# 2019 Global Energy Primer

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# Credit Suisse Global Energy Team

## Call Us Anywhere: We Can Help



# Credit Suisse Global Energy Events in 2019

- **February 10-13** 24th Annual Vail Energy Summit – Vail, CO
- **March 7** 2nd Annual Mini LNG Conference – NYC
- **March 25-28** Asian Investment Conference – Hong Kong
- **April 18** Energy Primer Day – NYC
- **May 6** 27th Annual Offshore Technology Conference and Tour – Houston, TX
- **May 8-9** Midstream & Utility 1x1 Conference – NYC
- **June 18-19** Annual Australian Energy Conference
- **June 5** Global Energy Conference – London
- **September 24-26** Houston Bus Tour – Houston, TX
- **October** Calgary Bus Tour – Calgary, Canada
- **November 4-6** China Investment Conference – Shenzhen, China
- **November** Latin America Oil & Gas Trip – Argentina and Brazil

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# Oil & US Natural Gas

**April 2019**


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# Crude Oil

# What Is Crude Oil?

- **Crude oil** is a mixture of hydrocarbons created from plant and animal remains over millions of years as a result of extreme pressure and temperatures.

- Crude oil is **processed by refiners** into a wide array of petroleum products, principally used in transportation, power generation, heating and as a chemical feed.

- In the United States, companies produce crude oil from wells drilled on **private leases** and **public lands** as well as from **offshore deposits**. Internationally, crude oil is supplied by a mix of International oil companies (**IOCs**) and National oil companies (**NOCs**).

- Crude oil ranges from almost clear, water-like fluids to black viscous semi-solids. These can be categorized into various **API degrees of gravity**. The higher the API gravity, the lighter the crude. Crude oils with higher API gravity typically yield greater proportions of lighter petroleum products like gasoline. Crude oils with higher than average **sulfur content** are known as "sour." Those with low sulfur levels are called "sweet."

- As oil is easily transportable and storable, the **market for crude and petroleum products** is global in nature. Market prices for raw crude oil are set at regional benchmarks, and typically trade at varying spreads to one another - local supply/demand dynamics, relative product quality and carrying/storage costs among several other factors. The most commonly quoted global benchmarks are **Brent** (North Sea UK) and West Texas Intermediate (**WTI**) in the US, both of which trade on futures exchanges.

- The Organization of Petroleum Exporting Countries ("**OPEC**") is a group of 14 oil-producing nations which control an estimated ~72% of global oil reserves (according to the BP Statistical Review) and are currently supplying ~36% of global oil (crude and liquids) production. OPEC historically served as the "swing" producer in the global market, altering production levels in order to keep supply/demand levels in balance and support price stability. However, the group temporarily abandoned this role in late 2014, partly in response to the rise of US shale/tight oil production, prompting the subsequent collapse in oil prices. It has resumed the swing supplier role again with its recent coordination with 10 non-OPEC members to reduce supply by 1.2 MMBbld, enabling a reduction in OECD inventories and the rally in oil prices YTD.

# Oil Price Macro View

- **We forecast 2019, 2020, and long-term WTI oil prices of $57.50/Bbl, $57/Bbl, and $60/Bbl, respectively; we model a longer-term WTI-Brent differential of $10/Bbl**

- **2019-20 supply and demand assumptions**
  - Forecast demand growth of ~1.2 MMBbld YoY in 2019 and ~1.3 MMBbld YoY in 2020, in line with 2018 albeit slower than the 1.5-1.7 YoY growth in 2016-17.
  - Modeling non-OPEC supply growth of ~1.7 MMBbld in 2019 and ~2.5 MMBbld in 2020, driven primarily by the US.
  - Following a ~0.8 MMBbld increase in 2018, we estimate global oil inventories draw ~0.3 MMBbld in 2019 leaving OECD inventories ~100 MMBbls below the 5-year average at YE19 (vs. 50 MMBbls above the 5-year average at YE18).

- **Long-term normalized oil price assumptions**
  - Given our assumption that the market needs non-OPEC production (excluding the US and FSU) to remain flat over the longer-term to maintain a balanced market, we believe a higher Brent/WTI price of $70/$60 per Bbl is required to incentivize a pick-up in major capital project sanctions necessary to offset base depletion.

- **Risks to Forecasts**
  - Global economic growth, OPEC+ production response to global balances, impact of Iran sanctions, geopolitical, correlation to the US dollar, speculative positioning, and threat of renewables to longer-term demand growth

# Credit Suisse Crude Oil Price Forecast

- **We forecast 2019, 2020, and 2021+/long-term WTI oil prices of $57.50/Bbl, $57/Bbl, and $60/Bbl, respectively.** As the market is near balance, our 2019 WTI/Brent price forecasts is slightly below the current 2019 futures strip prices.
- **Following a ~0.8 MMBbld increase in 2018, we estimate global oil inventories draw ~0.3 MMBbld in 2019,** leaving OECD inventories ~100 MMBbls below the 5-year average at YE19 (vs. 50 MMBbls above the 5-year average at YE18).
- **Our 2019 supply assumptions assume:** 1) US crude/liquids growth of 1.5/1.8 MMBbld, 2) OPEC+ adds back 0.3 MMBbld in 2H19 to offset declining output in Venezuela and Iran, 3) Iranian exports average ~1.2 MMBbld less than April 2018 (before the US exited the nuclear deal and decided to snapback sanctions on Iranian exports), and 4) Venezuela crude production nearly halves to ~600 MMBbld by YE19 from ~1.2 MMBbld in December 2018.

## Credit Suisse WTI and Brent Oil Price Forecast Versus the Futures Strip and Consensus

| WTI ($/Bbl) | 2016A | 2017A | 2018A | 1Q19A | 2Q19E | 3Q19E | 4Q19E | 2019E | 2020E | 2021E | 2022E |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **CS Forecast** | **$43.35** | **$50.87** | **$64.97** | **$54.87** | **$57.00** | **$59.00** | **$59.00** | **$57.50** | **$57.00** | **$60.00** | **$60.00** |
| Bloomberg Consensus | | | | | $60.00 | $63.00 | $63.00 | $60.30 | $65.30 | $63.60 | $64.50 |
| NYMEX Futures Strip | | | | | $63.85 | $63.58 | $62.74 | $61.99 | $60.23 | $57.03 | $54.97 |
| *CS vs. Consensus* | | | | | *-5.0%* | *-6.3%* | *-6.3%* | *-4.6%* | *-12.7%* | *-5.7%* | *-7.0%* |
| *CS vs. NYMEX Strip* | | | | | *-10.7%* | *-7.2%* | *-6.0%* | *-7.2%* | *-5.4%* | *5.2%* | *9.2%* |

| Brent ($/Bbl) | 2016A | 2017A | 2018A | 1Q19A | 2Q19E | 3Q19E | 4Q19E | 2019E | 2020E | 2021E | 2022E |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **CS Forecast** | **$45.56** | **$54.87** | **$71.18** | **$63.27** | **$67.00** | **$67.00** | **$69.00** | **$66.60** | **$67.00** | **$70.00** | **$70.00** |
| Bloomberg Consensus | | | | | $68.00 | $70.00 | $70.00 | $68.25 | $70.00 | $68.94 | $68.78 |
| ICE Futures Strip | | | | | $70.43 | $69.40 | $68.53 | $68.47 | $66.55 | $63.76 | $61.89 |
| *CS vs. Consensus* | | | | | *-1.5%* | *-4.3%* | *-1.4%* | *-2.4%* | *-4.3%* | *1.5%* | *1.8%* |
| *CS vs. NYMEX Strip* | | | | | *-4.9%* | *-3.5%* | *0.7%* | *-2.7%* | *0.7%* | *9.8%* | *13.1%* |

Source: NYMEX, the BLOOMBERG PROFESSIONAL™ service, company documents and Credit Suisse estimates.

# Key Global Oil Price Considerations

## 2019-20 Supply/Demand Assumptions

- **We forecast global demand growth of ~1.2 MMBbld in 2019 and ~1.3 MMBbld in 2020 to 100.4 and 101.8 MMBbld, respectively,** in line with the 1.3 MMBBld growth in 2018 albeit slower than the 1.5-1.7 YoY growth in 2016-17. Our forecasts are predicated on global GDP growth of 2.8% and 2.9% in 2019 and 2020, respectively.
  - **Non-OECD driving bulk of demand growth remains robust.** We forecast non-OECD demand growth in 2019-20 of ~1.1 MMBbld per annum, in line with the pace of 2014-18.
  - **OECD demand growth tempered by slowing economy.** We forecast 2019-20 YoY growth slowing to ~0.1-0.2 MMBbld per annum from ~0.3-0.4 MMBbld in 2017-18.
  - **2019 demand forecast modestly below consensus.** Our 2019 demand growth forecast of ~1.2 MMBbld is at the low end of the ~1.2-1.4 MMBbld range of forecasts from the IEA, EIA, and OPEC.
- **2019-20 supply growth driven by the US.**
  - **Robust US oil production**. We forecast 2019 crude oil production growth of ~1.5 MMBbld with NGLs contributing another ~0.3 MMBbld of liquids growth in 2019. For 2020, we forecast US oil growth of ~1.1 MMBbld and ~0.4 MMBbld of NGL growth.
  - **We forecast OPEC crude production will average 30.4 MMBbld and 30.0 MMBbld in 2019-20, respectively.**
- **Inventories near the five-year average.** OECD commercial stocks stood at 2,871 MMBbls at the end of February, <1% (or ~15 MMBbls) above the 5-year average.
  - **We estimate global oil inventories *draw* ~0.3 MMBbld in 2019,** compared to ~0.8 MMBbld *build* in 2018. We expect global balances to further tighten from a ~0.1 MMBbld draw in 1Q to ~0.5 MMBbld in 2Q before moderating to a ~0.3 MMBbld draw in 2H19. This should result in OECD stocks exiting 2019 ~80/100 MMBbls below year-ago/5-year average levels.
  - **On a days cover basis,** we estimate OECD inventories have declined from >65 days in early 2016 to ~60 days at the end of 2017 and has since remained around that level, with February 2019 level of 60.7 modestly below the five-year average of ~62 days.

# Key Global Oil Price Considerations

## Long-Term Normalized Price Assumptions

- **We forecast mid-cycle Brent/WTI oil prices of ~$70/$60 per Bbl**. Given our assumption that the market needs non-OPEC production (excluding the US and FSU) to remain flat over the longer-term to maintain a balanced market, we believe the higher Brent/WTI prices of $70/$60 per Bbl will be required to incentivize a pick-up in major capital project sanctions necessary to offset base depletion.

## Risks to Our View

- **Global economic growth**. Oil prices have benefited from demand growth near 1.5 MMBbld YoY in four of the past five years. Our 2019-20 oil demand forecasts assume slowing global GDP growth of 2.8% and 2.9%, respectively. The historical correlation between oil demand growth and global GDP shows that a 1% increase in global economic growth should translate to 0.5% of oil demand growth; thus, any material swing in GDP could swing demand growth at the precarious time that the market is approaching balance.

- **OPEC + Russia production response to global balances**. OPEC and ten allied non-OPEC oil producing countries led by Russia agreed in early December to cut crude output by 1.2 MMBbld from October 2018 levels. OPEC crude production declined by ~2.3 MMBbld from October to March, while Russia expects to achieve compliance level of a 230 MBbld cut in April. We believe the market is pricing in the likelihood that the OPEC+ supply agreement will be extended through year-end, so any news on the contrary would likely cause profit taking in the oil markets.

- **Impact of Iran sanctions.** When US/UN/EU multilateral sanctions were lifted in 2015, Iran was able to increase production by 1.1 MMBbld as it gained access to new export markets. The re-imposition of unilateral US sanctions adds several layers of uncertainties: 1) while US waivers on Iranian exports have resulted in less than expected Iranian oil coming off the market (production has declined ~1.1 MMBbld since May 2018 when the US decided to re-impose sanctions), as Iran sanctions waivers expire at the beginning of May, the pending US decision on renewal of waivers will also have a meaningful (likely tightening) impact on the market balances; and 2) angered by Saudi gaining market share, Iran has made threats to close the Strait of Hormuz where 17 MMBbld traverses daily (we would view a blockade as unlikely).

- **Geopolitical risk**. With OPEC spare capacity of just ~3.3 MMBbld of crude (or ~3% of global demand) in March, any geopolitical events that disrupt supply have the potential to drive up near-term oil prices. Geopolitical hotspots to monitor include **Libya** (currently producing ~1.1 MMBbld, up from <400 MBbld in 1H16 but at risk to disruptions from security breaches and the ongoing civil war), **Nigeria** (currently producing ~1.7 MMBbld, up from ~1.2 MMBbld in 3Q16 but also at risk from militant attacks), and **Venezuela** (at ~0.7 MMBbld, down >700 MBbld YoY and at risk of continued steep declines given the Venezuelan financial crisis). Of course, the greatest risk to supply is in the Middle East where escalating tensions between Iran and Saudi Arabia could potentially disrupt portions of their combined ~13 MMBbld of production.

- **Correlation to the US dollar**. As crude oil trades are transacted in US dollars, a strong upward move in the dollar reduces non-US countries purchasing power, thereby potentially hurting crude demand and prices. While the correlation has lessened over the last few years, the recent strength in the US dollar and weakening of emerging market currencies has heightened concerns regarding the potential adverse impact on global demand for crude oil.

- **Speculative positioning**. After surging to a record high of 496,111 contracts in January 2018, WTI net long position for managed money dropped to a 3-year low of 81,512 contracts at the beginning of 2019, helping to fuel the plunge in crude prices. This has since recovered to 275,529 contracts as of mid-April (above the five-year average of ~240,000), helping to drive the recovery in oil prices.

- **Threat of renewables to longer-term demand growth**. With seemingly new headlines daily about the rapid shift to electric vehicles (EVs), we want to highlight our expectation of rapid growth in EVs. However, this growth is off such a low base that the impact on medium-term oil demand is de minimus. Passenger vehicle demand represents ~19% of global oil demand and battery-operated EVs (BEVs) represent just 0.1% of the global passenger vehicle fleet today. Assuming sales of BEVs booms from 0.5MM units in 2017 to 5.5MM units in 2025 to 33MM units in 2040, BEVs will only be 2% and 15% of the global passenger vehicle fleet in 2025 and 2040, respectively. This implies global gasoline consumption would lose just ~500 MBbld of demand versus a case of no incremental market penetration from EVs.

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# Global Supply/Demand Forecast

| Demand (MMBbld) | 2016 | 2017 | Q1-'18 | Q2-'18 | Q3-'18 | Q4-'18 | 2018 | Q1-'19 | Q2-'19 | Q3-'19 | Q4-'19 | 2019 | 2020 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Global** | **96.4** | **97.9** | **98.5** | **98.8** | **99.9** | **99.6** | **99.2** | **99.5** | **100.2** | **101.0** | **101.0** | **100.4** | **101.8** |
| YoY | 1.7 | 1.5 | 1.9 | 0.7 | 1.5 | 0.9 | 1.3 | 1.0 | 1.4 | 1.1 | 1.5 | 1.2 | 1.3 |
| YoY (%) | 1.8% | 1.5% | 2.0% | 0.7% | 1.5% | 0.9% | 1.3% | 1.0% | 1.4% | 1.1% | 1.5% | 1.2% | 1.3% |
| **OECD** | **47.0** | **47.4** | **47.9** | **47.2** | **48.1** | **47.8** | **47.7** | **47.7** | **47.4** | **48.1** | **48.0** | **47.8** | **48.0** |
| YoY | 0.4 | 0.4 | 0.9 | 0.2 | 0.5 | (0.3) | 0.3 | (0.1) | 0.2 | 0.0 | 0.2 | 0.1 | 0.2 |
| YoY (%) | 1.0% | 0.9% | 2.0% | 0.3% | 1.0% | -0.6% | 0.7% | -0.3% | 0.5% | 0.0% | 0.5% | 0.2% | 0.5% |
| **Non-OECD** | **49.5** | **50.5** | **50.6** | **51.6** | **51.8** | **51.8** | **51.5** | **51.8** | **52.8** | **52.9** | **53.0** | **52.6** | **53.7** |
| YoY | 1.2 | 1.1 | 1.0 | 0.6 | 1.1 | 1.2 | 1.0 | 1.1 | 1.2 | 1.1 | 1.2 | 1.1 | 1.1 |
| YoY (%) | 2.5% | 2.1% | 2.0% | 1.1% | 2.1% | 2.4% | 1.9% | 2.3% | 2.2% | 2.1% | 2.3% | 2.2% | 2.1% |

| Supply (MMBbld) | 2016 | 2017 | Q1-'18 | Q2-'18 | Q3-'18 | Q4-'18 | 2018 | Q1-'19 | Q2-'19 | Q3-'19 | Q4-'19 | 2019 | 2020 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Global** | **96.1** | **96.8** | **98.1** | **99.2** | **101.0** | **101.6** | **100.0** | **99.4** | **99.7** | **100.7** | **100.8** | **100.2** | **102.2** |
| YoY | 0.4 | 0.6 | 1.7 | 3.0 | 4.2 | 4.0 | 3.2 | 1.2 | 0.5 | (0.2) | (0.9) | 0.1 | 2.1 |
| YoY (%) | 0% | 1% | 2% | 3% | 4% | 4% | 3% | 1% | 0% | 0% | -1% | 0% | 2% |
| **Non-OPEC** | **58.6** | **59.5** | **61.0** | **62.1** | **63.6** | **64.1** | **62.7** | **63.6** | **64.1** | **64.7** | **65.2** | **64.4** | **66.9** |
| YoY | 3.2 | 0.9 | 1.6 | 3.1 | 4.5 | 3.8 | 3.2 | 2.5 | 2.0 | 1.1 | 1.1 | 1.7 | 2.5 |
| YoY (%) | 6% | 1% | 3% | 5% | 8% | 6% | 5% | 4% | 3% | 2% | 2% | 3% | 4% |
| **OPEC** | **37.5** | **37.3** | **37.1** | **37.1** | **37.4** | **37.5** | **37.3** | **35.8** | **35.6** | **36.1** | **35.5** | **35.8** | **35.3** |
| YoY | (0.0) | (0.2) | 0.1 | (0.1) | (0.2) | 0.2 | 0.0 | (1.3) | (1.5) | (1.3) | (2.0) | (1.5) | (0.4) |
| YoY (%) | 0% | -1% | 0% | 0% | -1% | 1% | 0% | -4% | -4% | -4% | -5% | -4% | -1% |
| OPEC crude oil | 32.2 | 32.0 | 31.8 | 31.7 | 32.0 | 32.1 | 31.9 | 30.5 | 30.3 | 30.7 | 30.2 | 30.4 | 30.0 |
| YoY | 0.3 | (0.2) | 0.1 | (0.1) | (0.3) | 0.1 | (0.1) | (1.3) | (1.5) | (1.3) | (1.9) | (1.5) | (0.4) |
| YoY (%) | 1% | -1% | 0% | 0% | -1% | 0% | 0% | -4% | -5% | -4% | -6% | -5% | -1% |
| **Processing Gains** | **2.8** | **2.9** | **2.8** | **3.0** | **2.9** | **2.9** | **2.9** | **2.6** | **2.8** | **2.7** | **2.6** | **2.7** | **2.7** |

| Balance | 2016 | 2017 | Q1-'18 | Q2-'18 | Q3-'18 | Q4-'18 | 2018 | Q1-'19 | Q2-'19 | Q3-'19 | Q4-'19 | 2019 | 2020 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Implied inventory change (MMBbld)** | **(0.3)** | **(1.2)** | **(0.3)** | **0.4** | **1.1** | **2.1** | **0.8** | **(0.1)** | **(0.5)** | **(0.3)** | **(0.3)** | **(0.3)** | **0.5** |

Source: International Energy Agency, EIA, OPEC, Petrologistics, JODI, and Credit Suisse estimates.

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# Credit Suisse Forecasts Versus IEA, OPEC, and EIA

- **Our 2019 global demand growth forecast of ~1.2 MMBbld YoY** is below the 2017-18 levels and more conservative than the major forecasting agencies' estimates of ~1.2-1.4 MMBbld (April 2019 reports)**.**

- **We forecast 2019 non-OPEC supply growth of ~1.7 MMBbld YoY** (entirely from the US), just below the agencies' ~1.8-2.2 MMBbld range.

| | | (In MMBbld) | 2016 | 2017 | Q1-'18 | Q2-'18 | Q3-'18 | Q4-'18 | 2018 | Q1-'19 | Q2-'19 | Q3-'19 | Q4-'19 | 2019 | YoY Change '17/16 | YoY Change '18/17 | YoY Change '19/18 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Demand | IEA | OECD | 47.0 | 47.4 | 47.9 | 47.2 | 48.1 | 47.8 | 47.7 | 47.7 | 47.7 | 48.4 | 48.2 | 48.0 | 0.44 | 0.31 | 0.27 |
| | | Non-OECD | 49.5 | 50.5 | 50.6 | 51.6 | 51.8 | 51.8 | 51.5 | 51.8 | 52.8 | 52.9 | 52.9 | 52.6 | 1.06 | 0.95 | 1.12 |
| | | **Total demand** | **96.4** | **97.9** | **98.5** | **98.8** | **99.9** | **99.6** | **99.2** | **99.5** | **100.4** | **101.2** | **101.2** | **100.6** | **1.50** | **1.26** | **1.39** |
| | EIA | OECD | 46.8 | 47.2 | 47.6 | 47.0 | 47.9 | 47.5 | 47.5 | 47.6 | 47.1 | 48.2 | 48.3 | 47.8 | 0.41 | 0.28 | 0.30 |
| | | Non-OECD | 50.1 | 51.2 | 51.6 | 52.7 | 52.7 | 52.9 | 52.5 | 53.1 | 53.7 | 53.8 | 53.8 | 53.6 | 1.10 | 1.25 | 1.11 |
| | | **Total demand** | **96.9** | **98.5** | **99.2** | **99.7** | **100.6** | **100.5** | **100.0** | **100.6** | **100.8** | **102.0** | **102.1** | **101.4** | **1.51** | **1.53** | **1.41** |
| | OPEC | OECD | 47.0 | 47.4 | 47.7 | 47.2 | 48.2 | 48.1 | 47.8 | 47.9 | 47.4 | 48.4 | 48.3 | 48.0 | 0.45 | 0.39 | 0.21 |
| | | Non-OECD | 48.6 | 49.9 | 50.1 | 50.8 | 51.2 | 51.5 | 50.9 | 51.1 | 51.8 | 52.2 | 52.5 | 51.9 | 1.23 | 1.02 | 1.00 |
| | | **Total demand** | **95.6** | **97.3** | **97.8** | **98.0** | **99.4** | **99.6** | **98.7** | **99.0** | **99.2** | **100.6** | **100.8** | **99.9** | **1.68** | **1.41** | **1.21** |
| | CS | OECD | 47.0 | 47.4 | 47.9 | 47.2 | 48.1 | 47.8 | 47.7 | 47.7 | 47.4 | 48.1 | 48.0 | 47.8 | 0.44 | 0.31 | 0.08 |
| | | Non-OECD | 49.5 | 50.5 | 50.6 | 51.6 | 51.8 | 51.8 | 51.5 | 51.8 | 52.8 | 52.9 | 53.0 | 52.6 | 1.06 | 0.96 | 1.14 |
| | | **Total demand** | **96.4** | **97.9** | **98.5** | **98.8** | **99.9** | **99.6** | **99.2** | **99.5** | **100.2** | **101.0** | **101.0** | **100.4** | **1.49** | **1.27** | **1.23** |
| Supply | IEA | OPEC | 37.8 | 37.5 | 37.3 | 37.1 | 37.6 | 37.7 | 37.4 | 36.2 | | | | | -0.27 | -0.10 | |
| | | Non-OPEC | 59.1 | 59.9 | 61.1 | 62.1 | 63.4 | 64.2 | 62.7 | 63.4 | 63.9 | 64.9 | 65.5 | 64.4 | 0.77 | 2.81 | 1.75 |
| | | Total US production | 12.5 | 13.3 | 14.4 | 15.1 | 16.0 | 16.5 | 15.5 | 16.6 | 16.9 | 17.3 | 17.5 | 17.1 | 0.76 | 2.22 | 1.59 |
| | | **Total supply** | **96.9** | **97.4** | **98.3** | **99.2** | **101.0** | **101.9** | **100.1** | **99.6** | | | | | **0.50** | **2.71** | |
| | EIA | OPEC | 37.5 | 37.4 | 37.5 | 37.1 | 37.4 | 37.3 | 37.3 | 35.9 | 35.9 | 36.1 | 35.8 | 35.9 | -0.09 | -0.06 | -1.38 |
| | | Non-OPEC | 60.0 | 60.8 | 61.8 | 62.7 | 64.1 | 64.8 | 63.4 | 64.2 | 65.5 | 66.1 | 66.6 | 65.6 | 0.74 | 2.59 | 2.24 |
| | | Total US production | 14.8 | 15.7 | 16.8 | 17.4 | 18.4 | 19.0 | 17.9 | 19.1 | 19.8 | 20.1 | 20.6 | 19.9 | 0.82 | 2.23 | 1.99 |
| | | **Total supply** | **97.5** | **98.1** | **99.3** | **99.8** | **101.4** | **102.2** | **100.7** | **100.1** | **101.4** | **102.2** | **102.4** | **101.5** | **0.64** | **2.53** | **0.86** |
| | OPEC | OPEC | 37.0 | 37.0 | 36.7 | 36.6 | 36.9 | 37.2 | 36.8 | 35.5 | | | | | -0.07 | -0.11 | |
| | | Non-OPEC | 58.7 | 59.5 | 61.2 | 61.6 | 62.7 | 64.0 | 62.4 | 64.0 | 63.4 | 64.6 | 66.3 | 64.5 | 0.81 | 2.90 | 2.17 |
| | | Total US production | 13.6 | 14.4 | 15.5 | 16.2 | 17.2 | 17.7 | 16.7 | 17.9 | 18.1 | 18.6 | 19.5 | 18.5 | 0.79 | 2.26 | 1.87 |
| | | **Total supply** | **95.7** | **96.4** | **97.9** | **98.2** | **99.6** | **101.1** | **99.2** | **99.5** | | | | | **0.74** | **2.79** | |
| | CS | OPEC | 37.5 | 37.3 | 37.1 | 37.1 | 37.4 | 37.5 | 37.3 | 35.8 | 35.6 | 36.1 | 35.5 | 35.8 | -0.23 | 0.00 | -1.53 |
| | | Non-OPEC | 58.6 | 59.5 | 61.0 | 62.1 | 63.6 | 64.1 | 62.7 | 63.6 | 64.1 | 64.7 | 65.2 | 64.4 | 0.87 | 3.23 | 1.68 |
| | | Total US production | 13.5 | 14.3 | 15.5 | 16.1 | 17.1 | 17.6 | 16.5 | 17.8 | 18.3 | 18.5 | 18.8 | 18.4 | 0.83 | 2.20 | 1.81 |
| | | **Total supply** | **96.1** | **96.8** | **98.1** | **99.2** | **101.0** | **101.6** | **100.0** | **99.4** | **99.7** | **100.7** | **100.8** | **100.2** | **0.64** | **3.23** | **0.14** |

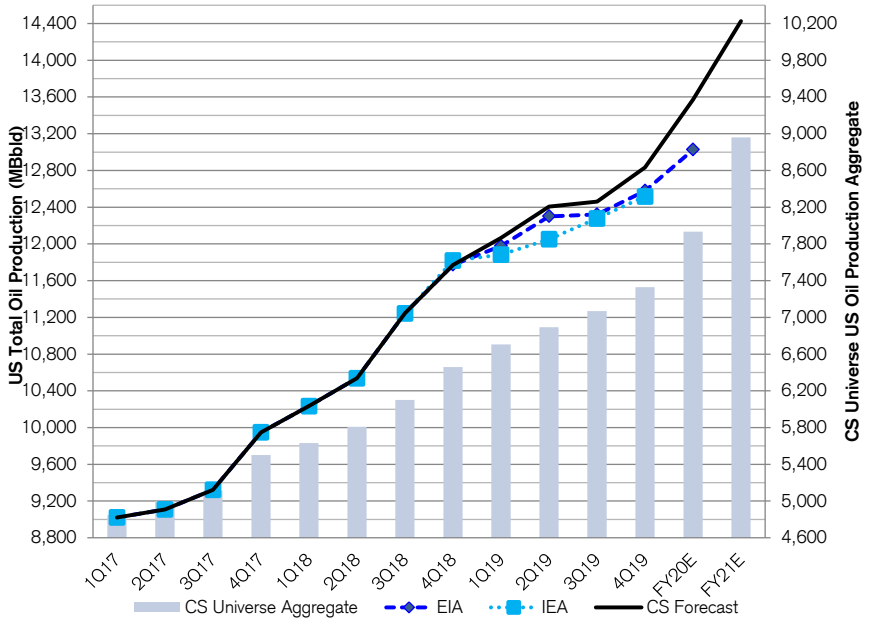
Source: International Energy Agency, Energy Information Administration, OPEC, and Credit Suisse estimates.

# US Crude Oil Production Growth Remains Robust in 2019-20

- **We expect US oil production to grow ~1.1 MMBbld from 4Q18 to ~12.8 MMBbld in 4Q19**. Our 2019 US production forecast of ~12.4 MMBbld is in line with the EIA estimate, while our 2020 forecast of ~13.4 MMBbld is ~0.3 MMBBld above the EIA's which we view as conservative. Beyond 2020, we estimate total US is capable of growing >800 MBbld per annum to reach ~15 MMBbld in 2022, with ~90% of the growth driven by the Permian Basin. (See next slide.)

- **Underpinning our view is the still robust production growth out of our universe of ~40 E&P and Integrated Oil companies,** which in aggregate represents >55% of total US oil production (in 4Q18). Our universe accounts for 55-60% of the total rig count and well completions in the largest oil resource plays including the Permian, Bakken, and Niobrara. This group alone is growing US oil production (adjusted for 20% royalty) by ~1.0 MMBbld YoY in 2019 and ~0.9 MMBbld YoY in 2020. Our top-down basin-level production is based on activity forecasts that mirror what companies in aggregate are projecting for each major basin.

**US Crude Oil Production (Actual/Credit Suisse Forecast)**




**Crude Oil Production By Region**

| | Permian | Bakken/ Niobrara/ Anadarko | Eagle Ford | Other Lower 48 Onshore | Federal GoM | Alaska | Total U.S. |
|---|---|---|---|---|---|---|---|
| **FY17** | **2,473** | **2,014** | **1,193** | **1,496** | **1,679** | **495** | **9,350** |
| **1Q18** | 3,021 | 2,272 | 1,251 | 1,508 | 1,672 | 511 | **10,235** |
| **2Q18** | 3,294 | 2,344 | 1,290 | 1,546 | 1,582 | 481 | **10,537** |
| **3Q18** | 3,534 | 2,493 | 1,341 | 1,597 | 1,847 | 431 | **11,244** |
| **4Q18** | 3,896 | 2,656 | 1,393 | 1,512 | 1,821 | 493 | **11,771** |
| **FY18** | **3,436** | **2,441** | **1,319** | **1,541** | **1,730** | **479** | **10,947** |
| **1Q19E** | 4,118 | 2,702 | 1,412 | 1,478 | 1,851 | 504 | **12,065** |
| **2Q19E** | 4,297 | 2,738 | 1,447 | 1,456 | 1,974 | 494 | **12,406** |
| **3Q19E** | 4,417 | 2,793 | 1,476 | 1,434 | 1,891 | 450 | **12,462** |
| **4Q19E** | 4,555 | 2,839 | 1,502 | 1,413 | 2,030 | 494 | **12,833** |
| **FY19E** | **4,347** | **2,768** | **1,459** | **1,445** | **1,937** | **485** | **12,441** |
| **1Q20E** | 4,649 | 2,878 | 1,520 | 1,400 | 2,197 | 518 | **13,161** |
| **2Q20E** | 4,847 | 2,925 | 1,532 | 1,392 | 2,273 | 498 | **13,466** |
| **3Q20E** | 5,004 | 3,002 | 1,538 | 1,383 | 2,212 | 460 | **13,599** |
| **4Q20E** | 5,181 | 3,091 | 1,544 | 1,375 | 2,378 | 493 | **14,061** |
| **FY20E** | **4,920** | **2,974** | **1,533** | **1,387** | **2,265** | **492** | **13,572** |
| **FY21E** | **5,667** | **3,205** | **1,557** | **1,355** | **2,152** | **492** | **14,427** |
| **FY22E** | **6,416** | **3,381** | **1,569** | **1,322** | **2,044** | **492** | **15,225** |

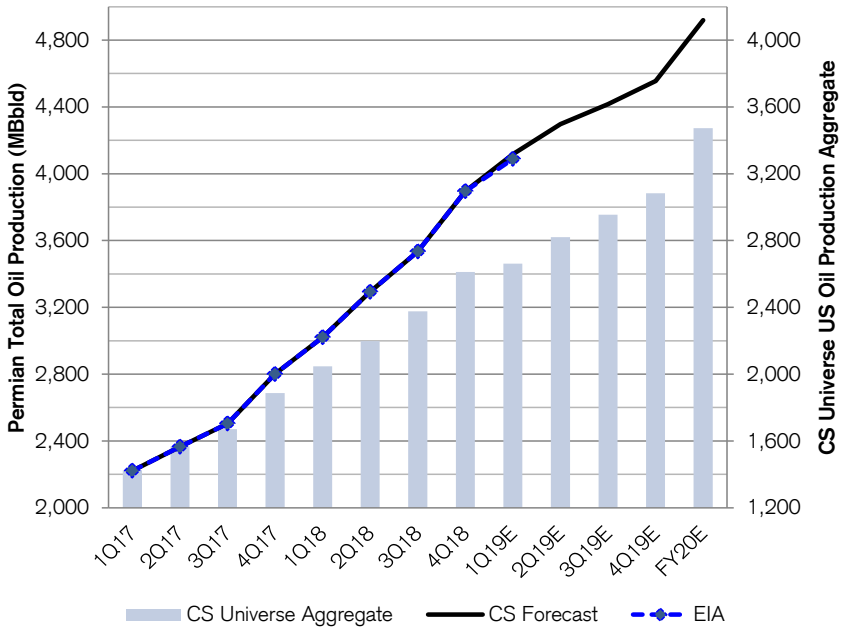
Source: EIA, IEA, Wood Mackenzie, company documents, and Credit Suisse estimates.

# Permian Continues to Drive US Crude Oil Production Growth

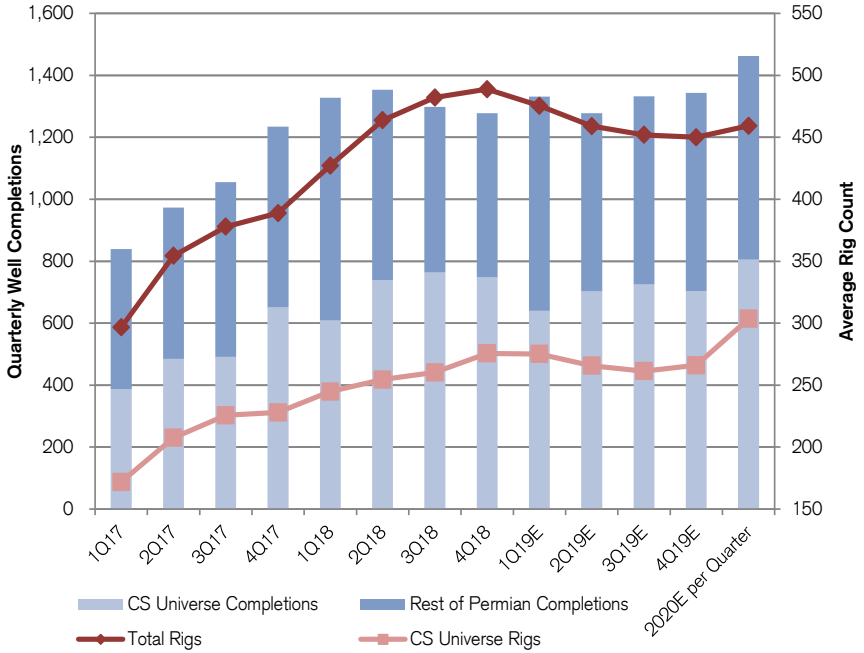
- **Despite the takeaway capacity constraint during 2018-19 (see next slide), US onshore crude production growth should continue to be driven by the Permian,** where we expect production to grow ~0.7 MMBbld YoY to ~4.6 MMBbld in 4Q19 and by an average of ~750 MBbld per annum during 2018-22.

- **We forecast total Permian gross wells completions will increase by ~65 wells (+5%) in 4Q19 vs. 4Q18, after declining during 2H18.** Our Permian basin-wide forecast is informed by the activity levels of our E&P and Majors coverage universe, which in aggregate accounts for ~2/3 of Permian oil production and >55% of the basin-wide rig and completion count in 4Q18, and we project it will grow by ~470 MBbld in 4Q19 vs. 4Q18, following ~730 MBbld in 4Q18 vs. 4Q17

**Permian Crude Oil Production (Actual/Credit Suisse Forecast)**




**Permian Rig and Completion Activity Level**




Source: EIA, IEA, Wood Mackenzie, company documents, and Credit Suisse estimates.

# Adequate Pipeline Takeaway Capacity Exists to Support Robust Permian Growth

- The next large slugs of Permian takeaway capacity are expected to come on stream in 2H19 to support robust crude production growth outlook.

| Takeaway Capacity (kb/d) | | | | 2017 | 2018E | 1Q19E | 2Q19E | 3Q19E | 4Q19E | 2019E | 1Q20E | 2Q20E | 3Q20E | 4Q20E | 2020E | 2021E | 2022E |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Pipeline** | **Operator** | **Origination** | **Destination** | | | | | | | | | | | | | | |
| Amdel Pipeline | ETP | Midland, TX | Nederland, TX | 40 | 40 | 40 | 40 | 40 | 40 | 40 | 40 | 40 | 40 | 40 | 40 | 40 | 40 |
| Basin Pipeline + Expansion | PAA | Colorado City, TX | Cushing, OK | 450 | 450 | 450 | 450 | 450 | 450 | 450 | 450 | 450 | 450 | 450 | 450 | 450 | 450 |
| Centurion Pipeline | OXY | Permian | Cushing, OK | 140 | 140 | 140 | 140 | 140 | 140 | 140 | 140 | 140 | 140 | 140 | 140 | 140 | 140 |
| Line 80 | PSXP | Hobbs, NM | Borger, TX | 28 | 28 | 28 | 28 | 28 | 28 | 28 | 28 | 28 | 28 | 28 | 28 | 28 | 28 |
| WA Line | PSXP | Goldsmith, TX | Borger, TX | 104 | 104 | 104 | 104 | 104 | 104 | 104 | 104 | 104 | 104 | 104 | 104 | 104 | 104 |
| Wink Pipeline | KMI | Scurry, Texas | El Paso, TX | 145 | 145 | 145 | 145 | 145 | 145 | 145 | 145 | 145 | 145 | 145 | 145 | 145 | 145 |
| West Texas Gulf | ETP | Colorado City, TX | Longview, TX | 250 | 250 | 250 | 250 | 250 | 250 | 250 | 250 | 250 | 250 | 250 | 250 | 250 | 250 |
| West Texas Gulf Exp - Houston Access | ETP | Colorado City, TX | Houston, TX | 40 | 40 | 40 | 40 | 40 | 40 | 40 | 40 | 40 | 40 | 40 | 40 | 40 | 40 |
| West Texas Gulf Exp - Longview Access | ETP | Colorado City, TX | Longview, TX | 30 | 30 | 30 | 30 | 30 | 30 | 30 | 30 | 30 | 30 | 30 | 30 | 30 | 30 |
| West Texas Gulf Exp - Nederland Access | ETP | Colorado City, TX | Nederland, TX | 40 | 40 | 40 | 40 | 40 | 40 | 40 | 40 | 40 | 40 | 40 | 40 | 40 | 40 |
| Longhorn Reversal + Expansion | MMP | El Paso, TX | Houston, TX | 275 | 275 | 275 | 275 | 275 | 275 | 275 | 275 | 275 | 275 | 275 | 275 | 275 | 275 |
| BridgeTex Pipeline | MMP | Colorado City, TX | Houston, TX | 400 | 400 | 400 | 400 | 400 | 400 | 400 | 400 | 400 | 400 | 400 | 400 | 400 | 400 |
| Cactus Pipeline | PAA | McCamey, TX | Gardendale, TX | 345 | 345 | 345 | 345 | 345 | 345 | 345 | 345 | 345 | 345 | 345 | 345 | 345 | 345 |
| Permian Express I | ETP | Midland, TX | Nederland, TX | 150 | 150 | 150 | 150 | 150 | 150 | 150 | 150 | 150 | 150 | 150 | 150 | 150 | 150 |
| Permian Express II | ETP | Midland, TX | Nederland, TX | 200 | 200 | 200 | 200 | 200 | 200 | 200 | 200 | 200 | 200 | 200 | 200 | 200 | 200 |
| Permian Express III | ETP | Midland, TX | Nederland, TX | 100 | 140 | 140 | 140 | 140 | 140 | 140 | 140 | 140 | 140 | 140 | 140 | 140 | 140 |
| Permian Longview & Louisiana Extension | ETP | Midland, TX | Longview, TX | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| Midland to Sealy Pipeline + Expansion | EPD | Midland, TX | Sealy, TX | 150 | 575 | 575 | 620 | 620 | 620 | 620 | 620 | 620 | 620 | 620 | 620 | 620 | 620 |
| Lone Star 12-Inch W. TX Pipe Conversion (Deferred) | ETP | Midland, TX | Corsicana, TX | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Freedom Pipeline (Cancelled) | KMI | Permian | Los Angeles, CA | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| **Total Pipeline** | | | | **2,987** | **3,452** | **3,452** | **3,497** | **3,497** | **3,497** | **3,497** | **3,497** | **3,497** | **3,497** | **3,497** | **3,497** | **3,497** | **3,497** |
| **Potential Expansions** | | | | | | | | | | | | | | | | | |
| Cactus II | PAA | Permian Basin | Corpus Christi, TX | -- | -- | -- | -- | 585 | 585 | 585 | 585 | 670 | 670 | 670 | 670 | 670 | 670 |
| Sunrise Extension + Loop (expandable to 200k bpd) | PAA | Midland / Colorado City, TX | Wichita Falls, TX | -- | 220 | 220 | 220 | 220 | 220 | 220 | 220 | 220 | 220 | 220 | 220 | 220 | 220 |
| BridgeTex Expansion | MMP | Colorado City, TX | Houston, TX | -- | -- | 40 | 40 | 40 | 40 | 40 | 40 | 40 | 40 | 40 | 40 | 40 | 40 |
| Gray Oak Pipeline (In Service: 2H 2019) | PSX / ENB | West Texas | Corpus Christi, TX | -- | -- | -- | -- | -- | 800 | 800 | 800 | 800 | 800 | 800 | 800 | 800 | 800 |
| Midland Sealy II (NGL Pipeline Conversion) | EPD | Permian Basin | Mont Belvieu, TX | -- | -- | 200 | 200 | 200 | 200 | 200 | 200 | 200 | 200 | 200 | 200 | 200 | 200 |
| PGC Pipeline | MMP/ETP/MPLX/DK | Permian Basin | Texas Gulf Coast | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Jupiter Crude Pipeline | Jupiter MLP | Orla, TX | Brownsville, TX | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 1000 | 1000 | 1000 | 1,000 |
| Wink-to-Webster | PAA / XOM | Wink / Midland, TX | Texas Gulf Coast | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 1000 | 1,000 |
| Permian-to-Nederland (no FID - assumed capacity) | ETP | Permian Basin | Nederland, TX | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 1000 | 1,000 |
| Epic Crude/NGL Conversion | NBLX/ALTM/Ares | Permian Basin | Corpus Christi, TX | -- | -- | -- | -- | 400 | 400 | 400 | 590 | 590 | 590 | 590 | 590 | 590 | 590 |
| Cactus III (no credit - potential 200-400 mbd) | PAA | McCamey, TX | Gardendale, TX | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Permian Express IV (no credit - potential ~200kbpd) | ETP | Midland, TX | Corsicana, TX | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| **Total Potential Expansion Opps** | | | | **0** | **220** | **460** | **460** | **1,445** | **2,245** | **2,245** | **2,435** | **2,520** | **2,520** | **3,520** | **3,520** | **5,520** | **5,520** |
| **Total Refineries** | | | | **413** | **413** | **413** | **413** | **413** | **413** | **413** | **413** | **413** | **413** | **413** | **413** | **413** | **413** |
| **Total Rail** | | | | **80** | **80** | **80** | **80** | **80** | **80** | **80** | **80** | **80** | **80** | **80** | **80** | **80** | **80** |
| **TOTAL TAKEAWAY** | | | | **3,480** | **4,165** | **4,405** | **4,450** | **5,435** | **6,235** | **6,235** | **6,425** | **6,510** | **6,510** | **7,510** | **7,510** | **9,510** | **9,510** |

| Production and Inflows (kb/d) | 2017 | 2018E | 1Q19E | 2Q19E | 3Q19E | 4Q19E | 2019E | 1Q20E | 2Q20E | 3Q20E | 4Q20E | 2020E | 2021E | 2022E |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Production** | | | | | | | | | | | | | | |
| Permian Crude Production | 2,459 | 3,240 | 4,118 | 4,297 | 4,417 | 4,555 | 4,347 | 4,649 | 4,847 | 5,004 | 5,181 | 4,920 | 5,667 | 6,416 |
| *Annual Increase (+- kb/d)* | *438* | *780* | *1,126* | *1,109* | *1,090* | *1,104* | *1,107* | *531* | *549* | *587* | *626* | *573* | *747* | *749* |
| **Total Production** | **2,459** | **3,240** | **4,118** | **4,297** | **4,417** | **4,555** | **4,347** | **4,649** | **4,847** | **5,004** | **5,181** | **4,920** | **5,667** | **6,416** |
| **Total Inbound Pipelines** | **125** | **125** | **125** | **125** | **125** | **125** | **125** | **125** | **125** | **125** | **125** | **125** | **125** | **125** |
| **TOTAL SUPPLY** | **2,584** | **3,365** | **4,243** | **4,422** | **4,542** | **4,680** | **4,472** | **4,774** | **4,972** | **5,129** | **5,306** | **5,045** | **5,792** | **6,541** |

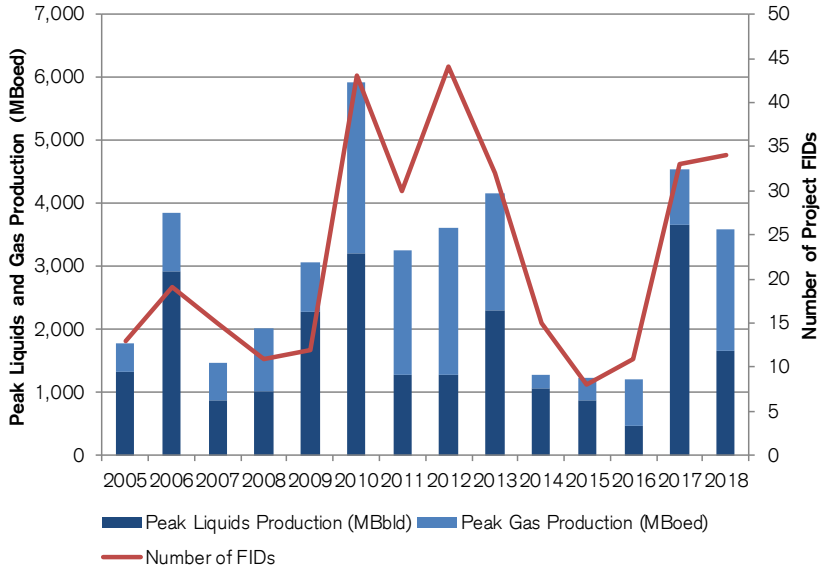
Source: company documents, WoodMackenzie, EIA, and Credit Suisse estimates.

# Decline in Major Project Sanctions in 2014-16 Should Lead to a Slowdown in Non-US, Non-OPEC Production Growth in 2019

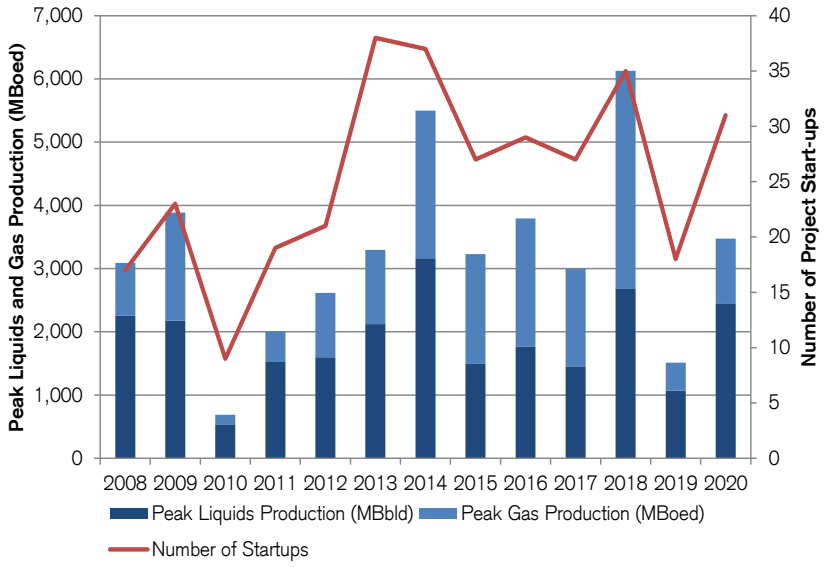
- From 2006 to 2013, the industry sanctioned >25 major capital projects per year with peak production >50 MBoed, but **the collapse in oil prices reduced the pace of sanctions to just ~11 per annum from 2014 to 2016**. However, driven by a combination of non-shale projects coming down the cost curve and increased conviction oil prices have seen their lows, the industry sanctioned 33 major capital projects in 2017 and 34 in 2018 according to Wood Mackenzie. Based on Wood Mackenzie data, these projects show a projected development of 11.2 Bboe and 23.1 BBoe of resources, respectively, with 81% and 46% of the projected peak production oriented to liquids. WoodMac projects another 74 sanctions in 2019 (of all capacity levels).

- We estimate **the slowdown in project sanctions should affect non-US non-OPEC production growth in 2019+.** Despite the slowdown in sanctions in 2014-16, projects coming onstream in 2016-18 had peak liquids production capacity of 1.8 MMBbld in 2016, 1.5 MMBbld in 2017, and 2.7 MMBbld in 2018; however, new fields coming onstream in 2019 should add just ~1.1 MMBbld in 2019.

**Project FIDs by Year**




**Project Startups by Year**




Source: Wood Mackenzie and company documents

# OPEC Complying With the Output Cut Agreement; Russia Falling Behind

- OPEC and allied non-OPEC oil producing countries including Russia agreed in early December to **cut crude output by 1.2 MMBbld from October 2018 levels.**

- **OPEC crude production** declined by ~2.3 MMBbld from October to March partly from US sanction against Iran (-0.6 MMBbld), disruptions in Venezuela (-0.5 MMBbld), and Saudi Arabia's over-compliance (-0.8 MMBbld). Meanwhile, **Russia** expects to achieve compliance level of a 230 MBbld cut in April.

| | | | | | Mar 2019 Output | |
|---|---|---|---|---|---|---|
| **MMBbld** | **Oct 2018** | **Jan 2019** | **Feb 2019** | **Mar 2019** | **vs. Feb '19** | **vs. Oct '18** |
| Algeria | 1.06 | 1.02 | 1.03 | 1.02 | -0.01 | -0.04 |
| Angola | 1.52 | 1.44 | 1.45 | 1.45 | 0.01 | -0.06 |
| Ecuador | 0.52 | 0.52 | 0.52 | 0.52 | 0.00 | 0.00 |
| Congo | 0.32 | 0.32 | 0.32 | 0.34 | 0.02 | 0.02 |
| Gabon | 0.19 | 0.20 | 0.20 | 0.21 | 0.01 | 0.03 |
| Equatorial Guinea | 0.12 | 0.11 | 0.12 | 0.12 | 0.00 | 0.00 |
| Iran | 3.33 | 2.73 | 2.73 | 2.70 | -0.03 | -0.63 |
| Iraq | 4.65 | 4.71 | 4.65 | 4.52 | -0.13 | -0.13 |
| Kuwait | 2.75 | 2.72 | 2.71 | 2.71 | 0.00 | -0.04 |
| Saudi Arabia | 10.64 | 10.18 | 10.12 | 9.79 | -0.32 | -0.84 |
| UAE | 3.18 | 3.08 | 3.07 | 3.06 | -0.01 | -0.12 |
| Venezuela | 1.21 | 1.15 | 1.02 | 0.73 | -0.29 | -0.47 |
| Libya | 1.12 | 0.9 | 0.9 | 1.10 | 0.20 | -0.02 |
| Nigeria | 1.76 | 1.7 | 1.7 | 1.73 | 0.01 | -0.03 |
| **OPEC Crude** | **32.36** | **30.79** | **30.56** | **30.02** | **-0.54** | **-2.34** |
| **Non-OPEC Contributors (CS Estimates)** | | | | | | |
| Azerbaijan | 0.78 | 0.79 | 0.81 | 0.79 | -0.01 | 0.01 |
| Mexico | 1.77 | 1.64 | 1.72 | 1.71 | -0.01 | -0.06 |
| Oman | 1.00 | 0.97 | 0.97 | 0.97 | 0.00 | -0.03 |
| Russia | 11.42 | 11.38 | 11.34 | 11.30 | -0.04 | -0.12 |
| **Non-OPEC Crude** | **14.96** | **14.78** | **14.83** | **14.77** | **-0.06** | **-0.19** |

Source: OPEC, IEA, and Credit Suisse estimates

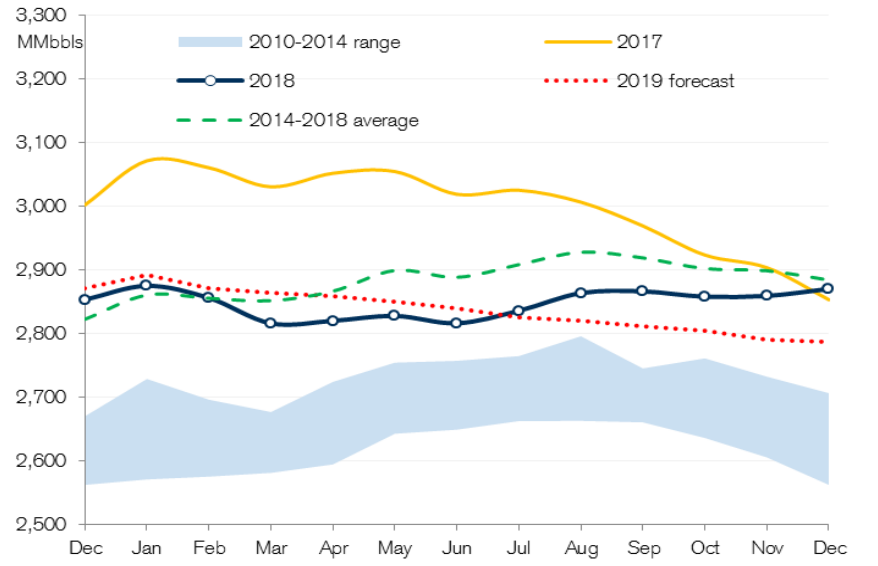
# OECD Commercial Inventories Near Five-Year Average

- After peaking in July 2016 at 3,127 MMBbls, OECD oil and product inventories declined to 2,816 MMBbls in March 2018 but has since risen to 2,893 MMBbls as of the end of January. With the market tightening, OECD commercial stocks fell to **2,871 MMBbls at the end of February, <1% (or ~15 MMBbls) above the 5-year average.**

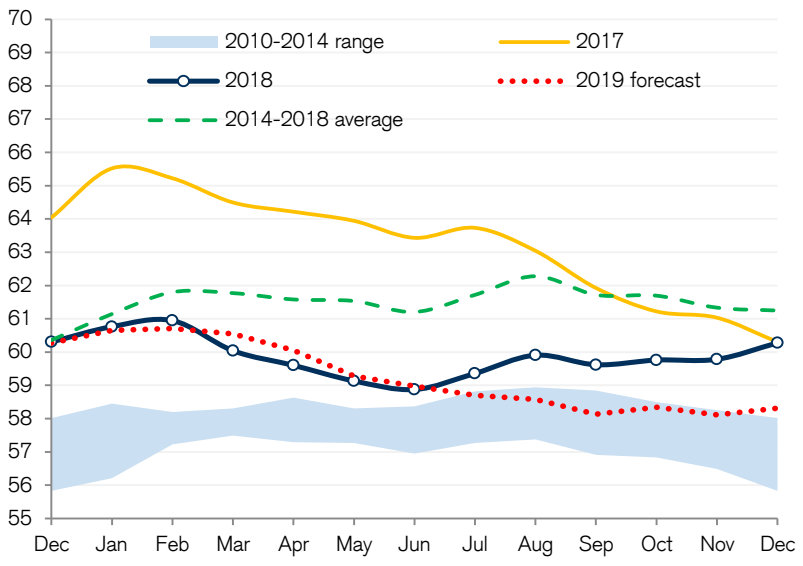
- **We estimate global oil inventories draw~0.3 MMBbld in 2019,** compared to ~0.8 MMBbld build in 2018. We expect global balances to further tighten from a ~0.1 MMBbld draw in 1Q to ~0.5 MMBbld in 2Q before moderating to a ~0.3 MMBbld draw in 2H19. This should result in a ~0.3 MMBbld draw in OECD inventories per quarter during 2Q-4Q19 (vs. the 5-year average of 0.3-0.4 MMBbld build in 2Q-3Q and a 0.4 MMBbld draw in 4Q), with stocks exiting 2019 ~80/100 MMBbls below year-ago/5-year average levels.

- **On a days cover basis,** we estimate OECD inventories have declined from >65 days in early 2016 to ~60 days at the end of 2017 and has since remained around that level, with February 2019 level of 60.7 modestly below the five-year average of ~62 days.

**OECD Global Crude Oil and Product Inventories**




**OECD Inventories on a Days Cover Basis**



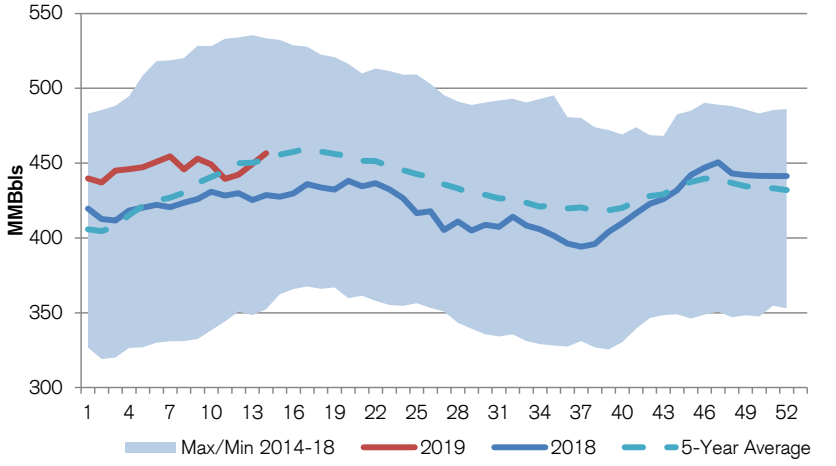

Source: International Energy Agency, JODI, and Credit Suisse Estimates

# US Crude and Product Stocks Modestly Above Year-Ago and the Five-Year Average Levels

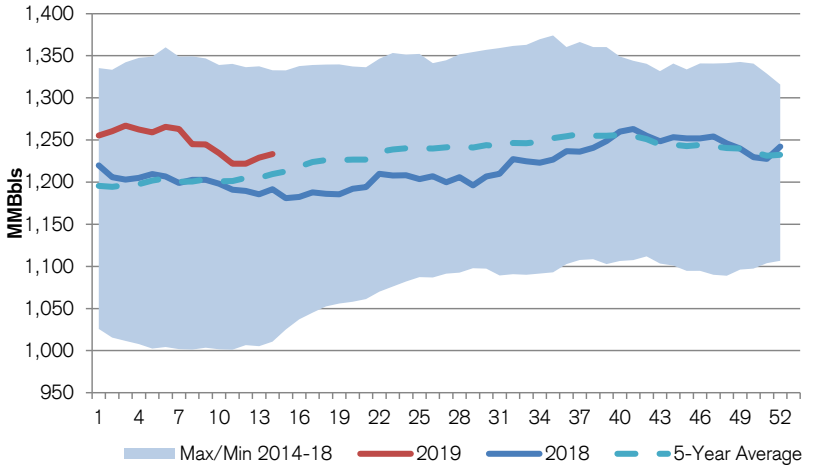
- **US crude oil inventory** now stands at ~457 MMBbls, ~7% (or ~28 MMBbls) above last year at this time and just ~1% (or ~4 MMBbls) above the five-year average.

- Meanwhile, **total US product stocks** (including crude oil) are ~1,233 MMBbls, ~4% above last year at this time (+42 MMBbls) as well as the five-year average (+24 MMBbls).

**Total US Crude Oil Stocks as of Week Ending 4/5/2019**




**Total US Product Stocks as of Week Ending 4/5/2019**

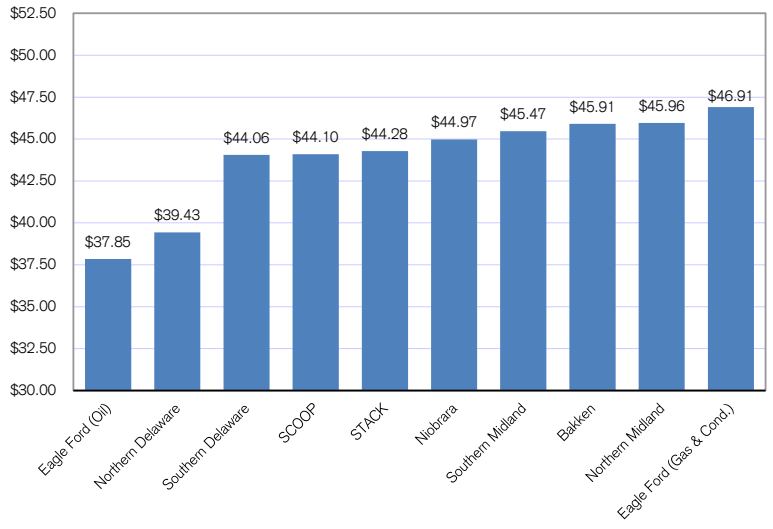



Source: Energy Information Administration

# Oil Price Breakevens for US Shale Plays and Global Cost Curve

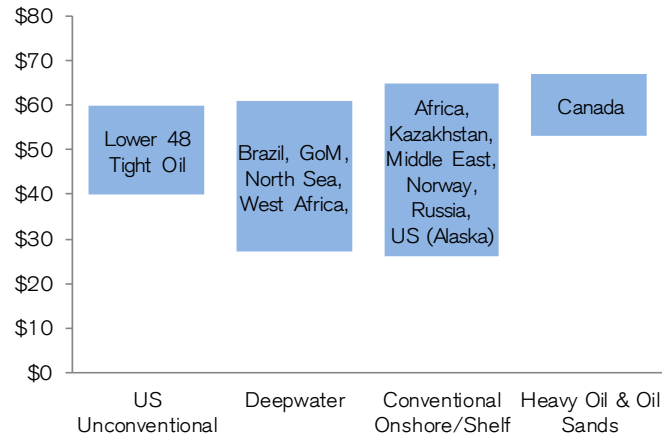
- We estimate **the majority of US unconventional oil plays to break even** (generating a 30% pre-tax IRR at the wellhead, assuming a $2.75/MMBtu Henry Hub gas price) **at a WTI price less than ~$50/Bbl**.
- Outside of the US, the combination of **declining oilfield service costs, standardization of development schemes, and high-grading have driven down the cost curve in deepwater and non-US conventional plays to $30-60/Bbl**, well below the $60-100/Bbl level pre-2014.

**WTI Price Required for Economic Well ($/Bbl)**




Source: Wood Mackenzie, company documents, and Credit Suisse estimates

**Global Oil Supply Cost Curve**



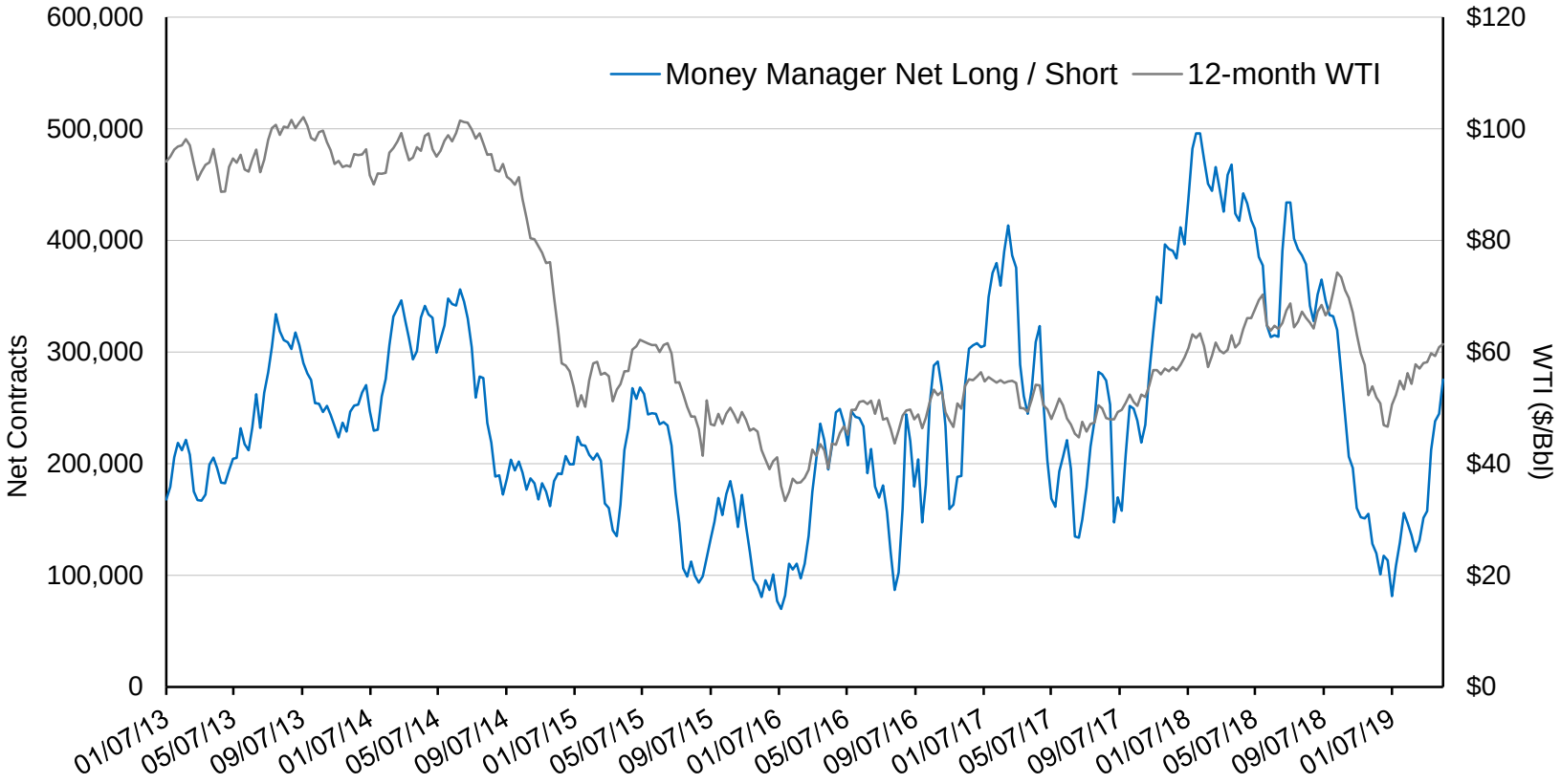

| | | | | |
|---|---|---|---|---|
| **Production (MMBbld)** | **7.1** | **10.4** | **42.5** | **2.8** |

Source: Wood Mackenzie, company documents, and Credit Suisse estimates

# Speculative Net Long Position Near Five-Year Average

- After surging to a record high of 496,111 contracts in January 2018, **WTI net long position for managed money dropped to a 3-year low of 81,512 contracts at the beginning of 2019,** helping to fuel the plunge in crude prices.

- **This has since recovered to 275,529 contracts as of mid-April** (above the five-year average of ~240,000 contracts), helping to drive the recovery in oil prices.




Source: CFTC and the BLOOMBERG PROFESSIONAL™ service

# US Natural Gas

# What Is Natural Gas?

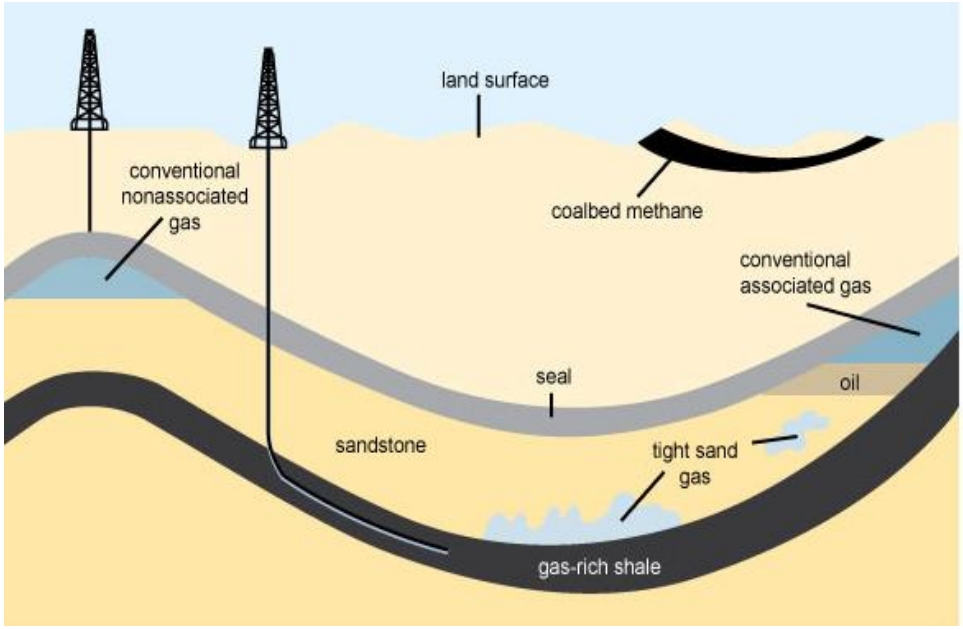
- **Natural gas** is a combustible, colorless and odorless gas consisting mostly of methane as well as small amounts of hydrocarbon gas liquids and nonhydrocarbon gases. In the United States, it is primarily used as a fuel and as a feedstock to produce industrial materials and chemicals.

- In the United States, natural gas is produced from gas-rich formations (such as the Marcellus Shale, Barnett Shale and Haynesville Shale plays) and as a by-product of oil-directed drilling, in which case it is referred to as "associated" gas. Natural gas also occurs in coal deposits ("coalbed methane").

- Natural gas produced from a well can be referred to as "wet" natural gas as it typically contains other liquid hydrocarbons (ethane, propane, butane, etc.). Gas processing involves separating the dry gas component (mostly methane) from the heavier natural gas liquids (NGLs), which can be marketed as separate products.

- Natural gas is measured on a unit basis in thousands of cubic feet (Mcf). In the United States, the benchmark spot price is Henry Hub, which is quoted on a $ per Millions of British Thermal Units basis (MMBtu). An Mcf is a volume unit, while MMBtu is an energy measurement.

- Because of the need for extensive pipeline systems and difficulty in shipping, natural gas is typically used in regions with indigenous supply. However, the ability to ship gas in liquid form (LNG) is gaining traction.

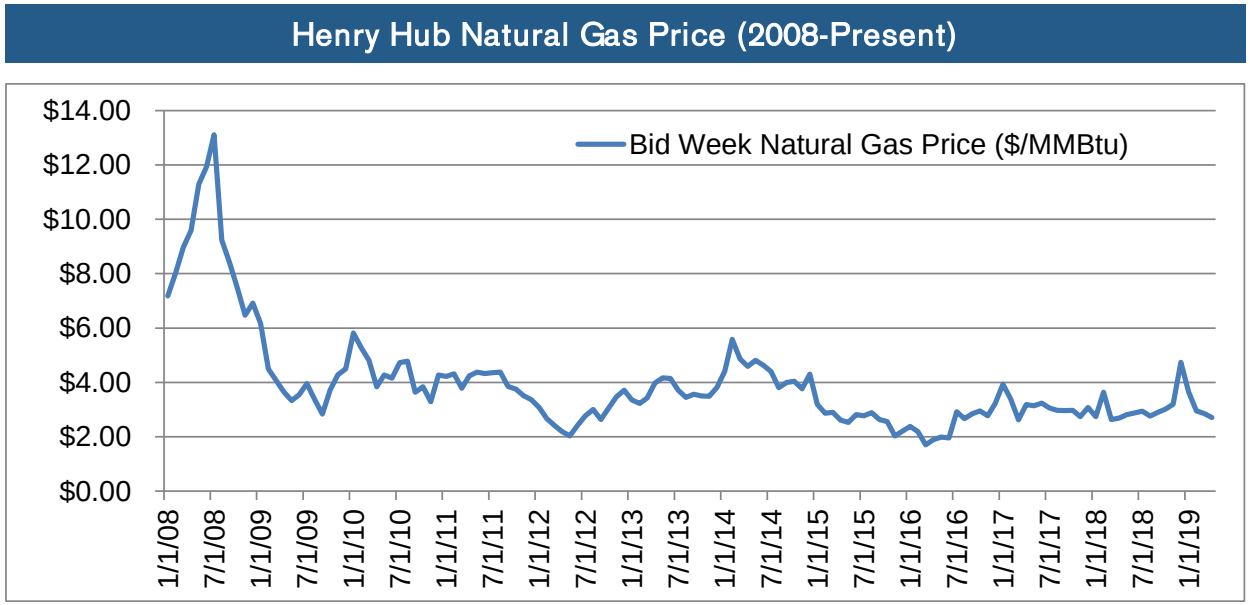



Source: Credit Suisse, EIA

# US Natural Gas Prices

- North America is mostly a largely closed market with natural gas prices driven by demand trends (weather, economic growth) and the cost of new supply, although growing LNG exports may slowly link prices to other global markets over the very long term.

- Over the past decade, NYMEX gas prices have traded as high as ~$13-14/MMBtu, but have leveled out to the ~$2-$3/MMBtu range over the last several years, driven by burgeoning supply growth out of the Northeast US and more recently from associated gas in oil plays like the Permian.




Source: Credit Suisse, EIA

# Credit Suisse US Natural Gas Price Forecast

- **We forecast 2019 natural gas prices average $2.95/MMBtu and longer-term, normalized prices of $2.75/MMBtu**.
- Our long-term forecast is predicated on our view that prices above $3.00/MMBtu will prompt too much drilling activity in dry gas plays outside the Northeast driving supply growth in excess of our forecast for demand.

## Credit Suisse Henry Hub Natural Gas Price Forecast Versus the Futures Strip and Consensus, 2016-2022E

| Henry Hub ($/MMBtu) | 2016A | 2017A | 2018A | 1Q19A | 2Q19E | 3Q19E | 4Q19E | 2019E | 2020E | 2021E | 2022E |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **CS Forecast** | **$2.46** | **$3.11** | **$3.08** | **$3.15** | **$2.85** | **$2.75** | **$3.10** | **$2.95** | **$2.75** | **$2.75** | **$2.75** |
| Bloomberg Consensus | | | | | $2.95 | $3.00 | $3.08 | $3.06 | $3.07 | $3.00 | $3.00 |
| NYMEX Futures Strip | | | | | $2.73 | $2.80 | $3.01 | $2.84 | $2.75 | $2.67 | $2.67 |
| *CS vs. Consensus* | | | | | *-3.4%* | *-8.3%* | *0.6%* | *-3.6%* | *-10.4%* | *-8.3%* | *-8.3%* |
| *CS vs. NYMEX Strip* | | | | | *4.4%* | *-1.8%* | *3.0%* | *3.9%* | *0.0%* | *3.0%* | *3.0%* |

Source: NYMEX, the BLOOMBERG PROFESSIONAL™ service, company documents and Credit Suisse estimates.

# Key US Natural Gas Price Considerations (Demand)

- **While US natural gas consumption (including LNG exports) was flattish in 2017, overall demand was up ~11.5% YoY (or ~9 Bcfd) in 2018. We forecast continued YoY growth of ~5% (or ~4 Bcfd) this year and ~6% (~5.5 Bcfd) in 2020.**

  - **Expect residential and commercial demand to return to more normal growth in 2019+.** With 1Q19 weather just ~3% colder than last year, we forecast residential and commercial demand to return to more normal growth of 1% per annum in 2019-20 from those two segments. Residential and commercial represent a combined ~28% of US natural gas consumption.

  - **Industrial demand should remain strong with four chemical plant expansions to commence over the next two years** (on top of the five new plants that started up in 2017-18), which we estimate should combine to utilize an incremental >1.0 Bcfd of natural gas by 2020. Industrial demand represents ~28% of US natural gas consumption.

  - **Continued retirement of coal/nuclear plants should equate to a loss of ~7.2 GW of power in 2019.** When coupled with new gas plants coming online, we forecast natural gas to pick up an incremental ~0.6 Bcfd of power demand this year; we'd note our estimate assumes a loss to renewables of >7.0 GW per annum. We expect a minimal impact from incremental coal to natural gas fuel switching this year.

  - **The accelerating ramp-up of LNG exports should enable ~5.0 Bcfd and ~7.0 Bcfd of natural gas demand in 2019-20E,** respectively up from 3.0 Bcfd in 2018. Higher 2019 exports are driven by start-up at Corpus Christi (Train 1 in 1Q and Train 2 in 3Q), Southern LNG (1Q) Cameron LNG (3Q) and Freeport LNG (3Q).

# Key US Natural Gas Price Considerations (Supply)

- **Following a surge in volume growth last year (+12% or >8.5 Bcfd YoY), we estimate the pace of US natural gas production growth moderates to a still-robust ~8% YoY (or >6.5 Bcfd) in 2019 and ~5% YoY (~4.5 Bcfd) in 2020.**

    - **Marcellus/Utica growth.** Following a material pick-up in YoY production growth from the Northeast last year (+4.9 Bcfd YoY, compared to ~2.0-2.5 Bcfd per annum in 2016-17) enabled by additional midstream capacity, we see regional volume growth moderating to ~2.8 Bcfd YoY in 2019 and ~2.1 Bcfd in 2020.

    - **Non-Northeast production growth.** After bottoming in December 2016 at ~48 Bcfd and flattening in 2017, non-Northeast gas production grew ~3.8 Bcfd YoY in 2018 and exited the year at ~58 Bcfd. We forecast continued growth momentum of ~4.0 Bcfd and >2.0 Bcfd in 2019-20 driven primarily by associated gas as well as higher Haynesville volumes.

- **Storage inventories remain well below historical levels.** Natural gas storage levels exited the withdrawal season (March) at 1.13 Bcf, ~500 Bcf below the five-year average and ~220 Bcf below year-ago levels. And we project storage enters next winter at ~3.5 Tcf on October 31st , a ~300 Bcf surplus to the year ago level and ~150 Bcf below the 5-year average.

# Credit Suisse US Natural Gas Supply Demand Forecast

| | | | | | | | | | | | | % Growth | | | | | | | CAGR | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019E | 2020E | 2021E | 15/'14 | 16/'15 | 17/'16 | 18/'17 | 19/'18 | 20/'19 | 21/'20 | 13-'18 | 18-'21 |
| **Demand (Bcf/d)** | | | | | | | | | | | | | | | | | | | | |
| Residential | 12.9 | 11.4 | 13.4 | 13.9 | 12.6 | 11.9 | 12.1 | 13.6 | 13.8 | 13.9 | 14.1 | -9.3% | -6.1% | 1.8% | 12.9% | 1.0% | 1.0% | 1.0% | 0.3% | 1.0% |
| Commercial | 8.6 | 7.9 | 9.0 | 9.5 | 8.8 | 8.5 | 8.7 | 9.5 | 9.6 | 9.7 | 9.8 | -7.6% | -3.3% | 2.2% | 10.0% | 1.0% | 1.0% | 1.0% | 1.1% | 1.0% |
| Industrial | 19.2 | 19.8 | 20.3 | 20.9 | 20.6 | 21.1 | 21.8 | 22.7 | 23.7 | 24.6 | 26.2 | -1.6% | 2.4% | 3.2% | 4.2% | 4.2% | 4.1% | 6.3% | 2.2% | 4.9% |
| Electric Power | 20.8 | 25.0 | 22.4 | 22.3 | 26.3 | 27.3 | 25.3 | 29.1 | 29.7 | 31.7 | 32.7 | 18.0% | 3.6% | -7.1% | 14.9% | 2.0% | 6.7% | 3.2% | 5.3% | 3.9% |
| Transportation | 5.5 | 5.8 | 6.3 | 6.1 | 6.2 | 6.2 | 6.3 | 7.0 | 7.3 | 7.7 | 8.1 | 1.9% | 1.2% | 0.2% | 11.6% | 5.0% | 5.0% | 5.0% | 2.0% | 5.0% |
| **Total** | **67.0** | **69.9** | **71.6** | **72.8** | **74.5** | **75.0** | **74.1** | **82.0** | **84.1** | **87.7** | **90.8** | **2.4%** | **0.6%** | **-1.1%** | **10.6%** | **2.6%** | **4.2%** | **3.6%** | **2.8%** | **3.5%** |
| YoY Growth | 1.6% | 4.3% | 2.4% | 1.7% | 2.4% | 0.6% | -1.1% | 10.6% | 2.6% | 4.2% | 3.6% | | | | | | | | | |
| **Supply (Bcf/d)** | **2011** | **2012** | **2013** | **2014** | **2015** | **2016** | **2017** | **2018** | **2019E** | **2020E** | **2021E** | **15/'14** | **16/'15** | **17/'16** | **18/'17** | **19/'18** | **20/'19** | **21/'20** | **13-'18** | **18-'21** |
| U.S. Dry Gas Production | 62.7 | 65.7 | 66.3 | 70.9 | 74.2 | 72.8 | 74.8 | 83.4 | 90.0 | 94.6 | 99.6 | 4.5% | -1.8% | 2.6% | 11.5% | 7.9% | 5.2% | 5.2% | 4.7% | 6.1% |
| Balancing Item | (0.3) | (0.2) | 0.1 | (0.8) | (0.7) | (0.7) | (1.0) | (0.5) | (0.7) | (0.7) | (0.7) | | | | | | | | | |
| U.S. Dry Gas Production | 62.5 | 65.5 | 66.4 | 70.2 | 73.4 | 72.2 | 73.7 | 82.9 | 89.3 | 93.9 | 98.9 | 4.7% | -1.7% | 2.2% | 12.5% | 7.7% | 5.2% | 5.3% | 4.5% | 6.0% |
| Canadian Imports | 8.5 | 8.1 | 7.6 | 7.2 | 7.2 | 8.0 | 8.1 | 7.8 | 7.8 | 7.8 | 7.8 | -0.3% | 10.8% | 1.8% | -4.4% | 0.0% | 0.0% | 0.0% | 0.3% | 0.0% |
| Mexican Imports | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | -34.7% | -1.8% | 47.1% | 146.2% | 0.0% | 0.0% | 0.0% | 25.4% | 0.0% |
| LNG Imports | 0.7 | 0.4 | 0.2 | 0.1 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 66.8% | 17.5% | -16.1% | -6.6% | 0.0% | 0.0% | 0.0% | -3.7% | 0.0% |
| U.S. Exports | (3.9) | (4.4) | (4.3) | (4.1) | (4.8) | (5.9) | (6.7) | (6.9) | (7.3) | (7.5) | (7.7) | 17.2% | 22.1% | 14.8% | 2.5% | 5.8% | 2.7% | 2.7% | 9.9% | 3.7% |
| LNG Exports (2016+) | - | - | - | - | - | (0.5) | (1.9) | (3.0) | (5.0) | (6.9) | (8.2) | | | | | | | | | |
| Total U.S. Imports | 9.3 | 8.5 | 7.9 | 7.3 | 7.4 | 8.2 | 8.3 | 8.0 | 8.0 | 8.0 | 8.0 | 0.7% | 11.0% | 1.4% | -4.3% | 0.0% | 0.0% | 0.0% | 0.3% | 0.0% |
| Total U.S. Exports | (3.9) | (4.4) | (4.3) | (4.1) | (4.8) | (6.4) | (8.7) | (9.9) | (12.3) | (14.4) | (15.9) | 17.2% | 22.1% | 14.8% | 2.5% | 5.8% | 2.7% | 2.7% | 18.1% | 17.2% |
| U.S. Net Imports (Exports) | 5.3 | 4.2 | 3.6 | 3.2 | 2.6 | 1.8 | (0.4) | (1.9) | (4.3) | (6.5) | (7.9) | -20.2% | -29.2% | -119.9% | NA | 125.7% | 49.0% | 22.9% | NA | 60.5% |
| Supplemental Gaseous Fuels | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| **Total** | **68.0** | **69.8** | **70.2** | **73.6** | **76.2** | **74.2** | **73.6** | **81.2** | **85.1** | **87.6** | **91.1** | **3.5%** | **-2.6%** | **-0.9%** | **10.4%** | **4.8%** | **3.0%** | **4.0%** | **3.0%** | **3.9%** |
| Implied Inventory Change | 1.0 | (0.1) | (1.4) | 0.8 | 1.6 | (0.8) | (0.6) | (0.8) | 1.0 | (0.0) | 0.3 | | | | | | | | | |
| Reported Inventory Change | 1.0 | (0.1) | (1.4) | 0.7 | 1.4 | (1.0) | (0.7) | (0.9) | | | | | | | | | | | | |

Source: EIA and Credit Suisse estimates

# Forecast Accelerating LNG Demand Growth in 2019-2020

- We forecast the pace **of US natural gas demand growth accelerates meaningfully to ~4-6 Bcfd per annum in 2019-2021E** (vs. the five-year average of ~2-3 Bcfd per annum), with much of the increase driven by the ramp-up of LNG exports.
- We expect **LNG sendout capacity to increase from ~3.0 Bcfd in 2018 to ~5.0 Bcfd in 2019 and approach ~7.0 Bcfd in 2020** driven by start-ups of the Corpus Christi, Cameron, Freeport, and Southern LNG projects.
- Longer term, **we estimate LNG exports of >8.0 Bcfd by 2021**. Our sendout forecasts assume export facilities are run at a 90% utilization rate, although Sabine Pass (the first major export facility) has been running at a higher utilization rate to date.

| | | Regulatory Approval Status | | | | | Volume (Bcfd) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | DoE | | | Sanctioned | Capacity | | | | | | |
| Project | Location | FTA | Non-FTA | FERC | FID | (MTA) | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 |
| Sabine Pass LNG | Sabine Pass, LA | √ | √ | √ | √ | 22.5 | 0.51 | 2.1 | 2.6 | 3.0 | 3.3 | 3.3 |
| Cove Point LNG | Cove Point, MD | √ | √ | √ | √ | 5.25 | | | 0.5 | 0.7 | 0.7 | 0.7 |
| Corpus Christi LNG | Corpus Christi, TX | √ | √ | √ | √ | 13.5 | | | | 0.6 | 1.2 | 1.2 |
| Southern LNG | Elba Island, GA | √ | √ | √ | √ | 2.5 | | | | 0.2 | 0.4 | 0.4 |
| Freeport LNG | Freeport, TX | √ | √ | √ | √ | 15 | | | | 0.2 | 1.3 | 2.0 |
| Cameron LNG | Hackberry, LA | √ | √ | √ | √ | 13.5 | | | | 0.9 | 1.8 | 1.6 |
| **Total Export Capacity** | | | | | | **72.3** | **0.5** | **2.1** | **3.1** | **5.5** | **8.6** | **9.1** |
| **CS Projected Exports** | | | | | | | **0.5** | **1.9** | **3.0** | **5.0** | **6.9** | **8.2** |

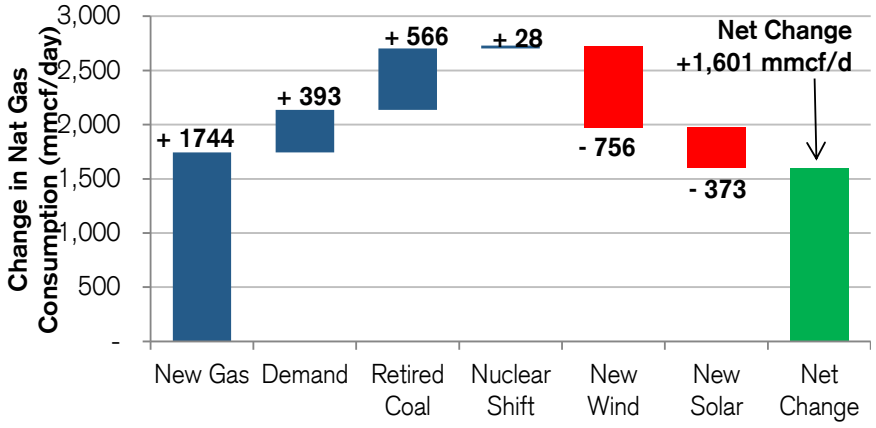
Source: Department of Energy, FERC. Company documents and Credit Suisse estimates

# Trend of Robust Power Demand for Gas Should Continue

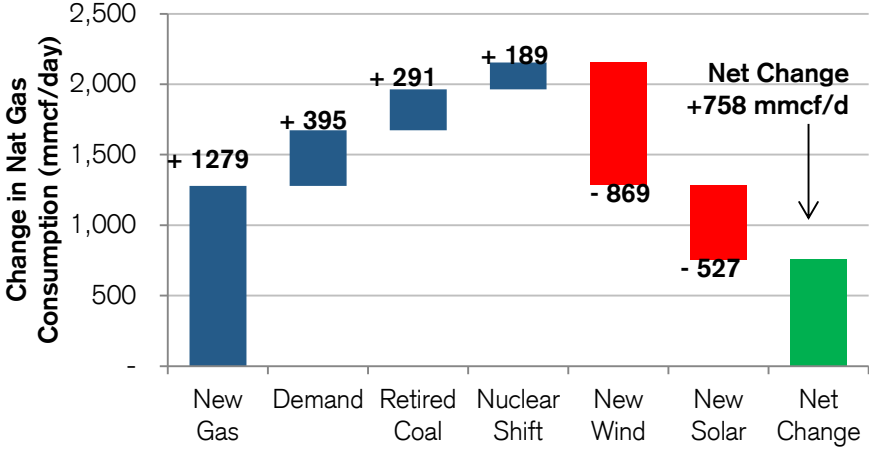
- Following demand growth of >5% per annum over the last five years, we expect continued positive demand growth from the electric power sector into 2019 driven by the **retirement of coal/nuclear plants**, which we estimate equated to a loss of ~7.2 GW of power demand last year with another ~1.0 GW to be picked up by natural gas and renewables in 2019.

- When coupled with new gas plants coming online, we forecast **natural gas to pick up an incremental ~0.8 Bcfd of power demand in 2019**; we'd note our estimate assumes a loss to renewables of >7.0 GW per annum.

**2018 Change in Natural Gas Demand from Electric Power Sector**




**2019 Change in Natural Gas Demand from Electric Power Sector**




Source: Company estimates, S&P Global Market Intelligence, Energy Information Administration, and Credit Suisse estimates

# Buildout of Chemical Infrastructure Driving Industrial Demand Growth

- **Industrial demand** represents nearly 30% of US natural gas consumption, and demand growth from this sector has been rising ~2.2% per annum over the past five years in step with economic growth.

- However, the collapse in US natural gas prices has prompted the Chemical industry to return to the US to build facilities powered by inexpensive US natural gas rather than higher-priced international naptha. **The start-up of these new facilities began in 2017 and should continue for the next few years, adding ~2 Bcfd of new demand growth from 2019-21.**

| Year | Company | Location | Expected Start-Up | Capacity ('000 MTPA) | Equivalent Gas Consumption (Bcfd) |
|---|---|---|---|---|---|
| **2017** | Dow Chemical | Freeport, TX | 2H17 | 1,500 | **0.45** |
| | OxyChem/Mexichem | Ingleside, TX | 2H17 | 550 | **0.17** |
| | | | | | **0.62** |
| **2018** | CPChem | Cedar Bayou, TX | 2Q18 | 1,500 | **0.45** |
| | ExxonMobil Chemicals | Baytown, TX | 2Q/3Q18 | 1,500 | **0.45** |
| | Indorama | Lake Charles, LA | 2Q/3Q19 | 420 | **0.13** |
| | | | | | **1.03** |
| **2019** | Sasol | Lake Charles, LA | 1Q19 | 1,550 | **0.47** |
| | Formosa Plastics | Point Comfort, TX | 2Q19 | 1,150 | **0.35** |
| | Shin-Etsu | Plaquemine, LA | 3Q19 | 500 | **0.15** |
| | | | | | **0.96** |
| **2020** | Axiall/Lotte | St. Charles, LA | 1Q20 | 1,000 | **0.30** |
| | | | | | **0.30** |
| **2021** | Shell | Monaca, PA | 2H21 | 1,500 | **0.45** |
| | Total/NOVA | Port Arthur, TX | 2H21 | 1,000 | **0.30** |
| | | | | | **0.75** |
| | | | | **Total (Bcfd)** | **3.65** |

Source: Credit Suisse estimates and company documents

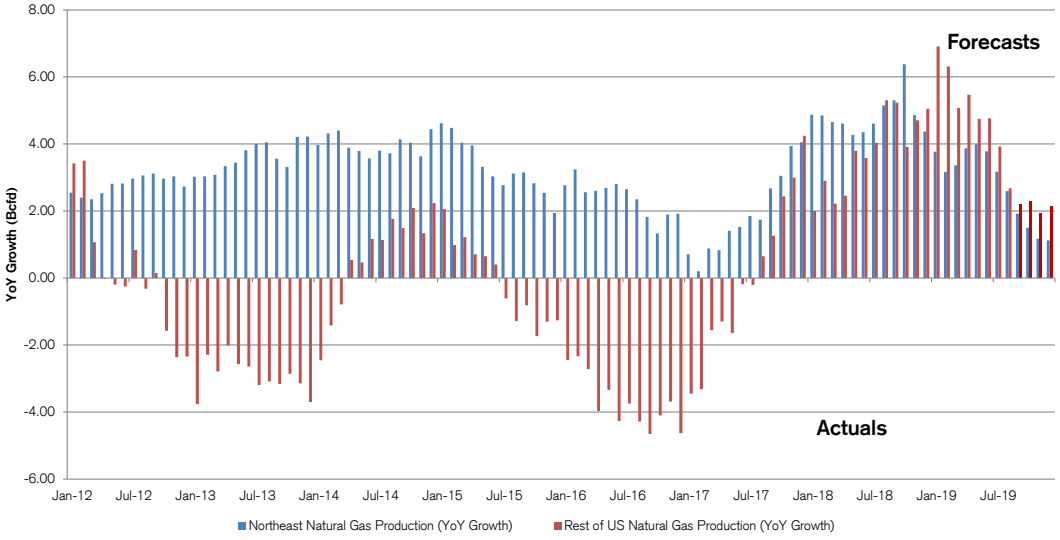
# Robust US Production Growth Driven by Marcellus and Associated Gas

- **The Northeast** (principally the Marcellus and Utica shales) grew ~3-4 Bcfd per annum in 2012-15 before pipeline bottlenecks constrained growth to ~2.0-2.5 Bcfd per annum in 2016-17, though easing of pipeline constraints last year enabled ~4.9 Bcfd of YoY growth in 2018.

- This wave of new pipelines coming onstream in late 2017 and 2018 sets the Marcellus/Utica up for continued growth over the next few years (albeit at a more modest pace vs. 2018); we **forecast YoY growth of ~2.8 Bcfd in 2019 and another ~2.1 Bcfd in 2020 from the Marcellus/Utica.**

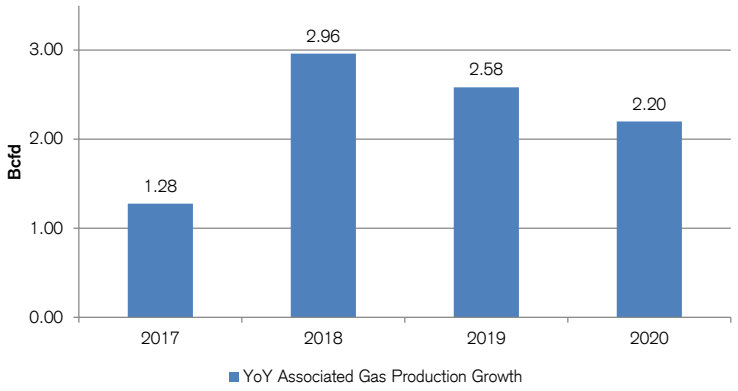
- After flattening in 2017, production from the **rest of the US** increased ~3.8 Bcfd YoY in 2018 and should rise ~4 Bcfd YoY in 2019 (and another >2.0 Bcfd YoY in 2020), driven by associated gas from oil-directed drilling and higher volumes in the Haynesville.

**Comparison of YoY Production Growth from the Marcellus/Utica vs. Rest of US (Bcfd)**




Source: Bentek, EIA, company documents and Credit Suisse estimates

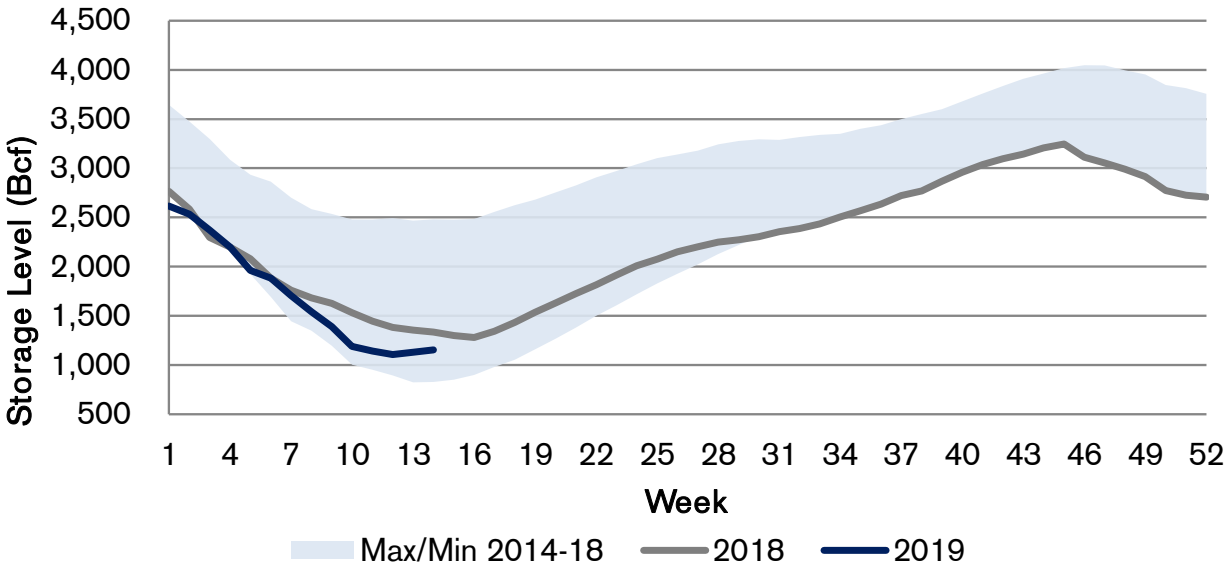
**YoY Growth in Lower 48 Associated Gas Production (Bcfd)**




Source: Wood Mackenzie

# Natural Gas Storage Levels Below Normal Exiting Winter

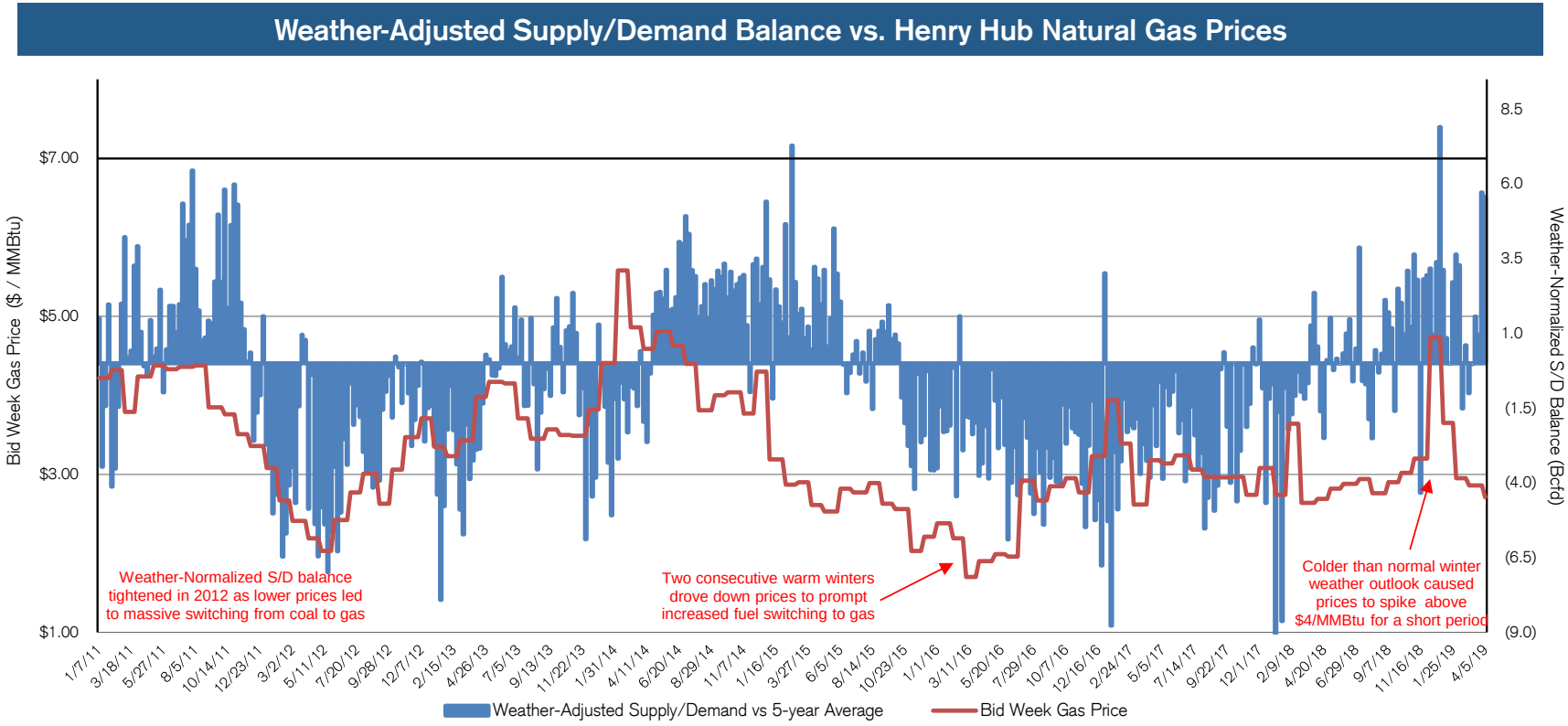
- **Natural gas storage levels** exited the withdrawal season (March) at 1.13 Bcf, ~500 Bcf below the five-year average and ~225 Bcf below year-ago levels.
- And **we project storage enters next winter at ~3.5 Tcf on October 31st ,** a ~300 Bcf surplus to the year ago level and ~150 Bcf below the 5-year average.




Source: Energy Information Administration

# Recent Natural Gas Storage Data Show Near Oversupplied Market

- While storage exited winter at 1.13 Tcf (500 Bcf below the 5-year average), prices remain below ~$3.00/MMBtu as the **weather-adjusted S/D balance is *oversupplied* by 3.5 Bcfd vs last year and the 5-year average over the past four weeks.**

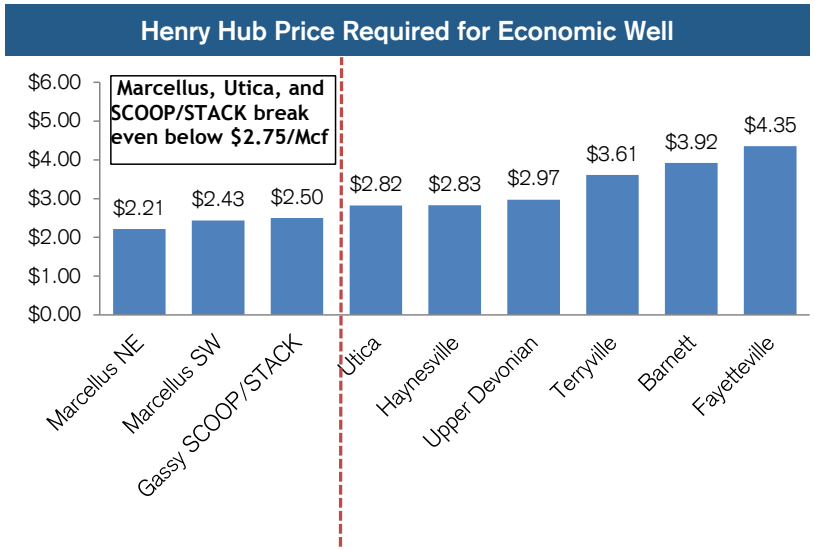



Source: Energy Information Administration, NOAA, Gas Daily, and Credit Suisse estimates

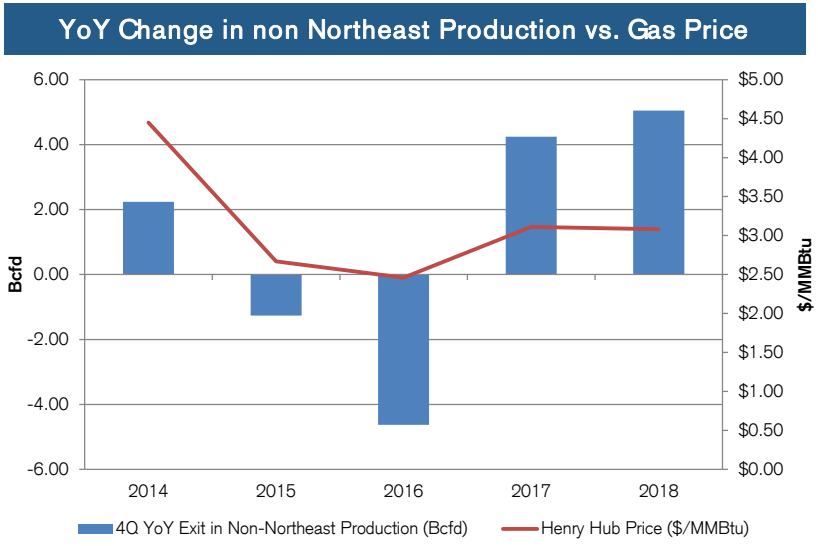
# Longer-Term Gas Price Above $2.75/MMBtu Brings on Too Much Supply

- While production growth has been consistent from the Marcellus/Utica, production from the rest of the US swings with the level of domestic natural gas prices for dry gas plays as well as associated natural gas from oil directed drilling with YoY **non-Northeast production growth occurring when prices exceed $2.75/MMBtu.**

- When prices are above $3.00/MMBtu, the economics are sufficient in numerous plays throughout the US to drive growth in non-Northeast production; **conversely, sub-$3.00/MMBtu prices prompts muted gas-directed drilling activity to levels that cause declines in non-Northeast production.**




Source: EIA, Bentek, Gas Daily, company documents and Credit Suisse estimates.




Source: EIA, Bentek, Gas Daily and Credit Suisse estimates.

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# Integrated Oils

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# What Is an Integrated Oil Company?

- Integrated oil companies (IOCs) operate throughout the entire oil and gas chain, from upstream production to refining and distribution.
- Typical business divisions include E&P (exploration and production), R&M (refining and marketing), and often times chemicals, gas and power.
- The Super Majors (e.g. ExxonMobil, Chevron, Total, Shell, BP, ENI, etc.) are global, while Emerging Majors (e.g. Petrobras, Rosneft, PTTEP, Lukoil, etc.) tend to be more focused locally.
- National Oil Companies (NOCs) in resource-rich regions are becoming more global (e.g. Saudi Aramco, Petronas, Pemex, etc.).
- *The focus of this presentation will be on the Super Majors.*

# What Are Some Key Investment Characteristics of a Super Major?

- Typically show little volume growth but generate meaningful free cash flow and pay a reliable, above average dividend yield.
- Historically have generated above average cost of capital returns in the Upstream by strong focus on capital discipline (project choice) and execution although less so in recent years.
- Investors more focused on ROCE, earnings, DACF, dividend yields, and return of cash rather than production growth as with E&Ps.
- Tend to hold up relatively well in periods of declining commodity prices due to integrated business model, strong balance sheets, and high dividend yields; conversely, they typically underperform other energy sub-sectors during periods of rising commodity prices.
- Stock prices are highly correlated to oil prices and performance of the broader market.
- Typically look most expensive on cash flow multiples (EV/DACF or EV/EBITDX) at the trough off the commodity cycle.
- Exposed to offshore and mega-project cost cycles as well as country specific political, fiscal, and economic risks. However, the US Majors are increasing their focus on US shale.

