.75	$19.15	$8.40
2028	1.200	1.050	$5.15	$4.50	$4.70	$4.80	$19.50	$8.55
2029	1.200	1.050	$5.25	$4.55	$4.80	$4.90	$19.90	$8.75
2030	1.200	1.050	$5.40	$4.65	$4.90	$5.00	$20.30	$8.90
2031	1.200	1.050	$5.50	$4.75	$5.00	$5.10	$20.70	$9.10
2032	1.200	1.050	$5.60	$4.85	$5.10	$5.20	$21.15	$9.25
2033	1.200	1.050	$5.70	$4.95	$5.20	$5.30	$21.55	$9.45
2034	1.200	1.050	$5.80	$5.05	$5.30	$5.45	$22.00	$9.65
2035	1.200	1.050	$5.95	$5.15	$5.40	$5.55	$22.40	$9.85
2036	1.200	1.050	$6.05	$5.25	$5.50	$5.65	$22.85	$10.00
2037	1.200	1.050	$6.20	$5.35	$5.65	$5.75	$23.35	$10.20
2038	1.200	1.050	$6.30	$5.45	$5.75	$5.90	$23.80	$10.45
2039	1.200	1.050	$6.40	$5.55	$5.85	$6.00	$24.25	$10.65
2040	1.200	1.050	$6.55	$5.70	$5.95	$6.10	$24.75	$10.85
2041	1.200	1.050	$6.70	$5.80	$6.10	$6.25	$25.25	$11.05
2041+	1.200	1.050	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%

Notes:

- Data sources include: EIA, OPEC, ARC Energy, Marex Spectron.
- Venezuelan Merey replaced BCF-17 in the OPEC basket March 1, 2009.

Pricing philosophy

Price forecasting takes into account many variables that can influence future prices. Our experience tells us that we must continually review the forecasting tools we use to predict where oil and gas prices are heading. However, one constant influence on oil and gas pricing is the geo-political landscape. This impact is most accurately reflected in the financial industry's futures market for commodities, a main influence when Deloitte creates its price forecast. In other words, Deloitte looks to both the futures and the past when creating forecasts.

This pricing philosophy challenges conventional thinking. The traditional view is based on the mean-reversion view of commodities presented by economists. Following this model, industry forecasts from 2000 to 2006 reflected a drop in prices over the long term from the current prices of the day – even though the futures market indicated otherwise. While the mean-reversion approach definitely has some merit, history has tended to reflect that the futures market is a more accurate barometer.

Client focus

At Deloitte, we believe it is part of our role to help our clients in both the oil and gas sector and the investment community make better long-term business decisions by providing them with the most accurate and realistic information. We understand that sound analysis of changing trends can influence decisions on mergers, acquisitions, divestitures and investments. One way we ensure our price forecasts are as accurate as possible, given the continuing impact of near-term volatility, is to review our pricing assumptions on a quarterly basis.

Our process

In preparing the price forecast, Deloitte considers the current monthly trends, the actual price and trends for the year-to-date and the prior year actual prices. The base forecast for both oil and gas is based on New York Mercantile Exchange (NYMEX) futures in US dollars.

Crude oil and natural gas forecasts are based on yearly variable factors, weighted to a higher percent for the current data and then reflect a higher percent to prior year historical data for the later years. Gas prices have been determined independently from oil prices, but still reflect the current competitive nature of the two fuels and historical oil-to-gas ratios for the latter years of the gas forecast.

We prepare our price and market forecasts based on information we collect from numerous government agencies, industry publications, oil refineries, natural gas marketers and industry trends. Inflation forecasts and exchange rates are also an integral part of the forecast.

These forecasts are Deloitte's best estimate of how the future will look, and while they are considered reasonable, changing market conditions or additional information may require alteration from the indicated effective date.

Glossary

Some of the words, phrases and acronyms we use frequently when talking about pricing are listed below:

AECO	Alberta Energy Company - historical name of a virtual trading hub on the NGX system
ANS	Alaska North Slope
ASCI	Argus Sour Crude Oil
AWB	Access Western Blend - Canadian condensate/bitumen mix
BR	Bow River Crude Oil
CAPP	Canadian Association of Petroleum Producers
CBOT	Chicago Board Of Trade
CGA	Canadian Gas Association
CME	Chicago Mercantile Exchange
DCQ	Daily Contract Quantity
DOB	Daily Oil Bulletin
EIA	Energy Information Administration
FERC	US Federal Energy Regulatory Commission
FOB	Free on Board (shipper term)
IEA	International Energy Administration
LLB	Lloydminster Blend Crude Oil
LNG	Liquefied Natural Gas
MESC	Middle East Sour Crude
MSO	Mixed Sour Crude Oil
MSW	Canadian Light Sweet
NEB	Canadian National Energy Board
NGX	Natural Gas Exchange
NIT	Nova Inventory Transfer
NRC	Natural Resources Canada
NYMEX	New York Mercantile Exchange
OECD	Organization of Economic Cooperation and Development
OPEC	Organization of Petroleum Exporting Countries
PADD	Petroleum Administration Defense District
USGC	US Gulf Coast
USWC	US West Coast
WCS	Western Canada Select Crude Oil
WTI	West Texas Intermediate
WTS	West Texas Sour

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