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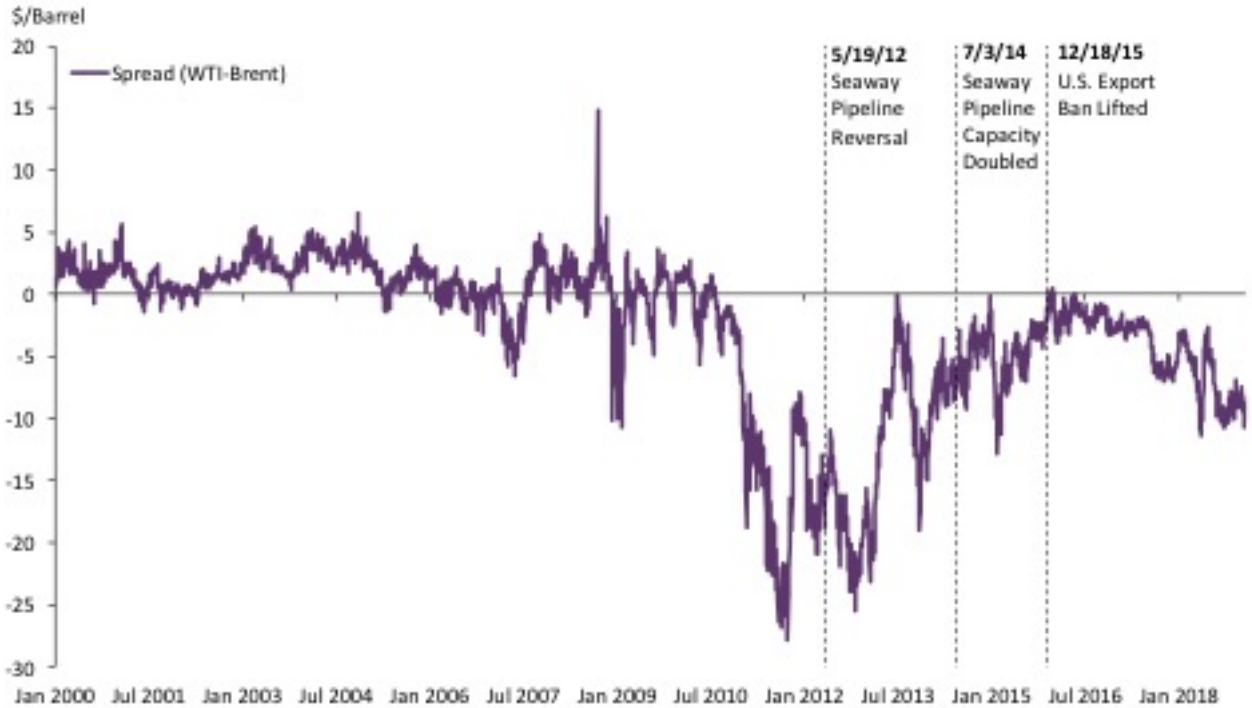
Battle of the Benchmarks: Brent Crude Oil and West Texas Intermediate

Article By:

Cornerstone Research

Brent Crude Oil (Brent) and West Texas Intermediate (WTI) are the two leading global benchmark references for crude oil prices. Historically, the two have often tracked very closely to each other, without significant price variations. The exceptions were the period between 2011 and 2015, when prices for the two diverged dramatically, and, to a lesser extent, the period since mid-2017.

Figure 1: Spread between WTI and Brent Futures Prices
1/1/2000-2/28/2019



Source: Bloomberg

Note: The spread is calculated as the price of the WTI futures contract closest to expiry minus the Brent futures contract closest to expiry. These prices are represented on Bloomberg as CL1 and CO1 respectively. CL1 trades on NYMEX and CO1 trades on ICE.