# Our Approach to Analyzing Integrated Oils

- **Factors correlated to Major Oil equity performance**
  - Oil prices, refining margins, and the S&P 500 Index
  - ROCE (rather than production growth) drives intra-sector relative performance
- **Key Valuation Metrics**
  - What oil price is reflected in Major Oil valuations?
  - EV/DACF vs. ROCE
  - Valuations of US Majors vs. European Peers

# What Drives Majors' Equity Performance?

- Since the early 2000s, the primary drivers of XOM's and CVX's share price performance have been **the price of oil, refining margins, and the performance of the broader market.**
- We estimate these three drivers' **correlation to XOM's and CVX's share price performance has been (on average) ~71%, ~71%, and ~65%**, respectively, over this time period.
- However, we'd note the correlation has been much **more consistently tied to the price of oil and S&P 500 Index than refining margins.**

| Correlation of WTI Price vs… | XOM | CVX | Average |
|---|---|---|---|
| ***2000-2018*** | **73%** | **68%** | **71%** |
| 2018 | 59% | 56% | 58% |
| 2017 | 45% | 80% | 62% |
| 2016 | 80% | 89% | 84% |
| 2015 | 55% | 58% | 57% |
| 2014 | 63% | 62% | 62% |
| 2013 | -2% | 44% | 21% |
| 2012 | 1% | 16% | 9% |
| 2011 | 76% | 76% | 76% |
| 2010 | 81% | 75% | 78% |
| 2009 | -10% | 54% | 22% |
| 2008 | 58% | 82% | 70% |
| 2007 | 85% | 83% | 84% |
| 2006 | -30% | -12% | -21% |
| 2005 | 63% | 76% | 69% |
| 2004 | 82% | 88% | 85% |
| 2003 | -31% | -11% | -21% |
| 2002 | -48% | -54% | -51% |
| 2001 | 64% | 21% | 43% |
| 2000 | 48% | 0% | 24% |

| Correlation of S&P 500 Index vs.. | XOM | CVX | Average |
|---|---|---|---|
| ***2000-2018*** | **58%** | **72%** | **65%** |
| 2018 | 74% | 47% | 60% |
| 2017 | -20% | 51% | 15% |
| 2016 | 71% | 92% | 81% |
| 2015 | 60% | 64% | 62% |
| 2014 | -1% | 9% | 4% |
| 2013 | 54% | 69% | 62% |
| 2012 | 81% | 72% | 77% |
| 2011 | 88% | 60% | 74% |
| 2010 | 86% | 88% | 87% |
| 2009 | 15% | 78% | 46% |
| 2008 | 79% | 81% | 80% |
| 2007 | 74% | 72% | 73% |
| 2006 | 85% | 75% | 80% |
| 2005 | 34% | 52% | 43% |
| 2004 | 42% | 34% | 38% |
| 2003 | 82% | 93% | 87% |
| 2002 | 91% | 87% | 89% |
| 2001 | 57% | 2% | 29% |
| 2000 | -34% | 39% | 3% |

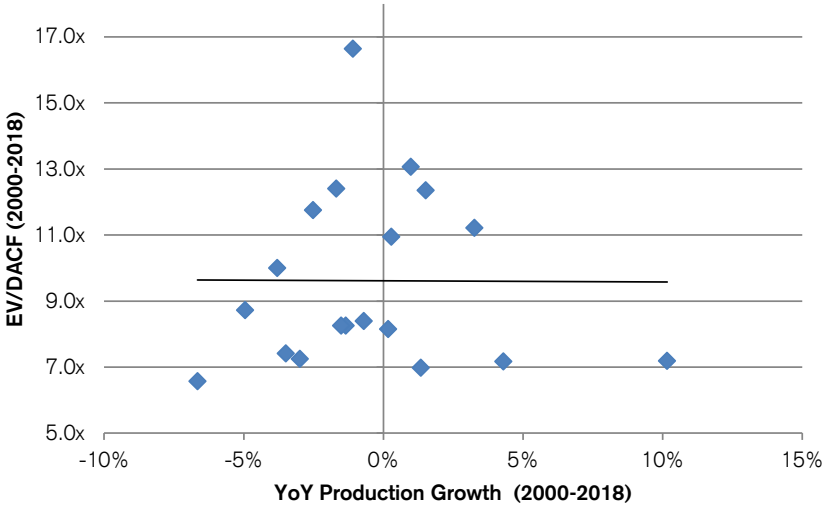
| Correlation of Refining Margins vs… | XOM | CVX | Average |
|---|---|---|---|
| ***2000-2018*** | **74%** | **68%** | **71%** |
| 2018 | 71% | 90% | 80% |
| 2017 | -91% | -66% | -79% |
| 2016 | 86% | 20% | 53% |
| 2015 | 8% | -47% | -19% |
| 2014 | 67% | 85% | 76% |
| 2013 | -24% | -98% | -61% |
| 2012 | 64% | 47% | 56% |
| 2011 | -16% | -15% | -15% |
| 2010 | 10% | 48% | 29% |
| 2009 | 28% | -84% | -28% |
| 2008 | 76% | 97% | 87% |
| 2007 | -13% | -25% | -19% |
| 2006 | -53% | -49% | -51% |
| 2005 | 97% | 80% | 89% |
| 2004 | 93% | 82% | 88% |
| 2003 | -94% | -53% | -73% |
| 2002 | -42% | -49% | -46% |

Source: Credit Suisse estimates and company documents

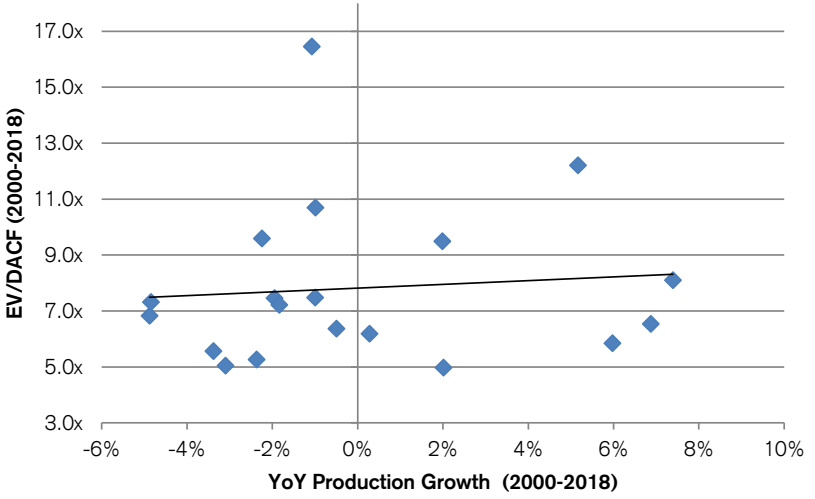
# Production Growth Not a Reliable Indicator of Valuation/Performance…

- Unlike E&Ps, the **Majors' relative valuation and equity performance are not highly correlated to year-on-year production growth.**
- From 2000 to 2018, XOM's and CVX's EV/DACF **valuations have shown effectively no correlation to annual production growth.**

**XOM's EV/DACF Multiple vs. Production Growth (2000-2018)**




**CVX's EV/DACF Multiple vs. Production Growth (2000-2018)**

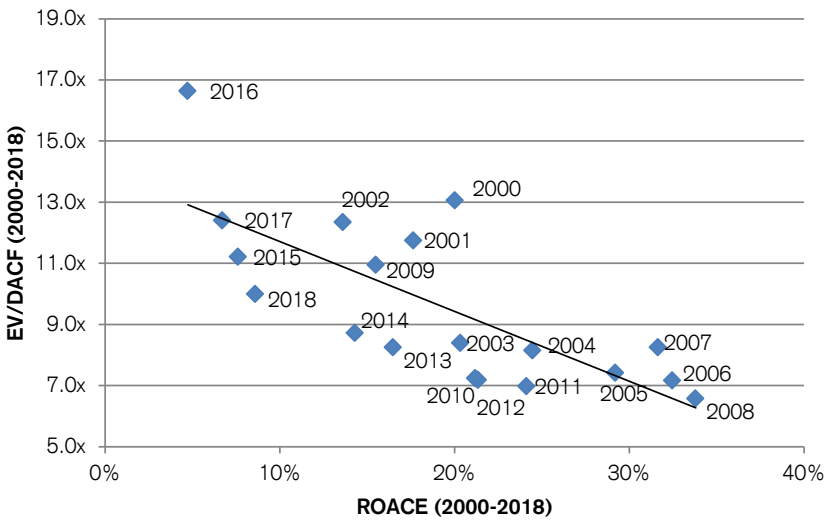



Source: Credit Suisse estimates and company documents

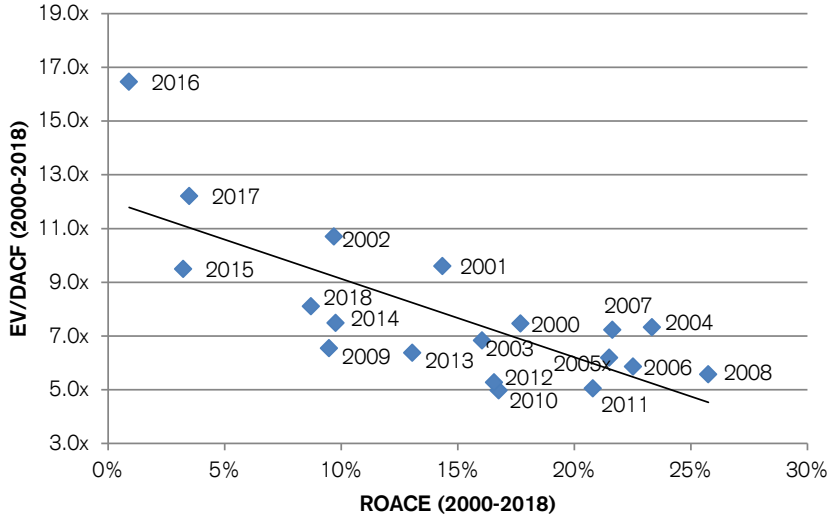
# …But Majors' Performance/Valuation Is Highly Correlated to ROCE

- Unlike production growth, XOM and CVX's EV/DACF multiples have had a **74% and 75% inverse correlation to ROCE from** 2000 to 2018.
- We attribute the high correlation to **investors being more focused on earnings, dividend yields, and return of cash from Majors**, as opposed to seeking more aggressive growth with E&Ps.
- The **inverse correlation suggests that investors typically value Majors, assuming near term earnings/returns will revert to a mean based on a longer-term mid-cycle price** (e.g., high multiples during years of depressed oil prices and ROCE like 2016, and low multiples during the years of super-normal oil prices and returns like 2011-14).

**XOM's EV/DACF vs. ROCE (2000-2018)**




**CVX's EV/DACF vs. ROCE (2000-2018)**

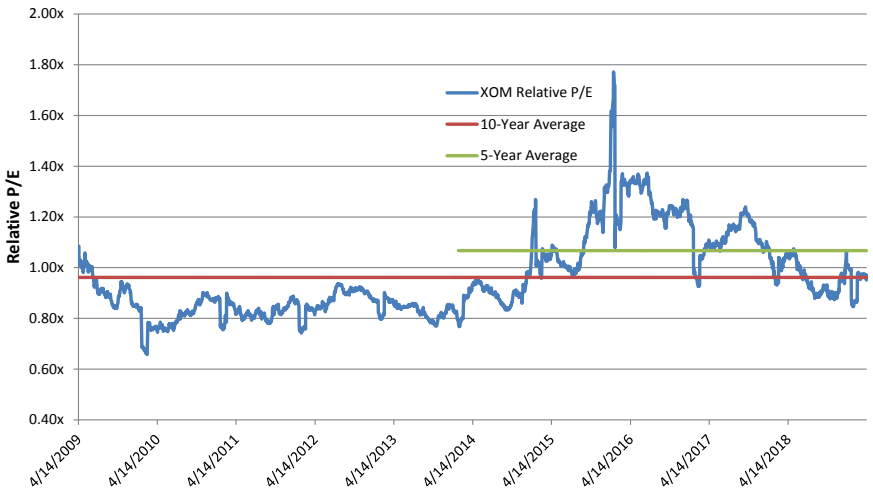



Source: Credit Suisse estimates and company documents

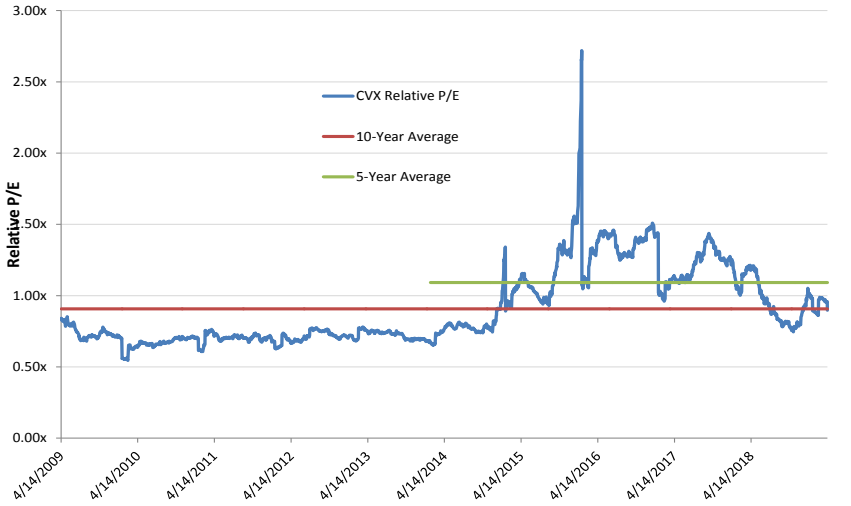
# What Oil Price Are the Majors' Equity Valuations Discounting?

- On relative P/E (vs. the S&P 500 Index and using consensus 2020 estimates), XOM and CVX are trading at ~0.95x and ~0.90x, compared to historical averages of ~0.96x and ~0.91x, respectively.
- Viewed another way, to trade at their historical relative P/Es, **XOM and CVX are effectively pricing in mid-cycle WTI prices of $57/Bbl and $56/Bbl**, respectively, above the E&Ps' ~$50/Bbl (WTI) and the European Majors' $55-$60/Bbl (Brent).
- **We attribute the higher relative P/Es to investors placing a premium on the Majors' stronger balance sheets and higher dividend yields relative to E&Ps.**

**XOM Relative P/E**




**CVX Relative P/E**

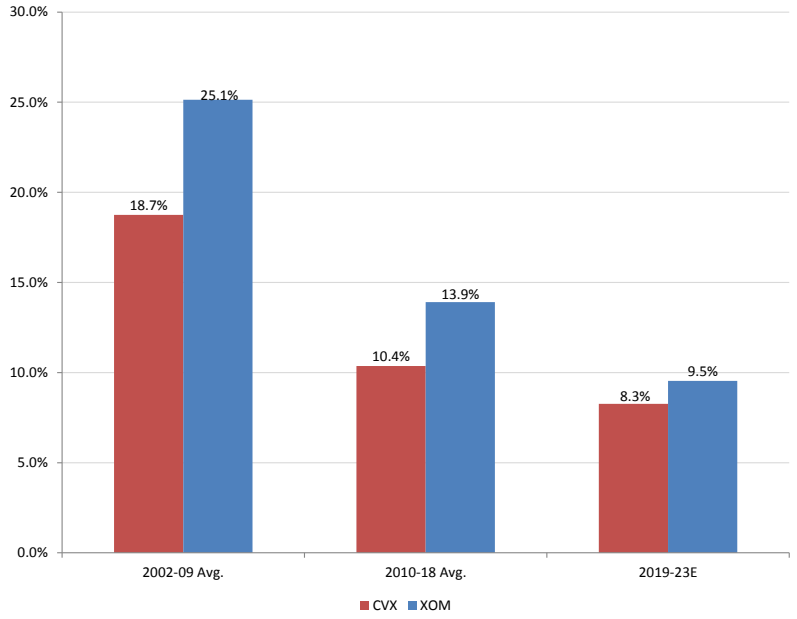



Source: Thomson Reuters

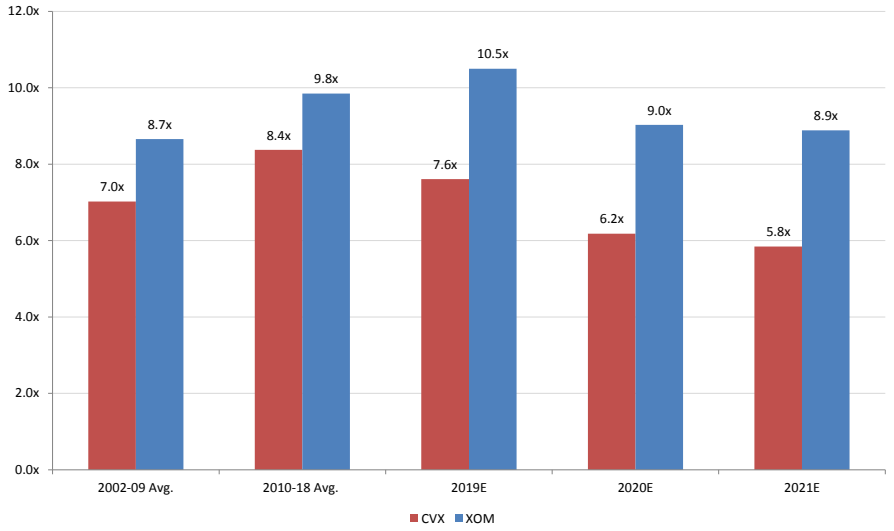
# Factoring Improving Relative ROCE, CVX Offers Better Value than XOM

- Historically superior, XOM's ROCE has **narrowed from a 640-basis-point premium to CVX in 2002-09 to a 350-basis-point premium in 2010-18 and should compress to just ~130 basis points in 2019-23E.**
- Despite the relative compression in its ROCE premium, **XOM is trading at a ~3.0 turn premium to CVX on 2019-21E EV/DACF under current futures strip prices (much wider than its historical average premium).**

**XOM vs. CVX ROCE (2002-2023E)**




**XOM vs. CVX EV/DACF (2002-2021E)**




Source: Credit Suisse estimates and company documents

# US Majors Look Expensive Relative to E&Ps and Integrated Peers

- To trade at their historical relative P/E multiples, **XOM and CVX are effectively pricing in mid-cycle WTI prices of ~$57/Bbl and ~$56/Bbl, respectively, well above the E&Ps' ~$50/Bbl (WTI) and the European Majors' $55-$60/Bbl (Brent).**
- On an EV/DACF basis and assuming current futures strip prices, **XOM and CVX are trading at 10.5x and 7.6x on 2019 estimates, below their historical averages but well above the Canadian (and European Integrateds)** despite now comparable ROCE.

**Relative Valuation Metrics Under Current Futures Strip Prices**

| | | EV/DACF | | | | | P/E | | | | Relative P/E* | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Company | Current Price | Historical Average | 2019 | 2020 | 2021 | 2022 | 2019 | 2020 | 2021 | 2022 | Historical Average | 2019 | 2020 | 2021 | 2022 |
| **U.S. Integrateds** | | | | | | | | | | | | | | | |
| Chevron | $119.76 | 8.8x | 7.6x | 6.2x | 5.8x | 5.7x | 14.9x | 12.8x | 13.8x | 14.6x | 0.91x | 0.87x | 0.79x | 0.90x | 1.00x |
| ExxonMobil | $80.92 | 10.7 | 10.5 | 9.0 | 8.9 | 8.7 | 18.2 | 14.5 | 14.4 | 13.6 | 0.96 | 1.06 | 0.90 | 0.94 | 0.93 |
| **Average** | | **9.8x** | **9.1x** | **7.6x** | **7.4x** | **7.2x** | **16.6x** | **13.7x** | **14.1x** | **14.1x** | **0.93x** | **0.97x** | **0.85x** | **0.92x** | **0.96x** |
| **Canadian Integrateds** | **CAD $** | | | | | | | | | | | | | | |
| Canadian Natural Resources | $39.59 | 8.2x | 5.4x | 5.2x | 5.1x | 4.6x | 9.7x | 10.5x | 11.9x | 11.7x | 1.24x | 0.66x | 0.79x | 0.96x | 0.99x |
| Cenovus Energy | $13.19 | 9.4 | 5.2 | 5.0 | 5.1 | 4.0 | 11.8 | 14.1 | 18.4 | 12.2 | 1.93 | 0.80 | 1.06 | 1.48 | 1.03 |
| Husky Energy | $14.38 | 7.7 | 4.0 | 3.5 | 3.3 | 2.8 | 10.6 | 9.6 | 11.3 | 9.3 | 1.89 | 0.72 | 0.72 | 0.91 | 0.79 |
| Imperial Oil | $38.73 | 11.6 | 6.1 | 6.2 | 6.2 | 5.7 | 11.4 | 11.8 | 13.2 | 13.0 | 1.13 | 0.78 | 0.89 | 1.07 | 1.10 |
| Suncor Energy | $43.88 | 7.6 | 5.9 | 5.3 | 6.2 | 6.0 | 11.7 | 10.0 | 15.8 | 16.0 | 1.38 | 0.80 | 0.75 | 1.27 | 1.35 |
| **Average** | | **8.9x** | **5.3x** | **5.0x** | **5.2x** | **4.6x** | **11.0x** | **11.2x** | **14.1x** | **12.4x** | **1.52x** | **0.75x** | **0.84x** | **1.14x** | **1.05x** |
| **North America Integrateds Average** | | **9.1x** | **6.4x** | **5.8x** | **5.8x** | **5.4x** | **12.6x** | **11.9x** | **14.1x** | **12.9x** | **1.35x** | **0.81x** | **0.84x** | **1.07x** | **1.03x** |

Source: Reuters, the BLOOMBERG PROFESSIONAL™ service, Company reports, and Credit Suisse estimates.

Note: Based on current NYMEX Brent, WTI, and Henry Hub futures strip prices: 2019 - $68.73/Bbl, $61.45/Bbl, & $2.87/MMBtu; 2020 - $67.54/Bbl, $60.98/Bbl, & $2.77/MMBtu; 2021 - $64.58/Bbl, $57.66/Bbl, & $2.68/MMBtu; 2022 - $62.53/Bbl, $55.58/Bbl, & $2.68/MMBtu; and 2023+ - $61.56/Bbl, $54.6/Bbl, & $2.75/MMBtu.

*Relative P/E is based on the S&P Index for the U.S. Integrateds and Toronto Stock Market Exchange Index for the Canadian Integrateds

# XOM vs. CVX: How Do They Stack Up?

- In summary, **XOM** will have materially higher capex spending over the next several years as it develops its "next generation" of upstream assets (Guyana, Brazil, US onshore, PNG, and Mozambique LNG); meanwhile, **CVX** is coming off peak capex spending and is delivering more immediate production growth and is better positioned to increase its cash returns to shareholders.

- We estimate XOM and CVX should both deliver a 2018-23 Upstream production CAGR of ~4%.

- CVX has a much larger relative footprint in US onshore (particularly in the prolific Permian Basin) whereas XOM is still heavily reliant on new offshore, conventional mega-projects which carry greater execution risk.

- At current futures strip prices, we estimate CVX will generate free cash flow (after dividends) of ~$13 billion per annum while XOM should *outspend* cash flow and dividends by >$3 billion per year from 2019-20. This FCF profile has enabled CVX to reinstate its share repurchase program (targeting ~$5 billion/annum), whereas we don't expect XOM will commit to a buyback over the next 2-3 years.

- Comparable dividend yields with XOM at ~4.1% and CVX at ~4.0%.

- XOM has superior 2019-20 ROCE of ~8.3% vs CVX's ~7.4%, but this gap is much narrower than XOM's historical premium of 400-600 bps.

- Despite the aforementioned points, XOM trades at a ~3.0 turn premium to CVX on 2019-21 EV/DACF at strip prices (much wider relative to its historical average premium of ~1.9x).

Credit Suisse Equity Research
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# Exploration & Production

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# What Is an E&P Company?

- **E&P companies lease or buy land (or mineral rights) in order to drill wells and produce oil and/or natural gas as well as natural gas liquids (NGLs).** E&Ps typically hire seismic companies to image the sub-surface and other oilfield service companies to drill wells they design. The vast majority of cash flows from wells on production are re-invested to drill additional prospects.

- **The vast majority of an E&P company's value is in its proved reserves**. With the growth of shale in the US, E&Ps are increasingly valued on risked probable and possible reserves that do not yet qualify to be categorized as proved reserves under SEC definitions.

- **E&P companies produce oil, natural gas, and NGLs, and pursue growth strategies via *exploration* or *acquire and exploit***.

    - **Oil vs gas mix**. This is generally driven by the different characteristics of various basins; e.g., Permian is oil weighted while the Marcellus is natural gas weighted.

    - **Exploration**. This entails searching for oil and gas in unproven areas via the drillbit.

    - **Acquire and exploit**. A strategy popularized in the 1990s when E&Ps purchased properties from larger companies (Majors) searching for larger prospects.

    - **Resource plays**. Oil and gas plays characterized by large contiguous acreage positions with fairly homogenous geologic characteristics across the acreage, enabling manufacturing style drilling. The combination of horizontal drilling and advanced well fracturing techniques on shale plays has unlocked numerous shale plays in the US, revitalizing the US oil and gas industry over the last 10 years.

- **Given the capital intensive nature of the E&P business, companies are generally evaluated on cash flow based metrics such as EV/EBITDX and net asset value although value investors are beginning to measure companies on FCF yield**.

# Top U.S. Oil Basins

## Williston Basin (Bakken)

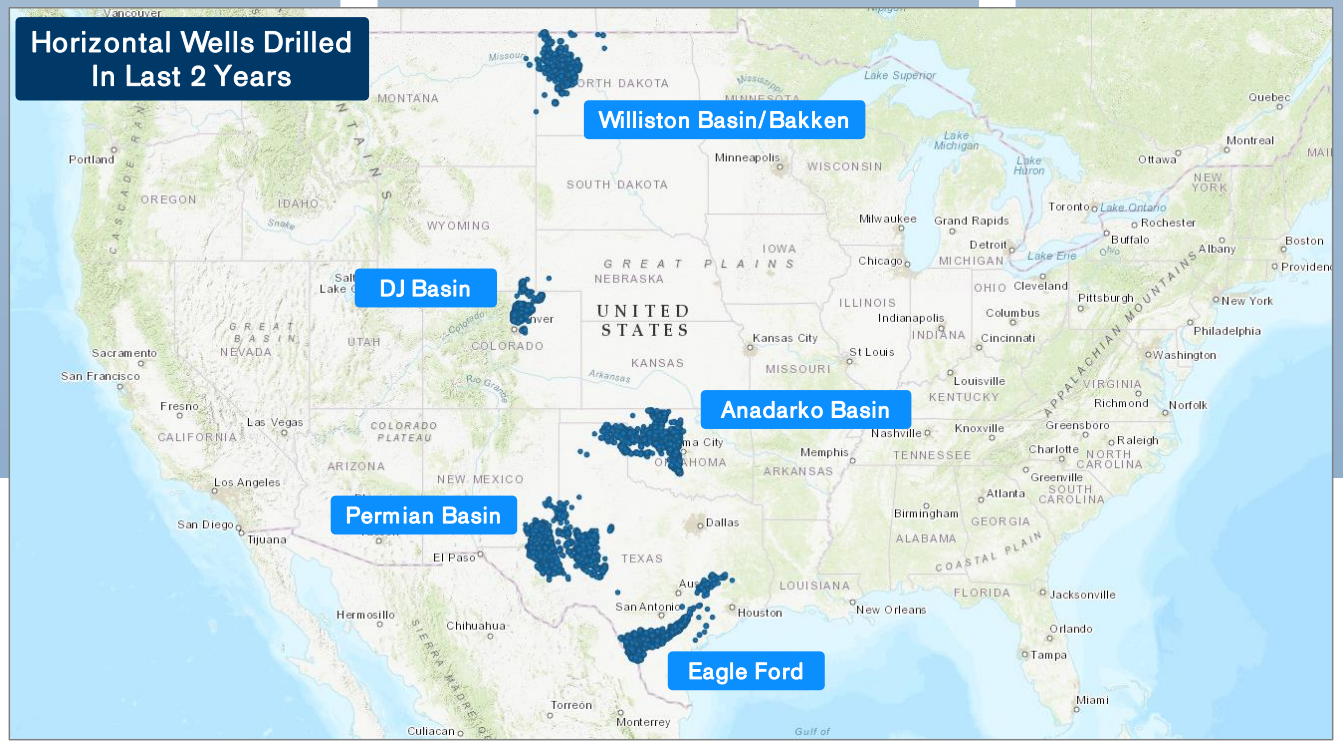
- **61 rigs currently running** (vs 55 a year-ago)
- **~$46/Bbl average breakeven**
- Operators under coverage: **CLR, EOG, HES, MRO, OAS, WLL**

## DJ Basin (Denver-Julesburg)

- **30 rigs currently running** (vs 24 a year ago)
- **~$45/Bbl average breakeven**
- Operators under coverage: **APC, NBL, PDCE, SRCI, WLL, XOG**

## Eagle Ford

- **78 rigs currently running** (vs 73 a year ago)
- **~$38/Bbl average breakeven in oil window and $47/Bbl in condensate window**
- Operators under coverage: **COP, DVN, ECA, EOG, MRO, MUR, NBL, SM**



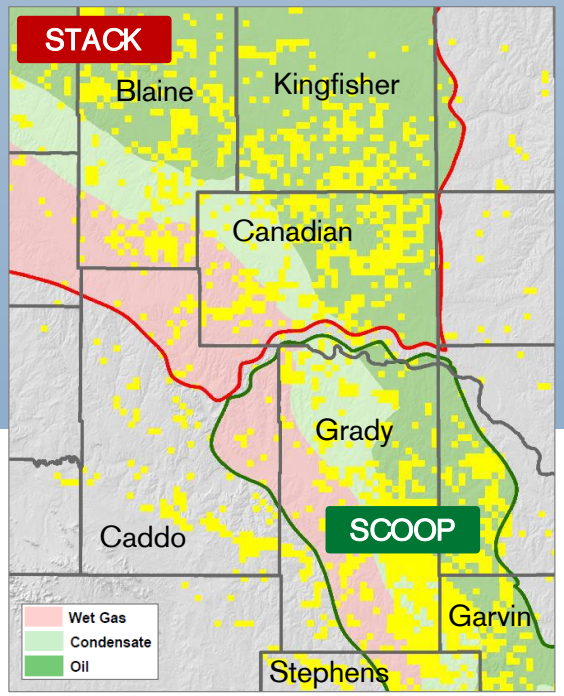

Source: DrillingInfo

*Note: Breakevens calculated using a pre-tax IRR of 30%*

# Top U.S. Oil Basins (Continued)

## Cana Woodford (Anadarko)

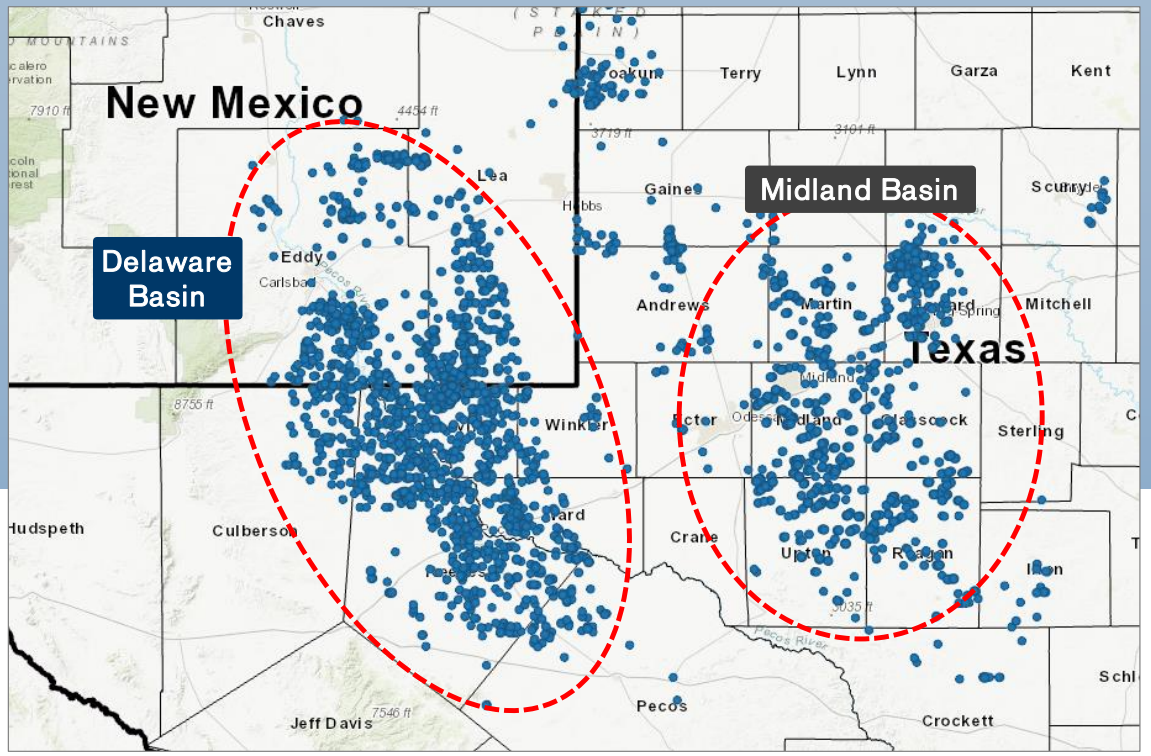
- **50 rigs currently running** (vs 63 a year ago)
- **STACK: ~$44/Bbl avg breakeven**
- **SCOOP: ~$44/Bbl avg breakeven**
- Operators under coverage: **CLR, DVN, ECA, MRO, XEC**




Source: Marathon Oil

## Permian (Midland & Delaware Basin)

- **462 rigs currently running** (vs 444 a year ago)
- **Delaware Basin:**
  - **~$39-44/Bbl average breakeven**
- **Midland Basin:**
  - **~$46/Bbl average breakeven**
- Operators under coverage: **APA, APC, CDEV, CPE, CXO, DVN, ECA, EOG, FANG, JAG, LPI, MRO, NBL, OXY, PDCE, PE, PXD, QEP, SM, WPX, XEC**



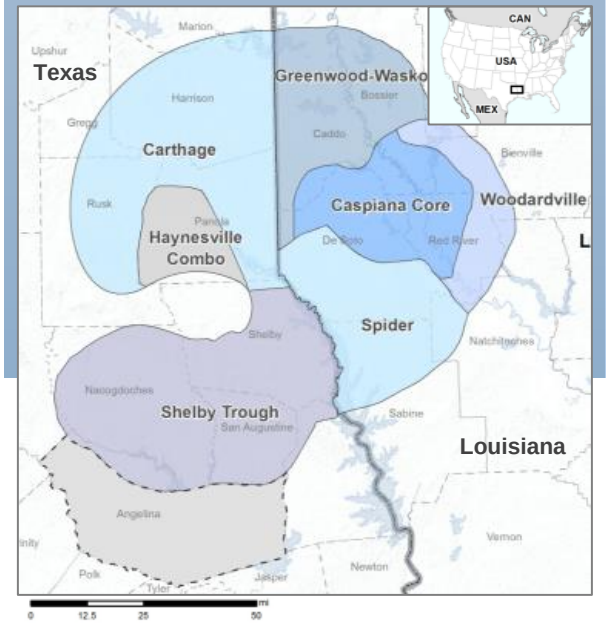

Source: DrillingInfo

*Note: Breakevens calculated using a pre-tax IRR of 30%.*

# Top U.S. Gas Basins

## Haynesville

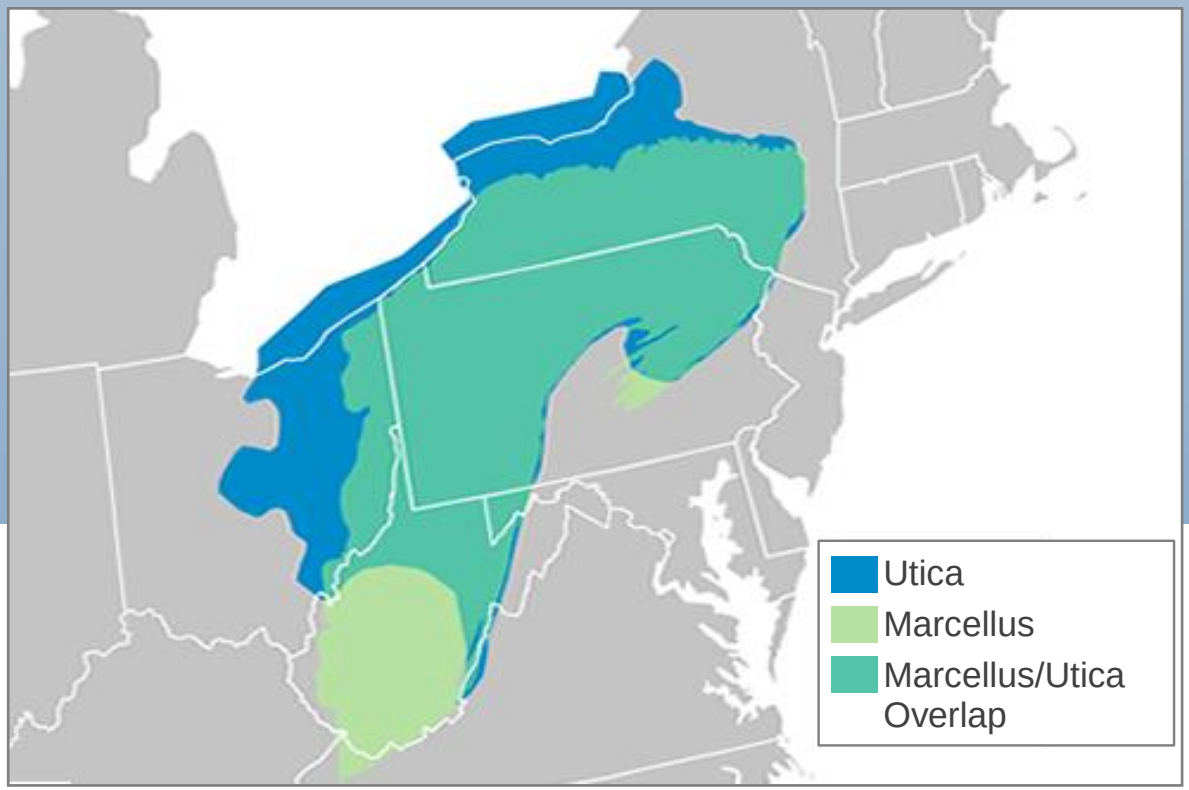
- **58 rigs currently running** (vs 52 a year ago)
- **~$2.85/MMBtu average breakeven,**
- Operators under coverage: **CHK, QEP**




Source: WoodMac

## Marcellus & Utica

- **68/15 Marcellus/Utica rigs currently running** (vs 56/24 a year ago)
- **Marcellus:**
  - **~$2.20-2.45/MMBtu avg breakeven**
- **Utica:**
  - **~$2.85/MMBtu avg breakeven**
- Operators under coverage: **AR, CHK, COG, EQT, GPOR, RRC, SWN**

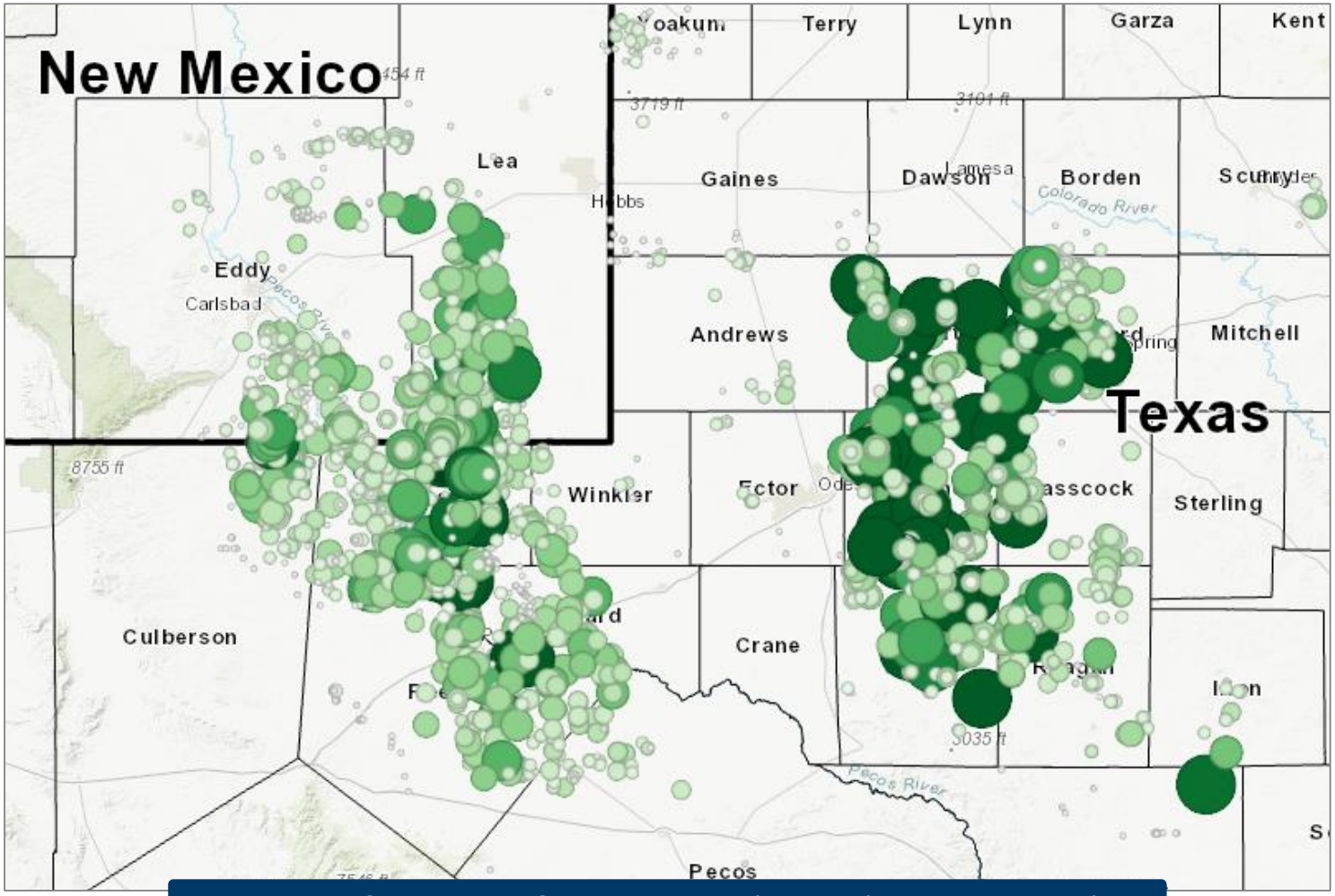



Source: U.S. Energy Information Administration

*Note: Breakevens calculated using a pre-tax IRR of 30%.*

# Within each basin there are sweet spots where returns are greatest

Investment returns are driven by production volumes, which are, in turn, driven by rock quality and an individual operator's ability to execute.




6 Month Cumulative Oil Production (Darker/larger = Higher)

Source: DrillingInfo

# Traditional E&P Company Metrics Are Becoming Outdated

- **E&Ps have traditionally been measured on various production and reserve metrics, which are still relevant to the business model but have grown increasingly less useful in terms of predicting/explaining stock price performance and relative valuation.**
  - **Proved reserves:** Total quantities of oil and gas estimated with reasonable certainty to be economically producible from known reservoirs and under current economic conditions and operating methods. E&P companies are required to disclose estimates of proved reserves annually in Form 10-K filed with the SEC, estimated using trailing 12-month average beginning-of-the-month oil and natural gas prices ("SEC pricing").
  - **PV-10.** Estimated discounted future cash flows from proved reserves, net of future production and development costs and income tax expense, also based on SEC pricing and disclosed annually in the 10-K.
  - **Reserve life.** Total year-end proved reserves divided by estimated current year production. Historically used to compare the longevity of future production among E&P companies, with investors generally rewarding a higher ratio with a premium valuation multiple.
  - **Reserve replacement ratio.** Incremental proved reserves added in a given year as a percentage of that year's total production. Over the long-term, E&Ps need to replace >100% of production in order to deliver future growth.
  - **Finding and development (F&D) cost.** Total costs incurred in exploration and development activities per barrel of oil-equivalent ("Boe") of proved reserves added.
  - **Recycle ratio.** Net income per Boe produced divided by average F&D cost/Boe. Measures how profitably E&P companies are reinvesting in future production growth.

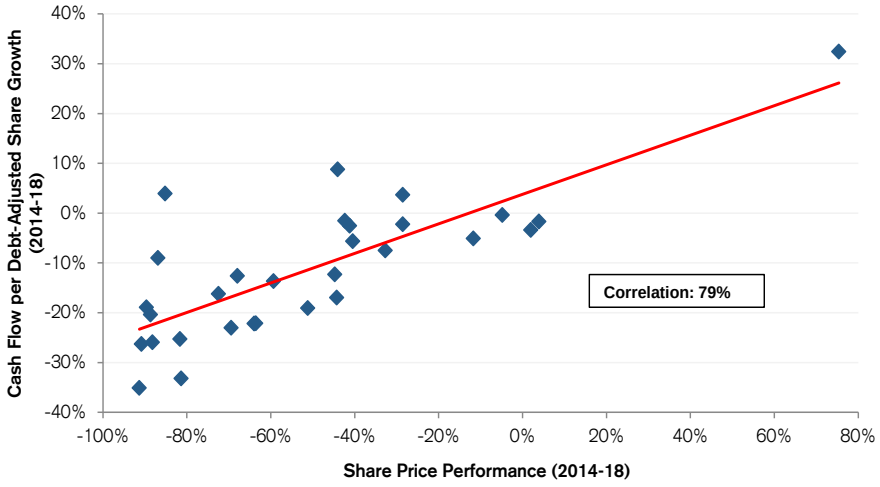
# What Does Drive E&P Stock Performance?

- **E&P investors are increasingly looking to differentiate companies on capital efficiency and return metrics, quality/depth of inventory (particularly onshore unconventional resource) and, more recently, relative free cash flow generation.**
- **On the following pages, we outline the key operating and financial metrics we view as most relevant in analyzing E&P companies, including:**
  - Production (and more importantly) cash flow per debt-adjusted share growth
  - Unbooked resource-to-proved reserves ratio
  - Normalized core drilling inventory
  - Free cash flow outlook

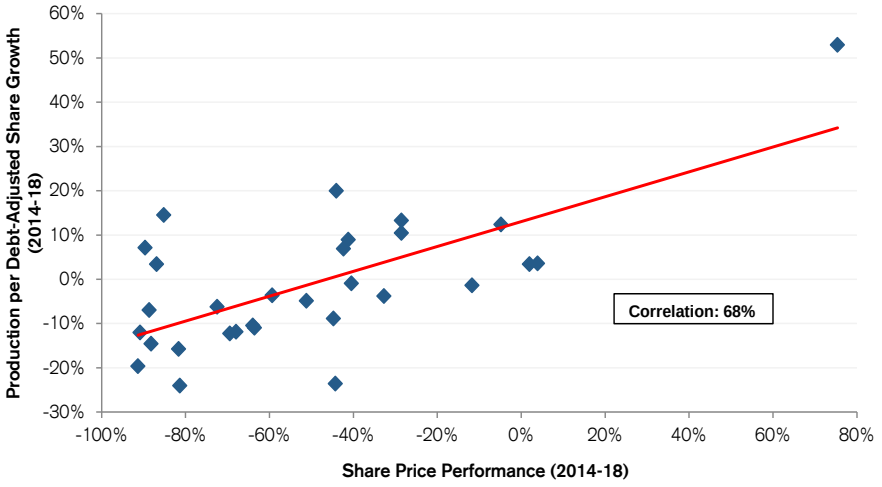
# Cash Flow Per Debt-Adjusted Share Growth: Metric with Highest Correlation to Intra-Sector Relative Performance

- **Debt-adjusted per share growth metrics factor disparate capital allocation decisions:** Growth capex, debt level changes, share repurchases, etc.
- These metrics are **increasingly being used in management compensation formulas** as they measure the capital efficiency of growth.
- We believe **cash flow per debt-adjusted share growth is a more effective metric than production per debt-adjusted share growth,** as it takes into account the margin differences caused by the changing oil:gas price relationship.
- Over the past five years, we estimate **the E&P sector has had a 79% and 68% correlation to cash flow and production per debt-adjusted share growth, respectively.**

**Stock Performance Correlation to Cash Flow Per Debt-Adjusted Share Growth**




**Stock Performance Correlation to Production Per Debt-Adjusted Share Growth**

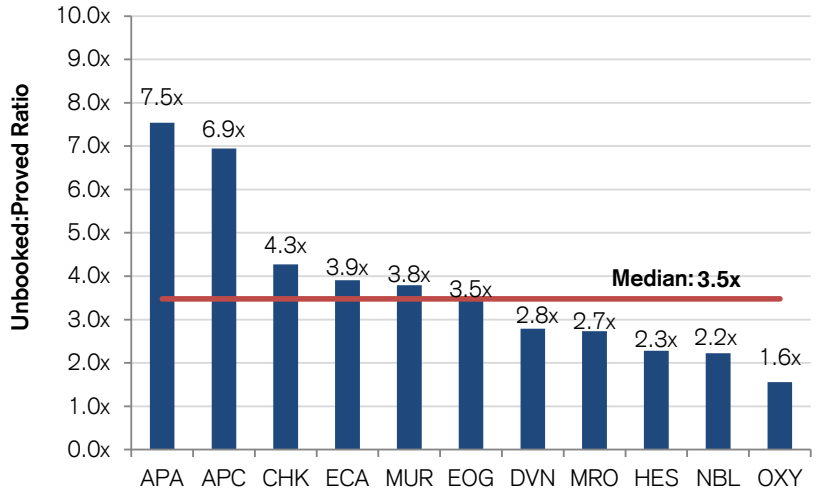



Source: NYMEX, the BLOOMBERG PROFESSIONAL™ service, company documents and Credit Suisse estimates.

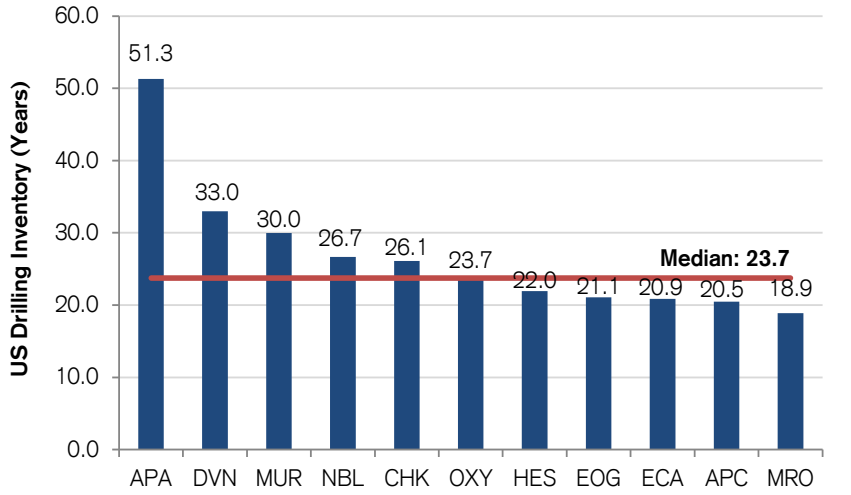
# Measuring Growth Visibility Through Resource Size and Inventory Depth

- In addition to measuring growth and, more importantly, the capital efficiency of that growth, we **monitor the relative resource size of each E&P company to gauge the potential duration of that growth.**
  - We estimate risked unbooked resource potential in shale plays and conventional exploration discoveries and compare those amounts to each companies' proved reserve base to estimate the relative size of their development inventory.
  - We also measure resource inventory life (US specifically for the large-cap E&Ps) defined as risked total well locations divided by 2019 forecast completions.
- We would note **the shortcomings of these metrics** are that they **do not take into account the relative quality** of each company's unbooked resource potential and **high-grading of the near term development programs**.

**Unbooked Resource–to–Proved Reserves (Large-Cap E&Ps)**




**US Resource Inventory Life* (Large-Cap E&Ps)**

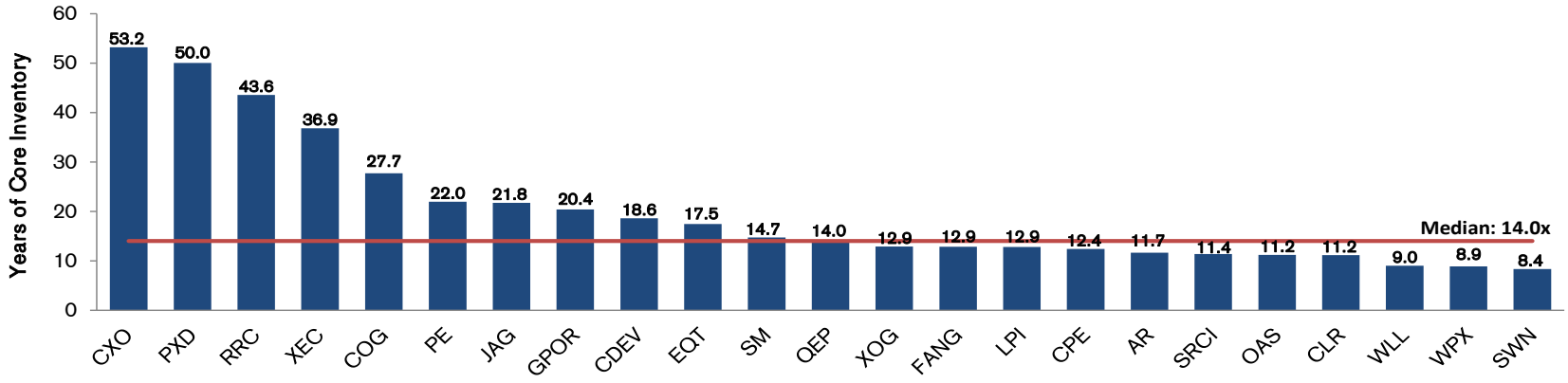



Source: Credit Suisse estimates and company documents

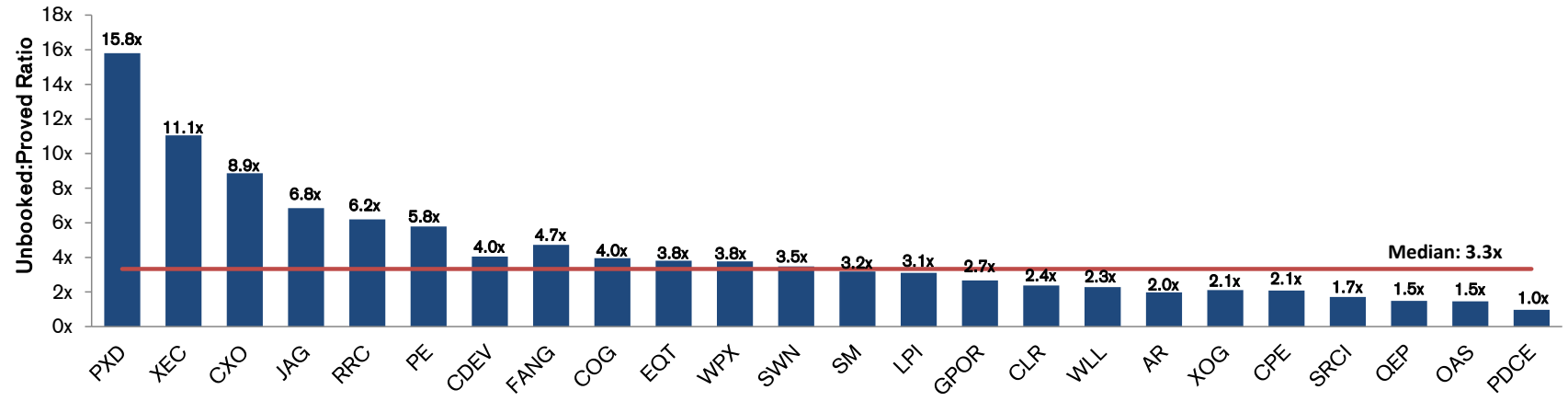
# Resource Size of SMID-Cap E&Ps Best Viewed on Core Inventory

- Oil-weighted **SMID-caps generally have larger relative unbooked resource potential** than the more developed and mature large-cap E&Ps.
- In addition to the unbooked-to-proved ratio, we pay close attention to the **core drilling inventory normalized to actual development targets** as another proxy for the size of a company's reinvestment opportunities.

**Normalized Core Drilling Inventory* (Years) – Resource E&Ps**




**Unbooked Resource: Proved Reserves (SMID-Cap E&Ps)**

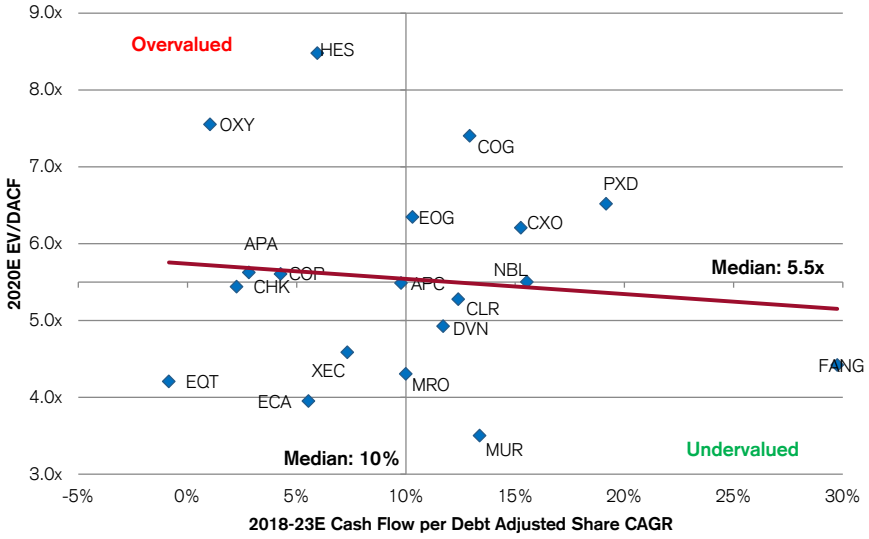



Source: Credit Suisse estimates and company documents

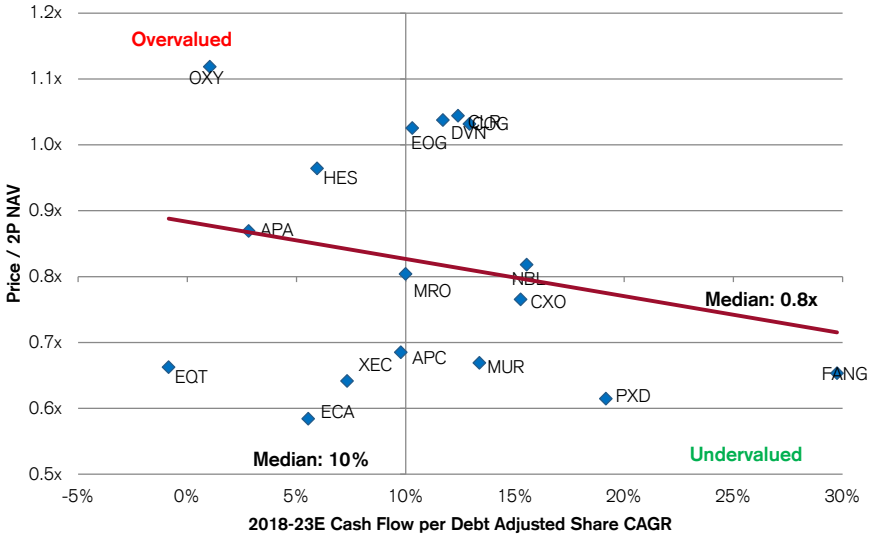
# Valuation vs. Cash Flow Per Debt-Adjusted Share Growth

- When comparing E&P companies, we believe the **most important analysis is to compare the multi-year cash flow per debt-adjusted share growth outlook to companies' valuation.**
- We **rely more on EV/DACF than Price/NAV for large-caps given** relatively similar absolute growth rates, reserve lives, and unbooked-to-proved reserve ratios.
- Given the disparity in growth rates and life cycles of **SMID-caps,** we equally weight **Price/NAV and EV/EBITDX** valuation metrics.

**EV/DACF vs. Cash Flow Per Debt Adjusted Share Growth for Large Caps**




**P/NAV vs. Cash Flow Per Debt Adjusted Share Growth for Large Caps**



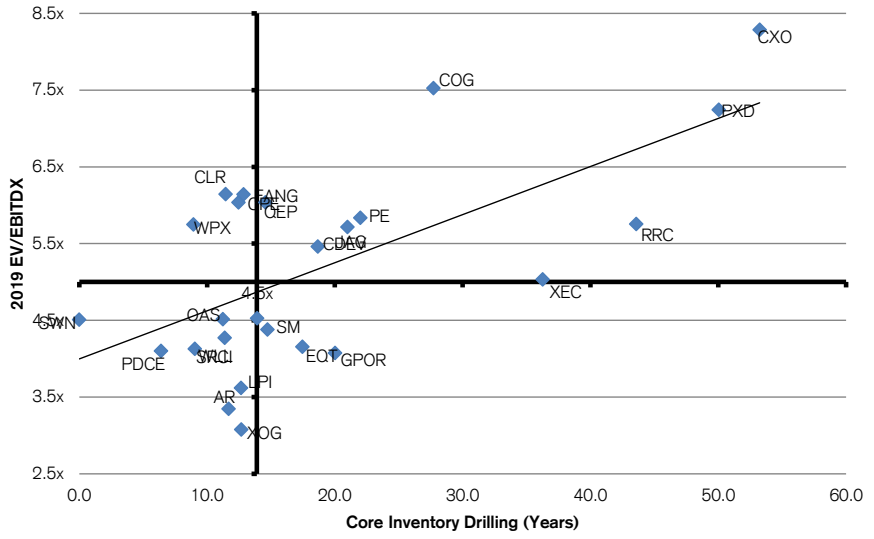

Note: Based on current NYMEX Brent, WTI, and Henry Hub futures strip prices: 2019 - $68.73/Bbl, $61.45/Bbl, & $2.87/MMBtu; 2020 - $67.54/Bbl, $60.98/Bbl, & $2.77/MMBtu; 2021 - $64.58/Bbl, $57.66/Bbl, & $2.68/MMBtu; 2022 - $62.53/Bbl, $55.58/Bbl, & $2.68/MMBtu; and 2023+ - $61.56/Bbl, $54.6/Bbl, & $2.75/MMBtu.

Source: Credit Suisse estimates and company documents

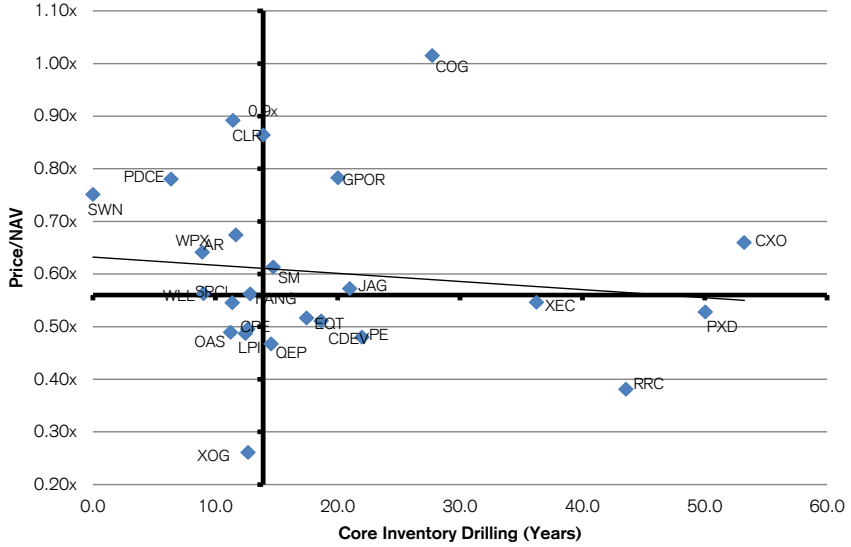
# Valuation Relative to Resource Size

- **We see three scenarios in which P/NAV is more relevant than EV/DACF or EV/EBITDX**:
  - **E&Ps with an unusually large resource base (high unbooked-to-proved ratio) appear more expensive on cash flow metrics**, which do not incorporate their longer-term growth potential (e.g., PXD trades at a premium EV/EBITDX multiple but at a discount on NAV);
  - **Companies with a materially below-average resource life may appear inexpensive on EV/EBITDX**, as cash flow in a given year represents a much higher percentage of total future cash flows compared to peers; in these cases, price/NAV should also be more heavily relied on than cash flow multiples (e.g., PDCE, WLL, etc.); and
  - **Comparing E&P companies with materially different growth rates** (e.g., comparing early growth vs. mature, slower-growth E&Ps).

**Core Inventory (Years) vs. 2019 EV/EBITDX for SMID-Cap E&Ps**




**Core Inventory (Years) vs. P/NAV for SMID-Cap E&Ps**




Note: EV/EBITDX multiples are bsed on current NYMEX Brent, WTI, and Henry Hub futures strip prices: 2019 - $68.73/Bbl, $61.45/Bbl, & $2.87/MMBtu; 2020 - $67.54/Bbl, $60.98/Bbl, & $2.77/MMBtu; 2021 - $64.58/Bbl, $57.66/Bbl, & $2.68/MMBtu; 2022 - $62.53/Bbl, $55.58/Bbl, & $2.68/MMBtu; and 2023+ - $61.56/Bbl, $54.6/Bbl, & $2.75/MMBtu.
P/NAV multiples are based on Credit Suisse official Brent, WTI, and Henry Hub commodity price forecasts: 2019 - $66.60/Bbl, $57.50/Bbl, and $2.95/MMBtu, 2020 - $67.00/Bbl, $57.00/Bbl, and $2.75/MMBtu, and 2021+ - $70.00/Bbl, $60.00/Bbl, and $2.75/MMBtu

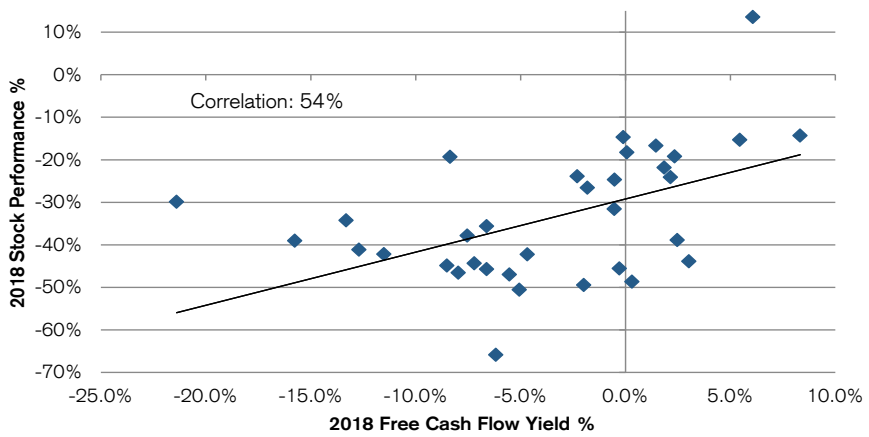
Source: Credit Suisse estimates and company documents

# New E&P Mantra of Financial Discipline Should Start with Living Within Cash Flow

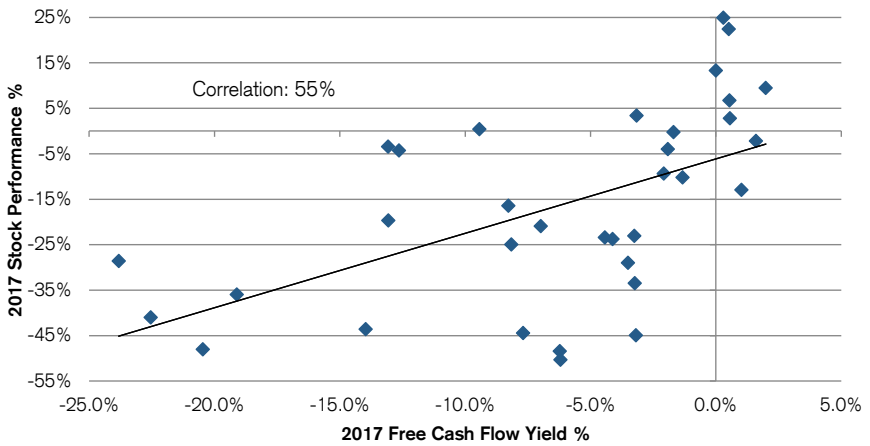
- After years of outspending cash flow (by ~24% on average from 2012-17) in order to grow production, E&Ps *underspent* cash flow (before dividends) by ~5% in 2018 and look poised to underspend by a wider ~15% in 2019 at current futures strip prices.

- Investors are increasingly favoring companies that "live within cash flow", as the **correlation between FCF yield and stock performance climbed to >50% in 2017-18 from -2% in 2016 and just 1% in 2015;** for **large caps, the correlation was ~80% in 2017-18.**

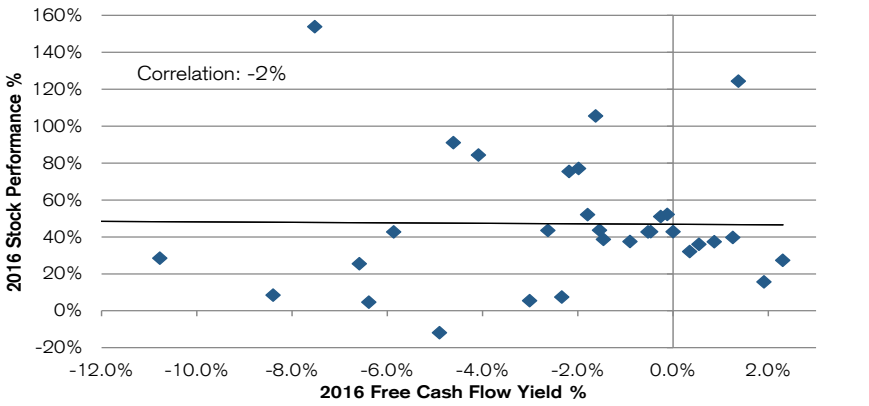
**2018 FCF Yield vs. 2018 Stock Performance**



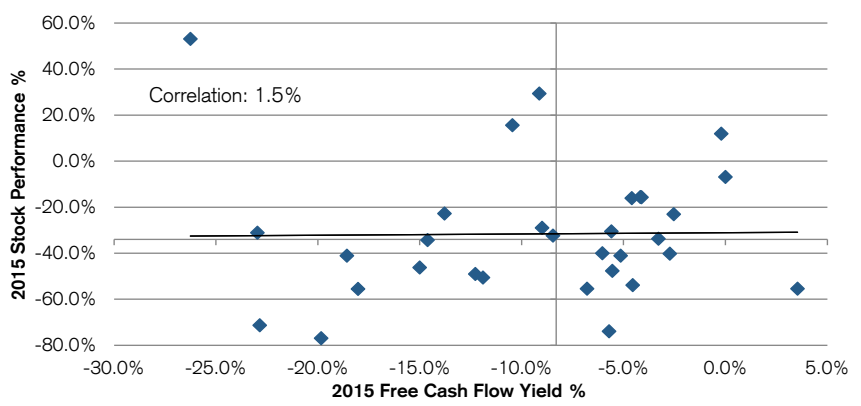

**2017 FCF Yield vs. 2017 Stock Performance**




**2016 FCF Yield vs. 2016 Stock Performance**




**2015 FCF Yield vs. 2015 Stock Performance**

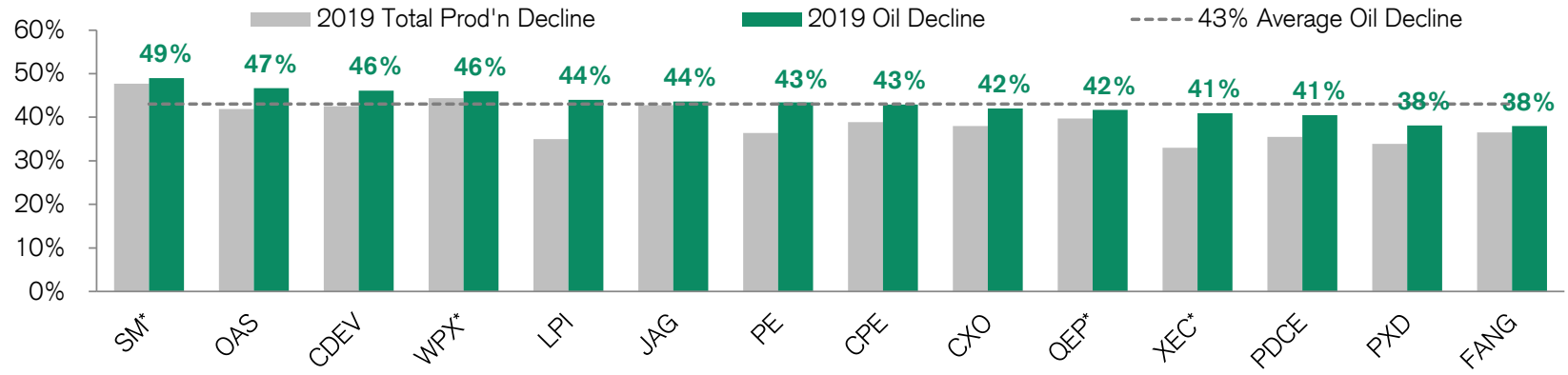



Source: Company documents, Thomson Reuters, and Credit Suisse estimates

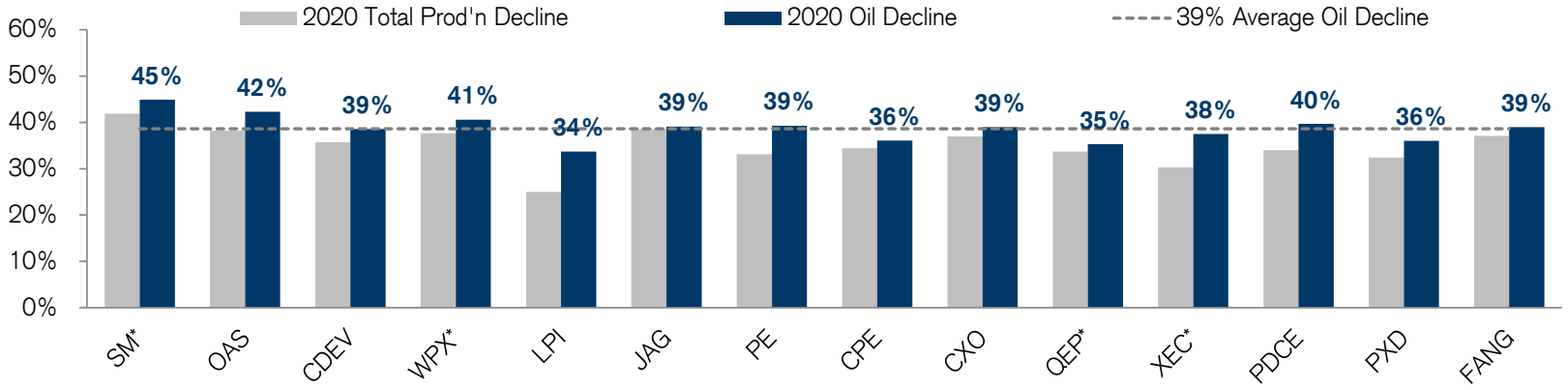
# Resource E&Ps Face Steep Base Decline Rates

**Steep base rate declines a hangover from the growth-chasing era.** Most E&Ps coming off a high growth stage of their lifecycle have oil base decline in excess of 40+% in 2019. This is perhaps the greatest obstacle to SMID E&Ps immediately generating free cash flow upon moderating activity. However, we do see PDP decline tempering by ~4% YoY on average in 2020, while those with more significant slowdowns improving the most.

## 2019 Base Rate Declines by Operator




## 2020 Base Rate Declines by Operator

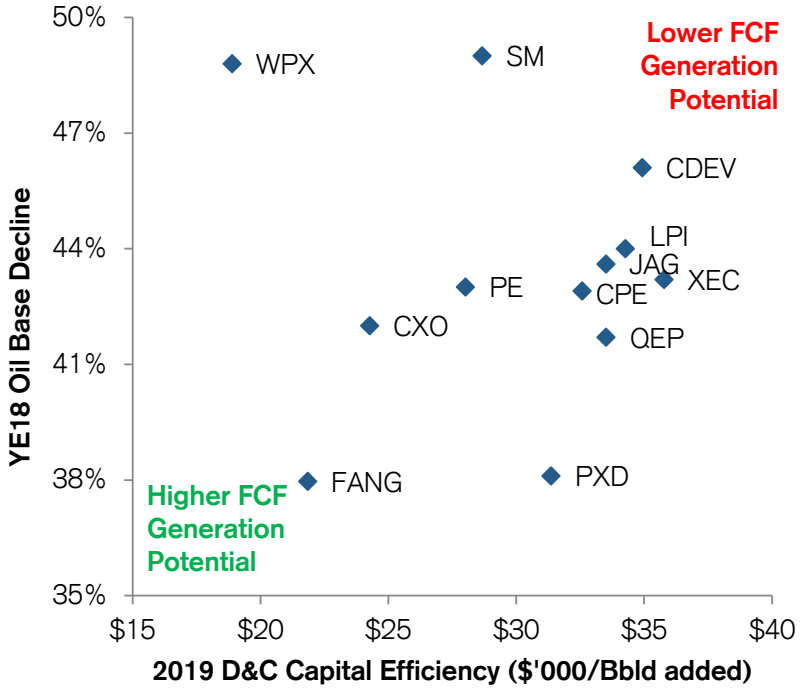



Source: Company data, Credit Suisse estimates *Represents base rate decline in Permian only.

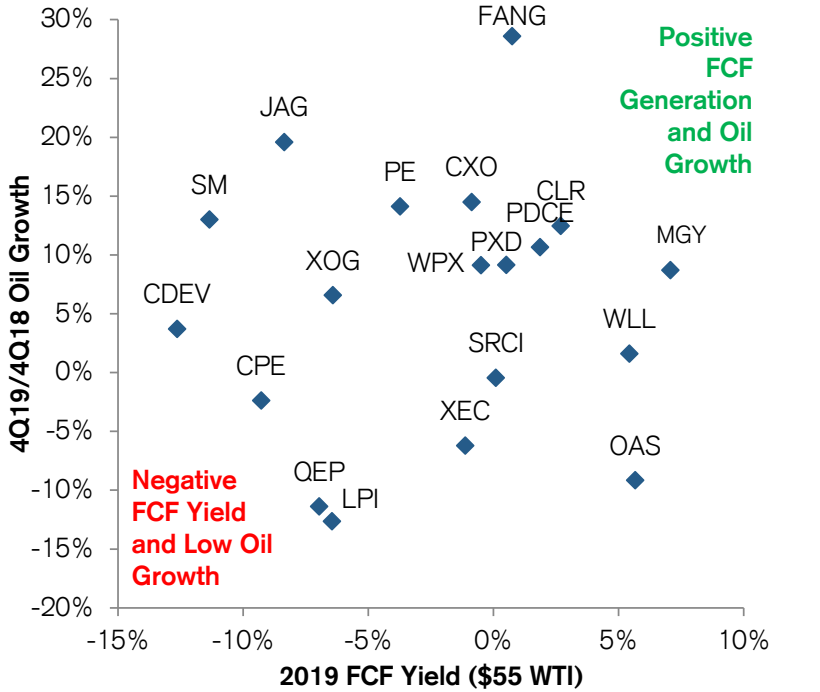
# Few Can Deliver Growth and Free Cash Flow

- Operators with **lower decline** (less production to replace) and **better capital efficiency** (lowest cost to offset base declines and add production) are best positioned to deliver an attractive combination of differentiated growth and FCF.
- Capital intensity should decline every year due to shallower PDP decline **IF** companies do not materially ramp back up activity.

## Lower Base Declines + Stronger Capital Efficiency




## Production Growth + Free Cash Flow




Source: Company data, Credit Suisse estimates

# E&P Sector Ripe for Increased Consolidation

- After several years of fairly subdued company-level M&A, 2018 saw two major corporate acquisitions in the Permian (**CXO** for **RSPP, FANG** for **EGN**), followed by another three corporate mergers in less than one week in October (**ECA-NFX, CHK-WRD** and **DNR-PVAC**), **BP's** ~$10.5 billion acquisition of **BHP's** onshore business, and reports of two large privately-held E&Ps (**Endeavor** and **Felix**) putting themselves up for a potential sale. And more recently, **CVX** agreed to acquire **APC**, marking the first E&P corporate acquisition for a Major.

- The recent pick-up in large-scale M&A marks a step-change in the sector's view toward corporate deals, and **we see a number of factors driving the trend further into 2019:**

  - Growing **disconnect between oil prices and equity valuations,** with E&P stocks now discounting a WTI price ~10-15% below the 1-year and 5-year futures strips

  - A desire from IOCs and large-cap E&Ps to shift further toward **shorter-cycle assets,** namely US shale -- which has increasing scarcity value

  - Dramatically **stronger balance sheets and FCF generation** relative to 2015-16

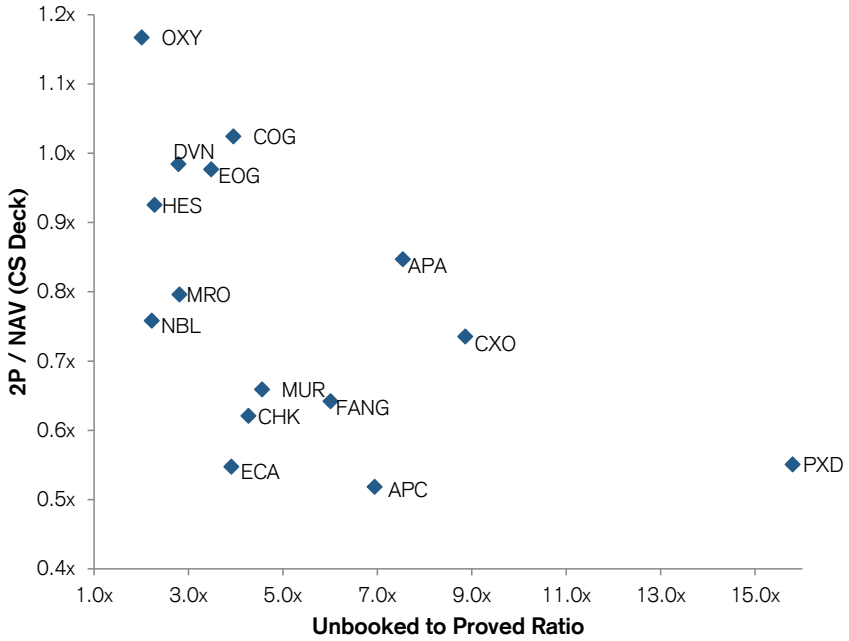
  - Growing need for **scale** as unconventional plays move into development mode

  - Scope for **material cost synergies** (i.e. G&A cost reductions), which we estimate could be worth a ~12% premium alone

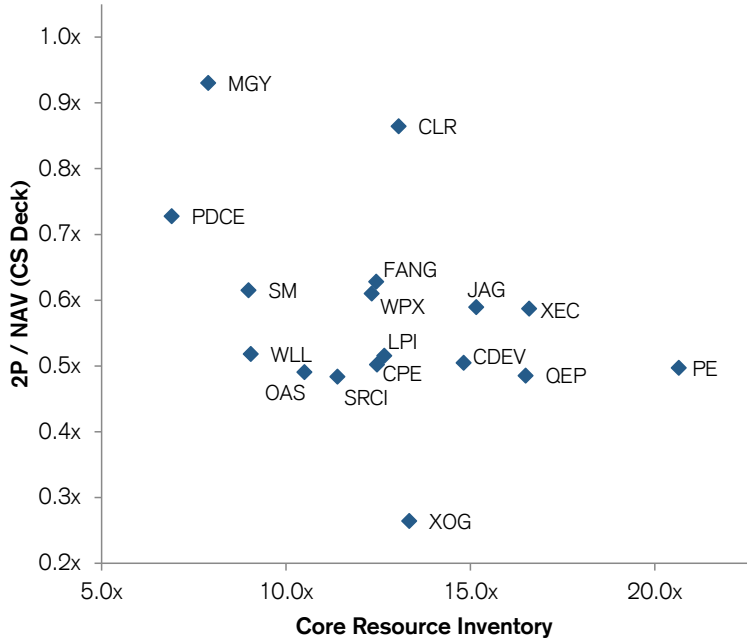
# E&P Sector Ripe for Increased Consolidation (Continued)

We think the **most likely sellers** to emerge will be the remaining **Permian pure-plays** with outsized inventory (PXD, PE, CPE, and CDEV trading at steep discounts to NAV) and **Marcellus-levered E&Ps** which could make sense as a target for a better-capitalized, gas-consuming Oil Major. In the **large-cap** space, we would note that NBL is both inexpensive and has a similar asset profile to APC.

**Large-Cap Unbooked Resource vs. P/NAV**




**SMID-Cap Core Inventory vs. P/NAV**




Source: Company data, Credit Suisse estimates

Note: Based on current NYMEX Brent, WTI, and Henry Hub futures strip prices: 2019 - $68.73/Bbl, $61.45/Bbl, & $2.87/MMBtu; 2020 - $67.54/Bbl, $60.98/Bbl, & $2.77/MMBtu; 2021 - $64.58/Bbl, $57.66/Bbl, & $2.68/MMBtu; 2022 - $62.53/Bbl, $55.58/Bbl, & $2.68/MMBtu; and 2023+ - $61.56/Bbl, $54.6/Bbl, & $2.75/MMBtu.

# Net Asset Value (NAV) Modeling

NAV is a discounted cash flow analysis of a producer's reserves. Here key assumptions include 1) future commodity prices, 2) production rates, and 3) operational costs.

**WPX Energy**

**Net Asset Value Summary**

CREDIT SUISSE

| | |
|---|---|
| Shares Out. (MM) | 420.6 |

| Proved Reserves | Liquids | Gas | Total | | NPV-10 | | |
|---|---|---|---|---|---|---|---|
| Oil & Gas Properties | (MMBbls) | (Bcf) | (MMBoe) | % Liq | ($/Boe) | ($MM) | ($/Share) |
| United States | 376 | 618 | 479 | 79% | $10.13 | $4,855 | $11.54 |
| **Total Proved Properties** | **376** | **618** | **479** | **79%** | **$10.13** | **$4,855** | **$11.54** |

| Other Assets | ($MM) | ($/Share) |
|---|---|---|
| Midstream (Incl. land investment) | $950 | $2.26 |

| Liabilities | ($MM) | ($/Share) |
|---|---|---|
| Long-Term Debt | (2,035) | ($4.84) |
| Working Capital | 24 | $0.06 |
| **Total Liabilities** | **($2,011)** | **($4.78)** |

| Unbooked Reserves | Liquids | Gas | Total | | NPV-10 | | |
|---|---|---|---|---|---|---|---|
| Oil & Gas Properties | (MMBbls) | (Bcf) | (MMBoe) | % Liq | ($/Boe) | ($MM) | ($/Share) |
| Delaware Wolfcamp A | 487 | 951 | 646 | 75% | $4.27 | $2,755 | $6.55 |
| Delaware Reeves Wolfcamp | 195 | 406 | 262 | 74% | $1.92 | $504 | $1.20 |
| Bone Spring | 256 | 546 | 347 | 74% | $0.59 | $204 | $0.48 |
| Delaware Wolfcamp D | 158 | 922 | 312 | 51% | $0.64 | $200 | $0.48 |
| Williston Basin | 218 | 148 | 243 | 90% | $7.95 | $1,933 | $4.60 |
| **Total Unbooked Resources** | **1,314** | **2,973** | **1,809** | **73%** | **$3.09** | **$5,597** | **$13.31** |
| **Total Net Asset Value** | **1,690** | **3,591** | **2,289** | **74%** | **$4.10** | **$9,390** | **$22.33** |

Source: Company data, Credit Suisse estimates

- SMID-cap "values" (OAS, WLL),

**Proved Oil & Gas Reserves**

YE Reporting | PV10 Modeling

**Liabilities // Other Assets**

LT Debt & WC | Midstream Assets

**Unproved/Unbooked Reserves**

Company disclosure & CS NAV Modeling

# Net Asset Value (NAV) Modeling (continued)

**Company Disclosure** + **Risking based on subjective factors and state data** + **Forecasted activity and CS price deck**

## Unbooked Resources NAV Assumption Summary By Resource Play

| Resource Play | Net Acreage | Wells Per Zone Per Section | Average Lateral | Implied Well | Gross Risked Total Drilling Inventory | Net Risked Total Drilling Inventory | Risked Unbooked Resource Potential (MMBoe) | YE19 Inventory | Unbooked NAV ($MM) | Unbooked NAV ($/share) |
|---|---|---|---|---|---|---|---|---|---|---|
| Delaware Wolfcamp A | 50,000 | 19 | 7,500 | 51 | 864 | 652 | 646 | 9.7 | $2,755 | $6.55 |
| Delaware Reeves Wolfcamp | 18,100 | 18 | 4,800 | 36 | 521 | 370 | 262 | 23.1 | $504 | $1.20 |
| Bone Spring | 56,000 | 8 | 7,500 | 120 | 453 | 331 | 347 | 0.0 | $204 | $0.48 |
| Delaware Wolfcamp D | 49,000 | 4 | 7,500 | 240 | 194 | 147 | 312 | 0.0 | $200 | $0.48 |
| Williston Basin | 85,800 | 13 | 9,600 | 102 | 463 | 386 | 243 | 5.0 | $1,933 | $4.60 |
| **Total** | | | | | **2,495** | **1,887** | **1,809** | **8.9** | **$5,597** | **$13.31** |

## Single Well Summary By Resource Play

| Resource Play | EUR (MBoe) | % Oil Mix | 30-Day IP (MBoed) | Year-1 Cumulative (MBoe) | Well Cost ($MM) | Implied NPV $/Acre | Implied NPV $/Location | Single Well Pre-Tax NPV/Well | Single Well After-Tax NPV/Well | Single Well Pre-Tax IRR (%) |
|---|---|---|---|---|---|---|---|---|---|---|
| Delaware Wolfcamp A | 1,550 | 55% | 2,027 | 389 | ($9.25) | $55,104 | $5.02 | $9.72 | $8.30 | 60% |
| Delaware Reeves Wolfcamp | 1,000 | 53% | 1,217 | 254 | ($8.00) | $27,865 | $1.43 | $3.79 | $3.27 | 28% |
| Bone Spring | 1,300 | 50% | 1,559 | 332 | ($9.00) | $3,639 | $0.61 | $6.90 | $5.93 | 43% |
| Delaware Wolfcamp D | 2,800 | 19% | 1,785 | 547 | ($9.50) | $4,079 | $1.36 | $6.72 | $5.29 | 35% |
| Williston Basin | 1,000 | 80% | 1,542 | 266 | ($6.75) | $22,533 | $6.33 | $10.62 | $8.54 | 101% |
| **Corporate Averages** | | | | | | | | **$8.01** | **$6.71** | **57%** |

Source: Company data, Credit Suisse estimates

# Credit Suisse E&P Coverage Universe: Key Valuation Metrics (Current Strip Prices)

| Company | Ticker | Price 4/12/19 | EV/EBITDX Hist. FY1 | EV/EBITDX 2019E | EV/EBITDX 2020E | EV/EBITDX 2021E | EV/DACF Hist. FY1 | EV/DACF 2019E | EV/DACF 2020E | EV/DACF 2021E | Organic Free Cash Flow Yield 2019E | Organic Free Cash Flow Yield 2020E | Organic Free Cash Flow Yield 2021E | Cash Flow per Share 2019E | Cash Flow per Share 2020E | Cash Flow per Share 2021E | NAV/Share 1P | NAV/Share 2P | P/NAV 1P | P/NAV 2P |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Global Large-Cap E&Ps** | | | | | | | | | | | | | | | | | | | | |
| Anadarko Petroleum | APC | $61.78 | 6.0x | 5.2x | 4.7x | 4.6x | 6.7x | 6.1x | 5.5x | 5.3x | 4.0% | 5.0% | 4.4% | $14.11 | $15.89 | $16.33 | $43.04 | $90.19 | 1.44x | 0.68x |
| Apache Corp. | APA | $36.50 | 4.7x | 4.5x | 4.6x | 4.6x | 5.5x | 5.2x | 5.6x | 5.5x | 9.9% | 6.8% | 4.5% | $10.06 | $9.52 | $9.69 | $16.95 | $42.00 | 2.15x | 0.87x |
| ConocoPhillips | COP | $67.37 | 5.3x | 5.4x | 5.2x | 5.4x | 6.4x | 5.9x | 5.6x | 5.7x | 9.5% | 9.4% | 7.9% | $11.99 | $12.38 | $11.95 | NA | NA | NA | NA |
| Hess Corp. | HES | $66.10 | 6.2x | 9.5x | 7.7x | 7.6x | 6.8x | 10.2x | 8.5x | 8.3x | -3.0% | -0.4% | 0.2% | $7.02 | $9.24 | $9.72 | $38.23 | $68.56 | 1.73x | 0.96x |
| Marathon Oil | MRO | $17.76 | 4.4x | 4.5x | 4.2x | 4.1x | 5.8x | 4.7x | 4.3x | 4.1x | 9.1% | 8.6% | 6.8% | $4.65 | $5.13 | $5.30 | $9.97 | $22.09 | 1.78x | 0.80x |
| Murphy Oil | MUR | $29.42 | 4.2x | 5.0x | 3.6x | 3.6x | 4.3x | 4.7x | 3.5x | 3.5x | 3.7% | 8.2% | 8.4% | $8.30 | $9.67 | $9.32 | $27.25 | $43.97 | 1.08x | 0.67x |
| Noble Energy | NBL | $26.87 | 7.1x | 6.8x | 5.1x | 4.4x | 7.2x | 7.5x | 5.5x | 4.7x | -2.1% | 7.5% | 8.5% | $4.93 | $7.01 | $8.12 | $19.30 | $32.84 | 1.39x | 0.82x |
| Occidental Petroleum | OXY | $65.33 | 6.5x | 6.6x | 6.7x | 6.6x | 8.5x | 7.4x | 7.6x | 7.4x | 6.1% | 5.1% | 4.9% | $9.82 | $9.84 | $10.27 | $39.85 | $58.41 | 1.64x | 1.12x |
| **Average** | | | **5.6x** | **5.9x** | **5.2x** | **5.1x** | **6.4x** | **6.5x** | **5.8x** | **5.6x** | **4.7%** | **6.3%** | **5.7%** | | | | | | **1.60x** | **0.85x** |
| **North American Large-Cap E&Ps** | | | | | | | | | | | | | | | | | | | | |
| Chesapeake Energy | CHK | $3.17 | 7.3x | 6.2x | 5.5x | 5.5x | 6.7x | 6.2x | 5.4x | 5.5x | -5.3% | 2.0% | 0.8% | $1.26 | $1.46 | $1.46 | $2.56 | $5.53 | 1.24x | 0.57x |
| Devon Energy | DVN | $33.48 | 6.3x | 5.4x | 4.9x | 4.7x | 7.0x | 5.5x | 4.9x | 4.8x | 5.4% | 5.9% | 4.3% | $7.26 | $8.43 | $8.33 | $18.58 | $32.27 | 1.80x | 1.04x |
| Encana | ECA | $7.57 | 6.5x | 4.5x | 4.0x | 3.9x | 6.5x | 4.5x | 4.0x | 3.9x | 7.1% | 7.2% | 5.8% | $2.53 | $2.84 | $2.83 | $4.79 | $12.96 | 1.58x | 0.58x |
| EOG Resources | EOG | $105.31 | 7.9x | 7.3x | 6.4x | 6.0x | 9.3x | 7.2x | 6.3x | 6.3x | 4.0% | 4.7% | 3.8% | $15.03 | $16.54 | $16.35 | $53.74 | $102.71 | 1.96x | 1.03x |
| **Average** | | | **7.0x** | **5.8x** | **5.2x** | **5.0x** | **7.4x** | **5.8x** | **5.2x** | **5.1x** | **2.8%** | **4.9%** | **3.7%** | | | | | | **1.65x** | **0.81x** |
| **Large-Cap Average** | | | **6.0x** | **5.9x** | **5.2x** | **5.1x** | **6.7x** | **6.3x** | **5.6x** | **5.4x** | **4.0%** | **5.8%** | **5.0%** | | | | | | **1.62x** | **0.83x** |
| **Oil-Weighted Resource Plays** | | | | | | | | | | | | | | | | | | | | |
| **Permian Basin** | | | | | | | | | | | | | | | | | | | | |
| Callon Petroleum | CPE | $8.21 | 7.4x | 6.0x | 4.7x | 4.2x | 7.4x | 5.3x | 4.3x | 3.8x | -6.4% | -0.4% | -1.6% | $2.22 | $2.76 | $3.13 | $6.78 | $13.97 | 1.21x | 0.59x |
| Centennial Resource Dev. | CDEV | $9.63 | 8.0x | 5.5x | 4.9x | 4.9x | 8.0x | 5.5x | 4.9x | 4.9x | -9.0% | -5.3% | -8.5% | $2.16 | $2.55 | $2.68 | $5.64 | $15.53 | 1.71x | 0.62x |
| Cimarex Energy | XEC | $70.83 | 6.9x | 5.0x | 4.5x | 4.4x | 6.9x | 5.1x | 4.6x | 4.4x | 3.1% | 5.6% | 5.9% | $15.86 | $18.08 | $18.85 | $28.45 | $110.42 | 2.49x | 0.64x |
| Concho Resources | CXO | $113.89 | 9.5x | 8.3x | 6.2x | 5.7x | 9.5x | 8.3x | 6.2x | 5.7x | 0.3% | 4.1% | 3.7% | $15.16 | $20.14 | $21.19 | $66.73 | $148.84 | 1.71x | 0.77x |
| Diamondback Energy | FANG | $106.28 | 11.7x | 6.1x | 4.4x | 3.8x | 11.7x | 6.2x | 4.4x | 3.8x | 3.5% | 8.6% | 9.0% | $20.56 | $28.00 | $30.24 | $59.38 | $162.72 | 1.79x | 0.65x |
| Jagged Peak Energy | JAG | $10.98 | 11.9x | 5.7x | 4.7x | 4.3x | 11.9x | 5.7x | 4.7x | 4.3x | -7.3% | -2.8% | 0.1% | $2.22 | $2.89 | $3.22 | $6.94 | $15.51 | 1.58x | 0.71x |
| Laredo Petroleum | LPI | $3.20 | 8.0x | 3.6x | 3.5x | 3.4x | 8.0x | 3.8x | 3.7x | 3.6x | 0.0% | 5.6% | 1.4% | $1.67 | $1.69 | $1.68 | $3.59 | $5.28 | 0.89x | 0.61x |
| Parsley Energy | PE | $20.29 | 12.0x | 5.8x | 4.4x | 4.2x | 12.0x | 5.8x | 4.4x | 4.2x | -1.5% | 5.1% | 4.0% | $4.33 | $5.85 | $5.81 | $14.76 | $35.78 | 1.37x | 0.57x |
| Pioneer Natural Res. | PXD | $168.32 | 10.3x | 7.2x | 6.5x | 5.6x | 10.3x | 7.2x | 6.5x | 5.6x | 2.6% | 2.0% | 2.0% | $24.02 | $27.21 | $31.77 | $81.87 | $273.87 | 2.06x | 0.61x |
| Viper Energy | VNOM | $34.00 | NA | 12.3x | 10.9x | 10.4x | NA | 12.4x | 11.0x | 10.5x | NA | NA | NA | $2.43 | $2.86 | $3.02 | $6.66 | $30.07 | 5.11x | 1.13x |
| **Average** (ex-VNOM) | | | **9.5x** | **5.9x** | **4.9x** | **4.5x** | **9.5x** | **5.9x** | **4.8x** | **4.5x** | **-1.6%** | **2.5%** | **1.8%** | | | | | | **1.65x** | **0.64x** |
| **Bakken** | | | | | | | | | | | | | | | | | | | | |
| Continental Resources | CLR | $49.08 | 8.5x | 6.1x | 5.3x | 4.7x | 8.5x | 6.1x | 5.3x | 4.7x | 5.0% | 4.8% | 4.5% | $9.58 | $10.80 | $11.62 | $17.04 | $47.00 | 2.88x | 1.04x |
| Oasis Petroleum | OAS | $6.62 | 6.1x | 4.5x | 4.7x | 4.7x | 6.1x | 4.6x | 4.7x | 4.8x | 9.4% | 3.5% | 2.9% | $2.84 | $2.64 | $2.56 | $3.80 | $9.92 | 1.74x | 0.67x |
| Whiting Petroleum | WLL | $30.35 | 5.2x | 4.1x | 3.7x | 3.5x | 5.2x | 4.0x | 3.6x | 3.4x | 12.5% | 14.6% | 13.9% | $12.91 | $13.45 | $13.29 | $9.14 | $42.28 | 3.32x | 0.72x |
| **Average** | | | **6.6x** | **4.9x** | **4.6x** | **4.3x** | **6.6x** | **4.9x** | **4.5x** | **4.3x** | **9.0%** | **7.6%** | **7.1%** | | | | | | **2.65x** | **0.81x** |
| **Niobrara** | | | | | | | | | | | | | | | | | | | | |
| Extraction Oil & Gas | XOG | $5.12 | 7.2x | 3.1x | 2.6x | 2.4x | 7.2x | 3.2x | 2.7x | 2.4x | -13.6% | 11.0% | 6.0% | $4.12 | $5.09 | $5.32 | $6.42 | $15.77 | 0.80x | 0.32x |
| PDC Energy | PDCE | $44.24 | 6.8x | 4.1x | 3.3x | 3.1x | 6.8x | 4.1x | 3.3x | 3.1x | 4.6% | 10.0% | 6.3% | $14.37 | $17.49 | $17.58 | $29.40 | $45.81 | 1.50x | 0.97x |
| SRC Energy | SRCI | $6.29 | 7.2x | 4.3x | 3.6x | 3.1x | 7.2x | 4.8x | 4.0x | 3.4x | 4.1% | 2.6% | 4.9% | $2.00 | $2.29 | $2.50 | $5.55 | $10.18 | 1.13x | 0.62x |
| **Average** | | | **7.1x** | **3.8x** | **3.2x** | **2.9x** | **7.1x** | **4.0x** | **3.3x** | **3.0x** | **-1.7%** | **7.9%** | **5.7%** | | | | | | **1.15x** | **0.64x** |
| **Multi-Basin/Other** | | | | | | | | | | | | | | | | | | | | |
| Magnolia Oil & Gas | MGY | $13.66 | 5.5x | 4.5x | 3.9x | 3.4x | 5.5x | 4.5x | 4.0x | 3.4x | 9.4% | 9.6% | 10.4% | $3.02 | $3.15 | $3.24 | $6.54 | $13.75 | 2.09x | 0.99x |
| QEP Resources | QEP | $8.18 | 5.5x | 4.6x | 3.3x | 3.2x | 5.5x | 4.4x | 3.2x | 3.1x | -3.7% | -0.4% | -0.6% | $2.46 | $3.27 | $3.39 | $4.98 | $14.26 | 1.64x | 0.57x |
| SM Energy | SM | $18.31 | 5.5x | 4.4x | 3.7x | 3.5x | 5.5x | 4.4x | 3.7x | 3.6x | -5.7% | 4.6% | 1.7% | $8.19 | $10.21 | $10.60 | $9.14 | $22.33 | 2.00x | 0.82x |
| WPX Energy | WPX | $14.31 | 7.3x | 5.7x | 4.3x | 3.9x | 7.3x | 5.6x | 4.2x | 3.8x | 1.4% | 6.0% | 5.7% | $3.11 | $4.05 | $4.24 | $8.34 | $19.09 | 1.72x | 0.75x |
| **Average** | | | **6.0x** | **4.8x** | **3.8x** | **3.5x** | **6.0x** | **4.7x** | **3.8x** | **3.5x** | **0.3%** | **5.0%** | **4.3%** | | | | | | **1.86x** | **0.78x** |
| **Oil-Weighted Group Average** | | | **7.9x** | **5.2x** | **4.3x** | **4.0x** | **7.9x** | **5.2x** | **4.3x** | **4.0x** | **0.4%** | **4.7%** | **3.8%** | | | | | | **1.77x** | **0.70x** |
| **Gas-Weighted Resource Plays** | | | | | | | | | | | | | | | | | | | | |
| Antero Resources | AR | $8.69 | 9.9x | 3.4x | 3.4x | 3.6x | 9.9x | 3.0x | 2.9x | 3.0x | -2.3% | 0.0% | 0.0% | $3.80 | $3.80 | $3.74 | $4.30 | $9.36 | 2.02x | 0.93x |
| Cabot Oil & Gas | COG | $27.30 | 10.8x | 7.5x | 6.8x | 6.3x | 10.8x | 7.6x | 7.4x | 7.1x | 6.4% | 5.9% | 5.8% | $3.69 | $3.70 | $3.78 | $14.29 | $26.46 | 1.91x | 1.03x |
| EQT Corp. (Upstream) | EQT | $21.33 | 9.3x | 4.2x | 4.3x | 4.4x | 9.3x | 4.0x | 4.2x | 4.4x | 5.1% | 4.3% | 5.1% | $8.49 | $7.91 | $7.36 | $15.03 | $32.20 | 1.42x | 0.66x |
| Gulfport Energy | GPOR | $7.74 | 8.3x | 4.1x | 4.2x | 4.4x | 8.3x | 4.0x | 4.1x | 4.3x | 12.8% | 7.4% | 6.8% | $4.70 | $4.83 | $4.68 | $2.26 | $8.74 | 3.42x | 0.89x |
| Range Resources | RRC | $10.32 | 11.1x | 5.8x | 4.9x | 4.8x | 11.1x | 5.8x | 4.9x | 4.8x | 6.5% | 11.4% | 11.5% | $3.72 | $4.44 | $4.34 | $12.94 | $22.19 | 0.80x | 0.47x |
| Southwestern Energy | SWN | $4.59 | 6.9x | 4.5x | 4.8x | 4.8x | 6.9x | 5.6x | 5.8x | 5.9x | -7.7% | -10.8% | -8.8% | $1.47 | $1.47 | $1.54 | $3.83 | $5.15 | 1.20x | 0.89x |
| **Gas-Weighted Group Average** | | | **9.4x** | **4.9x** | **4.7x** | **4.7x** | **9.4x** | **5.0x** | **4.9x** | **4.9x** | **3.5%** | **3.0%** | **3.4%** | | | | | | **1.80x** | **0.81x** |

Note: Based on current NYMEX Brent, WTI, and Henry Hub futures strip prices: 2019 - $68.73/Bbl, $61.45/Bbl, & $2.87/MMBtu; 2020 - $67.54/Bbl, $60.98/Bbl, & $2.77/MMBtu; 2021 - $64.58/Bbl, $57.66/Bbl, & $2.68/MMBtu; 2022 - $62.53/Bbl, $55.58/Bbl, & $2.68/MMBtu; and 2023+ - $61.56/Bbl, $54.6/Bbl, & $2.75/MMBtu.

Source: Company documents, Thomson Reuters, and Credit Suisse estimates

Credit Suisse Equity Research
Americas/United States

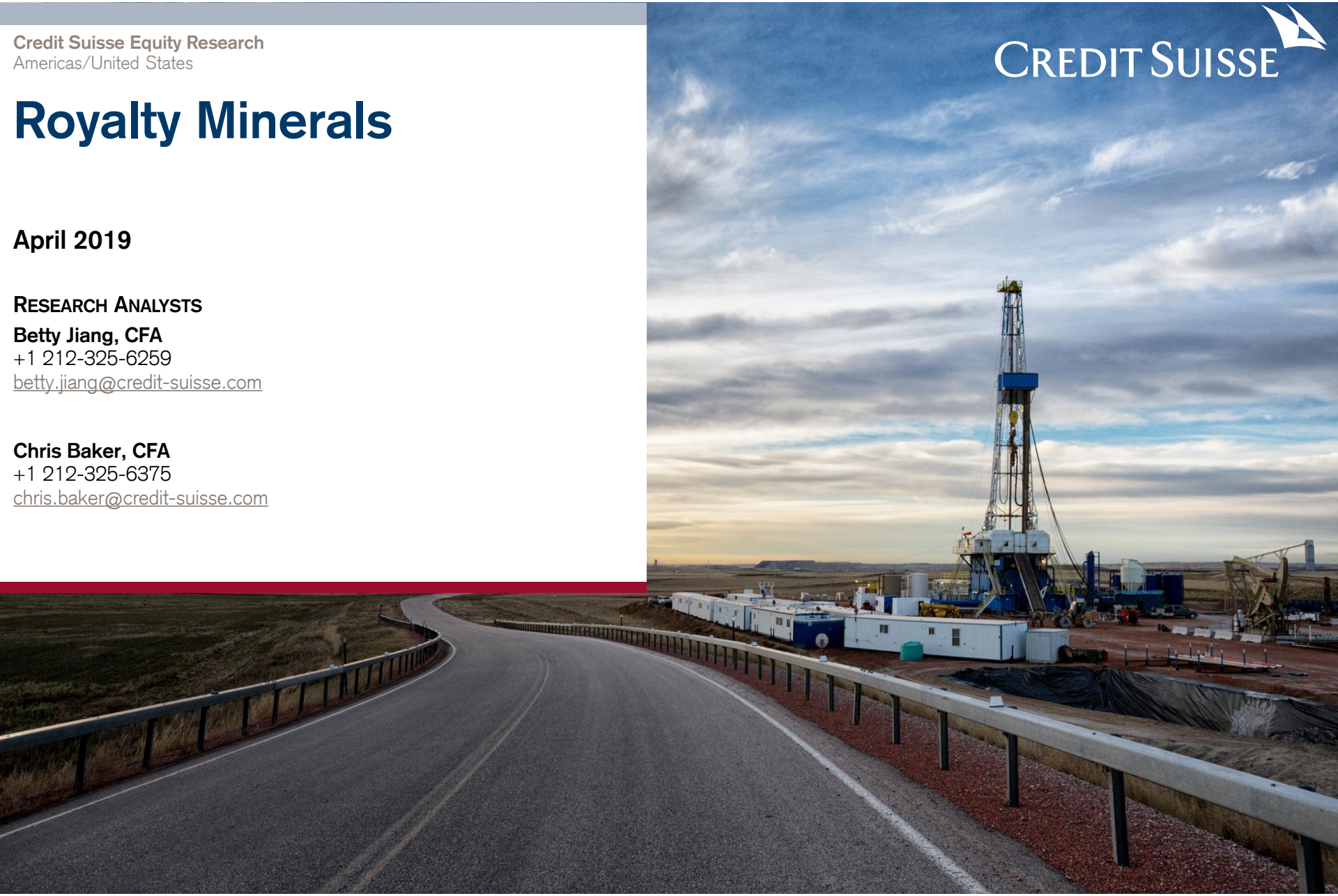
# Royalty Minerals

**April 2019**


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# RoyaltyCo Value Proposition

- New breed of public upstream E&P royalty minerals are focused on major US unconventional resource basins, establishing significant development runway and can generating organic production growth.
- Recent C-Corp conversions substantially broadened the investor base and improve market access.

## Pros

- **Highest free cash flow yield** in the energy universe; ~8% on average vs. limited-to-no FCF from Large-Cap E&Ps at strip prices (~4% at $65/Bbl), MLPs yield of 7-8%
- **Higher exposure to commodity prices** and theme of outsized US unconventional production growth
- **No capex or operating costs** enable higher cash margins than traditional E&Ps
- **Organic growth** through development of the undeveloped inventory on existing assets at no additional cost
- **Fragmented space presents opportunities to acquire** private royalty assets/companies at accretive valuations, with a very scalable business model
- **Free perpetual option on exploration, enhanced recovery production upside**… at no capital cost

## Cons

- **No control over the pace and timing of development** Unless the operator has a direct economic interest in the RoyaltyCo (e.g. FANG-VNOM), future development cadence is largely based on permit/DUC backlog visibility over the near to medium term, and educated probability analysis longer term
- **More uncertainty during commodity downcycles**, given exposure to both lower cash flow, and activity reduction; however, cash margin compression is less sensitive than traditional E&Ps
- **Access to capital markets** is necessary for large mineral acquisitions
- **Limited stock market liquidity.** All publically traded RoyaltyCos have small public float due to major sponsor ownership
- **Variable distribution model** creates quarterly volatility that fluctuates based on commodity prices

# RoyaltyCo Investment Framework

## Commodity Price/Macro

- Commodity price exposure
- Basin-level differential (adequate takeaway)
- Competitiveness vs. other yield vehicles

## Operator Quality/Sponsorship

- Concentrated exposure to high-quality operators with strong execution track records and financial capability
- Exposure to assets viewed as strategic by their E&P operator ensures active development
- Ability to direct investments to specific royalty assets (unique to VNOM)

**It's All About Cash Flow Visibility**

## Royalty Acreage Quality

- Concentrated exposure to most economic unconventional resource basins
- High royalty interest in core acreage blocks
- Undeveloped locations create future development running room

## M&A/Dropdown Visibility

- Management with strong M&A track records
- Ability to execute on accretive acquisitions without over-burdening the balance sheet
- M&A approach – targeting yield or NAV accretion
- Low-risk dropdown potential (typically done on a yield-accretive basis)

# RoyaltyCo Comparison At A Glance

| | | Viper Energy Partners | Falcon Minerals | Kimbell Royalty Partners | Prairie Sky | Black Stone Minerals |
|---|---|---|---|---|---|---|
| Valuation (Strip Deck*) | Rating | Outperform | Outperform | Neutral | Not Rated | Not Rated |
| | Market Cap ($MM) | $4,590 | $796 | $828 | $4,503 | $3,656 |
| | 2019E Yield | 7.3% | 7.7% | 8.6% | 5.0% | 10.8% |
| | 2020E Yield | 8.2% | 8.4% | 9.0% | 5.3% | 11.8% |
| | 2019E EV/EBITDX | 13.6x | 12.3x | 10.9x | 18.4x | 10.8x |
| | 2020E EV/EBITDX | 12.0x | 9.8x | 10.0x | 17.5x | 10.4x |
| Company Structure | Sturcture/K-1? | Up-C/No | C-Corp/No | Up-C/No | LTD/No | LP/Yes |
| | Limited Cash Tax Payer | Yes | Yes | Yes | Yes | Yes |
| Commodity Price | >50% Oil Production Mix | Yes | Yes | No | No | No |
| | Hedge Protection | No | No | Yes | No | Yes |
| Mineral Acreage Quality | Acreage Concentration to Top 3 Most Active Plays | Yes | Yes | Yes | No | No |
| | High NRI Concentration in Core Resource Plays | Yes | Yes | No | No | No |
| Operator Quality/ Sponsorship | Concentrated Operator Exposure | Yes | Yes | No | No | No |
| | Direct Operator Sponsorship | Yes | No | No | No | No |
| M&A | M&A Track Record (at the RoyaltyCo) | Yes | No | Yes | No | Yes |
| | Dropdown Potential | Yes | No | Yes | No | No |
| Shareholder | Lack of Potential Selldown from Private Equity Sponsor | Yes | No | No | Yes | Yes |

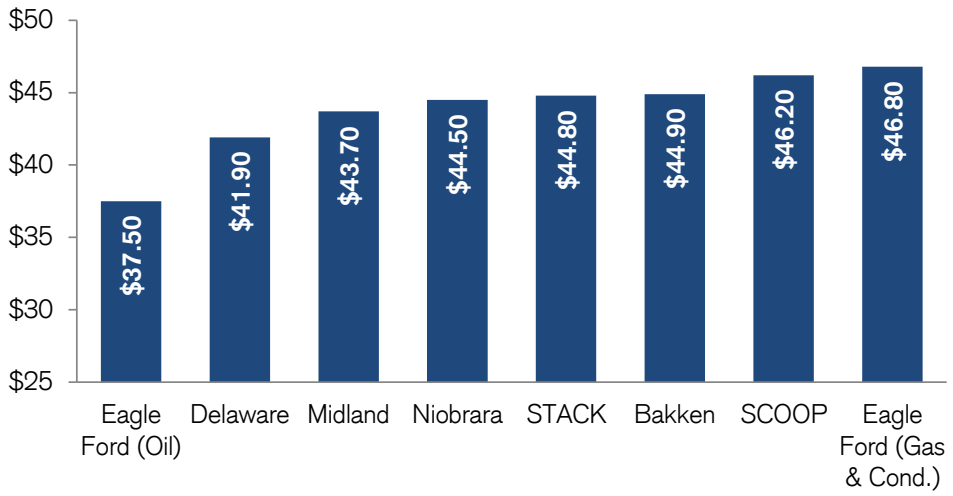
Note: Prairie Sky and Blackstone multiples based on FactSet consensus. Note: Based on current NYMEX Brent, WTI, and Henry Hub futures strip prices: 2019 - $68.73/Bbl, $61.45/Bbl, & $2.87/MMBtu; 2020 - $67.54/Bbl, $60.98/Bbl, & $2.77/MMBtu

Source: Company data, Credit Suisse estimates, Factset

# Production Growth Concentrated In A Few Core Counties

- **Location matters.** While RoyaltyCos have no control over the timing and pace of development, focusing on minerals under core acreage in the highest-return resource basins materially increases the probability of future development.
- **We estimate the majority of US unconventional oil plays break even at a WTI price under ~$50/Bbl** (30% pre-tax IRR at the wellhead, assuming a $2.75/MMBtu Henry Hub gas price).
- **In the current price environment, we prefer exposure to oil/liquids-levered basins** given higher cash margins where core acreage positions, Permian and Eagle Ford in particular, should see outsized capital allocation, particularly as operators high-grade activity in a lower price environment.

## WTI Price Required for Economic Well ($/Bbl)




## NRA Exposure To Key Resource Basins

| | MNRL | FLMN | KRP | VNOM |
|---|---|---|---|---|
| Permian | 33% | - | 16% | 95% |
| Bakken | 10% | - | 4% | - |
| DJ Basin | 22% | - | - | - |
| Eagle Ford | - | 100% | 4% | 5% |
| SCOOP/STACK | 27% | - | 33% | - |
| Gas | - | - | 6% | - |
| Other | 8% | - | 37% | - |

NRA = Net Royalty Acreage;
Source: Company data, Credit Suisse estimates

# Fragmented Minerals Market Primed for Consolidation

**Big opportunity set….**

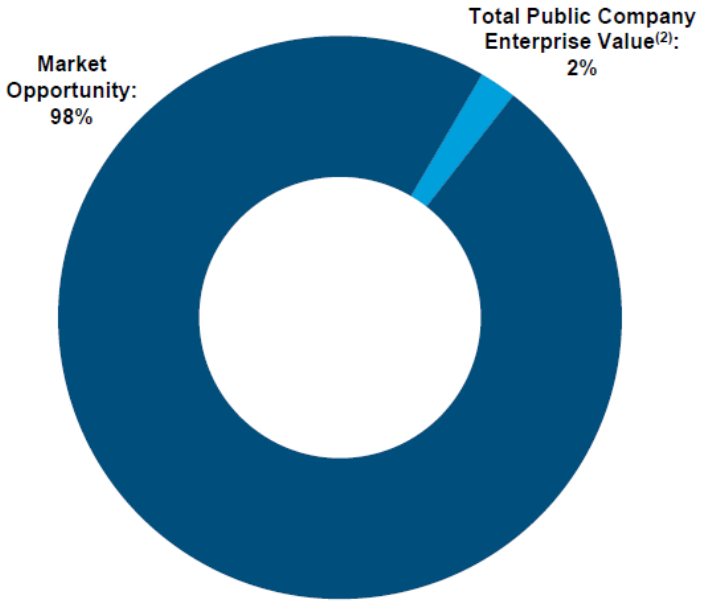
- Highly fragmented royalty minerals market with only a few publically traded RoyaltyCos
- ~$500 billion of estimated market value for US mineral assets, of which ~2% is publically traded
- >$7 billion invested by PE-backed mineral acquisition entities that are likely to seek an exit

**…for a limited pool of buyers**

- Acquisitions are an important part of every public US RoyaltyCos' long-term growth strategy
- Public RoyaltyCos can select the best acquisition opportunities (using technical evaluation and operator knowledge base) in order to create value for shareholders
- Optimal acquisition approach is a balance between NAV and yield accretion
- A strong M&A track record will increase investor confidence in the strategy

**Sizing the Minerals Market**

**Total minerals market size[1]: ~$500 billion**




*(1) Midpoint of market size estimate range. Based on production data from EIA and spot price as of 9/28/18. Assumes 20% of royalties are on Federal lands and there is an average royalty burden of 20%. Assumes a10x multiple on cash flows to derive total market size.*

*(2) Enterprise values of KRP, BSM, FLMN and VNOM as of September 28, 2018.*

*Source: Kimbell Royalty Partners*

# Process of Development Cadence Forecasting

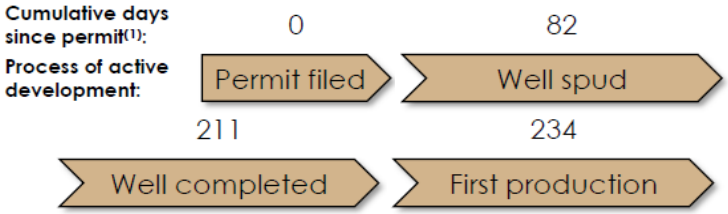
**Outside of commodity prices, activity levels are the single largest driver of cash flow**

**Near term – Company guidance**

- Heavy reliance on company guidance for near-term production contribution
- A portion of quarterly production is based on company estimates, which are trued up in the following quarter

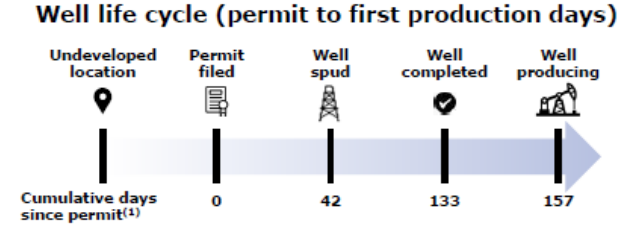
**Medium Term – Identify line-of-sight wells**

- Focus on permit to PDP conversion "cycle times"
- Average time from permit to first production varies from 157 days (FLMN) to 234 days (VNOM)
- Activity in high NRI acreage blocks can have outsized contributions (ie. Spanish Trail, Hooks Ranch)




*(1) average time measured for pads highlighted on page 12 of Oct'18 presentation*

*Source: Viper Energy Partners*




*Source: Falcon Minerals*

**Long Term – Core acreage and operator quality drive visibility**

- Core acreage: Activity on core acreage is a matter of when, not if
- Good operator: Strong execution track record and solid financial standing
- Strategic importance of the play to the operator: Single-basin operators have the most visibility, while multi-basin operators require understanding of the capital allocation priorities (i.e. importance of Eagle Ford for EOG)

# Valuation Metrics and Estimates

## RoyaltyCo Valuation Summary

| | | Valuation (CS Price Deck) | | | | | | | | | | Valuation (Strip Price Deck) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Distribution Yield | | | EV / EBITDX | | | EV / NRA | PDP / P | P / NAV | | Distribution Yield | | | EV / EBITDX | | | P / NAV | |
| Ticker | Price | 2019 | 2020 | 2021 | 2019 | 2020 | 2021 | 2019 | 2019 | 1P | 2P | 2019 | 2020 | 2021 | 2019 | 2020 | 2021 | 1P | 2P |
| **US Oil & Gas Royalty Companies** | | | | | | | | | | | | | | | | | | | |
| VNOM | $34.00 | 6.5% | 8.0% | 9.4% | 15.2x | 12.5x | 10.6x | $310.1 | 2.0 | 5.03x | 1.05x | 7.1% | 8.3% | 8.8% | 14.0x | 12.0x | 11.3x | 5.14x | 1.14x |
| FLMN | $9.27 | 7.6% | 9.1% | 18.7% | 10.5x | 10.1x | 8.7x | $311.6 | 1.6 | 1.24x | 0.78x | 7.7% | 9.1% | 16.9% | 12.2x | 10.2x | 9.6x | 1.34x | 0.85x |
| KRP | $17.65 | 8.5% | 8.7% | 9.9% | 10.4x | 10.3x | 9.2x | $33.2 | 3.0 | 3.05x | 0.64x | 8.8% | 9.2% | 9.2% | 10.7x | 9.9x | 9.8x | 3.20x | 0.64x |
| BSM | $17.86 | 10.9% | 11.8% | 11.8% | 10.8x | 10.4x | 10.4x | $58.6 | 1.4 | -- N/A -- | | --- | N/A | --- | --- | N/A | --- | -- N/A -- | |
| **Average** | | **8.4%** | **9.4%** | **12.5%** | **11.7x** | **10.8x** | **9.7x** | **$178.4** | **2.0** | **3.11x** | **0.82x** | **7.8%** | **8.8%** | **11.7%** | **12.3x** | **10.7x** | **10.2x** | **3.22x** | **0.88x** |
| **Canadian Oil & Gas Royalty Companies** | | | | | | | | | | | | | | | | | | | |
| FRU | C$9.51 | 6.6% | 6.6% | 6.6% | 4.9x | 4.8x | 4.8x | C$4.8 | 2.9 | -- N/A -- | | --- | N/A | --- | --- | N/A | --- | -- N/A -- | |
| PSK | C$19.23 | 5.2% | 5.2% | 5.0% | 17.7x | 17.9x | 16.8x | C$4.8 | 2.1 | -- N/A -- | | --- | N/A | --- | --- | N/A | --- | -- N/A -- | |
| **Average** | | **5.9%** | **5.9%** | **5.8%** | **11.3x** | **11.4x** | **10.8x** | **$4.8** | **2.5** | **-- N/A --** | | **---** | **N/A** | **---** | **---** | **N/A** | **---** | **-- N/A --** | |
| **RoyaltyCo Avg** | | **7.5%** | **8.2%** | **10.2%** | **11.6x** | **11.0x** | **10.1x** | **$120.5** | **2.1** | **3.11x** | **0.82x** | **7.8%** | **8.8%** | **11.7%** | **12.3x** | **10.7x** | **10.2x** | **3.22x** | **0.88x** |

## RoyaltyCo Distribution & Production Forecast

| | Distribution & Production (CS Price Deck) | | | | | | | | | | | Distribution & Production (Strip Price Deck) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Distribution Per Share | | | YoY DPS Growth | | Production (MBoed) | | | % Oil | % Prod'n Growth | | Distribution Per Share | | | YoY DPS Growth | |
| Ticker | 2019 | 2020 | 2021 | 2019 | 2020 | 2019 | 2020 | 2021 | 2019 | 2019 | 2020 | 2019 | 2020 | 2021 | 2019 | 2020 |
| **Credit Suisse US RoyaltyCo Coverage** | | | | | | | | | | | | | | | | |
| VNOM | $2.20 | $2.71 | $3.20 | 1.1% | 23.0% | 22.4 | 25.4 | 28.3 | 69.4% | 29.5% | 13.5% | $2.40 | $2.82 | $2.99 | 10.1% | 17.5% |
| FLMN | $0.70 | $0.85 | $1.73 | 19.1% | 20.3% | 5.5 | 6.7 | 8.0 | 54.9% | (3.7%) | 22.2% | $0.71 | $0.84 | $1.57 | 18.3% | 18.3% |
| KRP | $1.50 | $1.54 | $1.75 | (12.0%) | 3.0% | 11.4 | 12.5 | 13.1 | 27.0% | 83.3% | 9.8% | $1.55 | $1.62 | $1.63 | (8.8%) | 4.5% |
| **Avg.** | | | | **2.7%** | **15.5%** | | | | **50.4%** | **36.4%** | **15.2%** | | | | **6.5%** | **13.4%** |

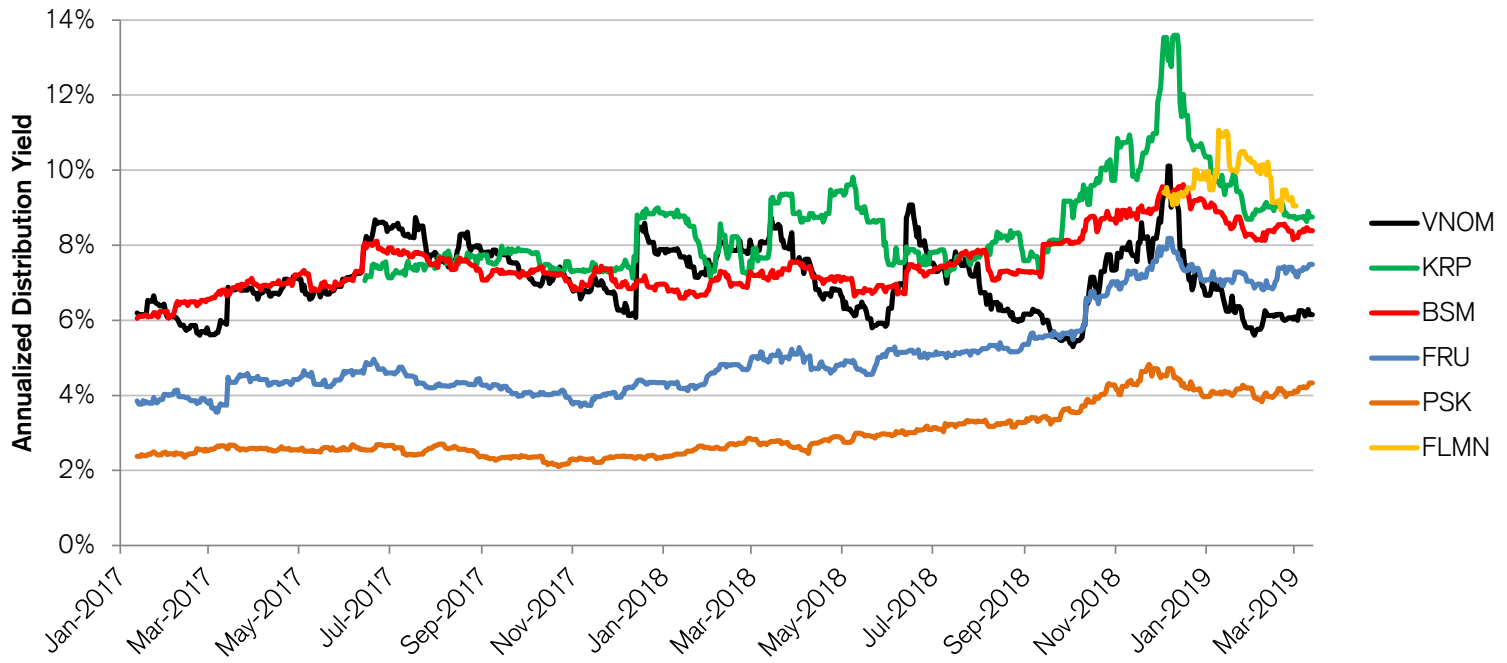
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Source: Company data, Credit Suisse estimates, Factset

# Public RoyaltyCo Historical Yields

Lack of consensus estimates makes forward yield analysis difficult; that said, **RoyaltyCo yields have averaged ~8.3% (ex PSK) of last quarters distribution over the past six months**, while US RoyaltyCos have traded at a slightly higher ~8.6%.

**Distribution Yield (Trailing QTR Annualized)**




| Avg Yield | VNOM | KRP | BSM | FRU | PSK | Avg |
|---|---|---|---|---|---|---|
| Last 6 Months | 7.1% | 10.1% | 8.8% | 7.2% | 4.2% | **7.5%** |
| Last 12 Months | 6.8% | 9.4% | 8.4% | 6.5% | 3.9% | **7.0%** |

Source: Company data, Credit Suisse estimates, Factset

Credit Suisse Equity Research
Americas/United States

# US Midstream

**April 2019**


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## Asset Overview

## Cash Flow Drivers

## Structures and Business Models

## Valuation and Fund Flows

# Asset Overview

Cash Flow Drivers

Structures and Business Models

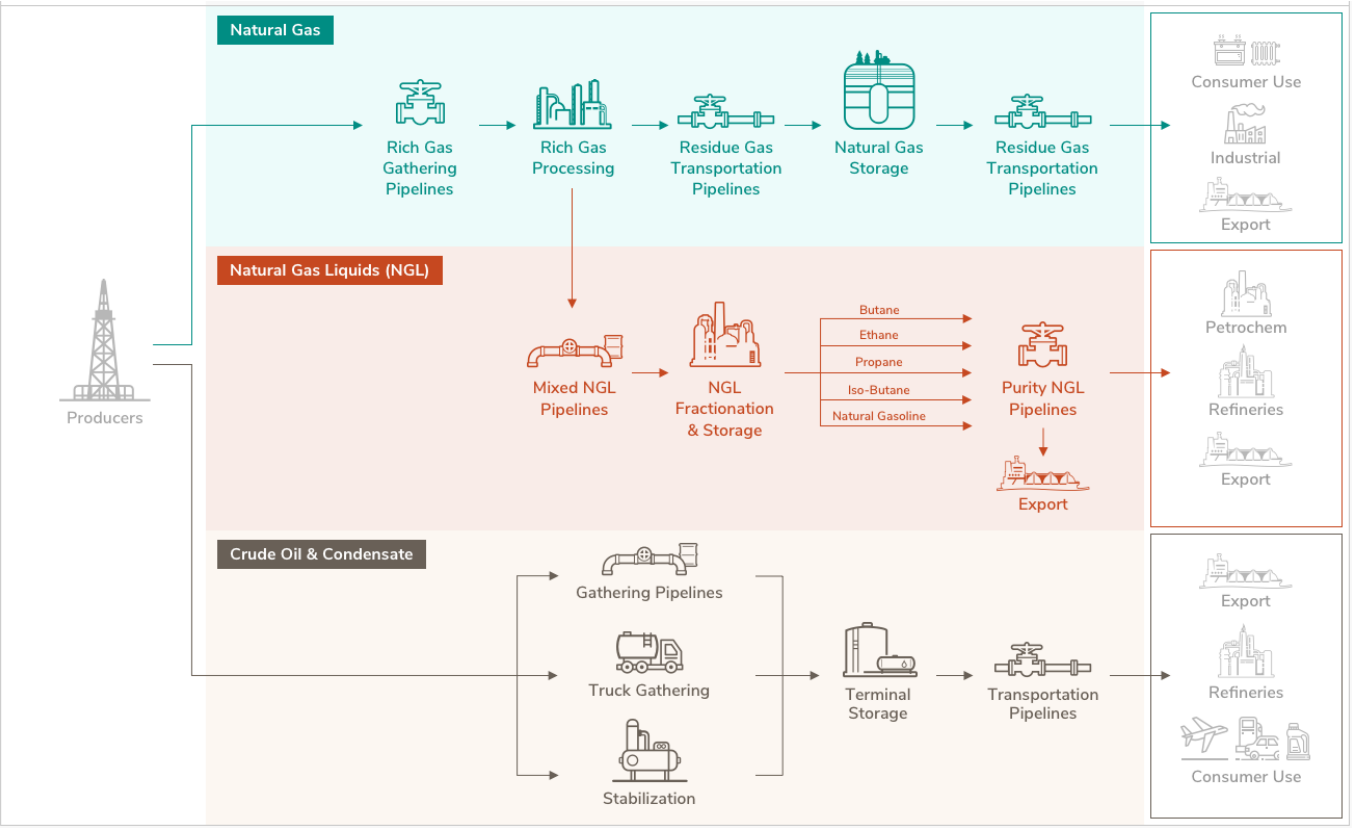
Valuation and Fund Flows

# Asset Overview

## Connecting Producers with Consumers

Midstream assets connect energy supply with energy demand and provide key intermediate services:

- **Supply Collection:** Midstream service providers move oil, natural gas, and natural gas liquids (NGLs) from wells drilled by upstream producers (exploration and production, or E&P, companies) to markets.
- **Intermediate Steps:** Beyond transportation, midstream companies will also treat, process, store, market, and – if needed – fractionate and export products.
- **Demand Distribution:** Midstream companies transport products to downstream consumers, including refiners for crude oil, utilities for natural gas, and petrochemical companies for NGLs, among others.

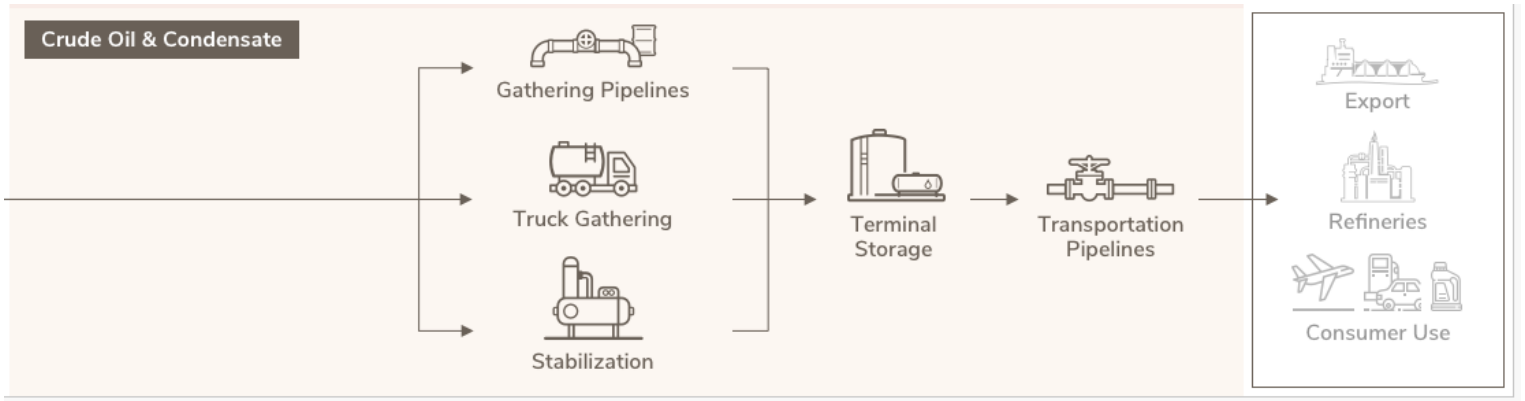



Source: EnLink Midstream Website

# Asset Overview
## Crude Oil: Overview

Crude oil is generally the highest margin product for E&Ps, who are thus highly incentivized to get their barrels to the best-priced markets. Midstream companies seek to provide this service.

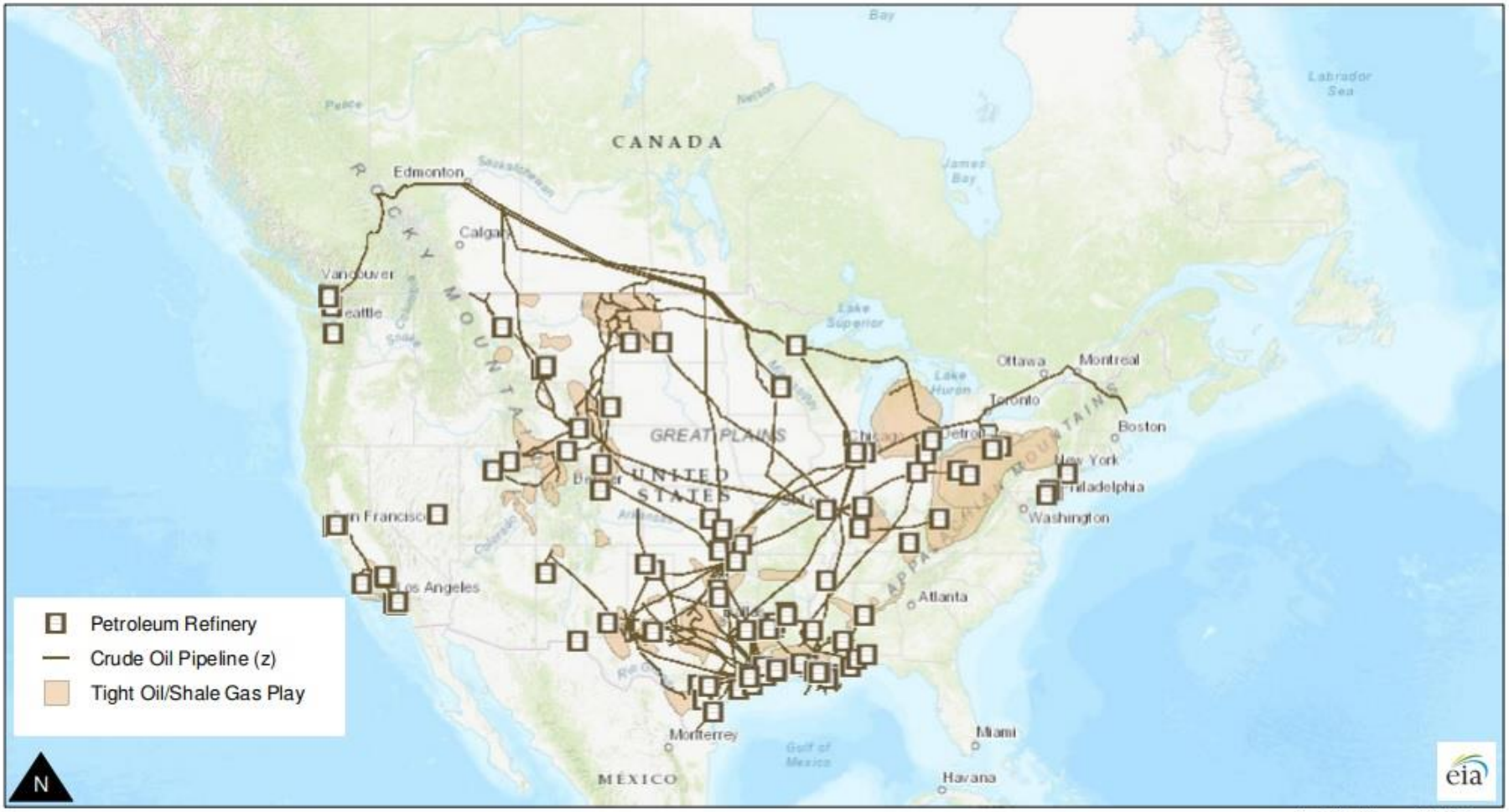
- **Assets:** Key assets in the value chain include pipelines, storage, and – increasingly – export facilities.
- **Key Supply Sources:** The most important onshore crude sources in the US are the Permian Basin in West Texas and SE New Mexico (4.1 mmb/d), the Bakken in North Dakota and East Montana (1.4 mmb/d), the Eagle Ford in South Texas (1.4 mmb/d), and the DJ Basin in Colorado (0.7 mmb/d).
- **Key Demand Centers:** Crude is transported to trading hubs (Cushing, Oklahoma and Houston, TX), major US refining centers (notably the Gulf Coast, Upper Midwest, among others), and GC exports.




Source: EIA Drilling Productivity Report; EnLink Midstream Website

# Asset Overview

## Crude Oil: US Pipeline Map

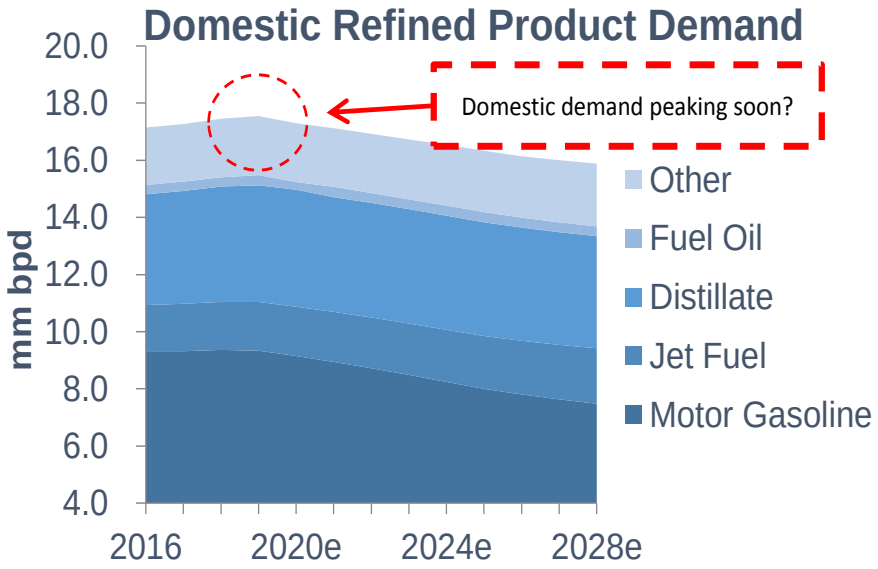


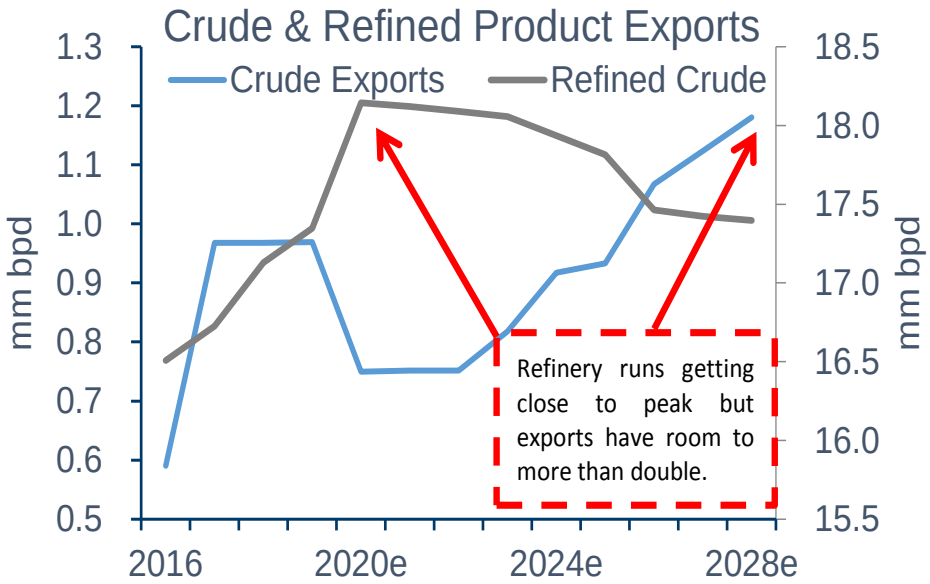

Credits

Source: EIA

# Asset Overview
## Crude Oil: Exports

- **US Demand Not Keeping Up with Supply:** The vast majority of incremental crude barrels produced and refined are making their way to the export market as a mechanism to clear domestic oversupply.
- **Optimizing for US Refiner Demand:** US refiners prefer a heavier crude slate, which further supports increased exports of domestic light sweet crude favored by less-complex refineries abroad.
- **Global Demand for Products:** Refined product exports are being pulled largely by LatAm markets that are short supply; with US domestic demand expected to wane, we believe exports will become even more critical.



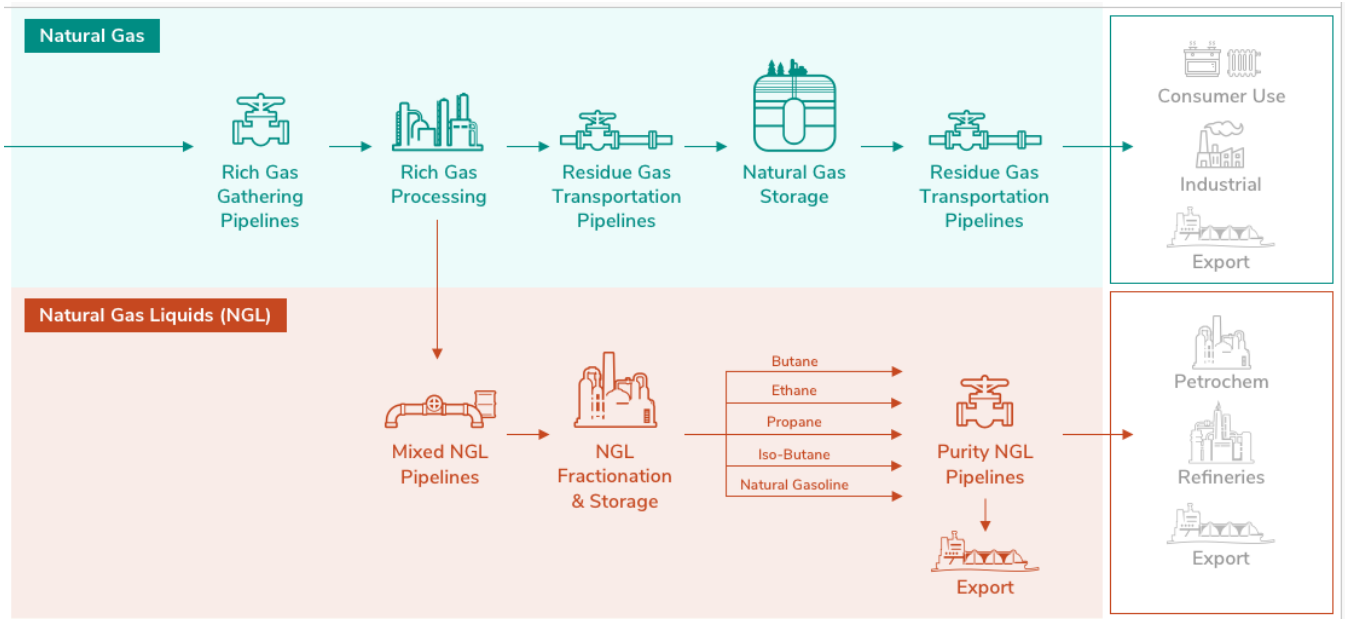




Source: Credit Suisse Research, EIA, Company Press Releases

# Asset Overview
## Natural Gas and NGLs: Overview

Natural gas is produced either as a primary product in gas-directed drilling or as a secondary product from oil-directed drilling, depending on the geology of the basin. Wellhead gas is considered "wet" gas, meaning it contains natural gas liquids (NGLs) as well as natural gas – these are separated out at processing plants.

- **Assets:** Key assets in the value chain include gathering, processing, long-haul dry gas pipe, long-haul NGL pipes, NGL fractionators, and purity NGL infrastructure. Also includes export facilities.
- **Key Supply Sources:** The most important onshore gas-directed basins are the Marcellus / Utica in PA, WV, and OH (31.1 bcf/d) and the Haynesville in LA/TX (10.3 bcf/d). Key associated gas sources are the Permian (13.8 bcf/d), the Anadarko in OK (7.7 bcf/d), and Eagle Ford (6.9 bcf/d).
- **Key Demand Centers:** Gas is moved to demand centers across the country as well as LNG export.




Source: EIA Drilling Productivity Report; EnLink Midstream Website

# Asset Overview

## Natural Gas and NGLs: US Pipeline Map

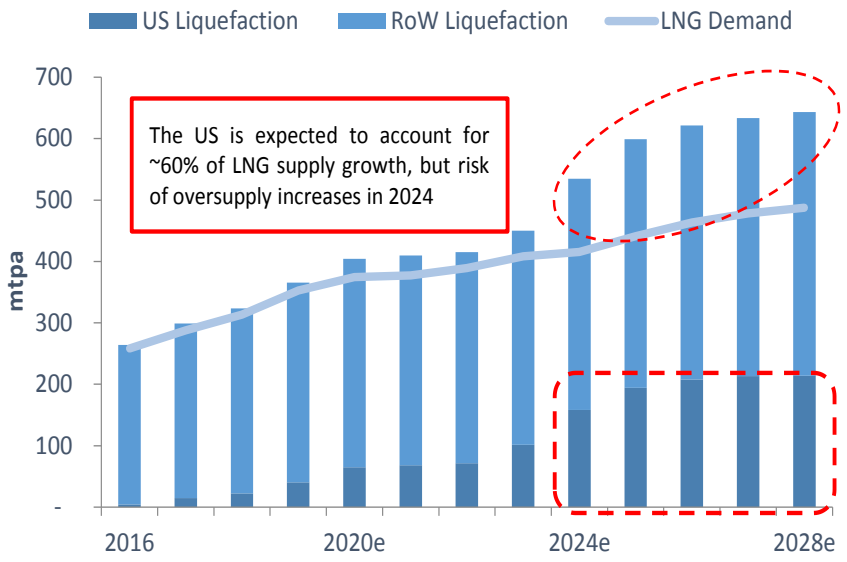


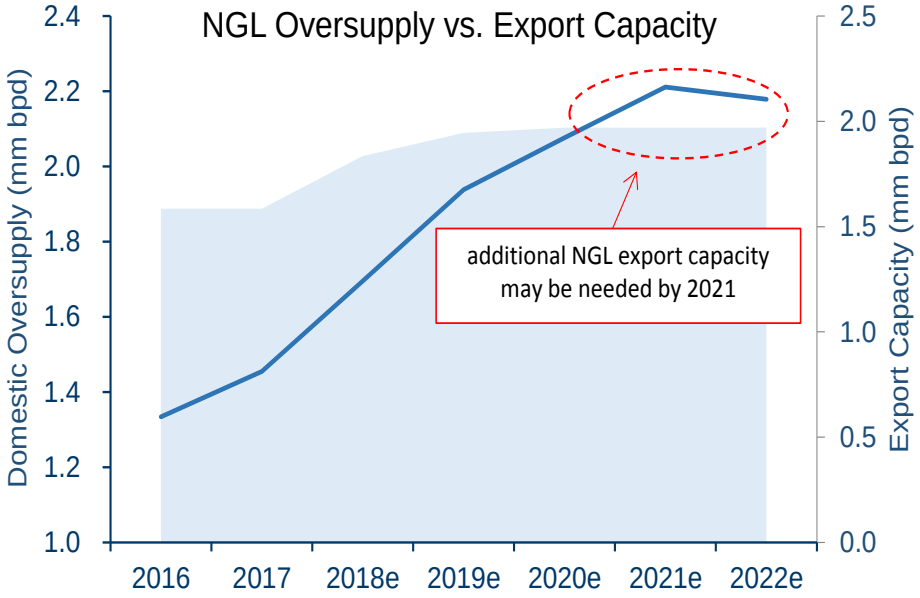

Credits

Source: EIA

# Asset Overview
## Natural Gas and NGLs: Exports

- **US Will Be a Major Natural Gas Exporter:** The US is expected to drive the majority of LNG supply growth over the next decade, accounting for nearly 60% of new supply. While risk of oversupply may escalate by 2024, we believe most of these new US terminals will be globally competitive.
- **NGLs Need to Move Offshore:** We believe exports will be increasingly called upon to clear the rapidly growing NGL Market. According to the EIA, domestic NGL production is expected to continue to outpace domestic demand, growing from 1.5mm bpd in 2017 to over 2.0mm bpd by 2020. Accordingly, we believe the market will need to clear this excess supply with exports.
- **NGL Export Capacity Coming:** Fortunately, latent capacity exists in the current system to facilitate growth without capex. That said, some recent expansions bridge the gap to 2020, at which point additional export infrastructure may need to be constructed to keep pace with domestic production.



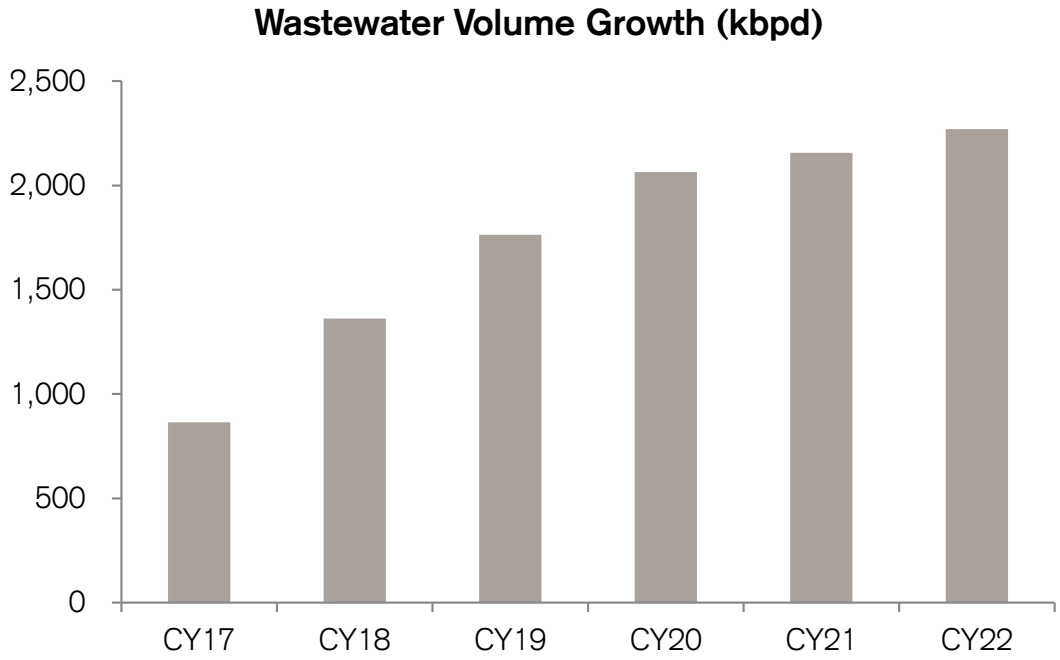




Source: Credit Suisse Research, EIA, Company Press Releases

# Asset Overview

## Emerging Opportunity: Water Services

- Water is currently a small but rapidly growing area of focus across midstream companies we cover.
- The Permian basin largely drives growth here, with other basins offering similar but less robust demand for infrastructure. Specifically, the DJ, Bakken, Marcellus, SCOOP, and STACK also present opportunities for growth and consolidation.
- The Delaware Basin in particular is seeing wells where 6 barrels of water is produced for every barrel of oil.
- The Midland Basin, while not as "wet" as the Delaware, is still expected to show a 1 or 2 water-oil ratio.




*Expected volume growth in reported wastewater volumes from select companies under coverage (NGL, TGE, EQM, OMP, AM, NBLX). Excludes freshwater volumes, which are less ratable and thus not as "suited" for midstream.

Source: Credit Suisse Research, EIA, Company Press Releases

Asset Overview

**Cash Flow Drivers**

Structures and Business Models

Valuation and Fund Flows

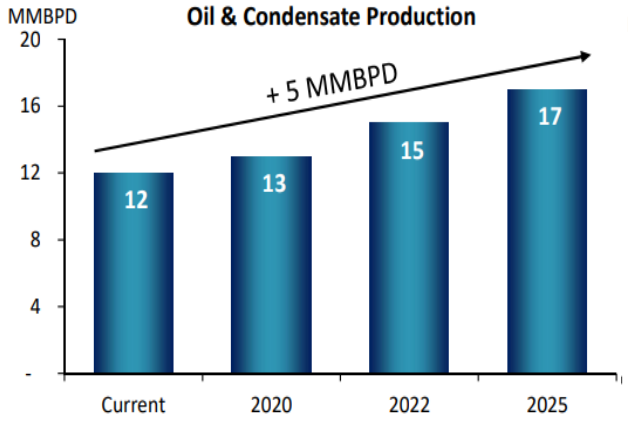
# Cash Flow Drivers

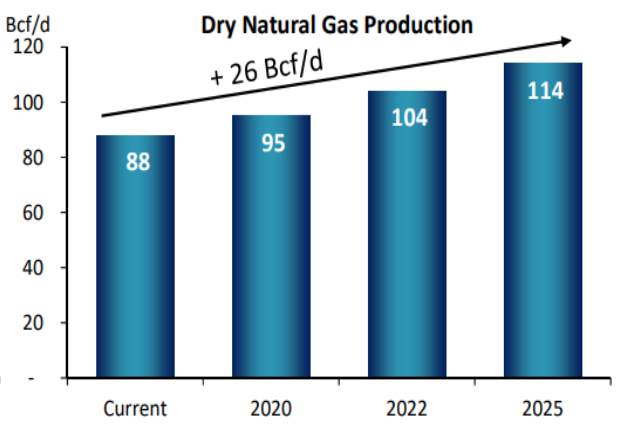
## Midstream Stocks Are Tied to Volume Growth

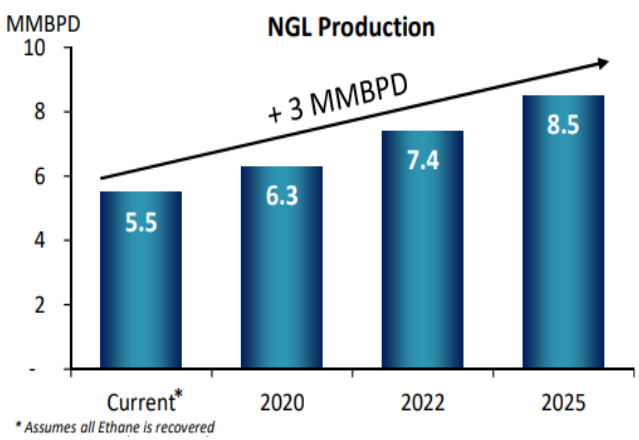
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As mentioned, the core midstream business model is to transport hydrocarbons from where they are produced to where they are consumed. **US demand – and where that demand exists – is not particularly variable** and tends to grow at or slightly above economic growth. But the **supply side – from oil and gas basins – tends to be much more volatile**, based on commodity prices and exploration activity / success. Thus, the supply side tends to be much more important for midstream company growth.

- **Crude:** US crude and condensate production could grow by almost 50% to ~17 mmb/d in 2025, largely driven by the Permian Basin and Eagle Ford.
- **Natural Gas:** Natural gas production could grow almost 30% to ~114 bcf/d in 2025, driven by the Permian and Northeast.
- **Natural Gas Liquids:** NGLs could see the highest growth at up to over 50% to 8.5 mmbd/d in 2025.




Source: Enterprise Products Presentation

# Cash Flow Drivers
## Focus on Basin Differentials

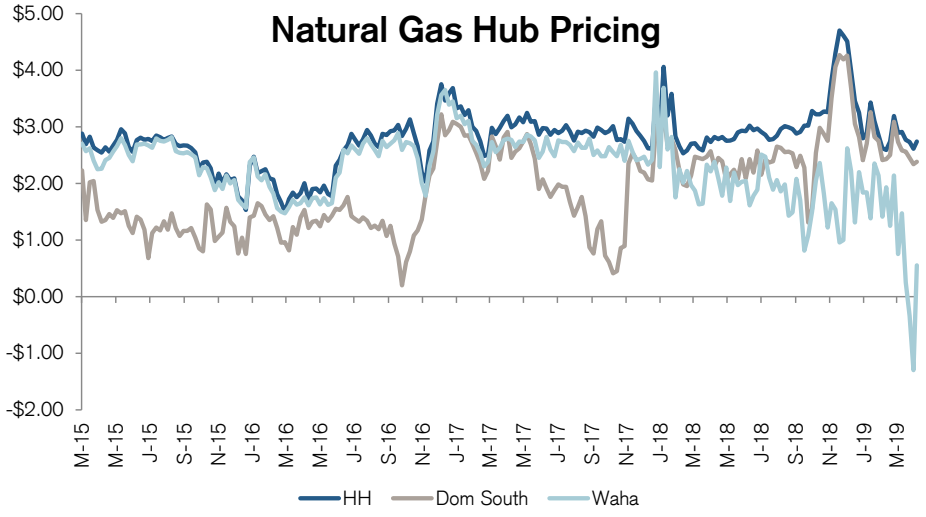
As part of that effort to move products from supply centers to demand, a key focus for producers and consumers alike is price optimization. Given differences in transportation pricing, existing transportation capacity, local demand, and supply growth, the gap between the two sides of the value chain can vary significantly. In growth-focused basins, these differentials often incentivize the construction of pipelines. Differentials should otherwise equal transportation (pipeline cost), all else equal.

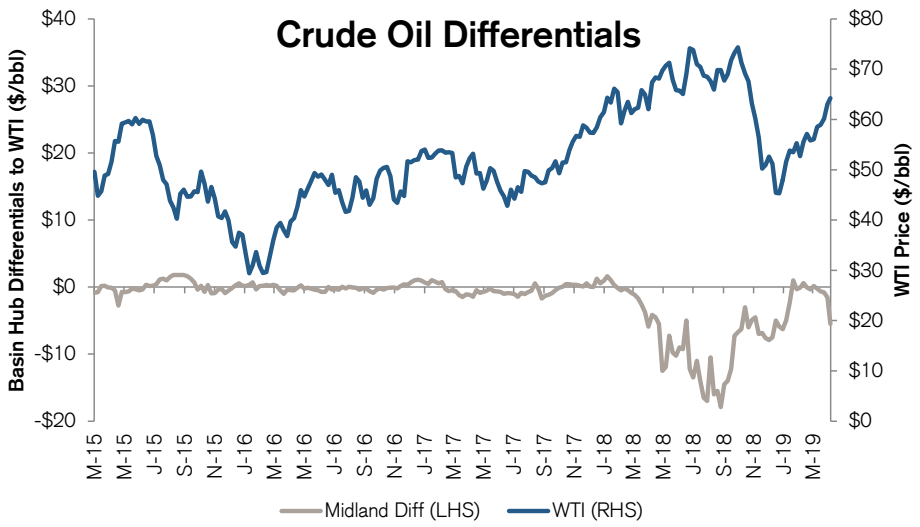
Key crude differentials to watch right now:

- **Midland-WTI:** Permian crude has traded at a discount as supply outstrips takeaway capacity.

Key gas differentials to watch right now:

- **Waha-HH:** The material growth in associated gas in the Permian has crushed.
- **Dominion South-HH:** New pipelines have alleviated bottlenecks in the Northeast, helping pricing.



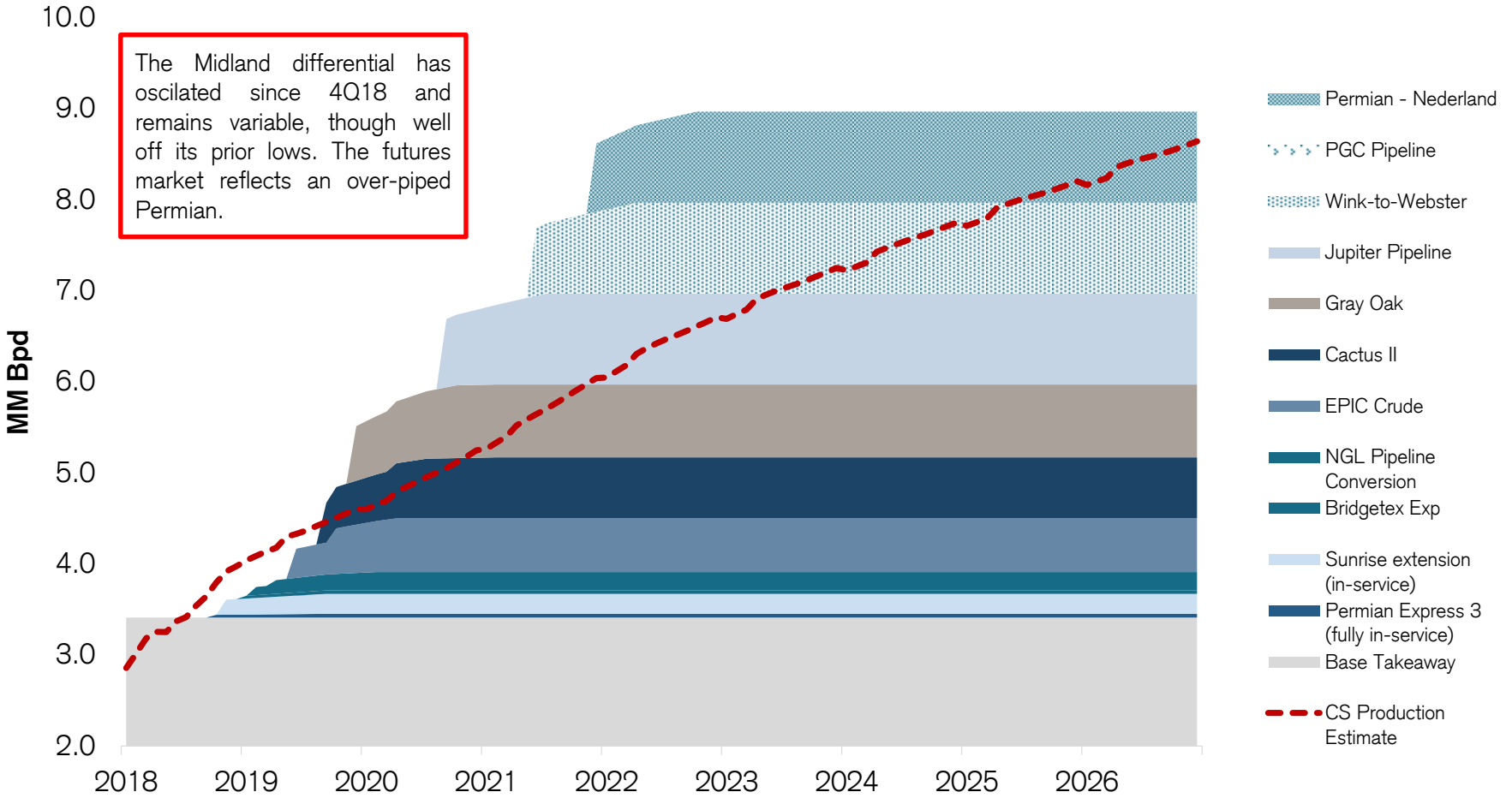




Source: the BLOOMBERG PROFESSIONALTM service

# Cash Flow Drivers

## Basin Case Study – Permian: Crude

The Permian is seeing impressive crude volume growth and local (Midland) prices are falling as existing pipeline capacity is maxed out. Companies are now building out new capacity to get these volumes to market. The tight near-term outlook (2019) and wide medium-term outlook (2022) point to classic midstream under / over-build cycles that the sector often experiences.

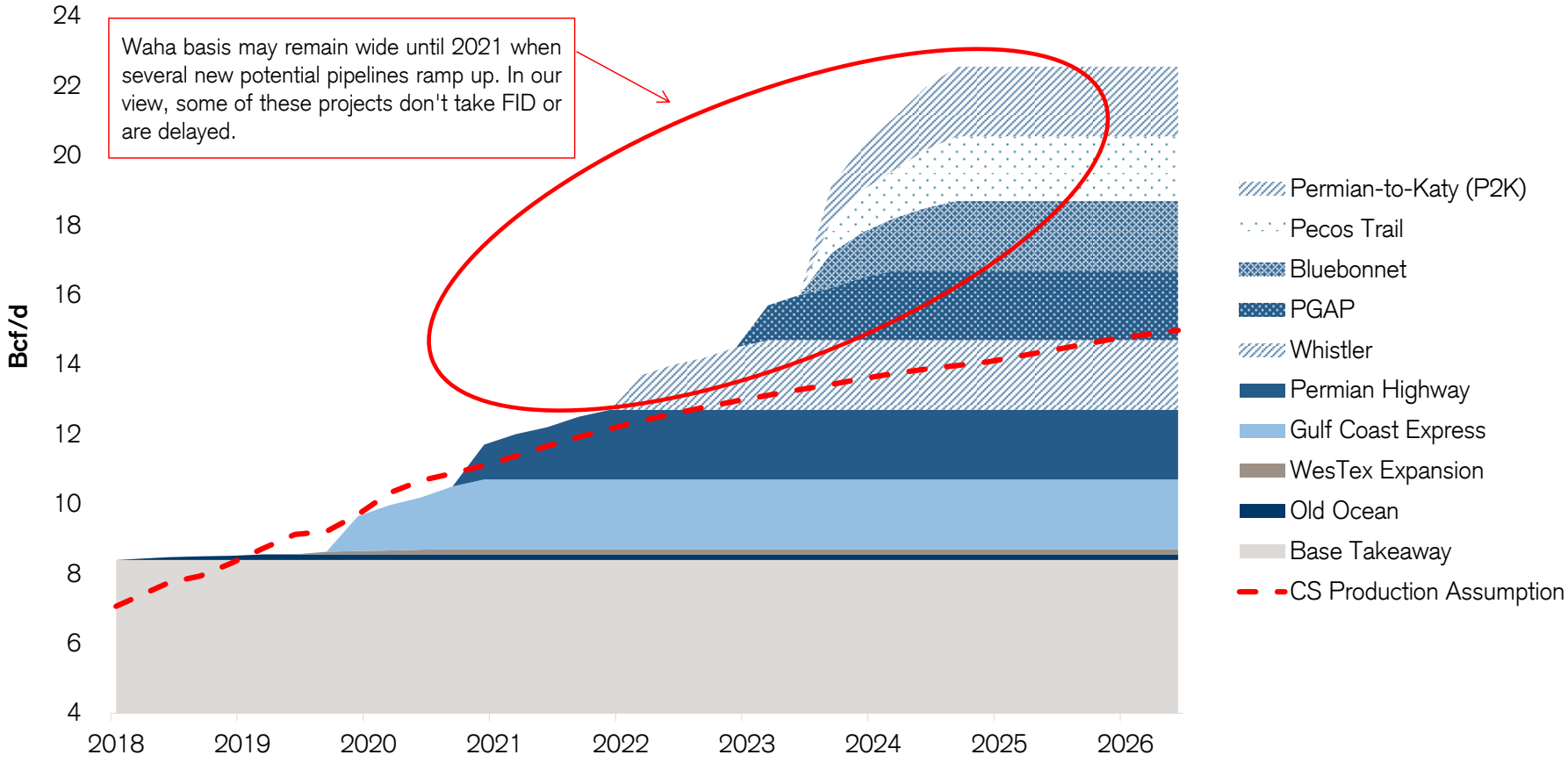



Source: Credit Suisse Research, EIA, Company Press Releases

# Cash Flow Drivers

## Basin Case Study – Permian: Gas

The growth in crude in the Permian is expected to bring significant associated gas volumes as well. Two pipelines are under construction to alleviate current bottlenecks, but the basin will need roughly another pipe each year to keep up with growth through the medium term. There are many proposals but no third FID yet.

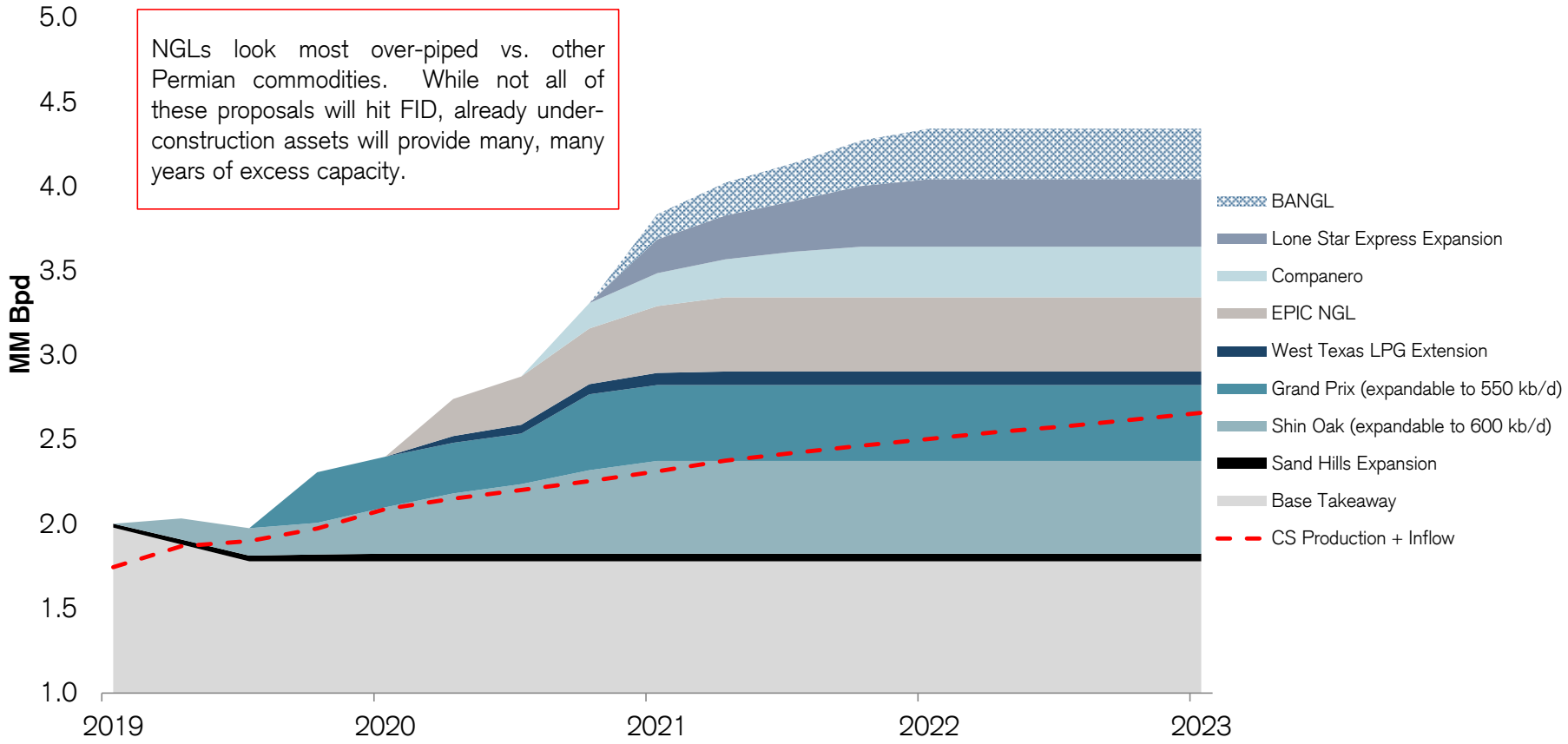



Source: Credit Suisse Research, EIA, Company Press Releases

# Cash Flow Drivers

## Basin Case Study – Permian: NGLs

With the considerable growth in gas will come material NGL volumes. Many more pipelines have been proposed for this product vs. gas given the wider set of services that integrated midstream players can offer downstream of NGL pipelines (notably fractionation and export). We expect significant overbuild right now.




Source: Credit Suisse Research, EIA, Company Press Releases

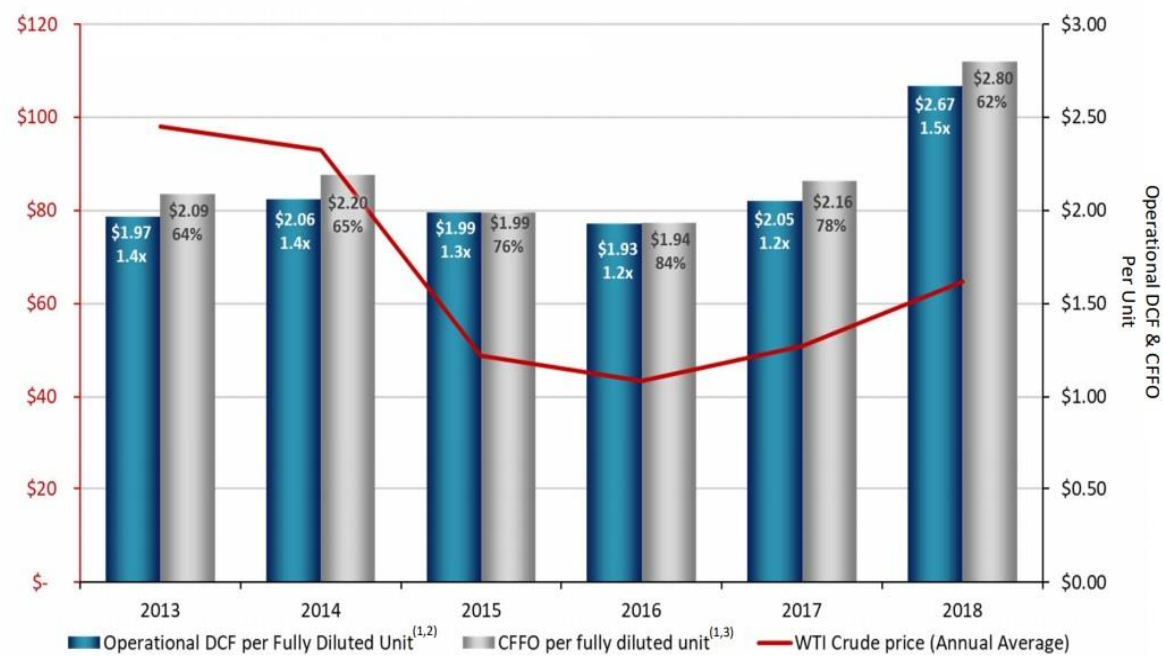
# Cash Flow Drivers

## Contract Profiles and Stability of Cash Flow

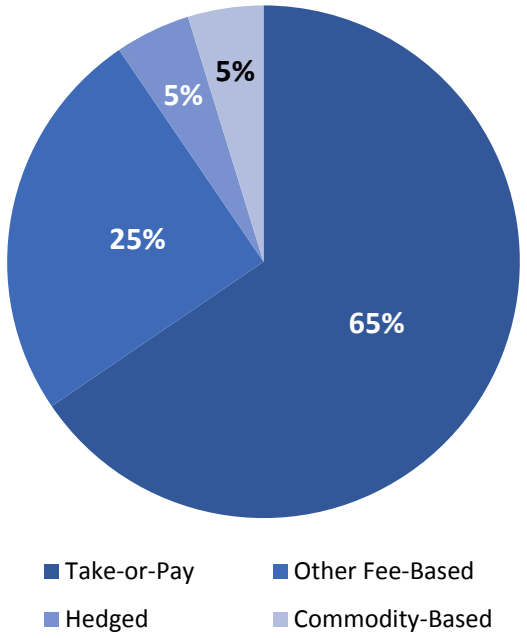
Midstream companies usually have little direct commodity exposure, and are instead paid on a dollar-per-unit basis. Many go further with "take-or-pay" contracts, which ensure payment regardless of actual volumes.

- **Pipelines, Storage, and Other Non-G&P Assets:** Mostly fee-based, with take-or-pay on larger pipelines usually seen. Contract tenors usually stretch from 5-10 years on crude and 10-20 on gas. Note that many gas (and products) pipelines have FERC-regulated rates, offering very stable returns.
- **Gathering & Processing:** Many gathering contracts are life-of-lease and/or acreage dedications with a per-unit fee. Processing contracts used to heavily-weighted towards commodity price-linked contracts, but more recently have shifted to traditional fee-based structures.
- **Marketing:** Many companies will use their own asset base as a conduit to buy, sell, and trade commodities. This can be either to facilitate customer activities or to capture incremental margin.

**EPD Example: Cash Flow Stability Through the Cycle**




**KMI Example: Very Little Direct Commodity Exposure**




Source: Enterprise Products and Kinder Morgan Analyst Day Presentations

Asset Overview

Cash Flow Drivers

## Structures and Business Models

Valuation and Fund Flows

# Structures and Business Models

## Moving Away from MLPs

- Midstream assets were traditionally organized as Master Limited Partnerships (MLPs), which are tax-advantaged structures designed to incentivize natural resource investment.
- These structures generally have separate general partners (GPs) and limited partners (LPs) and thus usually had different incentives. Incentive Distribution Rights (IDRs) allowed GPs to collect increasing shares of distributable cash flow as per-LP unit distributions grew and/or LP unit counts increased.
- Midstream companies have been evolving over the past few years by changing compensation structures, eliminating IDRs, and adopting stronger corporate governance practices.
- That said, we believe there is considerable room for improvement, as some companies have been reluctant to fully embrace this ongoing shareholder movement.

**CREDIT SUISSE MIDSTREAM SHAREHOLDER SCORECARD**

| | | | | |
|---|---|---|---|---|
| **First Quartile** | | | | |
| AM | KMI | NEXT | TELL | WMB |
| BPL | LNG | OKE | TRGP | |
| **Second Quartile** | | | | |
| ALTM | ET | MMP | PAA | WES |
| ENLC | ETRN | NFE | TGE | |
| **Third Quartile** | | | | |
| ANDX | EQM | HESM | PBFX | SUN |
| EPD | HEP | MPLX | SHLX | |
| **Fourth Quartile** | | | | |
| BPMP | DCP | NBLX | OMP | SMLP |
| CQP | DKL | NGL | PSXP | |

### Categories

1. Independent Directors: what % of BoD
2. Management Comp: Per Share vs. Aggregate
3. IDRs: do they exist and how onerous are they?
4. Executive Comp: as a % of EBITDA
5. Executive Comp: what % is in stock?
6. Director Comp: what % is in stock?
7. Structure: C-corp, MLP, or check the box?
8. Sponsor Buyout Threshold: low/high barrier

*These categories are not equally weighted and do not necessarily correlate with our price targets and recommendations which are based on risk/return metrics. We do consider these qualitative factors in our overall valuation framework when assessing potential risks and returns. The companies are listed in alphabetical order within quartile. Non-Operating General Partners have been excluded from this analysis.

Source: Credit Suisse Research, Company Filings

# Structures and Business Models

## More Simplifications Coming

- Many of the largest names in the midstream space are now proper C-corporations, but there are many more that could be next.
- We expect that, at the very least, most names will move to eliminate IDRs in the next few years as investors grow increasingly skeptical of their value and focus more on GP-LP incentive alignment.
- The remaining simplifications are more likely to take the form of IDR removals rather than roll-ups, as many of the remaining GPs are actual operating companies and not pure sponsor companies.
- Depending on the rate of remaining growth, valuations for IDR removals can range between **12x and 17x** cash flow based on historical deal multiples. That said, the most recent deals – notably PBFX (11x) and SMLP (9.2x) – were done as lower multiples and could be the start of a trend. Positive for LPs if so.

**Completed**

| Company | Type | Year |
|---|---|---|
| KMI | Roll-Up | 2014 |
| OKE | Roll-Up | 2017 |
| PAA | IDR Removal | 2016 |
| TRGP | Roll-Up | 2016 |
| HEP | IDR Removal | 2017 |
| ANDX | IDR Removal | 2017 |
| MPLX | IDR Removal | 2017 |
| TGE | Roll-Up | 2018 |
| WMB | Roll-Up | 2018 |
| LNG | Roll-Up | 2018 |
| ET | Roll-Up | 2018 |
| AM/AMGP | Roll-Up | 2019 |
| ENLK/ENLC | Roll-Up | 2019 |
| WES/WGP | Roll-Up | 2019 |
| ETRN/EQGP | Roll-Up | 2019 |
| EQM | IDR Removal | 2019 |
| PBFX | IDR Removal | 2019 |
| SMLP | IDR Removal | 2019 |

**Ongoing Discussions**

| Company | Type |
|---|---|
| DCP | IDR Removal |
| PSXP | IDR Removal |
| SHLX | IDR Removal |

**Potential Simplifications**

| Company | Type |
|---|---|
| BPMP | IDR Removal |
| CQP | Roll-Up |
| DKL | IDR Removal |
| HESM | IDR Removal |
| NBLX | IDR Removal |
| NGL | IDR Removal |
| OMP | IDR Removal |
| SUN | IDR Removal |

Source: Credit Suisse Research, Company Filings

# Structures and Business Models

## Increasing Focus on FCF and Self-Funding

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- Midstream historically returned the vast majority of retained cash (roughly CFO less maintenance capex) as distributions / dividends to investors, who were generally focused on income-generation.
- This lack of retained cash usually meant that companies had to tap the public equity markets to fund incremental projects, making the sector very dependent on open and accommodating capital markets.
- When capital markets access dried up in 2015 after the energy market collapse, the sector was forced to dramatically change its business model – first by tapping alternative funding, and then funding internally.
- Since then, there has been an increasing focus on building up cash balances to fund growth, largely at the expense of payout ratios (driven by either moderated distribution growth or outright cuts).
- Investors are now increasingly focused on companies that can generate true free cash flow.

**Fastest Growing Distributions**

| DISTRIBUTION GROWTH | 2018e | 2019e | 2020e | 2 Yr CAGR | Yield |
|---|---|---|---|---|---|
| AM | $ 0.94 | $ 1.24 | $ 1.60 | 31% | 11% |
| KMI | $ 0.80 | $ 1.00 | $ 1.25 | 25% | 8% |
| NBLX | $ 2.19 | $ 2.63 | $ 3.17 | 20% | 9% |
| OMP | $ 1.68 | $ 2.03 | $ 2.44 | 20% | 12% |
| BPMP | $ 1.12 | $ 1.29 | $ 1.48 | 15% | 9% |
| HESM | $ 1.41 | $ 1.62 | $ 1.86 | 15% | 9% |
| SHLX | $ 1.49 | $ 1.72 | $ 1.88 | 12% | 9% |
| WMB | $ 1.36 | $ 1.52 | $ 1.71 | 12% | 7% |
| OKE | $ 3.35 | $ 3.73 | $ 4.13 | 11% | 7% |
| PAA | $ 1.20 | $ 1.30 | $ 1.46 | 10% | 6% |
| PAGP | $ 1.20 | $ 1.30 | $ 1.46 | 10% | 6% |
| PSXP | $ 3.09 | $ 3.48 | $ 3.72 | 10% | 8% |

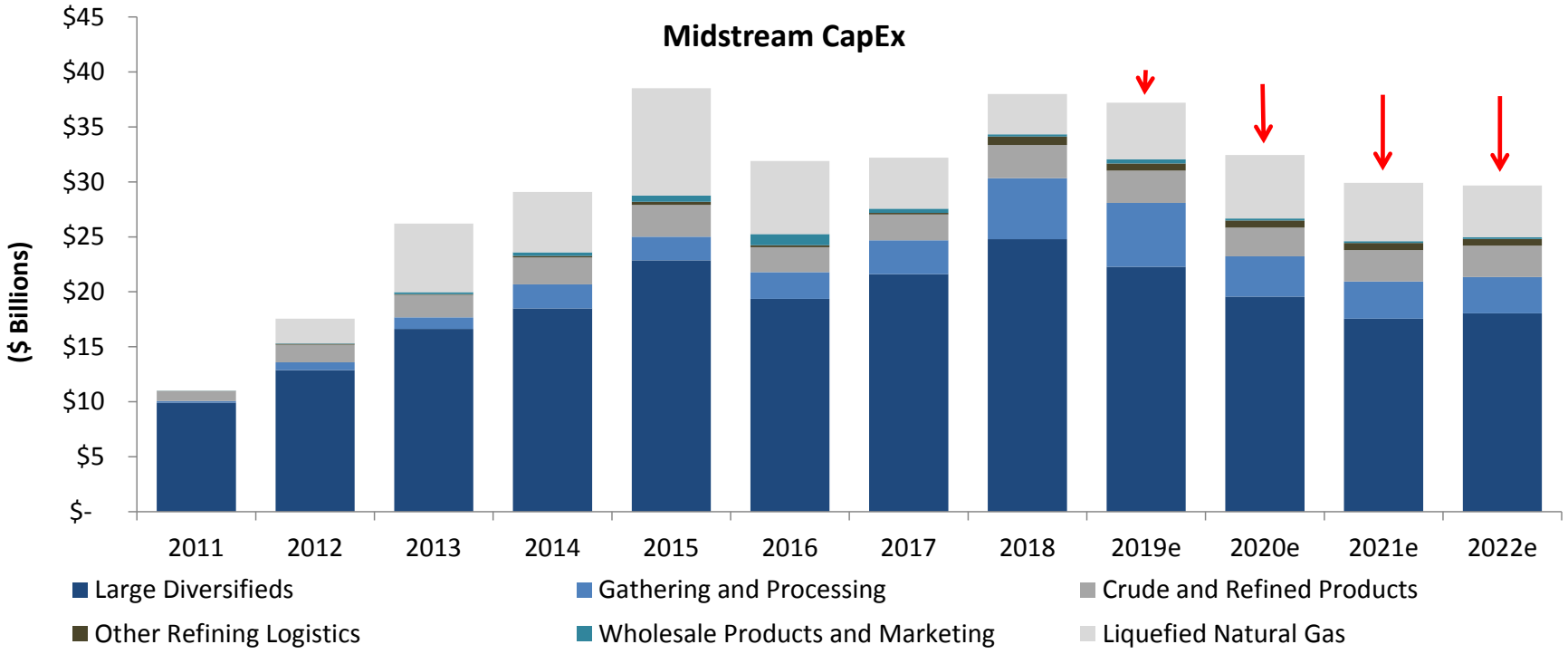
| Company | CS Commentary Regarding Buybacks |
|---|---|
| KMI | KMI has $1.5bln remaining on its $2bln repurchase program. |
| NGL | Mgmt is currently seeking consent to undertake a $150mm repurchase program. At current price levels, this would represent ~9.4mm shares (~8% of common units outstanding). |
| MPLX | We don't see room for buybacks in 2019 based on guidance, but it becomes possible in 2020 depending on the funding profile. |
| EPD | Based on mgmt commentary, EPD views share buybacks as reducing financial flexibility. Growing the distribution at the cost of high-growth projects is also unattractive to management. |
| ET | Mgmt expects either a return to distribution growth or buybacks once the rating agency's expectations are met (~4.5x leverage), which we view as a late 2019/early 2020 event. |
| TGE | On its 2Q18 earnings call, mgmt hinted at the possibility of increased distribution growth or share repurchases beginning in 2020. New ownership could change this outlook, however. |

Source: Credit Suisse Research, Company Filings

# Structures and Business Models

## Capex Expected to Moderate

- Midstream companies have historically been, and likely continue to be, very large capital spenders.
- That said, we believe 2018 represents the peak of the spending cycle; major projects have already entered service or are entering service in 2019. We view this as positive, allowing companies to harvest and return cash to investors or delever.
- We forecast a ~3% decline in 2019 capex and an additional ~11% decline in 2020.
- However, we remain concerned that management teams will continue to backfill capex budgets into perpetuity and potentially miss-time the market once again.

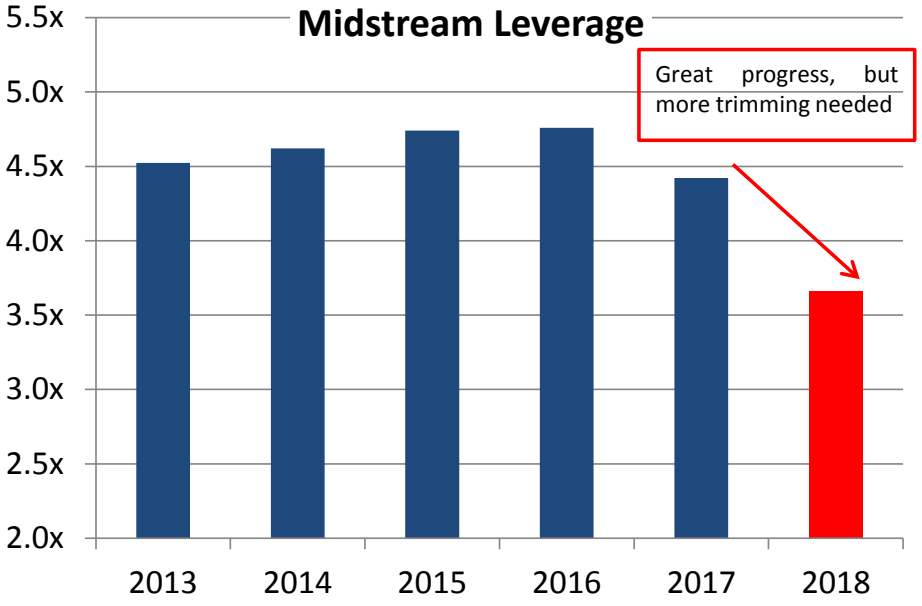


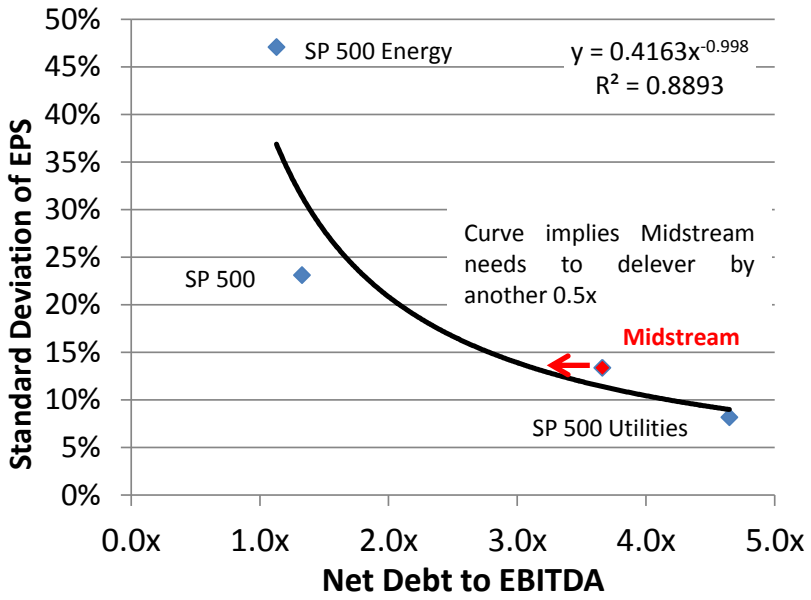

Source: Credit Suisse Research, Company Filings

# Structures and Business Models

## Leverage Levers Moderating, Need More Progress

- Midstream companies have made progress in cutting leverage, but we believe the sector still needs to de-lever by another 0.5x.
- We base this view on the relative volatility of Midstream earnings to the utilities sector, broader energy sector and the overall market. We found that the Midstream sector EPS standard deviation was over 60% higher than the utilities sector. Thus leverage should be lower to reflect the higher volatiltiy.
- The curve below implies Midstream needs to shave another 0.5x of leverage to be at parity with the broader energy sector and with the utilities sector.
- If Midstream companies are not going to increase capital returns to investors; we'd suggest de-leveraging even further as another alternative.




Source: Credit Suisse Research, Company Filings, the BLOOMBERG PROFESSIONALTM service

Asset Overview

Cash Flow Drivers

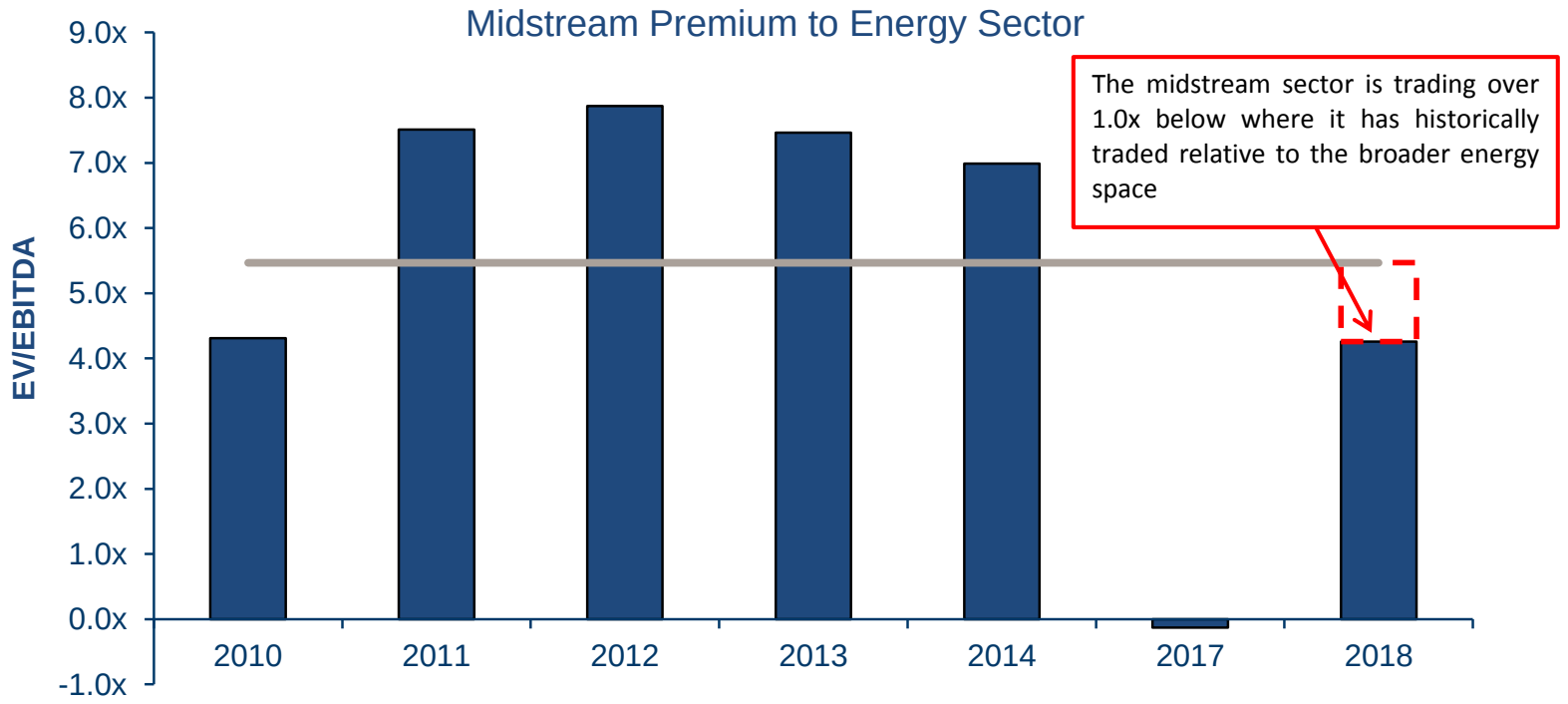
Corporate Structures

## Valuation and Fund Flows

# Valuation and Fund Flows

## Midstream Lagging vs. Energy

- We estimate midstream stocks are trading over one turn below the level at which they have historically traded relative to the broader energy sector. On average, the AMZ and AMZI have traded at roughly 5.5x turns above the S&P 500 Energy Index; however, the midstream indices are currently only trading roughly 4.3x above, which suggests room for expansion to close the gap.
- Some of the gap could be due to premiums on Upstream and Refining; however, the premium could be somewhat permanent owing to a paradigm shift toward capital discipline and focus on capital returns.
- In our view, Midstream management teams would be well served to adopt the capital discipline strategy. Change is under way but may take more time to play out.

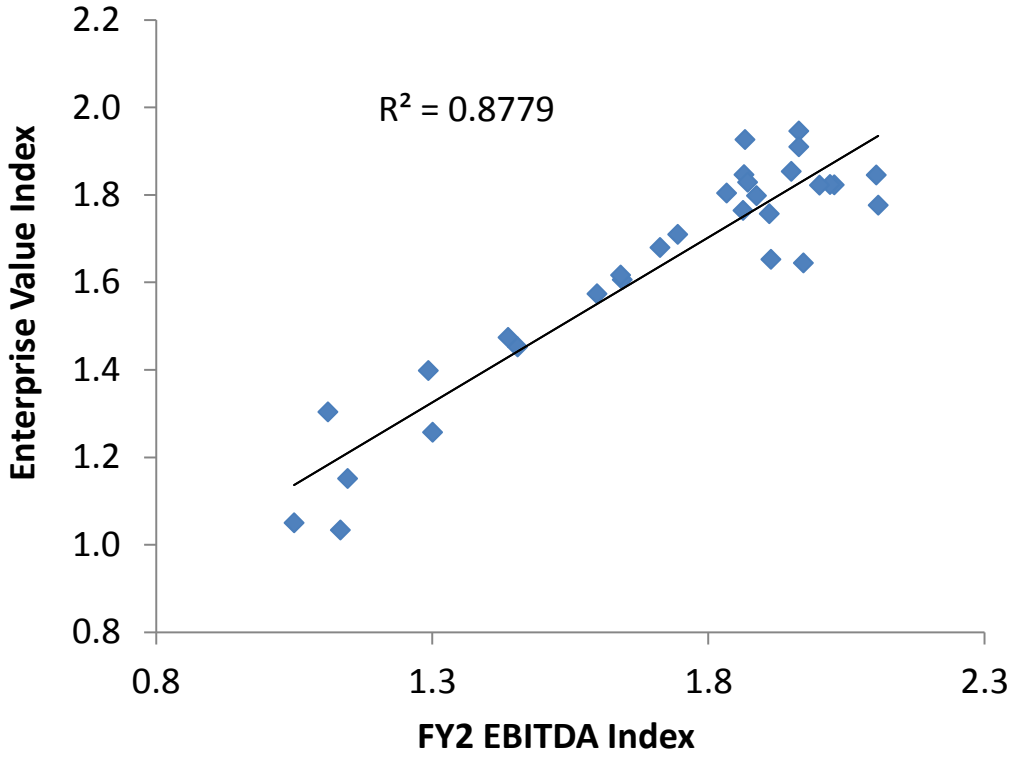



Source: Credit Suisse Research, FactSet, Company Filings

# Valuation and Fund Flows

## Forward Earnings Are A Critical Driver of Performance

- We believe forward earnings are the single largest driver of company performance; our analysis indicates stock performance exhibits a strong R-squared of **0.88** relative to changes in forward EBITDA.
- Accordingly, we believe this historical relationship supports our use of EV/EBITDA as a valuation metric.
- While commodity prices matter, we believe this indirect relationship is expressed through forward earnings estimates or via multiple expansion and contraction.
- As has been shown in considerable prior analyses, interest rates show little correlation with the sector. We expect no change here, especially as the sector becomes less yield focused.



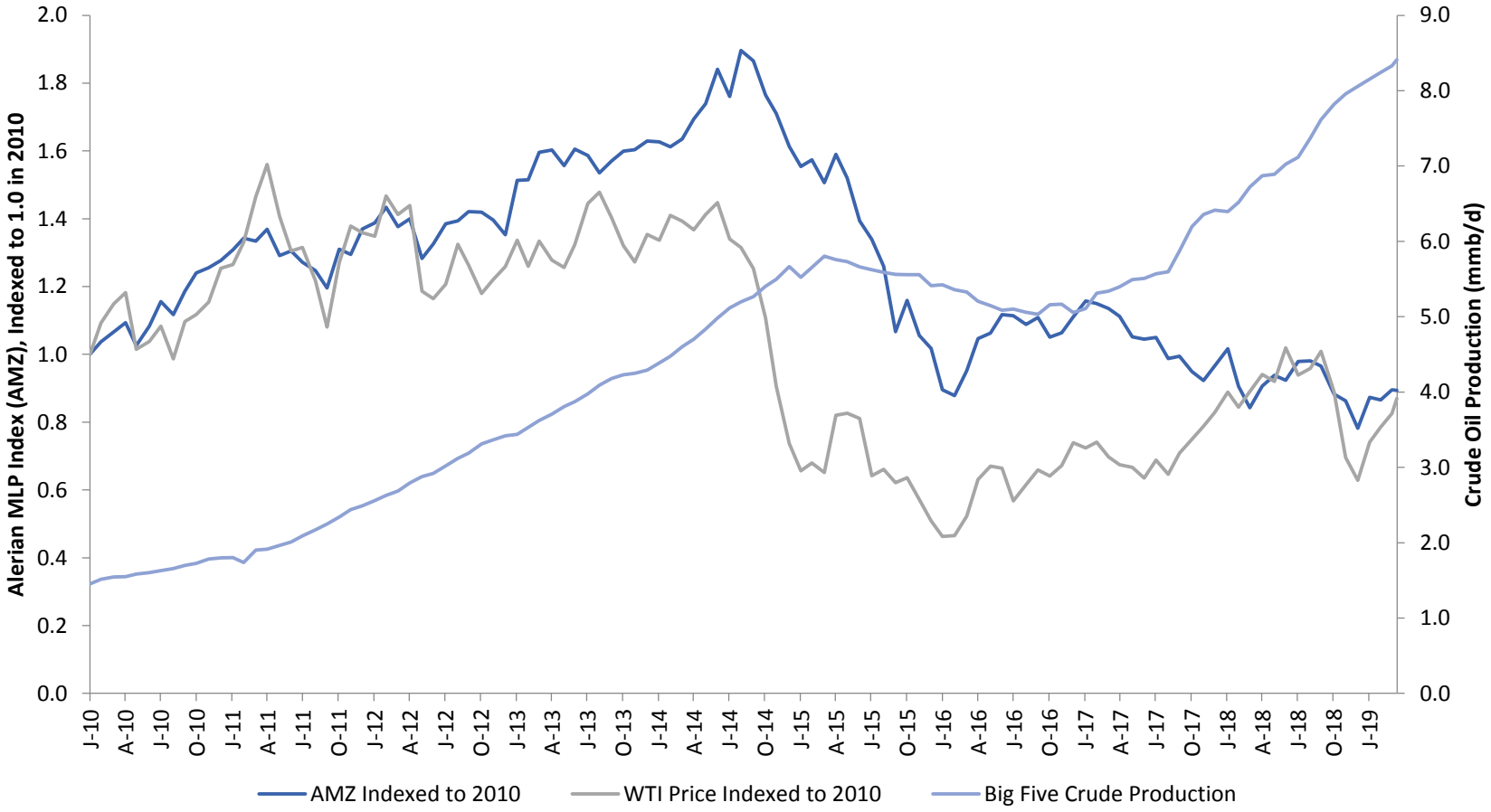

*Based on the performance of EPD, ET, KMI, MMP, OKE, PAA, and TRGP over the past 30 quarters. Compares stock enterprise value vs changes in FY2 EBITDA. Figures adjusted to logarithmic scale to measure the correlation of a change in price vs. change in estimate.

Source: Credit Suisse Research, FactSet, Company Filings

# Valuation and Fund Flows

## Little Direct Commodity Exposure, But Prices Matter

- Despite the relatively low direct commodity price exposure for midstream cash flows, stock prices tend to be fairly correlated with commodity prices – particularly since the 2014-2015 commodity downturn.
- We expect commodity sensitivity to decline as midstream business models improve (more FCF and better ROIC), but it will also take somewhat of a change in mindset for how these names are traded.

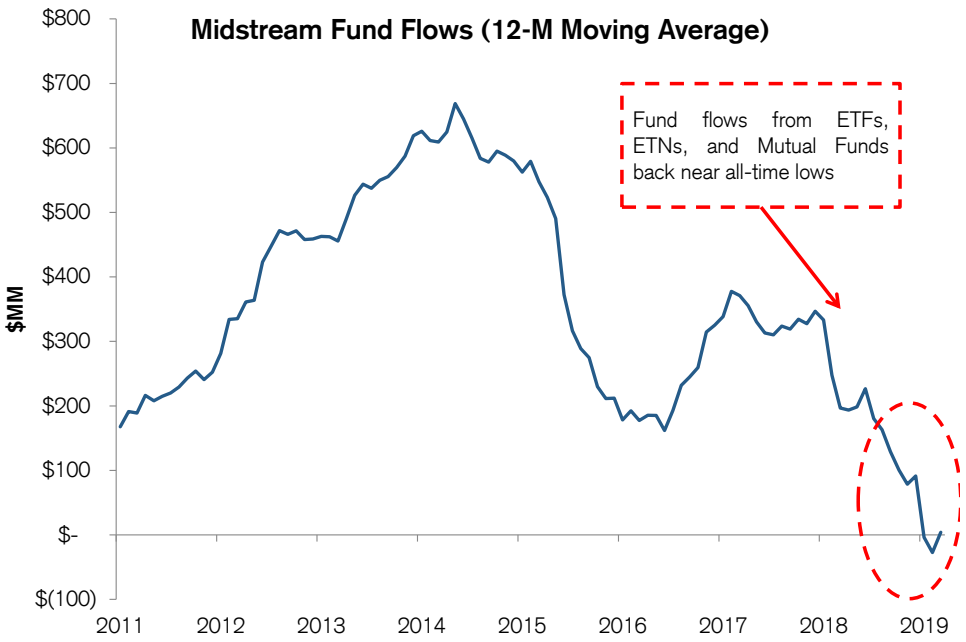


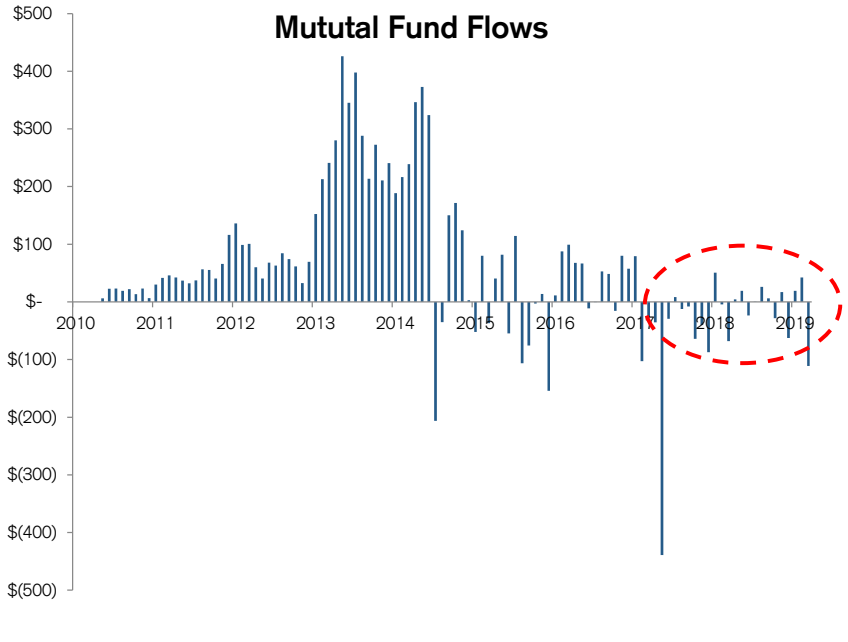

Source: EIA Drilling Productivity Report, FactSet

# Valuation and Fund Flows

## Fund Flows Remain a Headwind

- Fund flows into midstream continue to hit historic low levels, which is likely preventing a rerating for now.
- Following meaningful distribution cuts over the past three years, retail investors have largely left the midstream space. We believe the incremental buyer from here is likely an institutional buyer with a non-energy / generalist focus.
- In a bid to appeal to new investors, midstream companies have restructured to simplify their businesses and remove some of the more egregious MLP attributes such as IDRs and lack of corporate governance.
- It's still too early to tell if these house cleaning measures will be effective, but we believe these measures can only benefit investors and therefore should be positive for valuation.