One reason for the first price divergence was the growth of U.S. crude production of WTI. Without the necessary infrastructure or regulatory certainty to facilitate crude exports from the U.S. and provide an outlet for this additional supply, WTI prices decreased relative to Brent, and trading volume in Brent futures contracts overtook WTI futures. Between 2015 and mid-2017, however, both infrastructure and regulatory changes in the U.S. led to price parity becoming the norm again.

In mid-2017, prices began to diverge a second time as increases in crude prices led to a renewal of production growth and also contributed to a destocking of U.S. crude inventory. These and other market factors have caused the battle for benchmark supremacy to heat up again. In this latest round, WTI futures volumes are overtaking Brent futures.

This article examines the evolution and relationship between these two benchmarks and what factors have impacted their prominence as a benchmark.

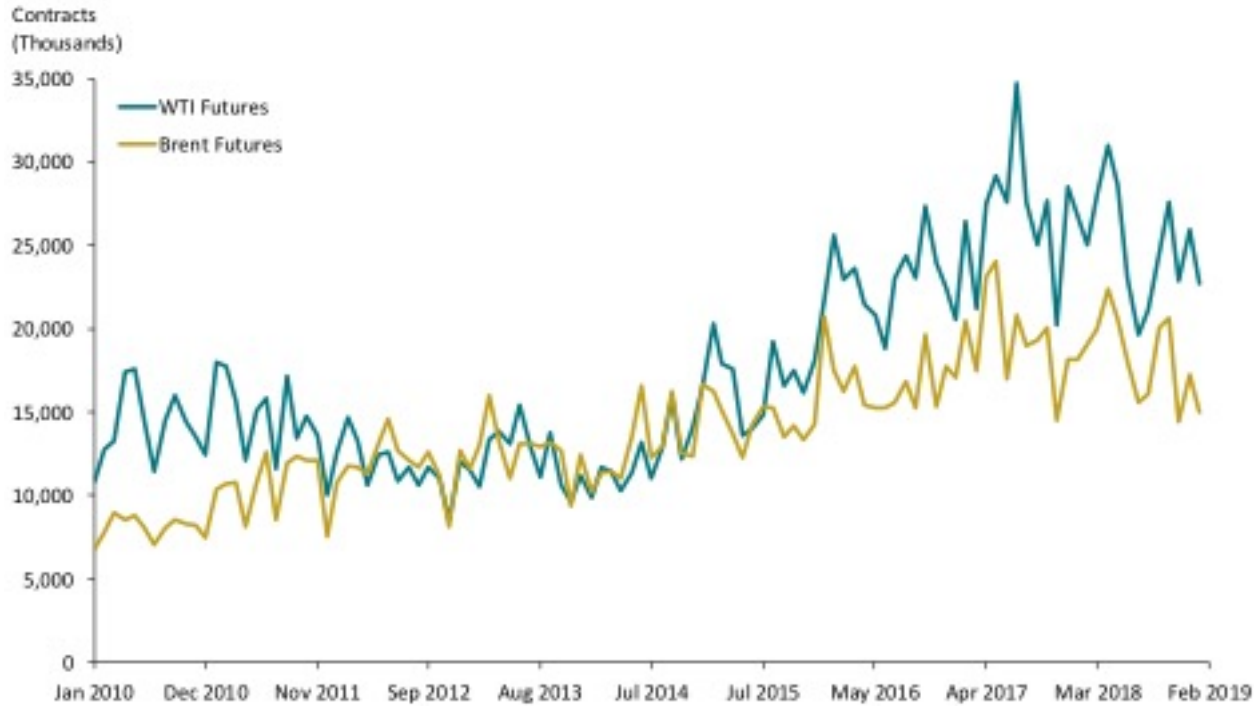
About the Benchmarks

While crude oil is not a homogeneous commodity, over time market conventions have gravitated towards the use of standardized benchmark reference rates. Each unique grade of crude is typically priced at a discount or premium relative to benchmark rates to reflect its quality, characteristics, and location. Benchmark grades tend to have certain characteristics, including large production volumes, stable market environments, and consistent quality characteristics.