Source: Credit Suisse Research, the BLOOMBERG PROFESSIONALTM service

# Valuation and Fund Flows

## Comp Sheet

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| | Current Price ($) | Rating | Target Px ($) | Px Upside (%) | Current Yld (%) | Total Return (%) | Coverage (2019E, x) | Leverage (2019E, x) | EV / EBITDA (2019E, x) | EV / EBITDA (2020E, x) | 2Yr EBITDA CAGR (%) | Price / Earnings (2019E, x) | Price / Earnings (2020E, x) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Large Diversifieds** | | | | | | | | | | | | | |
| DCP | $ 33.15 | OUTPERFORM | $ 40.00 | 21% | 9% | 30% | 1.2x | 5.0x | 9.5x | 8.5x | 12% | 26.8x | 14.5x |
| EPD | $ 29.33 | OUTPERFORM | $ 34.00 | 16% | 6% | 22% | 1.5x | 3.6x | 12.5x | 11.8x | 4% | 15.8x | 14.3x |
| ET | $ 15.49 | OUTPERFORM | $ 20.00 | 29% | 8% | 37% | 1.9x | 4.4x | 9.3x | 9.3x | 10% | 9.6x | 9.6x |
| KMI | $ 19.92 | OUTPERFORM | $ 23.00 | 15% | 4% | 20% | 2.2x | 4.5x | 10.3x | 10.0x | 3% | 20.6x | 19.0x |
| MPLX | $ 32.70 | OUTPERFORM | $ 39.00 | 19% | 8% | 27% | 1.4x | 3.7x | 10.5x | 9.8x | 10% | 12.9x | 12.0x |
| OKE | $ 70.04 | NEUTRAL | $ 70.00 | 0% | 5% | 5% | 1.3x | 4.6x | 15.5x | 13.5x | 12% | 23.1x | 19.2x |
| PSXP | $ 51.22 | OUTPERFORM | $ 59.00 | 15% | 6% | 21% | 1.2x | 3.5x | 9.5x | 8.8x | 13% | 13.0x | 11.1x |
| TGE | $ 24.63 | NEUTRAL | $ 25.00 | 2% | 8% | 10% | 1.3x | 3.3x | 10.5x | 12.0x | 2% | 15.5x | 24.0x |
| TRGP | $ 39.39 | OUTPERFORM | $ 50.00 | 27% | 9% | 36% | 0.9x | 5.2x | 13.0x | 10.0x | 16% | NM | 33.9x |
| WMB | $ 28.76 | OUTPERFORM | $ 33.00 | 15% | 5% | 20% | 1.6x | 4.6x | 12.3x | 11.8x | 5% | 32.3x | 29.3x |
| **Average (Market-Cap Weighted):** | | | | **16%** | **6%** | **22%** | **1.6x** | **4.2x** | **11.6x** | **10.9x** | **7%** | **17.9x** | **17.5x** |
| **Gathering and Processing** | | | | | | | | | | | | | |
| ALTM | $ 5.79 | OUTPERFORM | $ 8.00 | 38% | 0% | 38% | 0.0x | 0.0x | 23.0x | 12.0x | NM | 78.0x | 19.2x |
| AM | $ 14.03 | NEUTRAL | $ 15.00 | 7% | 11% | 18% | 1.1x | 3.0x | 11.0x | 9.5x | NM | 15.1x | 11.9x |
| ENLC | $ 12.41 | OUTPERFORM | $ 15.50 | 25% | 9% | 34% | 1.3x | 3.8x | 10.5x | 10.0x | 7% | 42.3x | 29.2x |
| EQM | $ 46.02 | NEUTRAL | $ 50.00 | 9% | 10% | 18% | 1.1x | 3.8x | 11.0x | 9.6x | 29% | 9.7x | 9.0x |
| ETRN | $ 21.23 | NEUTRAL | $ 22.00 | 4% | 8% | 12% | 1.1x | 0.4x | 12.3x | 10.0x | 11% | 16.0x | 14.0x |
| HESM | $ 21.40 | OUTPERFORM | $ 27.00 | 26% | 7% | 33% | 1.1x | 0.0x | 10.5x | 8.8x | 17% | 14.9x | 12.7x |
| NBLX | $ 37.01 | OUTPERFORM | $ 48.00 | 30% | 6% | 36% | 1.5x | 3.1x | 8.8x | 6.3x | 28% | 9.6x | 7.2x |
| OMP | $ 20.02 | OUTPERFORM | $ 28.00 | 40% | 9% | 49% | 1.8x | 1.4x | 7.0x | 6.0x | 60% | 6.9x | 7.0x |
| SMLP | $ 9.69 | UNDERPERFORM | $ 9.00 | -7% | 12% | 5% | 1.9x | 4.6x | 9.3x | 8.5x | 4% | 45.9x | 29.1x |
| WES | $ 32.22 | RESTRICTED | | | | | | | | | | | |
| **Average (Market-Cap Weighted):** | | | | **10%** | **6%** | **16%** | **0.8x** | **1.8x** | **7.8x** | **6.4x** | **9%** | **16.1x** | **10.6x** |
| **Crude and Refined Products** | | | | | | | | | | | | | |
| BPL | $ 33.76 | NEUTRAL | $ 35.00 | 4% | 9% | 13% | 1.3x | 4.3x | 10.3x | 9.3x | -1% | 12.5x | 10.4x |
| MMP | $ 62.88 | NEUTRAL | $ 68.00 | 8% | 6% | 14% | 1.2x | 3.3x | 13.5x | 13.5x | 6% | 15.5x | 14.5x |
| PAA | $ 24.56 | OUTPERFORM | $ 29.00 | 18% | 5% | 23% | 1.8x | 3.4x | 10.5x | 10.3x | 4% | 13.6x | 12.4x |
| PAGP | $ 24.97 | OUTPERFORM | $ 29.00 | 16% | 5% | 21% | 1.0x | 0.0x | 10.5x | 10.3x | 13% | 13.6x | 12.4x |
| SHLX | $ 20.63 | NEUTRAL | $ 22.00 | 7% | 8% | 14% | 1.2x | 3.1x | 10.0x | 9.0x | 23% | 10.6x | 11.0x |
| **Average (Market-Cap Weighted):** | | | | **12%** | **6%** | **19%** | **1.4x** | **3.0x** | **11.3x** | **11.0x** | **7%** | **13.8x** | **12.7x** |

Source: Credit Suisse Research, FactSet, Company Filings

# Valuation and Fund Flows
## Comp Sheet

CREDIT SUISSE

| | Current Price ($) | Rating | Target Px ($) | Px Upside (%) | Current Yld (%) | Total Return (%) | Coverage (2019E, x) | Leverage (2019E, x) | EV / EBITDA (2019E, x) | EV / EBITDA (2020E, x) | 2Yr EBITDA CAGR (%) | Price / Earnings (2019E, x) | Price / Earnings (2020E, x) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Other Refining Logistics** | | | | | | | | | | | | | |
| ANDX | $ 34.62 | UNDERPERFORM | $ 35.00 | 1% | 12% | 13% | 1.0x | 3.6x | 10.8x | 10.3x | 11% | 11.5x | 11.0x |
| BPMP | $ 15.25 | UNDERPERFORM | $ 15.00 | -2% | 8% | 6% | 1.2x | 2.6x | 12.3x | 10.0x | 31% | 10.8x | 8.7x |
| DKL | $ 32.74 | UNDERPERFORM | $ 30.00 | -8% | 10% | 1% | 1.1x | 4.8x | 9.0x | 8.3x | 18% | 9.1x | 7.7x |
| HEP | $ 27.18 | NEUTRAL | $ 31.00 | 14% | 10% | 24% | 1.0x | 3.9x | 12.0x | 11.8x | 4% | 14.2x | 13.5x |
| PBFX | $ 21.12 | NEUTRAL | $ 22.00 | 4% | 10% | 14% | 1.0x | 4.3x | 11.0x | 10.5x | 13% | 13.6x | 12.0x |
| **Average (Market-Cap Weighted):** | | | | **3%** | **11%** | **14%** | **1.0x** | **3.7x** | **11.1x** | **10.4x** | **12%** | **12.0x** | **11.1x** |
| **Wholesale Products and Marketing** | | | | | | | | | | | | | |
| NGL | $ 14.00 | NEUTRAL | $ 15.00 | 7% | 11% | 18% | 1.2x | 4.7x | 9.8x | 9.3x | 4% | NM | 25.8x |
| SUN | $ 30.79 | NEUTRAL | $ 32.00 | 4% | 11% | 15% | 1.2x | 4.7x | 8.8x | 8.8x | 2% | 14.5x | 13.5x |
| **Average (Market-Cap Weighted):** | | | | **5%** | **11%** | **16%** | **1.2x** | **4.7x** | **9.2x** | **9.0x** | **3%** | **14.5x** | **18.5x** |
| **Liquefied Natural Gas** | | | | | | | | | | | | | |
| CQP | $ 43.05 | UNDERPERFORM | $ 39.00 | -9% | 5% | -4% | 1.3x | 5.7x | 13.8x | 12.3x | 9% | 17.5x | 15.9x |
| LNG | $ 67.11 | OUTPERFORM | $ 84.00 | 25% | 0% | 25% | 0.0x | 8.9x | 15.5x | 12.3x | 21% | 21.2x | 12.3x |
| NEXT | $ 5.28 | NEUTRAL | $ 6.00 | 14% | 0% | 14% | --- | --- | --- | --- | --- | --- | --- |
| NFE | $ 11.41 | NEUTRAL | $ 17.00 | 49% | 0% | 49% | --- | --- | --- | --- | --- | --- | --- |
| TELL | $ 10.04 | OUTPERFORM | $ 13.00 | 29% | 0% | 29% | --- | --- | --- | --- | --- | --- | --- |
| **Average (Market-Cap Weighted):** | | | | **10%** | **3%** | **12%** | **1.3x** | **7.2x** | **14.5x** | **12.3x** | **14%** | **19.2x** | **14.3x** |
| **Coverage (Subsector-Cap Weighted):** | | | | **14%** | **6%** | **20%** | **1.5x** | **4.1x** | **11.4x** | **10.5x** | **8%** | **17.1x** | **15.7x** |
| Ex-LNG | | | | 14% | 6% | 21% | 1.5x | 3.7x | 11.1x | 10.4x | 8% | 16.9x | 15.8x |

Source: Credit Suisse Research, FactSet, Company Filings

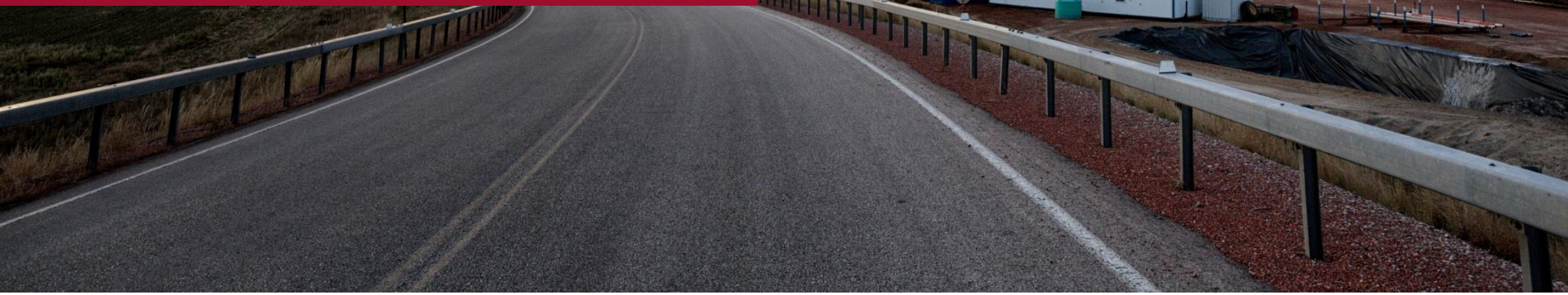
Credit Suisse Equity Research
Americas/United States

# Refining and Canadian Integrated

**April 2019**


**RESEARCH ANALYSTS**

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# Drivers of Refining Stock Price Performance

**Traditional catalysts/drivers:**

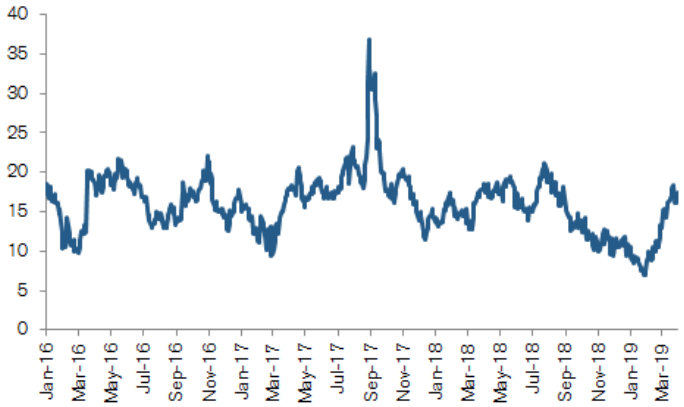
- Base Cracks
- Crude Price Differentials
- Gasoline Demand
- Distillate demand
- Gasoline and distillate inventory draws
- M&A announcements
- Planned + Unplanned downtime

**More recently, investors have been particularly focused on:**

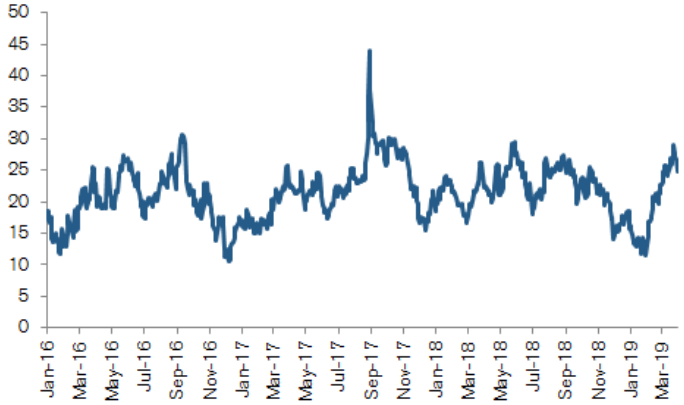
- Dividend Growth
- Buybacks
- IMO 2020

# Key Cracks

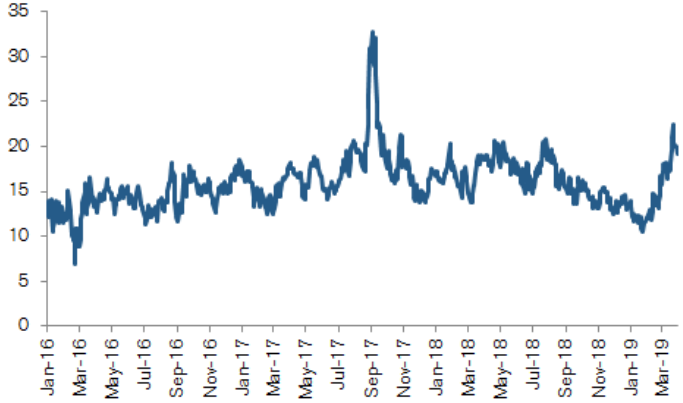
## East Coast



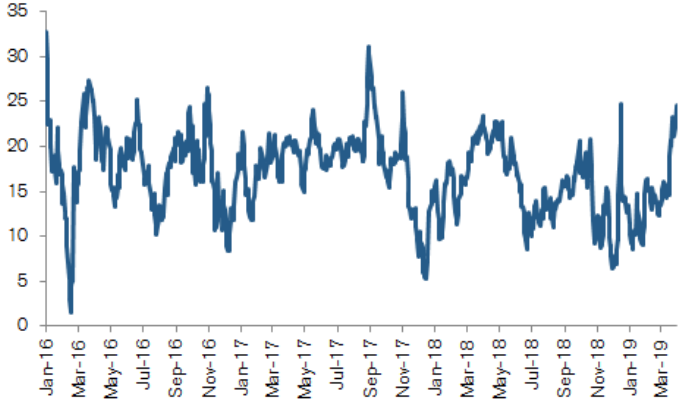

## Mid-Con




## Gulf Coast




## West Coast





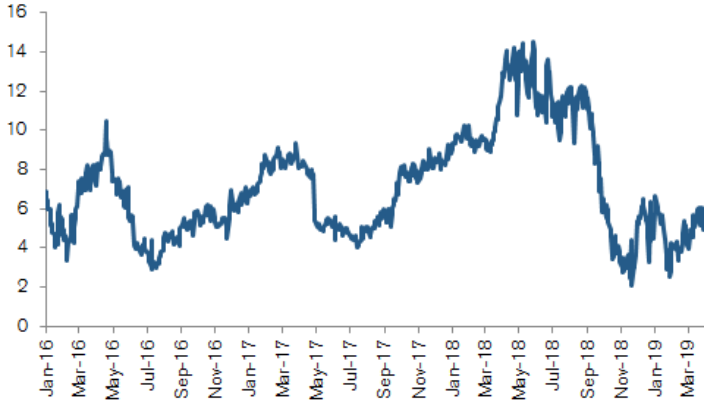

Source: The BLOOMBERG PROFESSIONAL™ service

# Key Diffs

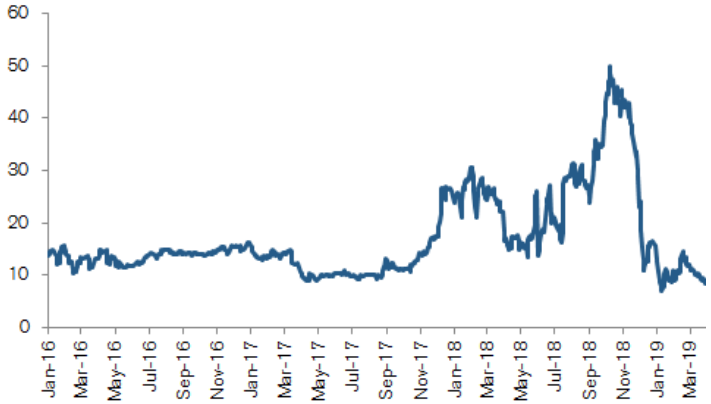
**Brent-WTI**



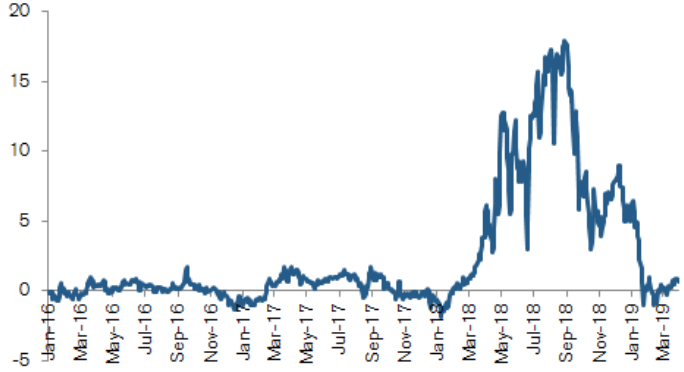

**LLS-Maya**




**WTI- WCS**




**WTI- Midland**






Source: The BLOOMBERG PROFESSIONAL™ service

# Executive Summary - View on Sector

**1) Gasoline inventory –** We started 2019 with gasoline inventory up +11MMbls YoY and this resulted in gasoline cracks turning negative in most regions. However, gasoline inventory is now -9.8MMbls below last year levels. This is the first time since Jan 2018 that US gasoline inventory has dropped below the 5 year average which we view very constructively.

**2) Distillate and IMO 2020 tailwind –** We think that while distillate margins will move higher ($2-$4/bbl), they will not spike ($5- $15/bbl) and that upside will be less than previously estimated. This suits the refiners, as this lowers the probability of government intervention.

**3) Preference for GC –** Starting mid-2019 to year-end 2020, we are tracking +3MMb/d of new pipe capacity that should deliver Permian crude to the GC, resulting in major price dislocation of light sweet crude on GC, which we expect will disproportionally benefit VLO (~$700m EBITDA upside). We are also tracking ~2MMb/d of new proposed pipes between Cushing and the Gulf Coast. While all these projects might not go through, we see a high probability of Seaway expansion, Capline reversal and PSX's Red Oak coming online.

# What do we like

**1) VLO (Outperform) –** VLO will be the biggest beneficiary of widening Brent-LLS spread. The spread has widened by ~$4/bbl in the past 6 weeks, and every ~$1/bbl wider Brent-Maya spread is ~$200m in EBITDA upside for VLO. With gasoline margins rebounding sharply, VLO is looking at a strong 2H19. VLO is also a catalyst-rich name, we expect besides heavy-light spread the light-light spreads on the GC will start to widen as Permian crude pipes begin to deliver crude to GC starting 2H2019.

**2) MPC (Outperform) –** We believe MPC will provide regional level gross margins which will allow investors to model refining earnings more accurately and have greater confidence in their own numbers. Second, we could get a time-line on possible combination of MPLX and ANDX. West Coast cracks have rebounded sharply and given all downtime at competitors we expect MPC's West Coast earnings to come in significantly stronger QoQ.

**3) DK (Outperform) –** Midland spread has re-widened to ~$5.0/bbl and DK is most levered to this this differential. WCS diff has narrowed from ~$50/bbl in early October to ~$8.25/bbl. DK is one of the few refiners that offer complete insulation from compression in WCS diff. DK with its high distillate yield.  (42%) and valuation discount will be attractive take out candidate in IMO 2020 world.

# Factors Triggering Refining Pullbacks

| S.No | Start Date | End Date | Perfomance | Diffs Contraction | Base Crack Weakness | RIN Price Spike | Product Inventory Build | Weak Product Demand | Capacity Addition | Wrongly Timed M&A | AMZ Weakness |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 3/16/2012 | 5/18/2012 | -14.0% | X | | | | X | X | | |
| 2 | 3/22/2013 | 9/20/2013 | -27.2% | X | | X | | | X | | |
| 3 | 9/5/2014 | 10/17/2014 | -12.7% | X | X | | | | | | |
| 4 | 11/21/2014 | 1/16/2015 | -22.2% | X | X | | X | X | | | X |
| 5 | 7/17/2015 | 9/4/2015 | -11.9% | | | | | | X | X | X |
| 6 | 12/4/2015 | 2/12/2016 | -32.0% | X | X | X | X | X | X | X | X |
| 7 | 4/22/2016 | 7/8/2016 | -27.7% | X | | X | | X | | X | |
| 8 | 1/12/2018 | 2/9/2018 | -14.6% | X | X | | X | | | | |



Source: Credit Suisse

# Drivers of Canadian Integrated Stock Price Performance

**Traditional catalysts/drivers:**

- Crude price
- Natural gas price (AECO)
- Heavy-light diffs (WTI-WCS)
- Light -light diffs (WTI-Syncrude)
- M&A announcements

**More recently, investors have been particularly focused on:**

- Incremental egress
- Buybacks and dividend growth
- Project startup delays

# Executive Summary - View on Sector

**1) Production Cuts – Legitimacy and Outlook –** The Alberta government has the legal authority as 'owners of resource' to implement and strictly enforce the announced provincial production cuts. Larger producers will have to cut by as much as 10-11% to satisfy the imposed curtailments. The Alberta Premier would like to see incremental egress capacity (Line 3 replacement) before completely rolling back the production cuts.

**2) GC refining needs more heavy –** Venezuelan crude production is down 1,500mb/d in the past 24 months.. The GC heavy-light spread is at or below breakeven and any incremental heavy barrels will be absorbed but the GC refining system.

**3) How will incremental barrels get to GC –** Line 3, Flanagan South Expansion, Capline Reversal, Red Oak.

**4) Preference for Crude Beta –** With OPEC + Russia committed to cutting 1.2 MMb/d of production and Saudi Arabia indicating that it is willing to curtail beyond the mandated quota to balance the market, the near-term setup on crude is bullish (up 14.3% in 2019 to date). Canadian cuts of 325mb/d further balance the global market, preventing global inventory builds in 1H19.

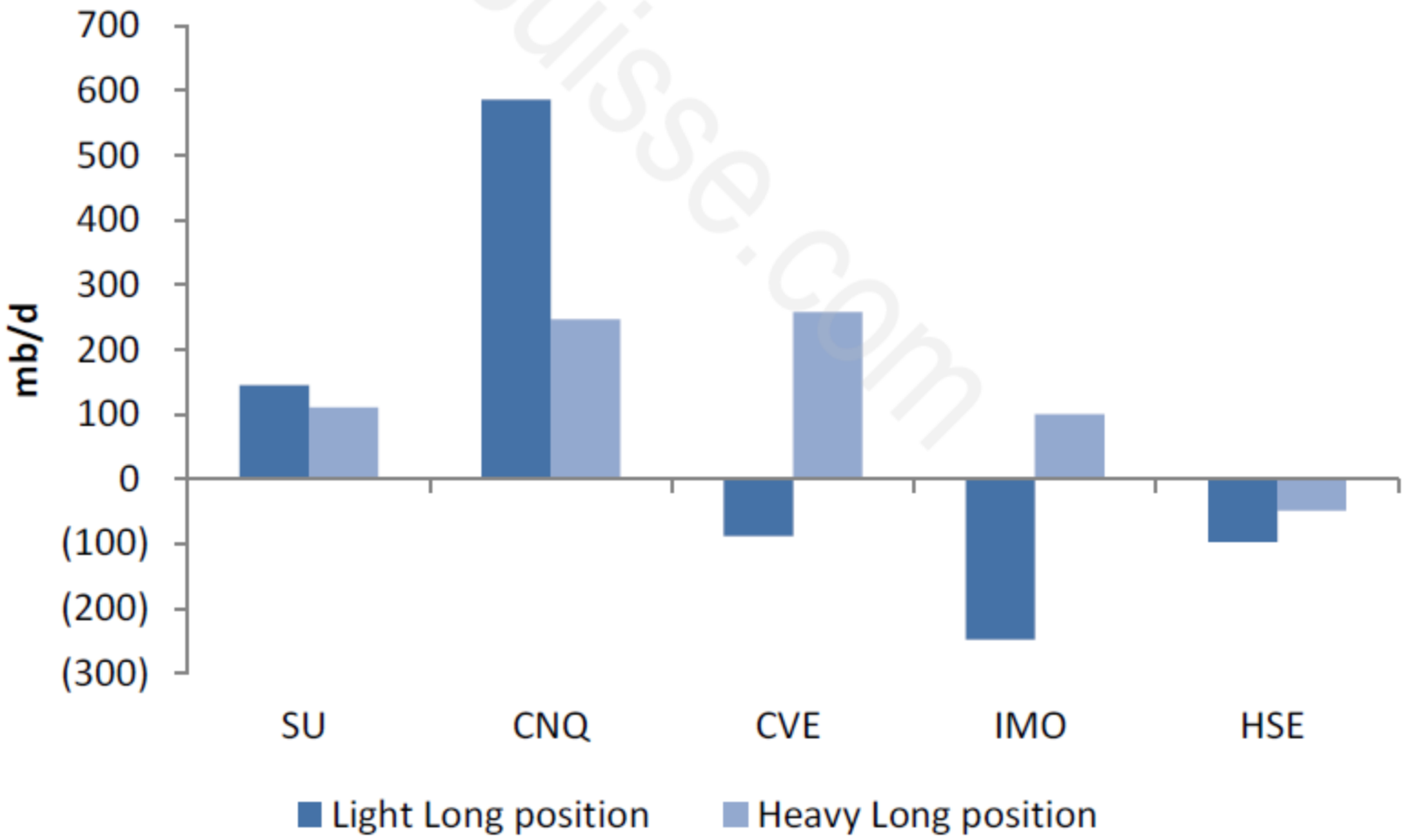
# What do we like

**1) CNQ (Outperform) –** We expect CNQ to the biggest beneficiary of the Alberta government's mandated production cuts. With no refining capacity and no committed pipeline capacity, CNQ sells all of its oil at Edmonton or at Hardisty. Since the announcement of production cuts, the diffs have narrowed by ~$20, which should be material earnings tailwinds. The start-up of ENB's Line 3 and incremental rail clearing stranded barrels are catalysts to watch.

**2) CVE (Outperform) –** In our view, CVE offers one of the best-levered plays to a crude price rebound, with oil making up 85% of the total volumes. We believe the Alberta production cuts together with the OPEC production cuts will drive tighter crude fundamentals in 1H19. Crude beta rebound companies with higher leverage tend to outperform names with better balance sheets (SU and IMO), which makes CVE even more attractive.

**3) SU (Outperform) –** Suncor's 17% annual dividend hike came in well above Street estimates of 12-15%. Besides its dividend hike, SU reloaded buyback by $2Bn. Suncor is one of the most shareholder-friendly energy companies, with an integrated business model, no AECO exposure, and dividend safety. Recently, BRK added 10.8MM shares of SU (0.7% outstanding, valued at ~$301M) to its portfolio in 4Q18. Looking at its investment pattern, we expect BRK will add to the position which should drive stock re-rating.

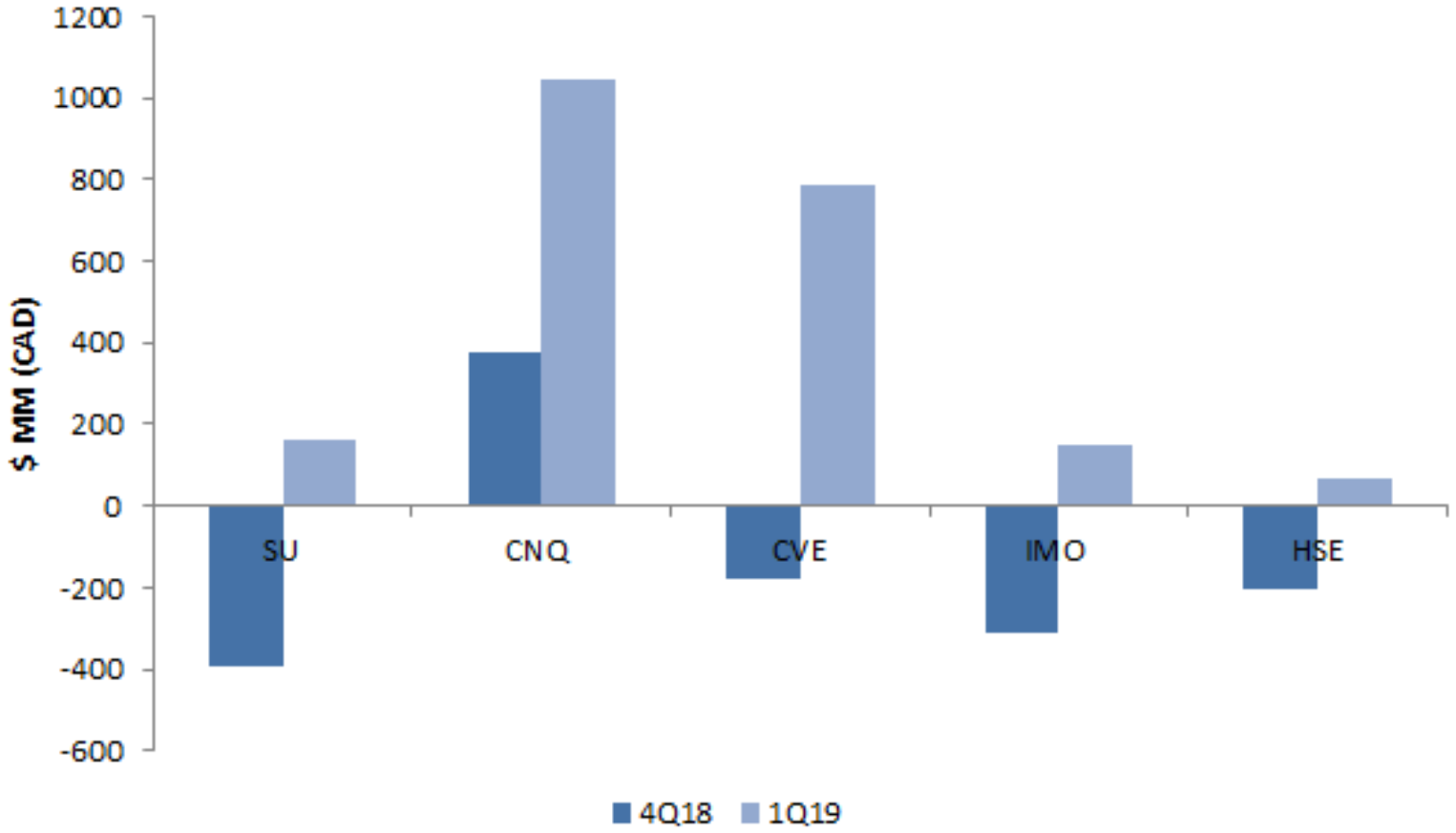
# Heavy Light Exposure




Credit Suisse.com

Source: Credit Suisse Estimates

# QoQ Change in Oil Sands Earnings




Source: Credit Suisse Estimates

Credit Suisse Equity Research
Americas/United States

# Oilfield Services & Equipment

**April 2019**


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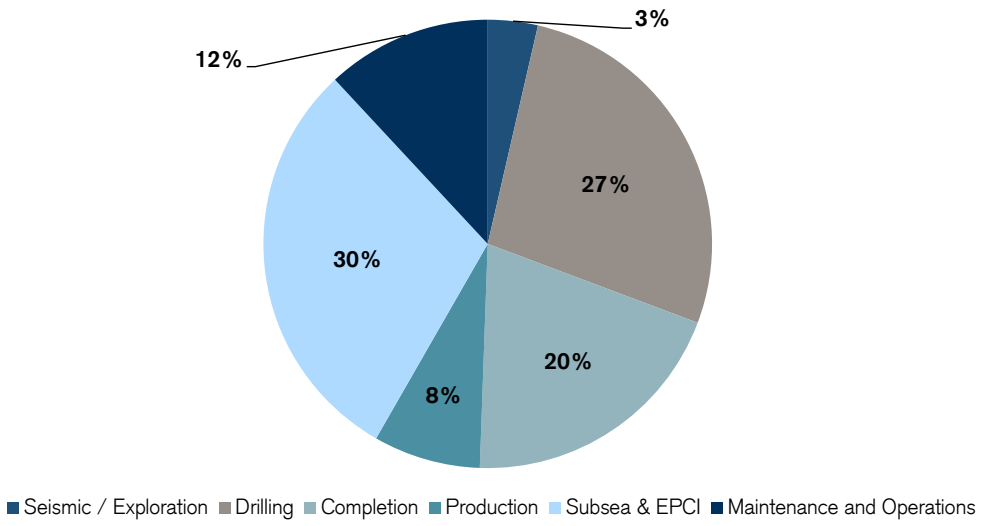

# Industry Segments

- Oil Service companies aid independent exploration and production companies (E&Ps), international oil companies (IOCs) and national oil companies (NOCs) in the exploration and production of oil and natural gas. Some of the largest Oil Service companies are SLB, HAL, BHGE, NOV, FTI and WFT.

- The industry is made up of several segments / life cycle categories.

1) **Seismic / Exploration**
2) **Drilling**
3) **Completion**
4) **Production**
5) **Capital Equipment & Offshore Services**

**2018 OFS Total Upstream Revenues: ~$317 B**



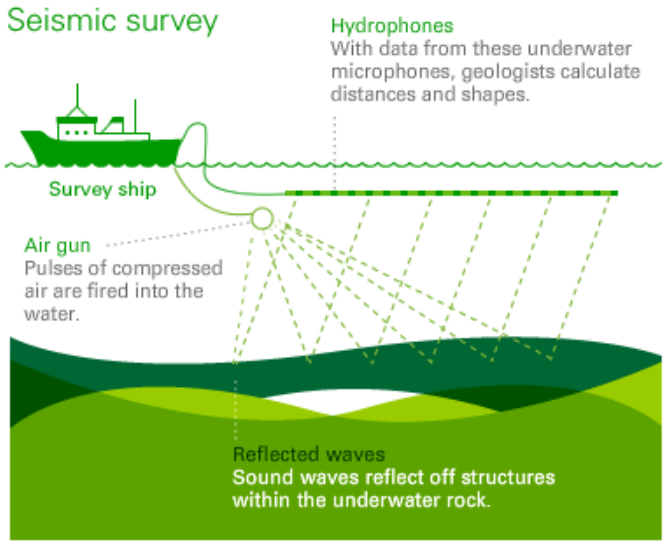

***Up 4% YoY***

CREDIT SUISSE Source: Rystad Energy

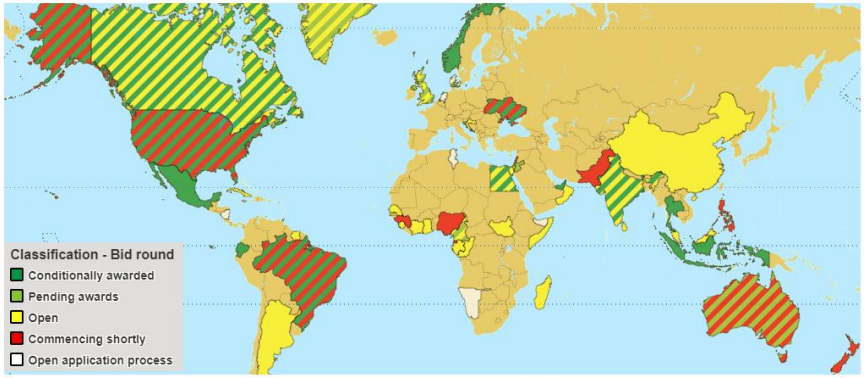
# Exploration: Seismic

- **Data Acquisition:** Collection of seismic data
- **Data Processing:** Third party processing of seismic data prior to interpretation
- **Late Sales:** Sales of non-exclusive seismic data from a multiclient library
- **Pre-funding:** Sales made prior to shooting a survey in exchange for discounted data on completion
- **Software:** Software products for seismic processing, interpretation, mapping, reservoir modeling and characterization, petrophysical evaluation, and engineering analysis that can run on workstations or PCs
- **Geophysical Equipment:** Data recorders, telemetry systems, geophones/hydrophones, energy sources (vibratory vehicles, air guns, etc.) used in data acquisition

## Marine Seismic Survey




## License Round Activity




Source: Spears & Associates, Petroleum Economist

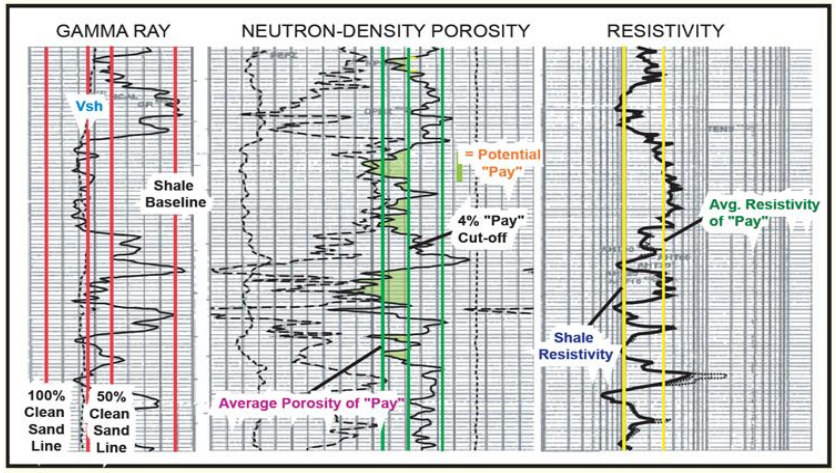
# Exploration/Drilling: Wireline Logging/LWD

Wireline logging includes both open and cased hole services:

- Open hole logging occurs during the drilling process and measures characteristics of the rock and the fluids contained therein.
- Cased hole logging refers to measurements taken in a well after a casing or liner has been set in the well. It is often applied in old wells to help operators determine what to do next (e.g., where to drill a side track well).

## Types of Log Measurements

- Electrical properties – resistivity and conductivity
- Neutron density (porosity)
- Pressure testing
- Sonic properties
- Dimensional measurements
- Formation fluid sampling
- Spectroscopy (lithography)



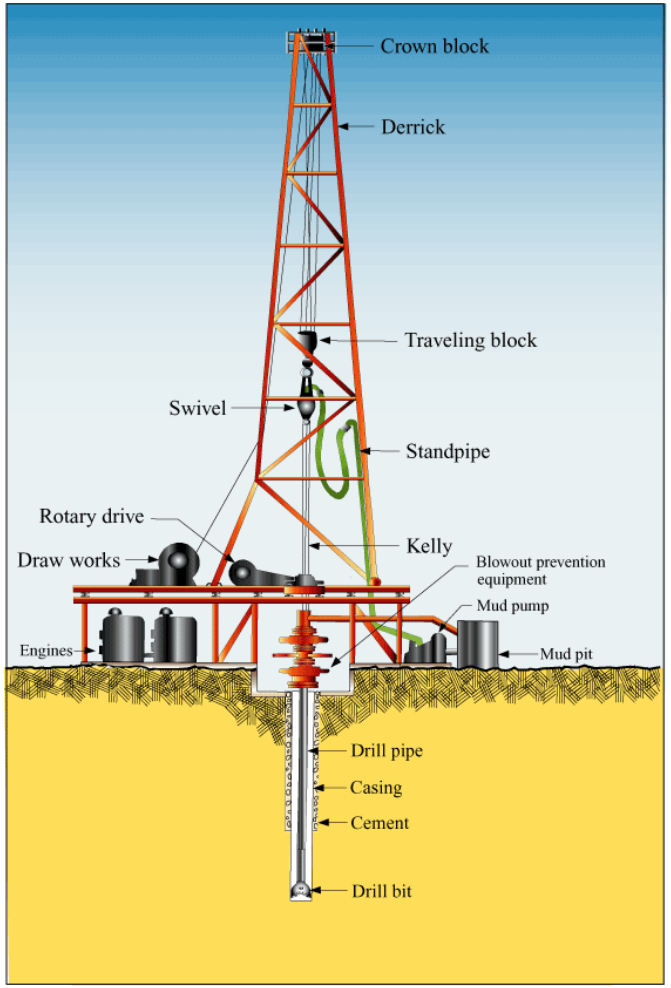


Source: Spears & Associates, Schlumberger, American Association of Petroleum Geologists

# Contract Drilling: Land Rigs

**Land Rigs** can be mechanical or electric and vary in terms of drilling depth and horsepower. They are used for onshore oil and gas drilling. Contractors are paid on a per day basis (i.e. dayrate). Key equipment includes:

- **Derrick:** A structure used for lifting and positioning the drilling string and piping above the well bore and containing machinery for turning the drill bit.
- **Top drive:** A device suspended in the derrick that rotates the **drill pipe** in order to drill the well.
- **Draw works:** A steel spool device that is used to reel out and reel in the drilling line.
- **Blow Out Preventer (BOP):** A large valve used to seal off a well being drilled or worked over at the surface to prevent the escape of pressure.



# Drilling: Bits

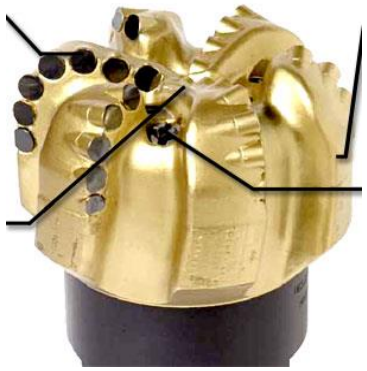
**Drill bits** come in two main categories: Roller-cone and fixed cutter. Technology advancement has led to steady share gains by PDC bits and is moving the market to buy on a $/ft drilled basis (i.e. a “rental” model), as opposed to a dayrate model.

- Roller cone bits have teeth typically made of milled steel or tungsten-carbon inserts mounted on three roller cone assemblies. They are best used in hard and medium strength formations.
- Fixed cutter bits usually use Polycrystalline Compact Diamond (PDC) inserts mounted on the body of the bit. Fixed cutter bits are often custom engineered for specific formation characteristics. PDC bits have typically been used for soft formations, but advancing technology now puts them in hard, abrasive rock.

**Roller or Tri-Cone**



**Fixed Cutter or Polycrystalline Compact Diamond (PDC)**



# Drilling: Fluid System

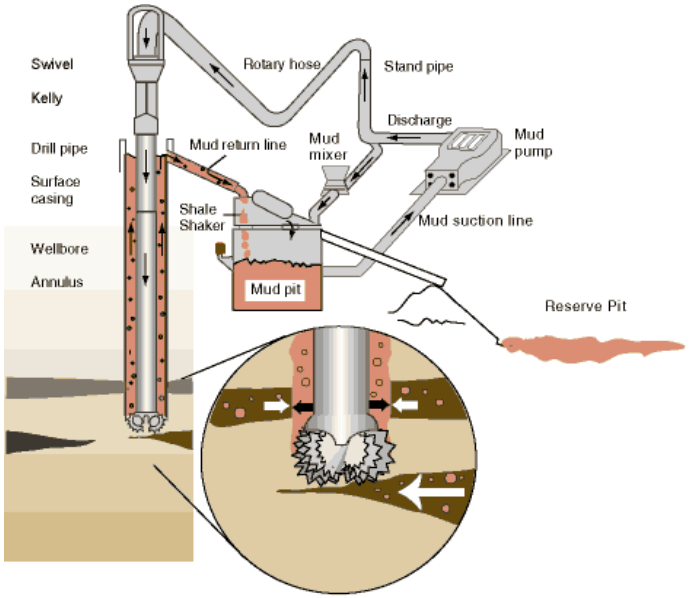
The **drilling fluid**, also known as **drilling mud**, is one of the major factors in the success or failure of the drilling operation. Drilling fluid serves three functions:

- Lifts cuttings to the surface
- Cools the drill bit
- Supports the integrity of the wellbore and prevents hydrocarbon "kicks" by providing weight/pressure that is generally greater than that of the reservoir (known as an "over-balanced" condition)

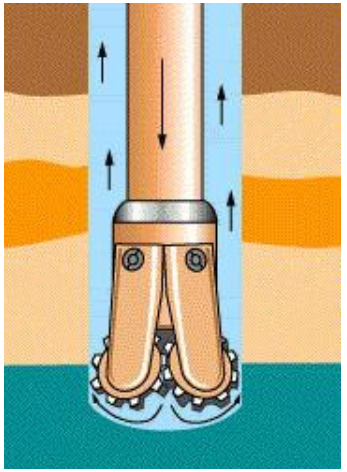
The **fluids handling system** re-circulates the drilling mud and includes:

- Mud pump
- Mud mixer
- Shale shaker - to remove cuttings from the subsurface
- Mud pit – to collect used mud for recirculation

**Fluid Circulation System**




**Fluid Enters the Well at the Bit**



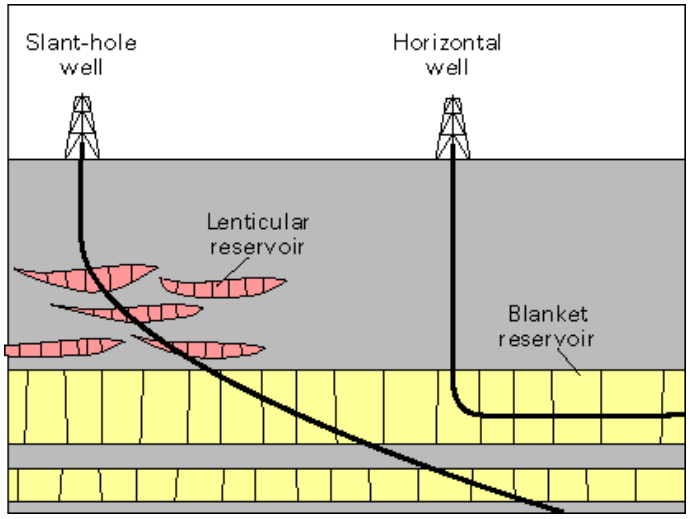
# Directional Drilling

**Directional drilling** entails drilling in a direction other than vertical. There are two methods:

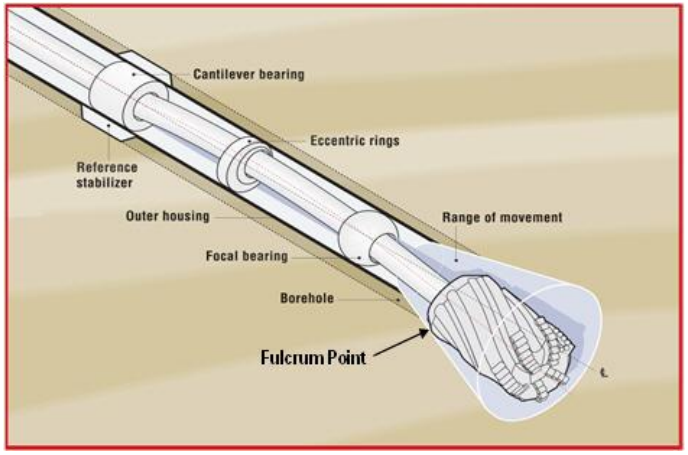
- **Conventional** uses a bend near the bit and a **steerable mud motor**. Drilling fluid is pumped through the mud motor, turning the bit and thereby allowing it to drill in the direction the bit points (unlike conventional [vertical] drilling, the drill string does not rotate).
- **Rotary Steerable Tools (RST)** allow the driller to "point" or "push" the bit without stopping drill pipe rotation, allowing for faster and smoother hole construction.

Drilling directionally entails use of steering systems (**Measurement While Drilling or MWD** and **Logging While Drilling or FEWD or LWD**). LWD measurements are generally similar to those taken in wireline logging.

**Directional and Horizontal Wells**




**Rotary Steerable Technology**




CREDIT SUISSE Source: Horizontal Drilling, Halliburton

# Contract Drilling: Offshore Rigs

## 3 Major Types – Drillships, Semisubs, Jackups

- **Floaters: Drill in 400 to 12,000 ft of water**
  - **Drillships:** Self-propelled (best for exploration) Dynamically Positioned (DP), highly mobile.
  - **Semisubmersibles:** Floating platform that can be DP or moored to the sea floor; better suited for development drilling.
  - Midwater (MW) – 400' to 4,999'
  - Deepwater (DW) – 5,000'-7,500'
  - Ultra-Deepwater (UDW) – 7,500'+
- **Jackups: Drill in shallow water (sub 500 ft)**
  - Platform with legs that rest on the ocean floor
  - 3 Sub-Classes: High Spec, Premium, Standard

Drillship



Semisubmersible



Jackup



# Completions

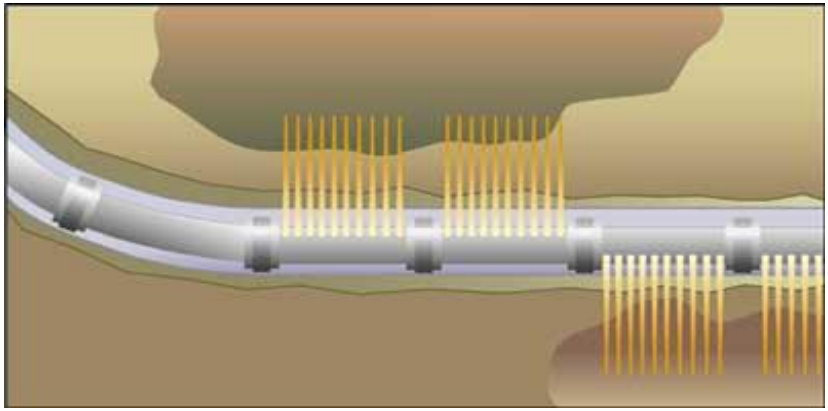
**Completing** the well is the process of accessing the reservoir including:

- Installation of casing and liner. **Casing** is large diameter steel pipe that is cemented into the well bore to ensure stability of the formation.
- Perforating the case to access the reservoir. A series of **chargers** are deployed to where the well accesses the reservoir.
- **Stimulation** (see next page)

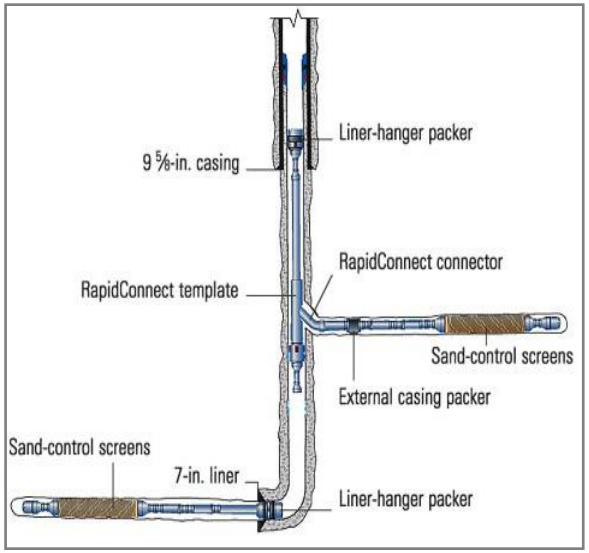
Other key productions include:

- **Packers and plugs** to isolate zones
- **Screens** to keep sands away from production
- **Isolation valves** to manage flows from multiple completion zones

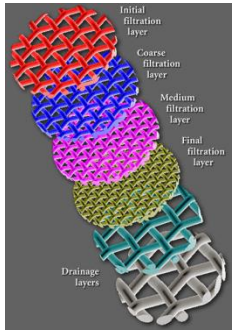
**Perforating Casing / Completion**



**Completion System**




**Screen Layers**



# Completions: Pressure Pumping

**Pressure pumping** consists primarily of cementing and various forms of production stimulation.

- **Cementing of Casing:** As described in the completions section, casing is cemented in place in the well bore. Cement is pumped through the casing to the end of the section and forced back up the well in the annulus (between outer wall and well) where it sets and hardens.
- **Stimulation** (majority of pressure pumping revenues): Services include **hydraulic fracturing** (dominant), **acidizing** and **nitrogen injection**.
- In fracturing, fluid is pumped at high pressures into the well bore to create/widen fractures in the formation so oil/gas can flow into the well.
- In acidizing, acids can be used to etch away rock.

**Frac Job**



**Frac Unit**



**Cementing Unit**



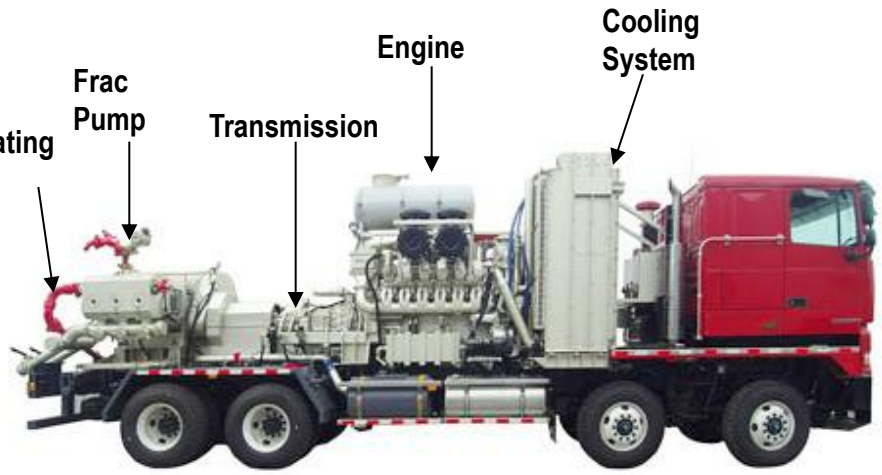
# Hydraulic Fracturing Equipment

**Treating Iron:** Temporary surface piping, valves and manifolds required to bring fluid treatment down to wellbore from the pump TechnipFMC (**FTI**) Weco™ and Chiksan™ and Forum Energy Technologies (**FET**).

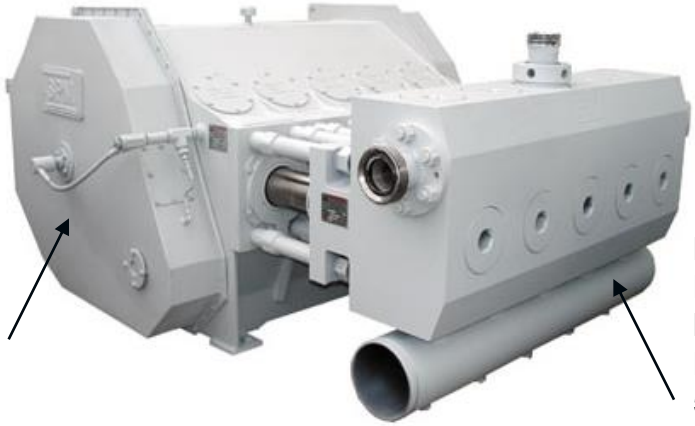
**Frac Pump:** A high-pressure, high-volume pump used in hydraulic fracturing.

- Manufacturers include independents such as National Oilwell Varco (**NOV**), Gardner Denver (**GDI**), Weir SPM (**WEIR.LN**), Kirby Corp. (**KEX**) and vertically integrated providers such as Halliburton (**HAL**) and FTS International (**FTSI**).

**Frac Truck**



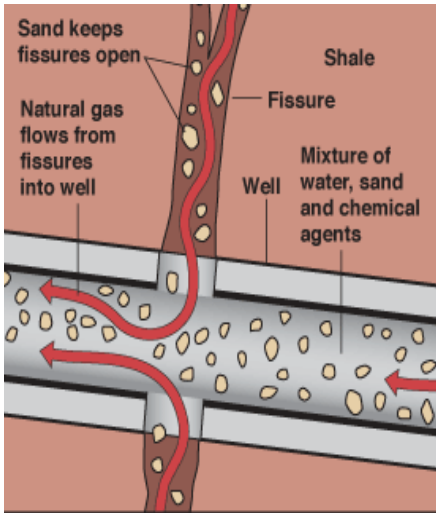

**Frac Pump**



# Completions: Proppants

- **Proppants** are used to keep fractures open and can be sand, resin-coated sand, and/or ceramic. Over the course of the oilfield downturn (2015-16) frac sand, specifically finer mesh sand, became the most popular due to its cost advantage, relative to performance.
- Logistics are important. How quickly and at what cost proppant can be delivered to a well site often determines who fills the order. Sand can be transported via, train, truck or through an alternative **"last-mile"** solution.

**Frac Sand Use Case**




**Types of Frac Sand**






Mine



Transport to Basin



Basin Transload



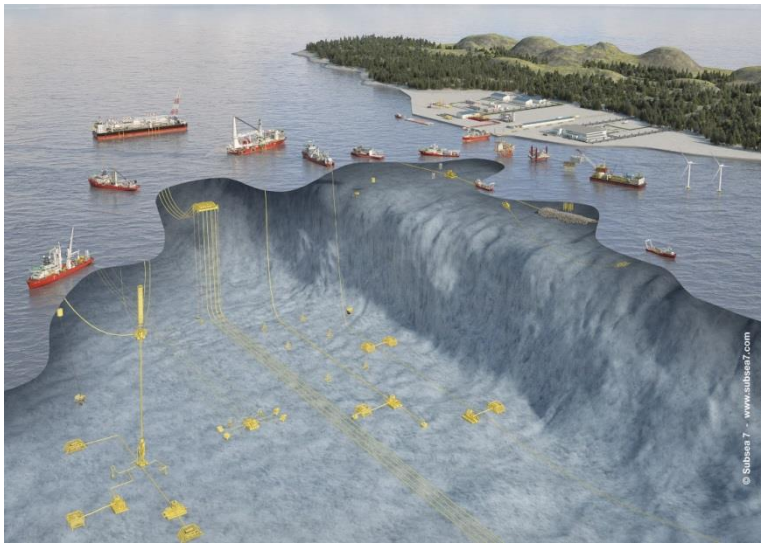
"Last Mile"

# Production: Offshore E&C

Offshore E&C has two main segments: construction of offshore assets (fabrication yards) and installation of offshore equipment (heavy assets).

- **Fabrication:** Typical metal-cutting and fabrication work; local content a key driver. Offshore now more of a focus thanks to weak shipping markets.
- **T&I:** Transport and installation of offshore infrastructure. No procurement involved, so margins are high, but low barriers to entry – vessel is crucial.
- **EPCI.** Lump-sum contracting for offshore developments. Clear green shoots for contract awards, but coming after three-year downturn. Offshore breakevens need to fall further to become competitive. Contractors increasingly exposed to new cycle profitability.
- **PLSV:** Pipelay support vessels. Long-term dayrate contracts for provision of flexible pipelay vessels.

**Offshore E&C Overview**




Source: Subsea 7

# Production: Subsea / SURF

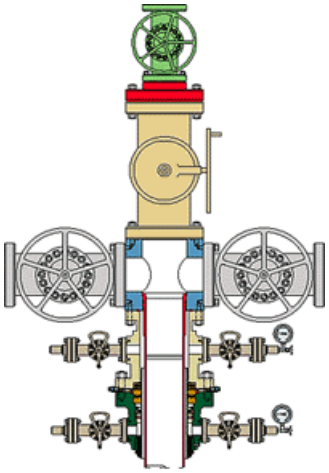
A **Christmas tree** is a set of valves that sit on top of the wellhead and control the flow of pressure of a producing well.

- **Surface trees** are installed on land and on offshore platforms.
- **Subsea trees** are installed on the sea bed.

**Manifolds** house equipment and pipes that control, direct and measure the flow of fluids to/from the subsea well.

**Umbilicals** are used for the control of subsea production systems. Umbilicals are made of either steel or thermoplastic tubes that contain fluid conduits for hydraulic power and chemical injection.

**Surface Tree**

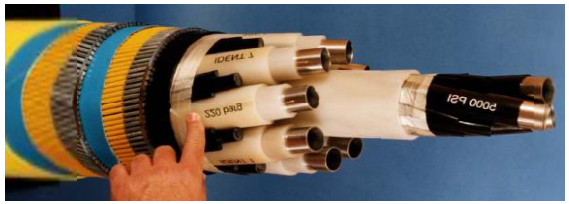


Geothermal Wellhead and Christmas Tree Assembly

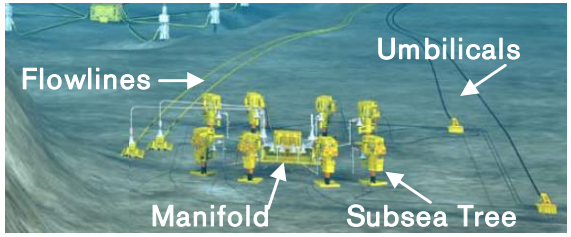
**Subsea Tree**



**Umbilical**



**Subsea Production System**





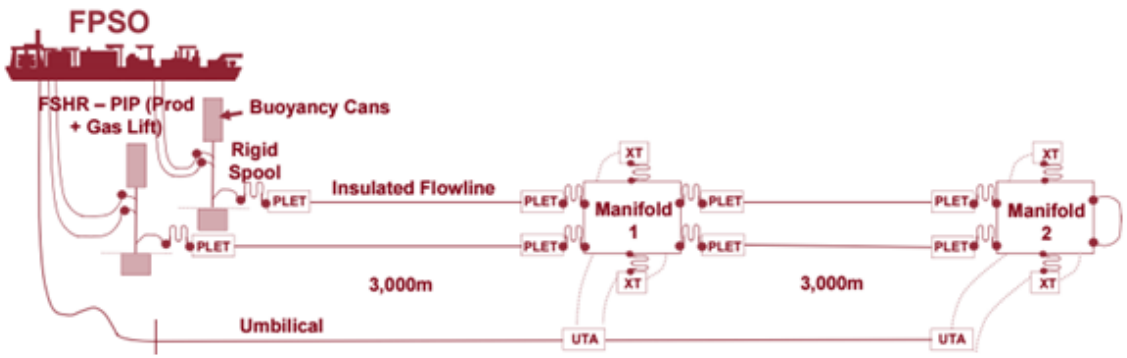
Source: TechnipFMC, Oceaneering, Umbilical Manufacturers' Federation

# Production: Integrated Subsea / SURF

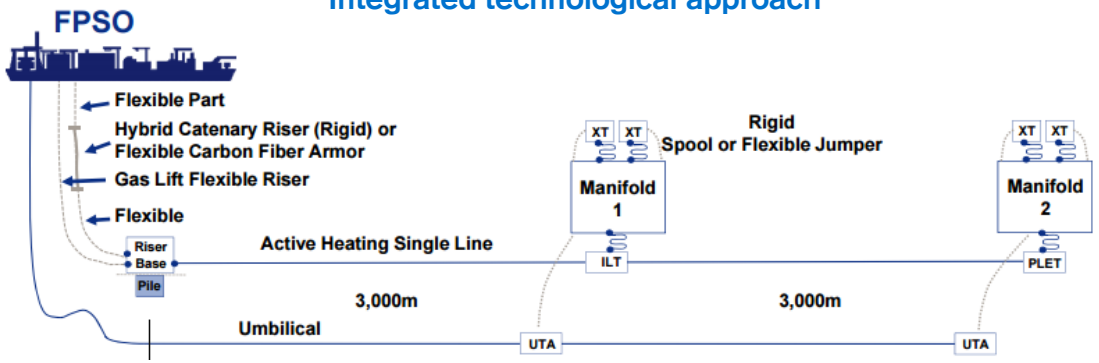
## New technologies leading to simpler and more cost effective field architecture

- Increased collaboration seeks to reduce interface between SURF and SPS systems through greater levels of simplification and standardization.
- Integrated solutions seek to lower capital costs, accelerate first oil/maximize production, and drive higher recovery rates. Achieved through early engagement with contractors – FEEDs now converting into EPCI work.
- Particularly well suited for brownfield tieback, but increasingly under consideration for greenfield.
- Fostering increased OFS collaboration between SURF and SPS contractors, and the client base. Key operator buy-in (BP, EQNR, XOM) and gaining traction.

### Traditional field development

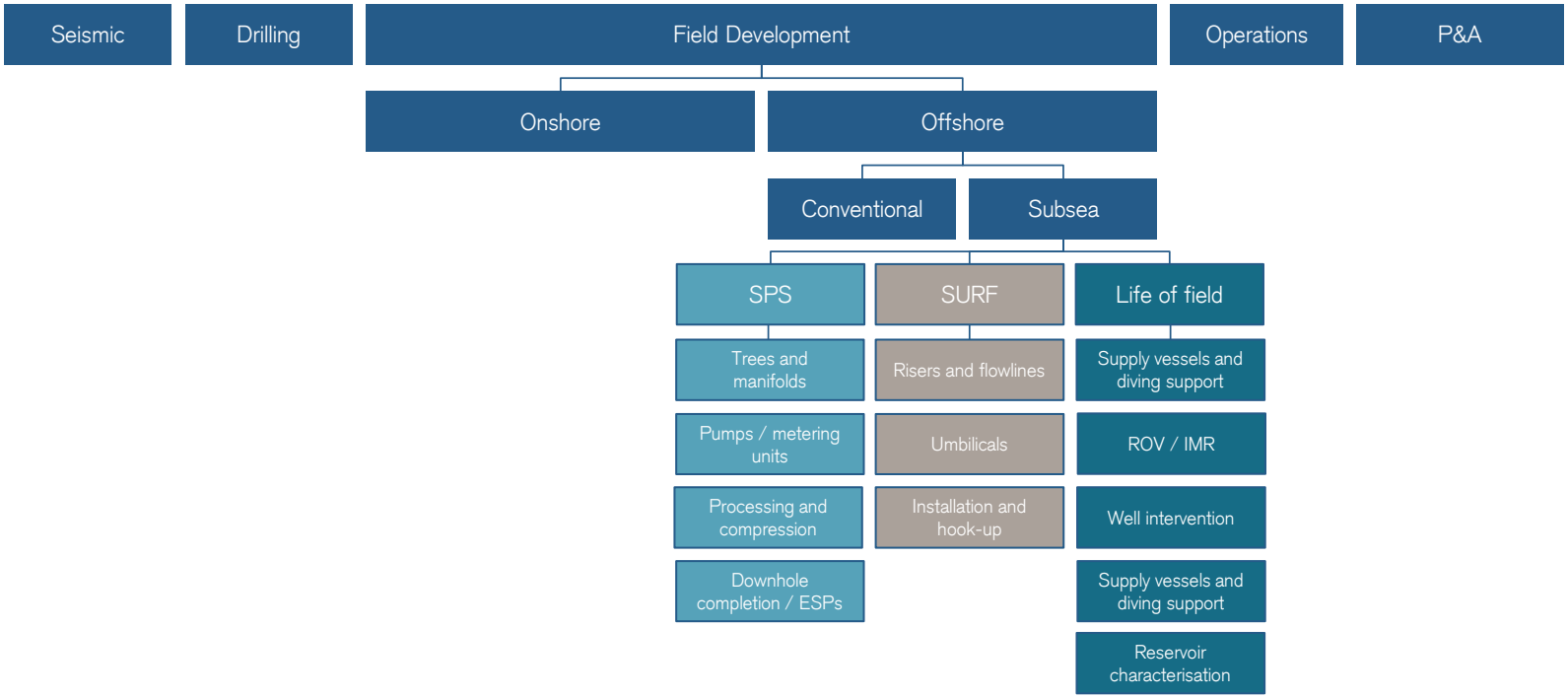



### Integrated technological approach



# Production: Integrated Subsea / SURF

## Subsea value chain and OFS offerings

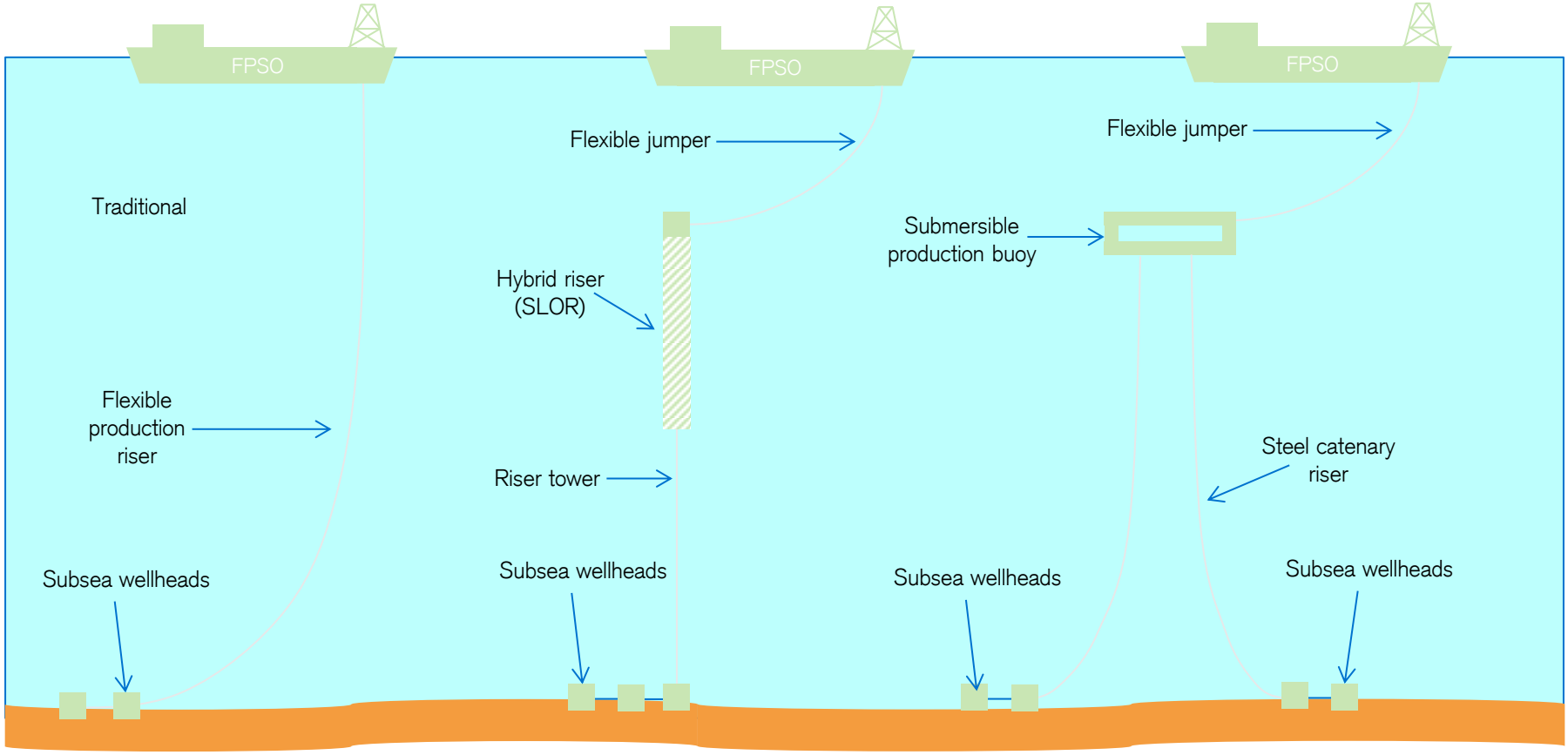



| | SPS | | | | SURF | | | Life of field | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Trees / manifolds | Pumps / metering units | Processing / compression | Downhole completion / ESPs | Risers and flowlines | Umbilicals | Installation / hook-up | Support vessels | ROV / IMR | Well intervention | Reservoir characterisation |
| TechnipFMC | ✓ | ✓ | ✓ | | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | |
| BHGE / McDermott | ✓ | | ✓ | ✓ | ✓ | | ✓ | | | ✓ | |
| OneSubsea / Subsea7 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Aker Solutions / Saipem | ✓ | | ✓ | | ✓ | ✓ | ✓ | | ✓ | | |

CREDIT SUISSE Source: Credit Suisse

# Offshore E&C: Subsea Technologies

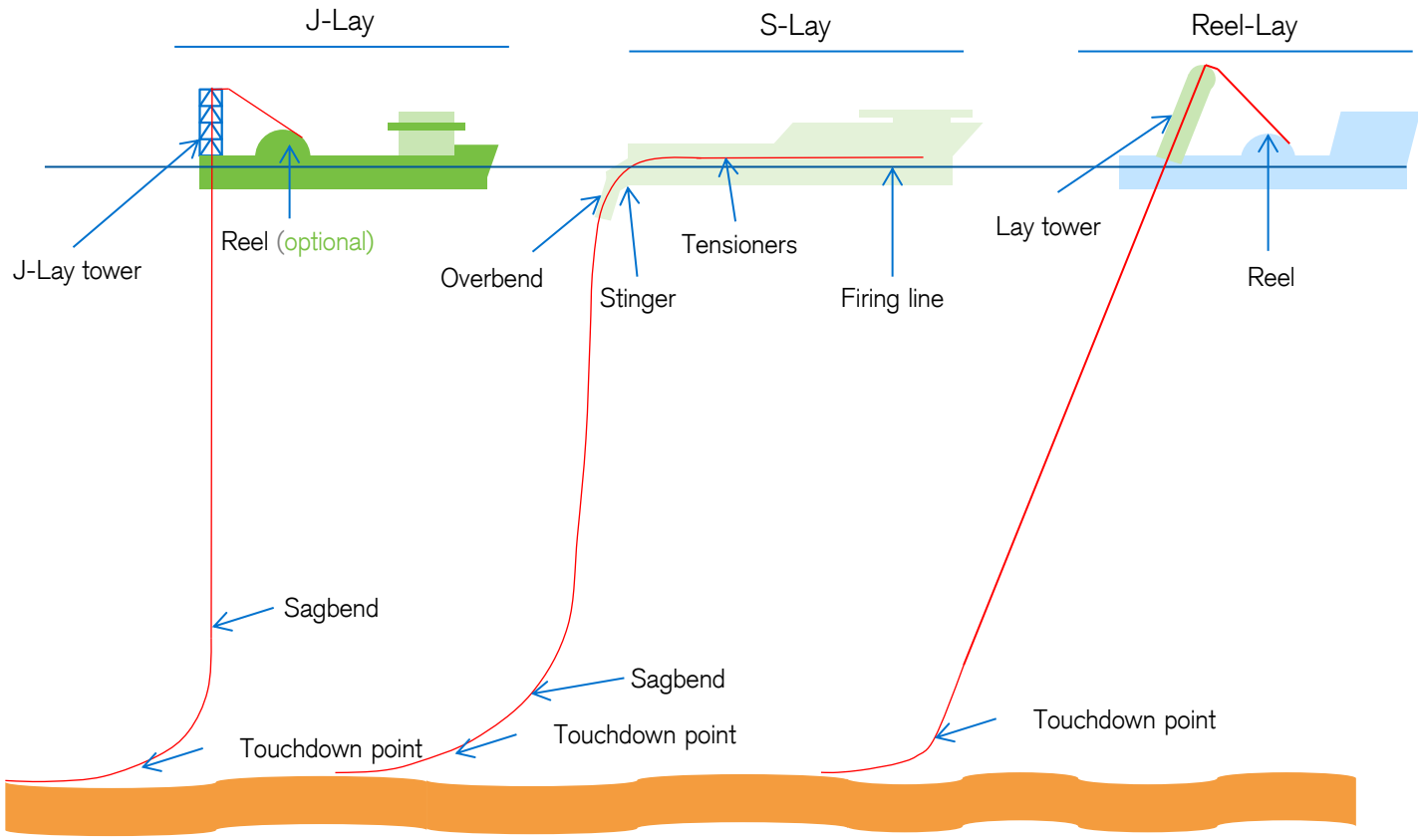
## Production riser choices – flowlines / jumpers are typically flexible; others can be rigid



# Offshore E&C: Installation Issues

## Pipelay Methods

- Engineering: lots of 'catenary equation' mathematics
- Key technologies: J-lay, S-lay, Reel-lay
- Different tension components and analysis
- J-lay: more suited for deepwater work – less stress on pipe, handles motion & currents better
- S-lay: used for gas trunklines
- Reel: used for flexibles

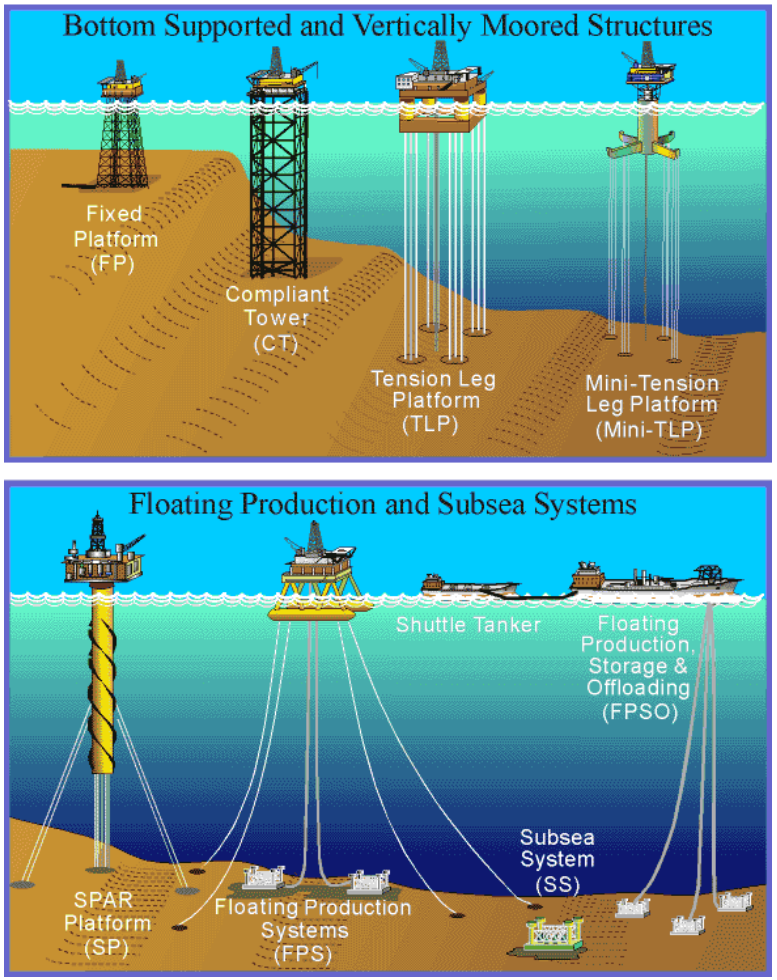


# Production: Offshore Systems

Offshore production infrastructure:

- **Fixed platforms** consist of a jacket driven into the seabed with a deck; water depths up to 1,500ft
- **Compliant towers** can sustain significant lateral deflections; water depths 1,000-2,000ft
- **Tension leg platforms** float but connected to the sea floor by vertical tendons; water depths up to 4,000 ft
- **SPAR platforms** have a large single vertical cylinder supporting a deck; water depths beyond 4,000 ft
- **Floating production systems** are semi-submersibles anchored by wire rope and chain, or dynamically positioned; water depths beyond 4,000 ft
- **Floating production, storage & offloading systems (FPSO)** are large tanker vessels moored to the seafloor; process and stow production from subsea wells and offload to a small tanker; suited for remote deepwater areas with no pipeline infrastructure; water depths beyond 4,000 ft

**Offshore Production Development Systems**



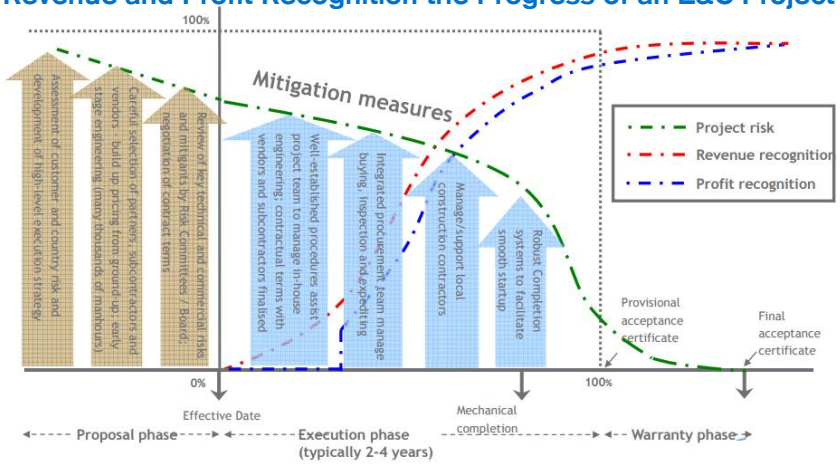

Source: MMS, Credit Suisse

# Production – Onshore E&C

**Onshore E&C** refers to the engineering, procurement, construction, installation and commissioning of onshore projects. Typically delivered as turnkey lump-sum, but increasingly so on a reimbursable or cost plus basis.

- **Competitive picture mixed:** Koreans retreated after cost overruns, but Indian and Chinese E&C becoming more competitive and domestic players increasingly prominent in Middle East.
- **Barriers to entry:** Always reputation/technology, but price often wins. Cost of entry into new regions is setting up local content; requirements to invest & employ locally in Saudi / Iran, etc. Encouraged to bid with local partners.
- **Variation orders:** When additional cost is incurred to stay on critical path. Increasingly difficult to be reimbursed – pending revenues a key risk and increased DSOs a concern.
- **Execution issues:** When unexpected costs outweigh contingencies. Cost overruns, delays, charges, write-downs, and fines. No quick fix.
- **Activity levels increasing:** After three downward years, awards to market inflected in 2017. Momentum continued into 2018 driven by Middle Eastern downstream work.

**Revenue and Profit Recognition the Progress of an E&C Project**




Source: Credit Suisse

# Production: Artificial Lift

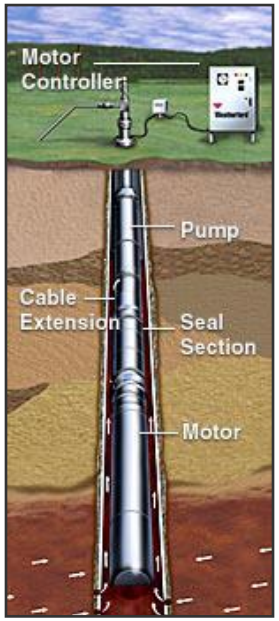
**Artificial lift** is a technology for mature oil and gas wells that need to boost fluids out of the wellbore, in particular as they produce water. The vast majority of oil wells in the US require some form of artificial lift from the very beginning.

- **Reciprocating rod pumps:** A plunger and valve assembly driven by surface motor (low tech).
- **Electric submersible pumps (ESPs).** Typically several centrifugal pump stages to access different wellbore sections driven by a downhole electric motor (highest tech).
- **Progressive cavity pumps (PCPs):** A surface motor rotates the sucker rods using a stator and rotor to cause fluid to flow upward.

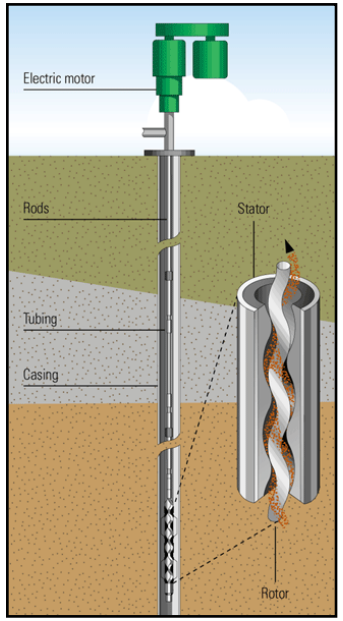
Rod Pump



ESP




PCP





Source: Spears & Associates, Weatherford, Independent Oil & Gas Service, Schlumberger

# Production: Compression

**Compression** raises the pressure of natural gas in the reservoir so that it will flow into pipelines and other facilities. There are three segments of compression:

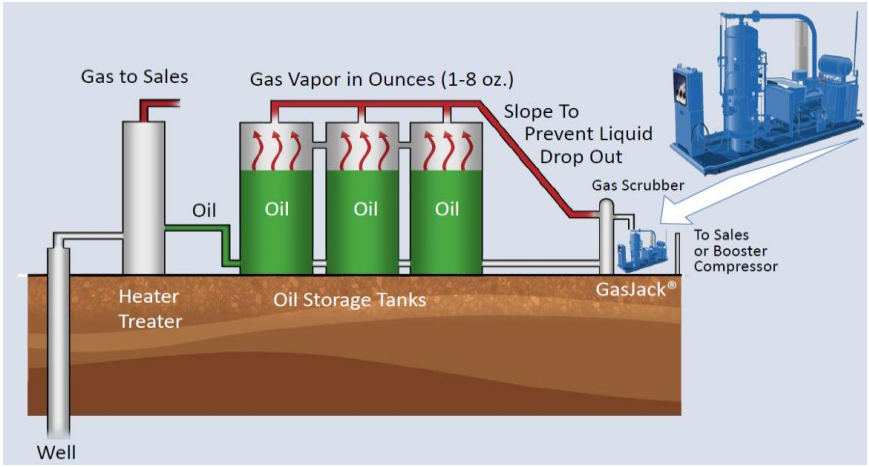
- Wellhead
- Gas gathering (production tank – vapor recovery)
- Processing

Compressors have historically been owned and operated by oil companies, but the U.S. is now approximately one-third outsourced to contract compression providers.

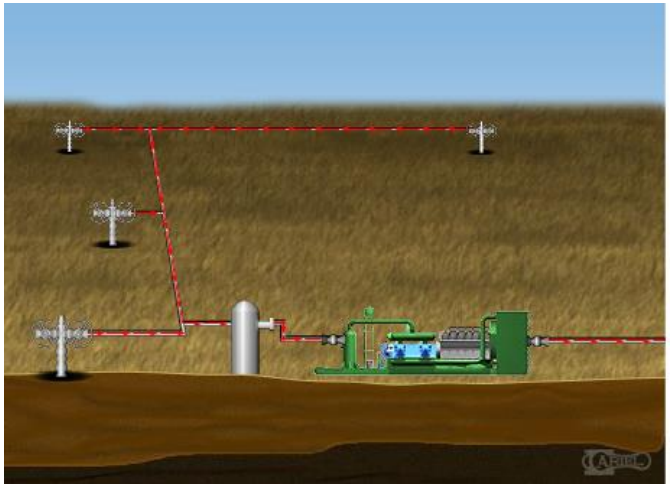
### Compressor



### Vapor Recovery Compression




### Gas Gathering Compression




Source: TETRA Technologies (Compressco), Ariel

# Production: Well Servicing

Well Servicing refers to the maintenance procedures that take place on a well after the well has been completed and production from the reservoir has begun. It is done to sustain and enhance the productivity of the well. Key products/services include:

- **Workover:** The process of performing major maintenance or remedial treatment on a well.
- **Coiled tubing:** Tubing used for the placement of fluids or manipulation of tools during workover.
- **Snubbing:** The process of putting drill pipe into the wellbore when the BOPs are closed and pressure is contained in the well.
- **Plug and abandonment:** The process of preparing a well to be permanently closed.

**Workover Rig**



**Coiled Tubing Unit**



# Company Specific Details

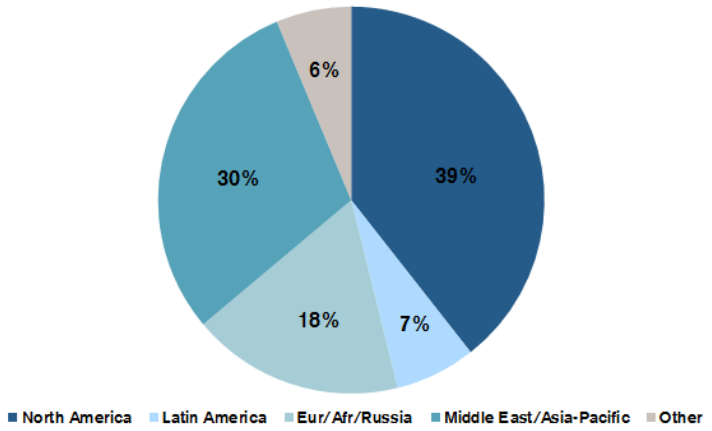


# Lifecycle Exposure and Select Companies

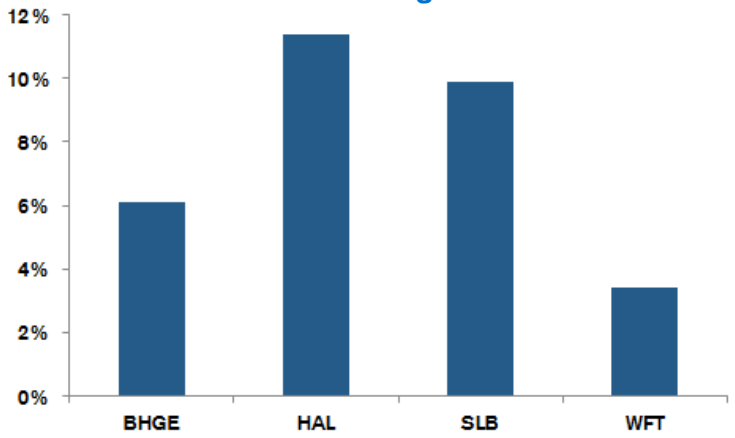
| Life Cycle Stage | Activities | Companies |
|---|---|---|
| **Exploration** | | |
| Initial Reservoir Analysis | Seismic Acq. / Processing | SLB, PGS, CGG, TGS |
| Evaluation | Wrieline Logging | SLB, HAL, BHGE |
| | Production Testing | SLB, HAL, CLB |
| | Coring | SLB, CLB |
| **Drilling** | | |
| Contract Drilling | Land | NBR, HP, PTEN, PDS |
| | Offshore | RIG, ESV / RDC, NE, DO |
| Drilling Services | OCTG | TS, X |
| | Directional | SLB, BHGE, HAL, WFT |
| | Fluids | SLB, TTI, NR |
| | Bits | BHGE, SLB, HAL, APY |
| **Completions** | | |
| Completion Services | Pressure Pumping | HAL, FTSI, PTEN, RES, PUMP |
| | Rental Tools | SLB, BHGE, HAL, WFT, SPN |
| | Casing and Handling | FI, WFT |
| | Proppant | SLCA, CVIA, HCLP, SND |
| **Production** | | |
| Well Servicing | Workover Rigs | KEG, BAS |
| | Coiled Tubing | SLB, HAL, SPN, NINE |
| | Cased Hole Wireline Logging | SLB, HAL, BHGE, WFT, NINE |
| Production Enhancement | Artificial Lift | BHGE, SLB, WFT, APY |
| | Chemicals | BHGE, SLB, ECL |
| | Compression | AROC, CCLP, NGS |
| Logistics Support | Supply Boats | TDW, HOS, NAO |
| | ROV | OII, HLX, FTI, SUBC |
| | Helicopters | BRS |
| | Proppant Logistics / Last Mile | SLCA, HCLP, SOI |
| **Equipment/Infastructure** | | |
| Development | Engineering / Design | FTI, SUBC, SPM |
| | Fabrication | MDR, GIFI |
| | Installation | FTI, HLX |
| Production | Subsea / Surface Equipment | FTI, SLB, BHGE, WHD, AKSO |
| | Umbilicals | OII, FTI, AKSO |
| | Risers / Flowlines | BHGE, FTI, DRQ |
| Capital Equipment | Rigs | NOV, SLB |
| | Production Units | NOV, OIS |

# FY2018 Oilfield Services Overview

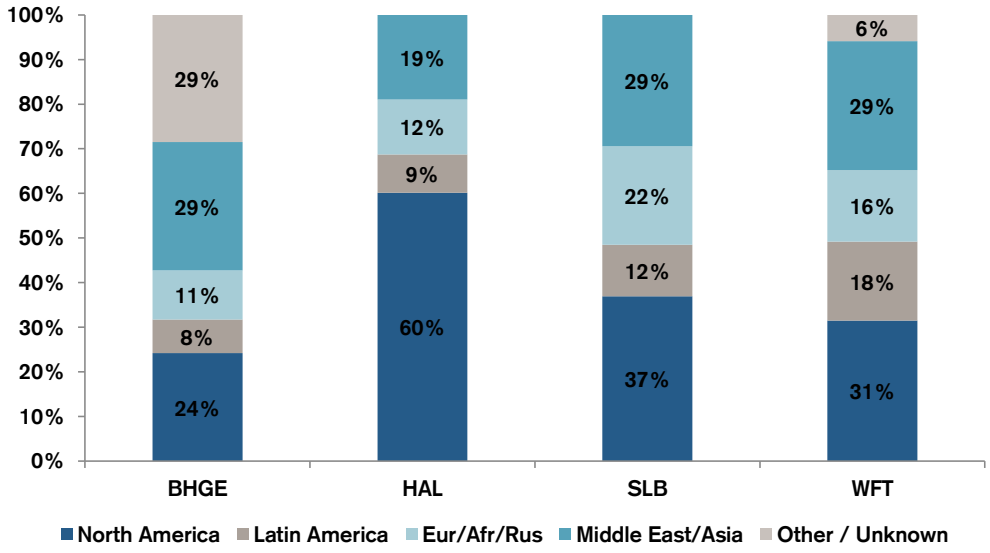
## OFS Upstream Revenues Geographic Segmentation




## EBIT Margins

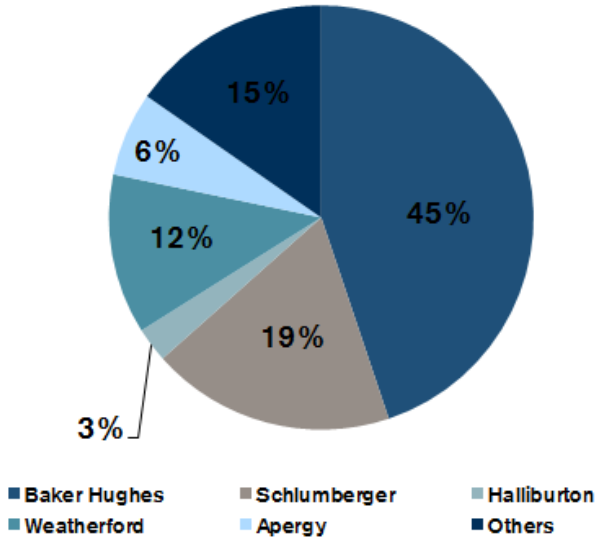



## Diversified Service Revenue by Region (as % of Segment Revenues)

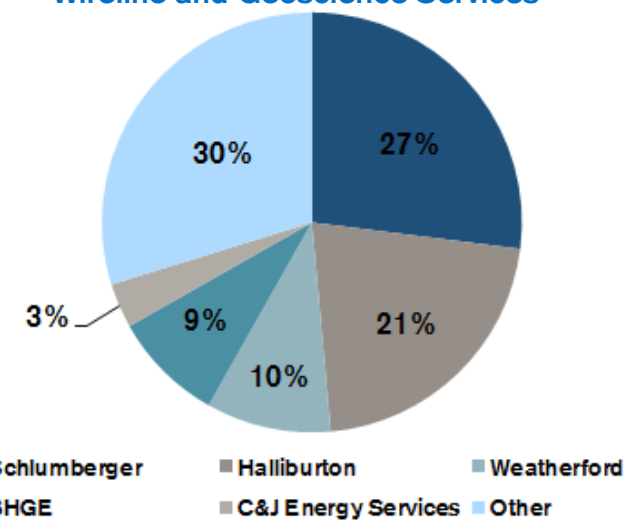


# 2018 Market Share for Various OFS Submarkets

## Artificial Lift

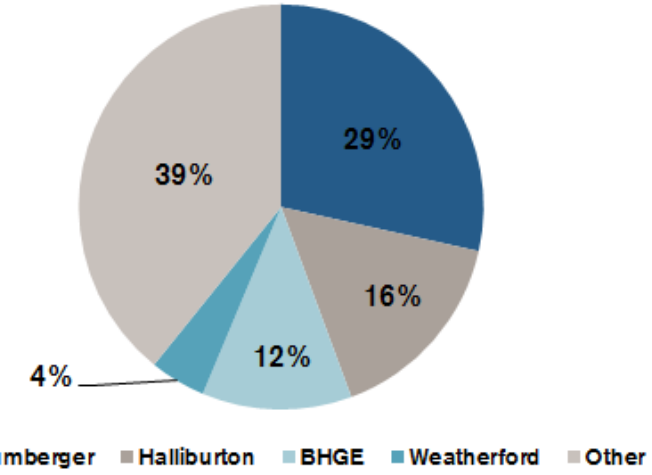



## Wireline and Geoscience Services

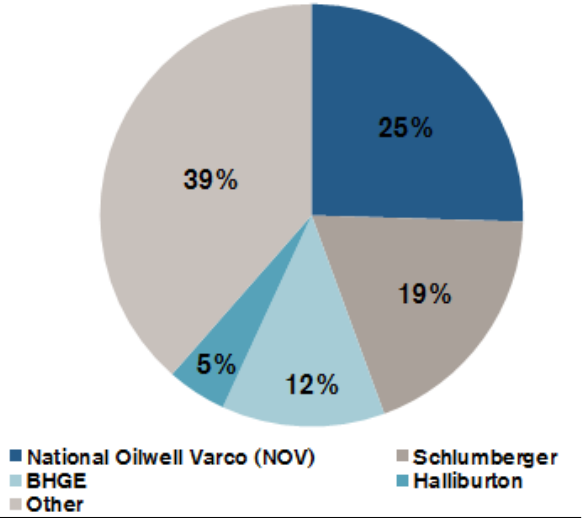



**2018 Revenues**
Artificial Lift = $8.0B
Coiled Tubing = $11.0B
Drilling Services = $16.9B
Drill Tools = $9.6B

## Drilling Services



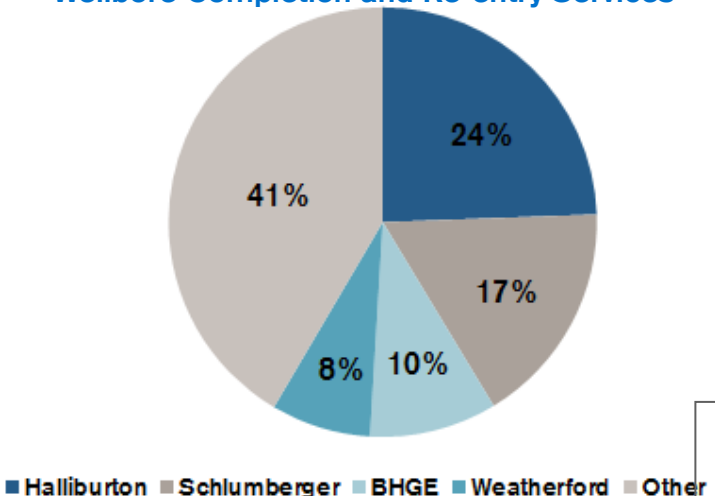

## Drill Tools



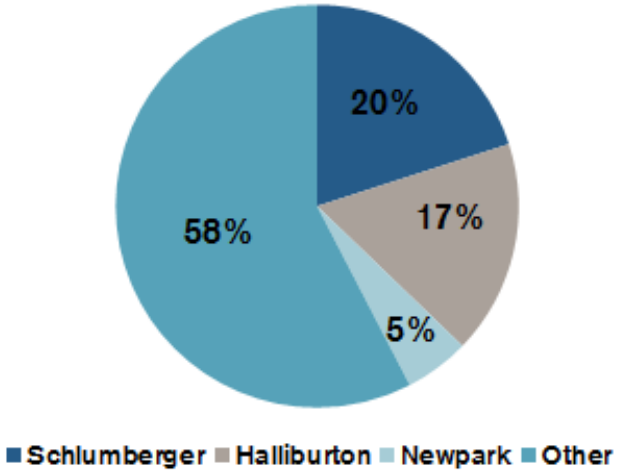

CREDIT SUISSE Source: Rystad Energy

# 2018 Market Share for Various OFS Submarkets

## Wellbore Completion and Re-entry Services



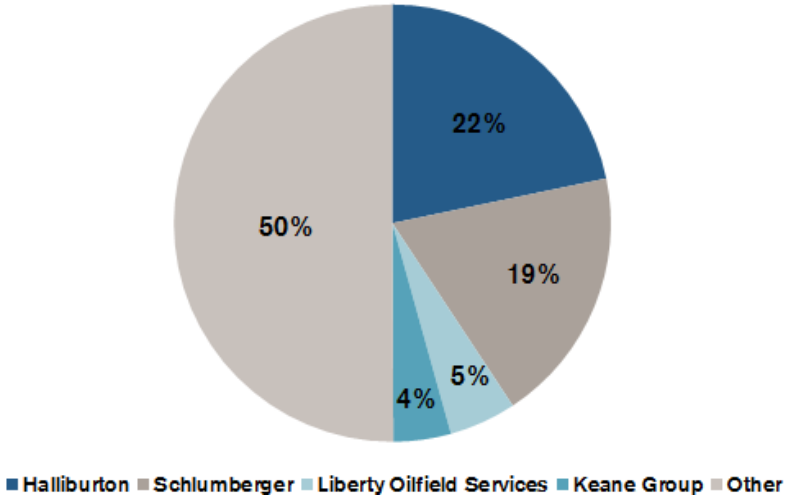

## Drilling Fluids



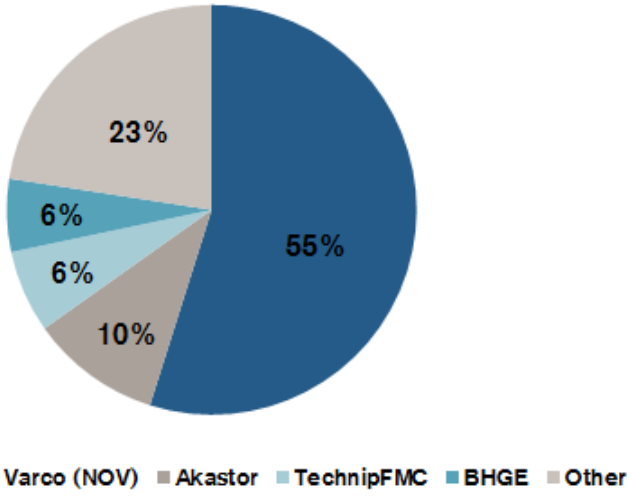

**2018 Revenues**

Well Stimulation = $43.4B
Wellbore and Re-entry Svcs = $22.2B
Drilling Fluids = $12.4B
Rig Equipment = $3.4B

## Well Stimulation Services



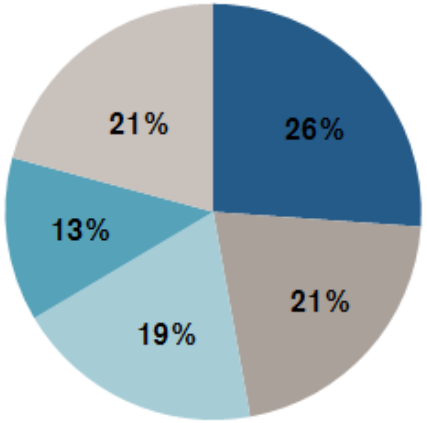

## Rig Equipment




CREDIT SUISSE Source: Rystad Energy

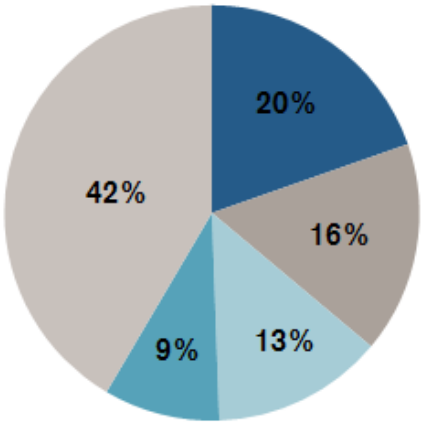
# 2018 Market Share for Various OFS Submarkets

## Subsea Equipment




TechnipFMC Schlumberger BHGE Aker Solutions Other

## Seismic

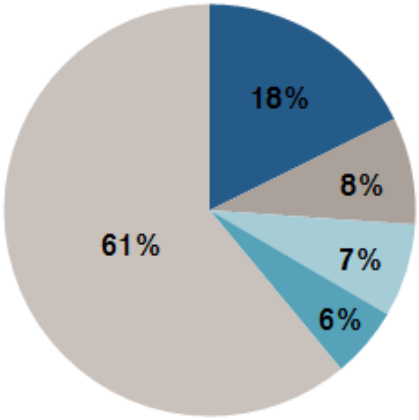



Schlumberger CGG PGS TGS Other

**2018 Revenues**

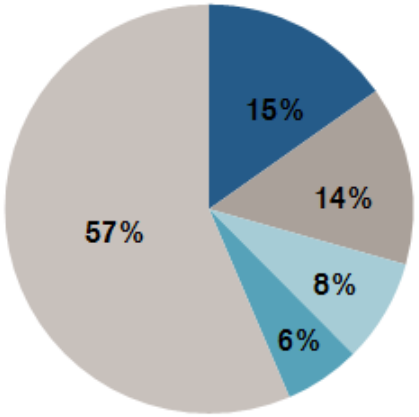
Land Contract Drilling = $17.5B
Offshore Contract Drilling = $19.5B
Subsea Equipment = $6.4B
Seismic = $6.3B

## Offshore Contract Drilling




Transocean ENSCO Maersk Seadrill Other

## Land Contract Drilling




Nabors Helmerich & Payne Patterson-UTI Eurasia Drilling Other

CREDIT SUISSE Source: Rystad Energy

# Offshore Drillers: Floater Exposure by Region

## North Sea main hotspot, with recovery in Brazil, Mexico, and West Africa key

- RIG, SDRL, and ESV have the largest floater fleets and largest geographic footprint with ~35% of total marketed floater supply today
- RIG, ESV, and SDRL still have newbuilds left to deliver – yards have been accommodative on delaying delivery and providing financing
- RIG has upgraded one of its four newbuilds to accommodate the world's first 20K PSI BOP to drill ultra high-pressure high-temperature wells – the first of what should be only a handful (~3-4 total) of 20K equipped rigs this cycle
- RIG remains the leader in harsh environment as the largest player in the North Sea with roughly one-third of total marketed floater supply

| Rigs by Region | RIG | ESV* | SDRL | DO | NE | Maersk |
|---|---|---|---|---|---|---|
| US GoM | 7 | 4 | 5 | 4 | 3 | 1 |
| North Sea | 11 | - | 2 | 4 | - | - |
| W Africa | 6 | 6 | 4 | - | - | 3 |
| South America | 1 | 1 | 2 | 2 | 2 | - |
| APAC | 4 | 2 | 2 | 2 | 2 | 1 |
| Med / Black Sea | 1 | 2 | - | - | 2 | 1 |
| Aus | 1 | 2 | - | 1 | - | - |
| Canada | 2 | - | 1 | - | - | - |
| Mexico | - | 2 | - | - | - | - |
| Other LATAM | 1 | 1 | 1 | - | - | 1 |
| Other | - | - | - | - | - | 1 |
| **Total Marketed Supply** | 34 | 20 | 17 | 13 | 9 | 8 |

| Regional Breakdown as % of Total | RIG | ESV | SDRL | DO | NE | Maersk |
|---|---|---|---|---|---|---|
| US GoM | 21% | 20% | 29% | 31% | 33% | 13% |
| North Sea | 32% | - | 12% | 31% | - | - |
| W Africa | 18% | 30% | 24% | - | - | 38% |
| South America | 3% | 5% | 12% | 15% | 22% | - |
| APAC | 12% | 10% | 12% | 15% | 22% | 13% |
| Med / Black Sea | 3% | 10% | - | - | 22% | 13% |
| Aus | 3% | 10% | - | 8% | - | - |
| Canada | 6% | - | 6% | - | - | - |
| Mexico | - | 10% | - | - | - | - |
| Other LATAM | 3% | 5% | 6% | - | - | 13% |
| Other | - | - | - | - | - | 13% |

*Pro Forma for RDC Merger

# Offshore Drillers: Jackup Exposure by Region

## Middle East the largest market

- The Middle East and APAC continue to be the two pillars of jackup activity, making up two thirds of global demand today
- ESV now dominates the ME market and has solidified its position following the merger with RDC and its JV with Saudi Aramco
- ESV and Maersk control a majority of the NSEA jackup market
- Stranded jackup newbuilds have slowly been delivering (being acquired) as rates have been accommodative and yards have been willing to negotiate

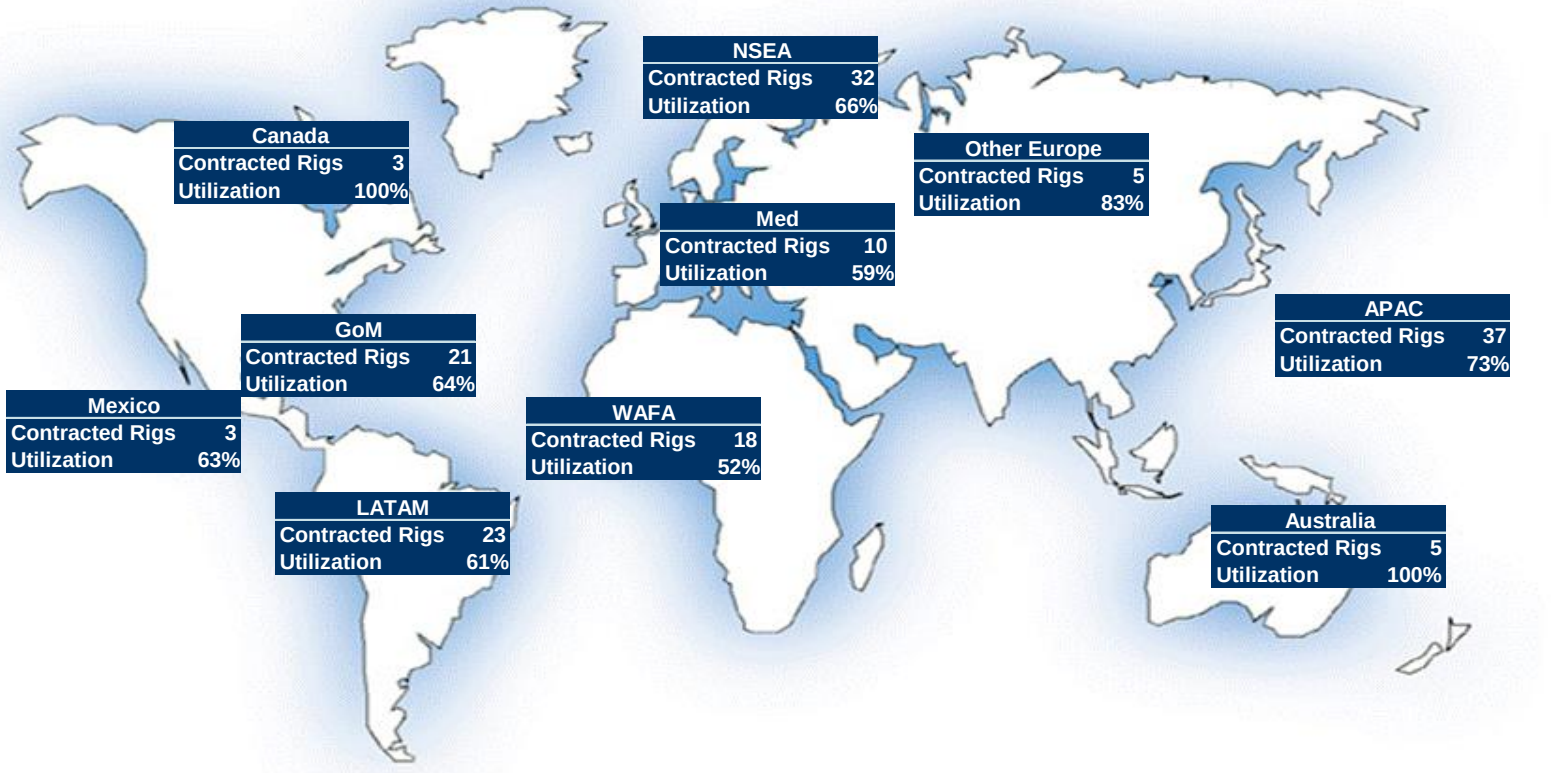
| Rigs by Region | ESV* | COSL | SHLF | Borr | SDRL | Maersk |
|---|---|---|---|---|---|---|
| Middle East | 27 | 4 | 16 | 2 | 6 | - |
| North Sea | 11 | - | - | 5 | - | 12 |
| APAC | 3 | 27 | 11 | 10 | 2 | 1 |
| Mexico | - | 3 | - | 1 | 5 | - |
| US GoM | 6 | - | - | - | - | - |
| W Africa | 1 | 1 | 5 | 5 | - | - |
| Other | - | - | 1 | - | - | - |
| Med / Black Sea | 3 | - | 1 | - | - | - |
| Australia | 1 | 1 | - | - | - | - |
| South America | - | - | - | - | 2 | |
| Other LATAM | 3 | - | - | - | - | - |
| **Total Marketed Supply** | 55 | 36 | 34 | 23 | 15 | 13 |

| Regional Breakdown as % of Total | ESV | COSL | SHLF | Borr | SDRL | Maersk |
|---|---|---|---|---|---|---|
| Middle East | 49% | 11% | 47% | 9% | 40% | - |
| North Sea | 20% | - | - | 22% | - | 92% |
| APAC | 5% | 75% | 32% | 43% | 13% | 8% |
| Mexico | - | 8% | - | 4% | 33% | - |
| US GoM | 11% | - | - | - | - | - |
| W Africa | 2% | 3% | 15% | 22% | - | - |
| Other | - | - | 3% | - | - | - |
| Med / Black Sea | 5% | - | 3% | - | - | - |
| Australia | 2% | 3% | - | - | - | - |
| South America | - | | | - | 13% | - |
| Other LATAM | 5% | - | - | - | - | - |

*ESV is Pro Forma for the RDC deal and includes all owned / leased rigs in the ARO JV (ex. Newbuilds)

# Offshore Drillers: Rigs by Geography – Floaters

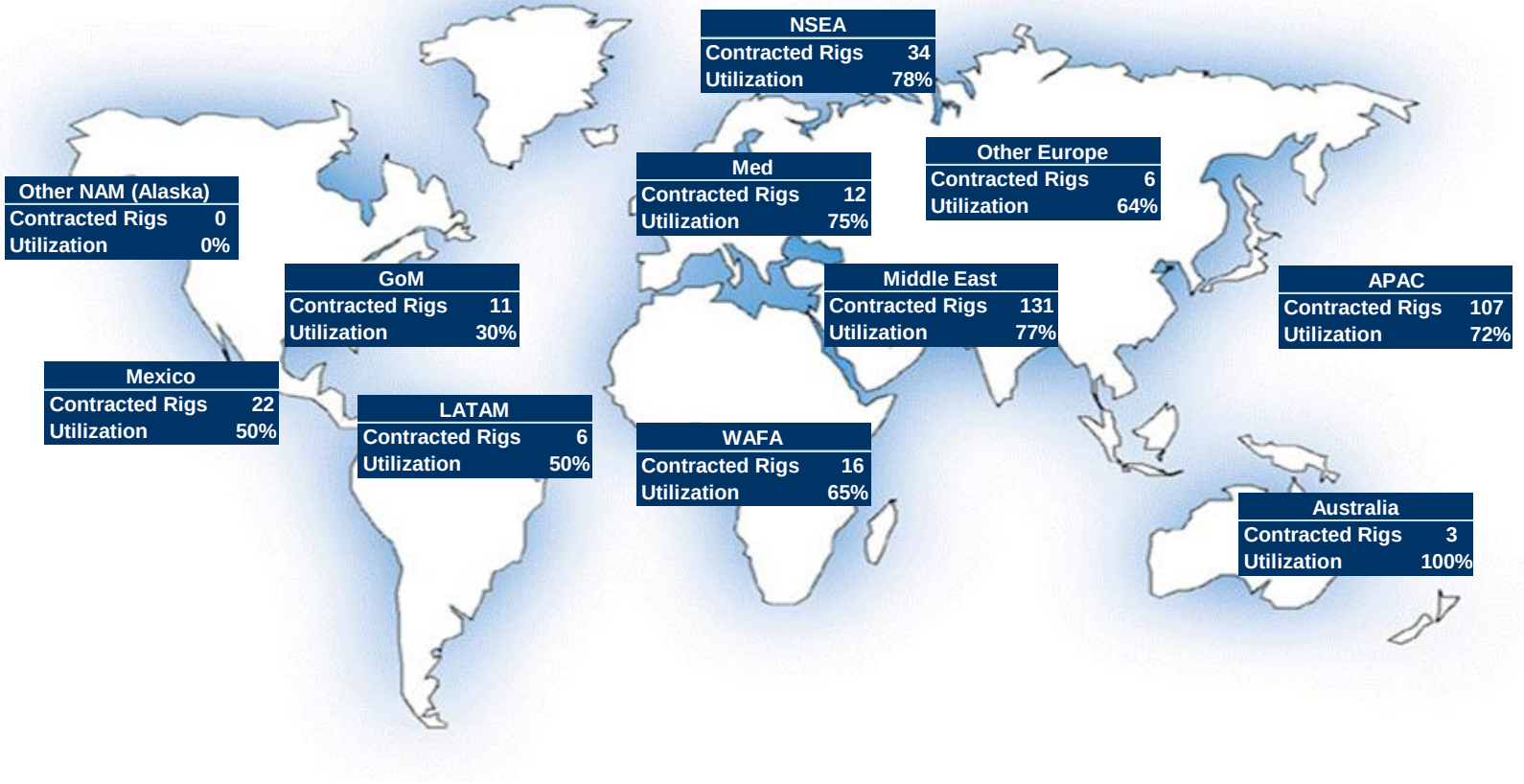
## GoM, WAFA, Brazil, and NSEA the focus




- **North Sea** has risen to become the single largest basin for floater demand, primarily made up of older moored semisubmersibles (UK) and high-spec (HE) harsh environment semisubs (Norway). To work in the North Sea, a rig must be purpose built at construction (rare exception)
- **Golden Triangle** (Brazil, US GoM and WAFA) – remain the largest basins for deepwater floaters
- **APAC** (three basins: Southeast Asia, Far East, Indian Ocean) – have grown to be strong mixed (semis/drillships) floater demand drivers
- **Global contracted floater fleet:** 157 (up 8% Y-Y); Working Floater Fleet: 110 (up 5% Y-Y)
- **Global contracted utilization:** 65% (vs. 56% April 2018); marketed utilization: 79% (73% April 2018); working floater utilization: 46% (41% April 2018)

# Offshore Drillers: Rigs by Geography – Jackups

## Middle East, Asia Pac, North Sea the focus




- **Busy Basins**: Middle East and APAC are the largest Jackup markets (~67% of contracted fleet)
- **Global contracted jackup fleet:** 355 (up 9% Y-Y); Working Jackup Fleet 295 (up 7% Y-Y)
- **Global contracted utilization:** 69% (60% in April 2018); marketed utilization 79% (71% April 2018); working Jackup utilization : 57% (52% in April 2018)

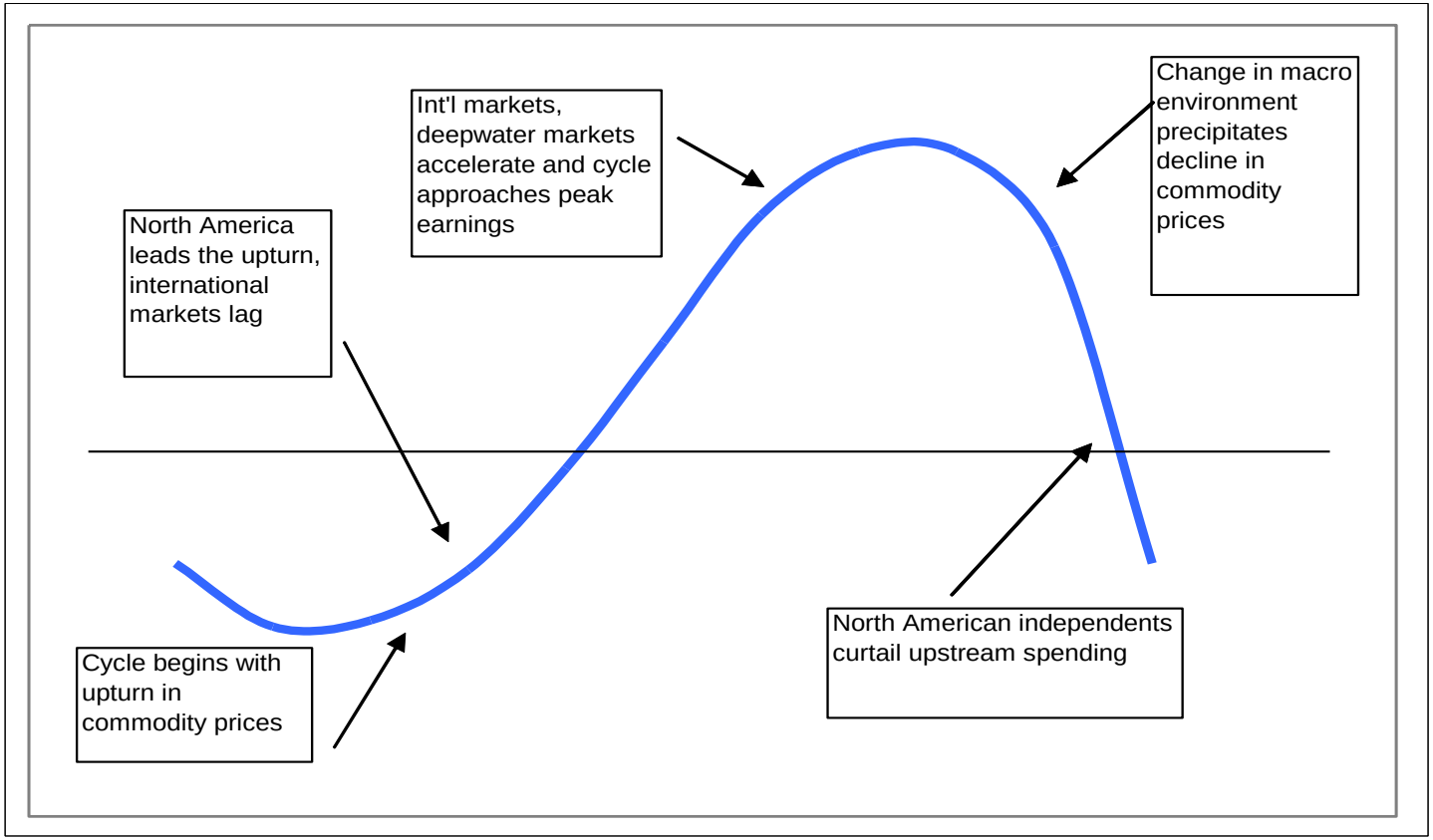
CREDIT SUISSE Source: IHS Petrodata

CREDIT SUISSE

# Investing

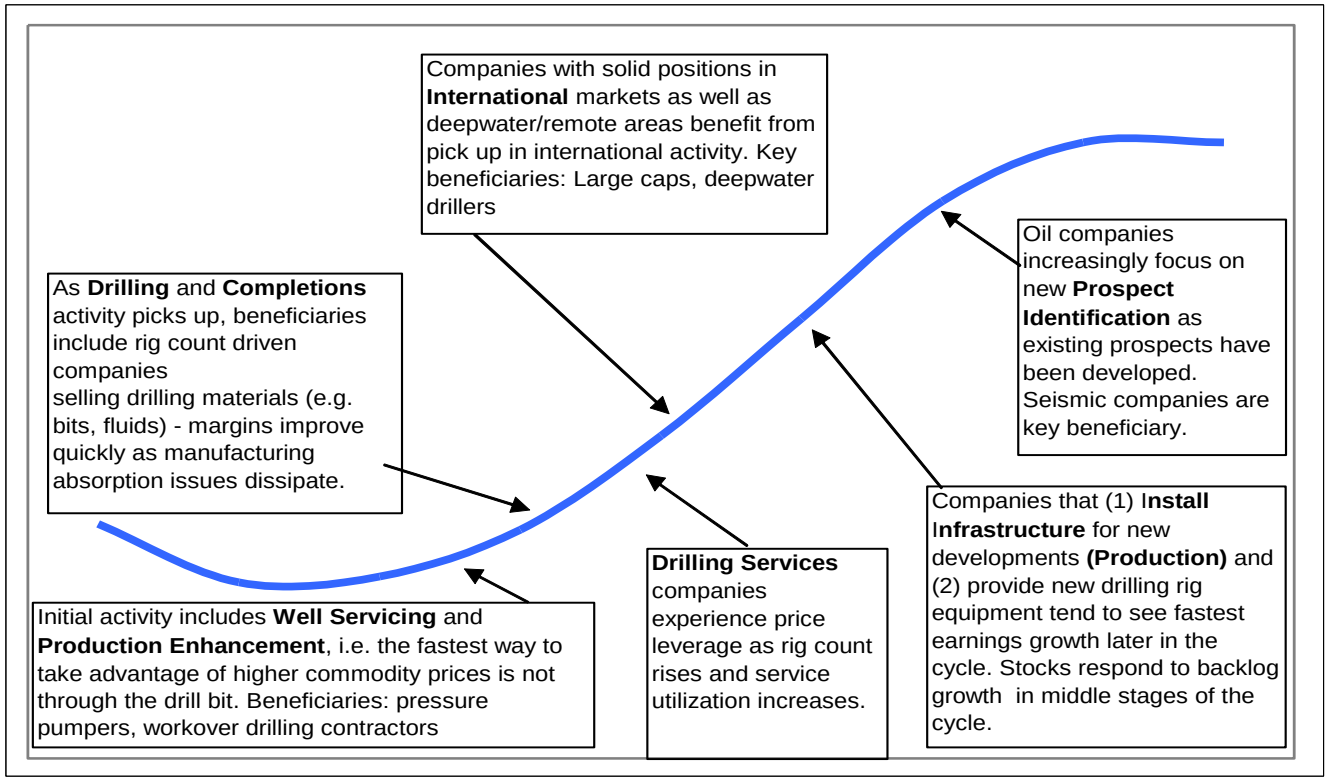


# The Traditional Upstream Spending Cycle



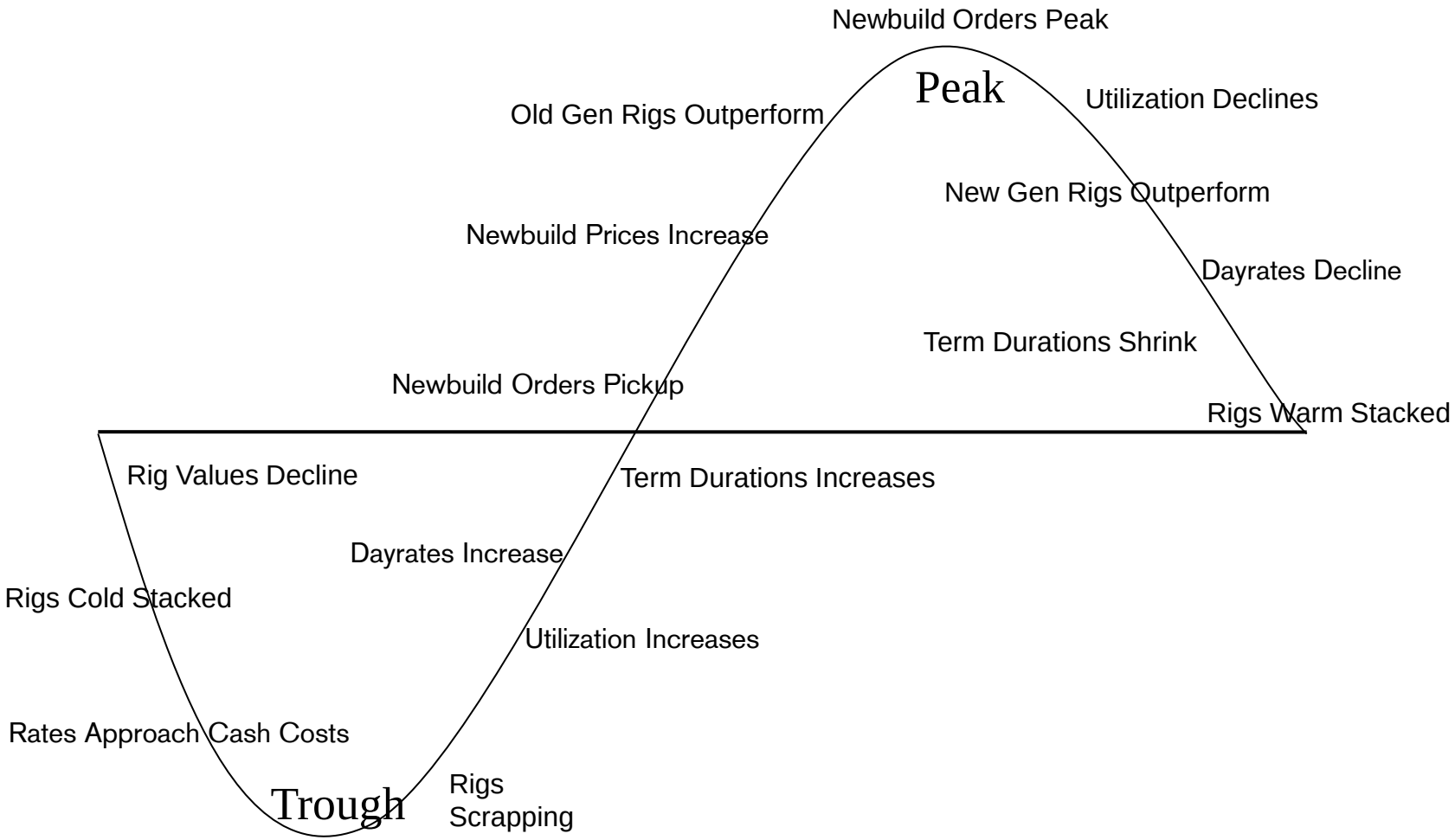

- North America generally leads in a resumption in upstream spending because more of the activity is conducted by smaller (more nimble) operators (E&P companies). With shorter time horizons, generally, the North American operators are also the first to curtail spending in a downturn.