Both Brent and WTI are considered higher-quality crudes relative to crude oil produced in the Middle East and Russia, and require less refining to produce useable petroleum products.[i] Both are often referred to as “light and sweet” because of their high quality.[ii]

Their futures trading volumes have grown substantially over time, averaging more than eight times the volume in 2018 than in 2000. This increase is often explained by price volatility, the use of commodities as inflation protection, and an expansion of tradable products to better meet the needs of market participants.[iii]

Figure 2: Monthly Volume Comparison of ICE Brent and CME WTI Futures
1/1/2010-2/28/2019



Source: Bloomberg

Note: The aggregate future volume is the sum of the volumes of all maturities of ICE Brent and CME WTI futures. All futures volumes are aggregated on a monthly basis.

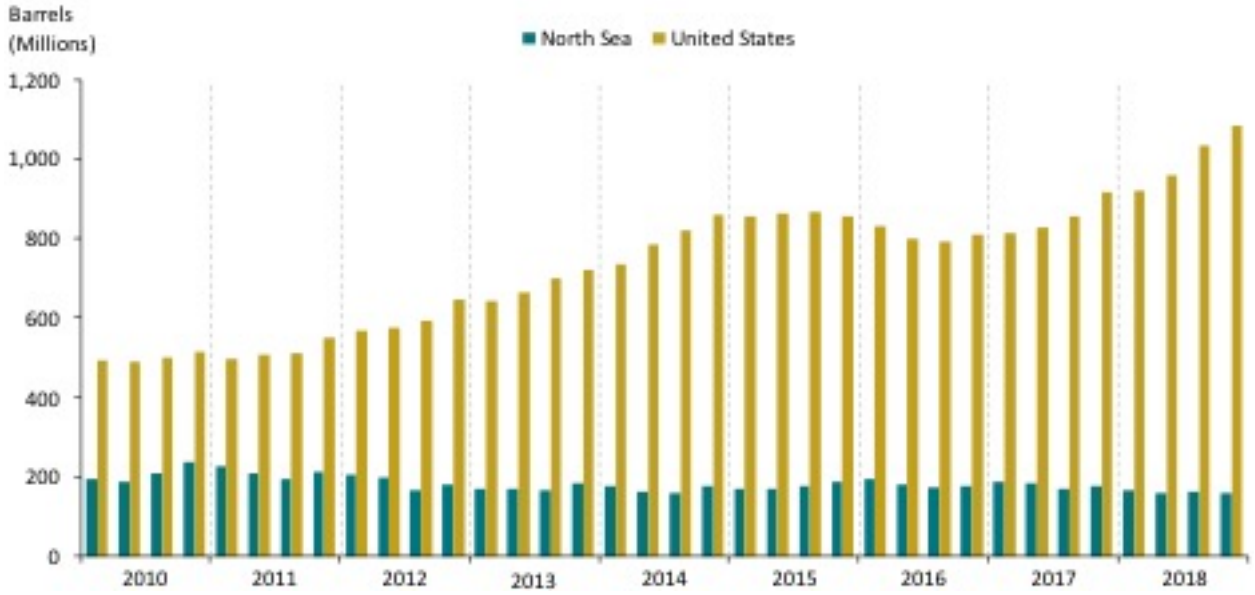
These benchmarks, however, are distinct in many ways. Brent, a European crude benchmark, is based on production from multiple oilfields in the North Sea. WTI is a U.S. crude benchmark that reflects the land-based crude oil stored in Cushing, Oklahoma.

In addition, while both Brent and WTI have developed futures markets with high volumes and many participants, Brent trades mainly on the Intercontinental Exchange (ICE) and WTI trades mainly on the CME Group (CME).

Surge of U.S. Crude Gives Brent the Edge

Between 2010 and 2018, extraction from shale reserves almost doubled the overall production of crude oil in the U.S. This growth was driven by new technological advancements that enabled horizontal drilling and fracking, coupled with historically high crude prices that led to massive infrastructure investments. Most of the new production came from PADD 3, comprising states in the Gulf Coast (see Appendices A and B). Expanded production resulted in increased supply and inventory of domestic oil in Cushing, Oklahoma, the main storage and pipeline hub for U.S. crude.

Figure 3: Total Quarterly Production of Crude Oil in North Sea and United States[iv]
Q1 2010-Q4 2018



Source: Dow Jones; Reuters News; U.S. Energy Information Administration

Note: The Seaway pipeline began pumping oil from Cushing, Oklahoma, to Houston, Texas, from May 19, 2012, to reverse the direction of the oil flow. The reversed service line had an initial capacity of 150,000 bpd and increased to 400,000 bpd in January 2013 and 850,000 bpd in July 2014.

Until 2010, WTI generally traded at a small premium over Brent, due in part to its lighter and sweeter characteristics. Given the increasing supply of U.S. crude, however, WTI prices declined relative to Brent, reaching a discount of more than $27 in October 2011.

WTI Catches Up

Two significant events helped to reverse the price disparity between WTI and Brent. The first was an investment in infrastructure to bring the oil to market.

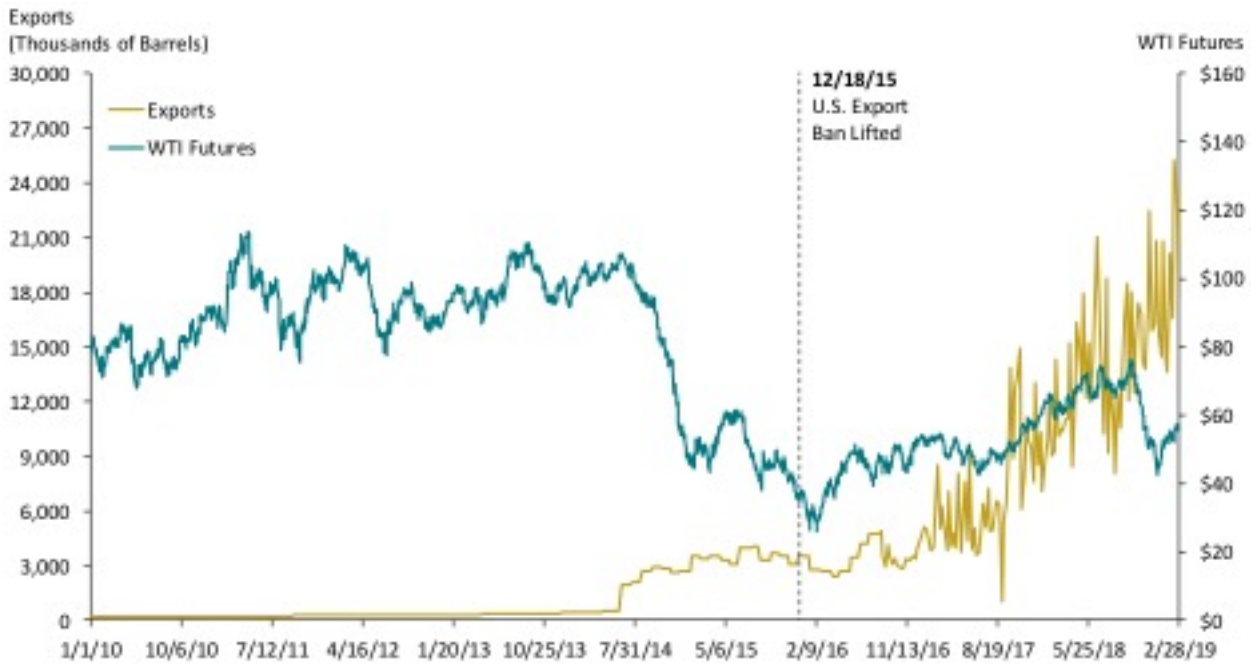
Cushing, Oklahoma, is landlocked and inaccessible by tanker or barge, and pipelines are key to moving crude. When U.S. crude oil production increased rapidly, the existing pipeline was positioned to pipe crude *into*, but not out of, Cushing. In May 2012, Seaway Crude Pipeline Company LLC reversed the flow of the Seaway pipeline in order to pipe crude from Cushing to the Gulf Coast. When it reached full capacity in January 2013, the Seaway pipeline began moving about 400,000 bpd of crude oil to Texas. A twin (loop) of the pipeline, designed to run parallel to the existing line, was built and doubled the transportation capacity of crude oil to 850,000 bpd starting in July 2014.[v] An additional 100,000 bpd expansion is scheduled to come online in the first half of 2019.[vi]