# Oil Services Activities Through the Cycle



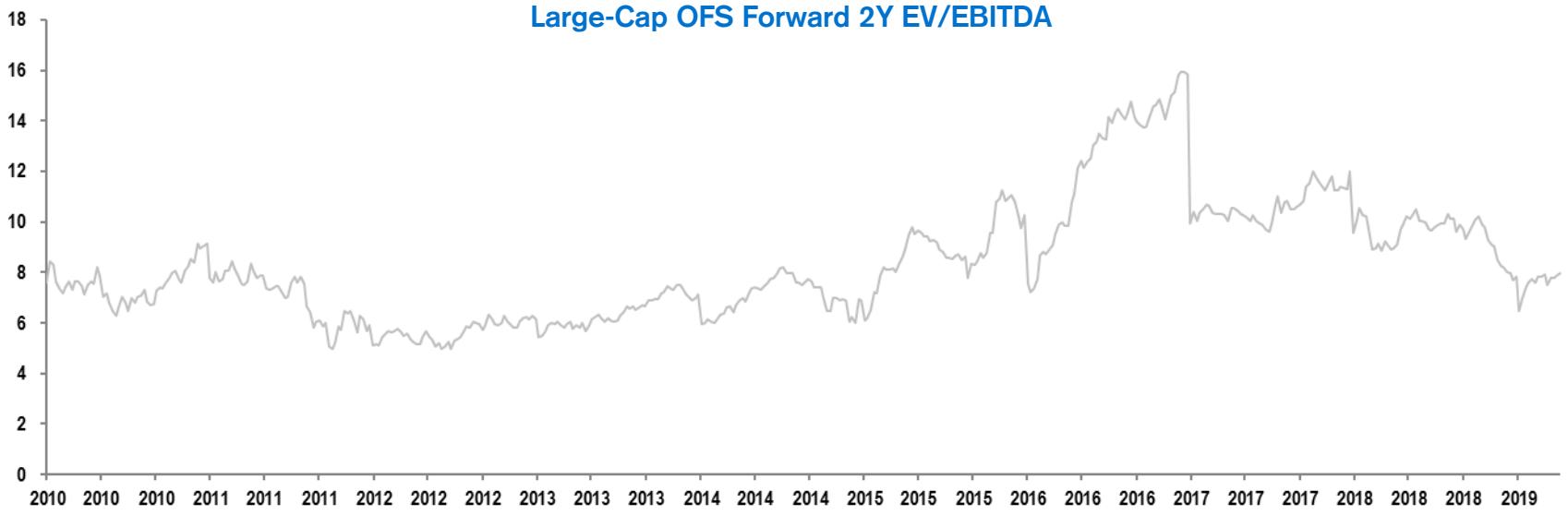

- Production-related services are the most resilient and the first to "revive," but traditionally have the lowest beta. Secular challenges related to hydrocarbon production sustained higher-than-expected growth in the most recent upcycle.
- With more confidence in sustained higher commodity prices, drilling- and completion-related activity responds. Exploration is generally the last to strengthen and the first to fall in a downturn in oil prices.

# Offshore Drilling: The Cycle



# Traditional Valuation Methodologies

- **Services:** As an earnings momentum group, shares have generally been valued on a multiples basis (P/E, but increasingly EV/EBITDA during the recent downcycle given negative accounting profits). A DCF analysis is helpful to determine the appropriate multiple for the current position in the cycle (e.g., peak multiples on trough earnings).
- **Equipment:** The backlog visibility, which can extend out as far as three years, lends itself to DCF. However, forward earnings metrics are also used, especially at the bottom of cycles.
- **Drillers:** With high asset intensity associated with owning the rigs, and different depreciation methods used by the companies, the industry tends to use forward year multiples. In the recent upcycle, backlog visibility lends itself to a DCF. In troughs, replacement value metrics are also used.




CREDIT SUISSE Source: the BLOOMBERG PROFESSIONAL ™ service (Services group is SLB, HAL, BHGE, WFT)

# Indicators

## Leading Indicators

- **E&P upstream capex.** Oil company spending budgets (generally set early in the calendar year, although US onshore E&Ps will revise budgets intra-year).
- **Seismic.** Licensing rounds, oil company exploration budgets, sustained higher commodity prices. This is particularly important for offshore activity.

## Coincident Indicators

- **Oil and natural gas prices.** Because oil and natural gas prices dictate future E&P capex trends, the group moves directionally with commodity prices.
- **Earnings.** As a traditional earnings momentum-driven group, quarterly earnings matter.
- **Rig count.** North American rig counts are updated weekly (sources include Baker Hughes, RigData) or bi-weekly (The Land Rig Newsletter). Non-North American rig counts are updated monthly (Baker Hughes).
- **Pricing.** Contract drilling shares are generally highly correlated with the trajectory of day rates, sand prices trade with recent spot market sales, and pressure pumping stocks move with revenue per stage trends.

# Key Trends



# Oilfield Services I:

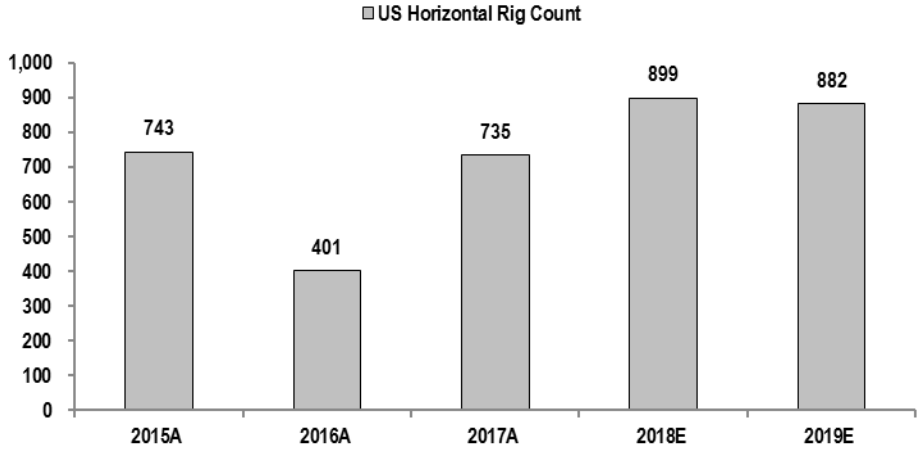
## We did it again – Oilfield Services a victim of its own success

- **We over-supplied the market (again).** We did it to natural gas in the late 2000s. Now we've done it to oil twice in about five years. We now find ourselves in a position in which OPEC must cut production to accommodate US growth in 2019. This implies a relatively flattish outlook for the international markets. Furthermore, it appears E&P capital efficiency is sufficient to grow production in 2019 on marginally lower capex budgets. Hence, the OFS industry is staring down relatively flat global spend in 2019 year on year and most subsegments remain over-capitalized. Furthermore, the better-than-expected production growth from US land likely pushes any deepwater recovery out by an additional ~1-2 years (mid-cycle offshore rig rates by ~2023).
- **Against this backdrop, we prefer names with a sustainable niche or secular trend rather than those relying on a cyclical inflection.** In a roughly flattish environment characterized by overcapacity, we are biased toward names that can defend margin.
  - **HAL** - optionality to a higher oil price, less dependent on deepwater than SLB
  - **BHGE** – defensive (given lack of NAM onshore exposure; LNG exposure) despite the GE overhang
  - **WHD** - consolidated market with great margin and return profile and best-in-class management team
  - **PUMP** - pure-play Permian pressure pumper differentiated via a partnership-based model + deep relationships
  - **NINE** - very well run company without pressure pumping exposure
  - **SOI** - secular growth even in a stagnant market w/sand silos + recently introduced chemical storage units

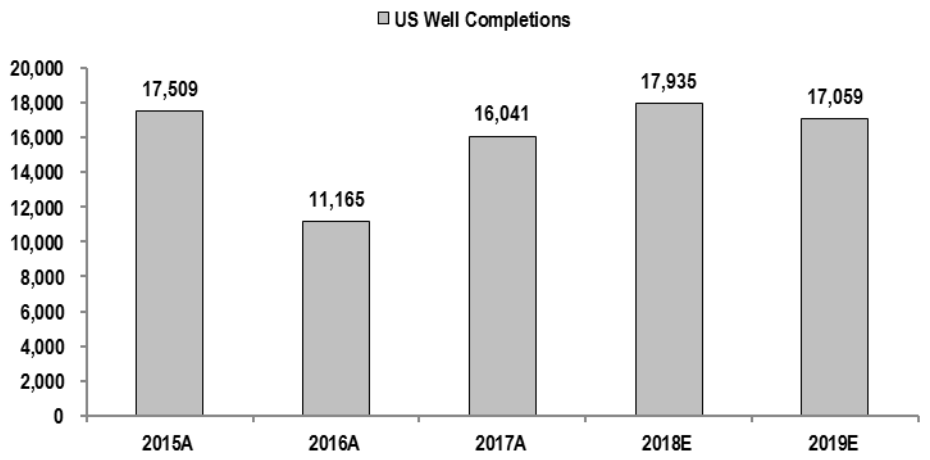
# Oilfield Services II:

## Spending growth takes a pause as int'l accommodates US growth

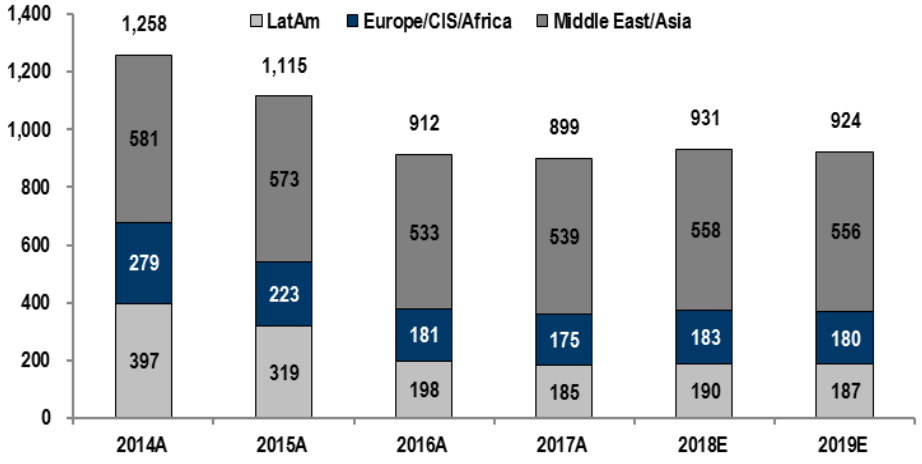
**In 2019, we forecast modest y/y declines in the US rig count…**



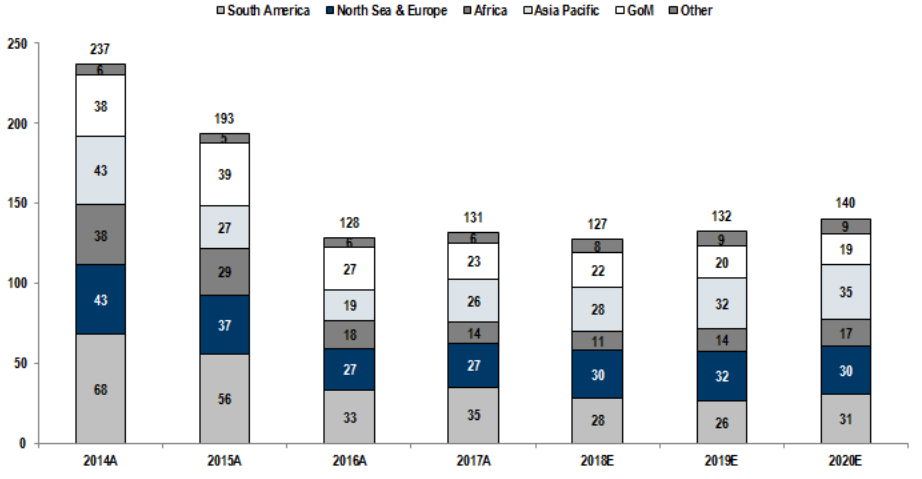

**… as well as US completions**




**We expect a flattish int'l environment…**




**… and a slight uptick in an anemic floating rig demand**

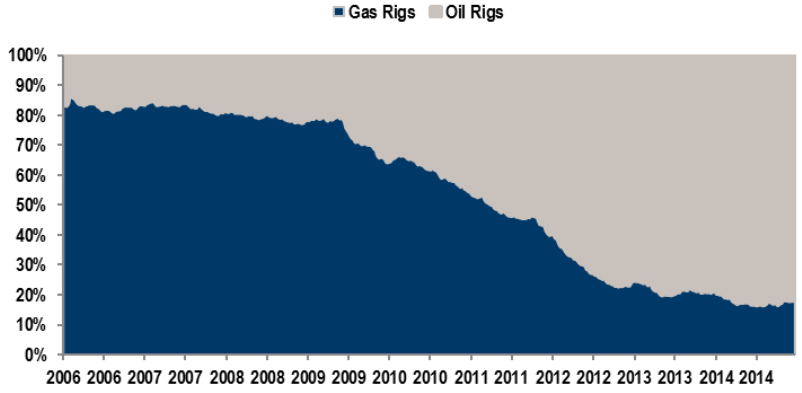



CREDIT SUISSE Source: Baker Hughes Rig Count, EIA DPR

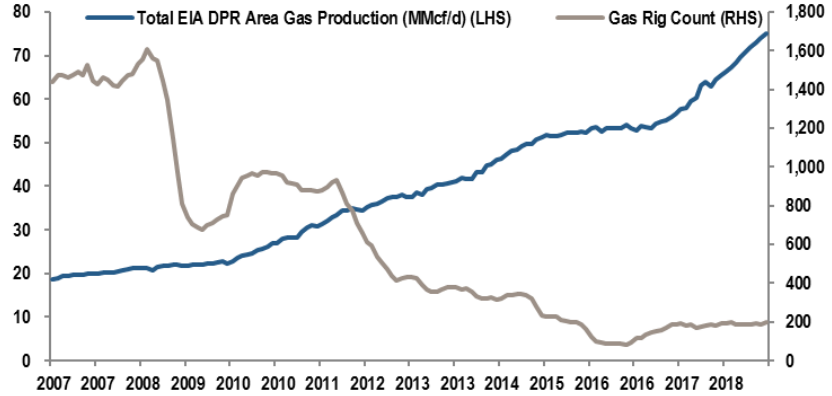
# Oilfield Services III:

## Déjà Vu: First it was natural gas…

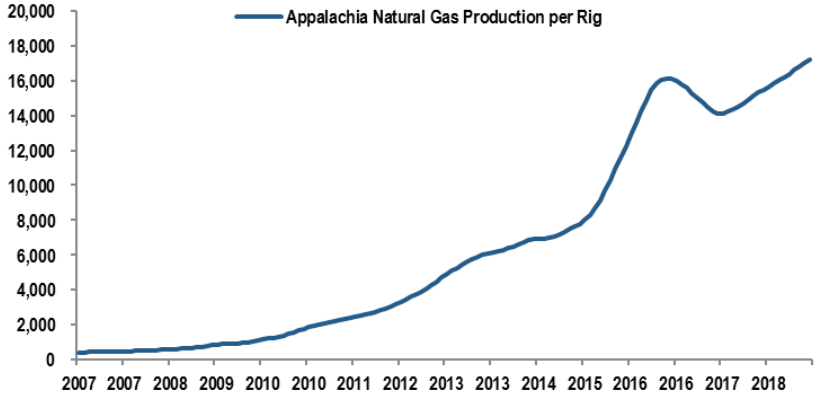
**US gas rig count peaked in 2008 at ~1,600; industry took advantage of strong prices; this drove rapid advancement in drilling and completion technologies…**



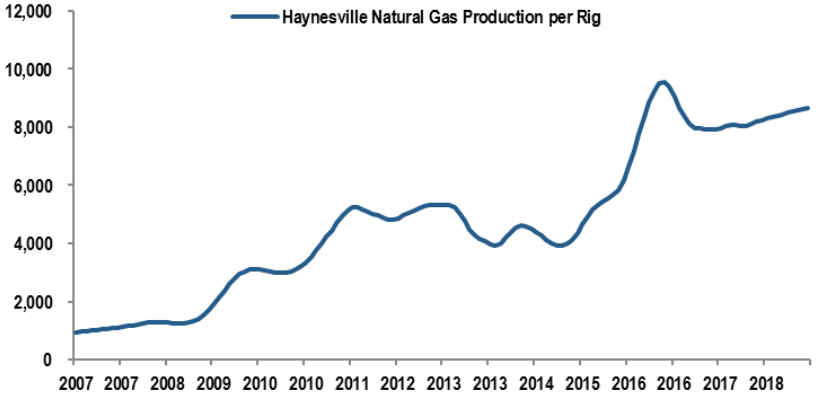

**… the application of these technologies drove significant production increases despite a falling rig count**




**These technological gains are evident in the natural gas production to rig ratios in the Appalachia region…**




**… as well as in the Haynesville**

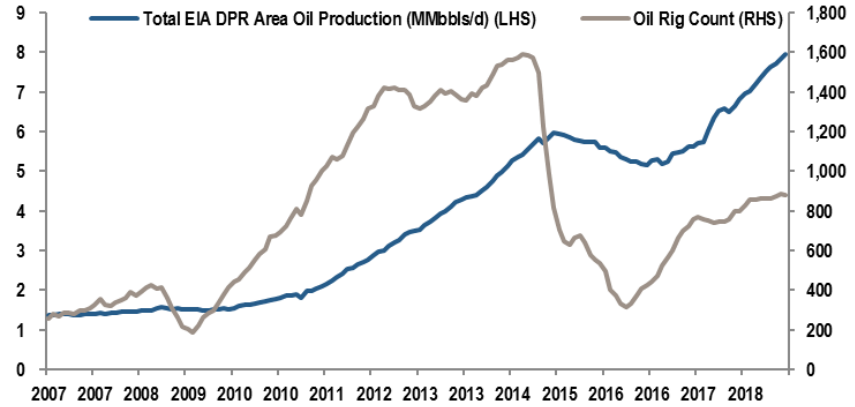



CREDIT SUISSE Source: Baker Hughes Rig Count, EIA DPR

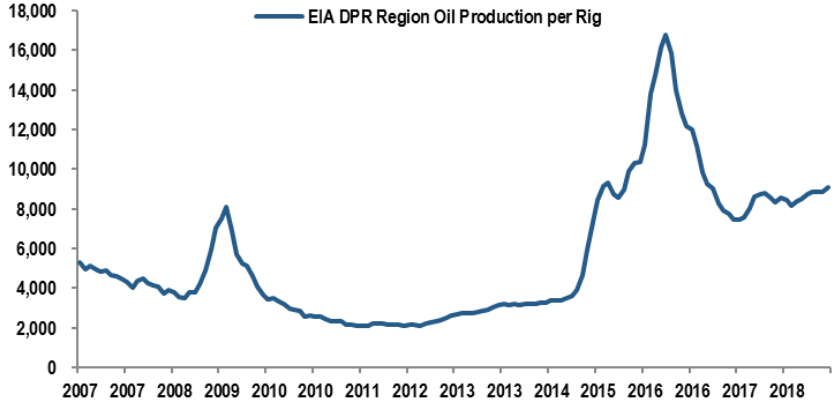
# Oilfield Services IV:

## Déjà Vu: … Now it's oil

**The dynamic in oil is not nearly as dramatic as in natural gas…**




**… but we see the same dynamics emerging**




- The US E&P industry has proven more efficient at lower oil prices than had been anticipated
- In 2014, the US grew oil production dramatically; this growth required others to cut production to accommodate it
- OPEC+ refused and decided to let market forces drive oil prices lower; this took WTI to ~$26/bbl by Feb 2016
- Under such price pressure, OPEC+ cut oil production to boost oil prices
- This production cut accommodated a higher oil price, which the US E&P industry capitalized on to grow production…
- … to a degree that proved (once again) too much for the market to handle
- Technologies and operating efficiencies of all kinds are working to lower the breakeven price of oil and gas production, resulting in a reversal, at least for now, in the "up and to the right" view of oil prices
- The winners will be the ones that provide the most impact to lower break-evens, boosting returns for customers and themselves


Source: Baker Hughes Rig Count, EIA DPR

# Oilfield Services V:

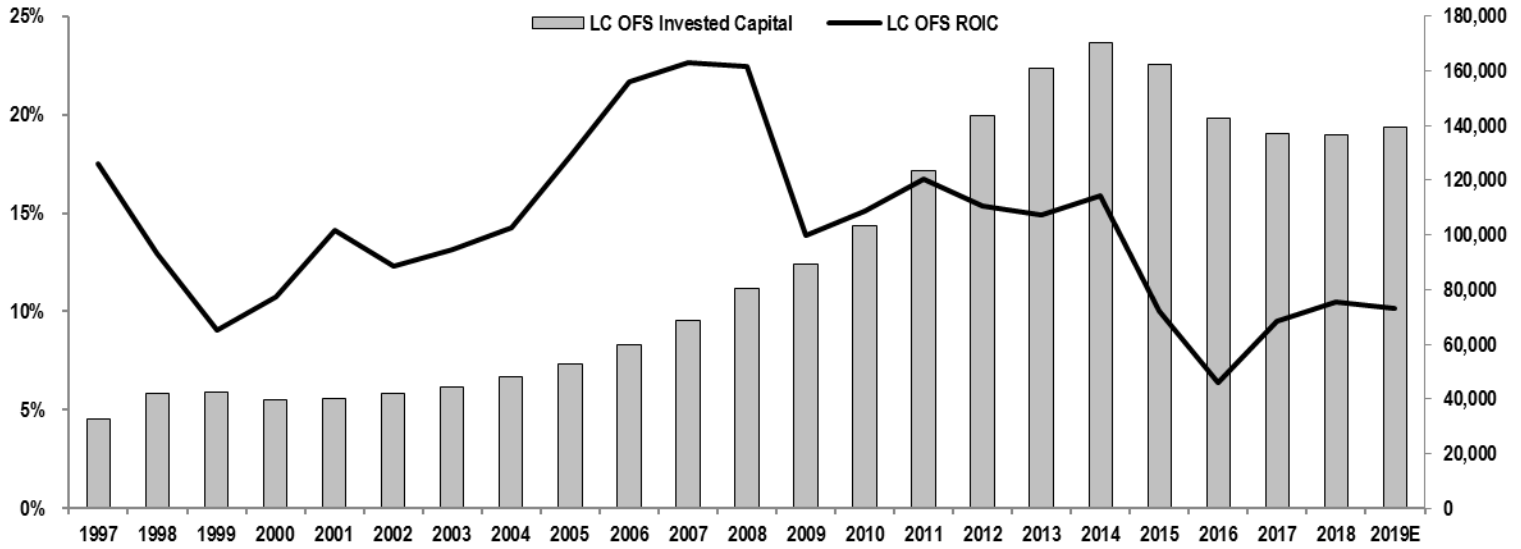
## The market had sent a price signal (lower oil prices) to US producers that they needed to slow their rate of production growth




- Entering 2019, we are reminded of 2017: world producers reducing production to support oil prices…
- … but those barrels can come back on the market very quickly; that acts as a cap on oil prices near term
- Only low oil prices can impact US production levels
- We expect activity to slow down in 2019, though not nearly to the extent of 2015/16
- Most companies will remain cash flow positive, indicating a rational reduction in metrics, not panic
- Consolidation and an increased focus on capital allocation will be critical
- Return metrics will win out over growth metrics
- Ability to adapt will be critical

# Oilfield Services VI:

## This dynamic is set against a backdrop in which large-cap OFS has struggled to maintain historical levels of returns




- The above chart shows aggregate ROIC (NOPLAT / Average Invested Capital) for the large-cap OFS sector (SLB, HAL, BHGE, WFT) against average invested capital
- Returns for the sector peaked in 2008; despite the high-margin deepwater boom 2010-14, returns fell over this period (from low-20% in 2006-08 to mid-teens in 2009-14) on the back of a dramatic increase in the invested capital base (almost a 3x increase from 2006 to 2014)
- Given the strong positive correlation between changes in returns and changes in share price, this is the greatest challenge facing the OFS sector

Credit Suisse Equity Research
Americas/United States

# Canadian Infrastructure

**April 2019**


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# Canadian Infrastructure Universe

| Name | Ticker | Currency | Target Price | Rating | Current Price | Shares O/S | Market Cap (Millions) |
|---|---|---|---|---|---|---|---|
| **Canadian Energy Infrastructure** | | | | | | | |
| AltaGas Ltd. | ALA.TO | CAD | | NR | $18.30 | 276 | 5,049 |
| **Enbridge Inc.** | **ENB.TO** | **CAD** | **$55.00** | **OUTPERFORM** | **$49.93** | **2,023** | **101,015** |
| **Gibson Energy Inc.** | **GEI.TO** | **CAD** | **$26.00** | **OUTPERFORM** | **$23.66** | **145** | **3,421** |
| Inter Pipeline Ltd. | IPL.TO | CAD | | NR | $22.26 | 407 | 9,055 |
| **Keyera Corp.** | **KEY.TO** | **CAD** | **$32.00** | **NEUTRAL** | **$32.73** | **212** | **6,932** |
| **Kinder Morgan Canada Limited** | **KML.TO** | **CAD** | **$16.00** | **NEUTRAL** | **$15.59** | **116** | **1,813** |
| Logistec | LGTa.TO | CAD | | NR | $44.00 | 7 | 325 |
| Parkland Fuel Corp. | PKI.TO | CAD | | NR | $40.12 | 146 | 5,860 |
| **Pembina Pipeline Corporation** | **PPL.TO** | **CAD** | **$54.00** | **OUTPERFORM** | **$50.04** | **509** | **25,469** |
| Tidewater Midstream | TWM.TO | CAD | | NR | $1.47 | 331 | 486 |
| **TransCanada Corp.** | **TRP.TO** | **CAD** | **$70.00** | **OUTPERFORM** | **$62.05** | **924** | **57,306** |
| Valener Inc. | VNR.TO | CAD | | NR | $26.20 | 39 | 1,031 |
| Westshore Terminals | WTE.TO | CAD | | NR | $21.15 | 67 | 1,411 |
| **Utilities/Power** | | | | | | | |
| Algonquin Power and Utilities | AQN.TO | CAD | | NR | $15.30 | 499 | 7,634 |
| AltaGas Canada Inc. | ACI.TO | CAD | | NR | $19.09 | 30 | 573 |
| Atco Ltd. | ACOx.TO | CAD | | NR | $46.11 | 101 | 4,677 |
| Atlantic Power | ATP.TO | CAD | | NR | $3.20 | 110 | 351 |
| **Brookfield Infrastructure Partners** | **BIP.N** | **USD** | **$46.00** | **OUTPERFORM** | **$41.44** | **393** | **16,274** |
| **Brookfield Renewable Partners** | **BEP_u.TO** | **CAD** | **$36.58** | **OUTPERFORM** | **$41.70** | **180** | **7,497** |
| **Canadian Utilities Limited** | **CU.TO** | **CAD** | **$36.00** | **NEUTRAL** | **$36.65** | **274** | **10,043** |
| **Capital Power Corporation** | **CPX.TO** | **CAD** | **$28.00** | **NEUTRAL** | **$31.38** | **102** | **3,206** |
| **Emera Inc.** | **EMA.TO** | **CAD** | **$50.00** | **NEUTRAL** | **$50.44** | **236** | **11,896** |
| **Fortis Inc.** | **FTS.TO** | **CAD** | **$50.00** | **NEUTRAL** | **$50.00** | **431** | **21,546** |
| **Hydro One Limited** | **H.TO** | **CAD** | **$19.00** | **UNDERPERFORM** | **$21.28** | **596** | **12,682** |
| Innergex Renewable | INE.TO | CAD | | NR | $14.23 | 133 | 1,900 |
| Maxim Power Corp. | MXG.TO | CAD | | NR | $1.98 | 53 | 104 |
| Northland Power | NPI.TO | CAD | | NR | $23.95 | 179 | 4,292 |
| **TransAlta Corporation** | **TA.TO** | **CAD** | **$10.00** | **NEUTRAL** | **$9.80** | **285** | **2,789** |
| TransAlta Renewable | RNW.TO | CAD | | NR | $13.78 | 264 | 3,638 |
| **Diversified Financials** | | | | | | | |
| **Brookfield Asset Management** | **BAM.N** | **USD** | **$58.00** | **OUTPERFORM** | **$31.38** | **994** | **31,198** |
| **Brookfield Business Partners** | **BBU.N** | **USD** | **$50.00** | **OUTPERFORM** | **$39.79** | **177** | **7,060** |

**BAM, BBU, and BIP are in USD*

**NR = Not Under CS Coverage*

Source: Credit Suisse estimates

# An Overview

- Assessing the Infrastructure Opportunity

- Multiple Maps with Meaning
  - A picture is worth a thousand words
  - Given the nature of the assets, maps are necessary

- Analytical Approach
  - Understand Supply-Demand: Regionally and Globally
  - Regulatory Dynamics along with legal and political realities are paramount
    - Never underestimate regulatory power as everything can change with the stroke of pen
    - A lot turns on notions of “reasonableness” which is a difficult concept
  - Long-cycle industry
    - Quarters are not as important as longer-term sustainable trends
    - Be concerned about the quality of the moat surrounding a business
  - Debt markets more important than equity markets
    - More debt than equity on most balance sheets
    - Affects financing and relative valuation through the cycle

# Assessing the Infrastructure Opportunity

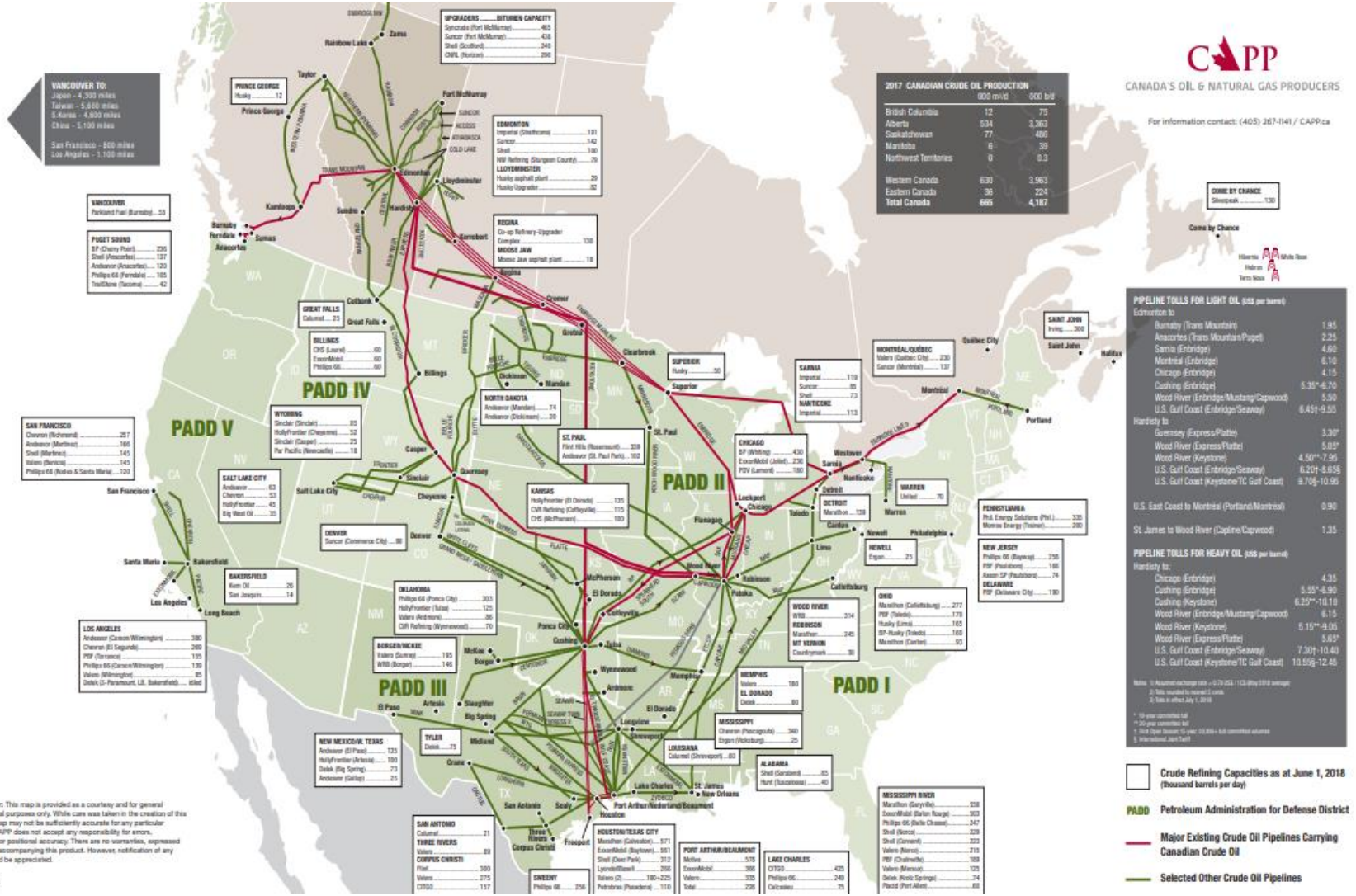
- The Canadian Energy Infrastructure Players are among the most significant in North America, but also in a Global context
- Market capitalization of the Canadian sector is roughly US$270bn and, in a broad sense, comprises ~15% of the TSX Composite (the main Canadian benchmark)
- Some key statistics:
  - Canadian companies move more than ~40% of North America's natural gas volumes
  - Canadian companies move ~30% of North American crude volumes
  - The Western Canadian Sedimentary Basin is largely dominated by Canadian infrastructure companies in the value chain

**iShares Global Infrastructure ETF Constituents**

| Ticker | Name | % Weighting of Index |
|---|---|---|
| TCL | Transurban Group | 5% |
| AENA | AENA SME SA | 4.94% |
| **ENB** | **Enbridge** | **5%** |
| ATL | Atlantia SpA | 4.51% |
| NEE | NextEra Energy | 4% |
| DUK | Duke Energy Corp | 3.12% |
| D | Dominion Energy Inc | 3% |
| **TRP** | **TransCanada Corp** | **2.76%** |
| IBE | Iberdrola SA | 3% |
| GET | Getlink SE | 2.66% |

*"On a variety of Infrastructure Indices, the Canadian names are among the most frequently inclusions with sizeable weights. Namely: Enbridge, TransCanada, Inter Pipeline and Pembina Pipeline"*

# Major North American Crude Oil Pipelines and Refineries



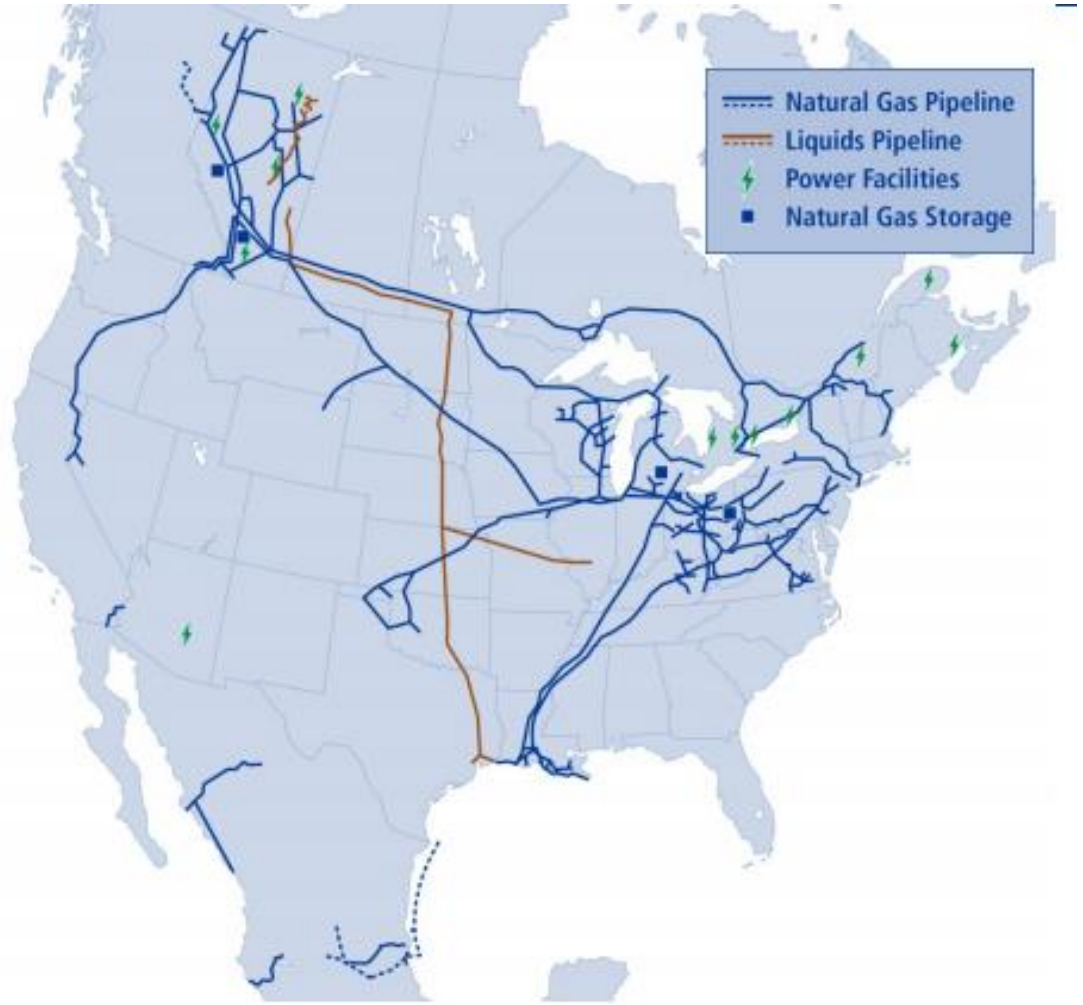

Source: Enbridge Inc.

# Enbridge's Asset Base – *Large Scale Natural Gas and Liquids Pipelines Across the Continent*



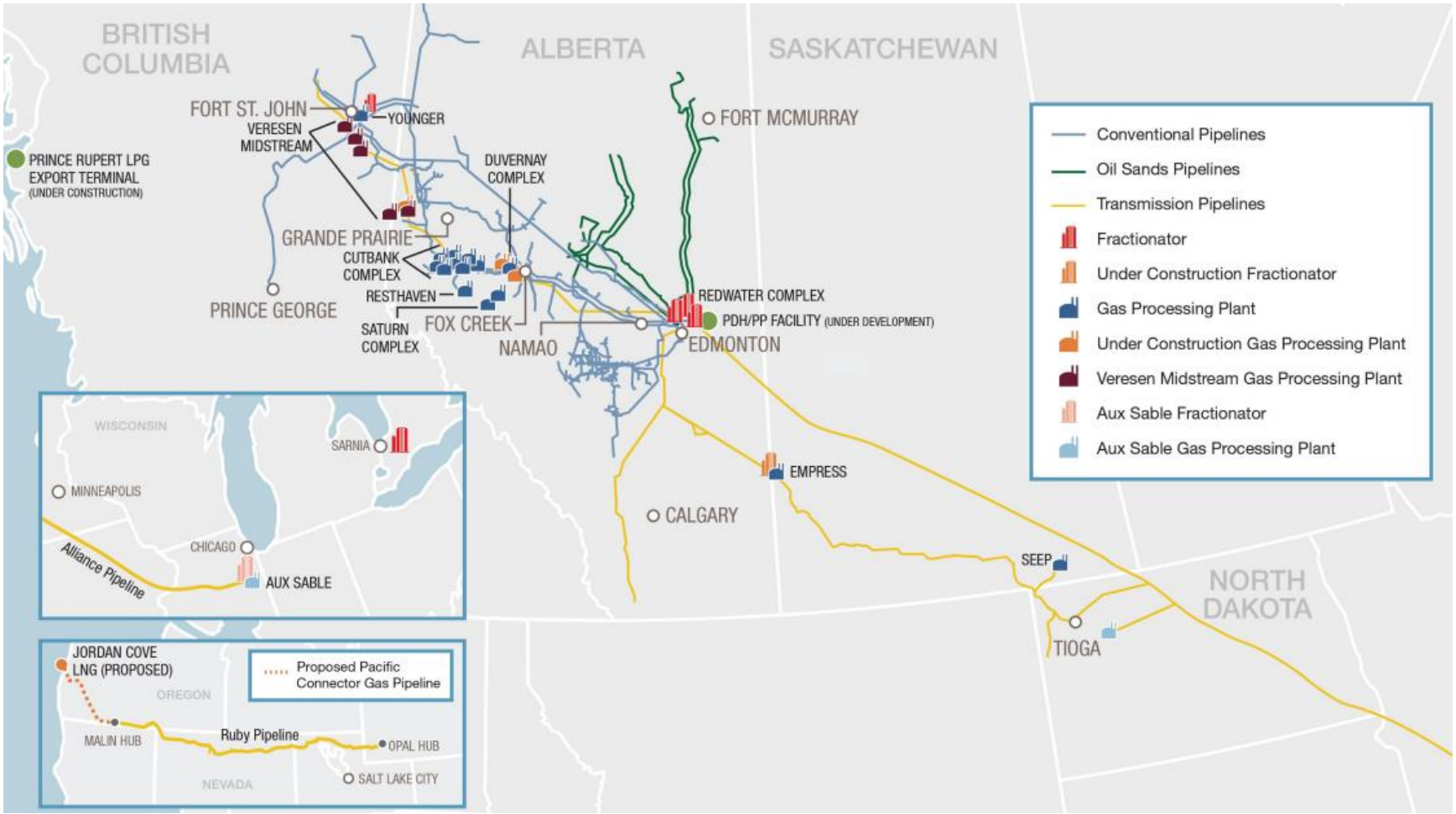

Source: Enbridge Inc.

# TransCanada – *Key Crude Pipes (with Controversy) and Concentrated M&Ms Positioning (Marcellus & Montney)*



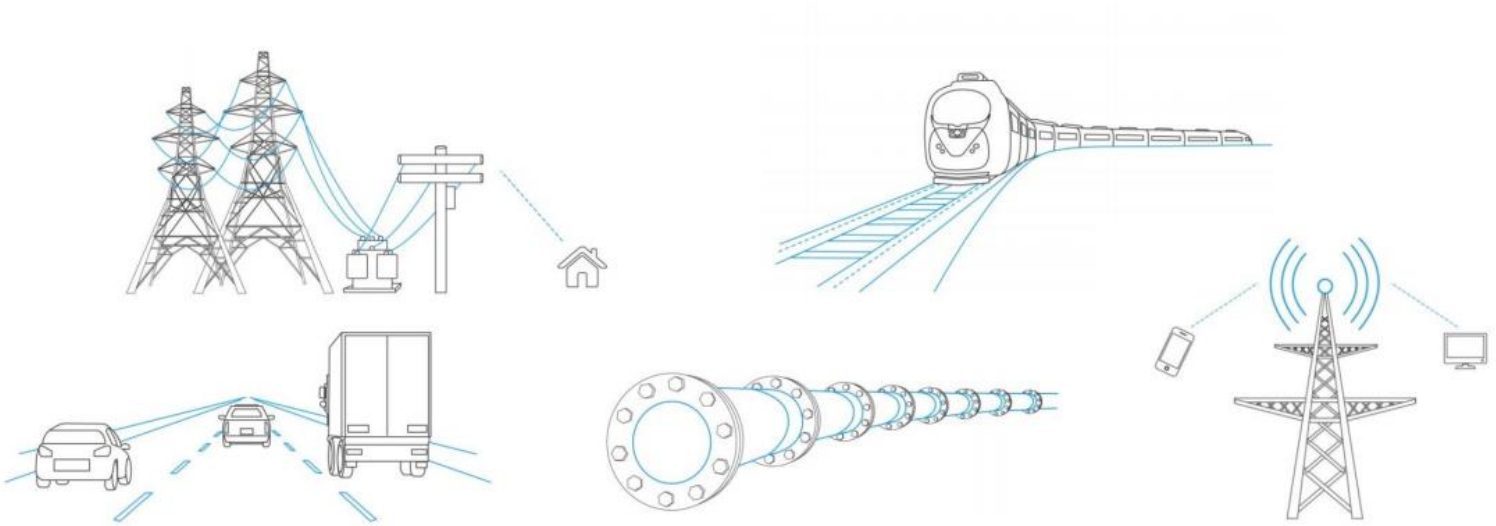

Source: TransCanada Corp.

# Pembina's - *A Natural Network on Canada's Shale Plays*




Source: Pembina Pipelines

# BIP – Growing a Midstream Business: *North America and Beyond in Core Markets with Size*



## 2018 Year in Review

**Sale of Chilean Transmission Assets**



**Purchase of North River**



**Enercare Purchase**

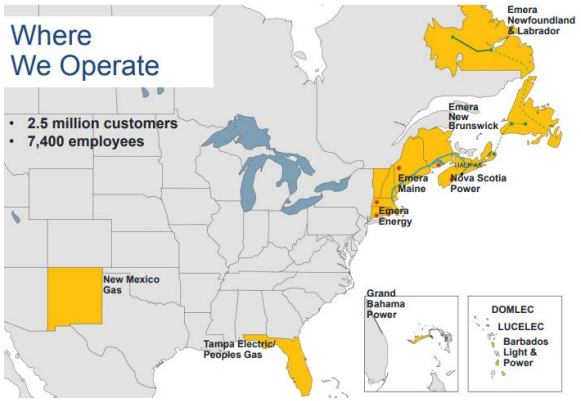
**Indian Foray with the Purchase of EWPL**



Source: Brookfield Infrastructure Partners

# Selected Canadian Utility Company Asset Maps

## Emera




Source: *Emera*

## Fortis



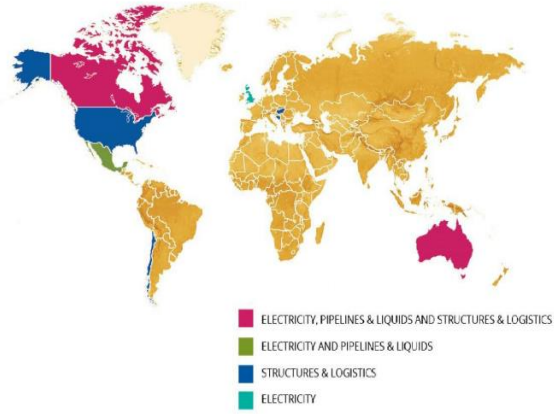

Source: *Fortis*

## Hydro One



Source: Hydro One

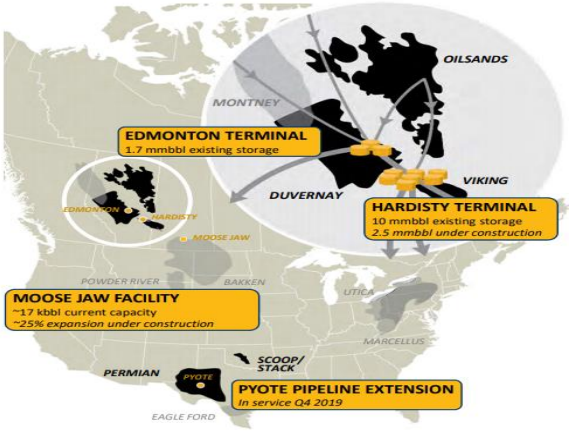
## Canadian Utilities



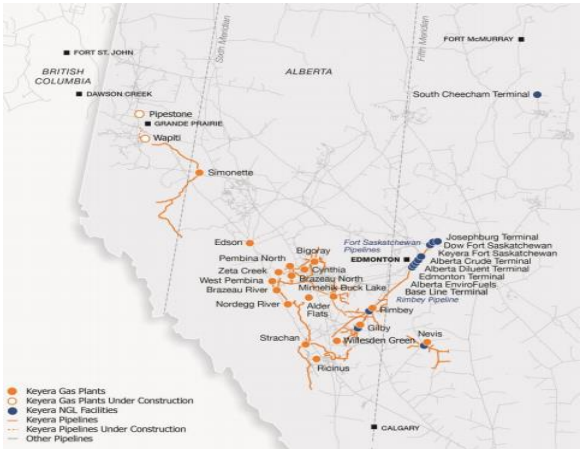

Source: Canadian Utilities

# Selected Other Maps

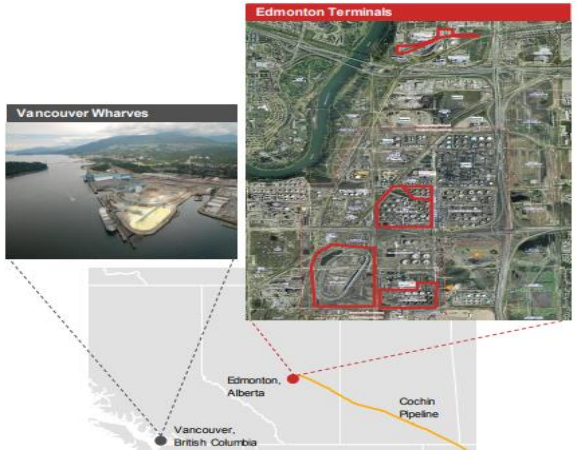
## Gibson Energy



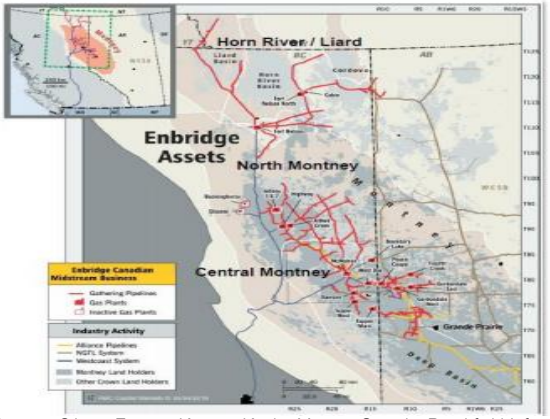

## Keyera



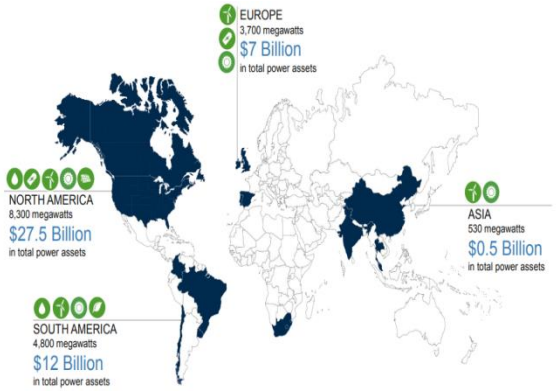

## Kinder Morgan Canada



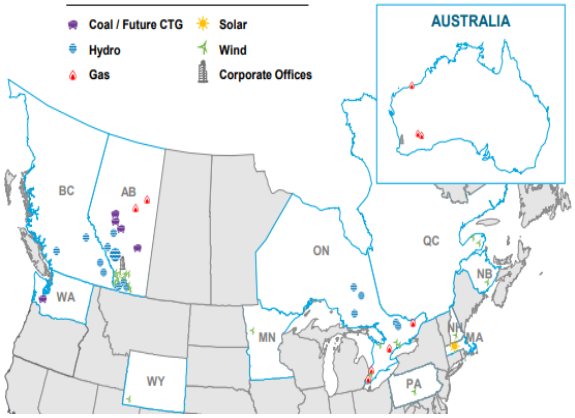

## Brookfield's North River Assets




## Brookfield Renewable Portfolio




## TransAlta Portfolio




Source: *Gibson Energy, Keyera, Kinder Morgan Canada, Brookfield Infrastructure Partners, Brookfield Renewable Partners & TransAlta*

# Analytical Approach

- Supply-demand dynamics matter for those putting steel into the ground
  - You cannot easily move the asset, so spend a lot of time on the underlying fundamentals to appreciate the potential risk-reward
- Regulatory dynamics and Political Perils
  - Never underestimate regulatory power as everything can change with the stroke of pen
  - A lot turns on notions of “reasonableness” which is a difficult concept
  - Appreciate the political reality of any jurisdiction(s) – especially when crossing borders
  - In the last decade, too much time spent focused on courts and political process – but that is how things have changed
- Assessing Infrastructure as a Long-cycle industry
  - Quarters are not as important as longer-term sustainable trends
  - Be concerned about the quality of the moat surrounding a business
  - Delving into some differences that make Canada unique
- Debt markets more important than equity markets
  - More debt than equity on most balance sheets
  - Affects financing and relative valuation through the cycle
  - For many reasons, the Canadians are also the clear capital market leaders with a robust ability to use preferred shares along with commercial paper market access

# Supply-Demand

- Some considerations in relation to Supply and Demand include:
  - There are broader global markets, but regional and local dynamics are typically more important on a company-by-company basis in the short-term; whereas, the big supply-demand themes tend to be longer-term in nature (putting aside major global disruptions)
  - Appreciate the underlying geology as resource bases face different dynamics and decline rates, water cuts, parent-child issues, quality of the product coming out of the ground and, among other things, the types of rock can notably impact infrastructure assets
  - Take a very pragmatic view of producer expectations and production guidance
  - There is an array of hydrocarbons to consider on the spectrum
  - Power market dynamics revolve around the world's most volatile commodity (i.e. electricity) that fluctuates dramatically intra-day and on other intervals, but is the lifeblood of an economy
  - Government related issues, including: the rule of law, the nature of the regulatory process, the business climate, royalty regimes and government stability
  - Timing is Everything!

# Revisiting Regulatory

- The Regulatory Compact Matters
  - A considerable amount of the infrastructure sector is a natural monopoly and, accordingly, there is a need for regulation to prevent the exercise of monopoly power
  - Many critical regulatory principles turn on the notion of "reasonableness" with reasonable returns in a service territory or asset base being part of the Regulatory Compact
  - Reasonable rates of return can turn on several notions, including:
    - A mechanical formula that typically revolves around Sovereign Bond Yields plus an Equity Risk Premia or some other similar return calculations
    - What are reasonably comparable assets for similarly situated assets?
    - What return profile is required to attract capital?
    - What would an unconstrained free-market support in the absence of regulation?
  - "Reasonable" goes beyond rates of return and also considers capital profiles, tariffs (with a view of avoiding rate shock), extreme and unforeseen events, etc.

# Political Perils

- For the most part (putting aside the recent issues with the Province of Ontario and Hydro One), the level of politicization with regulatory processes and, broadly, infrastructure assets in Canada is far less than many jurisdictions

- In one form or another, ***NIMBY-ism (Not in My Back Yard) or BANANA (Build Absolutely Nothing Anywhere Near Anyone)*** have long existed, however, the coordinated efforts to fight infrastructure projects in the courts and regulatory process has become more pronounced

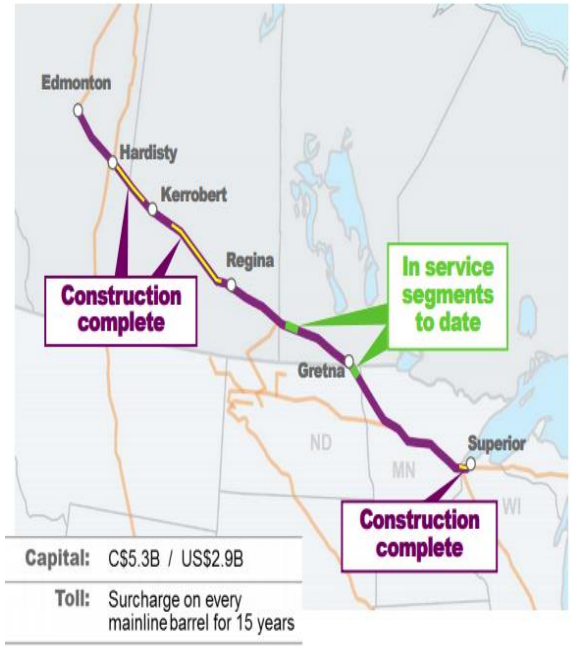
- For pipelines, the process became more challenging roughly 10-years ago and the often mundane regulatory processes grew in prominence and became much more political. Regulators in Canada are not overtly political, however, the politics around them is becoming more challenged – especially with the larger and more controversial projects

- Election activity matters much more than previously – which is extremely difficult for capital allocation in a long-dated industry with approval processes on mega-projects now taking longer than a decade. Therefore, the political process requires a lot more attention and needs to be risked.

- A consequence of the political realities is that larger projects are really becoming the domain of only a handful of companies – that if completed should be able to earn excess returns.

# Pipeline Purgatory: Thoughts on L3R, KXL and TMEP

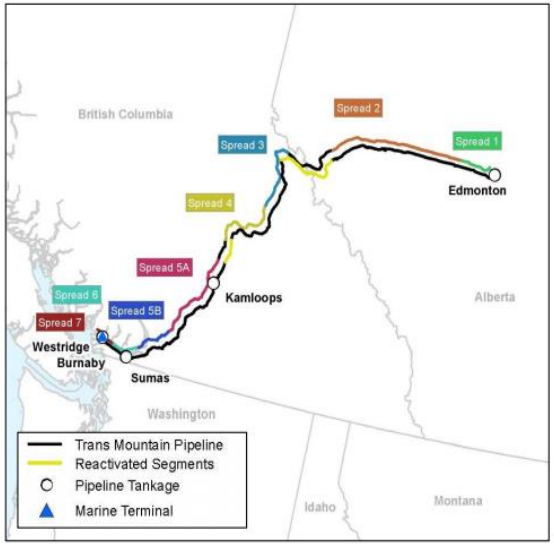
### Line 3 Replacement




### Keystone XL




### Trans Mountain Expansion Project




Source: Enbridge, Kinder Morgan and TransCanada Corp.

# Assessing Infrastructure as a Long Cycle Industry

- Supply-Demand dynamics underpin capital investment decisions
- Quarters don't matter as much as the years, but they provide capital market opportunities
- Networks Matter – incrementalism is a critical advantage
- Legacy investments are extremely important as significant cost advantages can exist versus new investments
- The Path to Approval: How easy/difficult and does it translate into an acceptable return profile
- How Big is the Moat: what other options exist – for both the supply/demand and substitution
- Consider the counterparties and the quality of contracts
- On a continual basis: Don't forgot about the Political and Regulatory Environment

# Delving into Differences

- What is the duration of the resource along with the counterparty exposure?
- Nature of the contracts or regulatory environment will affect the debt market access, the pricing of debt, covenants and,  in general, the volatility around returns
- Canadian capital markets are robust for preferred shares and other hybrid products that provides an overall cost-of-capital advantage versus many other regions
- There Canadian capital market is skewed with mainly longer-term money and far less hedge fund or shorter-term money than the US – these factors matter for investing behaviour and fundamentally how stocks will act around events
- Canadian has a petrodollar and large weights for Energy Infrastructure stocks on the overall index along with Energy and Materials – these broader Index/Country moves can significantly affect performance
- Regulatory framework in Canada is quite different and not typically politicized

# A Debt Discussion

- Given the nature of the asset base, most of the balance sheets in the sector have well above average debt levels compared to the broad market
- In many cases, debt will form the majority of the balance sheet – especially if one considers the use of hybrid instruments along with preferred equity
- Therefore, following the debt markets, terms, spreads, issuance trends is often more important than equity markets to understand the major pivots in valuation
- As with many assets, the financing environment significantly affects valuation through the cycle on a macro basis, but also on a granular level of regulated returns in a rate base construct (or similar design)
- The Canadians tend to have very robust ability to use preferred shares along with commercial paper market access in multiple global markets with duration

# Some Key Themes

01 **Public-Private Divide and Valuation Deltas**

02 **The Rates Reality**

03 **Focused on Flows**

04 **Foreign Exchange**

# The Public-Private Valuation Divide

## YTD Private Market Activity in the North American Midstream Space

| Announce Date | Buyer | Sellers | Asset | Deal Value ($MM) | EBITDA Multiple |
|---|---|---|---|---|---|
| 4/2/2019 | Stonepeak Infrastructure Partners | Concho Resources, Quantum Energy, Post Oak and WPX | Oryx Gathering System | $3,600 | |
| | Brookfield | Reliance Utilities | East-to-West Pipeline | $1,830 | |
| 3/18/2019 | Canada Pension Plan Investment Board | The Williams Companies Inc | OVM and UEO | $1,340 | 16x |
| 1/31/2019 | The Blackstone Group; GIC; Enagas SA | Tallgrass Energy LP | Tallgrass Energy | $4,775 | 12.6x |
| 1/10/2019 | SemCAMS Midstream ULC | KKR & Co LP; SemGroup Corp | SemCAMS Midstream | $1,009 | |

## North American Large Diversified Midstream Public Valuations as of 4/10/2019

| | Ticker | Price on 9-Apr-19 | Market Cap ($m's) | EV ($m's) | EV/EBITDA 2019E | EV/EBITDA 2020E | 2YR EBITDA Growth (%) | Leverage 2019E |
|---|---|---|---|---|---|---|---|---|
| **Large Diversified** | | | | | | | | |
| DCP Midstream LP | DCP | $ 32.97 | $ 4,725 | $ 10,031 | 8.4x | 7.3x | 12% | 4.4x |
| Enbridge Inc. | ENB.TO | $ 49.14 | $ 99,417 | $ 163,509 | 12.6x | 11.7x | 4% | 4.8x |
| Enterprise Products Partners LP | EPD | $ 29.26 | $ 63,929 | $ 89,763 | 12.0x | 11.4x | 5% | 3.5x |
| Energy Transfer LP | ET | $ 15.47 | $ 40,522 | $ 86,131 | 8.3x | 8.0x | 14% | 4.4x |
| Keyera Corp. | KEY.TO | $ 31.77 | $ 6,729 | $ 9,063 | 11.0x | 10.0x | 6% | 2.8x |
| MPLX LP | MPLX | $ 32.60 | $ 25,890 | $ 39,214 | 10.1x | 9.2x | 11% | 3.4x |
| ONEOK Inc | OKE | $ 69.87 | $ 28,838 | $ 38,207 | 14.6x | 12.2x | 13% | 3.6x |
| Pembina Pipeline Corporation | PPL.TO | $ 49.50 | $ 25,194 | $ 32,574 | 11.2x | 10.6x | 12% | 2.5x |
| Phillips 66 Partners LP | PSXP | $ 52.04 | $ 6,458 | $ 9,505 | 7.6x | 6.7x | 11% | 2.5x |
| Tallgrass Energy LP | TGE | $ 24.54 | $ 6,877 | $ 10,073 | 10.1x | 10.5x | 43% | 3.2x |
| TransCanada Corp. | TRP.TO | $ 61.31 | $ 56,623 | $ 96,148 | 10.3x | 9.9x | 7% | 4.2x |
| Targa Resources Corp | TRGP | $ 39.99 | $ 9,297 | $ 15,725 | 11.6x | 9.1x | 28% | 4.7x |
| Williams Companies Inc | WMB | $ 28.71 | $ 34,789 | $ 57,035 | 11.3x | 10.6x | 7% | 4.4x |
| Buckeye Partners LP | BPL | $ 33.76 | $ 5,192 | $ 9,905 | 11.2x | 10.3x | -2% | 4.7x |
| Andeavor Logistics LP | ANDX | $ 34.85 | $ 8,557 | $ 13,511 | 9.5x | 8.7x | 13% | 3.5x |
| Kinder Morgan Inc. | KMI | $ 19.89 | $ 45,023 | $ 79,067 | 10.3x | 9.9x | 3% | 4.4x |
| **Large Diversified Average (Market-Cap Weighted)** | | | | | 11.2x | 10.4x | 8.3% | 4.1x |

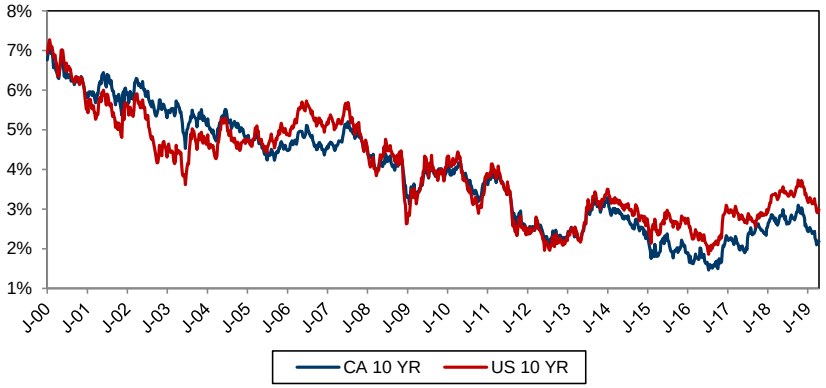
Source: Thomson Reuters

# An Infrastructure Advantage

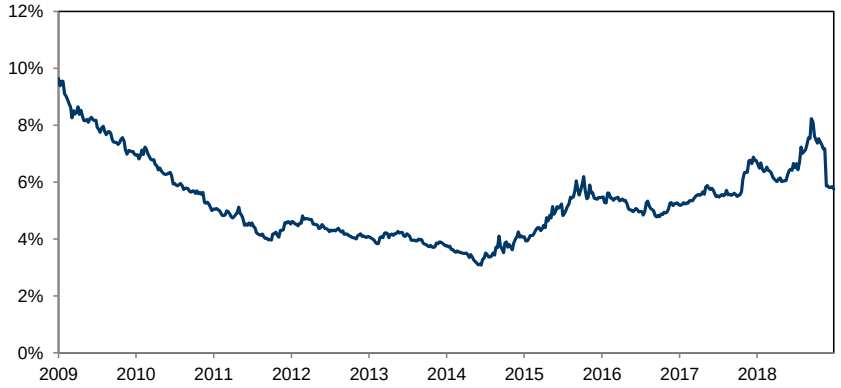
- Related to the public-private valuation divide is the valuation delta existing between many energy producing companies that hold infrastructure and the pure infrastructure companies
- Less volatile business models (not being a price-taker) and the often very significant use of debt create a cost-of-capital advantage for the infrastructure names
- Accordingly, the potential for an accelerating M&A theme among energy commodity producers may create a number of very interesting asset acquisition opportunities for infrastructure players along with surfacing value for the producer
- Counterparty risk, contractual terms, transfer pricing and other factors will be some of the key pivot points in the determining the potential for value creation from this potential market opportunity

# The Rates Reality

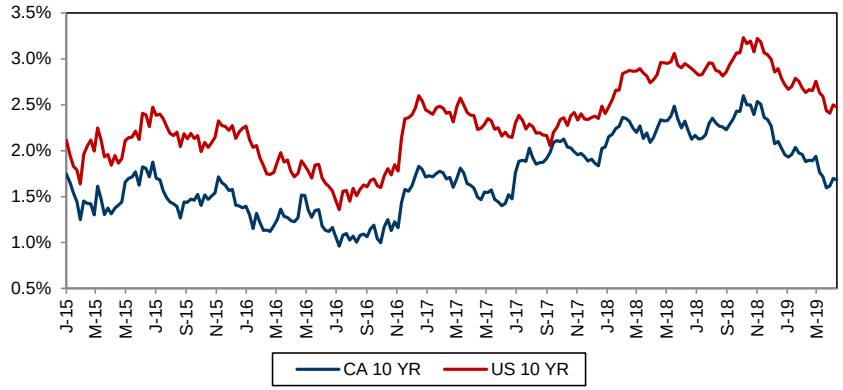
**Canadian and US 10 YR Yields**
Jan 2000 - April 2019




**Midstream Dividend Yield**
April 2009 - April 2019




**Canadian and US 10 YR Yields**
Jan 2015 - April 2019




**Midstream Dividend Yield Spread**
April 2009 - April 2019




Source: Bloomberg

# Rates Reality Part Deux

- The reality of interest rates underpins return frameworks in many regulatory environments – either explicitly or implicitly

- In an industry with limited growth, the ability to compound capital is critical and there is a major focus from infrastructure investors on dividend growth rates

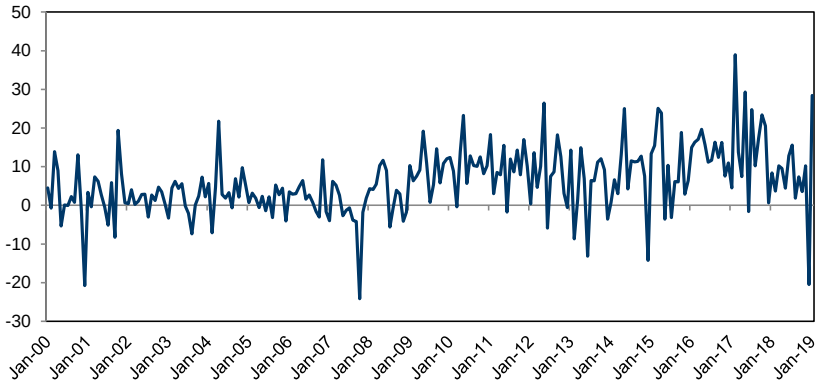
- Many investors (long-only and hedge fund) will have a major focus on the ability for an infrastructure company to deliver dividend growth through the cycle with a good understanding of the dividend (sometimes distribution) discount model (DDM) at the foundation:

$$P = \frac{D}{k-g}$$

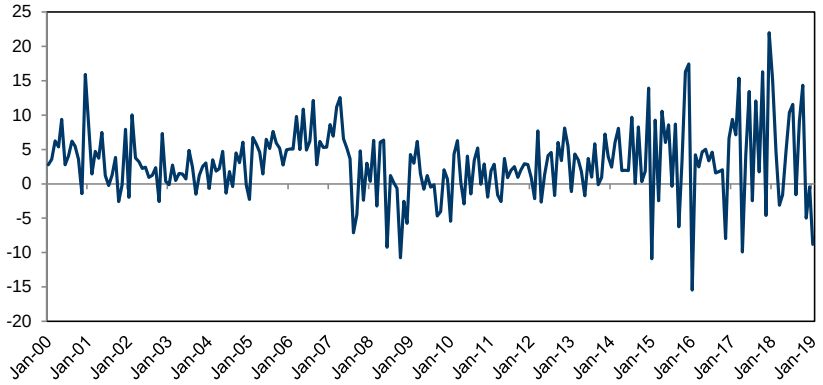
*P = Price*
*D = Dividend*
*k = Required Return*
*g = Growth Rate*

# Focused on Funds Flow

**Foreign Investment into Canadian Securities (in C$ Billions)**
Jan 2018 - Jan 2019




**Canadian Investment in Foreign Securities (in C$ Billions**
Jan 2018 - Jan 2019

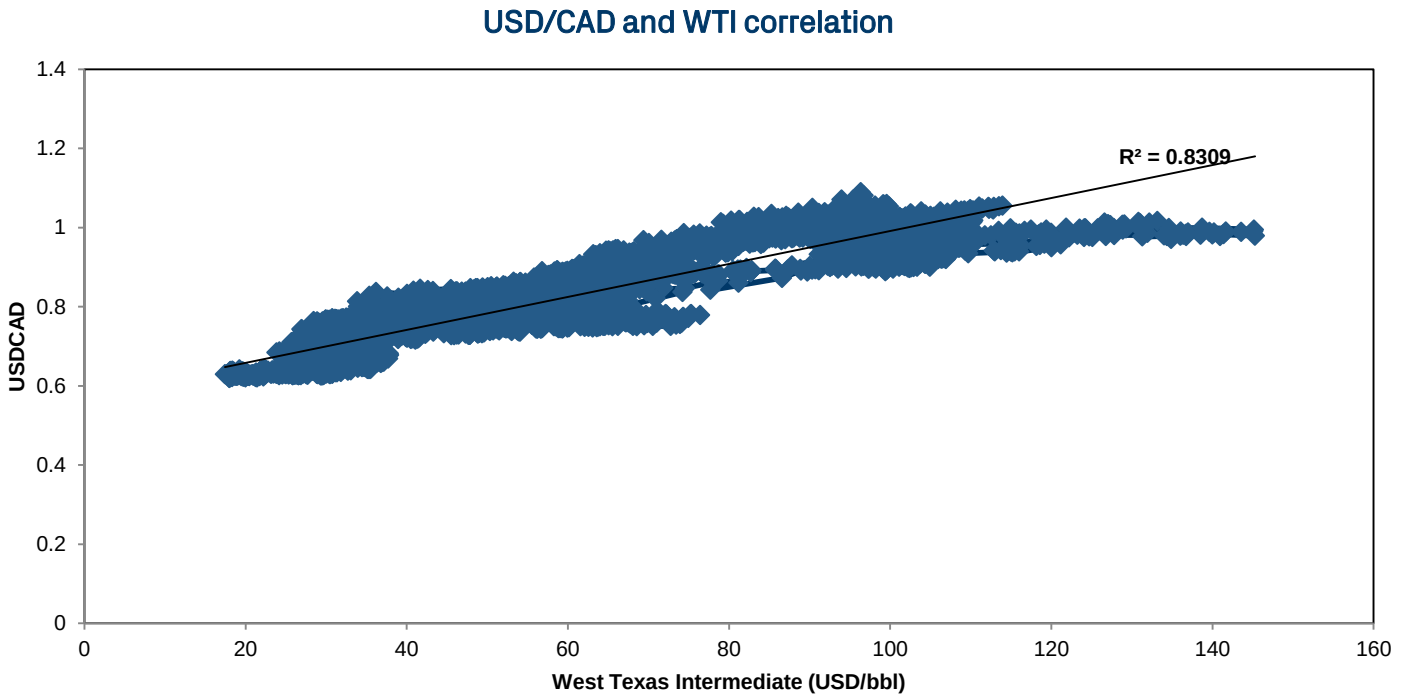



| | Jan-18 | Feb-18 | Mar-18 | Apr-18 | May-18 | Jun-18 | Jul-18 | Aug-18 | Sep-18 | Oct-18 | Nov-18 | Dec-18 | Jan-19 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Foreign Investment into Canadian Securities** | **8.37** | **3.67** | **10.20** | **9.52** | **4.41** | **12.76** | **15.57** | **1.86** | **7.39** | **3.59** | **10.24** | **-20.49** | **28.40** |
| Canadian Money Market Instruments - Governments | -1.12 | 1.98 | 2.15 | -3.15 | -0.59 | 0.38 | -1.09 | 1.10 | 5.32 | 2.22 | 1.85 | -0.03 | 2.35 |
| Canadian Money Market Instruments - Corporations | 7.95 | 0.25 | 4.19 | 1.20 | -1.71 | -1.85 | 1.00 | 2.82 | 1.12 | -4.69 | -2.26 | -0.80 | 2.72 |
| Canadian Bonds - Government | -3.02 | -9.07 | -13.66 | -1.86 | 0.98 | -1.74 | 6.74 | -2.76 | -7.38 | 2.69 | 5.15 | -9.37 | 15.20 |
| Canadian Bonds - Corporations | 2.02 | 7.65 | 16.85 | 10.90 | 8.60 | 14.49 | 5.92 | -4.60 | 7.07 | 1.57 | 2.56 | -15.50 | -0.89 |
| Canadian Equity and Investment Fund Shares | 2.53 | 2.85 | 0.66 | 2.42 | -2.86 | 1.48 | 3.01 | 5.30 | 1.26 | 1.80 | 2.94 | 5.21 | 9.02 |
| **Canadian Investment in Foreign Securities** | **15.17** | **4.65** | **-3.12** | **-1.62** | **4.67** | **10.38** | **11.57** | **-1.59** | **9.08** | **14.37** | **-4.98** | **-0.43** | **-8.80** |
| Foreign Money Market Instruments | -0.15 | 0.07 | 1.46 | -1.33 | 0.77 | -0.84 | 1.42 | -0.12 | 0.12 | 0.98 | 0.68 | -0.77 | -0.54 |
| Foreign Bonds | 0.78 | 0.82 | 6.10 | 4.50 | 7.73 | 7.26 | 11.13 | 2.28 | 3.79 | 4.33 | -0.33 | -0.30 | 2.08 |
| Foreign Equity and Investment Fund Shares | 14.54 | 3.76 | -10.68 | -4.79 | -3.83 | 3.96 | -0.99 | -3.75 | 5.17 | 9.06 | -5.33 | 0.64 | -10.34 |
| **Net Flows (Foreign Inv. In CA - CA Inv. Foreign Mkt.)** | **-6.80** | **-0.98** | **13.32** | **11.13** | **-0.26** | **2.38** | **4.00** | **3.45** | **-1.69** | **-10.78** | **15.22** | **-20.06** | **37.20** |

Source: Statistics Canada

# FX is a Big Issue for the Canadian Market

- Very simply, the CAD is largely viewed as a "petrodollar" and the overall capital market is skewed towards commodities (many of which are USD proxies)
- A stronger CAD impacts the economics of certain firms (cost structures), but can also benefit from non-Canadian operations having stronger cash flows




Source: Bloomberg, Credit Suisse Estimates

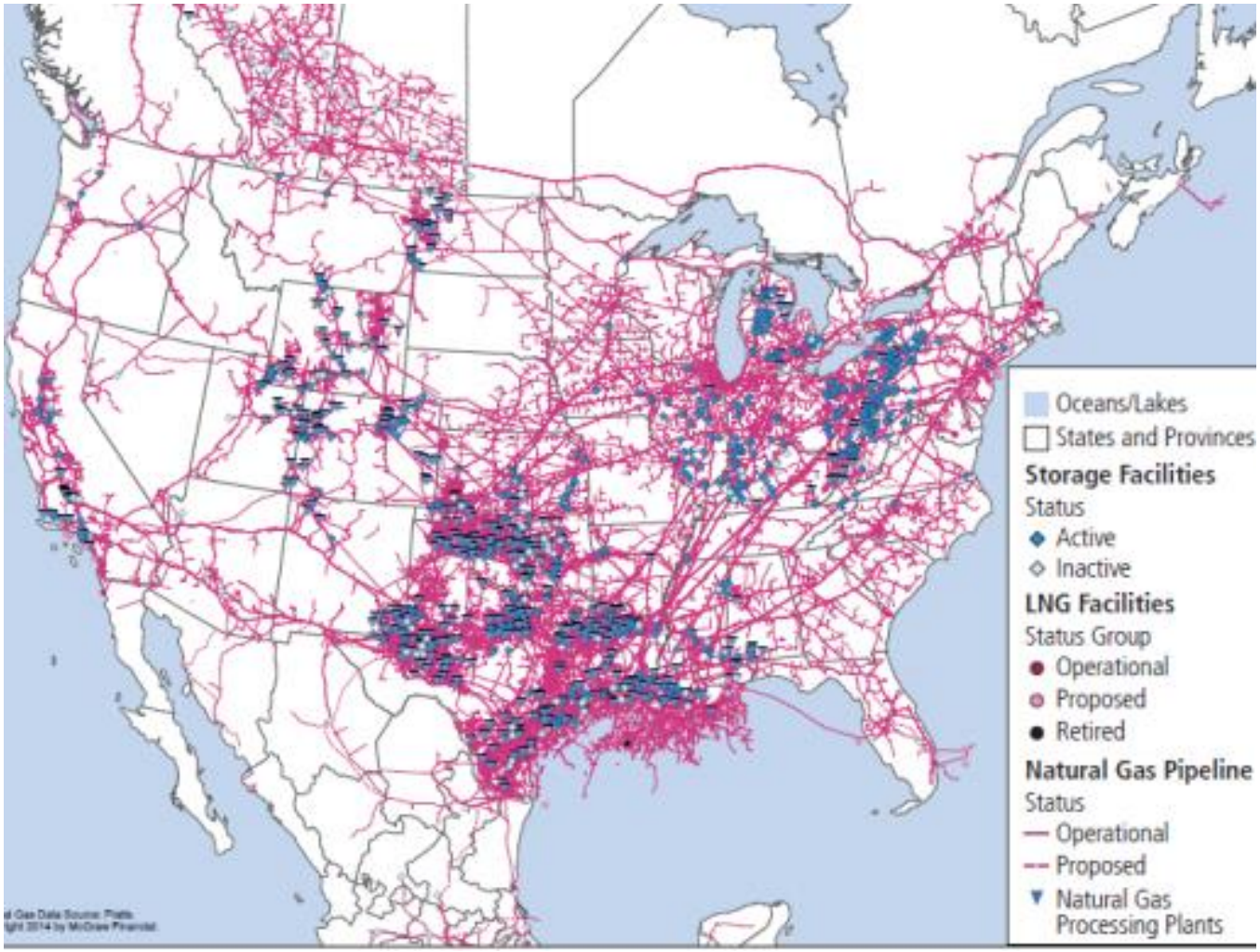
# Appendix: Considering Some of the Basics



# Natural Gas Developments

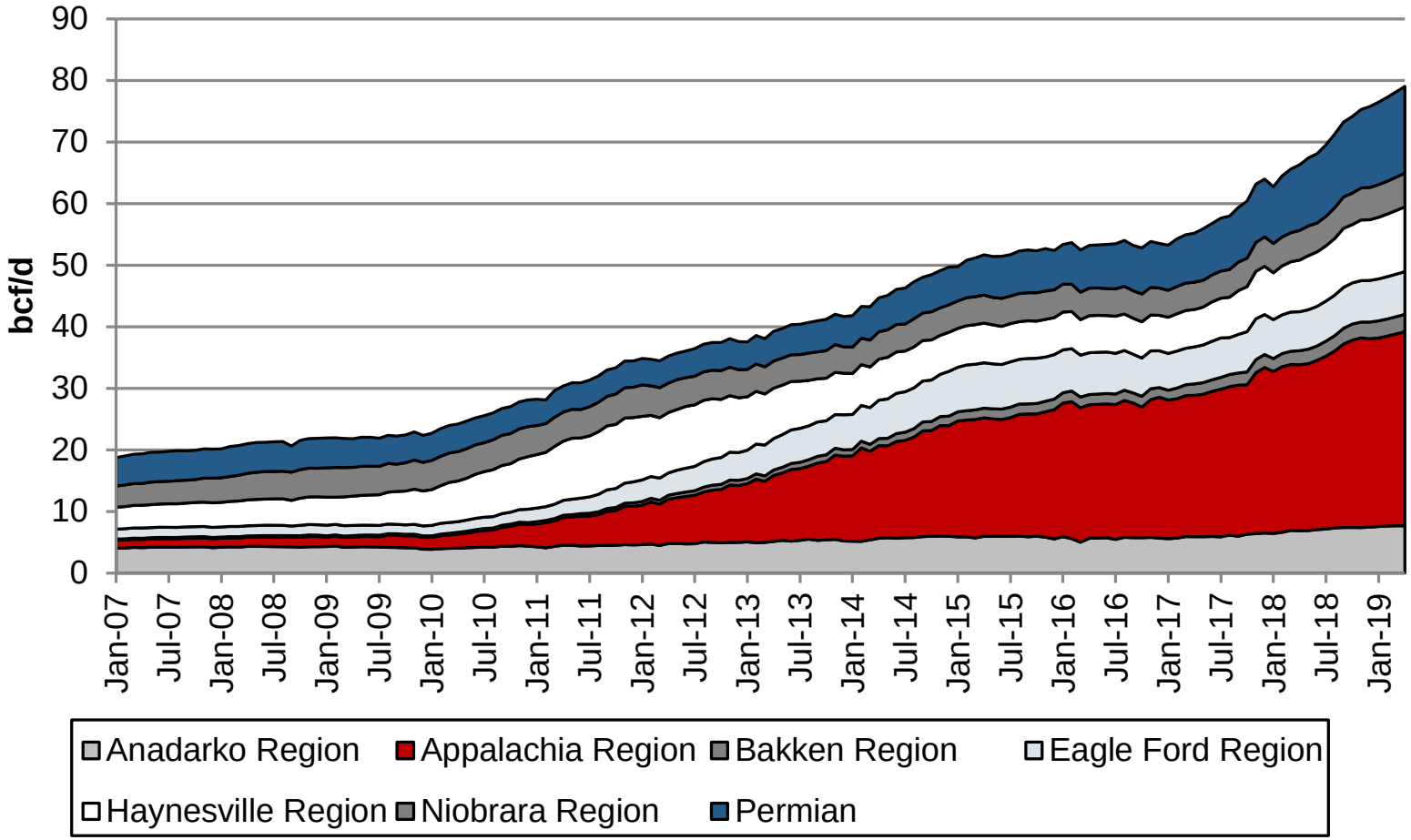


# Energy Infrastructure is Critical to Appreciate




Source: EIA

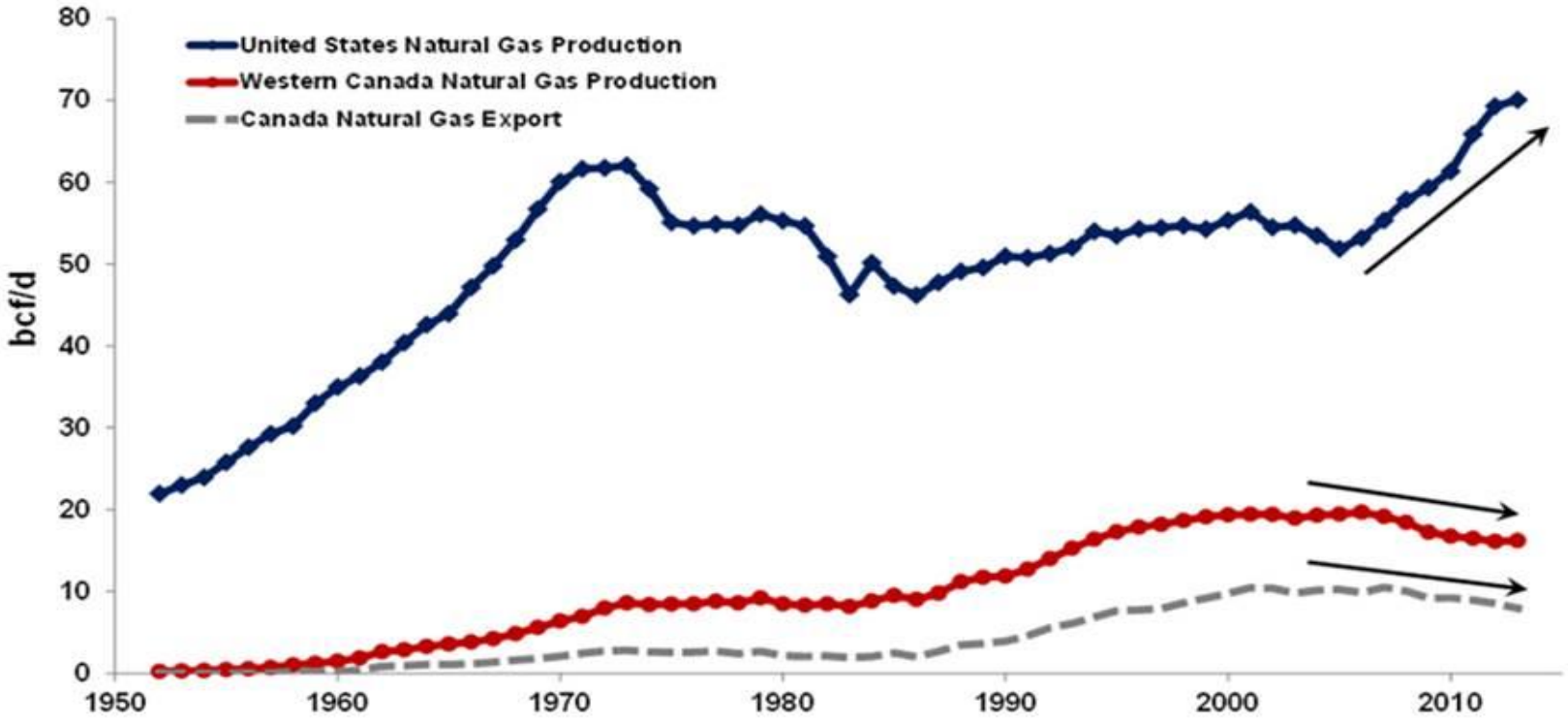
# The Rise of the Shale Plays had a Profound Impact on North America's Energy Infrastructure




Source: EIA

# US Growth and Canadian Declines: Helped Underpin Two Major Business Transformations (ENB and TRP)

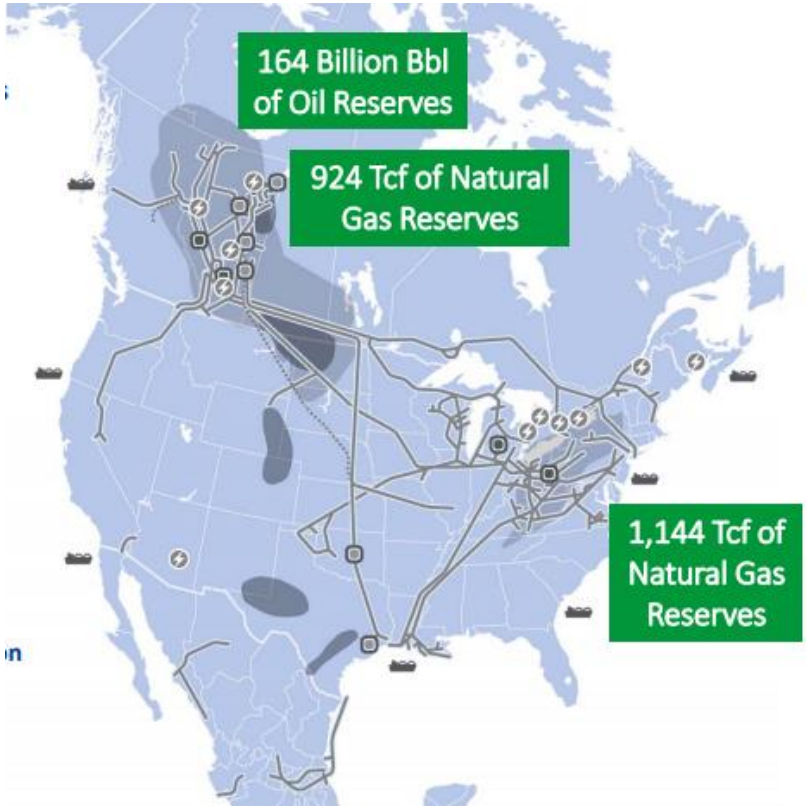
**Canadian vs. U.S. Gas Production**




Source: EIA, CAPP, Credit Suisse

# Enviable Shale Resource Base, but Proximity Matters

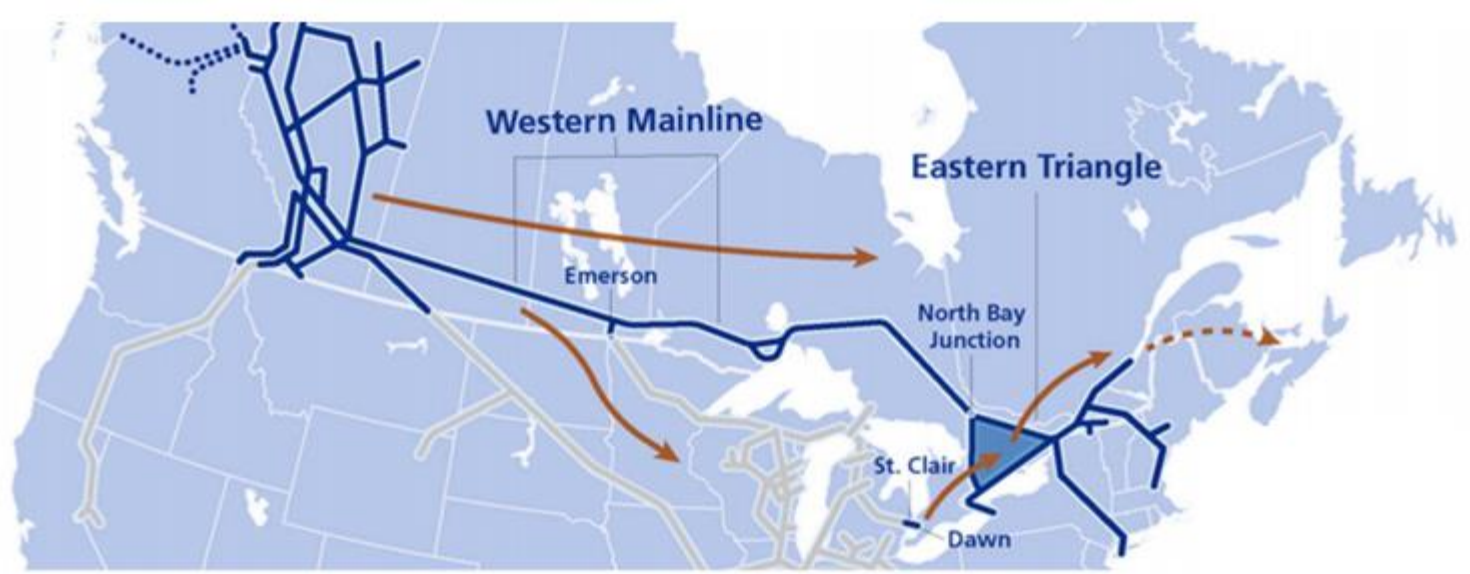
- Western Canada has a very prolific resource base of shale hydrocarbons with legacy infrastructure into some markets that are new battlegrounds against US shale plays.
- Proximity to demand matters, however, selected regions in the US have issues on building infrastructure
- In general, the major Canadian shale plays are more favourable in terms of fiscal regimes (royalty structures) along with having an undersupplied Natural Gas Liquids market (i.e. oil related diluent market) versus the US. Yet, some major risks exist around pricing differentials and regional infrastructure (versus long-haul egress).
- Canadian LNG developments face challenges, but are likely to occur in the mid-2020s.




Source: TransCanada, EIA, CAPP, Credit Suisse estimates

# Opportunities for the Montney and the Mainline

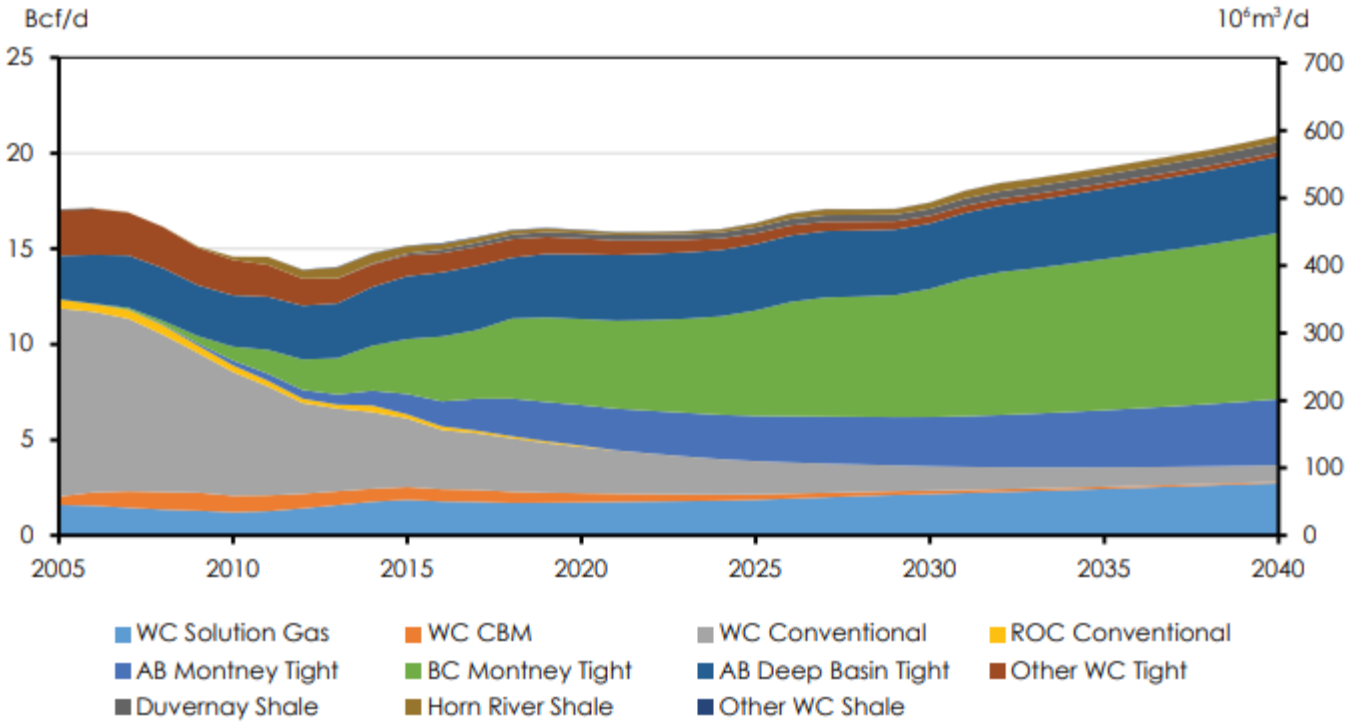
- Looks to be a very clear "Trump window" supporting selected pipeline projects;
- May provide opportunities to see significant re-purposing of existing infrastructure with new build that redirect commodity flows; in a meaningful fashion; and
- Extending existing assets on the basis of a "network effect" should provide the larger scale players some clear advantages.