The second event was a change in trade policy by the federal government. Traditionally, the U.S. government has tightly controlled oil exports. In fact, for 40 years, it had enforced a ban on exporting crude oil, allowing only minor exceptions such as oil shipped through the Trans-Alaska Pipeline, heavy oil from certain fields in California, and some small trades with Mexico.[vii]

At the end of 2015, the government lifted the ban on exporting crude oil from the continental U.S. Crude oil no longer had to be refined or lightly refined before exporting.[viii] Since the repeal of the ban, crude oil exports have risen, prompted by the increase in oil prices and by OPEC’s drive to cut production.[ix]

Figure 4: Weekly Levels of U.S. Crude Oil

1/1/2010-2/28/2019



Source: U.S. Energy Information Administration; Bloomberg

Note:

1. In the past, the U.S. Commerce Department had given export licenses for particular types of oil. Crude from Alaska's Cook Inlet, oil passing through the Trans-Alaska Pipeline, oil shipped north for Canadian consumption, heavy oil from particular fields in California, some small trades with Mexico, and some exceptions for re-exporting foreign oil made up those exports.

2. The WTI futures is the price of the futures contract on WTI traded on CME closest to expiry (front month) on any given day. The Bloomberg ticker for this is CL1.

Another factor that expanded trading options for physical oil traders was the widening of the Panama Canal in mid-2016. The locks in the canal were widened to 180 feet from 109 feet and became accessible to new, larger ships called New Panamax that can carry more than twice as much cargo as previous ships crossing the canal (see Appendix C).[x] The waterway shrinks distances between refineries situated along the Gulf of Mexico and Asia to 9,000 miles from 16,000 miles, allowing U.S. producers to better compete in one of the world's biggest oil-consuming markets.

On a global scale, the U.S. produces about 10 percent of the world's crude oil, and exports less than 15 percent of its total production, making up less than 2 percent of global volumes.[xi] As of late January 2019, U.S. output had surpassed daily production in Russia and Saudi Arabia, making the U.S. the world's leading oil producer. Although the U.S. export volumes may be small, they are important because they represent additional market options for the increasing production in the U.S., and U.S. production is able to quickly respond to global market factors and supply the marginal crude oil necessary to fill temporary fluctuations in demand.[xii]

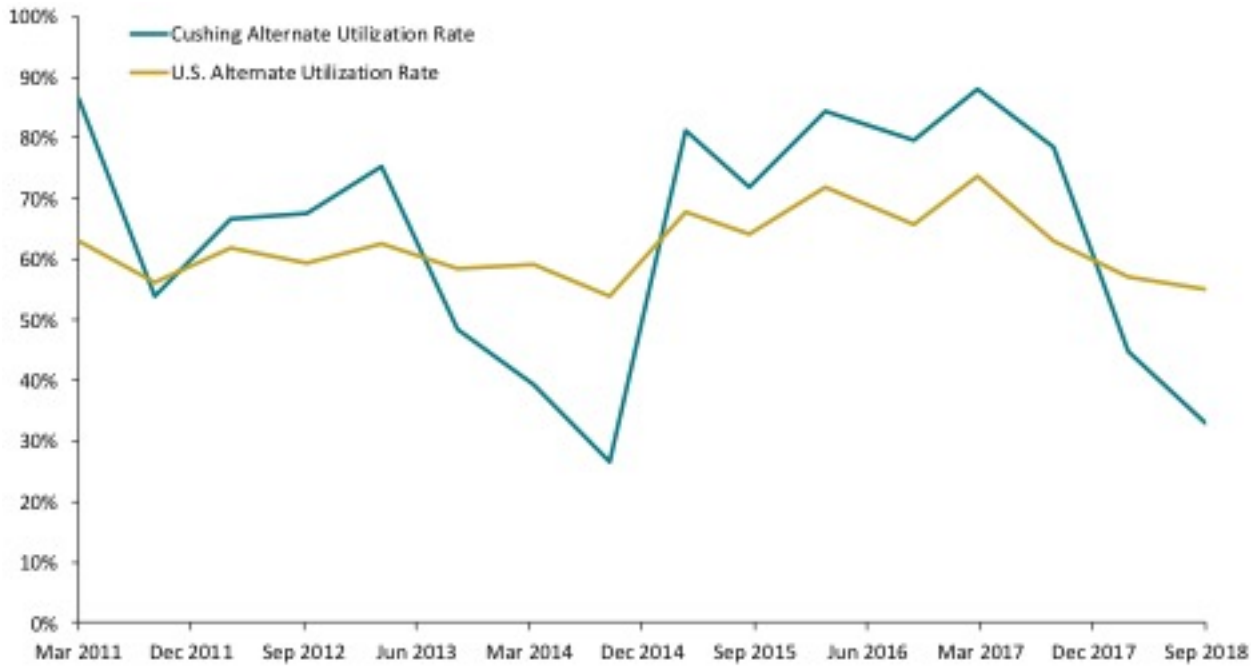
With WTI's improved access to the Gulf Coast and with the export ban lifted, U.S. crude producers and exporters have more options regarding where and to whom to sell the crude.

New Supply Resumes Downward Price Pressure

Since mid-2017, the U.S. crude oil industry has witnessed a renewal in production growth. Production in Q4 2018 was 30 percent higher than Q2 2017 (see Figure 3). This growth was largely driven by an increase in crude oil prices from a range of $25-$55 a barrel between 2016 and H1 2017, to $60-$75 a barrel between the beginning of 2018 and the end of Q3 2018.

Additionally, as prices rose, crude oil kept in storage during the period of lower prices was destocked. In other words, it was no longer profitable to store oil because current prices exceeded the cost of storage and anticipated future prices. For a time, the futures forward curve shifted from contango to backwardation.[xiii]

Figure 5: Storage Capacity Utilization of U.S. Crude Oil
3/2011-9/2018



Source: U.S. Energy Information Administration

Note: Alternate Utilization Rate measures crude oil stores in tanks as well as crude oil in pipelines and in transit by rail in proportion to the sum of the tanks' working storage capacity and stocks in transit.

These factors contributed to WTI prices decreasing relative to Brent prices and, as of early 2019, WTI was trading at close to a $10 discount to Brent. Interestingly, unlike the prior divergence in prices, growth in the trading of the WTI futures contract has outpaced that of Brent futures contracts (see Figure 2).

Figure 6: WTI and Brent Futures Prices
1/1/2003-2/28/2019

Source: Bloomberg

Note:

1. The WTI futures contract is the price of the futures contract on WTI traded on NYMEX closest to expiry (front month) on any given day. The Brent futures contract is the price of the (front month) futures contract on Brent traded on ICE closest to expiry on any given day. The Bloomberg tickers for these are CL1 and CO1 respectively.

2. The Seaway pipeline began pumping oil from Cushing, Oklahoma, to Houston, Texas, on May 19, 2012, to reverse the direction of the oil flow. The reversed service line had an initial capacity of 150,000 bpd and increased to 400,000 bpd in January 2013 and 850,000 bpd in July 2014.