Source: Company data, TRP Investor Presentation

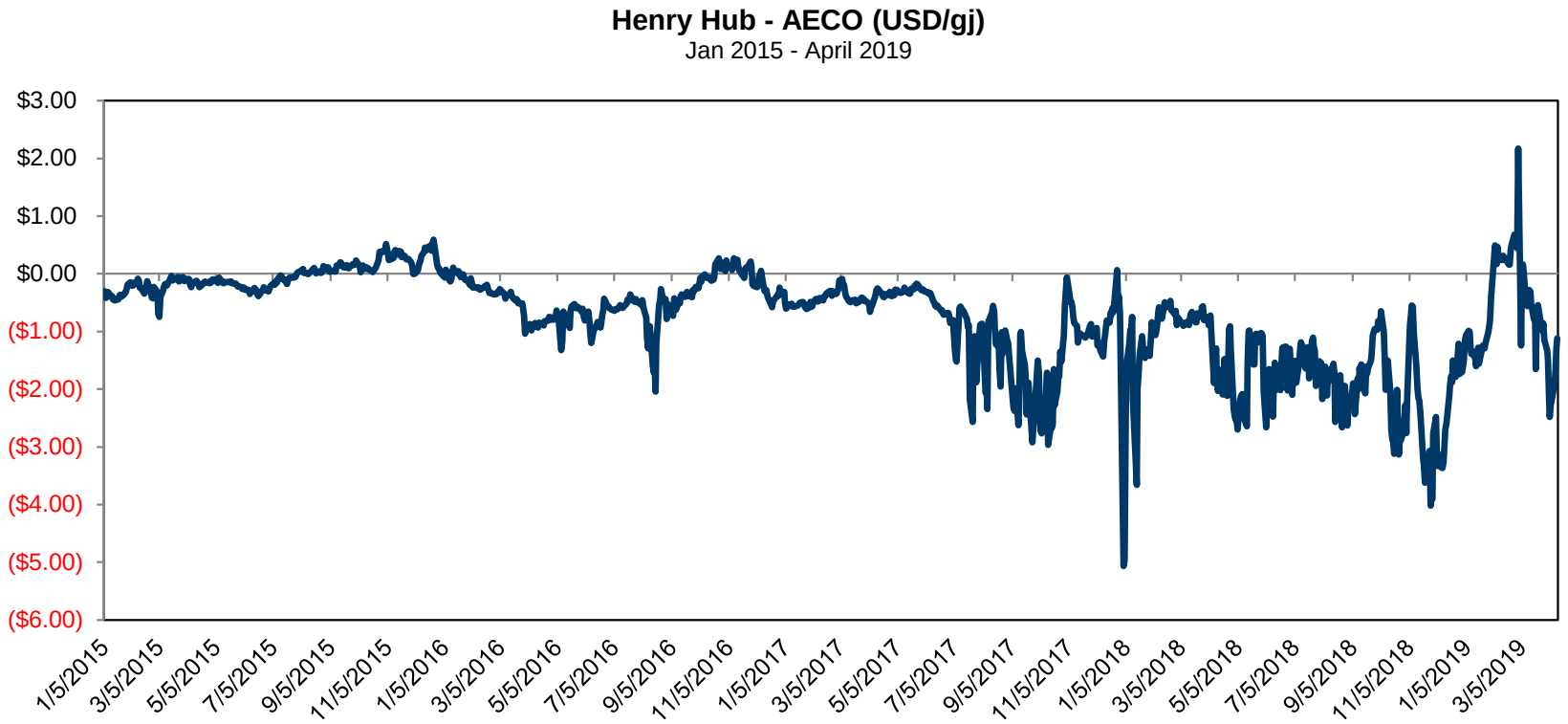
# Canadian Gas Production Outlook

- Canadian historical production peaked in 2001 at 17.5bcf/d, 15.2bcf/d in 2016, and expected to reach 16.9bcf/d in 2040 by NEB forecast under a robust HH gas price.
- Montney has grown to 30% of natural gas production, projected to reach 7.9bcf/d by 2040 – a 74% increase from 2016.
- Western Canadian conventional production made up 21% of total production in 2016, which will see a decline to 10% of total in 2040.




Source: NEB

# Consider the Basis Differentials




Source: Bloomberg

# Canada LNG Opportunity is Large, but Distant in Time

| Project | Export License | Export Volume Million Tons per Annum (Mtpa) - Billion Cubic Feet | Status | Owner | Start Year |
|---|---|---|---|---|---|
| Kitimat LNG | 20 | 10 MTPA - 1.3 Bcf/d | Proposed | Chevron | - |
| LNG Canada | 40 | 26 MTPA - 3.5 Bcf/d | FID | Shell, PETRONAS, Mitsubishi, KOGAS | Mid 2020s |
| Cedar LNG Project | 25 | 6.4 MTPA - 0.8 Bcf/d | Proposed | Hasila Nation | - |
| Orca LNG | 25 | 24 MTPA - 3.2 Bcf/d | Proposed | Orca Nation | - |
| New Times Energy | 25 | 12 MTPA - 1.6 Bcf/d | Proposed | New Times Energy | - |
| Kitsault Energy | 20 | 20 MTPA - 2.7 Bcf/d | Proposed | Kitsault Energy | - |
| Stewart LNG Export | 25 | 30 MTPA - 4.0 Bcf/d | Proposed | Stewart Energy | - |
| Triton LNG | 25 | 2.3 MTPA - 0.3 Bcf/d | Proposed | AltaGas/Kosan | - |
| Woodfibre LNG | 25 | 2.1 MTPA - 0.3 Bcf/d | Proposed | RGE Group | - |
| WesPac LNG Marine Terminal | 25 | 3 MTPA - 0.6 Bcf/d | Proposed | WesPac Midstream | - |
| Discovery LNG | 25 | 20 MTPA - 2.6 Bcf/d | Proposed | Rockyview Resources | - |
| Steelhead LNG | 25 | 30 MTPA - 4.3 Bcf/d | Proposed | | |
| Goldboro LNG | 25 | 10 MTPA - 1.4 Bcf/d | Proposed | Pieridae Energy | |

Source: Canadian LNG Projects

# Gathering, Processing and Transportation



# Thinking about the GPT business

- For natural gas infrastructure industry, the gathering, processing and transportation (GPT) portion of the value chain is critical, but tends to have a different risk profile than larger diameter pipelines. GPT typically has volumetric exposure and generates revenues under a variety of arrangements, including:

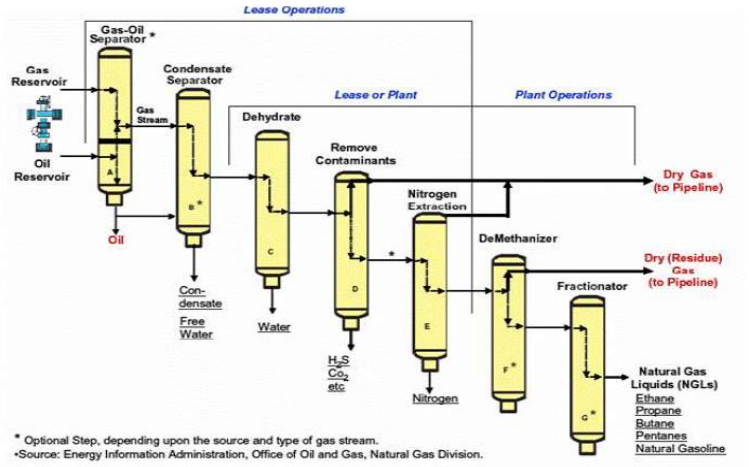
- ***Fee based arrangements: usually no direct commodity price exposure and revenues are generated on the basis of a per unit of volume. Quite often set up as take or pay contracts with capacity fees or reservation fees being paid regardless of the volume.***

- ***Commodity based arrangements: direct exposure to commodity prices that include:***
  - *Percentage of proceeds*: a percentage of the natural gas and NGLs that are processed are retained and can be sold by the processor as a form of payment.
  - *Percentage of liquids*: receiving a percentage of the NLGs from the natural gas (similar to POP) that can be sold.
  - *Percentage of index*: processor buys raw natural gas based on a percentage of an index basis, processes the natural gas and resells that processed natural gas for the index price. The spread is retained as a revenue.
  - *Keep-whole/wellhead purchase*: the processor takes ownership of raw natural gas, extracts and retains the NGLs. The same energy content must be retained to customer and, therefore, revenues come from NGL sales only.

# NGLs a Bigger Part Of The Smaller Canadian Midstreamers

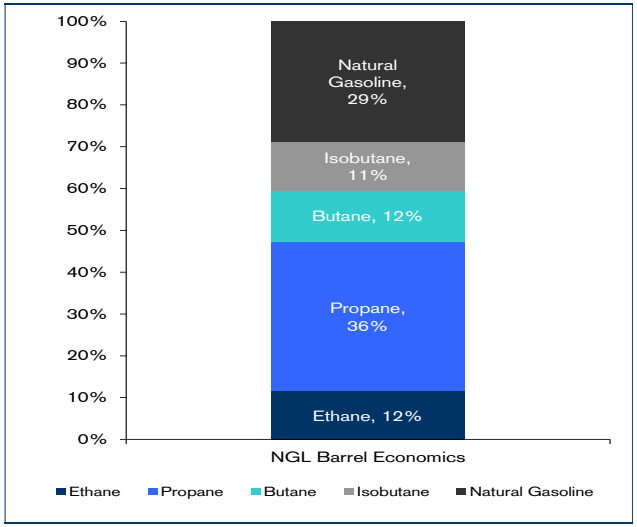
– Canadian processing companies tend to have much less “pure” NGL exposure than their US counterparts, however, some signs indicate the risk profile is changing.

**Natural Gas Liquids processing and fractionation value chain**



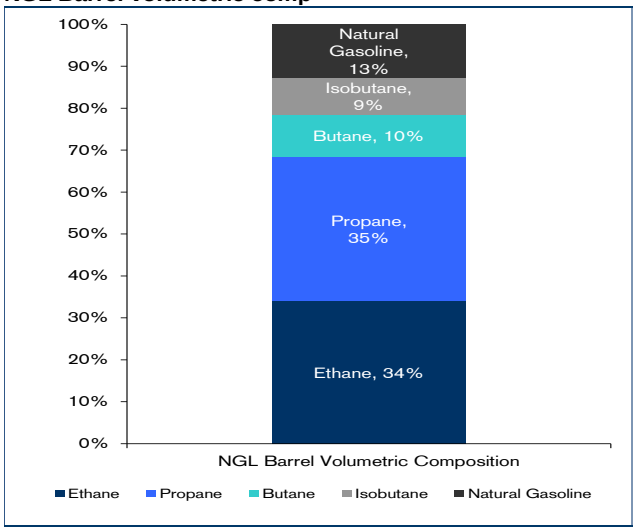

*Source: EIA, Office of Oil and Gas, Natural Gas Division*

**NGL Barrel Economics**




*Source: Bloomberg and Credit Suisse estimates*

**NGL Barrel volumetric comp**

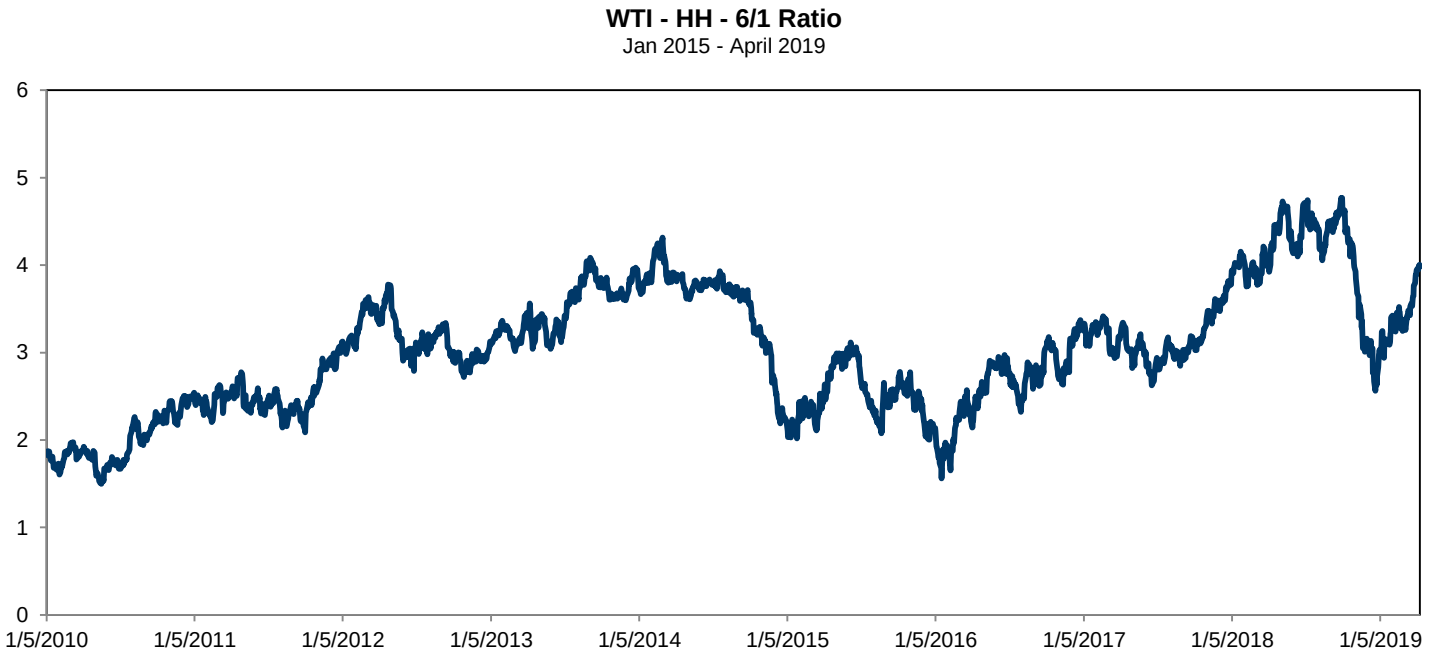



*Source: Bloomberg and Credit Suisse estimates*

Source: EIA, Office of Oil and Gas, Natural Gas Division, Bloomberg, Credit Suisse etimates

# Focused on Fractionation

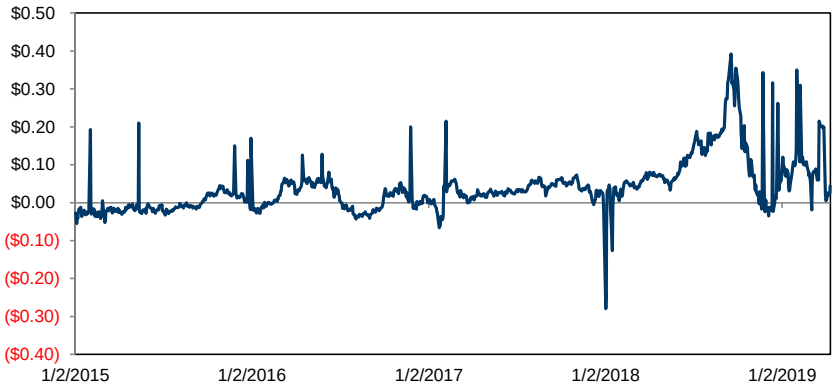
- A critical part of the natural gas value chain is the fractionation process. Fractionation for natural gas involves taking advantage of the different boiling points to separate the various liquids from the natural gas. The economics for processing is typically described as the "frac spread". The Frac spread is the premium/discount in value between natural gas and the separated NGLs. Critically, NGLs tend to be related to crude prices and the energy content of one barrel of oil to a MMBtu of natural gas is 6:1. Yet, that pricing relationship seldom holds true.




Source: Bloomberg

# Frac Spreads - Historical

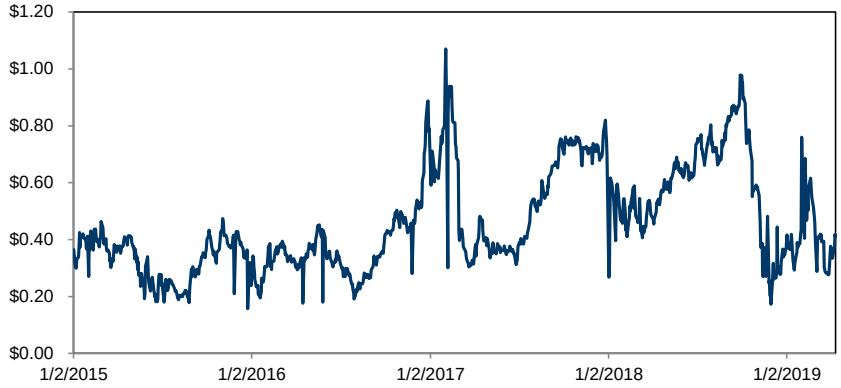
**Mont Belvieu Ethane Margin (USD/bbl)**
Jan 2015 - April 2019



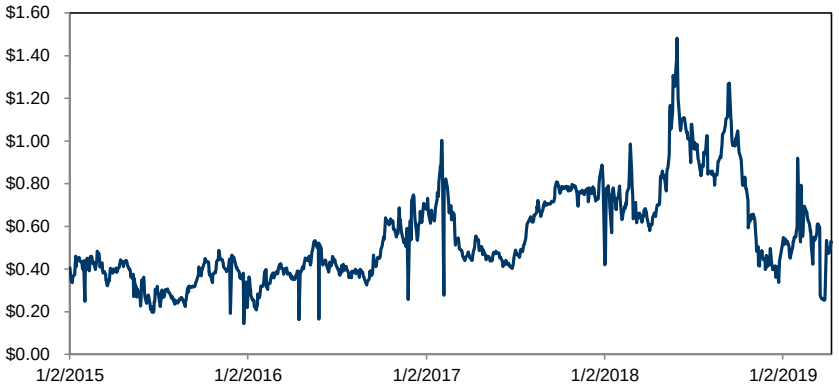

**Mont Belvieu Propane Margin (USD/bbl)**
Jan 2015 - April 2019




**Mont Belvieu Butane Margin (USD/bbl)**
Jan 2015 - April 2019




**Mont Belvieu Iso Margin (USD/bbl)**
Jan 2015 - April 2019




Source: Bloomberg

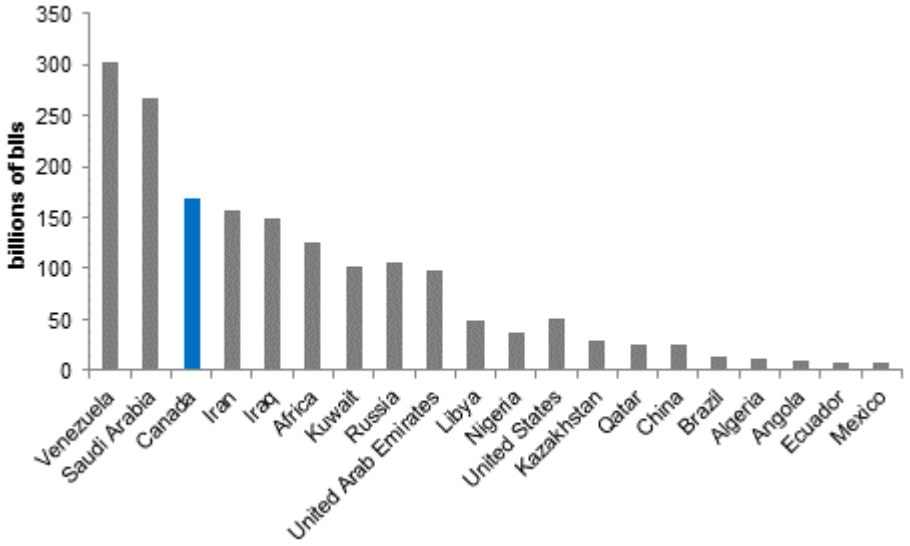
# Oil Sands Dynamics



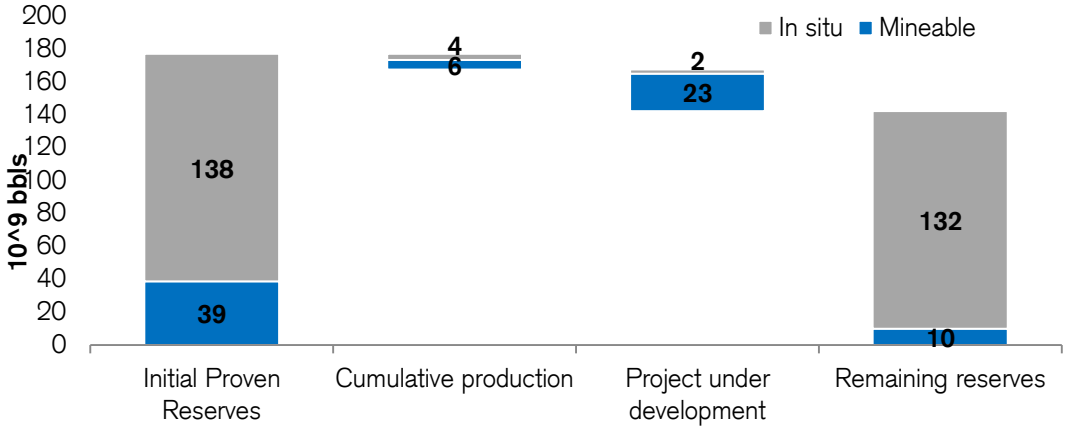
# Oil Sands Reserves

- As of 2016, Alberta's oil sands proven reserves were 165.4 billion barrels and third largest in the world or about 11 percent of total global oil reserves.
- 93 percent of remaining oil sands reserves are deep within the ground and is only recoverable by in situ (drilling) methods.
- The oil sands formations are designated in three areas: Athabasca, Cold Lake and Peace River. Combined, they cover an area of about 140,000 square kilometres.

**2017 Proved Reserves (in billion of bbls)**




**Oil sands reserves development**



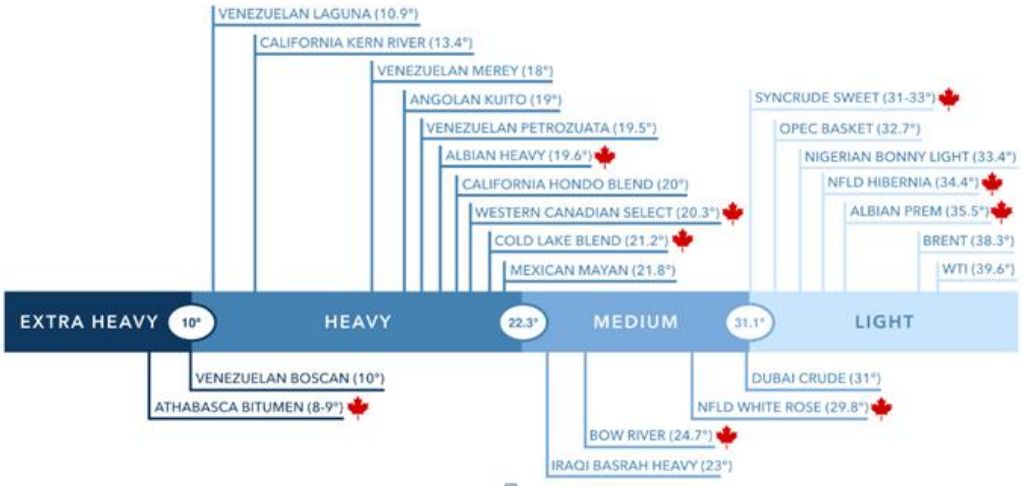

Source: AER, EIA, Credit Suisse estimates

# What are Oil Sands and Bitumen?

- **Oil sands** are a mixture of sand, water, clay and bitumen.
- **Bitumen** is a highly viscous and heavy liquid with an API <10°. Crude bitumen is too heavy to flow or be pumped without being heated or diluted by a lighter hydrocarbon to make it transportable on pipelines.

- **Two Major Major Recovery methods:**
- **Mining**: Large shovels scoop the oil sands into trucks that then take the sands to crushers where the large clumps of earth are broken down. Mixture then thinned out with water and transported to plant where bitumen is separated from the other components and upgraded to create synthetic oil.

- **In-situ**: Most common forms of in situ extraction involve drilling several wells into a deep oil sands deposit and then injecting steam underground at varying pressures. The steam heats the bitumen so it can flow to a well and be pumped to surface. In situ requires less land than mining but needs relatively more water source to operate



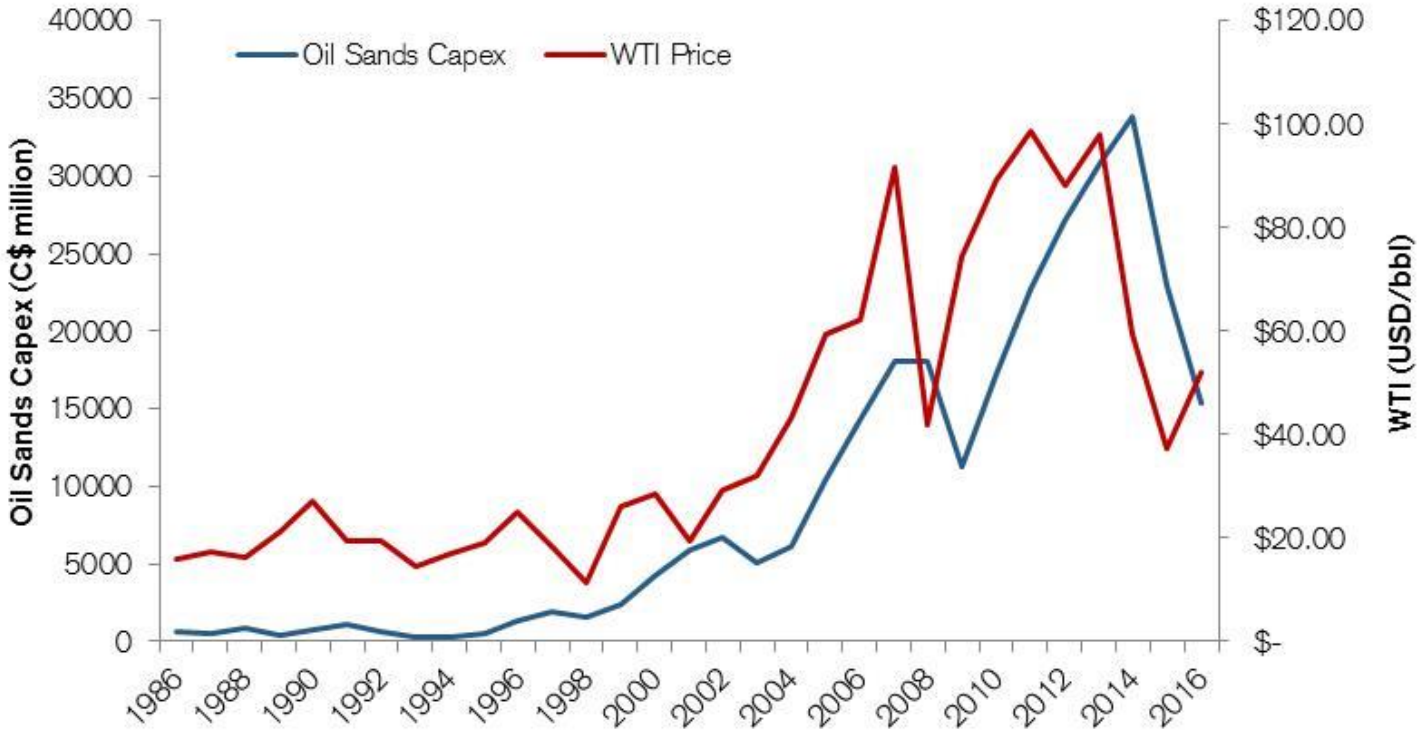

Source: DOE, Oil Sands Magazine

# Understanding the Oil Sands Cost Structure

- Oil sands projects are capital intensive with high upfront capital and operating costs as large facilities are required to process bitumen to heavy. Moreover, legacy mining projects also have additional op cost from on-site upgraders to process bitumen to light barrels. Nonetheless, oil sands projects provide producers with greater certainty of sustainable production given its long reserve life (30-50 yrs), low decline rates, and high recovery (90% for Mining, 60-70% for SAGD) compared to shale or offshore projects
- Most in-situ projects generate steam using natural gas fired generators, the single highest operating cost for these in situ thermal projects is the cost of natural gas. Relative to in-situ, mining and upgrading use proportionately less natural gas.
- Producers have reduced the exposure to energy cost by producing natural gas, targeting lower SOR (reservoir quality, process improvement, and technology) and running co-generation facility that process both steam for wells and electricity to power the facilities and offset by selling electricity back to the grid.

Source: NEB, Credit Suisse estimates

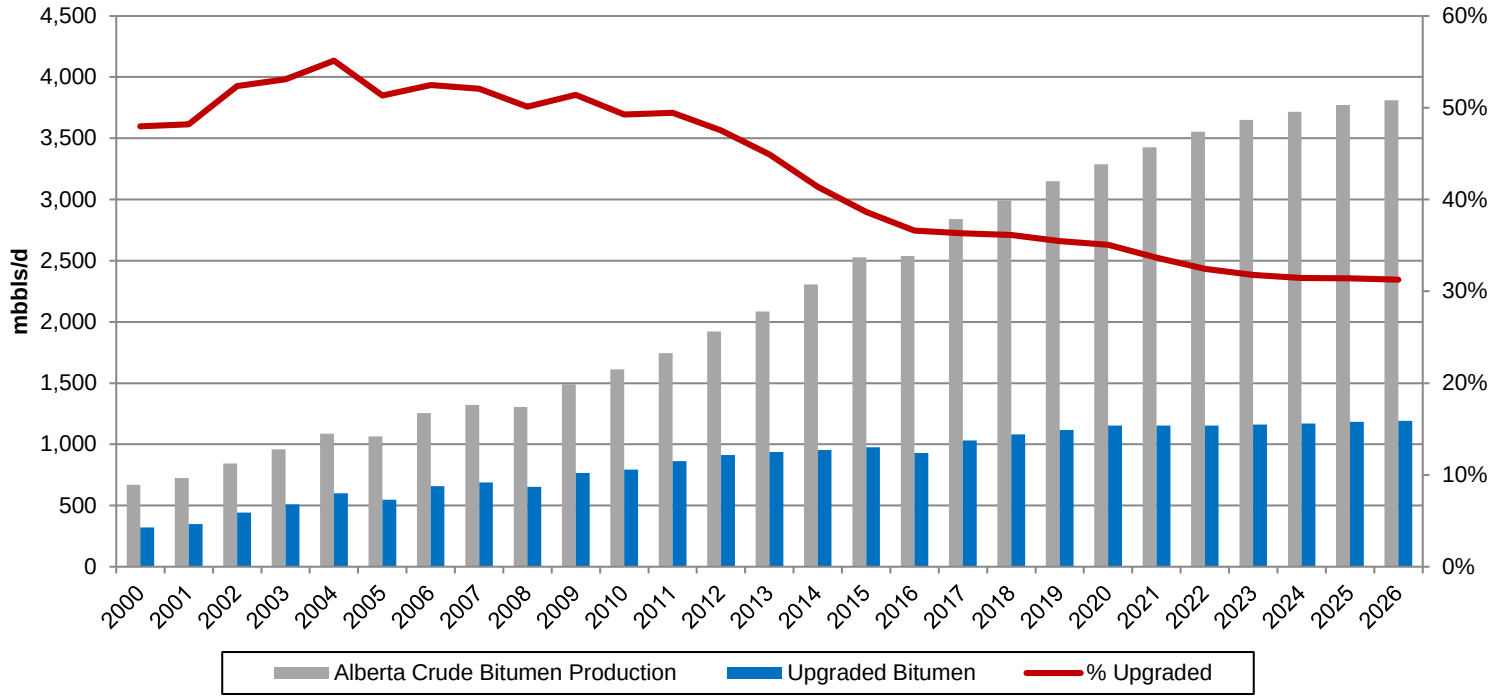
# Oil Sands Capex and the Oil Price along with Divestitures




Source: CAPP

# Bitumen Processing: Upgrading to Light

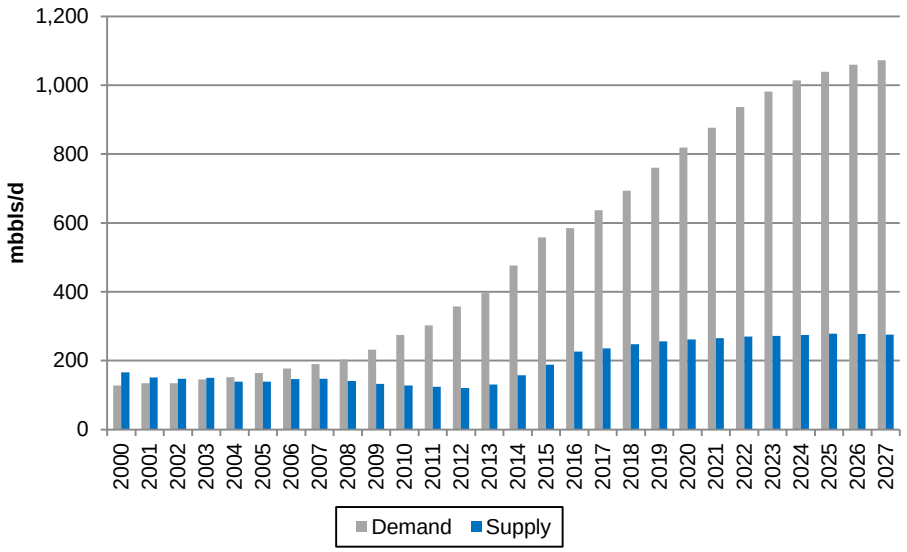
- Most upgrading is done by first removing carbon (coking) and then stabilizing of oil (hydrotreating) to create synthetic crude oil (SCO). SCO is used as replacement for conventional crude oil for refining to gasoline, diesel, jet fuel and heating oil. Most bitumen produced by legacy mining projects is upgraded.

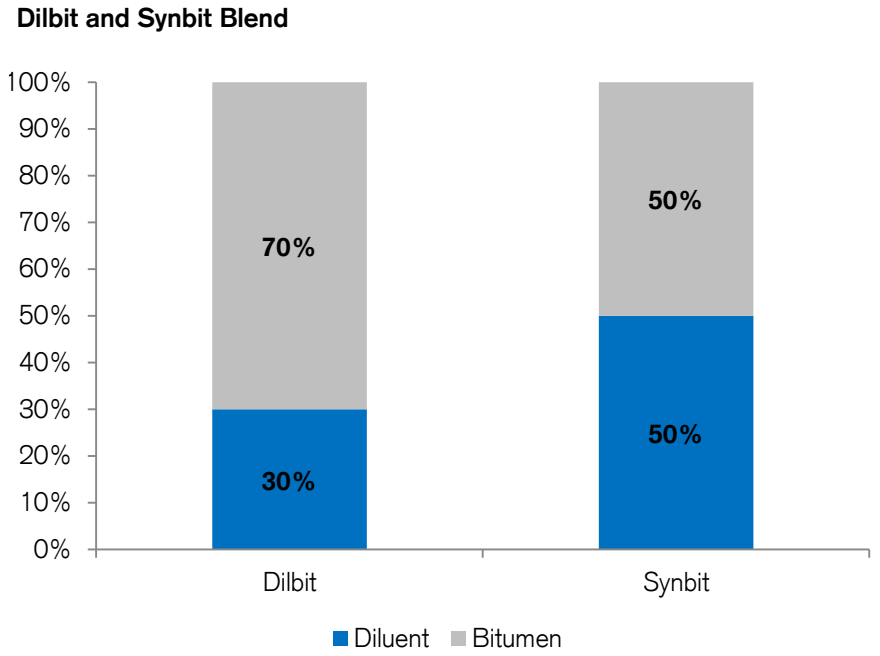



Source: AER, Credit Suisse estimates

# Bitumen Processing: Blending To Heavy

- To reduce the viscosity of bitumen so that it flows efficiently in a pipeline, bitumen is often diluted with light petroleum liquid to produce diluted bitumen, or dilbit. Dilbit approximates the characteristics of typical conventional heavy crude oil. Most common diluents are condensate or pentanes (C5+). Oil sands demand for diluent is filled by imports from US. If SCO is used as a diluent, then it is called a synbit.



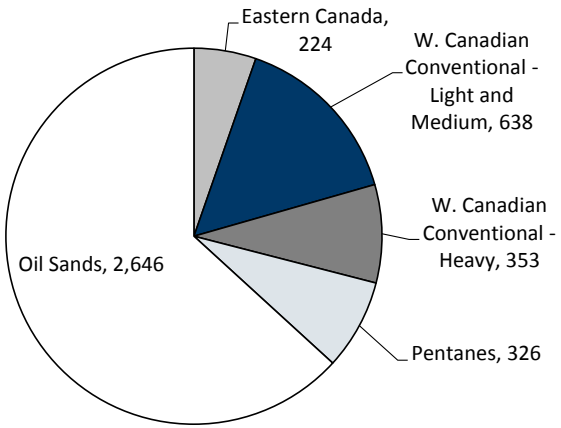




Source: AER

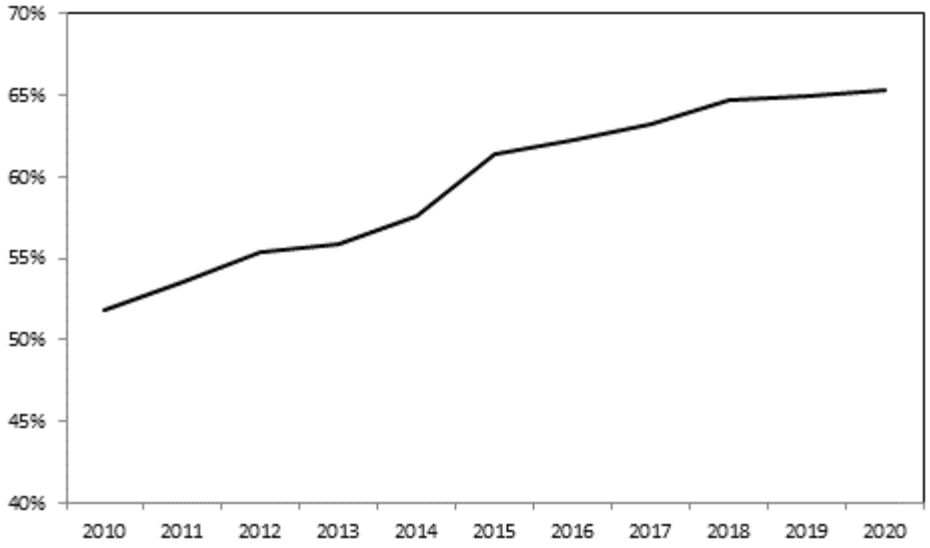
# Components of Canadian Crude Production

- Total Canada Production: 3.9 Mb/d.
- Production is heavily levered to the Oil Sands play, out of 2.4 Mb/d produced in 2016, 43% was extracted via Mining method and 57% via In Situ method.

**Production by Type – 2017 (mmbls/d)**




**Oil Sands as a % of total Production**

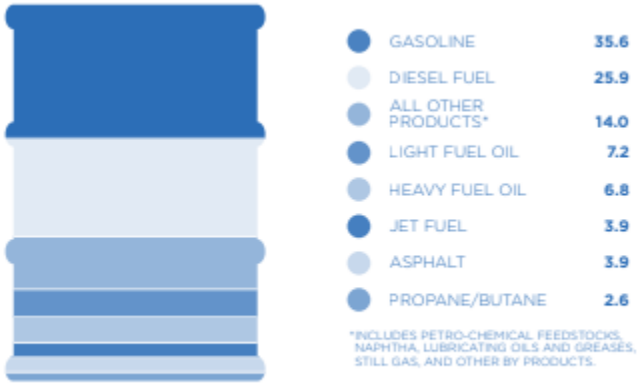



Source: CAPP

# Components of Canadian Crude Demand

- Total Canadian Refining Capacity: 1.9 million bbls/d
  - ~30% of Canadian crude is processed by Canadian refineries
- Crude Exports: 3.0 mmb/d
- 99% of Canadian exports are to the U.S.
  - U.S. Midwest (PADD II) received 66%
  - U.S. West Coast (PADD V) received 6%
  - U.S. East Coast (PADD I) received 6%
  - U.S. Rockies (PADD IV) received 8%
  - U.S. Gulf Coast (PADD III) received 14%

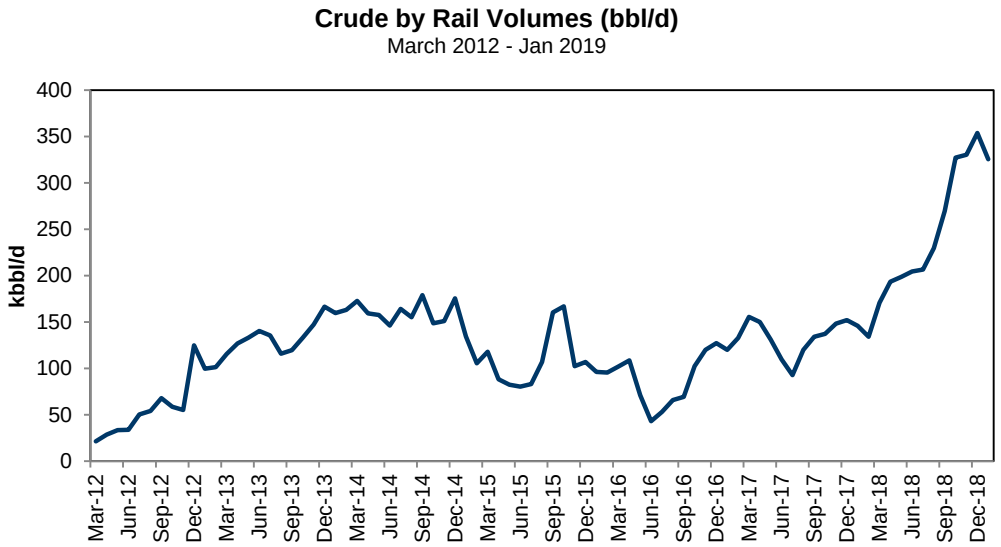
## Average Output From a Barrel of Oil (%)




Source: CAPP, NEB, Oil Sands Magazine

# US Remains Canada's Key Export Market

- ~3 MMbbls/d of crude oil is currently being transported out of western Canada through pipelines including TransCanada Keystone, Enbridge Mainline and Kinder Morgan Trans Mountain systems.
- Rail has gained some momentum recently to service projects with limited or no access to pipeline capacity. 2017 export by rail averaged 131kbd vs current rail capacity of estimated ~650 kbd.
- A number of pipeline projects are being proposed to ease constraints and to allow continue growth of bitumen production:
  - TransCanada Keystone XL (+830kbd)
  - Enbridge Northern Gateway (+525kbd)
  - Kinder Morgan Trans Mountain Expansion (+590kbd)




Source: CAPP 2015 Crude Oil Forecast, Markets & Transportation

# Heavy Oil Pricing at a Discount

- Heavy crude is sold on stream at Western Canadian Select (WCS) market price, while upgraded bitumen (synthetic crude oil) can be sold to a price close to WTI, minus any transport cost.

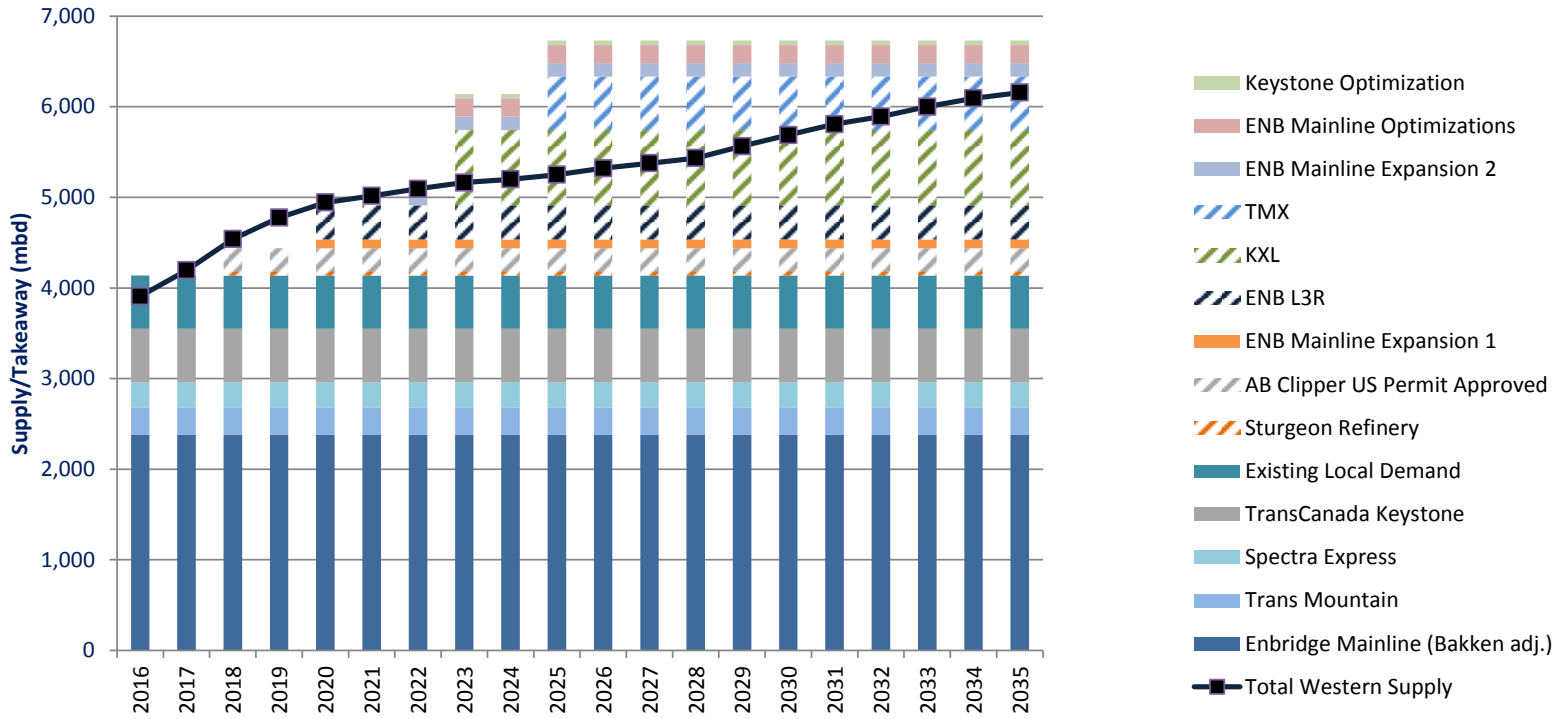



Source: Bloomberg, CME

# Key Risk is Pipe Takeaway Capacity

- Canadian crude supply is expected to outpace current pipe capacity in the near term – rail will continue to play a meaningful role as a result. Longer term, Canada could be long pipe by early next decade. Given setback in the past, producers and investors may remain wary of new infrastructure actually materializing.

**Illustrative Western Canada Supply Outlook & Takeaway Capacity**




Source: Credit Suisse estimates

# Technological Changes on the Horizon

- A number of factors are driving technological change in the oil sands, including: issues around carbon, the nature of the oil sands, potential for margin expansion and, among other things, greater efficiencies. Some of the processes include:
  - Solvent-assisted SAGD (SA-SAGD)
  - Cyclic solvent process (CSP) – piloting
  - Liquid addition to steam to enhance recovery (LASER)
  - Field piloting ESEIEH (radio-frequency heating with solvent)
  - N-Solv's BEST (vaporized solvent)
  - CO2 management technology that is expected to yield lower emissions and improved water recycling
  - Solvent-aided process (SAP)

Source: Company data, Research Infosource

CREDIT SUISSE

# Power and Utilities



# Power and Utilities

- The Canadian Provinces comply with the US Federal Energy Regulatory Commission's definitions for competitive markets to enable power to be sold across the border
- Yet, most of the Canadian power markets are dominated by Government-owned entities that are completely integrated or structurally separated into generation, transmission and distribution
- Lots of government backed contracts supporting private power players generation assets in both natural gas and renewables, but also in nuclear
- Privately owned utilities come in many forms, however, the return frameworks are usually based on rate base methodologies
- Alberta power market closing in on certainty regarding capacity markets. That transition will be first Provincial power market in a capacity market format. The Ontario market will likely be next, but not until the mid-2020s.
- The pricing and regulation of carbon a developing issue in the Canadian market with a major initiative being pushed by the Federal Government . Yet, a number of Provinces are leading a lawsuit against the Federal Government.

# M&A: The Canadians Came to the US and Conquered

- After a considerable amount of cross-border M&A of Canadians into the US, we expect a breather from southbound activity with the Canadian's re-trenching, validating the deals and de-levering
- Strategic opportunities for value chain extensions or outright basin expansions will exist, however, capital markets do not look overly supportive for this type of activity right now
- Look for potential activity from the likes of Brookfield in the midstream space to "help" solve some specific problems for a number of the industry players
- Selected cross-border transactions includes:
  - Enbridge (ENB) for Spectra Energy (SE) and related roll-ups
  - TransCanada (TRP) for Columbia Pipeline Group (CPGX) and related roll-up
  - Fortis Inc. (FTS) for ITC Holdings Inc. (ITC)
  - Emera Inc. (EMA) for TECO Energy (TE)
  - Algonquin Power & Utilities (AQN) for The Empire District Electric Company (EDE)
  - Hydro One (H) for Avista (AVA) - failed

Credit Suisse Equity Research
Americas/United States

# Power and Utilities

**April 2019**


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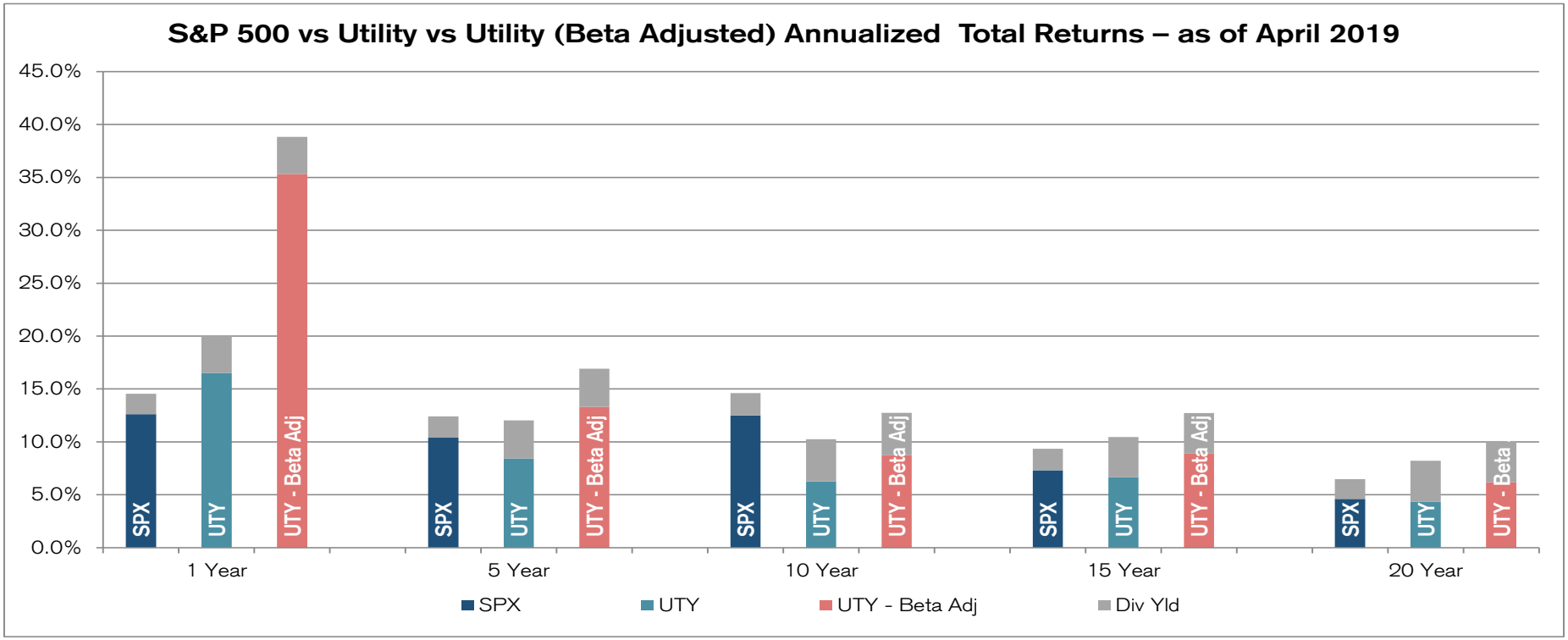
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# Utility Total Returns Have Been Durably Competitive…

## Utilities have been (and are) better investments than conventional wisdom holds




- **Conventional market wisdom** holds that Utilities are less exciting than the market from a total return perspective.

- **Utilities hold their own against other sectors.** However, when looking at total returns for Regulated Utilities vs. the S&P 500 (including the impact of reinvesting dividends), we have seen Utilities offer equal to better total returns than the S&P over a wide range of time periods before reflecting the benefits of a lower overall risk profile (i.e., 0.45-0.75 beta).

Source: the BLOOMBERG PROFESSIONAL™ service, Credit Suisse estimates

# …And Looking Forward, Utilities Offer Competitive Risk-Adjusted Total Returns Too

## But they trade at a significant premium

| Impact of relative earnings growth rates on relative risk-adjusted total return | Utes @ 21% tax | S&P @ 21% tax | Implied Utes Premium (Discount) | Current 2020 P/E Premium (Discount) |
|---|---|---|---|---|
| Div | 3.2% | 1.6% | | |
| Long-term EPS Growth expectation * | 5.0% | 9.9% | | |
| Long-term future beta assumption | 0.60 | 1.00 | | |
| **Risk-adjusted Total Return** | **11.5%** | **11.5%** | **0.1%** | **+14.6%** |

* CS estimate for S&P 500 earnings growth had been 10%-11% for 2018 prior to tax reforms.

* The latest CS estimate for S&P 500 earnings growth as of the Mar 2019 CS Sector Roadmap is 9.9% for 2020. https://plus.credit-suisse.com/s/V7guZM4A

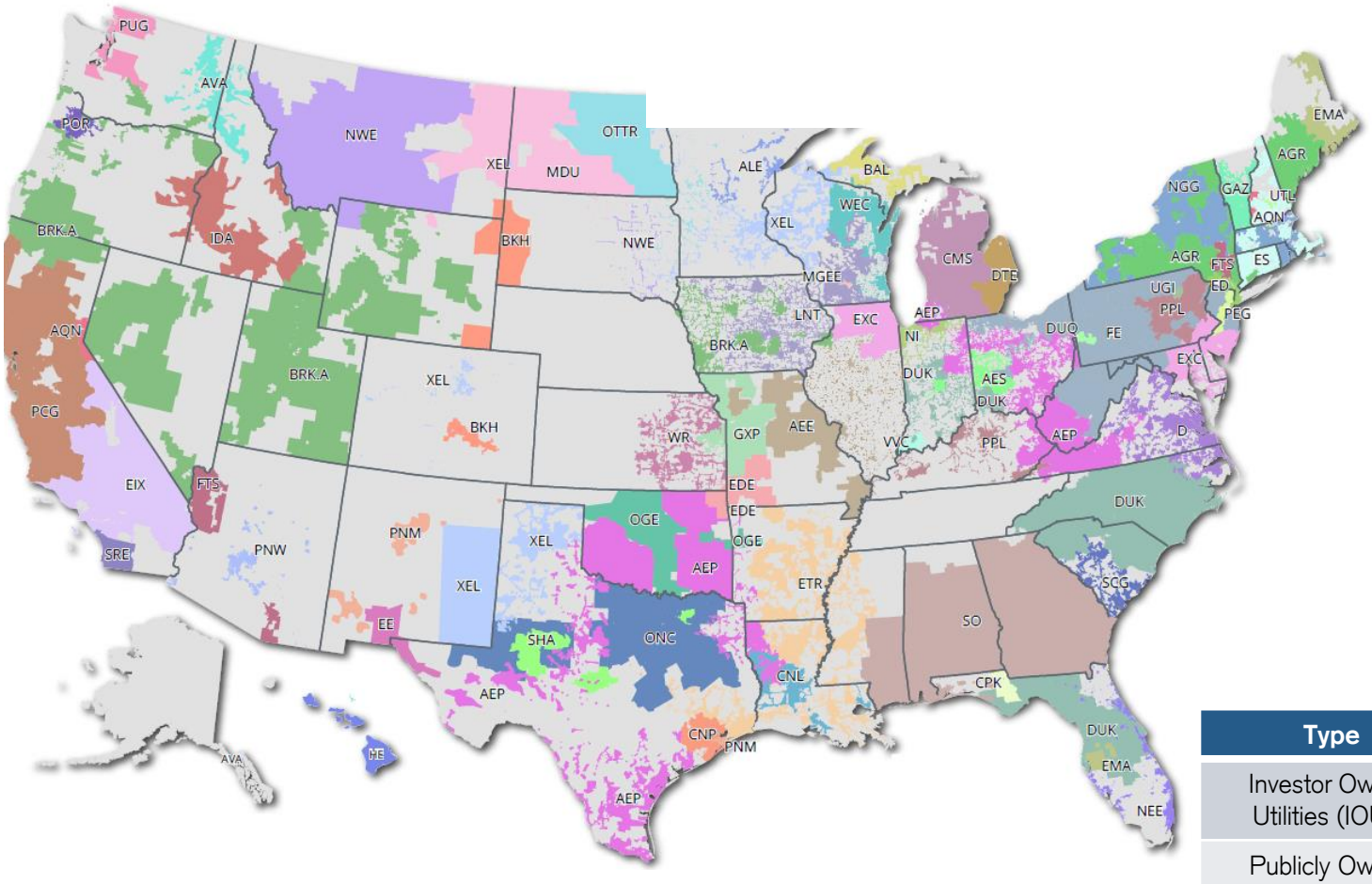
* Consensus EPS estimates for the UTY index over the next three years imply an average 4.8% earnings growth expectation.

- **Growth at lower risk.** Generally, Utilities offer 5%-7% average ratebase growth generating a consensus expectation for ~5% EPS growth and a ~3.2% dividend yield, generating total returns (unadjusted) of ~8%-9% at a low 0.6 forward beta.

- **Comparable risk-adjusted returns with other sectors.** At a 21% tax rate and adjusting for risk (beta), utilities provide a ~11%-12% risk adjusted total return which implies a 0.1% P/E premium vs the S&P.
  - We have estimated that this is -6% less than the 6.0% premium justified at a 35% tax rate (tax reform benefits utilities less than other companies).
  - The S&P 500 offers 1.6% yield and long-term consensus and CS earnings growth expectation of 9.9%, providing nearly the same total return when adjusting for beta.

Source: the BLOOMBERG PROFESSIONAL™ service, Credit Suisse estimates

# Location of Investor-Owned Electric Utilities

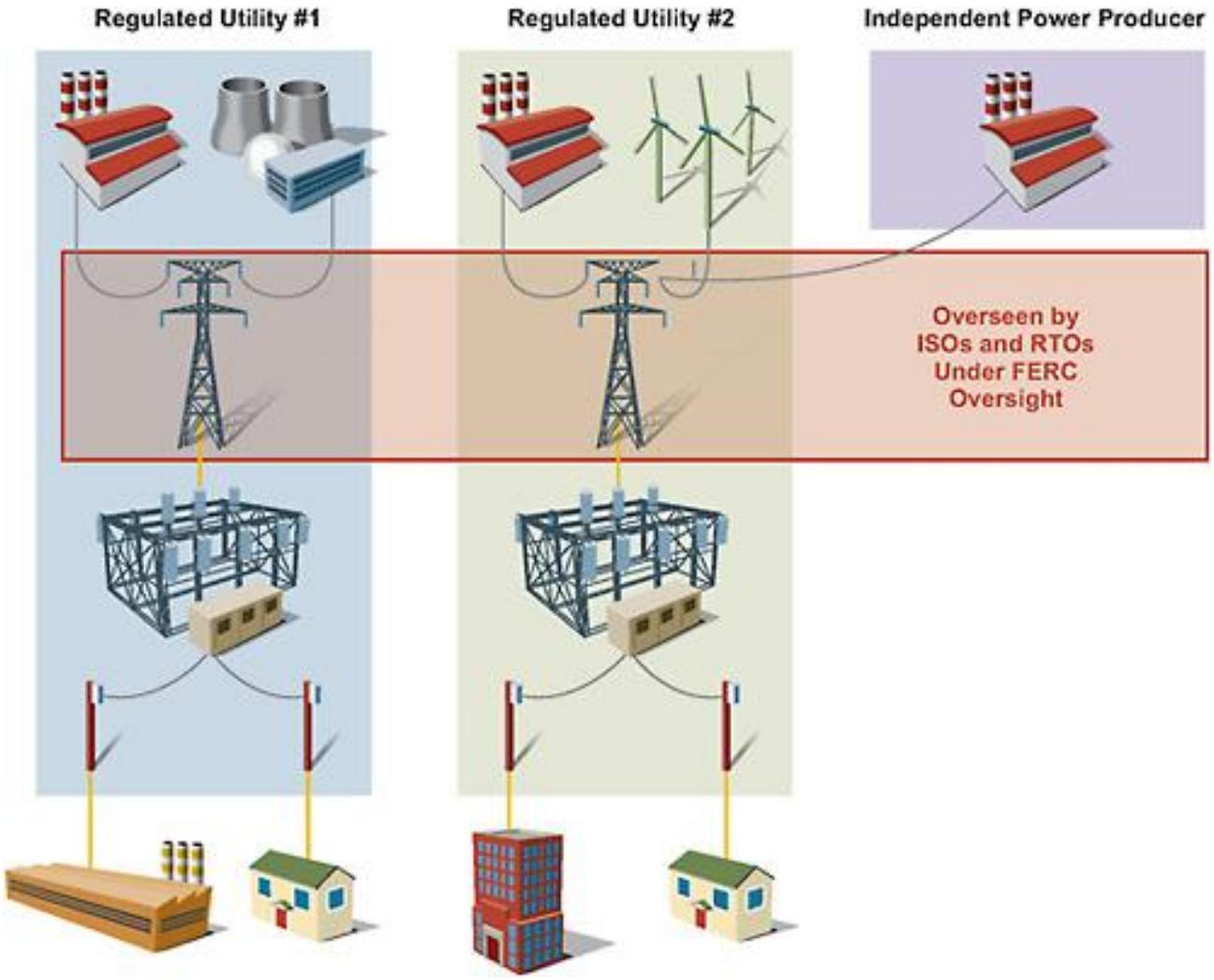



| Type | Count |
|---|---|
| Investor Owned Utilities (IOUS) | 189 |
| Publicly Owned Utilities | 2013 |
| Cooperatives | 877 |
| Federal Power Agencies | 9 |
| **Total Utilities in US** | **3,088** |

Source: SNL, American Public Power Association

# Generation, Transmission, and Distribution

The building blocks of the power system




## Generation

- Production of electricity from various fuel types (coal, gas, nuclear, solar, wind, etc.)

## Transmission

- Link generators to substations / distributors
- High voltage and generally cover longer distances to bring electricity from power plants to the consumer

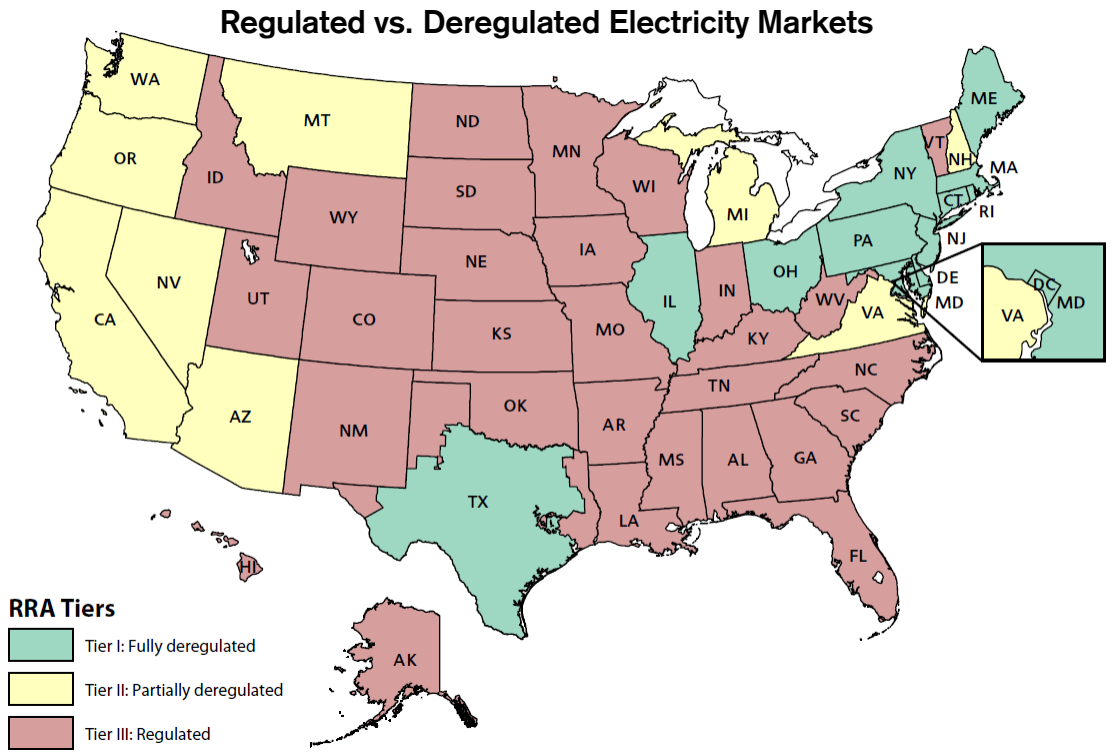
## Distribution

- Link distributors to retail customers
- Low voltage

Source: America's Energy Future: Technology and Transformation (2009) (www.nap.edu), Credit Suisse estimates

# Power Markets: Regulated, Deregulated, and Some In-between

## True power market competition is concentrated in the Northeast and Texas




- Starting in the mid-1990s a number of states started the process of deregulating power markets on the premise that competition would lower costs. In almost all cases of deregulation, the states left transmission and distribution (T&D) assets as regulated utilities while power generation transitioned to competition. After the Enron/California Energy crisis, interest in deregulation slowed materially.
- While explicitly broken out as three buckets, we would think of states as either being deregulated (the green ones) and regulated (red/yellow) since the partially deregulated states do not have a particularly functional competitive backdrop.

Source: SNL

# Our Preferred Valuation Methodology: Target Year P/E Multiple

| Valuation Methodology - Target Year P/E Multiple | | | |
|---|---|---|---|
| | $ 5.00 | 2020 EPS | **Looking 1-3 years forward captures visible differences in near-term growth prospects** |
| | 19.0x | 2020 Blended Multiple | A blended and weighted average peer forward P/E multiple that reflects where the market is trading based on the future near-term growth prospects of peers. |
| + | 1.0x | Premium (discount) | **Apply a premium (discount) to the peer P/E multiple that reflects qualitative factors beyond near-term growth prospects** |
| X | 20.0x | Valuation P/E Multiple | |
| | $ 100 | **Target Price (12-month view)** | |
| | $ 90 | Current Stock Price | |
| | 11.1% | Upside (downside) | |
| | 2.0% | Current Dividend Yield | |
| | **13.1%** | **Total Return (12-month view)** | |

- We use 2020 EPS as our baseline, which allows us to better capture different growth profiles within a visible investment timeline.
- We apply target P/E multiples of 18.5x for electric utilities and 20.1x for gas utilities to our 2020 earnings estimates. In this example, the blended multiple is 19.0x, which we then boost by 1.0x to account for qualitative factors beyond the near-term growth picture.
- Total return incorporates the expected value at the target multiple in addition to dividends received over the forward 12-month period.

- We find the total return methodology of using the dividend yield plus warranted stock value (at a target multiple) to be an appropriate balance between a dividend reinvestment model and simple P/E measure.

Source: Credit Suisse estimates

# Overview of Regulated Utilities, Integrateds and IPPs

## Regulated Utilities

| | Company | Ticker | Mkt. Cap ($ BN) |
|---|---|---|---|
| 1 | Duke Energy | DUK | $65.7 |
| 2 | Dominion Resources | D | $61.0 |
| 3 | Southern Co. | SO | $54.2 |
| 4 | American Electric Power* | AEP | $41.4 |
| 5 | Xcel Energy* | XEL | $28.7 |
| 6 | Consolidated Edison | ED | $27.6 |
| 7 | Wisconsin Energy* | WEC | $24.4 |
| 8 | PPL Corp* | PPL | $23.0 |
| 9 | DTE Energy | DTE | $22.7 |
| 10 | Eversource Energy | ES | $22.4 |
| 11 | Edison International* | EIX | $20.4 |
| 12 | American Water Works Corp.* | AWK | $18.8 |
| 13 | Ameren Corp* | AEE | $17.6 |
| 14 | CMS Energy Corp | CMS | $15.6 |
| 15 | Westar Energy* | WR | $14.5 |
| 16 | Great Plains Energy * | GXP | $11.5 |
| 17 | Alliant Energy Corp.* | LNT | $11.1 |
| 18 | Pinnacle West* | PNW | $10.7 |
| 19 | PG&E Corp* | PCG | $10.1 |
| 20 | OGE Energy Corp.* | OGE | $8.4 |
| 21 | ITC Holdings Corp.* | ITC | $7.0 |
| 22 | Pepco Holdings* | POM | $6.8 |
| 23 | Scana* | SCG | $6.8 |
| 24 | TECO Energy* | TE | $6.5 |
| 25 | Portland General * | POR | $4.6 |
| 26 | Black Hills Corp | BKH | $4.4 |
| 27 | Allete Inc.* | ALE | $4.2 |
| 28 | Spire | SR | $4.2 |
| 29 | PNM Resources* | PNM | $3.7 |

## Integrateds

| | Company | Ticker | Mkt. Cap ($ BN) |
|---|---|---|---|
| 1 | NextEra Energy | NEE | $91.0 |
| 2 | Dominion Resources | D | $61.0 |
| 3 | Exelon Corp | EXC | $48.3 |
| 4 | Sempra Energy* | SRE | $35.1 |
| 5 | Public Svc. Enterprise Grp* | PEG | $30.1 |
| 6 | FirstEnergy Corp* | FE | $21.9 |
| 7 | Entergy Corp* | ETR | $18.1 |

## IPPs

| | Company | Ticker | Mkt. Cap ($ BN) |
|---|---|---|---|
| 1 | Vistra Energy | VST | $12.7 |
| 2 | AES Corp* | AES | $12.0 |
| 3 | NRG Energy* | NRG | $11.8 |

** Not covered by Credit Suisse*

Source: FactSet Reuters, Credit Suisse estimates

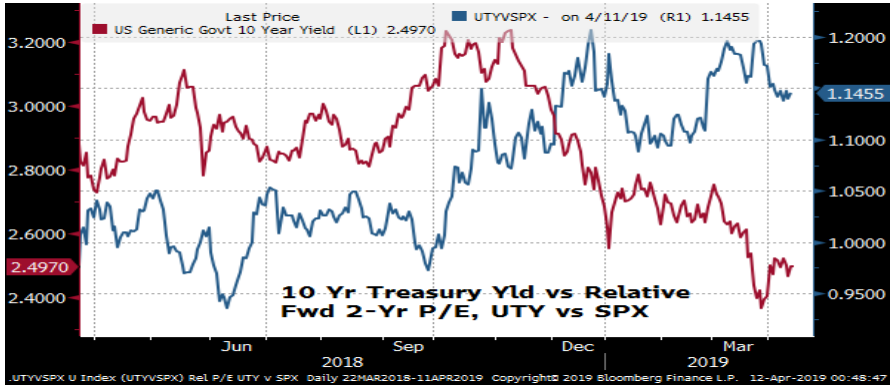
# US Power & Utilities – Themes for 2019

## This Flight to Safety Is Overbooked – but Favor Integrateds and Transmission

- **Overall, US regulated utilities look heavily overvalued vs the S&P 500 forward P/E.** With a flight to safety amid a flattening yield curve, regulated utilities are about 15% expensive vs the broader market. With a volatile broader market, the utility sector has been the primary equity safe haven in recent months, holding up relatively well despite (fleeting) expectations for a rising 10-year yield. The regulated utility group now trades at a +15% premium forward P/E relative to the S&P 500 but we view parity as appropriate for 2.5%-3.0% yields for the 10-Year in the next 12-months, implying -15% downside on a relative basis. Sensitivity is 1% relative valuation for every 10 bps move in the 10-Yr.
- **Continue to reiterate our thesis that integrated utilities with non-regulated business exposure will outperform purely regulated names as yields rise.** We continue to reiterate Outperform-rated NEE for its 40% exposure to the fast-growing non-regulated renewables sector, CNP after weakness following the VVC closing this year, and EXC for recent orders to bring Pepco's rates up and possible approval from federal regulators on "Fast Start" energy market reforms as well as possible capacity market reforms that would improve margins for its non-regulated nuclear fleet.
- **For Regulated utilities, favor Transmission and Grid Modernization.** With FERC conducting paper hearings in New England and MISO to improve its ROE methodology for electric transmission, we expect fewer complaint filings and more certainty over the fate of proposed projects in the coming years. We expect this to benefit several names most directly exposed, including ES, WEC with its 60% ownership of American Transmission Company (ATC), DUK through its Indiana transmission program (and a non-utility JV with ATC), and uncovered AEP, FE, AEE, and PEG.

### 10-Yr Bond Yield vs 2-Yr Forward Relative P/E Utes vs SPX

Utilities look 15% expensive vs historic correlation to bond yields




### What is the Appropriate Relative P/E?

~Parity P/E correlates to a 2.5%-3.0% 10-Year Yield

| 10-Year Yield vs Relative P/E (Utes/S&P) Regression analysis 1/2010-1/2014 (higher correlation at higher yiel | | | | | | |
|---|---|---|---|---|---|---|
| Correlation R^2 | 0.678 | | | | | |
| **Input: 10-Yr Yield** | | **2.5%** | **3.0%** | **3.3%** | **3.5%** | **4.0%** |
| Slope of linear regression | | -0.125 | -0.125 | -0.125 | -0.125 | -0.125 |
| Y-axis | | 1.423 | 1.423 | 1.423 | 1.423 | 1.423 |
| Regression result | | 11.1% | 4.8% | 1.1% | -1.5% | -7.7% |
| Apply Tax-Reform Factor | | -5.8% | -5.8% | -5.8% | -5.8% | -5.8% |
| **Appropriate Relative P/E (Utes/S&P)** | | **5.3%** | **-1.0%** | **-4.7%** | **-7.2%** | **-13.5%** |

| 10-Year Yield vs Relative P/E (Utes/S&P) Regression analysis 1/2014-10/2018 (less correlation at ultra-low yie | | | | | | |
|---|---|---|---|---|---|---|
| Correlation R^2 | 0.061 | | | | | |
| **Input: 10-Yr Yield** | | **2.5%** | **3.0%** | **3.3%** | **3.5%** | **4.0%** |
| Slope of linear regression | | -0.03 | -0.03 | -0.03 | -0.03 | -0.03 |
| Y-axis | | 1.121 | 1.121 | 1.121 | 1.121 | 1.121 |
| Regression result | | 4.6% | 3.1% | 2.2% | 1.6% | 0.1% |
| Apply Tax-Reform Factor | | -5.8% | -5.8% | -5.8% | -5.8% | -5.8% |
| **Appropriate Relative P/E (Utes/S&P)** | | **-1.2%** | **-2.7%** | **-3.6%** | **-4.2%** | **-5.7%** |

| | | | | | |
|---|---|---|---|---|---|
| **Average of the two periods** | **2.1%** | **-1.8%** | **-4.1%** | **-5.7%** | **-9.6%** |
| **where it is now ==>** | | **+14.6%** | | | |

Source: the BLOOMBERG PROFESSIONAL™ service, Credit Suisse custom indices

# US Power & Utilities – Themes for 2019

## This Flight to Safety is Overbooked – but Favor Integrateds and Transmission

- **Large-cap bellwether names benefit from defensive inflows….and are most at risk when the party ends.** Among the regulated names, SMID-caps should outperform the bellwether large-caps in periods of group underperformance, and we highlight PNW, NI (now at an attractive discount as they resolve issues in Massachusetts), CMS, and now ES as well. Among the large-caps, we compare with Underperform rated large caps SO and ED.

- **Grid modernization & trackers.** We continue this ongoing theme into 2019. Regulated electric utilities continue to put forward long-term plans to improve distribution grids to handle increasing renewables penetration, electric vehicles, smart meter systems, and time of use net metering. Much of this spending is expected to fall under regulatory trackers that provide more certainty of investment returns. For 2019, look for plan approvals in Connecticut and Massachusetts (ES), NC (DUK), Michigan (CMS, DTE). Also see some possibility for SO, and expect to hear more from PNW, WEC, CA utilities.

- **High growth and lower costs for Wind, Solar, Batteries.** With prices rapidly declining, we expect NEE/NEP to benefit in 2019 and beyond. Through 2020, we expect electricity pricing from wind to decline ~5% annually to $12-$18/MWh and solar output pricing to decline ~8% annually to $20-$25/MWh. For batteries, we expect ~15% annual cost declines to $150/kWh by yearend 2020 before paring to a 7% annual reduction by 2030, ultimately reaching $70/kWh or less. We forecast about 13% annual growth in cumulative US wind/solar capacity through 2020 vs only 0.5% for traditional power. Renewables account for ~10% of US generation capacity now and are projected to rise to 13%-15% by 2020 and 18%-25% by 2040.

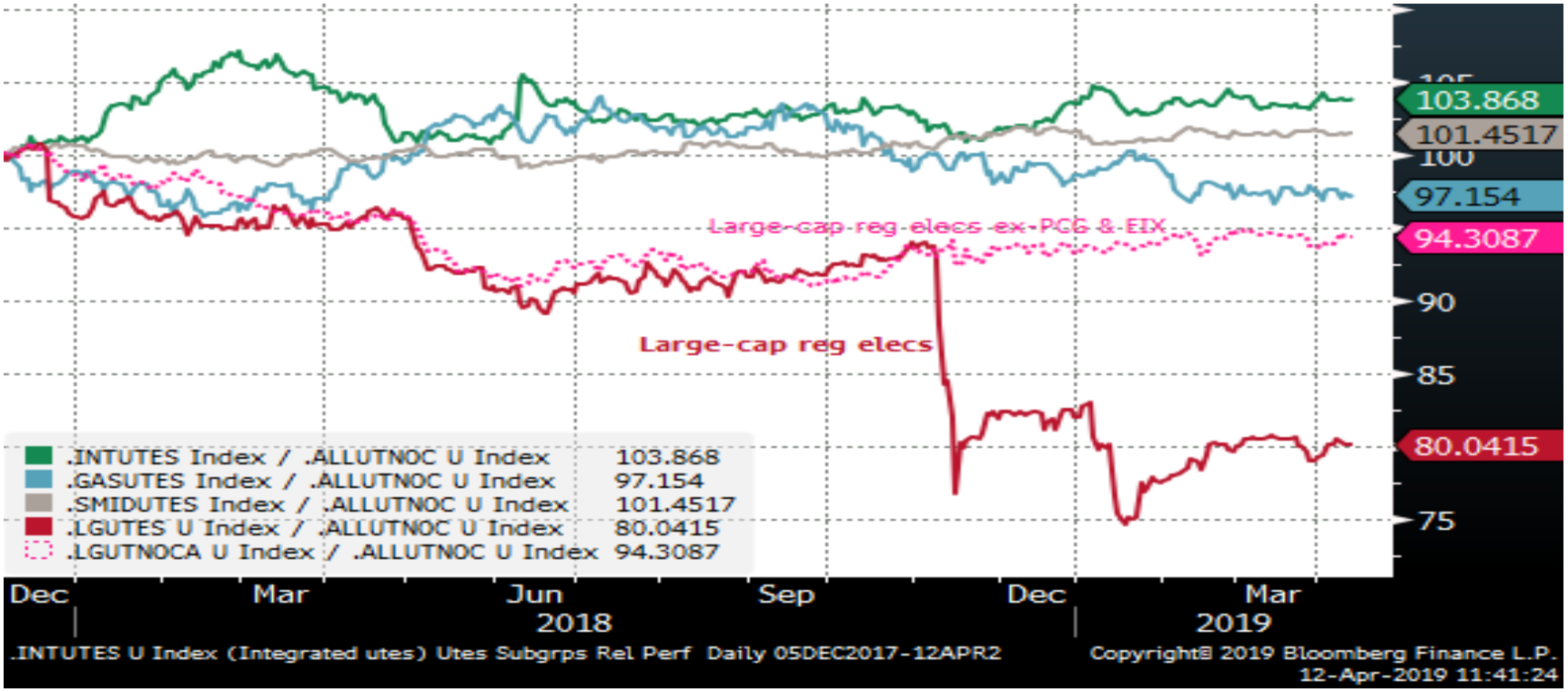
Source: the BLOOMBERG PROFESSIONAL™ service, Credit Suisse custom indices

# US Power & Utilities – Relative Performance

## This Flight to Safety is Overbooked – but Favor Integrateds and Transmission

**California utilities have hit the large-cap Regulateds hard**, but both Integrated and Regulated large-cap names have been outperforming small and mid-cap names, especially the gas utilities.

### Utility Subsector Relative Performance – Integrateds Still Favored into 2019



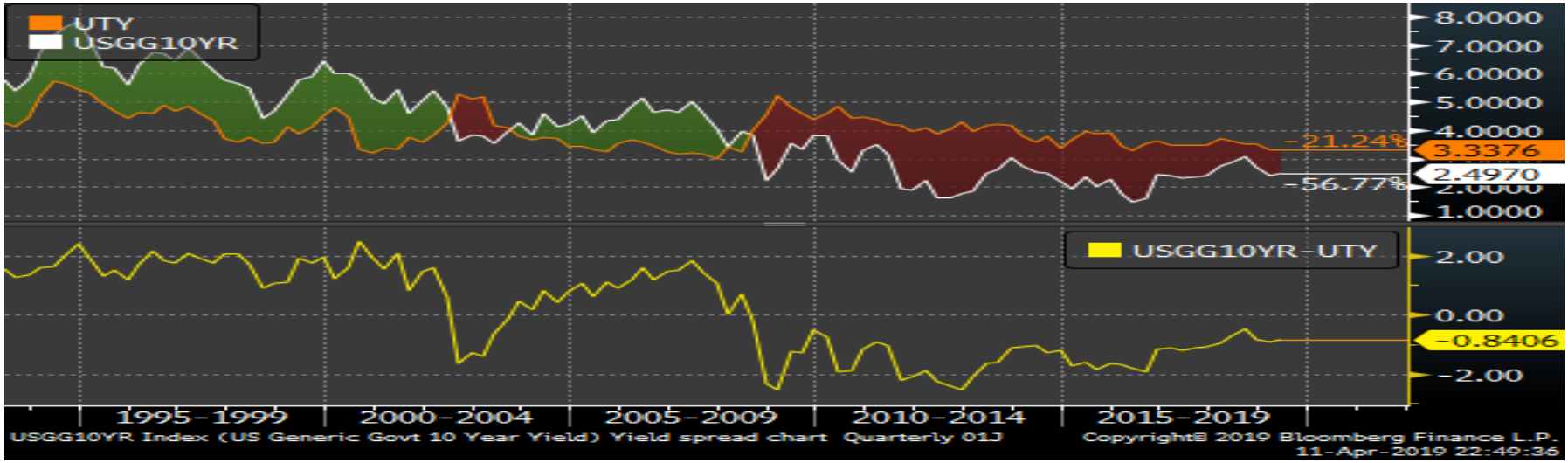

Source: the BLOOMBERG PROFESSIONAL™ service, Credit Suisse custom indices

# US Power & Utilities – Dividends are Important

## Dividend Yield Support Keeps Valuations High Even as Bond Yields Fluctuate

- **Utility dividend yields remain ~84 bps above Treasury bond yields – and that's not normal.** The current situation where ultra-low Treasury bond yields are lower than utility dividend yields is abnormal vs history. Recall that before 2008, bond yields used to be higher by as much as 200 bps and investors believed that dividend yields should be lower as equities have capital appreciation based on 10-15% "safe" ROEs.
- **We have taken notice of the contracting spread between rising 10-year Bond yields and utility dividend yields** during recent market volatility, a possible sign that the group is responding more positively to its underlying yield support in the face of fluctuating and/or rising rates. We continue to expect this more recent trend to revert back to "normal" as bond yields begin to rise again, especially as they move out of an "ultra-low" condition and back toward 3.5%-4.5% levels (10-year). Hence, we see the current "inverse" relationship (red spread in the chart) as a sort of cushion for equity prices against the impact of rising interest rates and bond yields.
- **Utilities are trading at a steep premium now.** Also, the historical correlation to the 10-Year Treasury Yield suggests that utility P/Es should be at parity vs the S&P 500 P/E.

**Looking for Green Again - Utility Dividend Yields vs. 10-Yr Bond Yield Spread since 1993**

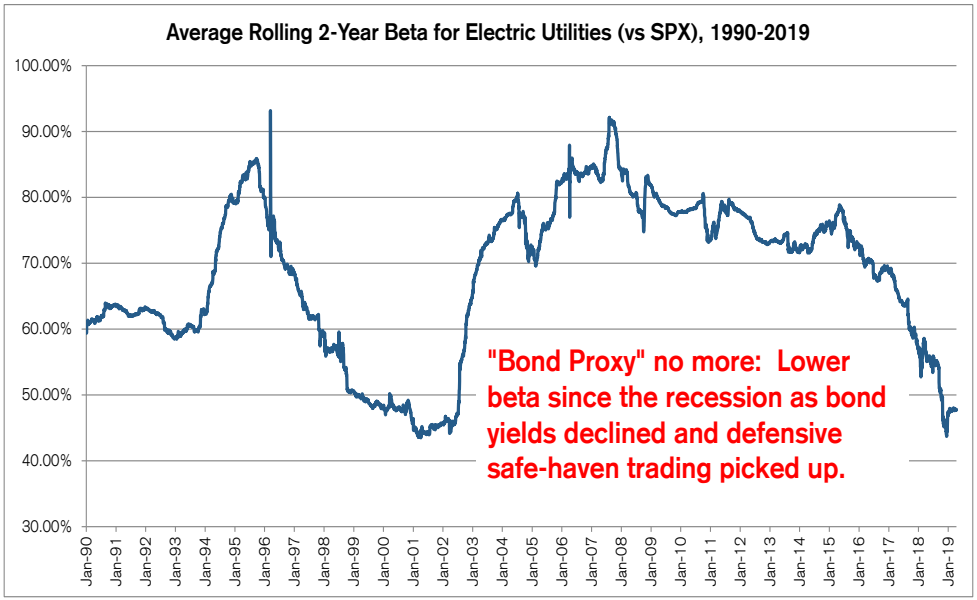



Source: the BLOOMBERG PROFESSIONAL™ service, Credit Suisse custom indices

# Utilities Are Less of a Bond Trade Today than in the Past

## Utilities deserve the bond proxy title when yields are higher; Less so today

### Average Rolling 2-Year Beta for Electric Utilities (vs SPX), 1990-2019




### Correlation of Relative P/E to 10-Year Treasury Yields, 2010-2019



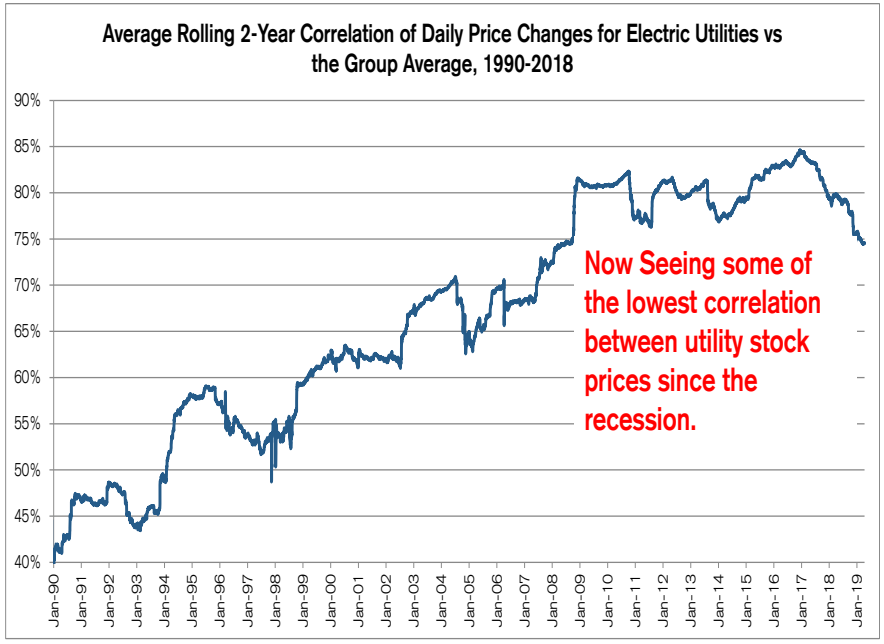

- **Correlations have dropped sharply.** The relative P/E between Utilities (UTY Index) and the S&P 500 (SPX) was strongly correlated (R2=0.68) with the 10-Year yield from 2010-2013, but this dropped sharply (R2=0.01) from 2014-2019 at lower yields.
- **Less impact from bonds; more impact from volatility.** With lower bond yields, utility equities are less reactive to yield competition with bonds and more responsive to defensive inflows during periods of equity market volatility.
- **Lower beta since the recession** as defensive safe-haven trading has dominated the sector.

Source: Company data, the BLOOMBERG PROFESSIONAL ™ service

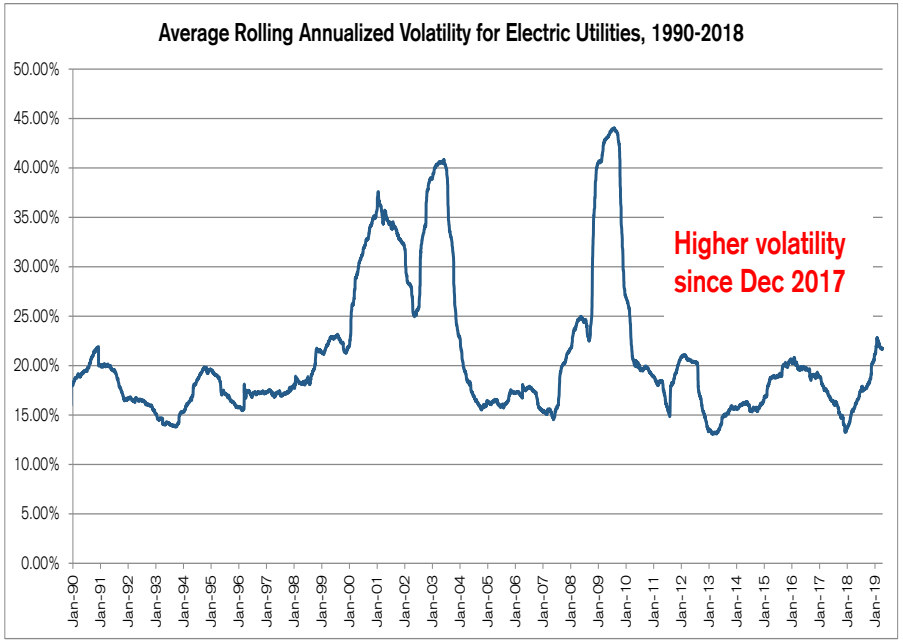
# Intra-sector Correlations Have Dropped Sharply in the Past Two Years

- **Correlations and Volatility.** The next two charts illustrate the increasing correlation between utility stock movements since 1990 (an average of each stock's correlation vs. the group average daily movement), even while annualized volatility has remained fairly steady aside from recessionary spikes in 2001-2003 and 2007-2010.
- **Higher correlations since 1990** are likely a symptom of increased hedge-fund participation in the sector, programmatic trading, and the popularity of Exchange Traded Funds (ETFs), with higher correlations making it tougher on market/beta-neutral strategies typically run by sector-focused hedge funds.
- **Correlations are lower and volatility is higher recently.** However, the more recent reduction in average sector correlations since July 2017 is notably pronounced and harder to write off as a temporary blip. Reduced correlation and higher volatility may be an indicator of more individual stock selectivity based on fundamental analysis even as the sector serves as a defensive safe haven.

## Average Rolling 1-Year Correlation of Daily Price Changes for Electric Utilities vs. the Group Average, 1990-2019




## Average Rolling Annualized Volatility for Electric Utilities, 1990-2019



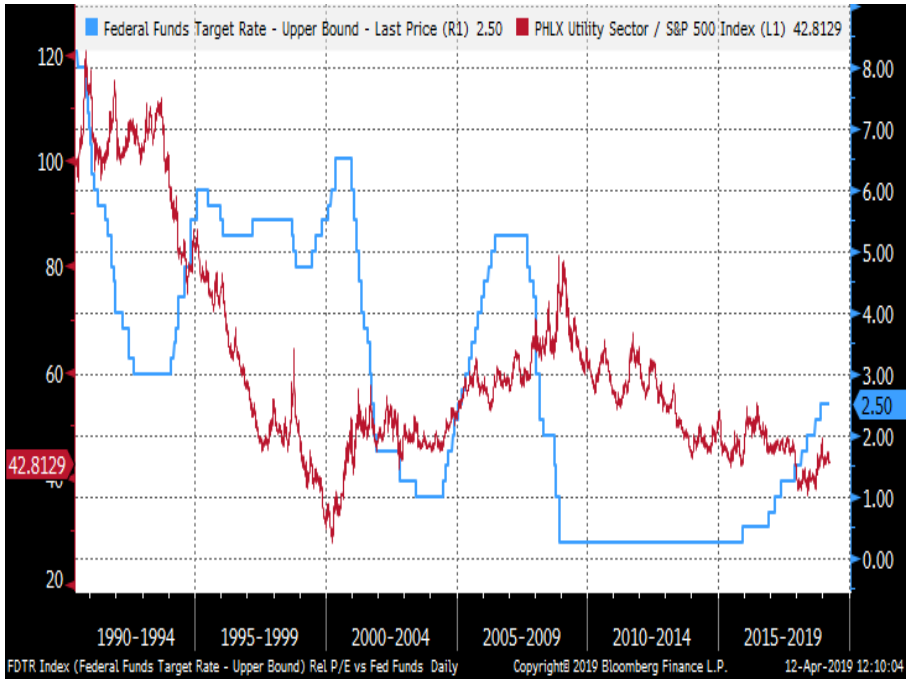

Source: the BLOOMBERG PROFESSIONAL™ service, Credit Suisse custom indices

# Utilities Haven't Been Reactive to Either the Fed or the Yield Curve

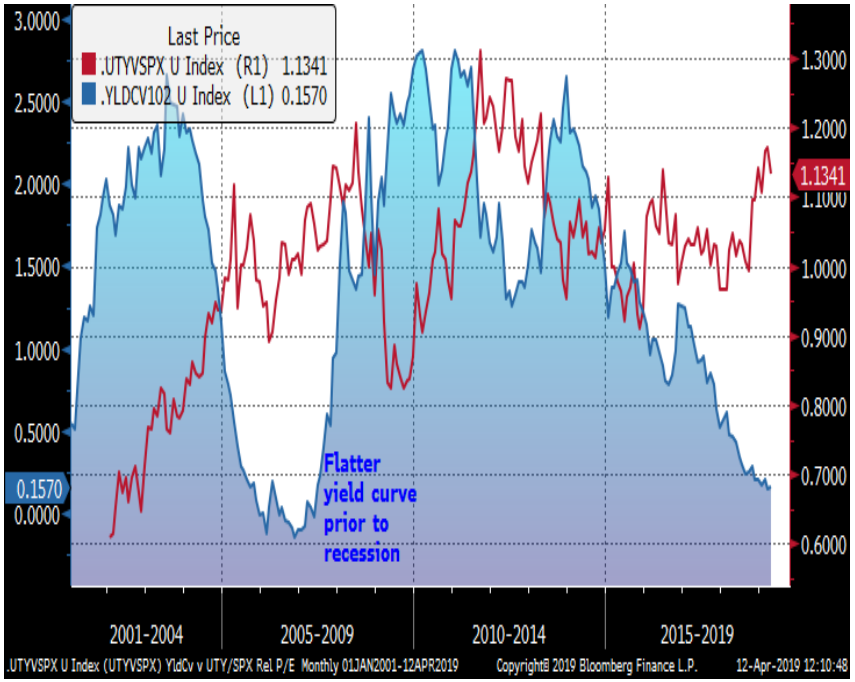
- **What about the Fed?** While utilities tend to trade inversely to the initial shock of a rate change, the longer-term picture reveals much less correlation between the two, particularly since the recession of 2001/2 ended.

- **What about the yield curve?** Intuitively, a flatter yield curve should be a leading indicator of economic trouble, with defensive in-flows resulting in utility-sector outperformance. However, the reality is that we see little useful correlation between the relative performance of utilities (vs. SPX) and the flattening of the yield curve. Below we plot out the changing spread between 10-Yr yields and 2-Yr yields (blue shaded area) vs. utility performance (red line).

## Fed Funds Target Rate vs. Relative Performance of UTY vs. SPX, (normalized back to 1990)




## Flatter Yield Curve vs. Utes Relative Performance vs. SPX, 2000-2019




Source: the BLOOMBERG PROFESSIONAL™ service, Credit Suisse custom indices

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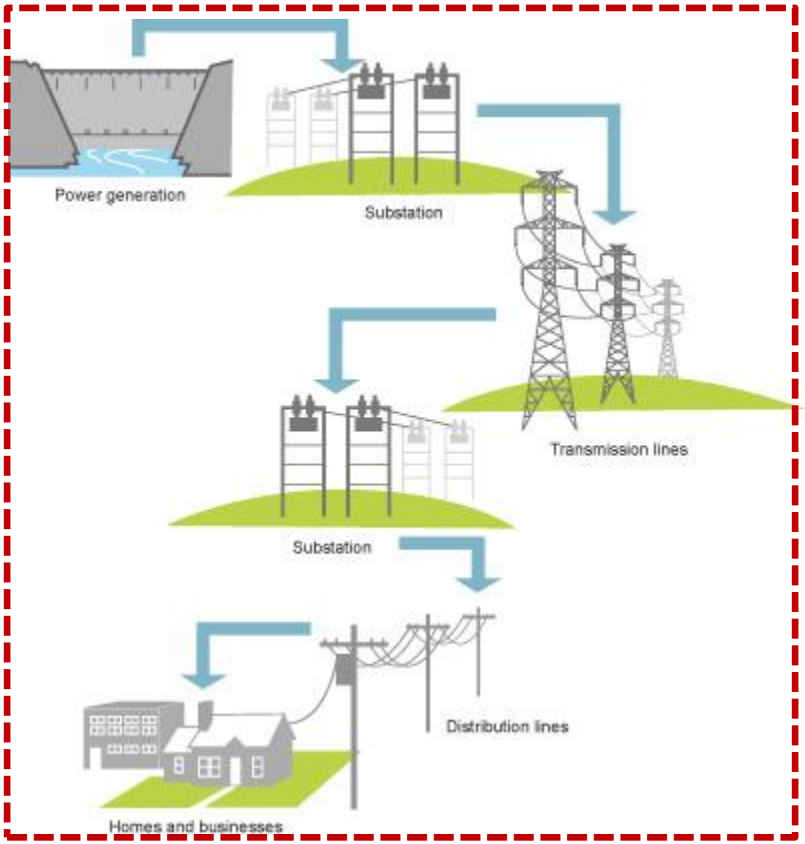
# Regulated Utilities



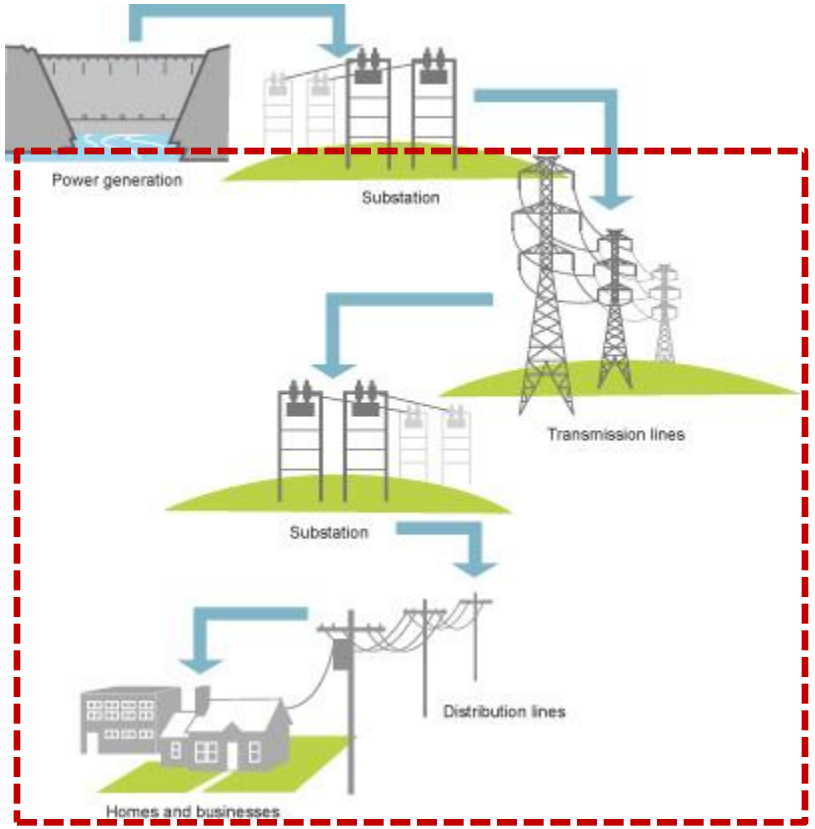
# Regulated Utility – Vertically Integrated vs T&D

The vast majority of power-related assets are housed within regulated utilities

**Vertically Integrated Utility**




**T&D Utility**



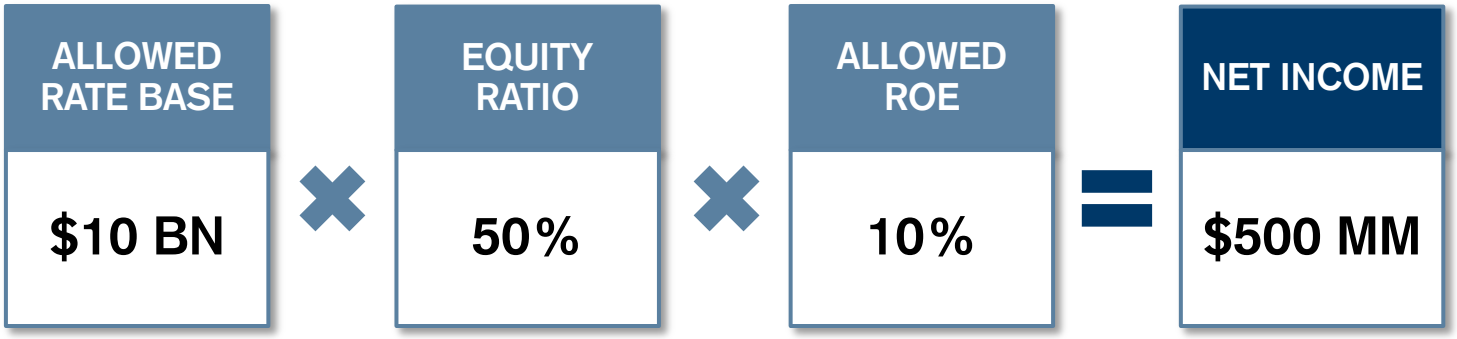

- Vertically integrated utilities and T&D ('wires only') utilities own transmission and distribution systems.
- Vertically integrated utilities own generation resources whereas T&D utilities purchase power from third-party providers.

Source: https://www.portlandgeneral.com, Credit Suisse estimates

# Regulated Utilities – 3 Simple Building Blocks

## A transparent methodology to derive **net income requirement**

**Regulated Utilities – Net Income Derivation**



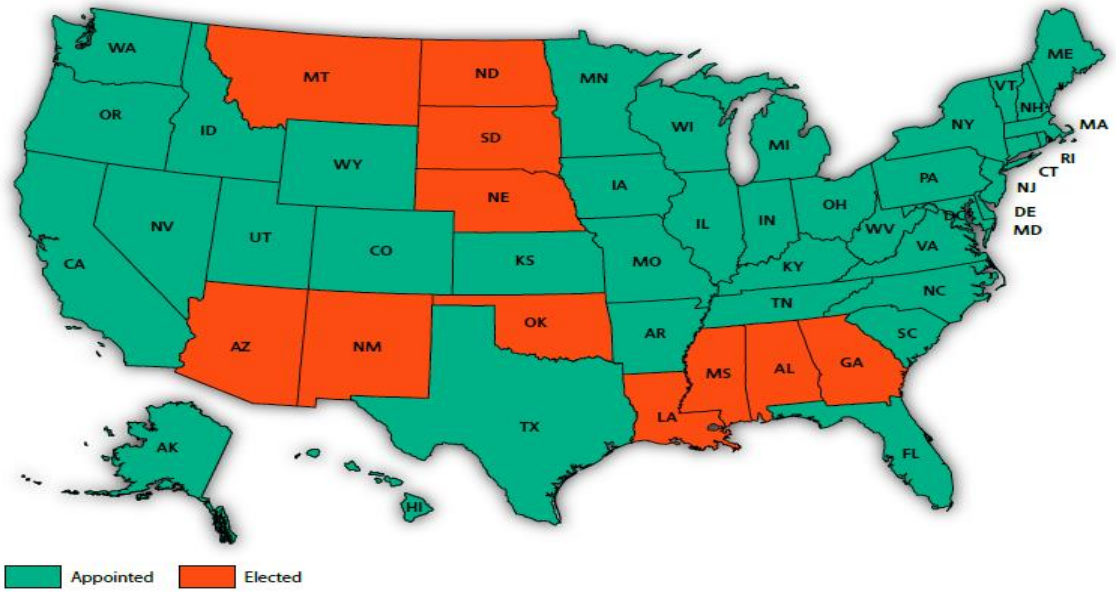

- The building blocks of the regulated utility business model can be captured in three discrete drivers which when multiplied together should give a simplistic look at utility earnings power:
  - **Rate base:** Similar to ***net PP&E*** after some adjustments, rate base is the invested capital in the business upon which the regulated utility is allowed to earn a return. Because rate base is net of depreciation, utilities must reinvest at least their annual depreciation to keep rate base flat. Many jurisdictions have added equity return capability to other spend that is not yet in official rate base – items typically include **AFUDC** (Allowance for Funds Used During Construction – an item akin to Construction Work in Progress).
  - **Equity ratio:** Regulators have a prescribed capital structure for monopoly utilities with a general target of 50% equity and 50% debt +/- around 2% with the aim of having the lowest WACC.
  - **ROE:** The targeted return set by regulators that the utility should earn on the equity capital invested in the business, which has been reasonably consistent just under 10% for the past 3 years (see later slide).
- Under this construct, regulated utilities are able to most directly grow their earnings through faster rate base growth followed by improvements in ROEs (although that has not happened in years).

Source: Credit Suisse estimates

# Utilities Are Regulated Primarily at the State Level

## The Commissioners overseeing utilities are both elected and appointed

**State Commissions – Elected vs Appointed**




- Utilities are regulated at the state level by ~3-5 Commissioners that serve in a governmental agency titled Public Utility/Service Commission (PUC/PSC), Corporation Commission (CC), or a similar name.
- The Federal Energy Regulatory Commission (FERC) has regulatory oversight for electric and gas transmission while distribution and generation is done at the state level.
- Interestingly, the role of Utilities Commissioner in a number of states is still an elected position. In states with Appointed Commission, the positions are generally appointed by the Governor and may require representatives from both political parties.

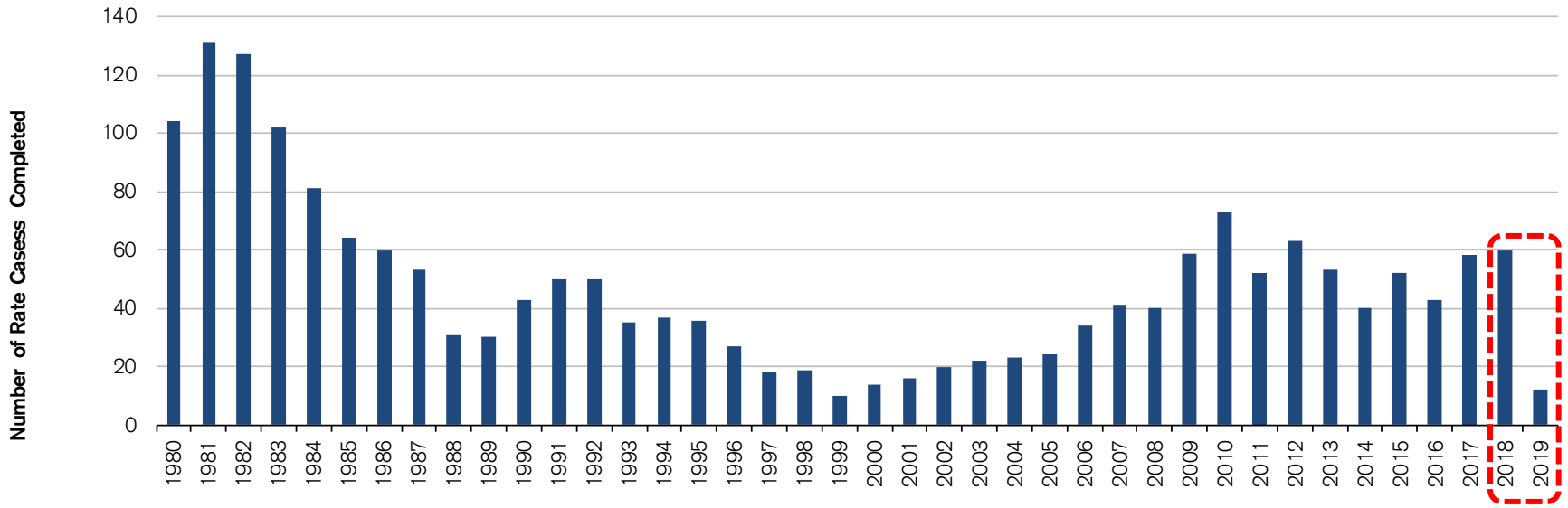


*Source: SNL*

# Utilities Seek Revenue Increases Primarily Through Rate Cases

## Utility rate increases are determined in a thorough regulatory proceeding

**# of Rate Cases Completed per Year**




- Regulated utilities seek rate increases from the state regulators to receive recovery of costs and return on capital for the money they invest (growth in rate base). The process will vary by state, but generally involve extensive filings to explain in detail the need for, and financials behind, a requested increase that can run into the 1000s of pages. Rate cases generally take 9-18 months to complete with the industry norm generally around 12 months.
- The industry is filing more rate cases (blue bars above) than in the 1990s and early 2000s as a result of the cyclical nature of infrastructure investment and an emphasis on environmental remediation and transmission expansion since 2005.

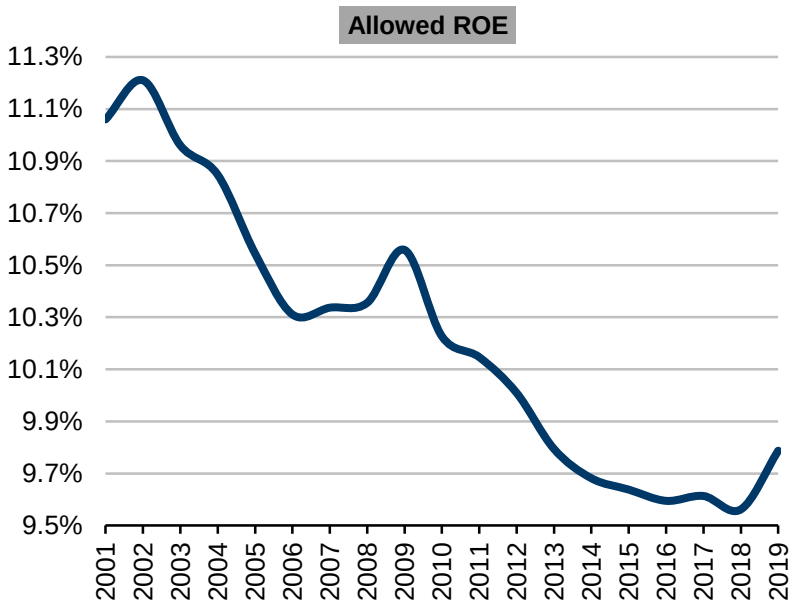
Source: SNL Financial, Company Reports

# Regulators Are Finally Increasing Allowed ROEs

## Rate cases include setting the allowed ROE for the business, now rising in high 9%'s

- Regulators set customer rates by working backwards; starting with the return on equity (ROE) to be granted to investors and then adding other costs, including recovery of capital expenditures, appropriateness of costs, operating expenses, taxes, and fuel.
- ROEs have held firm in the mid-high 9%'s despite declining bond yields.

| Year | Avg. ROE | Max ROE | Min ROE |
|---|---|---|---|
| **2018** | **9.56** | **10.00** | **8.69** |
| 2017 | 9.62 | 10.25 | 9.00 |
| 2016 | 9.60 | 10.55 | 8.64 |
| 2015 | 9.64 | 11.00 | 9.00 |
| 2014 | 9.68 | 10.25 | 9.17 |
| 2013 | 9.79 | 10.95 | 8.72 |
| 2012 | 10.01 | 10.50 | 9.25 |
| 2011 | 10.15 | 11.35 | 9.20 |
| 2010 | 10.25 | 11.15 | 9.40 |
| 2009 | 10.54 | 11.50 | 8.75 |
| 2008 | 10.33 | 11.00 | 9.10 |
| 2007 | 10.33 | 11.35 | 9.10 |
| 2006 | 10.41 | 11.60 | 9.55 |
| 2005 | 10.52 | 11.75 | 9.75 |
| 2004 | 10.86 | 12.00 | 10.25 |

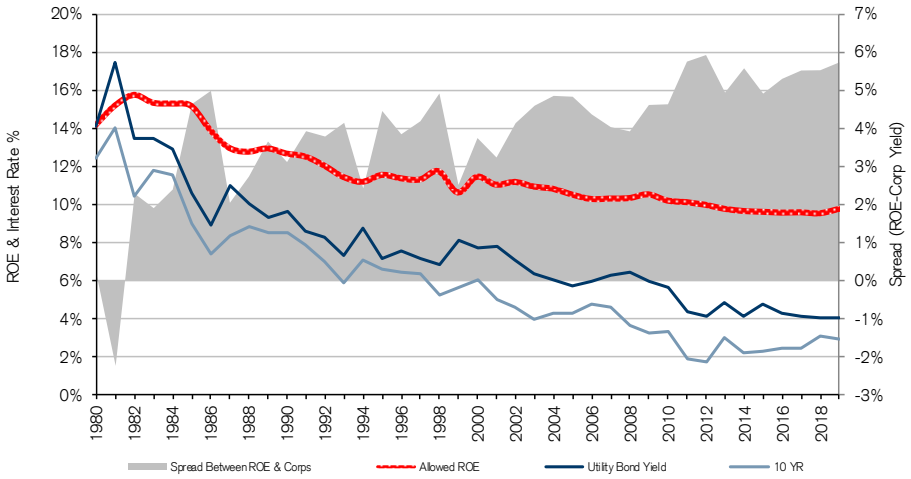



Source: SNL

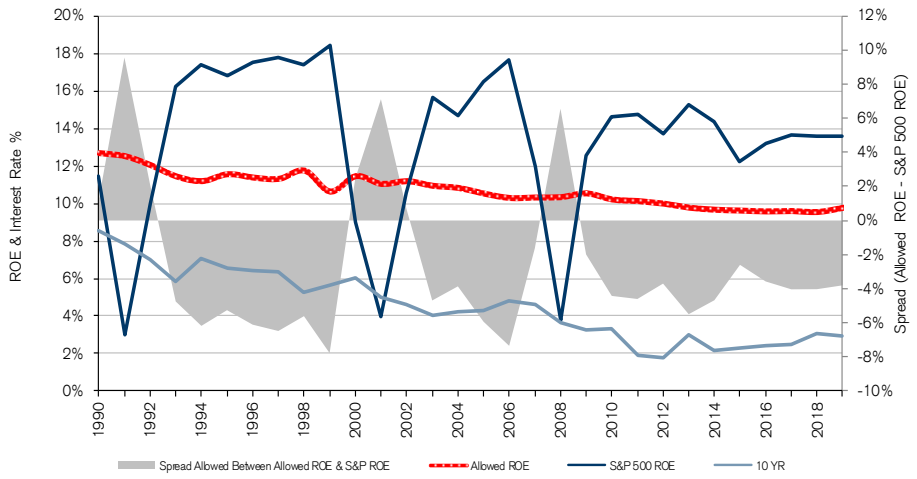
# Allowed ROEs Are Still Robust Relative to Interest Rates

## The spread between ROEs and bond yields remains historically wide

**Utility ROEs vs Utility Bond Yields**




**Utility ROEs vs S&P 500 ROEs**



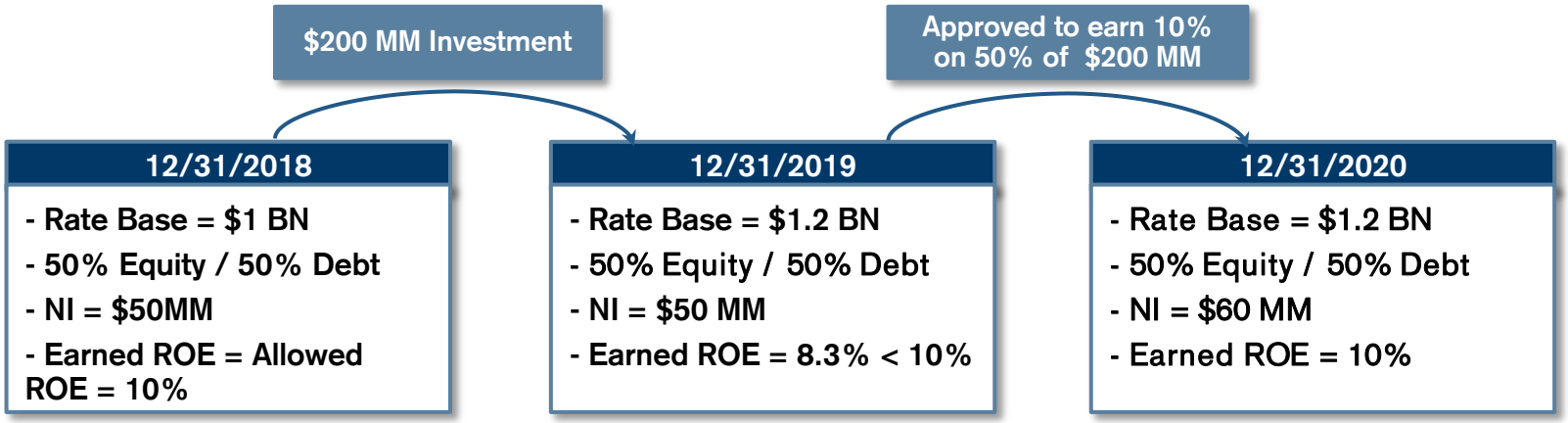

- ROE durability may reflect the outcome of a variety of concerns beyond alignment with interest rates through the CAPM formula. These include a competition for capital between states, the desire to attract jobs in a tough economy, low commodity/fuel prices that help keep bills low, and the need to maintain a robust market for utility equity to support heavy capital investment in long-term hard assets year after year.

Source: Credit Suisse estimates, SNL Financial, company data

# A Challenge for Utilities: Overcoming Regulatory Lag

Even though monopolies, utilities still need to work hard to earn their ROEs

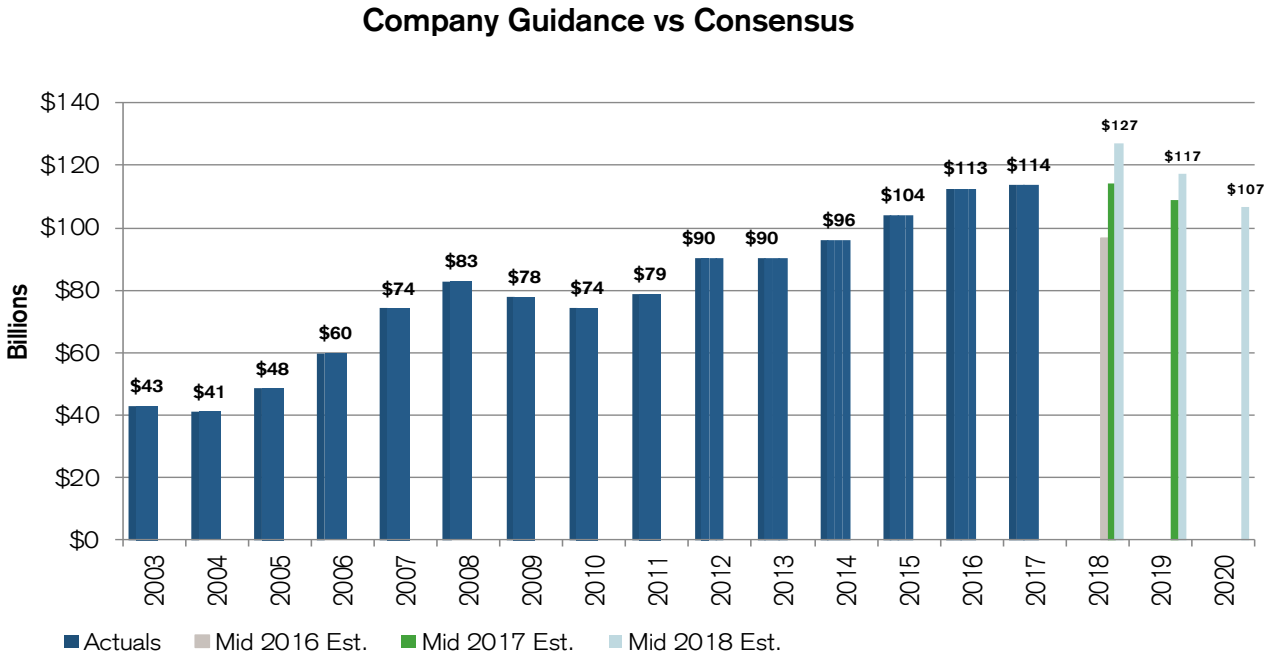
**Regulatory Lag Example**




- While regulated utilities enjoy an approved rate of return on their capital investments, utilities generally earn less than their allowed ROEs due to the lag between when they invest capital and when they are awarded a revenue increase to compensate for the investments made (refer back to rate cases generally taking 9-18 months and are largely based on historical costs and investment).
- The gap between the allowed and earned ROE is known as regulatory lag.
- To mitigate the regulatory lag:
  - Decoupling: revenues collected are not linked to volumetric sales
  - Forward test year: rate making is based on forecasted costs instead of historical costs
  - Cost trackers: costs are recovered as incurred through an automatic mechanism (pension, enviro, fuel clause, AFUDC, etc)
  - Cost management

# Industry Capital Expenditures Growing Significantly Since 2003

## Future capex always looks lower initially, but revised forecasts are always higher

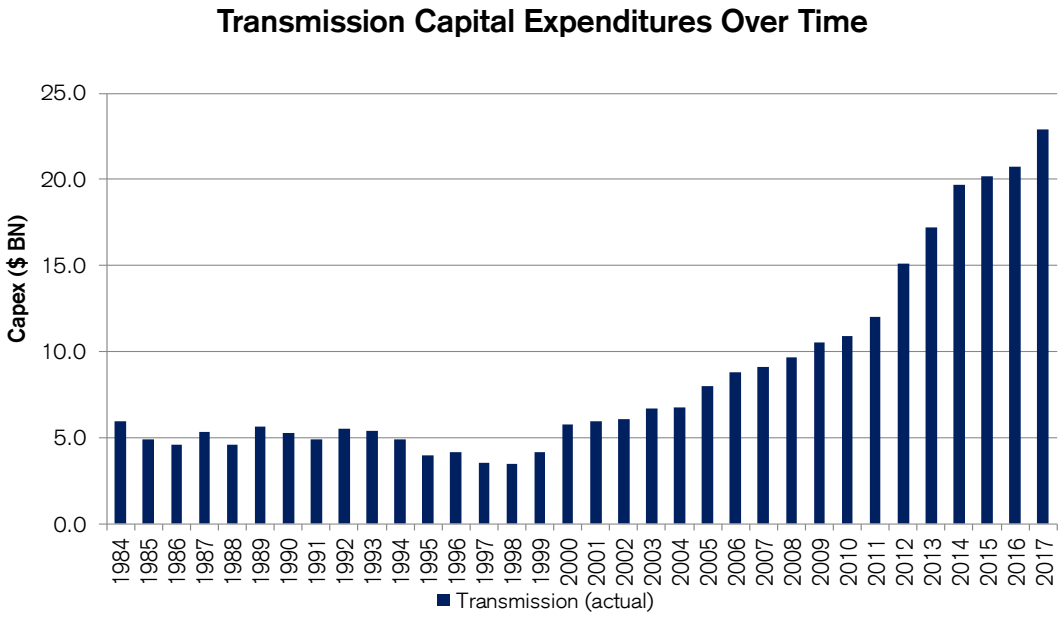



- Utility industry re-investment has increased significantly since 2003 / 2004, representing to us a change to the 'modern era' of utilities with greater emphasis on (1) **improving reliability** on an aging system and (2) meeting a range of **environmental compliance** obligations at power plants, and going forward the increasing integration of renewables *(that have higher capital intensity, higher system integration costs)*.
- A regular worry we hear from investors is doubts about the durability of Utility growth often pointing to the EEI projected capex data where spending is expected to fade (green bars). We see real reason for sustained higher spending (T&D reliability in particular) but should also note that EEI forecasts consistently reset higher with time (each year's estimate shifts higher as we get closer to the actual year) reflecting the industry's conservative capex forecasting.

Source: Edison Electric Institute.

# Transmission Capex Has Been on an Upswing

## Consistent with growing share in total assets



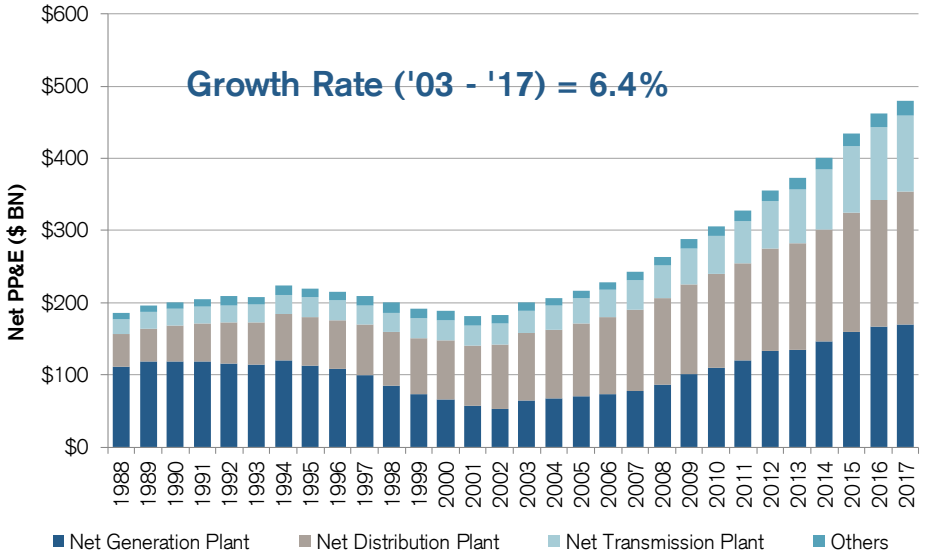

- Transmission capex has taken over the past decade or so, first attracted by the robust FERC regulated returns, near real-time cost recovery, and identified opportunities to build new transmission lines largely to bring new generation to market, especially renewable resources that are located far from load pockets.
- We see the next major opportunity for transmission growth in the mid-2020s, once renewable technology becomes cheap enough to thrive without tax credits and begins to spread to new areas further away from load centers.

Source: Edison Electric Institute

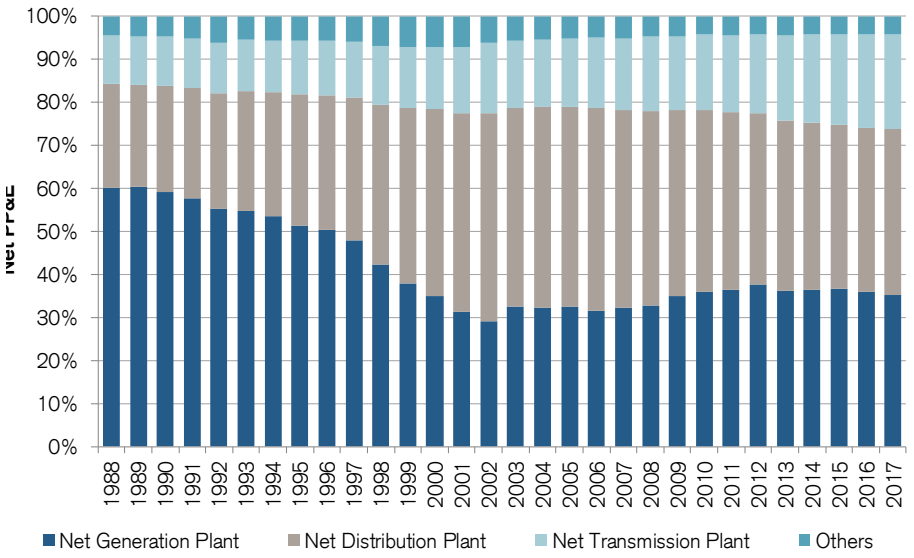
# Utility Asset Growth Has Risen Since 2003

## Total investment increases over time with transmission taking some share

**Breakdown of Net PP&E ($ BN)**




**Breakdown of Net PP&E (%): Transmission Growing**



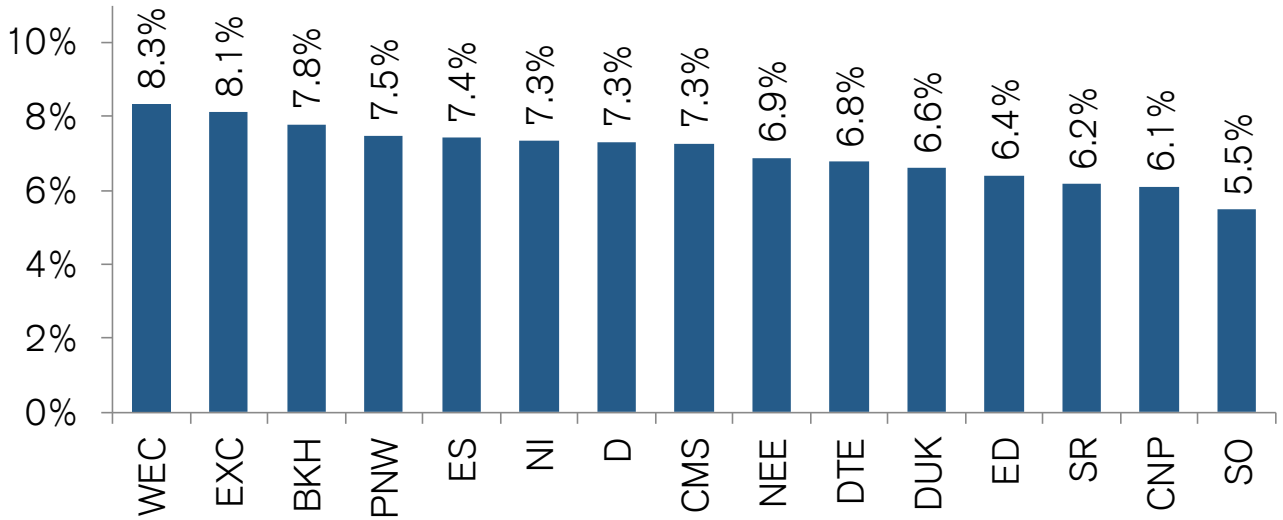

- A simple look at net PP&E for Regulated Utilities has shown ~6.4% growth starting in 2003:
  - take advantage of healthy allowed ROEs and market interest in growing yield vehicles
  - responding to environmental compliance needs and renewable mandates later in the decade, despite lackluster demand growth and requirements for new generation.
- Increasing proportion toward transmission investment, reflecting the broad need for replacement of aging equipment and renewable integration and the attractiveness of FERC regulated returns with generally higher ROEs and more timely revenue recovery (less lag).
- Going forward: we see increased transmission spending for utility scale renewables as well as significant distribution upgrades in jurisdiction with growth of distributed generation.

Source: SNL

# Rate Base Continues to Steadily Grow Annually at 6-8%

Identified capex needs by the utilities drive a robust earnings outlook

**Rate Base Growth '17-'21**



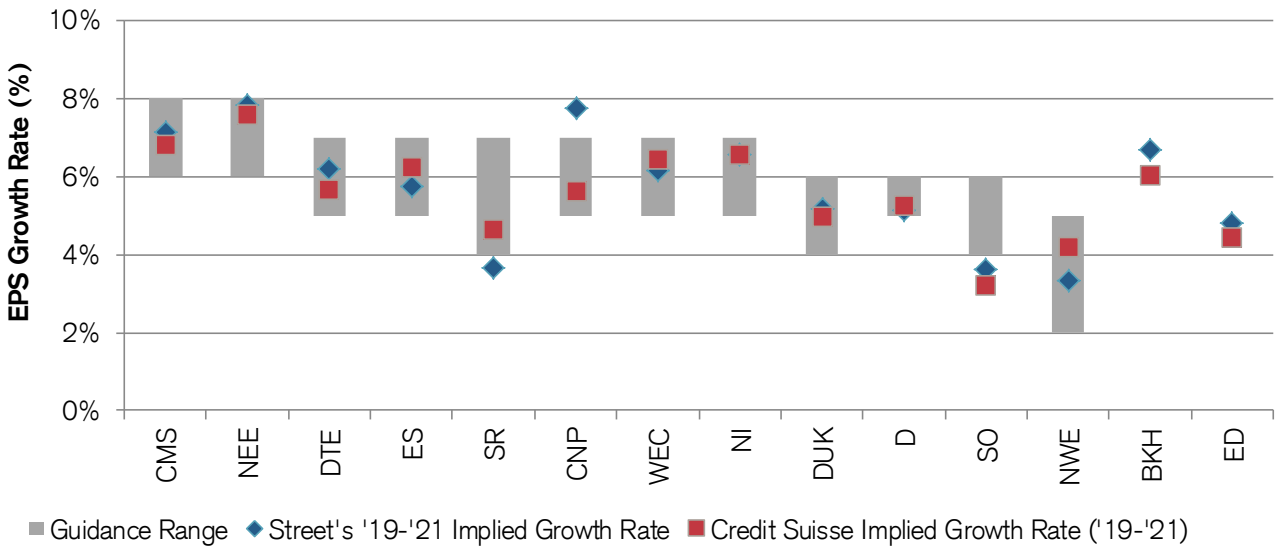

- Rate base growth through 2020 is running in the mid-high single digits for most utilities and ahead of targeted EPS growth of 4-6% as equity dilution, etc., erodes some of the conversion of asset-based growth to EPS.
- Companies toward the lower end of the growth range will need to remain diligent and manage O&M levels in order to meet their longer-term growth EPS rates.

Source: Company data, Credit Suisse estimates, * CNP growth off 2018 base includes M&A

# Rate Base Growth Translates into EPS Growth

- Most utilities have EPS growth targets to 2020 of 4-7% annually, underpinned by the rate base growth from the preceding slide. Further, rate base growth expectations are typically (although not always) derived from highly visible capital project plans – with room for upside as time progresses as new investment needs are identified.
- Comparing company guidance against Street estimates we see consensus in-line with what the companies expect.
- This suggests that the stocks are fairly valued, with estimates in the middle of company guidance, and with any upward or downward momentum in estimates driving the stocks.

**Company Guidance vs Consensus vs CS Estimates**

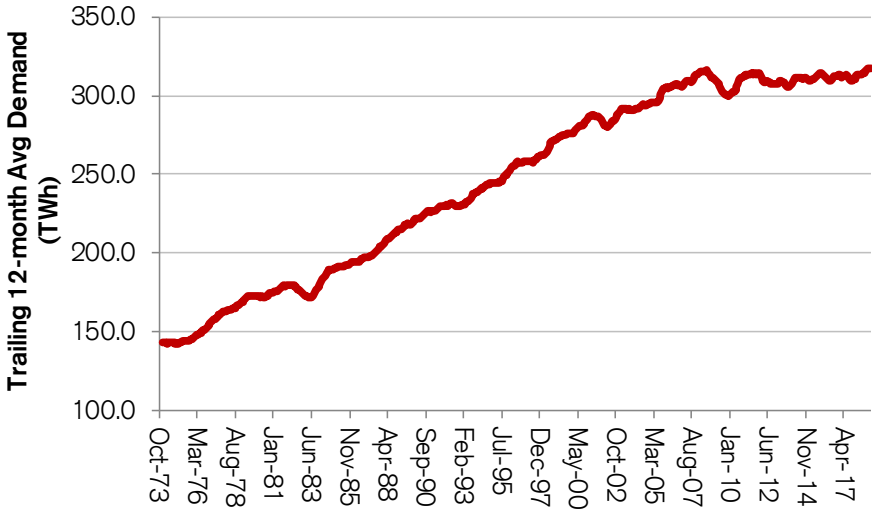



Source: Credit Suisse estimates I/B/E/S Estimate for all consensus numbers, FactSet, SNL, Company Filings

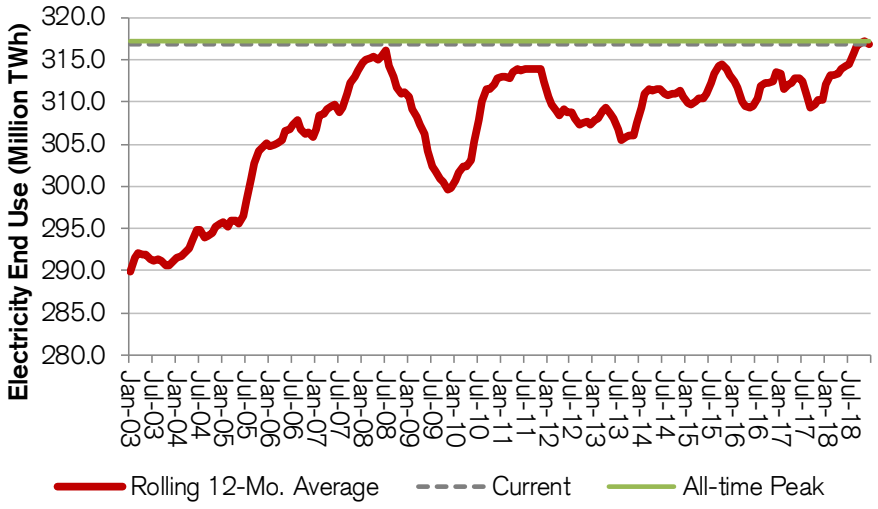
# Structural Challenges: Demand Has Languished

## Total US power demand is reaching the highs set in 2008 again

**Total Retail Sales 1973-Current (TWh)**




**Total Retail Sales 2003- Current(TWh)**




- US Power demand is now net down 3.05% versus the 2008 peak before the Great Recession using trailing 12-month demand numbers.

- Even more striking has been the retrenchment in consumption even from 2011 levels, highlighting the continued drag of energy efficiency and a level of weather normalization after a couple hot summers.

Source: EIA.gov, Credit Suisse estimates

# Earnings Growth Without Revenue Growth: Lowering O&M Creates Headroom to Support Incremental Capex

## Lowering tax rate to 21% allows potential 11% increase in ratebase

**Savings and Incremental Capex Equivalent**

| Savings and Incr. Capex | | Savings and Incr. Capex | |
|---|---|---|---|
| Rate Base | **$7.25** | Rate Base | **$8.05** |
| Equity | 50% | Equity | 50% |
| ROE | 10.0% | ROE | 10.0% |
| Interest Rate | 5.5% | Interest Rate | 5.5% |
| Depr Life | 30 | Depr Life | 30 |
| Tax Rate | **35%** | Tax Rate | **21%** |
| **Net Income** | **$0.36** | **Net Income** | **$0.40** |
| Taxes | $ 0.20 | Taxes | $ 0.11 |
| **Pre-tax Income** | **$0.56** | **Pre-tax Income** | **$0.51** |
| Int Exp | $ 0.20 | Int Exp | $ 0.22 |
| Depr | $ 0.24 | Depr | $ 0.27 |
| **Revenues** | **$1.00** | **Revenues** | **$1.00** |

- Reducing operating expenses leaves "headroom" in customer revenues to support higher capital cost for stronger investment, opening up the opportunity for utilities to invest additional capex at 7-8x the savings.
- Lower income tax rates help just the same. For example, $1 of savings supports $7.3 of ratebase under 35% tax rate or $8.1 of ratebase under 21% tax rate (11% more).
- Increasing a regulated annual capital budget by 11% further translates into 150 bps of additional growth CAGR if fully invested plus another 20 bps from *reduced* deferred taxes (typically a subtraction from ratebase). See next slide.

Source: Credit Suisse estimates

# Steel for Fuel - A Cleaner Way to Boost Growth

Lowering fuel costs also provides room in customer bills for clean investment

**Steel for Fuel**





- With fuel costs as a pass-through expense (no return earned) for regulated utilities, utilities have a built-in incentive to build more renewables.
- Replacing fossil fuel generation with wind resources reduces the fuel portion of a customer's bill and substitutes it with recovery of and on capital investment in wind turbines (and solar panels).
- This strategy, which was pioneered by XEL under its "steel for fuel" program. Similar initiatives are underway at CMS, NI and others.
- Win-win situation for regulators, consumers, and environmental groups, striking a balance between supporting state RPS goals and stabilizing customer rates.

Source: NextEra Energy, Tennessee Valley Authority, http://www.yokogawa.com, Credit Suisse estimates

# Incremental Capex and Rate Base Growth Illustration

New tax rules create the opportunity to increase capex 11% and grow ratebase 170 bps faster.

**Base Case – Generic Utility 5.4% CAGR assuming PATH Bonus Depreciation at 35% Tax Rate**

| Calculation of ratebase ($M) | Year | 2017 | 2018 | 2019 | 2020 |
|---|---|---|---|---|---|
| **Maintenance Capex - 20-yr MACRS depn for def taxes** | | **103** | **107** | **110** | **114** |
| **Growth Capex - 20-yr MACRS depn for def taxes @ 35% tax rate** | | | | | **72** |
| **Growth Capex - bonus depn 50/50/50/40/30 under PATH @ 35% tax rate** | | **65** | **67** | **69** | |
| Total Capex | | 168 | 174 | 180 | 186 |
| Cumulative PP&E | | 3,331 | 3,505 | 3,685 | 3,871 |
| Cumulative Depreciation | **20** | (2,260) | (2,370) | (2,484) | (2,603) |
| Cumulative Deferred taxes | | (52) | (62) | (70) | (71) |
| **Ratebase** | | **1,019** | **1,073** | **1,131** | **1,197** |
| Capex/Depn | | **1.6x** | **1.6x** | **1.6x** | **1.6x** |
| CAGR vs Year Zero | | | | | **5.4%** |

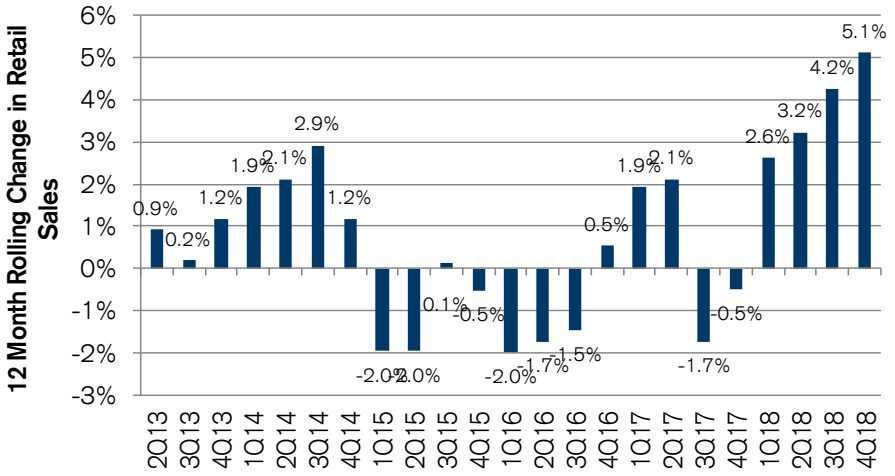
**Demonstration +170 bps incremental growth assuming no PATH after 2017, 11% higher capex, and a 21% Tax Rate**

| Calculation of ratebase ($M) | Year | 2017 | 2018 | 2019 | 2020 |
|---|---|---|---|---|---|
| **Maintenance Capex - 20-yr MACRS depn for def taxes** | | **104** | **108** | **113** | **118** |
| **Growth Capex - 20-yr MACRS depn for def taxes @ 21% tax rate** | | | **84** | **88** | **91** |
| **Growth Capex - bonus depn 50% under curtailed PATH @ 21% tax rate** | | **81** | | | |
| **Growth Capex - bonus depn 100% @ 20% tax rate** | | | | | |
| Total Capex | | 185 | 192 | 200 | 209 |
| Cumulative PP&E | | 3,362 | 3,554 | 3,755 | 3,964 |
| Cumulative Depreciation | **20** | (2,262) | (2,375) | (2,492) | (2,616) |
| Cumulative Deferred taxes | | (34) | (35) | (36) | (37) |
| **Ratebase** | | **1,066** | **1,145** | **1,226** | **1,311** |
| Capex/Depn | | **1.8x** | **1.8x** | **1.8x** | **1.8x** |
| CAGR vs Year Zero | | | | | **7.1%** |

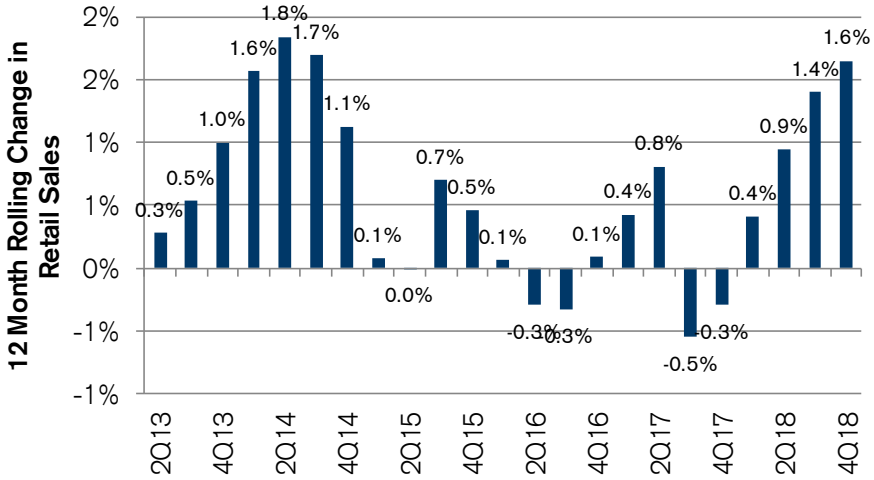
Source: Credit Suisse estimates

# Industrial Sales Growth Picking Up – Usually a Leading Indicator

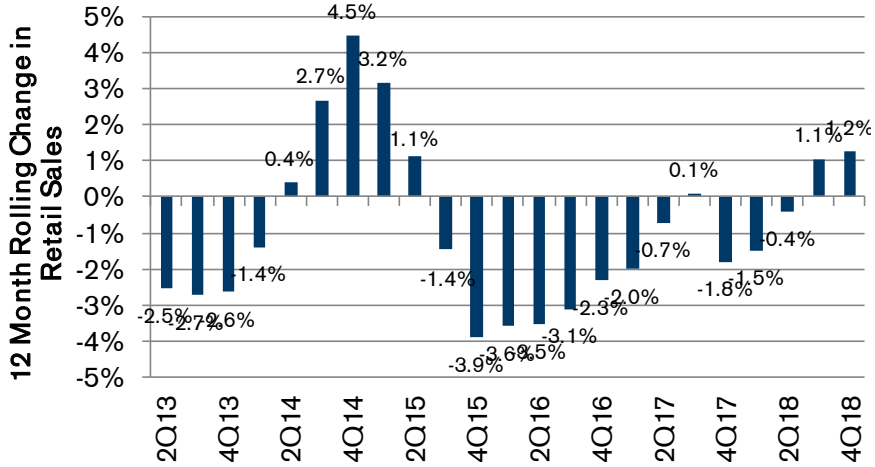
### Rolling Change in Residential Retail Sales



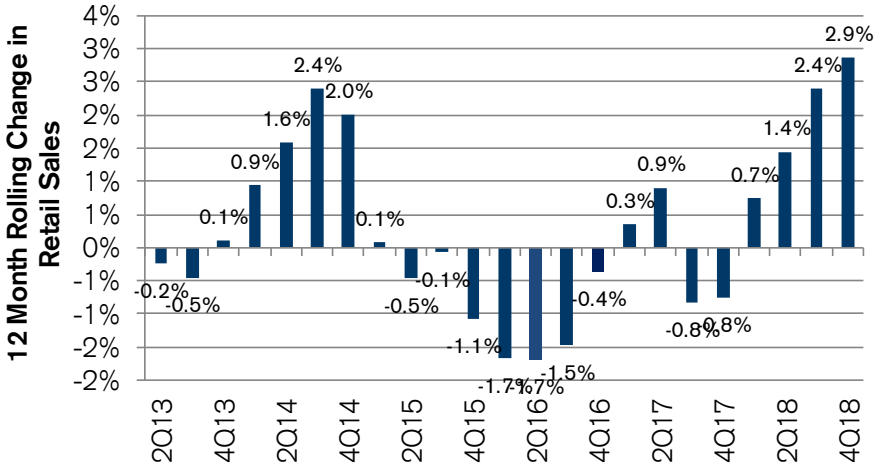

### Rolling Change in Commercial Retail Sales




### Rolling Change in Industrial Sales




### Rolling Change in Total Retail Sales

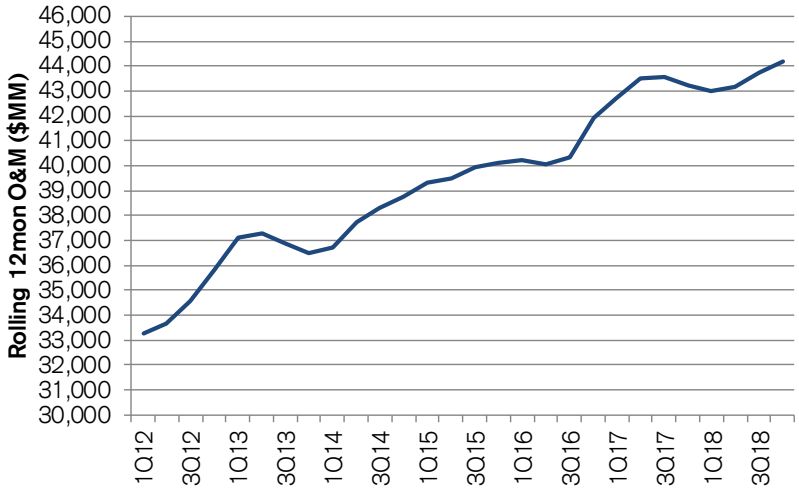



Source: EIA.gov, Credit Suisse estimates, EEI, the BLOOMBERG PROFESSIONAL ™ service

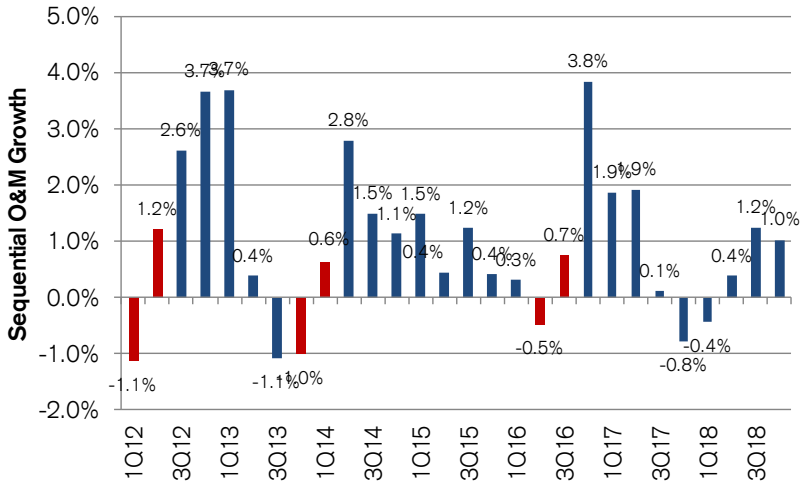
# More Active Cost Management Gives Utilities Flexibility

## More focus on managing O&M to below inflation

**Rolling 12 Month O&M**
*weighted by market cap*




**Sequential Change in Rolling 12 month O&M**
*weighted by market cap*



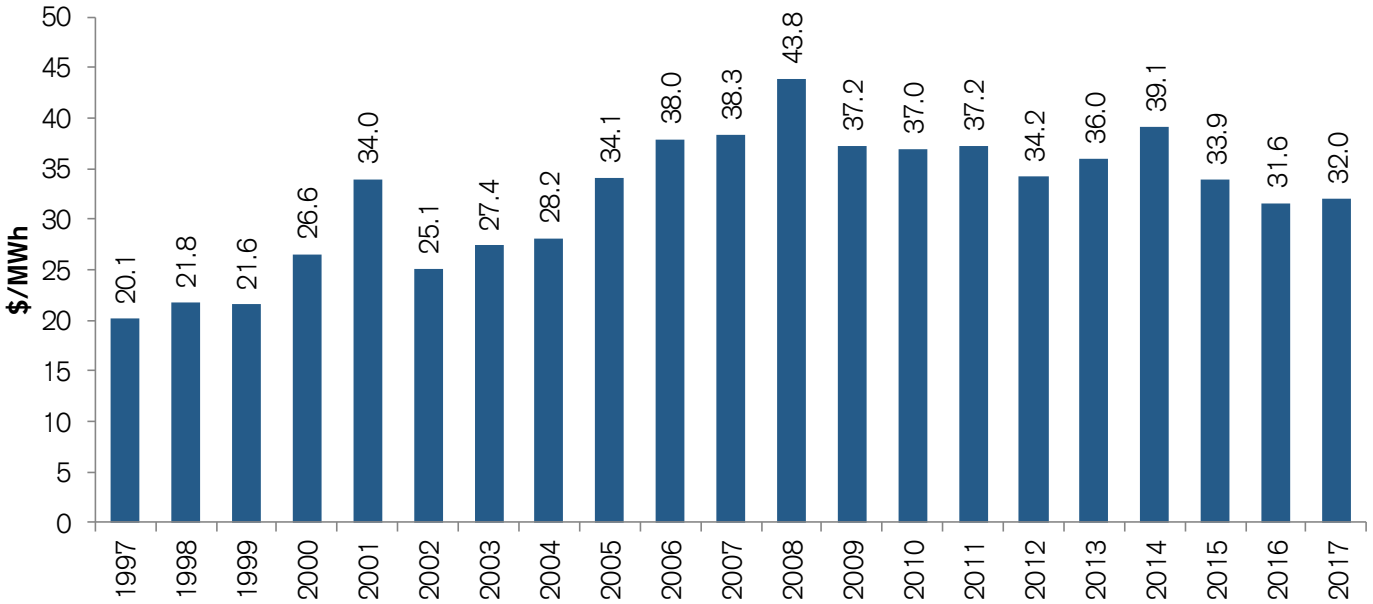

- Utilities are showing a concentrated focus on managing O&M expenses through a combination of efficiency driven capital investment, changing labor relationships (lower pension expense), and more active use of benchmarking to target best (or at least better) in-class performance.
- The benefits of O&M cost management can be seen simply as a way to improve earned ROEs but is more commonly a tool to help mitigate pressure on customer bills that come with more investment.

Note: Sample set comprised of Utilities currently under Credit Suisse coverage
Source: FactSet Reuters, Company data, Credit Suisse estimates

# The Absolute Cost of Power Has Been Stable

The drop in natural gas prices has led to deflationary trends in power costs

**Fuel Expense and Purchased Power Costs per MWh of Electricity Delivered**

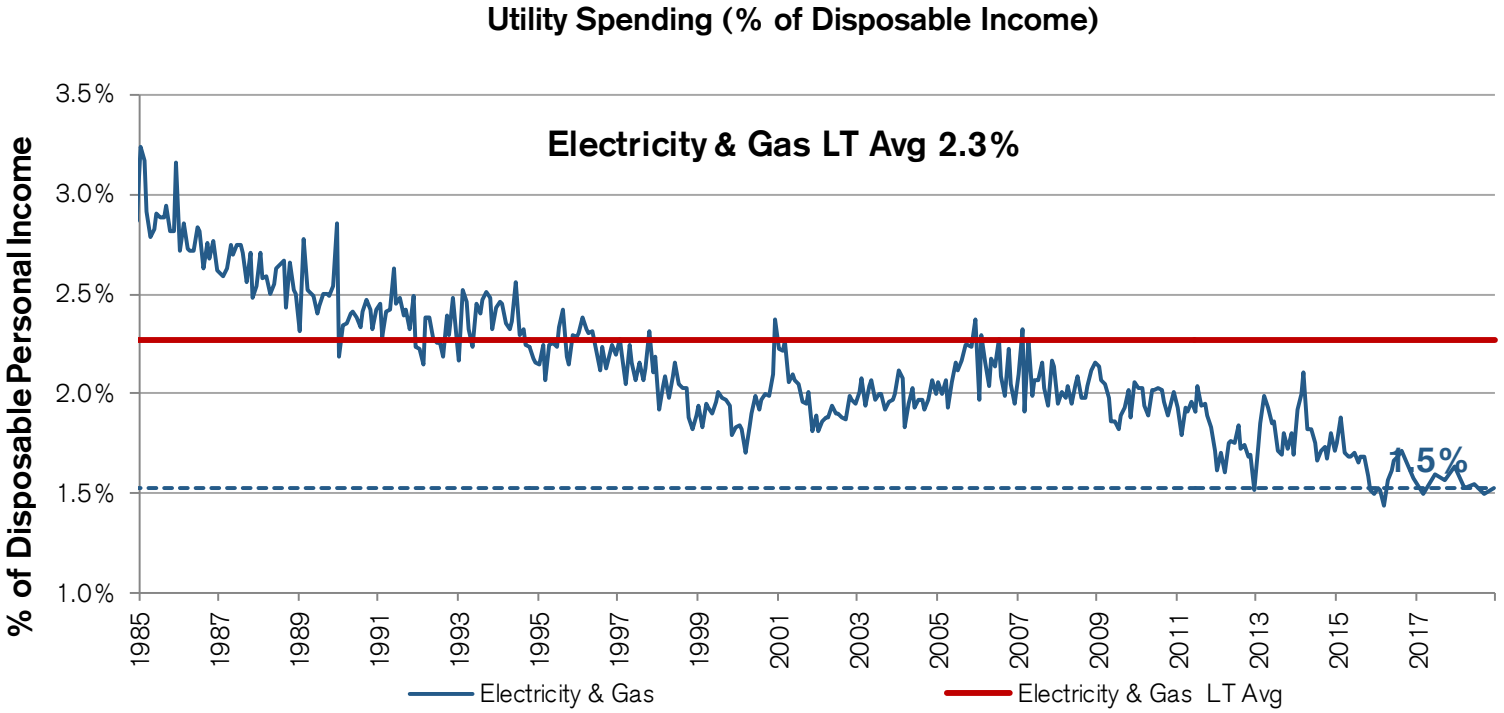



- Declines in commodity prices (notably natural gas) have stabilized the energy cost component of electricity bills in recent years.
- We think the industry will need to be diligent going forward in managing the cost of power as natural gas prices trend higher (and with greater volatility) and as the pending retirement of coal plants due to EPA rules push more output to higher cost units.

Source: SNL Financial, company reports

# Utility Bills Are Still Historically Cheap

## Spending as % of disposable income near historic lows

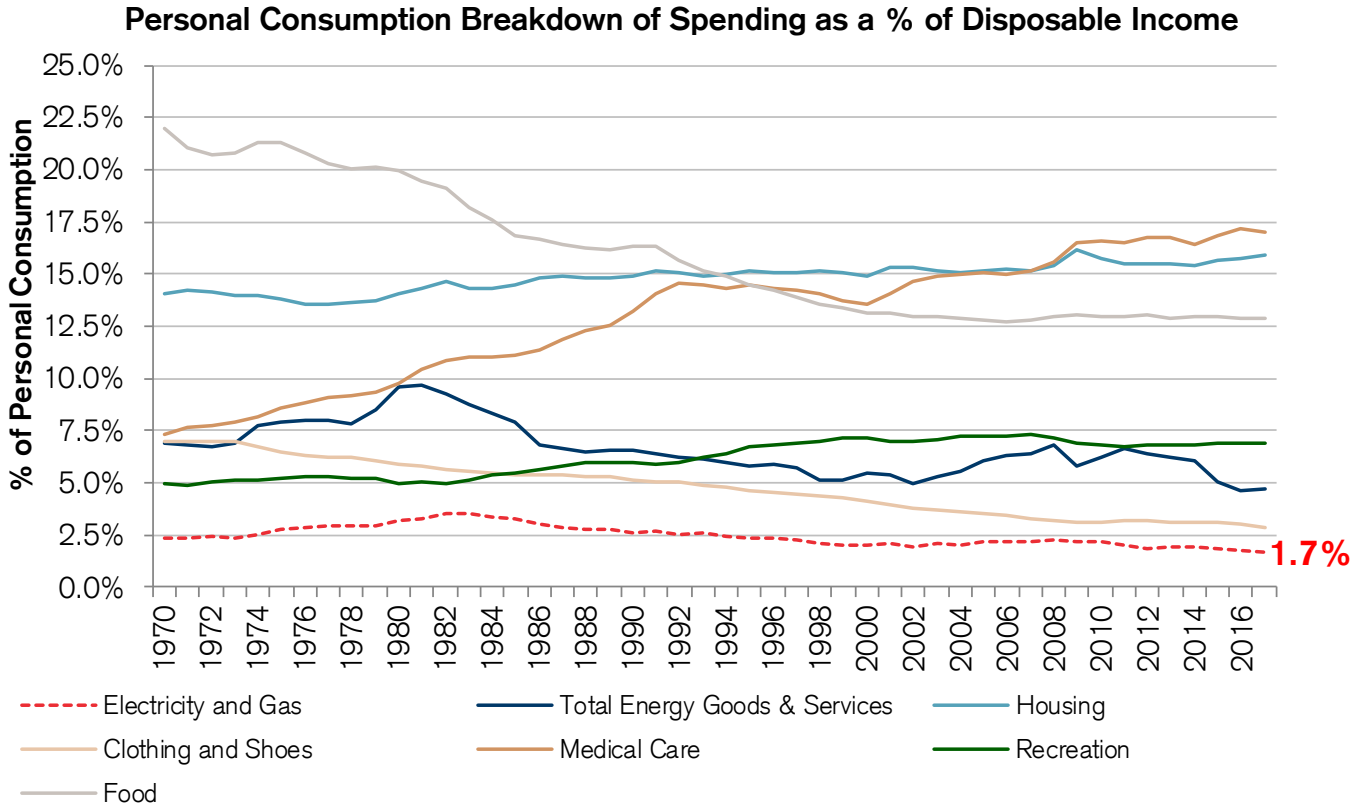



- Spending on Utilities as a percentage of personal disposable income (PDI) has been falling for more than a generation, approaching all time lows of 1.5% but have bounced with the cold winter in 2015.
- Resetting to the LT average of 2.3% would suggest headroom of over $99bn; with the '80's peak reaching +$269bn.

Source: Bureau of Labor Statistics, Credit Suisse estimates

# Utilities Are Integral to Life, Yet a Small Monthly Expenditure

## Utility bills are a small piece of overall wallet share




- While integral to daily life, spending on electricity remains a very small piece of the overall consumer wallet share (red line) and has stayed below 2% since the financial crisis (at 1.7% in 2017).

Source: Bureau of Labor Statistics, Credit Suisse estimates

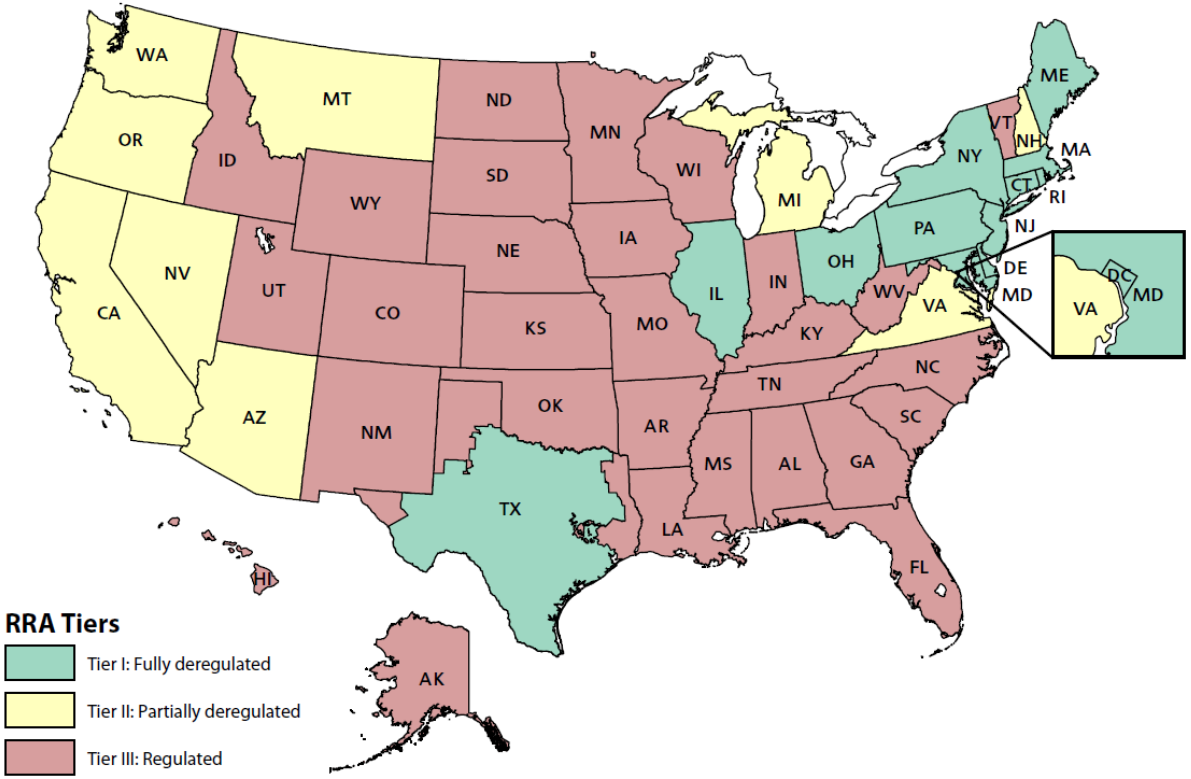
# Competitive Power



# Deregulated Power Markets Are Primarily in the Northeast and Texas

Competition has endured in markets with early transition and regional support

**Regulated vs. Deregulated Electricity Markets**




- Competitive power markets are deregulated for power generation while monopoly wires businesses (transmission and distribution) are owned by regulated utility monopolies (it would make no sense to have extra sets of wires everywhere).
- The primary power markets are PJM (covers the Mid-Atlantic going west to Illinois), NEPOOL (which covers the New England states), NYISO (NY state), and ERCOT (Texas).

*Source: SNL*

# Definition of Common Terms

| Term | Explanation |
|---|---|
| **Heat Rate (Power Plant)** | - The amount of thermal energy (gas, coal) used by a power plant to produce 1 MWh and is a proxy for a power plant's efficiency in converting fuel into electricity. |
| **Heat Rate (Power Price)** | - Calculated by dividing the power price by the natural gas price. This application of heat rate is primarily as a quick way to compare the market price of power against the cost to produce power from a gas plant; when the market heat rate is higher, a gas plant is economic and vice versa. |
| **Spark Spread (SS)** | - Measures a natural gas plant's gross margin<br>- Is the difference between **power price** received and **the cost of gas** used<br>- **SS** ($/MWh) = **Power Price** ($/MWh) – **Gas Price** ($/MMBtu)* **Plant Heat Rate** (MMBtu/MWh) |
| **Dark Spread (DS)** | - Measures a coal plant's profitability<br>- Is the difference between **power price** received by the coal generator and **the cost of coal** burned<br>- **DS** ($/MWh) = **Power Price** ($/MWh) – **Coal Price** ($/ton)***Heat Rate** (MMBtu/MWh)/ **Heat Content** (MMBtu/ ton) |
| **Quark Spread (QS)** | - Measures a nuclear plant's profitability<br>- Is the difference between **power price** received by the nuclear generator for the power generated and **the cost fuel** used<br>- **QS** ($/MWh) = **Power Price** ($/MWh) – **Nuclear Fuel Cost** ($/MWh) |

Source: Credit Suisse estimates

# Definition of Common Terms

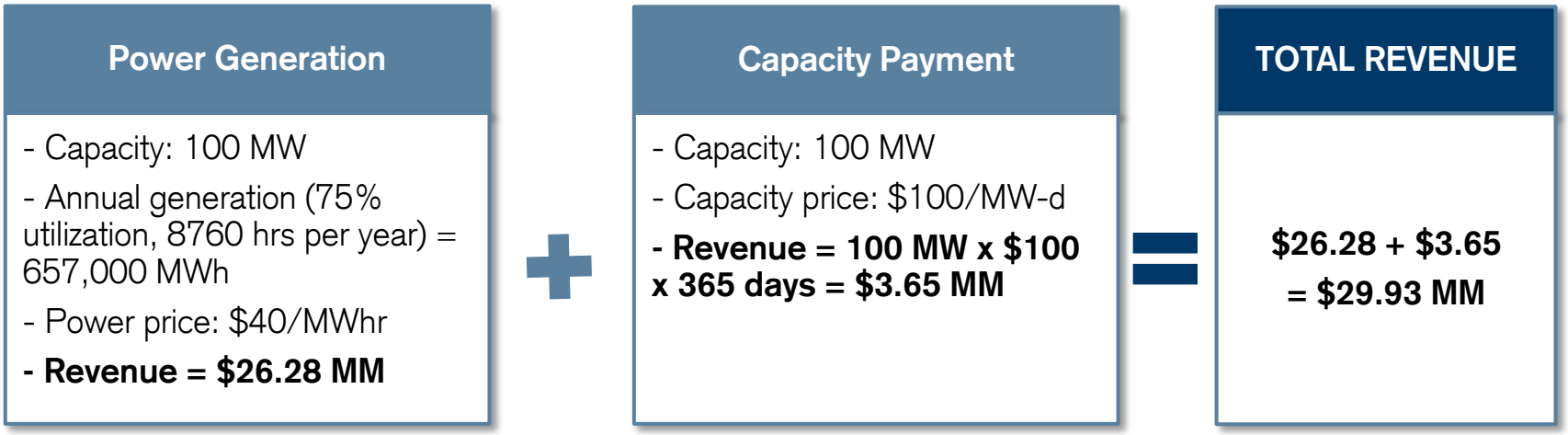
| Term | Explanation |
|---|---|
| **Distinction between MW and MWh** | - **MW**: is a unit of productivity that measures the maximum amount of electricity that a power plant can potentially produce.<br>- **MWh**: is unit of output that measures the actual amount of energy produced by a generating resource in one hour and is the unit upon which power is priced. |
| **Reserve Margin** | - Electricity is an on demand resource so there always need to be more available capacity than there is demand with a targeted 'cushion' to account for reliability or delivery challenges; generally speaking markets target a reserve margin around 15% or higher (meaning 15% more capacity than the peak moment of demand)<br>- The reserve margin is calculated by dividing total capacity by the peak moment of demand in a given year and subtracting by 1. |
| **RPM (Reliability Pricing Model)** | - Is PJM' s capacity market which aims to procure capacity three years in advance in competitive auctions to meet forecasted power demand. |
| **FCM (Forward Capacity Market)** | - Is ISO-NE's forward capacity market through which ISO-NE will hold auctions to procure capacity needed three years out (very similar to PJM's RPM) to meet forecasted power demand. |

Source: Credit Suisse estimates

# Revenue Streams: How Competitive Generators Get Paid

## Competitive power plants derive revenues from energy plus capacity payments

**Revenue Streams for Competitive Generation Companies**



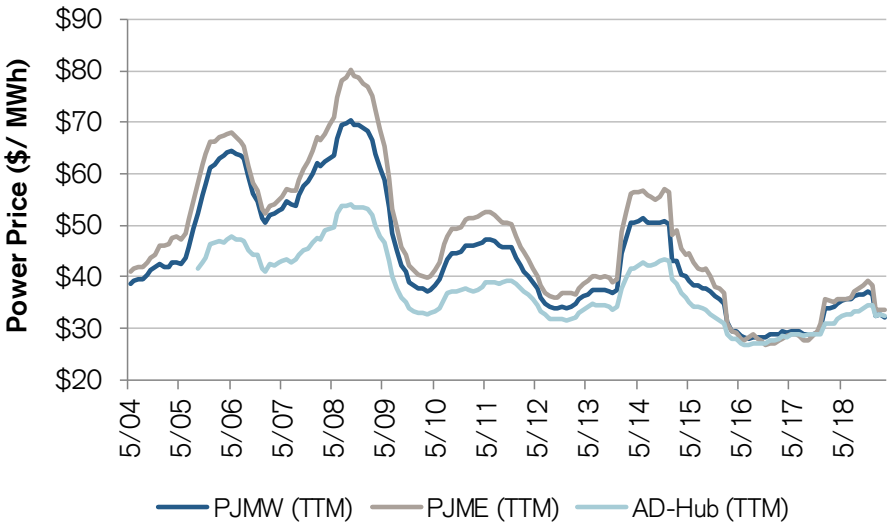

- Competitive generation companies derive their revenues from selling generated power in the energy markets and from receiving capacity payments.
  - Power generation – the actual electricity produced by the power plant – is sold into competitive power markets and will collect a price calculated as $ / MWh. Generators sell in the open market and through hedged forward sales. All else equal, a plant with a higher utilization rate will derive a greater amount of revenue from the energy market.
  - Capacity revenues are a second source of revenue for generators and are essentially insurance payments based simply on the capacity to produce power, rather than for the energy output itself. Some plants are needed for reliability (to meet a targeted reserve margin) but don't run often enough to be profitable from energy payments alone. Capacity payments are determined both through organized auctions (PJM, NEPOOL, and MISO) and bilateral contracts. Auctions are held 3-4 years prior to delivery to provide adequate pricing signals to attract plant investment as needed.

Source: Credit Suisse estimates

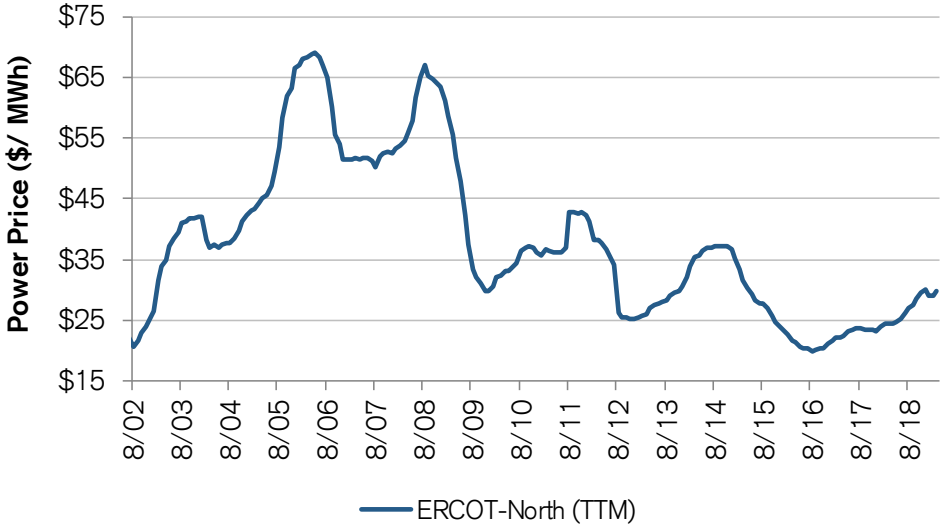
# Long-term Historical Power Prices Have Trended Lower with Nat Gas

Recent rise in ERCOT due to coal plant retirements and tighter reserve margins

**PJM – Power Spot Prices (Trailing 12M Avg)**




**ERCOT North – Power Spot Prices (Trailing 12M Avg)**




- While power usage generally rises over time, power prices do not follow the same trend. Power prices largely reflect the supply-demand balance, and the operational cost of the marginal generation resource which is a function of fuel prices and the plant's heat rate.

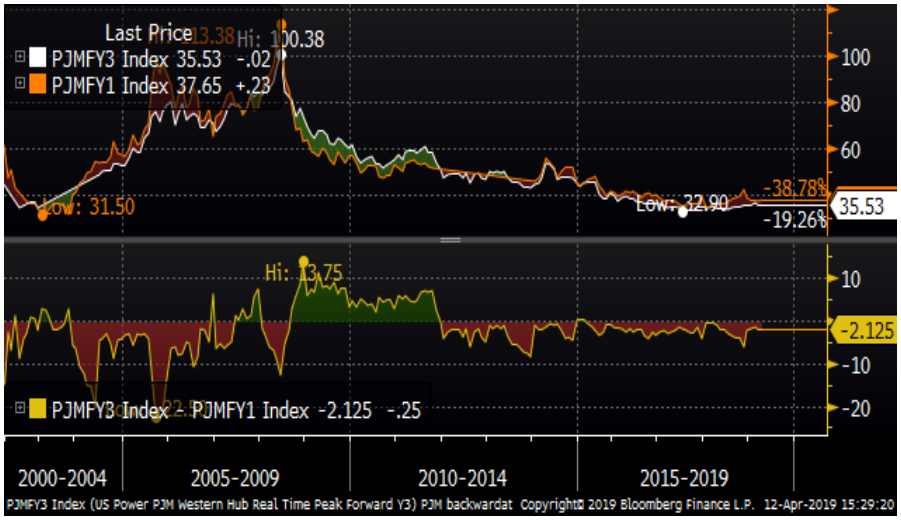
- Around the clock (ATC) power prices in PJM have declined $14 on average between the pre-2010 ($54) and post-2010 ($40) periods while ERCOT ATC has observed a drop of about $18 ($48 for the pre-2010 period vs $30 for the post-2010 period).

*Source: SNL*

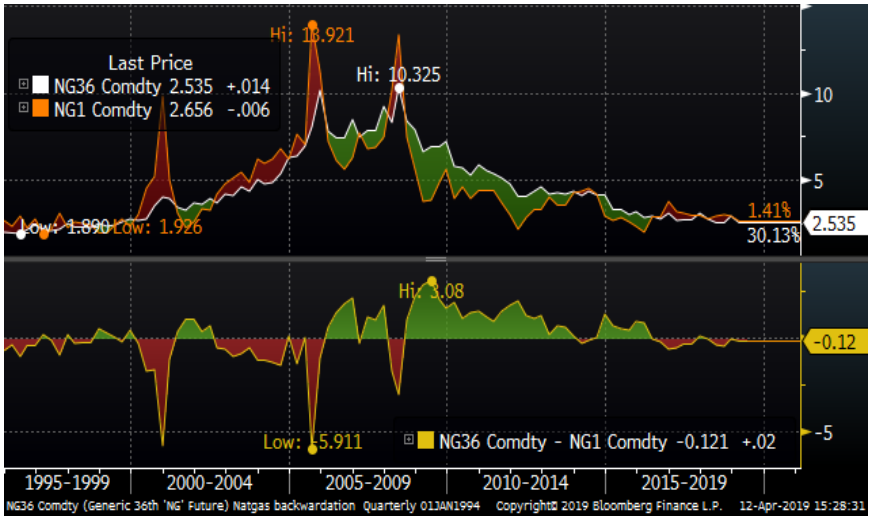
# Power Prices Push Lower and Return to Backwardation

## Lower prices with cheaper gas, increased renewables, coal plant closures

**PJM-W – Forward vs Prompt Power Prices**




**Henry Hub – Forward vs Prompt Gas Prices**



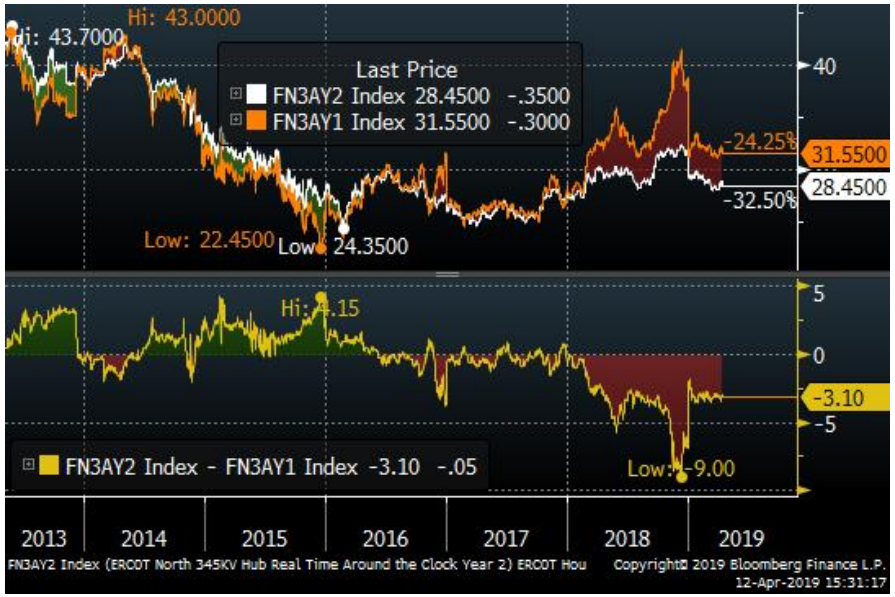

- Gas is typically the marginal fuel setting power prices in most markets, although low gas prices are now on par with eastern coal pricing, resulting in lower coal plant capacity factors (running hours) and early coal retirements.
- Forward gas and power have typically been backwardated despite developers' optimism on future pricing. A lack of trading liquidity for future vintages is usually cited, although the collapse of prompt pricing in the wake of the recession temporarily resulted in a contango through January 2014. The Polar Vortex appears to have returned the cycle to backwardation, although mild winters in 2015/16 temporarily pushed the gas curve into contango.
- Underlying supply-demand fundamentals: (1) Continued coal plant retirements; (2) Continued growth in US shale gas production; (3) Increased renewables with no fuel costs that eliminate hourly marginal profitability for fossil and nuclear generation; (4) Weather; (5) Weak demand growth as a result of energy efficiency and the pace of economic recovery.

Source: the BLOOMBERG PROFESSIONAL ™ service

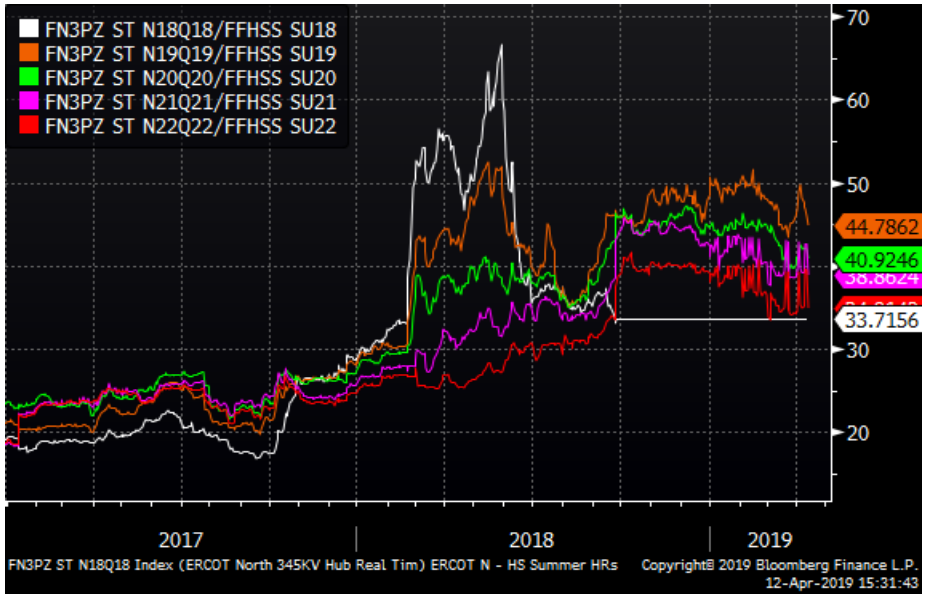
# Recent ERCOT Price Improvements Are More Near-Term

## But backwardation persists, suggesting tighter reserve margins won't last

**ERCOT – Forward vs Prompt Power Prices**




**ERCOT – Forward Marginal Heat Rates for Summers 2018-2022**




- Coal retirements have reduced ERCOT reserve margins and caused forward power prices to rise. However, the forward curve remains in steepening backwardation as prices two years out remain well below next year's pricing.
- Summer heat rates have blown out the most, but these are backwardated too.
- While backwardation would suggest that reserve margins will eventually widen, the lack of trading liquidity in out-years also depresses forward prices.
- The lack of a capacity market in Texas increases the volatility of both prompt and forward energy pricing.

Source: the BLOOMBERG PROFESSIONAL ™ service

# Higher Shale Gas Pricing is Driving PJM Spark Spreads Down

## But…backwardation has declined since the end of 2018, suggesting stability

**PJMW– Forward vs Prompt Power Prices**



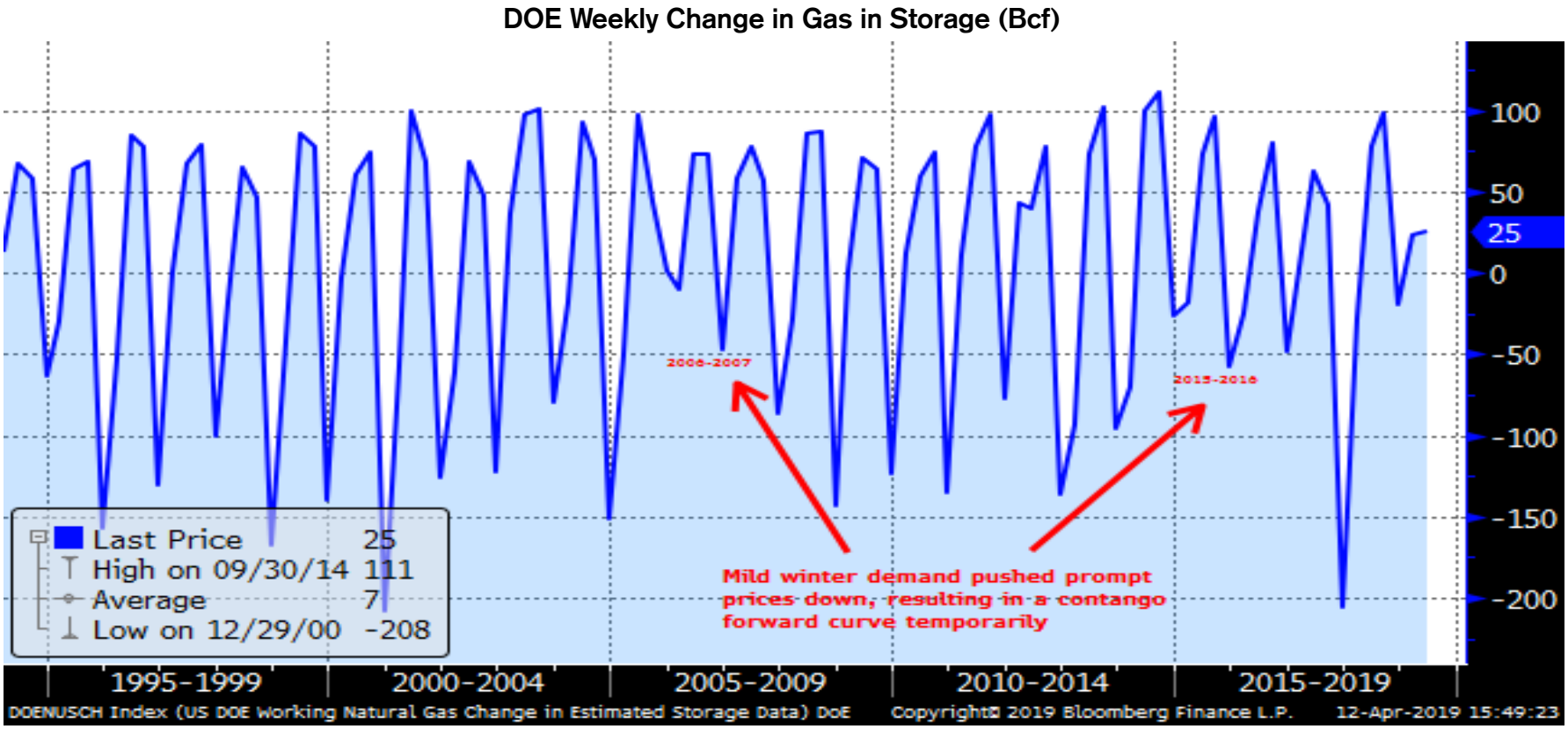

**PJMW– 1-3 year Forward Spark Spreads vs Tetco M3**




- The decline in backwardation in 2019 and convergence of forward spark spreads suggest that forward prices on the curve are converging, perhaps a sign of s/d stability.
- The recent decline in spark spreads in 2019 is likely driven by higher shale gas pricing as a result of lower production, with a muted effect on marginal power pricing due to healthy generation supply.
- These trends are supported by a flattening supply curve as suggested by the last few years of capacity auction results.

Source: the BLOOMBERG PROFESSIONAL ™ service

# How Weather Affects the Forward Power Pricing Curve

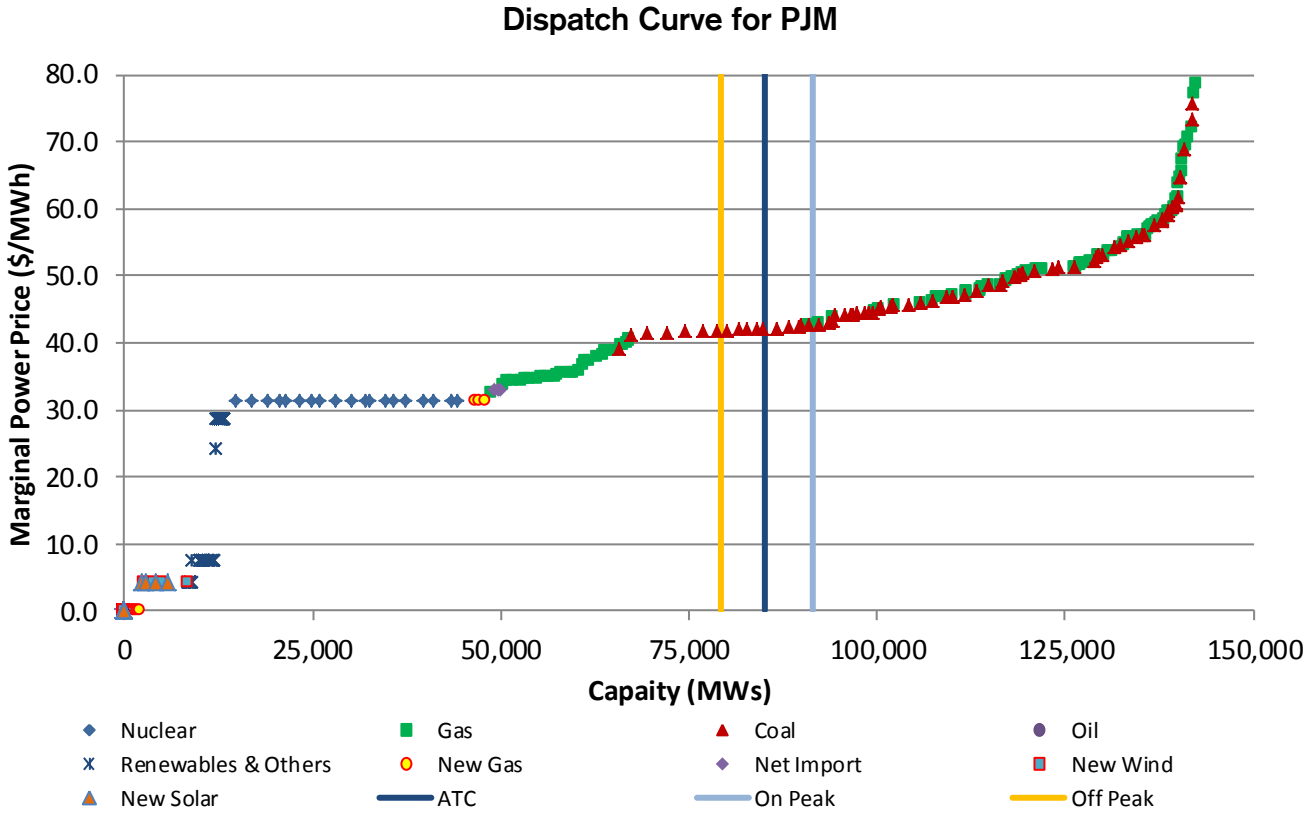



- Seasonal weather affects gas storage levels which may impact the price of gas for months or even years to come. As the marginal fuel for power production, it has similar effect on the forward power price curve.

Source: the BLOOMBERG PROFESSIONAL ™ service

# Illustrative Supply (Dispatch) Curve for PJM

Supply curve is flatter today than in the past with cheaper natural gas prices



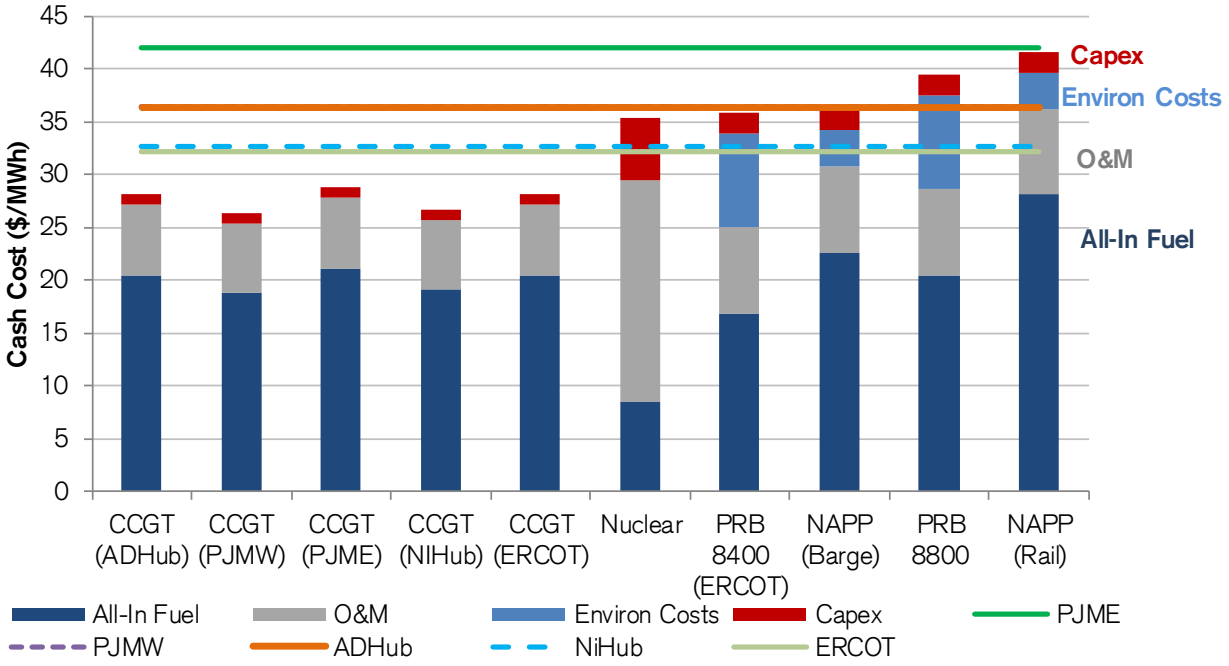

- Power markets broadly have seen a change in the shape of economic supply, with lower natural gas prices bringing down the cost of generation for gas plants and often leaving them to dispatch ahead of coal generation.

Source: SNL, Credit Suisse estimates

# Do Power Prices Have a Floor?

## New gas-fired power plants drive the pricing boat, but renewables take a bite

**New Build Marginal Cash Cost with Static Power Price and Utilization Rates**




**Capex costs** reflect the ongoing maintenance capex required to sustain the plants but not captured in earnings

**Environmental costs** include the consumables to run equipment, representing a real burden for coal plants with PRB most impacted from TRONA costs

**O&M costs** represent the historically observed costs of operating power plants specific to fuel / plant type

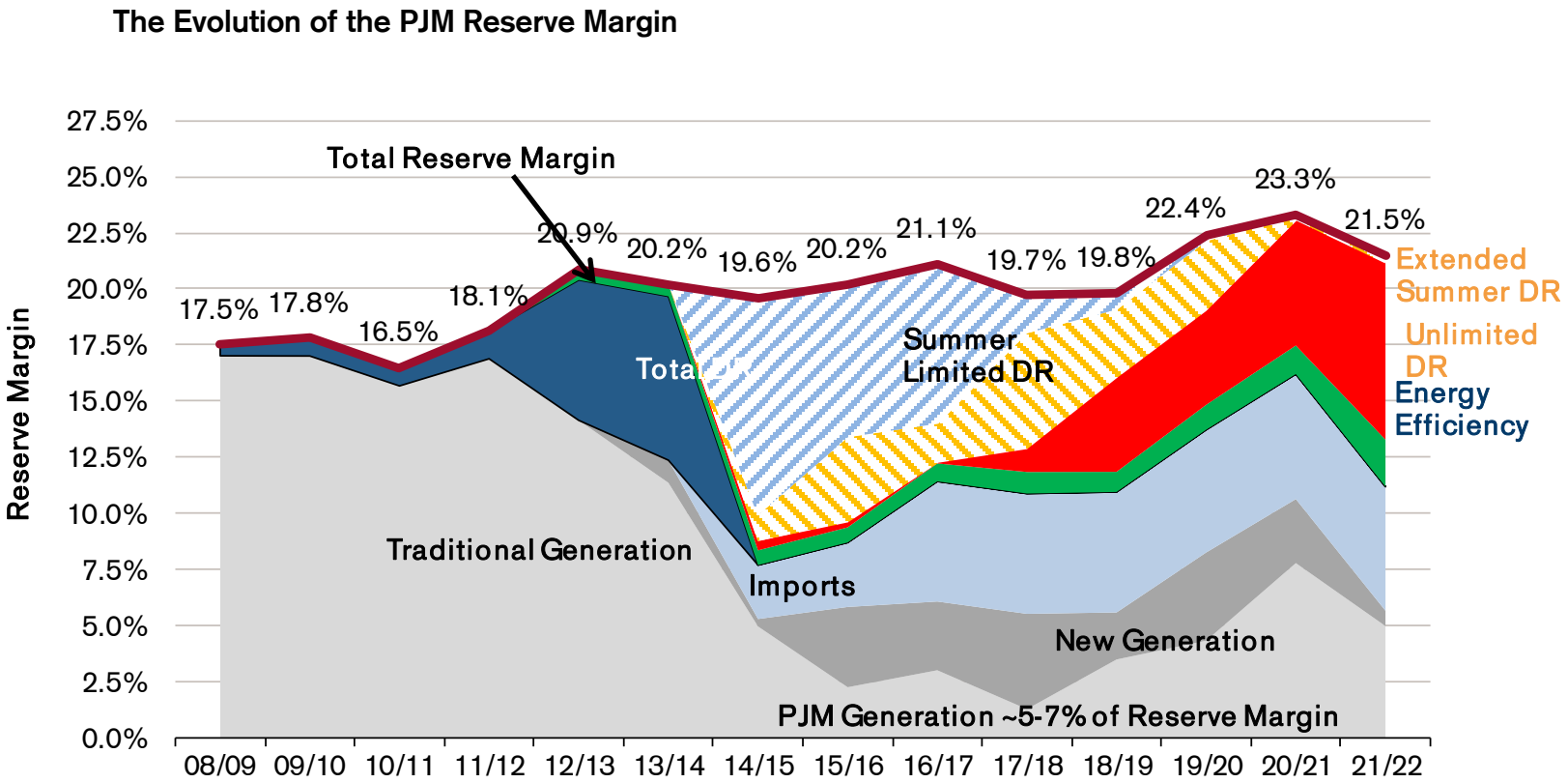
**All-in-Fuel costs** represent the plant specific costs; For CCGTs we use current forwards at local natural gas basis with AD-Hub using Dominion South gas, PJM-W using a blend of Dominion South and TETCO-M3, and PJM-E using TETCO-M3

- Weak prompt gas pricing and new efficient CCGTs keep marginal pricing low.
- Access to low cost of capital and low-cost fuel drives new-build economics, especially over shale plays.
- Intermittent wind and solar dispatch with essentially no marginal cost, absorbing revenue from nuclear and fossil plants needed to operate the grid reliably. Capacity payments and state subsidies can help.
- Eventually, batteries could solve the problems of renewable intermittency and even help provide other ancillary services, but this is likely at least 5-10 years away from economic viability.

Source: Credit Suisse Estimates, SNL, Company data

# PJM Reserve Margins Have Been Bolstered by Non-Plant Resources

## Dependence on plants outside of PJM, newbuilds, and demand response (DR)



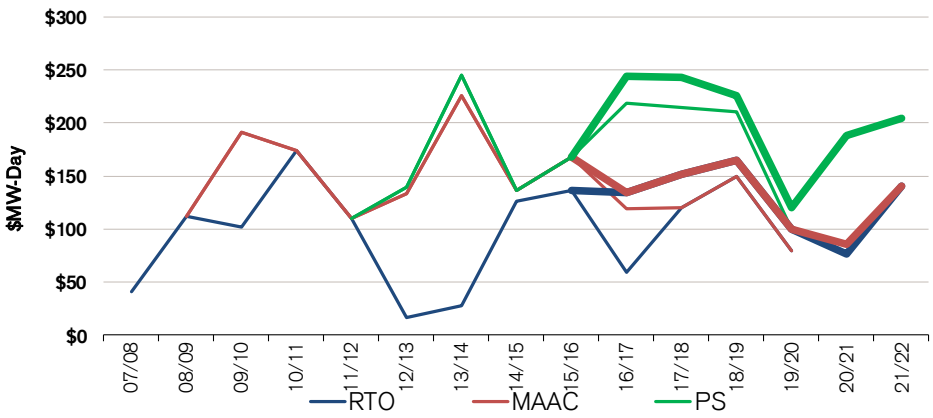

**While the headline reserve margins remain robust at ~20%, the dependence on non-physical installed generation should lead to increased power market volatility and capacity price upside if DR is excluded in the future under stricter Capacity Performance standards.**

Source: Credit Suisse estimates, PJM

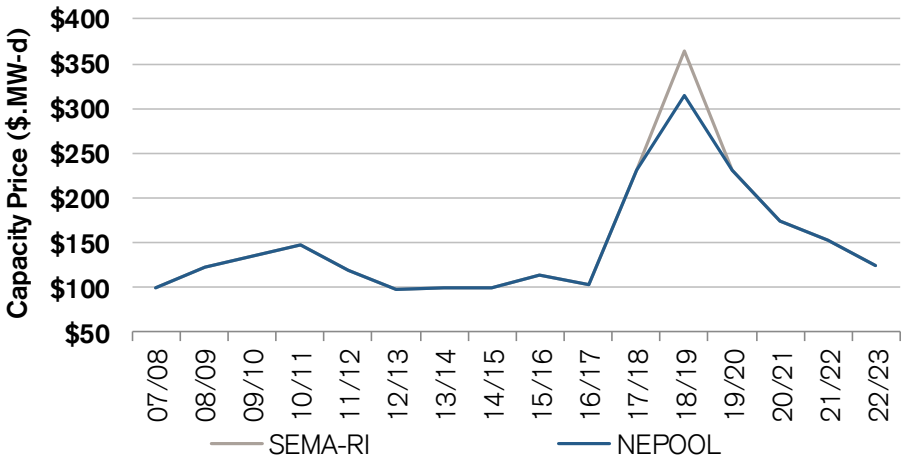
# Historical Capacity Prices Have Been Consistently Inconsistent

A fixed source of revenues for power plants but capacity prices are spastic

**PJM – RPM's Historical Results**




**ISO-NE – FCM's Historical Results**



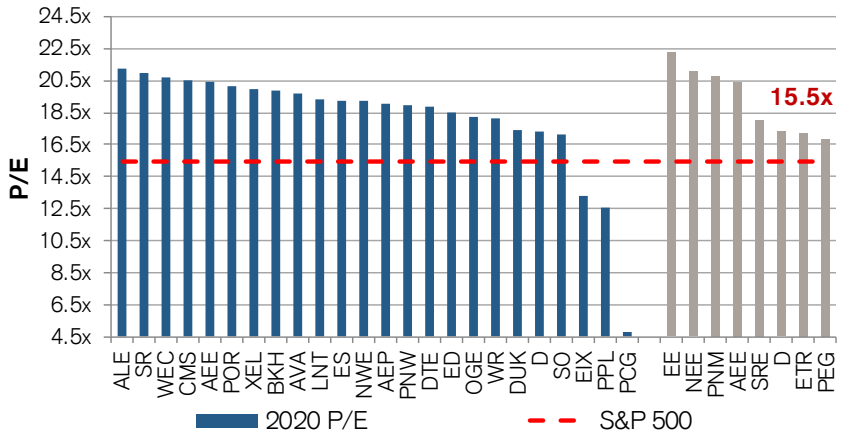

- Capacity auctions by design are intended to provide forward pricing signals about supply-demand fundamentals, with prices rising as markets tighten in a way to attract either new builds or upgrades at existing plants to support reliability. Unfortunately auction prices have been much more volatile, lowering market confidence in the repeatability of these revenue streams.
- In PJM, the capacity performance (CP) product has a positive and upward impact on capacity price by putting greater emphasis (and penalties) on plants to support reliability at a higher level of accountability than in the past. However, this is offset by lower forecasted demand growth and new-build driven by low cost of capital and low-priced natural gas. Demand response participation under 100% CP beginning in 2020/21 is a factor too.

Source: Credit Suisse estimates, PJM

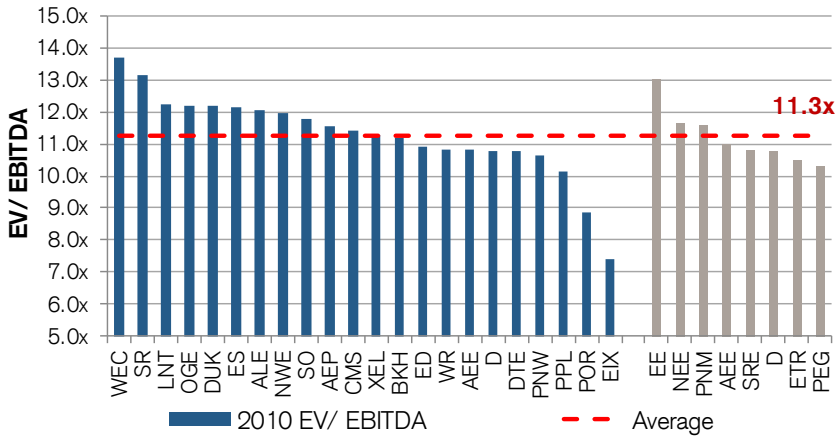
# Integrateds Trade at Lower Mults with Generally Higher Yields

## Power assets generate relatively high cash flow but low earnings vs regulateds

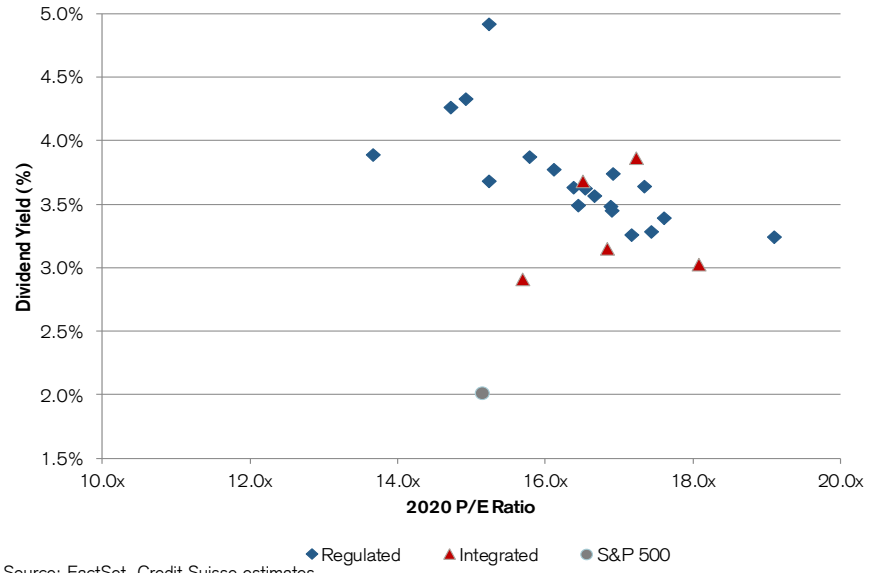
**2020 P/E**




**2020 EV/ EBITDA**




**P/E vs Dividend Yield**




- Due to outperformance in 2018, Integrated utilities with competitive power operations currently trade at premium multiples with ~28bps lower dividend yield.
- Hedging programs provide 1-3 years of stability but a non-regulated retail sales operation can provide higher margins over longer periods for specifically matched power fleets.
- Most integrateds are reducing their exposure to power markets through asset sales and the redirection of investment toward regulated operations.

Source: FactSet, Credit Suisse estimates

CREDIT SUISSE

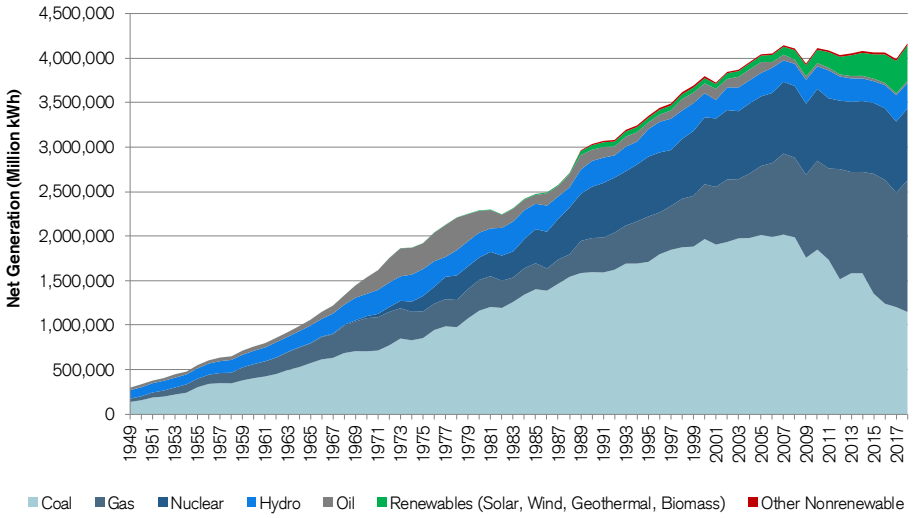
# Power Plants and Generation



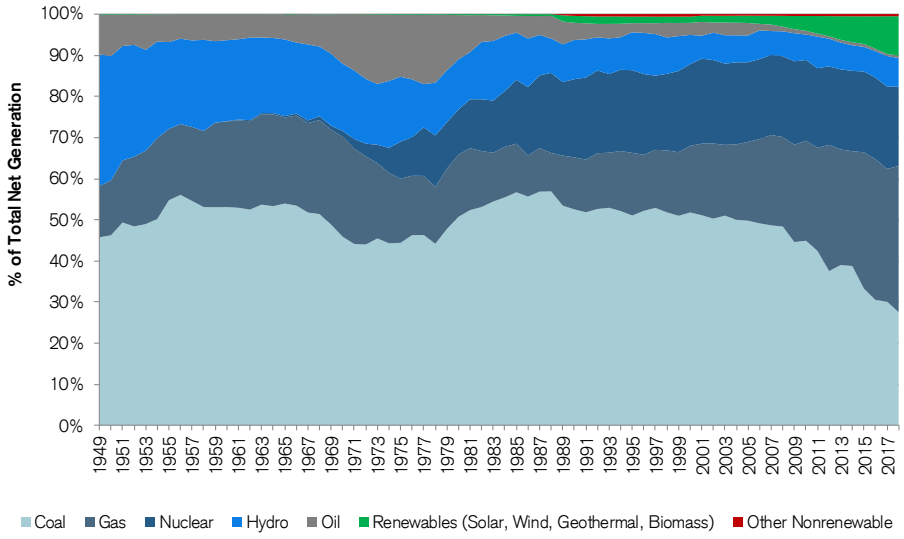
# The US Power Supply Is Evolving (1949-2018)

## Natural gas and renewables are taking share while oil and coal have lost

**Total US Generation (1949 – 2018)**




**% of Total US Generation (1949 – 2018)**



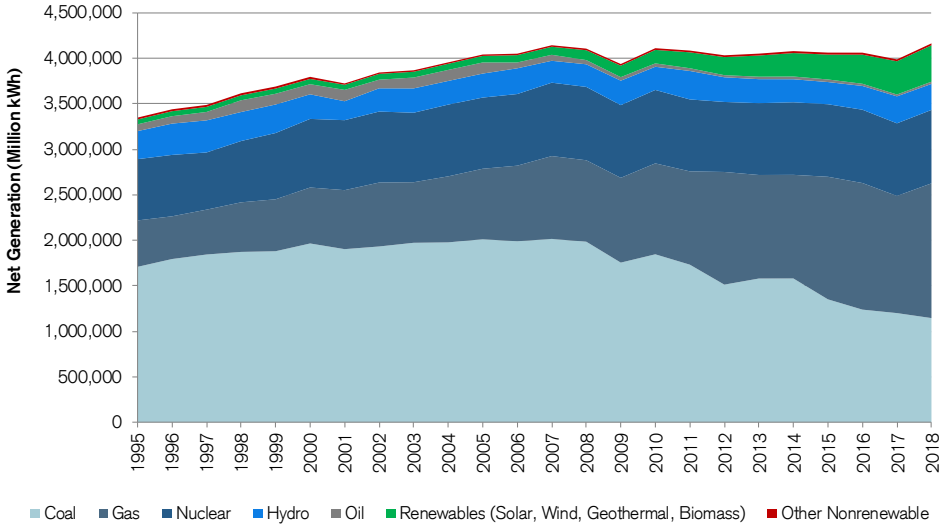

- The growth in US power demand over 60 years has been significant, notwithstanding the weakness since 2008.
- Coal generation was a significant driver in power generation from 1950-1995 but has subsequently faded and lost market share on a relative basis.

Source: EIA

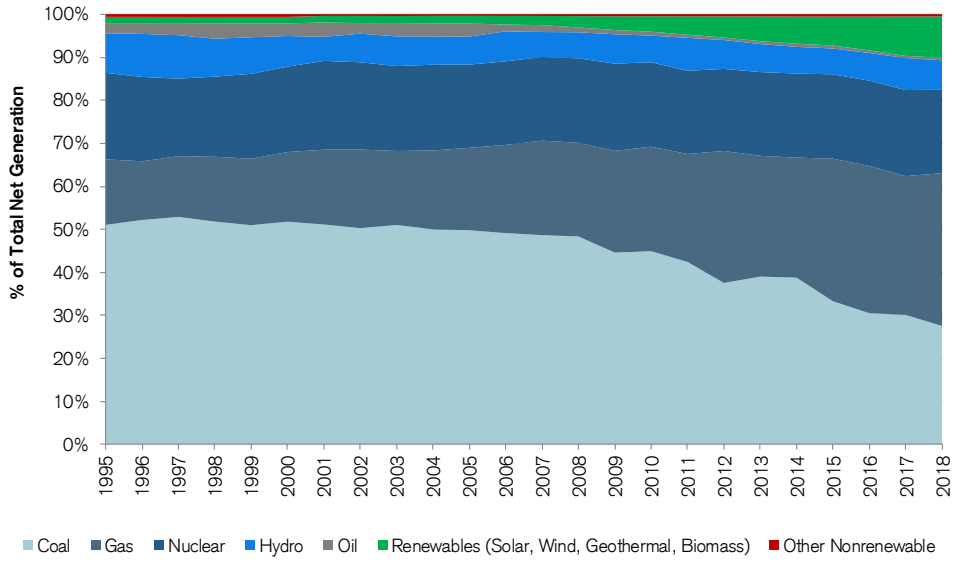
# Share Gains by Gas and Renewables More Pronounced

## Coal has ceded considerable market share since the mid 2000s

**Total US Generation (1995 – 2018)**




**% of US Total Generation (1995 – 2018)**



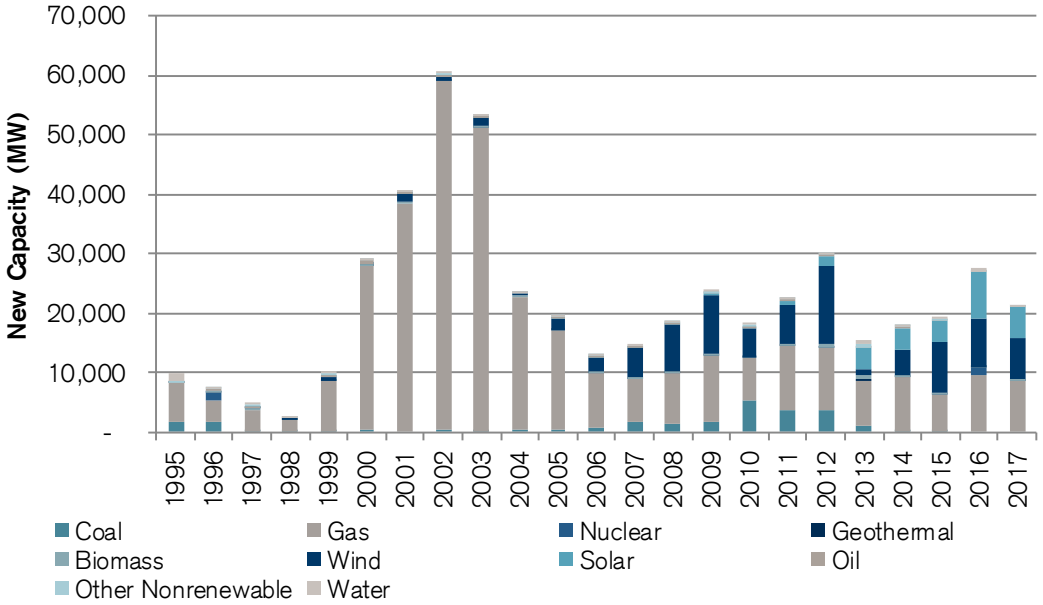

- The growth in gas generation particularly over the past 15 years has gone far in changing the landscape of fuel consumption and emission profiles in the US.
- Renewables have received a lot of attention and investment (bright green above) but still have a long way to go for significant market share particularly considering there is a healthy legacy layer on hydro included in that baseline.