Brent Crude Loses Steam

At the same time that U.S. crude production was booming, and trade policy was becoming less restrictive, production at the original oil fields that comprise Brent was steadily declining, including at the eponymous Brent oilfield (see Figure 3).

As production decreased, the composition of the benchmark changed with the gradual addition of new oil fields. These oilfields include Forties and Oseberg (added in 2002) and Ekofisk (added in 2007). Brent's production base is thus referred to by the acronym of the four crude oil streams: BFOE. A fifth stream, Troll, was added in 2018, referred to as BFOE-T.[xiv]

The addition of Troll was an attempt to maintain a robust production base to support the Brent benchmark. In late 2018, S&P Global Platts (Platts) initiated an industry consultation on whether to make two additional changes to the benchmark. The first is to add Rotterdam cost-and-freight price (CIF) for the North Sea grades, which would likely double the volume of crude underlining the benchmark. The second is to include Russian, Central Asian, West African, or U.S. shale field crude in the Brent benchmark.[xv]

As each new field is added, the quality of oil and the ownership structure of what is considered Brent crude oil changes slightly (see Appendix D). The original Brent field oil has an API gravity of 37.5 degrees and a sulfur content of 0.4 percent, making it light and sweet.[xvi] However, the addition of the

Forties field, which cannot be considered sweet as it exhibits sulfur content as high as 0.82 percent, has changed the oil quality of the benchmark.[xvii] Additionally, the Troll oil field has an API gravity of 35.9 degrees, too low to be considered light.[xviii]

Figure 7: Quality, Ownership, and Monthly Flow of Oil Fields Related to Brent Crude

Field	Quality	Ownership Partners	Monthly Flow as of March 2019 (in '000 Barrels)	Year Added to the Brent Benchmark
Brent	Light, Sweet	Shell 50.00% ExxonMobil 50.00%	2,400	1975
Forties/Buzzard	Light, Not Sweet	*Forties:* Apache 97.14% ExxonMobil 2.61% Shell 0.25% *Buzzard:* Nexen 43.21% Suncor 29.89% Chrysaor 21.73% Dyas: 4.70% Oranje-Nassau Energy: 0.46%	11,400	2002
Oseberg	Light, Sweet	Equinor 49.30% Petoro 33.60% Total 14.70% ConocoPhillips 2.40%	3,600	2002
Ekofisk	Light, Sweet	Total 39.90% ConocoPhillips 35.11% Vår 12.39% Equinor 7.60% Petoro 5.00%	6,600	2007
Troll	Not Light, Sweet	Petoro 56.00% Equinor 30.58% Shell 8.10% Total 3.69% ConocoPhillips 1.62%	5,400	2018

Source: Thomson Reuters Monthly Production Data; https://www.cmegroup.com/rulebook/NYMEX/; https://www.platts.com/IM.Platts.Content/MethodologyReferences/MethodologySpecs/Crude-oil-methodology.pdf; http://factpages.npd.no/factpages/; http://www.offshore-technology.com/projects/brentfieldnorthseaun/; https://www.offshore-technology.com/projects/forties-oil-field-north-sea/; http://www.nexencnoocltd.com/en/Operations/Conventional/UKNorthSea/Buzzard.aspx; http://www.offshore-technology.com/projects/forties-oilfield-a-

timeline/; https://www.ineos.com/businesses/ineos-fps/business/forties-blend-quality/; http://www.reuters.com/article/us-oil-platts-idUSKBN13R1PH; https://www.offshore-technology.com/projects/buzzard/; https://www.norskpetroleum.no/en/facts/field/oseberg/; http://www.conocophillips.no/our-norway-operations/greater-ekofisk-area/; https://www.offshore-technology.com/projects/troll-phase-three-development-north-sea/

Note:

1. Crude oil is considered “light” if it has an API gravity of between 37 and 42 degrees. Crude oil is considered “sweet” if it is low in sulfur content (