Source: EIA

# Capacity Additions Strongly Favor Gas and Increasingly Renewables

## Technological advances dramatically boosted share gains for gas generation

**New Generation Additions**



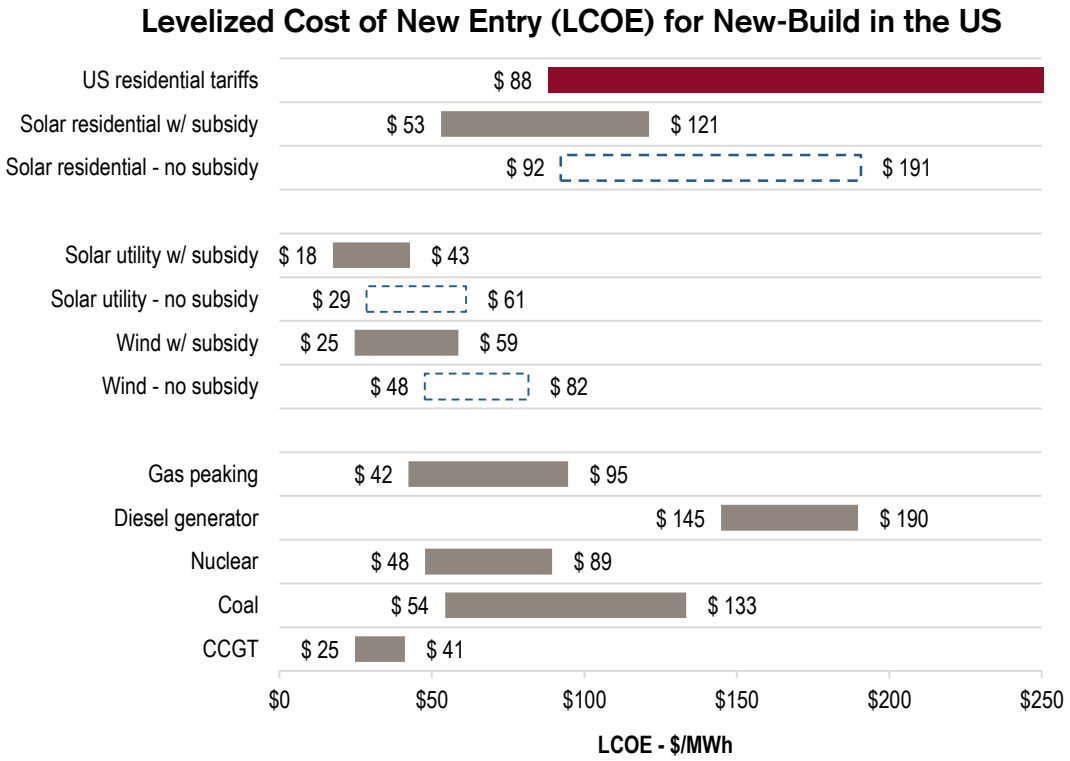

| | '95-'99 | '00-'04 | '05-09 | '10-14 | '15-17 | TOTAL |
|---|---|---|---|---|---|---|
| Biomass | 827 | 556 | 1,145 | 2,003 | 599 | **5,130** |
| Coal | 3,483 | 1,292 | 5,582 | 13,778 | 2 | **24,136** |
| Gas | 24,146 | 198,247 | 53,019 | 45,148 | 24,401 | **344,962** |
| Geothermal | 101 | 86 | 304 | 287 | 137 | **915** |
| Nuclear | 1,179 | - | - | - | 1,270 | **2,449** |
| Oil | 1,130 | 1,946 | 756 | 987 | 115 | **4,935** |
| Other Non-renewable | 961 | 178 | 339 | 887 | 341 | **2,705** |
| Solar | 2 | 13 | 353 | 10,185 | 16,422 | **26,974** |
| Water | 1,527 | 613 | 151 | 1,293 | 711 | **4,296** |
| Wind | 918 | 3,900 | 27,022 | 29,579 | 23,822 | **85,241** |

- New capacity additions since 2000 have been significantly driven by new gas generation capacity originally led by (a) the advancement of the combined cycle gas turbine (CCGT) power plant that was over 30% more efficient than simple gas plants (b) EPA's implementation of rules limiting coal plant emissions of NOX/SOX and eventually mercury made the CCGTs even more attractive relative to the initial coal plant remediation costs and (c) the introduction of competitive power markets defaulted to developers building the new CCGT technology where they saw lower capital costs and a perceived cost advantage relative to coal plants.
- The 5-year extension of federal tax credits for wind and solar in Dec 2015 have driven investment in these two resources in 2015/16. Renewables made up approximately half of new additions in 2017 as cost curves continue to decline, we expect renewables growth to continue in 2018 followed by a new leg in the 2020s particularly in combination with battery storage as materials costs continue to decline for both , resolving intermittency issues.

Source: SNL

# Newbuild Generation Has a Wide Range of Delivered Power Costs

## Gas generation remains the low cost option for newbuild




- Levelized cost of entry (LCOE) is the overall measure of the competitiveness of the generating technology, reflecting the complete cost of electricity from new resources (which are higher than where we see forward power prices clearing today in competitive markets).
- We should note that the LCOEs are changing fairly rapidly, particularly with efficiency improvements in both wind and PV solar causing those cost curves to decline and for natural gas generation (the CC plants) given the abundance of low cost natural gas in the US.

Source: EIA, NREL, Credit Suisse Estimates, Company Data

# Nuclear Power Plant

The zero carbon, low(er) cost baseload resource but they're getting old

## Nuclear Power Plant

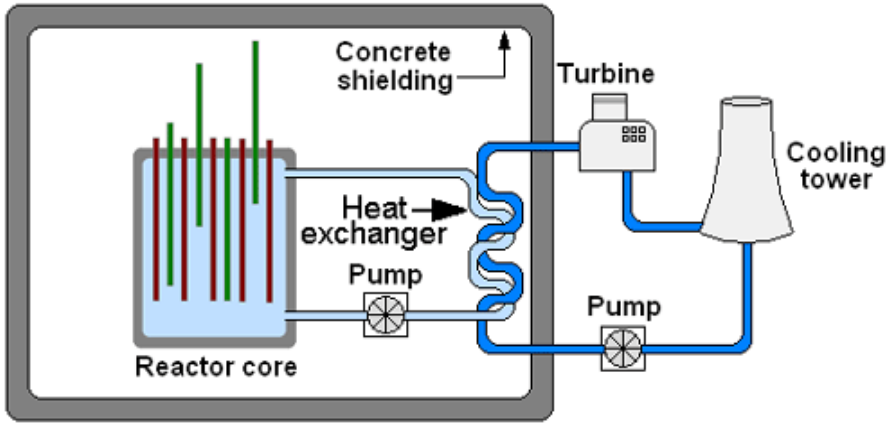


## Operating Costs & Other Stats

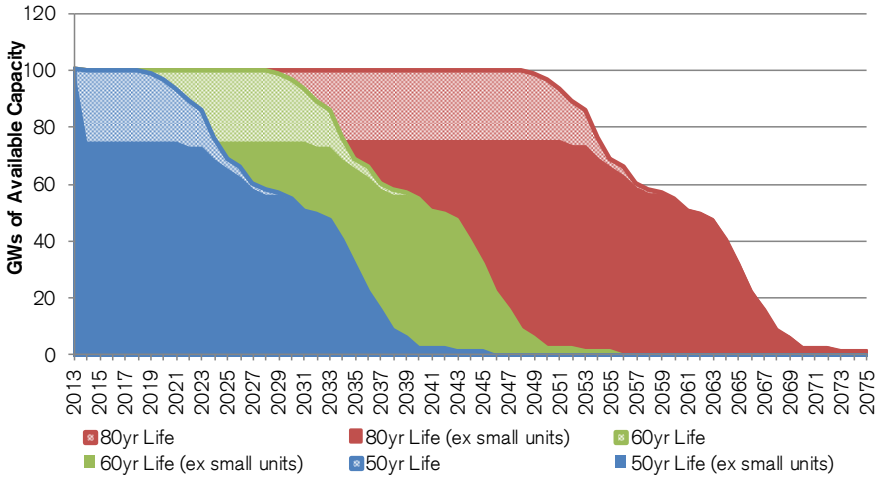
| Cost Derivataion | |
|---|---|
| Nuclear Fuel Cost ($/MWh) | $6.5 - 8.0 |
| O&M ($/MWh) | $18.0 - 20.0 |
| Maintenance Capex ($/MWh | $5.0 - 7.0 |
| **Total Cost ($/MWh)** | **$29.5 - 35.0** |

| Other Stats | |
|---|---|
| Utilization | 88% |
| CO2 Emission | 0 |

## Nuclear Power Plant – How It Works




## Nuclear Retirements




Source: Tennessee Valley Authority, http://www.green-planet-solar-energy.com, EEI, SNL, Credit Suisse estimates

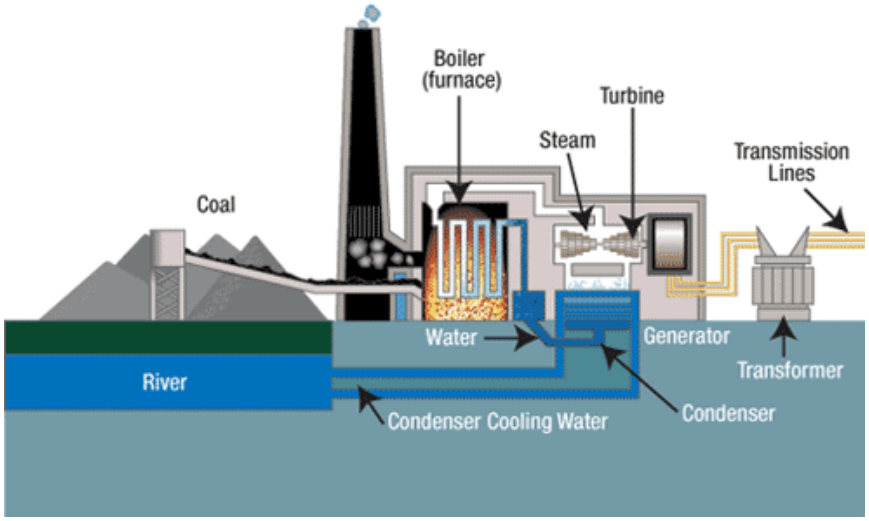
# Coal Power Plant

## Best days are in the past; EPA rules and cheap gas will sustain shrinkage

### Coal Power Plant



### Coal Power Plant – How It Works




Source: Tennessee Valley Authority, Credit Suisse estimates

### Operating Costs & Other Stats

| Cost Derivataion | CAPP Coal |
|---|---|
| **Fuel Cost** | |
| Coal Costs | $55 |
| Delivery Costs | $20 |
| All-in Costs ($/ton) | $75 |
| Heat Content (MMBtu/lb) | 12.5 |
| **Coal Cost ($/MMBtu)** | **$3.00** |
| Coal Plant Heat Rate | 9.5 |
| **Total Fuel Cost ($/MWh)** | **$28.50** |
| **O&M ($/MWh)** | **$8.00** |
| **Environmental ($/MWh)** | **$3.44** |
| **Total Cost ($/MWh)** | **$39.94** |

| Other Stats | |
|---|---|
| Utilization | 57% |
| CO2 Emission (lbs/MMBtu) | 205 |
| CO2 Emission (lbs/MWh) | 1,948 |

# Natural Gas Power Plant

## The default newbuild conventional power plant option

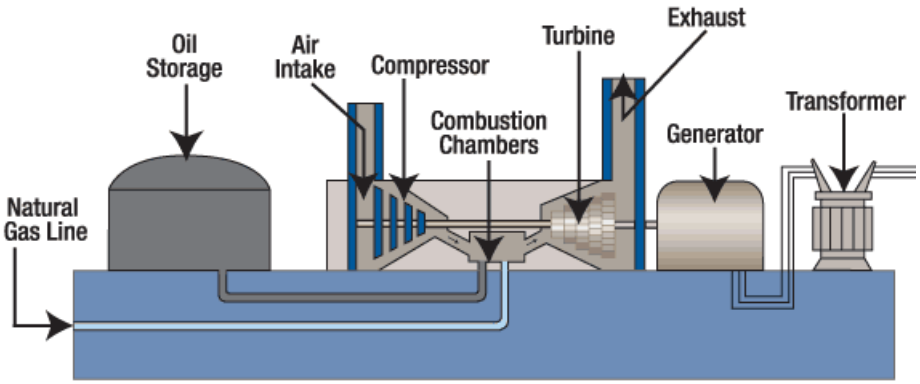
### Natural Gas Power Plant



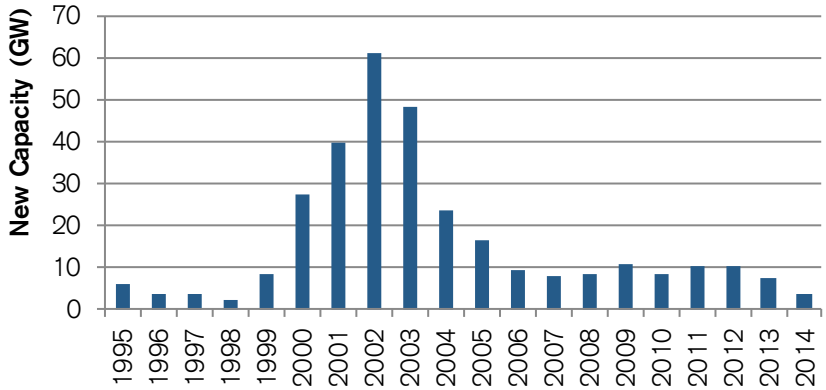
### Operating Costs & Other Stats

| Cost Derivataion | NYMEX Gas |
|---|---|
| **Fuel Cost** | |
| Gas ($/ MMBtu) | $2.75 |
| Delivery Costs ($/ MMBtu) | $0.50 |
| **Gas Costs ($/MMBtu)** | $3.25 |
| Gas Plant Heat Rate | 7.5 |
| **Total Fuel Cost ($/MWh)** | **$24.38** |
| **O&M ($/MWh)** | **$4.50** |
| **Total Cost ($/MWh)** | **$28.88** |
| **Other Stats** | |
| Utilization (Peakers) | 2 - 20% |
| Utilization (CCGTs) | 55 - 85% |
| CO2 Emission (lbs/MMBtu) | 117 |
| CO2 Emission (lbs/MWh) | 878 |

### Natural Gas Power Plant – How It Works




### Gas Capacity Additions




Source: Tennessee Valley Authority, Credit Suisse estimates

# Hydro Power Plant

## The original renewable but hard to imagine newbuild in the US

### Hydro Power Plant

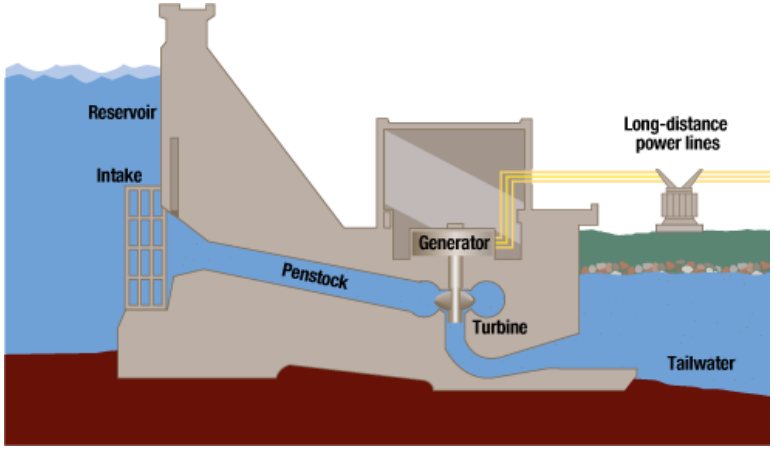


### Operating Costs & Other Stats

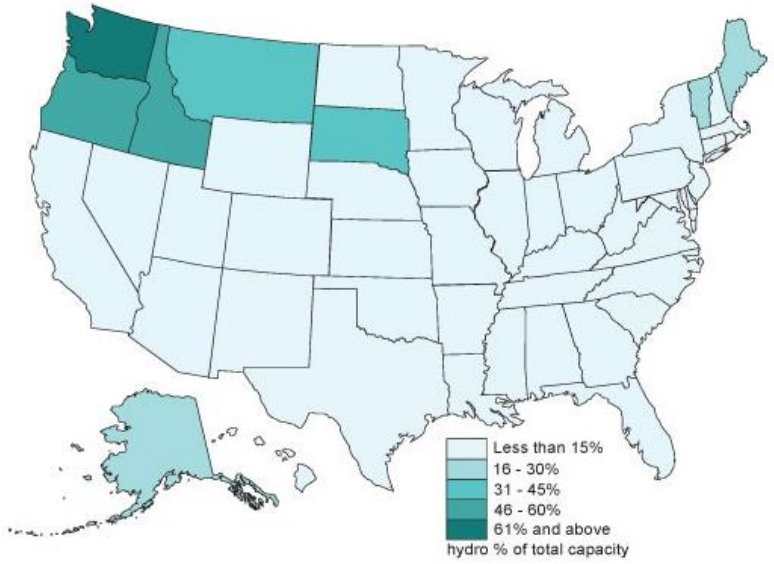
| Cost Derivataion | |
|---|---|
| Fuel Cost ($/MWh) | $6.0 |
| O&M ($/MWh) | $4.0 |
| **Total Cost ($/MWh)** | **$10.00** |

| Other Stats | |
|---|---|
| Utilization | 42% |
| CO2 Emission | 0 |

### Hydro Power Plant – How It Works




### Share of Hydropower in State's Total Capacity




Source: Tennessee Valley Authority, https://www.nwcouncil.org, EIA, Credit Suisse estimates

# Wind Power Plant

The growth story for renewables over past 15 years; total costs are competitive

## Wind Power Plant

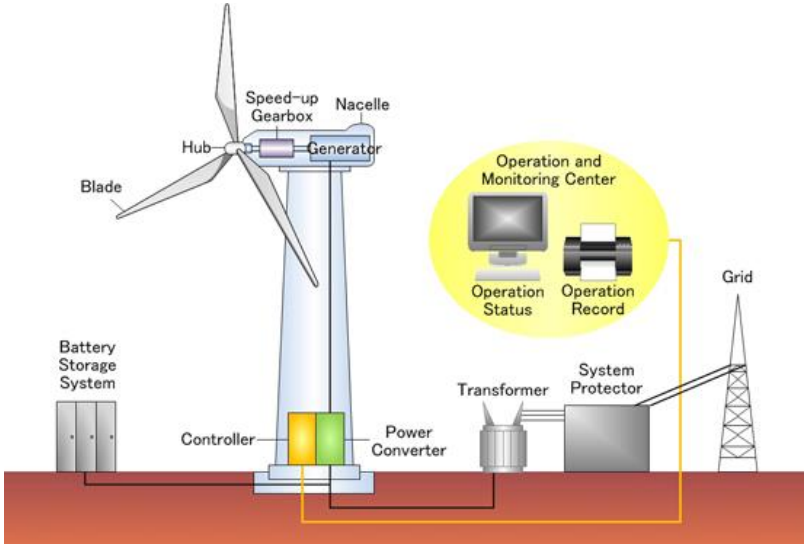


## Operating Costs & Other Stats

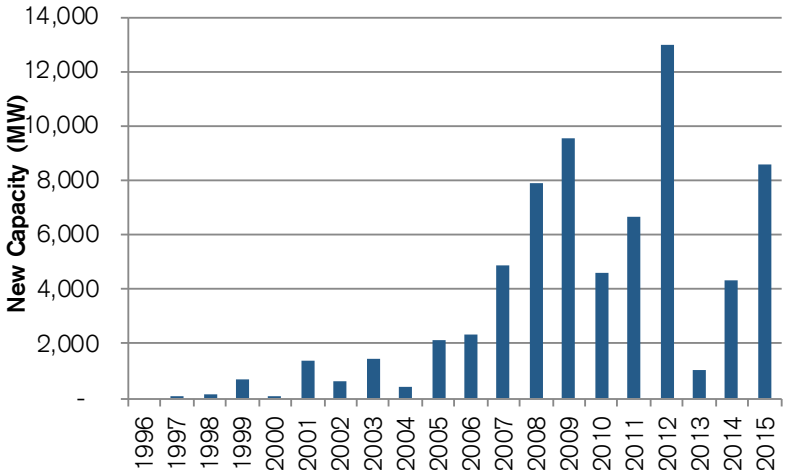
| Cost Derivataion | |
|---|---|
| Fuel Cost ($/MWh) | $0.0 |
| O&M ($/MWh) | $13.0 |
| **Total Cost ($/MWh)** | **$13.00** |

| Other Stats | |
|---|---|
| Utilization | 30 -60% |
| CO2 Emission | 0 |

## Wind Power Plant – How It Works




## Annual Wind Capacity Additions




Source: NextEra Energy, http://www.yokogawa.com, SNL, AWEA, Credit Suisse estimates

# Solar Power Plant

Solar is the next wave of renewable growth with falling costs and load alignment

## Solar Power Plant

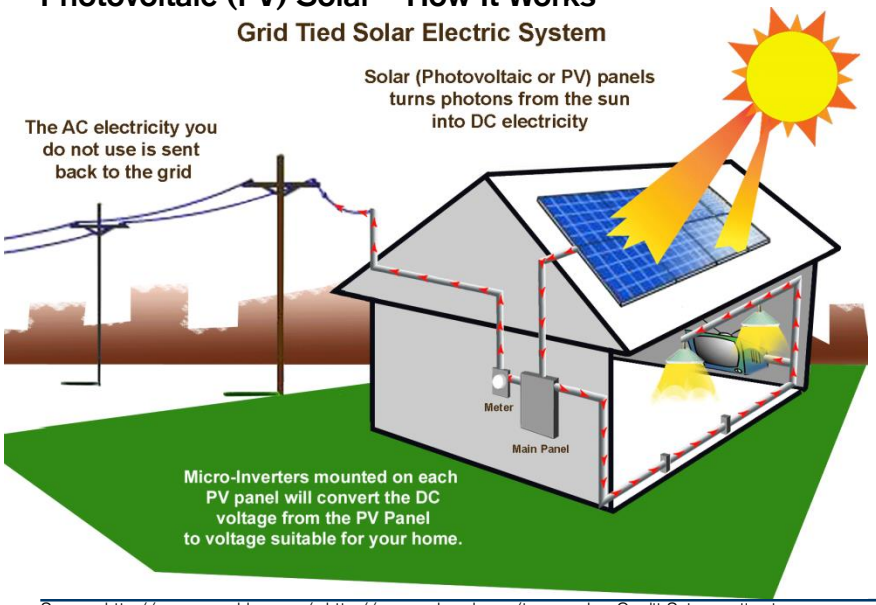


## Operating Costs & Other Stats

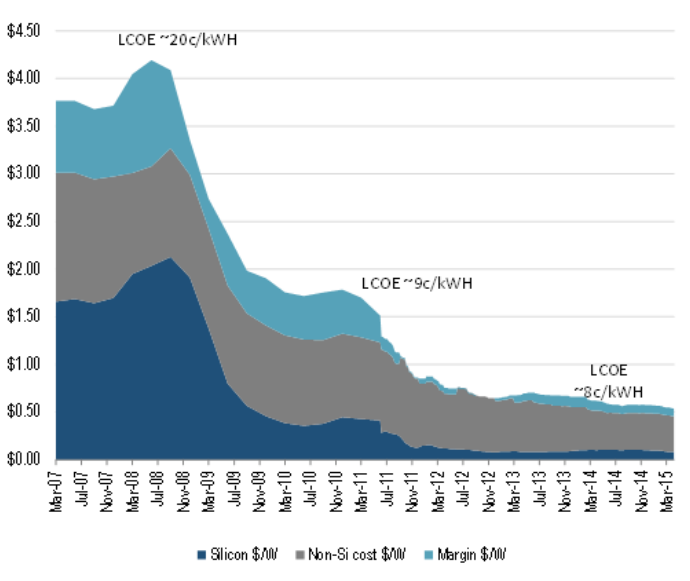
| Cost Derivataion | |
|---|---|
| Fuel Cost ($/MWh) | $0.0 |
| O&M ($/MWh) | $11.0 |
| **Total Cost ($/MWh)** | **$11.00** |

| Other Stats | |
|---|---|
| Utilization | 15 - 25% |
| CO2 Emission | 0 |

## Photovoltaic (PV) Solar – How It Works




## Levelized Cost of New Entry for Solar




Source: http://esarenewables.com/, http://www.solarsol.com/typography, Credit Suisse estimates

# How to Calculate Operating Costs of Coal and Gas Plants

'Cheap' natural gas has brought CCGTs to a discount vs. coal

**Fuel Cost for a Coal Plant**

| Assumptions | CAPP Coal |
|---|---|
| Coal Costs | $55 |
| Delivery Costs | $20 |
| **All-in Costs ($/ton)** | $75 |
| Heat Content (MMBtu/lb) | 12.0 |
| **Coal ($/MMBtu)** | $3.13 |
| Coal Plant Heat Rate | 10.0 |
| Envi. Cost ($/MMh) | $3.44 |
| **Fuel Cost ($/MWh)** | **$34.69** |

**Fuel Cost for a Gas Plant**

| Assumptions | NYMEX Gas |
|---|---|
| Gas ($/MMBtu) | $2.75 |
| Delivery Costs ($/MMBtu) | $0.50 |
| **All-in Costs ($/MMBtu)** | $3.25 |
| Gas Plant Heat Rate | 7.5 |
| **Fuel Cost ($/MWh)** | **$24.38** |

- Power plants' operating costs include fuel costs, O&M, environmental equipment, and maintenance capex.
- One of the biggest components of a power plant's operating costs is its fuel expense which can vary depending on the fuel used by the plant. The fuel costs reflect the heat content of the fuel (CAPP coal vs. PRB Coal) and the plant's efficiency (heat rate, i.e. how much thermal energy is needed to generate a unit of electricity by the plant).
- As shown in the examples above, a plant's fuel cost per unit of electricity generated can be derived by multiplying the plant's heat rate and the fuel cost expressed in terms of $/MMBtu.

Source: Credit Suisse estimates

# Coal to Gas Switching Floor

| | Northern App | Central App | Ill. Basin | Rockies | PRB |
|---|---|---|---|---|---|
| Avg. Btu/lb | 13,000 | 12,500 | 11,800 | 11,500 | 8,800 |
| Sulfur (%) | 2.00% | 1.00% | 3.00% | 0.60% | 0.33% |
| $SO_2$ (Lb/MMBtu) | 3.1 | 1.6 | 5.1 | 1.0 | 0.8 |
| Coal market price ($/ton) | 55.14 | 70.71 | 35.04 | 40.53 | 12.32 |
| Estimated shipping costs ($/ton) | 18.00 | 25.00 | 10.00 | 22.50 | 22.50 |
| Cost of coal delivered ($/ton) | 73.14 | 95.71 | 45.04 | 63.03 | 34.82 |
| Sulfur Dioxide ($SO_2$) | | | | | |
| Avg. $SO_2$ (LB per ton) | 80.00 | 40.00 | 120.00 | 24.00 | 13.20 |
| Allowance price per ton of $SO_2$ | 2.31 | 2.31 | 2.31 | 2.31 | 2.31 |
| Cost of $SO_2$ per ton of coal | 0.09 | 0.05 | 0.14 | 0.03 | 0.02 |
| Cost of $SO_2$ per MMBTU | 0.004 | 0.002 | 0.006 | 0.001 | 0.001 |
| MMBtu per ton of coal | 26.00 | 25.00 | 23.60 | 23.00 | 17.60 |
| MWh @ selected heat rate | 2.48 | 2.38 | 2.25 | 2.19 | 1.68 |
| Total coal cost per MMBtu before NOx | 2.82 | 3.83 | 1.91 | 2.74 | 1.98 |
| Nitrogen Oxide (NOx) | | | | | |
| NOx Rate of marginal coal generation (Lb/MMBTU) | 0.15 | 0.15 | 0.15 | 0.15 | 0.15 |
| NOx allowance price ($/ton) | 2.75 | 2.75 | 2.75 | 2.75 | 2.75 |
| Cost of NOx per Ton of Coal ($/ton) | 0.01 | 0.01 | 0.00 | 0.00 | 0.00 |
| Cost of NOx per MMBTU | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Total/all-in cost of coal ($/ton) | 73.24 | 95.76 | 45.19 | 63.06 | 34.84 |
| Estimated additional plant O&M ($/MWh) | 1.50 | 1.50 | 1.50 | 1.50 | 1.50 |
| Total marginal cost per MWh from coal ($/MWh) | 31.08 | 41.72 | 21.60 | 30.29 | 22.29 |
| Total coal cost per MMBtu ($/MMBtu) | 2.82 | 3.83 | 1.91 | 2.74 | 1.98 |
| Efficiency adjustment vs. CCGT power plant (%) | 40% | 40% | 40% | 40% | 40% |
| **Floor on natural gas ($/MMBtu) - efficiency adjusted** | **4.09** | **5.51** | **2.82** | **3.98** | **2.91** |
| Sample Comparison to Nat Gas | 3.69 Tetco M-3 | 3.69 Tetco M-3 | 3.01 Chicago | 3.06 Kern River | 3.08 SoCal Border |

- This data is based on spot pricing for which gas-power is now significantly cheaper than coal-power in most basins, a factor driving down near-term marginal value for coal plants.
- The 'floor' on natural gas price above is the equivalent all-in cost of coal per MMBtu to produce a MWh, below which a coal plant is uneconomic to run on a marginal basis, i.e., daily dispatch.

*Source: SNL*

CREDIT SUISSE

# Policy & Disruption:
# Carbon, Renewables, Energy Efficiency, Distributed Energy Resources & Storage



# US Power, Utilities, and Alternative Energy

## Alternative Energy: Continue to prefer project developers over manufacturers

**Good start to 2019.** 2019 is shaping up to be an increasingly positive year for renewable project developers that benefit from lower module prices (tapering solar import tariff in the US and supply glut through 2020), compressing financing spreads, US tax credit extension that can be secured through 2023 by investments in 2019, California's rooftop mandate starting 2020 that expands the residential market, faster than expected decline in battery storage costs that accelerates renewable adoption as the cheapest cost of electricity globally, a Democratic party in the House supportive of pro-renewable policies (tax credit extension, national renewable portfolio standard), favorable state renewable policies, popular support for renewables among end-consumers and corporates.

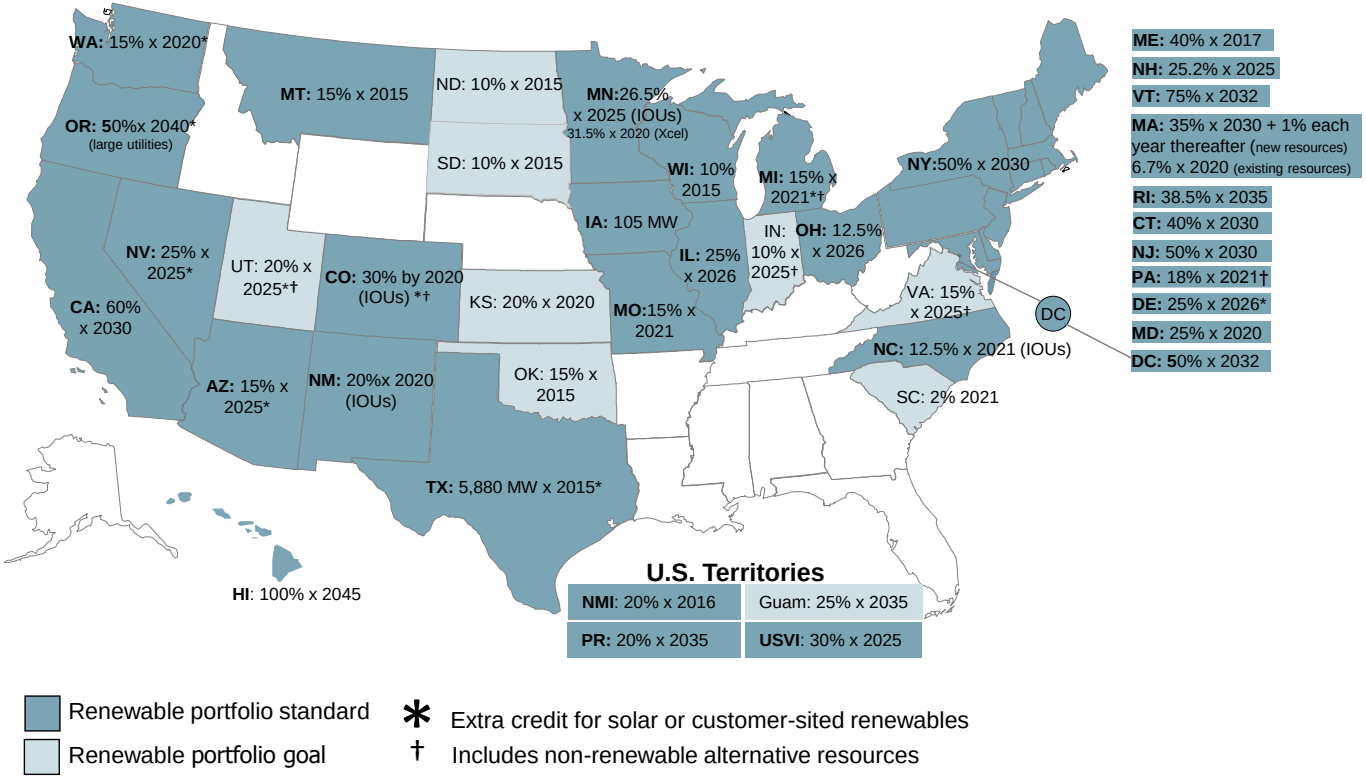
**Limited growth risk:** Rate inversion is positive for solar developers as they refinance short term debt with longer-term project debt at lower costs that better match contracted cash flows. A potential reduction in electricity load growth or utility capex due to market slowdown could delay utility renewable investments to early 2020s, but see limited impact to solar, wind and storage demand that enjoys strong regulator, consumer, and corporate support. Residential solar will be attractive for homeowners as it is cheaper than retail electricity cost in 40+ states, though we could see an uptick in leasing business if cash sales decline. **Key catalysts:** ITC safe harbor plans (by 2H19), CA rooftop mandate partnerships (by 3Q19).

**Surprise factors:** Better than expected China solar target (i.e., >300 GW by 2020) could be positive for solar module prices and manufacturers, negative for solar developers, US withdraws imports against solar imports (positive for developers and manufacturers, negative for FSLR, SPWR), Potential Democratic bills to indefinitely extend renewable tax credits (that sunset after 2023, positive for all), standalone tax credits for battery storage products (positive for retrofit demand).

Source: the BLOOMBERG PROFESSIONAL™ service, Credit Suisse custom indices

# Renewable Policy Standard Is Supportive of New Renewables

## 29 states have rules or targets in place to draw more renewable build




- In 29 states, a Renewable Policy Standard (RPS) has been established requiring utilities to procure a certain amount of energy delivered to state customers from renewable sources. VA, NJ, NV, and AZ have RPS updates pending.
- While RPS can vary across states in terms of the adoption pace and the types of renewable resources that can be used to meet the target, the common goal is generally to generate 10-25% of total electricity in the state from renewables in the 2020-25 time frame.

Source: DSIRE, www.dsireusa.org, US Government Data

# Meeting the Existing RPS Targets Will Require Significant Investment

## We estimate compliance for the states with rules costing ~$109 BN

**Incremental Renewable Capacity in US to Meet Current RPS by 2030**

| | | Solar | Wind | Investment Required |
|---|---|---|---|---|
| | 0% / 100% | 0.0 GWs | 65.5 GWs | $98 billion |
| | 10% / 90% | 13.4 GWs | 58.9 GWs | $100 billion |
| | 20% / 80% | 26.8 GWs | 52.4 GWs | $103 billion |
| | 30% / 70% | 40.2 GWs | 45.8 GWs | $105 billion |
| Mix of | 40% / 60% | 53.6 GWs | 39.3 GWs | $107 billion |
| ncremental renewabl | **50% / 50%** | **67.0 GWs** | **32.7 GWs** | **$109 billion** |
| capacity additions | 60% / 40% | 80.4 GWs | 26.2 GWs | $112 billion |
| Solar/Wind | 70% / 30% | 93.8 GWs | 19.6 GWs | $114 billion |
| | 80% / 20% | 107.2 GWs | 13.1 GWs | $116 billion |
| | 90% / 10% | 120.6 GWs | 6.5 GWs | $118 billion |
| | 100% / 0% | 134.0 GWs | 0.0 GWs | $121 billion |

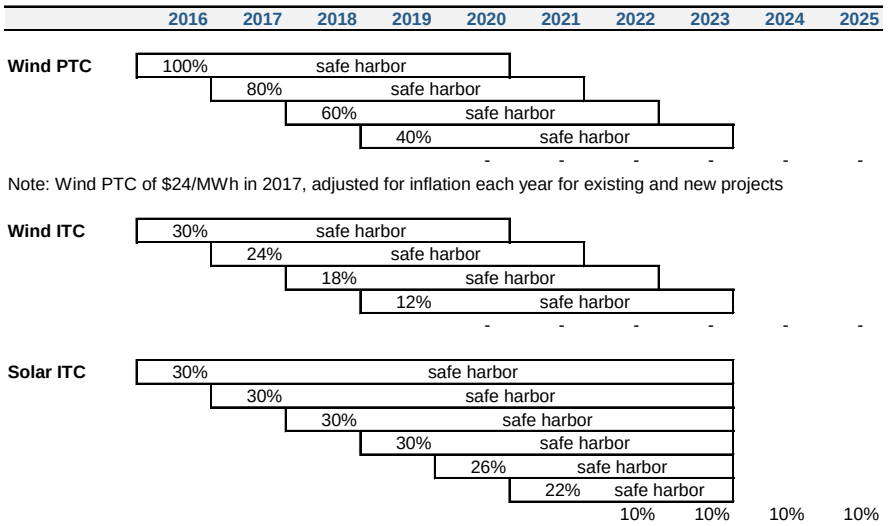
*Note: Assumes solar capacity factor of 22.0% and costs of $0.90/w, wind capacity factor of 45.0% and costs of $1.50/w*

- Renewable energy targets will require considerable investments. We estimate ~$109 billion of investment directly in wind and solar capacity with some variability depending on mix between the two resources. Further, we see continued need for transmission investment to connect many of these projects since population centers are often further away from where it is always windy or flat and sunny.
- In the table above, we show a summary sensitivity table detailing the relationship between wind/solar installation breakdown and investment needs.

*Source: Credit Suisse estimates*

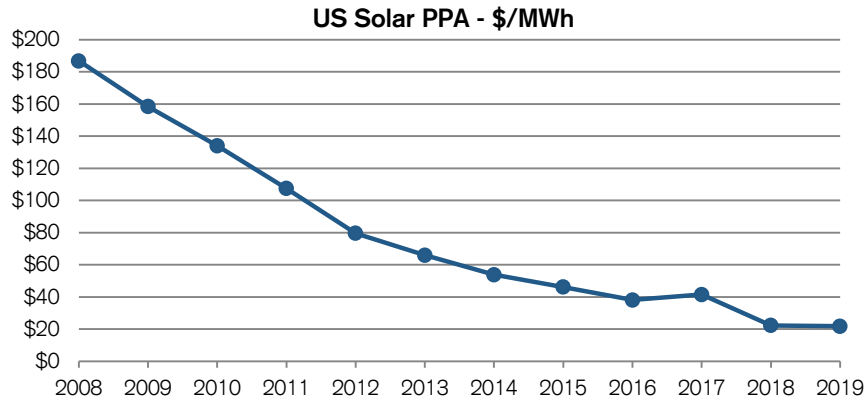
# US Solar & Wind Subsidies & Cost Declines

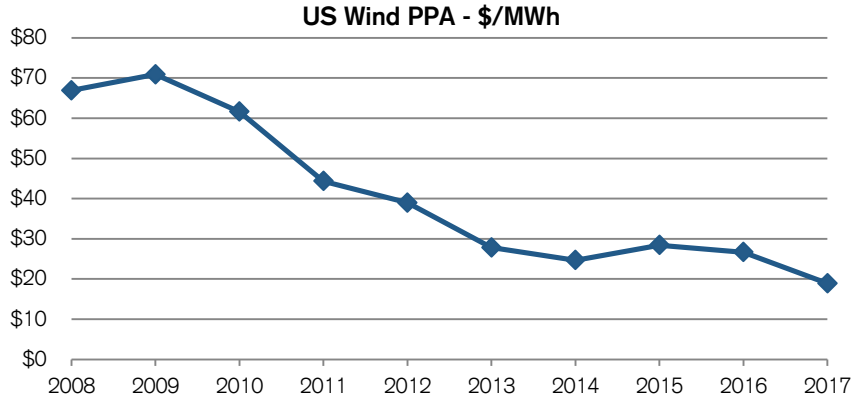
## Subsidy Regime Extended in December 2015: Visibility Through 2023




## Solar & Wind PPAs are declining

***Utility-scale Solar & Wind PPAs have fallen >70% since 2008***

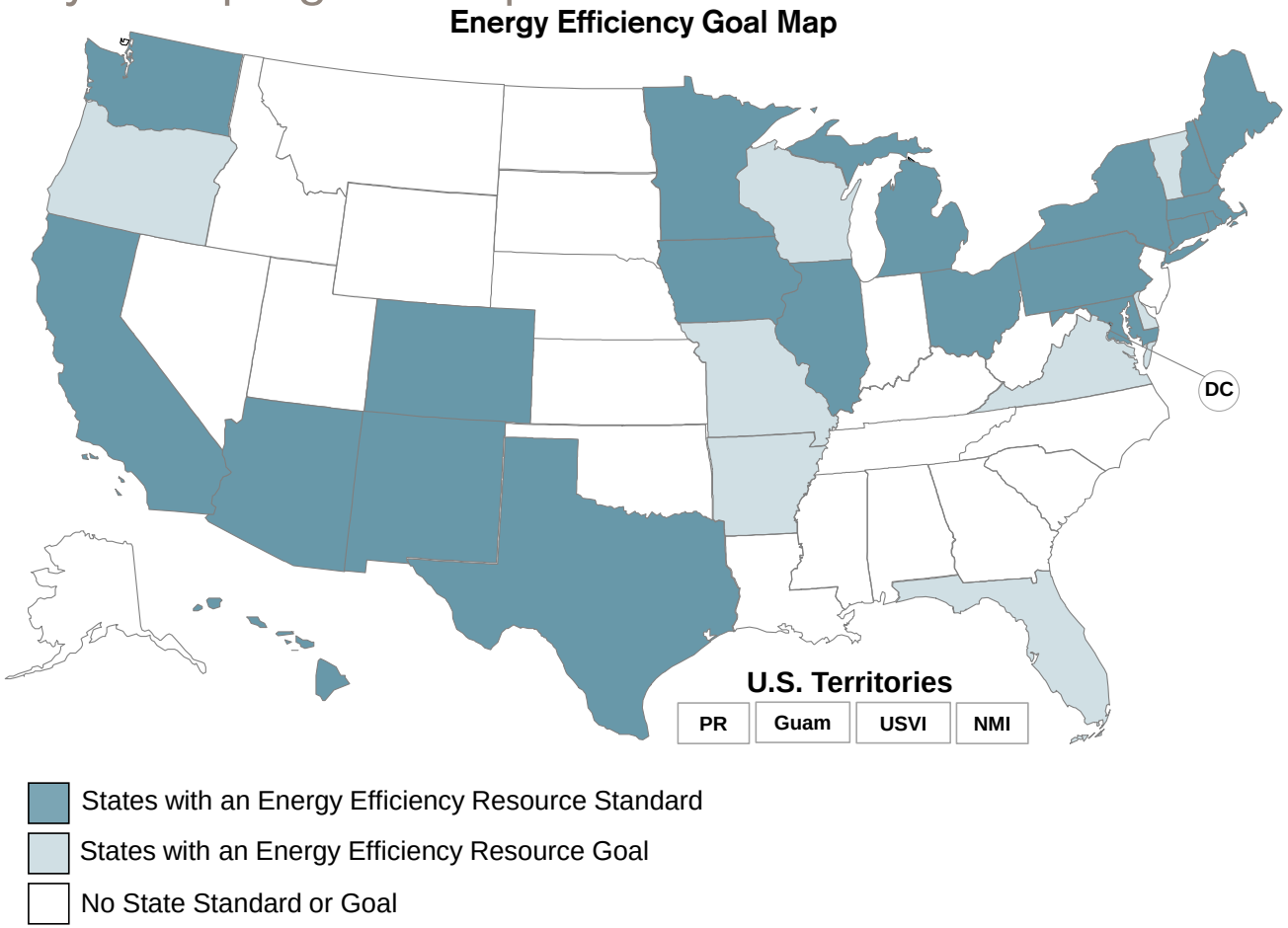



Source: GTM, Lawrence Berkley Laboratory

# Energy Efficiency Goals Aim to Change the Rate of Demand Growth

## 28 states today have programs in place




- Often thought of as a low cost way to lower emissions, states have more actively embraced targets to lower the rate of power demand growth.

*Source: DSIRE, www.dsireusa.org*

Credit Suisse Equity Research
Americas/United States

# Alternative Energy & YieldCos

**April 2019**


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# Long-term energy transition

## Low-cost cleaner energy

| Generation | Demand side | Electrification | Regulatory |
|---|---|---|---|
| • Wind<br>• Solar<br>• Fuel Cells (H2, CH4) | • Distributed Generation<br>• Energy Storage<br>• Demand Response<br>• Energy Efficiency | • Electric Vehicles<br>• Heating/Cooking | • Utility 2.0<br>• 2-Way Grid<br>• Clean energy standards<br>• Green New Deal |

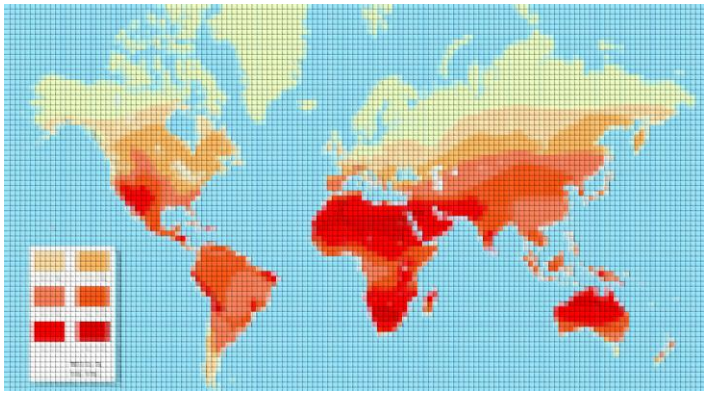
**Key debates in the transition**

- Is manufacturing commoditized or IP protected?
- Impact of energy storage on renewable adoption
- Who controls behind-the-meter energy generation and storage?
- What does Utility 2.0 look like with decentralized solar and storage?
- How much government support and incentives are needed and/or desirable to meet societal goals and deadlines?

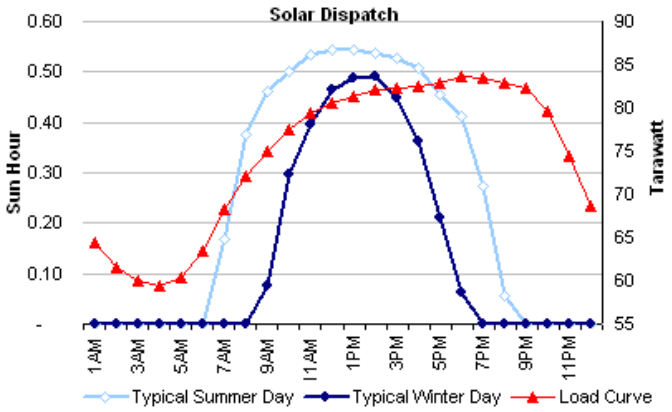
# Basics of Solar

## Resource and Technology Characteristics

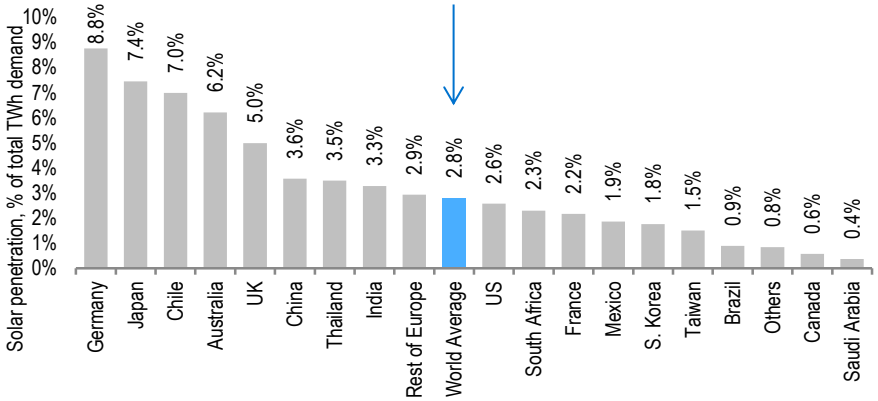
### Ample resource available globally



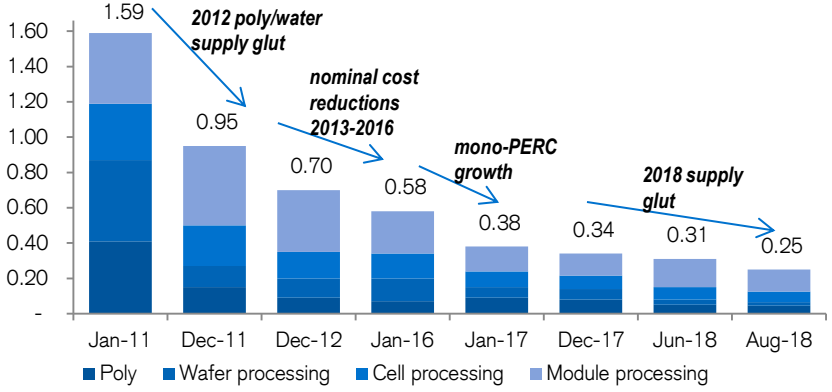
### Peak demand coincident resource




### Low penetration of global energy generation




### Substantial improvement in hardware cost




Source: Credit Suisse, Government data, EIA, BP Statistical, GTM/SEIA, BNEF

# Basics of Solar

## Ideal distributed generation source

**Most forms of energy generation (renewable or not) use turbine technology to generate energy – i.e. what Edison used in late 19th century**

- Fossil fuels burn to produce steam to rotate turbines
- Nuclear heats water to produce steam to rotate turbines
- Wind turbines
- Geothermal uses naturally available hot steam to rotate turbines

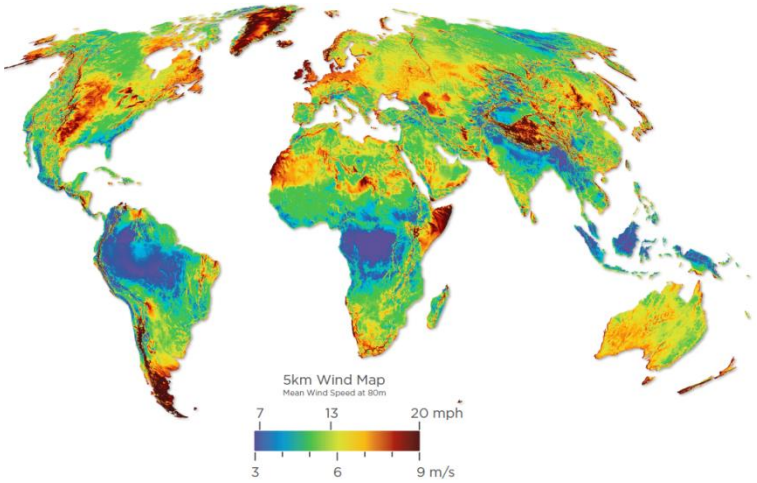
**Solar involves no moving parts (or minimal if using a tracker) and modular scaling units from 300 watts (1 module) to 500,000,000 watts (0.5 GW solar plants)**

- This makes solar (and fuel cells) ideal for distributed generation – generation that occurs close to the point of consumption (e.g., rooftops, etc.)
- Ongoing maintenance is simple and inexpensive – no feedstock cost risk
- Solar is not limited by location (as sunshine is widely available) although solar irradiance levels significantly impact utilization rates
- No carbon emissions from solar
- For manufacturers, commoditized market for polysilicon and panels results in highly competitive market with declining margins and a need to keep innovating ahead of massive Chinese dominance over the industry.
- For developers, declining hardware and capital costs, low market penetration levels, and competition with regional utility retail or wholesale electricity pricing drive economics (rather than competition with other developers).

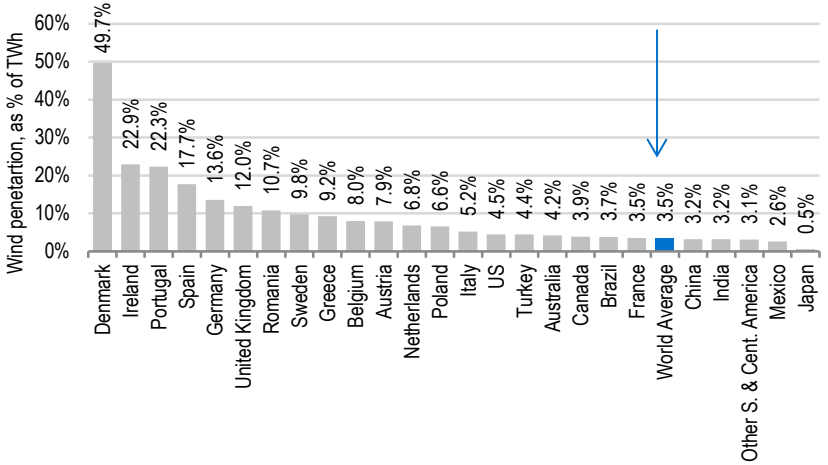
# Basics of Wind

## Resource and Technology Characteristics

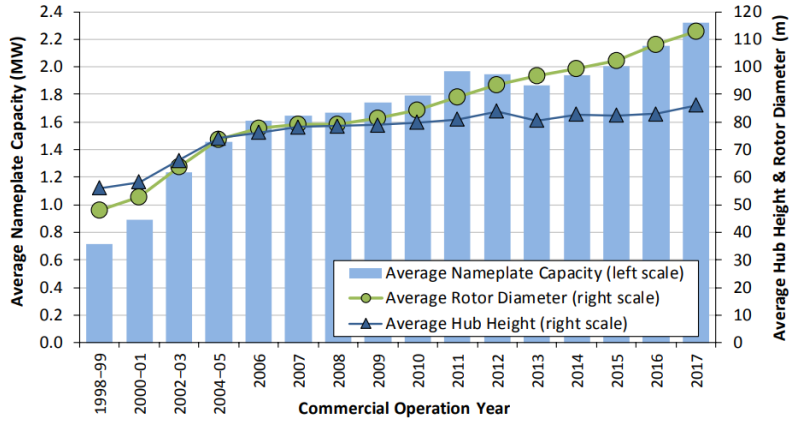
### Regional Powerhouse



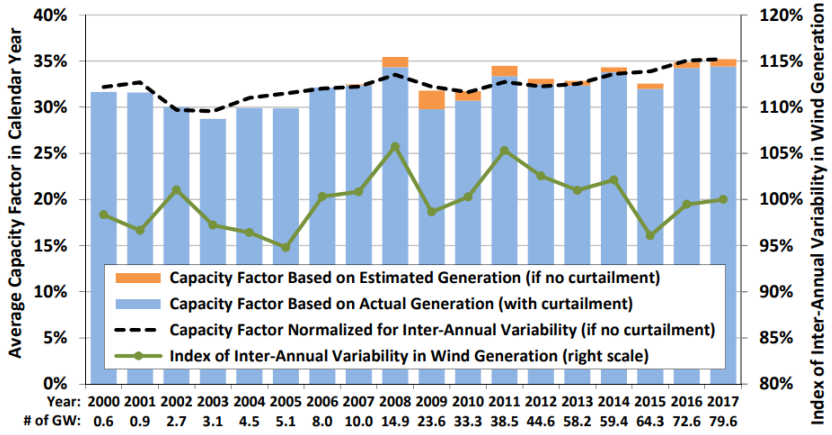

### Low penetration of global energy generation




### Bigger turbines mean larger nameplate capacity




### And significant increases in capacity utilization




Source: Government data, EIA, BP Statistical, NREL IHS, GTM/SEIA, Company data, Credit Suisse estimates

# Basics of Wind

## Renewable feedstock for traditional method

**A wind turbine converts kinetic energy from the wind into mechanical energy for the grid**

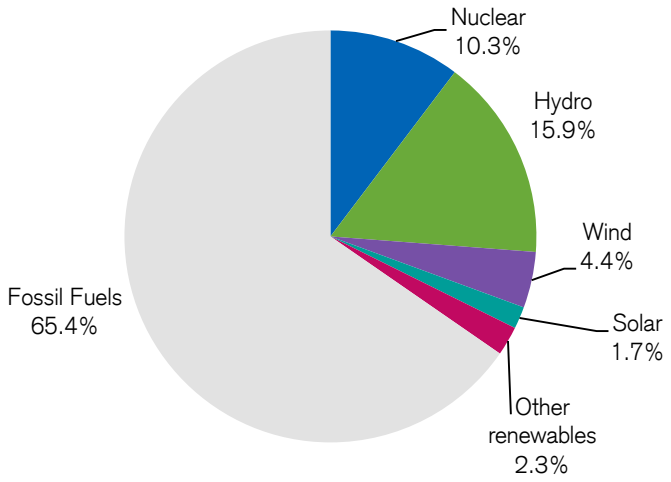
- No fuel cost and thus no energy commodity price risk
- Ongoing maintenance is relatively inexpensive, although more complicated than solar
- Improvements in hub height and blade length have substantially increased capacity utilization to the point where subsidized wind is among the lowest-cost electricity resource in high wind regions
- No carbon emissions
- Hardware and capital costs, wind resource, and regional wholesale electricity rates drive economics
- Land availability and proximity to transmission are important considerations

**Offshore wind picking up strength**

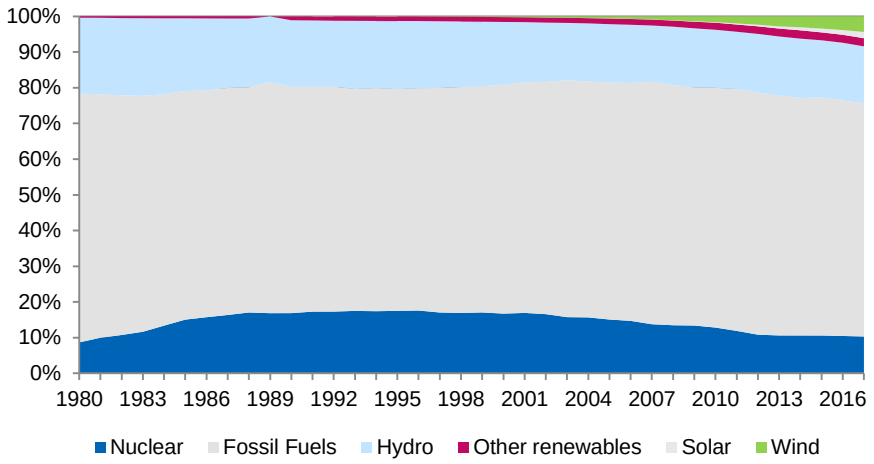
- Higher wind resource available in offshore locations
- Ideal for less sunny coastal regions with limited solar and onshore wind (i.e. Northeast US, Europe)
- Avoids limits to land availability, transmission access, and not-in-my-backyard (NIMBY) issues

# Wind and Solar in the Global Picture

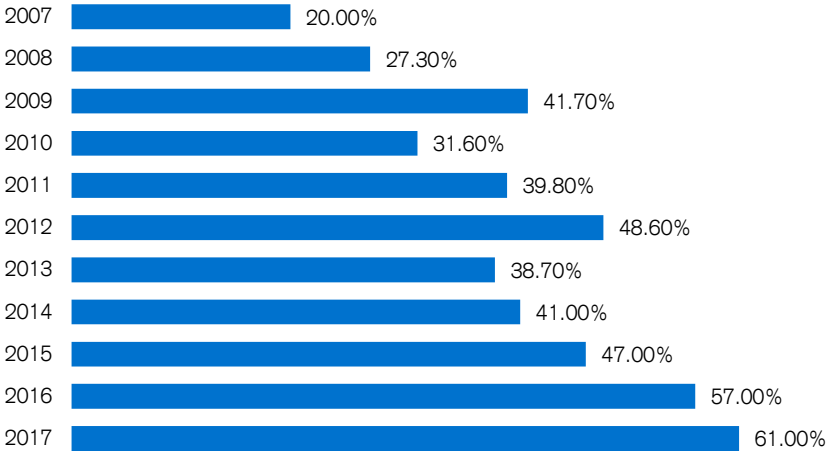
### 2015 share of global electricity generation



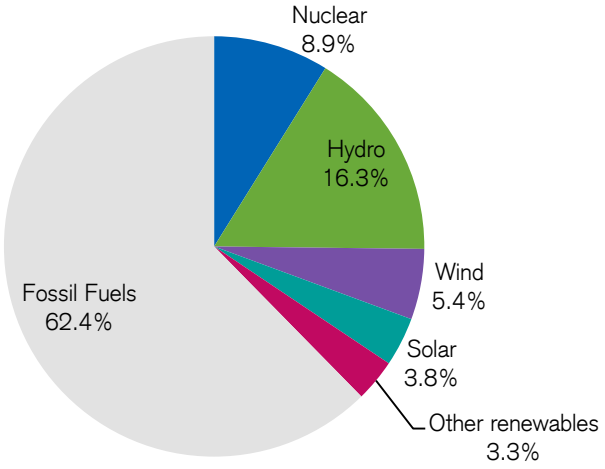

### Share of global electricity generation through time




### >60% of new generating capacity from renewables




### 2020 share of global electricity generation



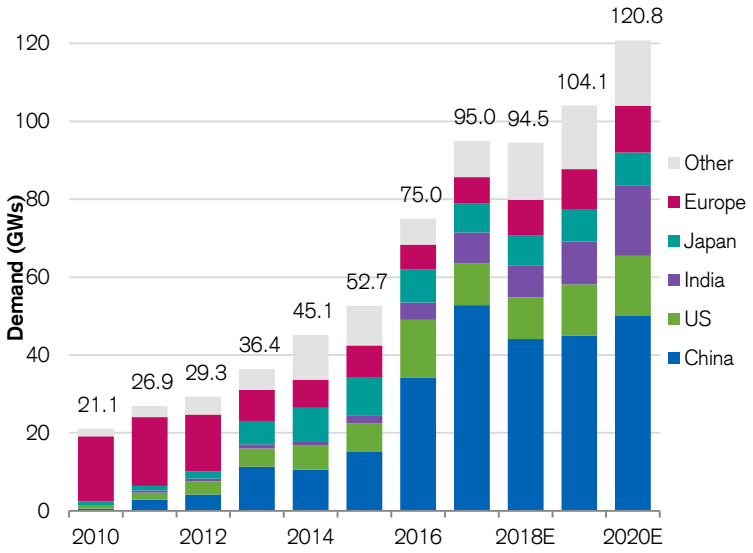

Source: Government data, EIA, BP Statistical, IHS, GTM/SEIA, Company data, UN Environment Programme Credit Suisse estimates

# Wind and Solar Demand

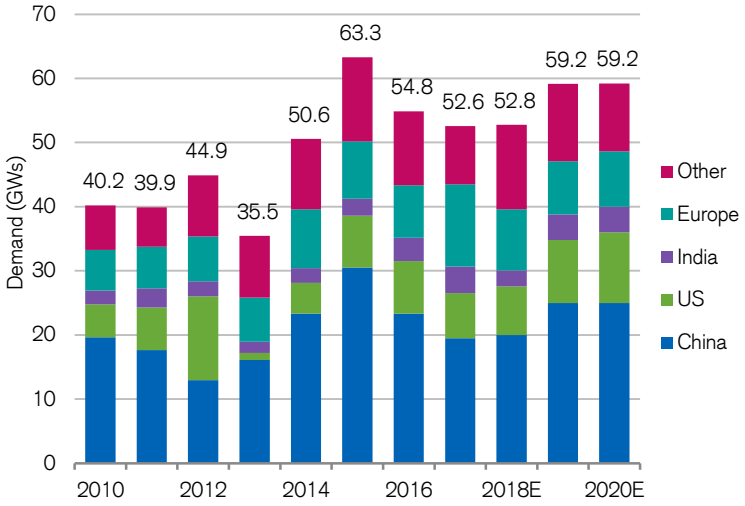
## Policy-driven demand to demand driven policy

- We estimate solar demand to grow at a CAGR of 8% through this decade while wind demand steadies
- Near-term growth is fueled by favorable policies and incentives in the US, China, India and other countries
- More and more countries and regions are transitioning to renewables and solar with no incentives

### Annual solar demand, CS est



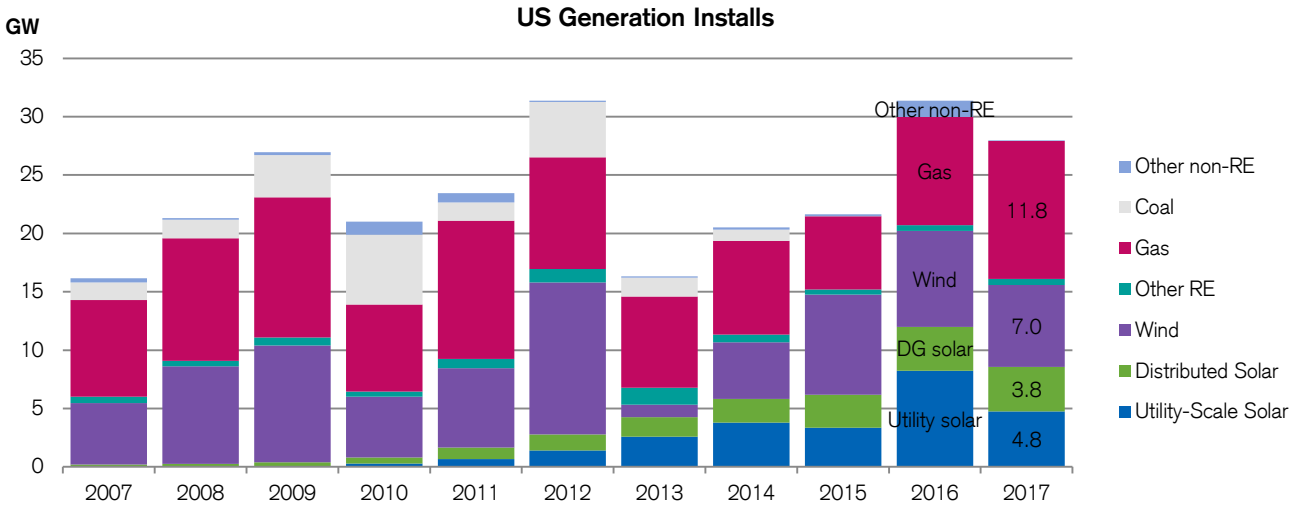

### Annual wind demand, CS est

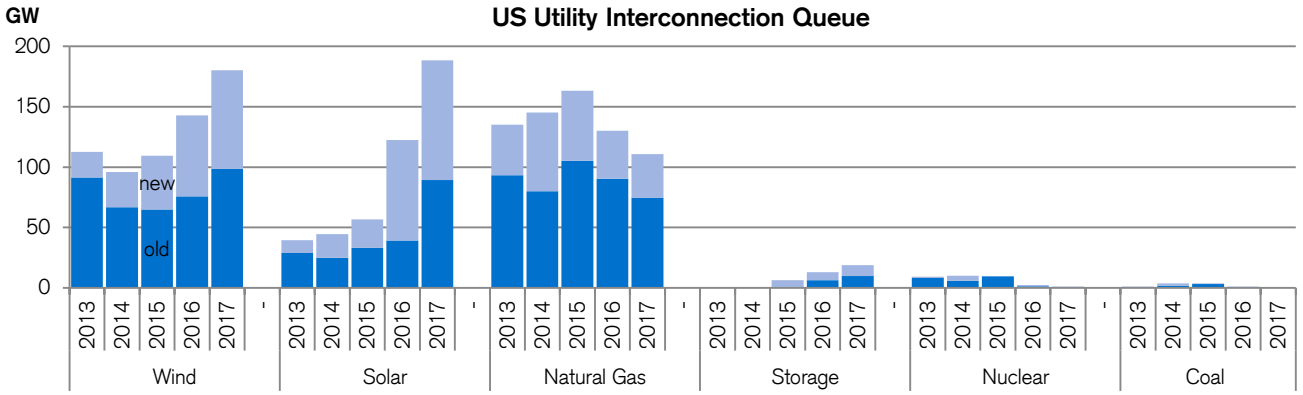



Source: Credit Suisse Estimates, I/B/E/S Estimate for all consensus numbers, Thomson, SNL, company reports

# US New Installations

## Renewables >50% of new install and queue



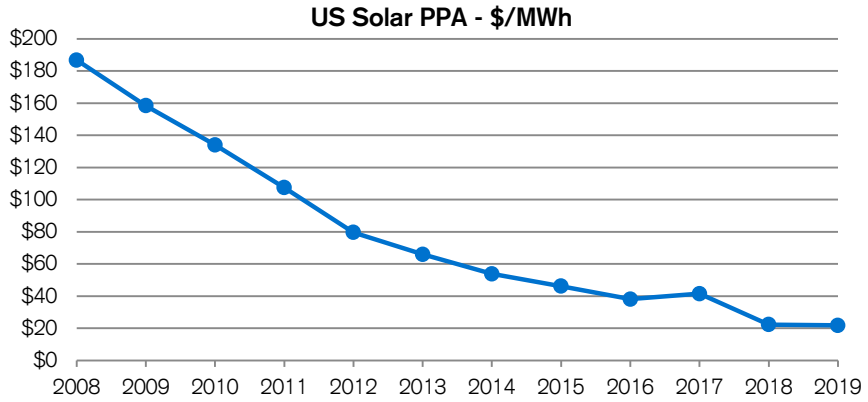



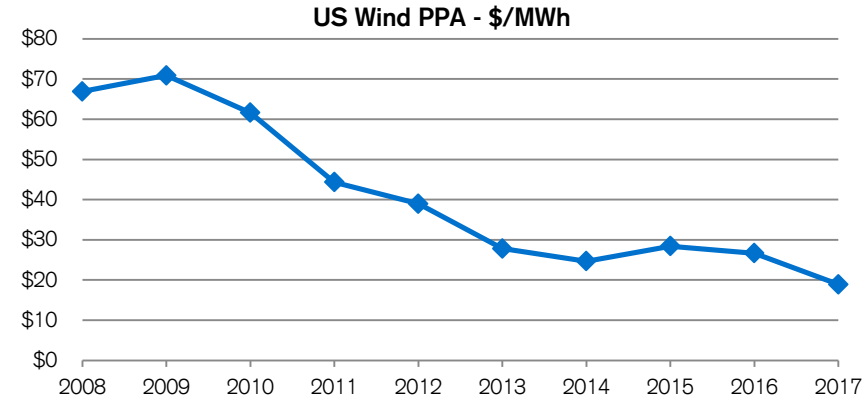

Source: LBL – 35 interconnection queues across the US

# Wind and Solar Economics

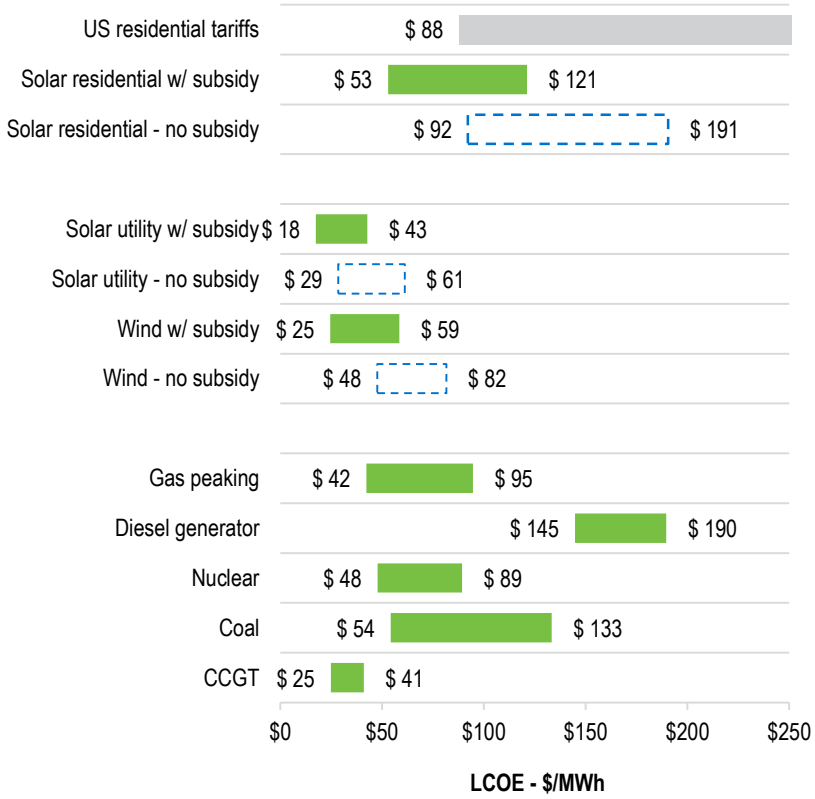
## Attractive economics increasingly drive demand

### PPAs declined >70% in the US Solar (top) & wind (bottom)




### Renewables are cost competitive vs traditional energy

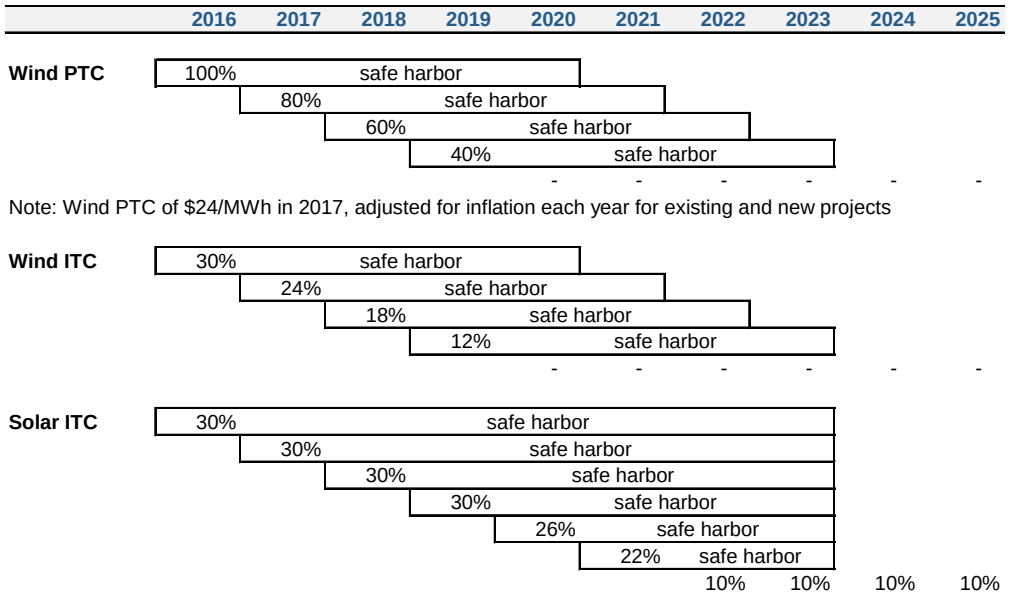



Source: IEA, EIA, Eurostat, Company data, Credit Suisse Research

# Solar and Wind

## US Tax Credits Available Through 2023

- IRS safe harbor rules require companies to invest 5% of value in 2019 to secure solar tax credits through 2023




Source: IRS

# Solar Supply Chain

Value in downstream, upstream manufacturing is highly commoditized




Source: Credit Suisse Research

# Solar Value Chain

## Segment drivers

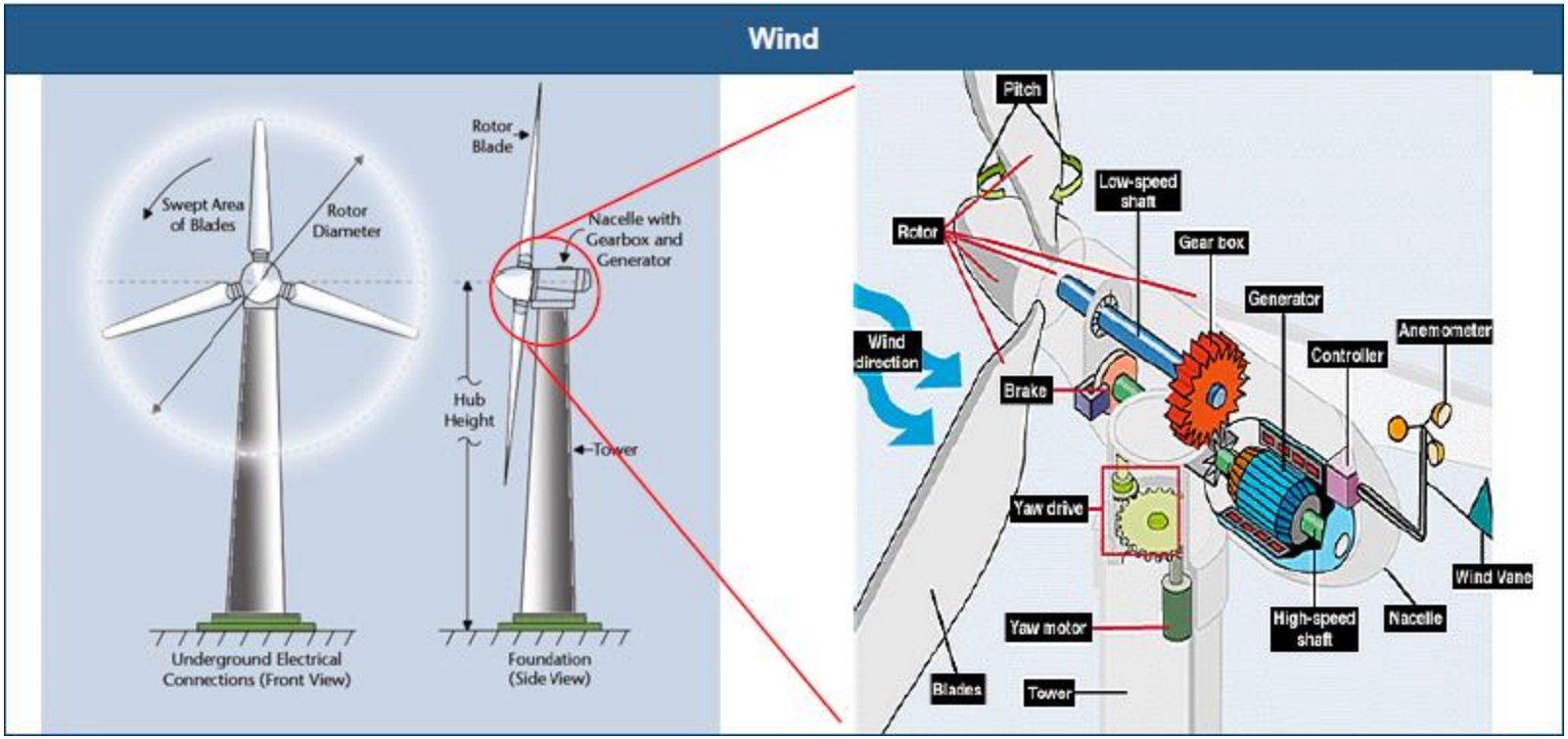
Upstream | Ancillary | Downstream

| | C-Si Poly Silicon | C-Si Wafer | C-Si Cells | C-Si Modules | Thin film panels | Inverters | BOS | Utility scale solar | Rooftop solar (mostly US) | Operators & YieldCos |
|---|---|---|---|---|---|---|---|---|---|---|
| Market Stage | Mature | Mature | Mature | Mature | Mature | Mature | Mature | Mature | Growing | Nascent |
| Barriers to Entry | High (size, capital intensive) | Medium (capital intensive) | Low | Low | High (IP) | Medium (IP) | Low | Medium (capital intensive) | Medium (capital intensive) | Medium-High (need reliable sponsor) |
| Reliance on Direct Subsidies | No | No | No | No | No | No | No | Yes | Yes | No |
| Manufacturing capex $/watt | $0.20-0.60 | $0.12-0.15 | $0.10-0.13 | ~$0.03 | $0.30/W | | | | | |
| Production cost $/watt | $8-10/kg or ~$0.03-0.05/W | Processing $0.06/W | Processing $0.08/W | Processing $0.11/W | $0.30-0.35/W | $0.05-0.40/W | $0.50-0.75/W incl inverter & installation | $0.60-$1.10/W | $2.50-$3.00/W | |
| Gross Margin $/watt (or %) | Mid-high teens. Historically, >20% in undersupplied years and breakeven gross margins when oversupplied | | | | | >30% for resi >15-20% for utility | | 10%-15% | | Yields: 5%-10% |
| Major Companies | OCI, GCL, Hemlock, Wacker, DQ | GCL, Longi, Tongwei, JKS | Module vendors | CSIQ, JKS, SPWR, Longi | FSLR | SEDG, ENPH, SMA, Sungrow, Huawei | | AZRE, CSIQ, FSLR, SPWR, NEE, Scatec, NeoEn | RUN, VSLR, TSLA | NEP, PEGI, TERP, AY, CWEN |

Source: Company data, Credit Suisse estimates

# Wind Supply Chain

## Value in downstream, upstream manufacturing margin constrained




Source: Credit Suisse Research

# Wind Value Chain
## Segment drivers

| | Blades | Bearings | Gearboxes | Generators | Towers | Integrated Players | Downstream Developers/ Utilities | YieldCos |
|---|---|---|---|---|---|---|---|---|
| **Market Concentration** | Concentrated | Concentrated | Concentrated | Fragmented | Fragmented | Concentrated | Fragmented | Concentrated |
| **Main Companies** | TPIC<br>LM Glasfiber<br>Euros<br>NOI<br>Abeking & Rasmussen | SKF<br>NTN<br>Timken<br>Kaydon | Winergy<br>Hansen<br>Moventas | ABB,<br>Winergy,<br>GE<br>Elin | Trinity<br>TowerTech<br>DMI<br>Coiper | Vestas,<br>Gamesa,<br>Nordex,<br>Suzlon | Acciona,<br>Iberdrola, Dong,<br>EDF | NEP, PEGI, AY,<br>TERP, CWEN |

Source: Company data, Credit Suisse estimates

# Beyond Sun and the Wind

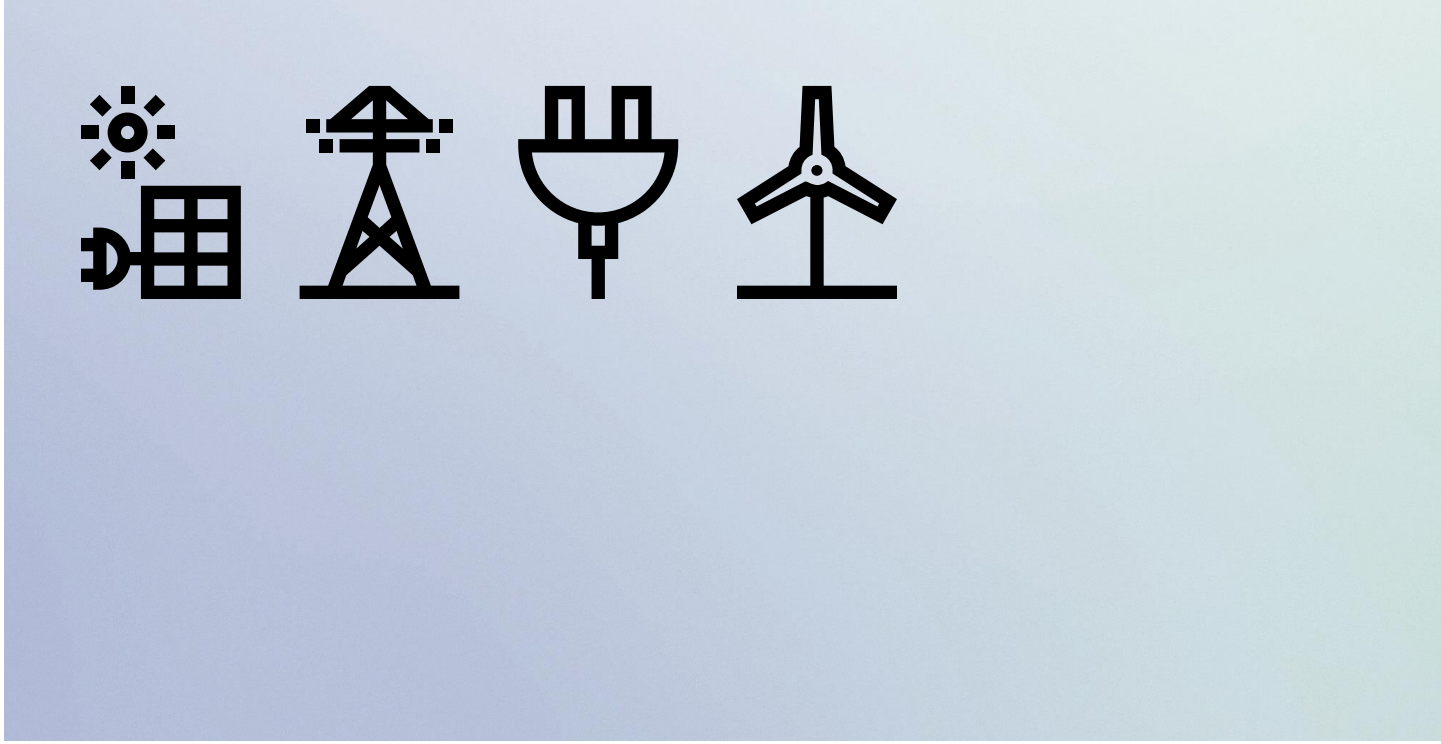
## Other Technologies

- **Fuel Cell**
  - No moving parts (except for a fan to blow air into the fuel)
  - Different chemistries, but similar functions. Generates electricity from Hydrogen, Methane, or Natural gas using a fuel cell with quiet operation across a thin, solid ionic membrane with lower CO2 output and negligible SOx/NOx emissions compared with traditional fossil fuel generation. Key challenges include cost reduction and access to low-cost feedstock.
  - Bloom Energy's proprietary solution used mainly in power markets for reliability applications (hospitals, data centers), but cost reductions and technology upgrades could expand market
  - Fuel Cells, Ballard Power used in transportation/fork-lift applications

- **Batteries**
  - Stationary battery storage is increasingly economical for peaking applications, when installed with low-cost intermittent generation technologies such as solar and wind.
  - Battery storage adoption is driven by declining costs of lithium ion batteries as most global battery manufacturing capacity makes them for consumer electronics and electric vehicles.
  - "Flow" batteries that store energy using liquid chemistry are essentially rechargeable fuel cells. They would be more suitable for large scale stationary applications, but the current form factor is too large and unsuitable for mobile use, which has inhibited any manufacturing at scale. Would be a better alternative than lithium ion at utility scale, but still only experimental stages for now (e.g., Primus Power).

- **Smart meters**
  - Deployment run rate grew in 2008 to 2011 supported by stimulus funding in the US and grid upgrades
  - Installation run rate has stabilized at ~6m installations/yr in the US since 2014. Expect demand growth for grid-modernization and support dynamic retail tariffs

# Deep Dive

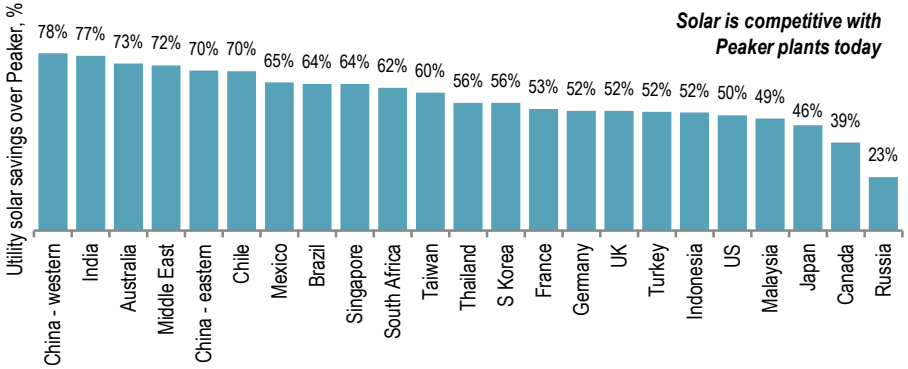


# Solar Economics

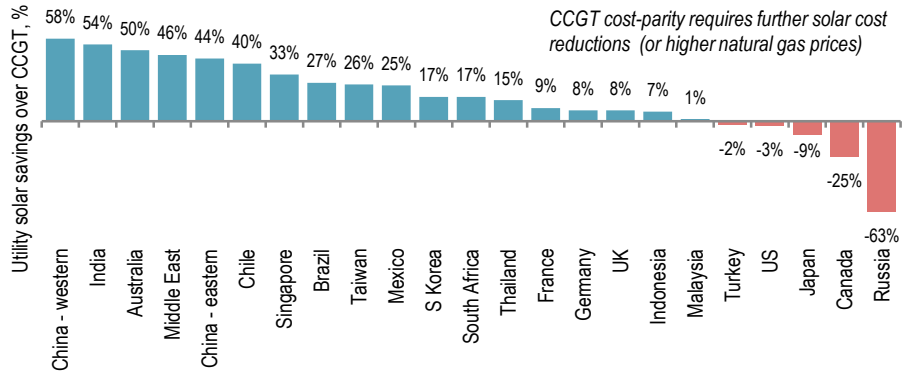
## And more markets are at grid parity today

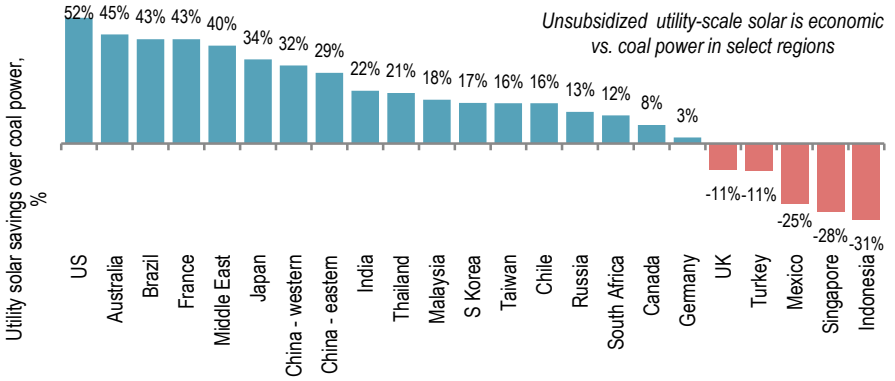
### Low cost solar systems have helped achieve the "holy-grail" in solar – Grid Parity

#### More markets are at parity today, without subsides, when compared to new Natural Gas peakers




#### But parity with CCGT and coal would require further cost reductions or higher fuel costs




Note: Interactive model available upon request.

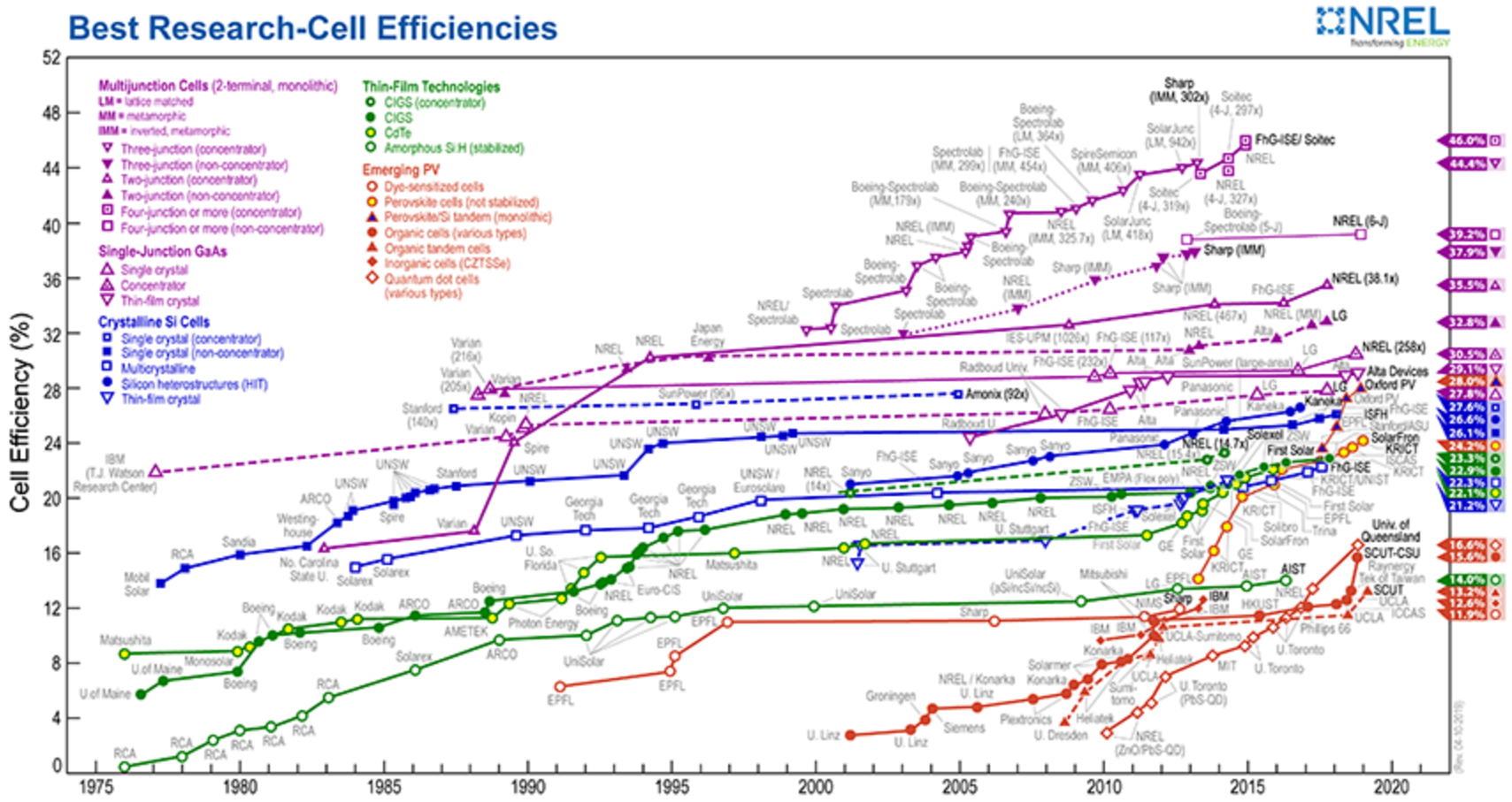
**Solar assumptions:** region specific sunhours, system cost of ~$0.9-$1.0/w for developed nations and ~$0.6-0.8/w for emerging countries, assumes no subsidy. For fixed mount systems, assumes no trackers.

**Natural gas assumptions:** capex of $0.8/W, natural gas delivered cost of ~$3.5/MMBtu in US, ~$5.5 in Europe, and ~$7.5 in Asia. Capacity factor of 85% for CCGT, and 20% for peaker.

**Coal plant assumptions:** Capex of $5/w in US and $3/w in most markets. 80% utilization, and $2.5/mmBTU fuel cost. Cost of capital varies by region – 5%-6% for developed markets, and ~10%-12% for emerging markets.

Source: Credit Suisse Renewables & Alternative Energy Equity Research, IEA, EIA, Eurostat, OpenEI.

# Solar Efficiency Improvements

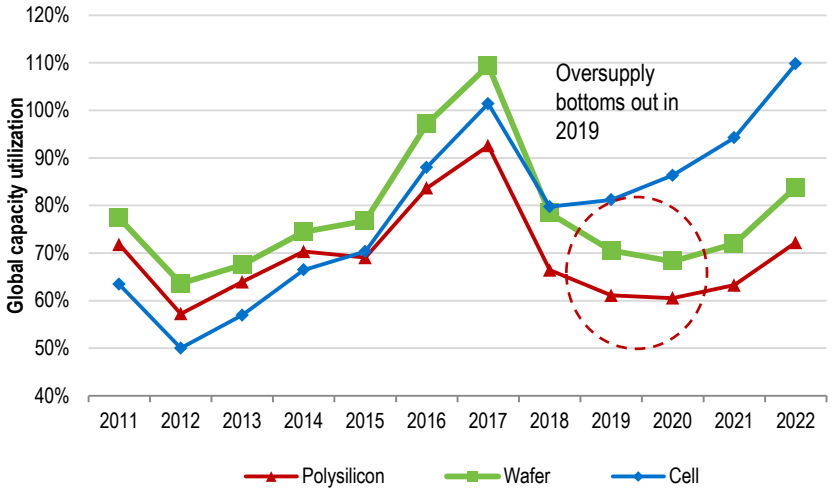



Source: NREL

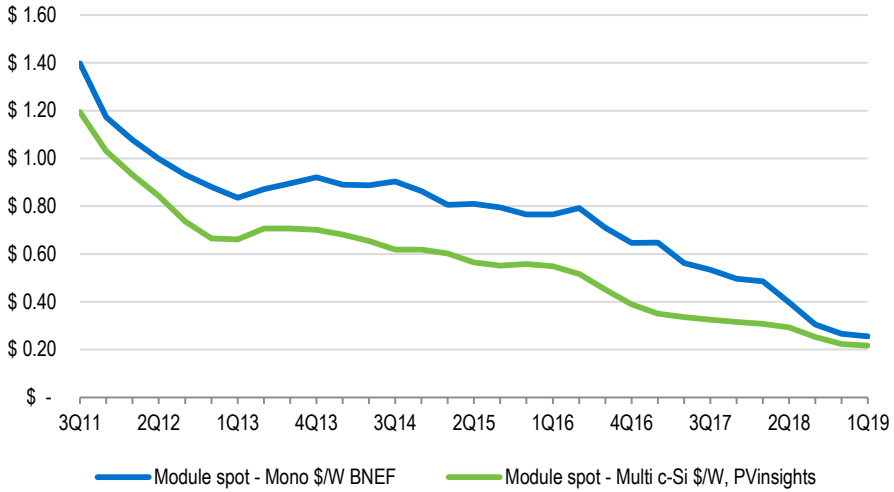
# Solar Oversupply

## Glut bottoming out in 2019

### 2018 demand slowdown exacerbated supply glut, which bottoms out in 2019




### Module prices fell >25% in 2018, but stabilizing in 2019

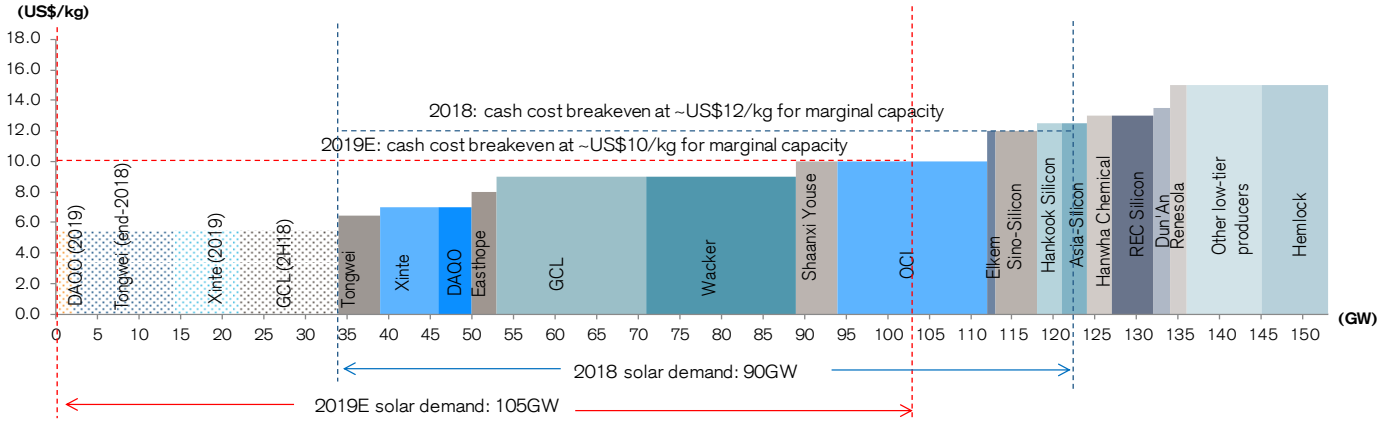


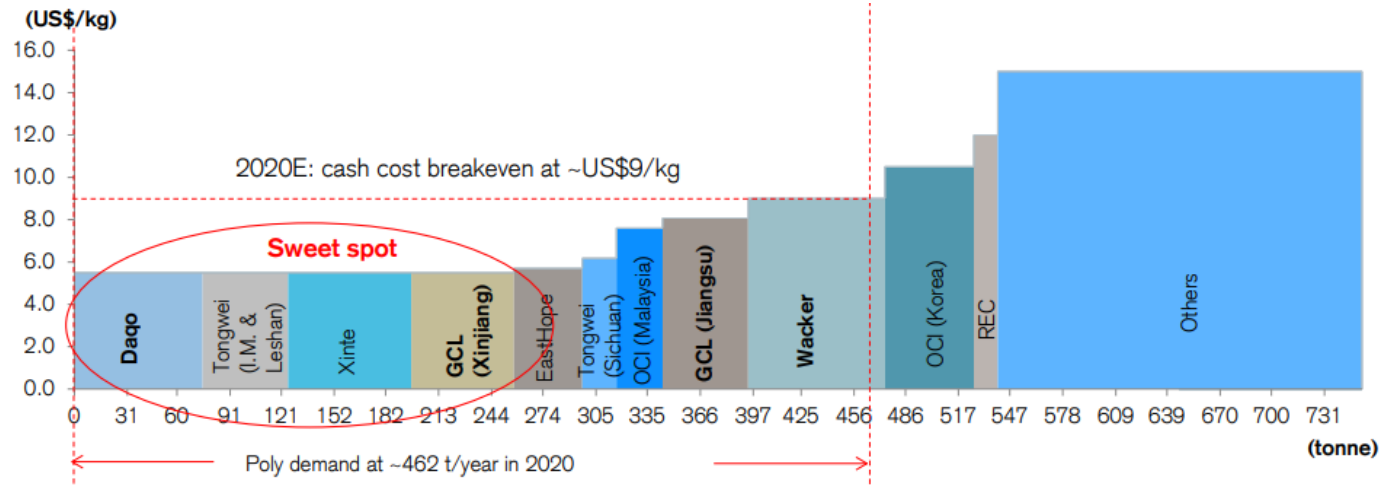

Manufacturers margins bottomed out in 2018 and are improving in 2019/20

Source: Credit Suisse Research, Company data, PVinsights

# Solar Polysilicon

## Clearing price - $10/kg in 2H19, $9/kg in 2020



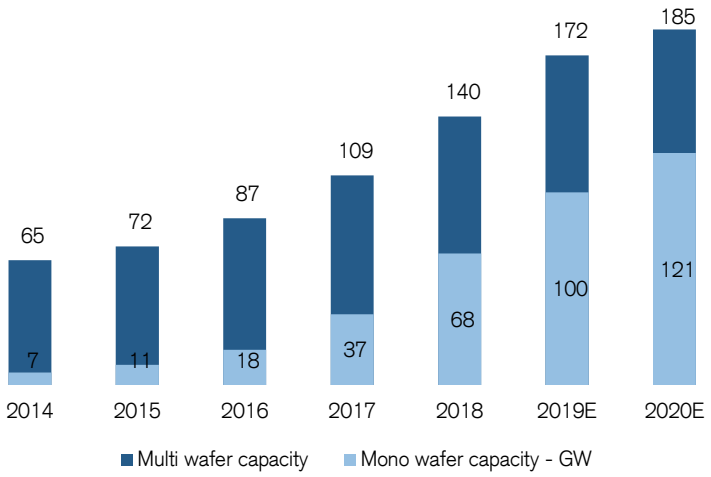




Source: Credit Suisse, Company data

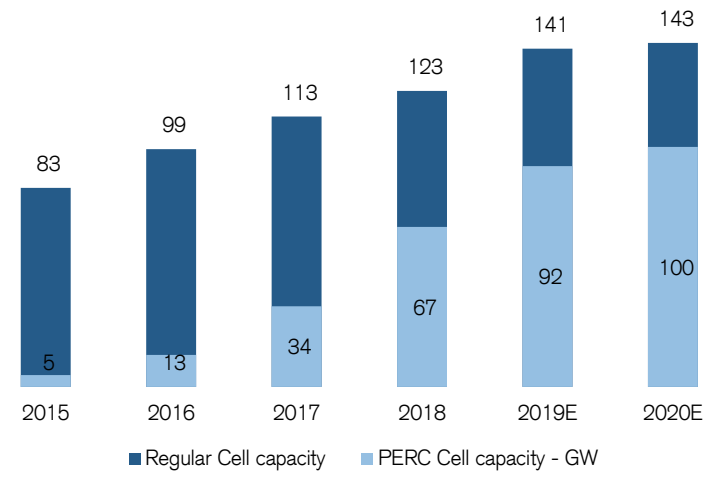
# Solar Manufacturing

## Tale of technology upgrade cycles

### Manufacturers are upgrading to mono wafers




### ..and to PERC cells



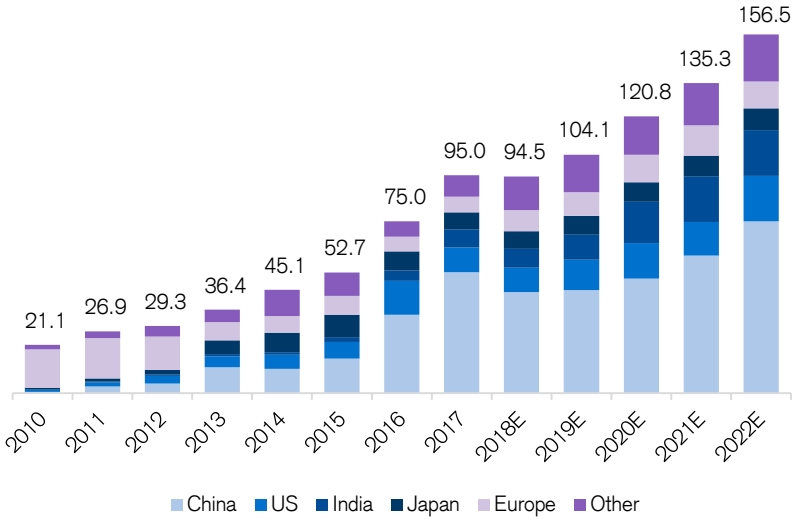

Upgrade cycles are driving higher capacity additions at same or lower capex, and lower production cost at higher module level efficiencies

Source: ITRPV Ninth Edition 2018

# Global solar demand

## Unsubsidized solar demand growth

- China
  - 46% of global solar demand in 2018 due to 2018 driven by feed-in-tariff subsidy, but gradually moving away from subsidy by 2021. Will continue to command 40-50% of global solar demand
- India
  - 100 GW by 2022 government target, vs 5.5 GW in 2015 and 26 GW in 2018. Unsubsidized market, but demand driven by centralized government auctions
- Europe
  - Demand now driven by unsubsidized government auctions in most regions
  - Growing residential solar demand in Western Europe
- Australia
  - Utility scale demand for 2020 target
  - Growing residential market
- US
  - Tax credits drive subsidized demand through 2023
- Other regions
  - Secular demand growth due to declining solar PPAs competitive with fossil fuels




Source: Credit Suisse BNEF, GTM/SEIA, government data

# US Utility Scale Solar

## Low-cost + RPS Demand

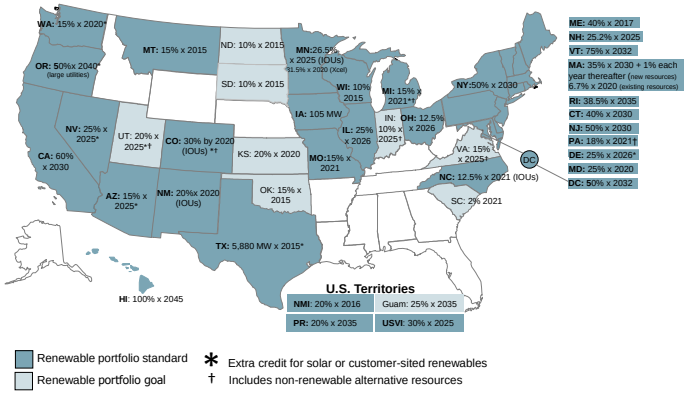
- US utility-scale solar demand driven by renewable portfolio standard (RPS)
  - 29 states and DC have RPS in place
  - We expect 87 GW of solar demand for these states by 2030, assuming 50% of demand is met from solar
- The 30% Investment Tax Credit (ITC) was extended to 2021 (vs step down to 10% on Jan 1, 2017)
- Commercial demand and PURPA drives demand in non-RPS states

### Visibility to 67 GWs Incremental Solar Capacity Required in US to Meet 2030 Renewable Portfolio Standards (RPS)

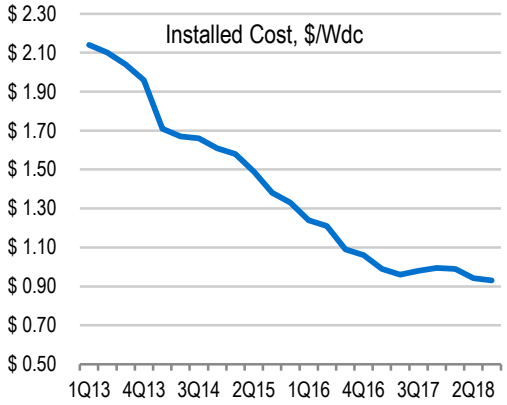
| Incremental Solar Capacity Required in US to Meet Current RPS | | by… 2020 | by… 2030 |
|---|---|---|---|
| Solar share of incremental renewabl capacity additions | 0% | 0.0 GWs | 0.0 GWs |
| | 10% | 2.9 GWs | 13.4 GWs |
| | 20% | 5.7 GWs | 26.8 GWs |
| | 30% | 8.6 GWs | 40.2 GWs |
| | 40% | 11.4 GWs | 53.6 GWs |
| | **50%** | **14.3 GWs** | **67.0 GWs** |
| | 60% | 17.2 GWs | 80.4 GWs |
| | 70% | 20.0 GWs | 93.8 GWs |
| | 80% | 22.9 GWs | 107.2 GWs |
| | 90% | 25.8 GWs | 120.6 GWs |
| | 100% | 28.6 GWs | 134.0 GWs |

*Note: Assumes solar capacity factor of 22.0%, wind capacity factor of 45.0*

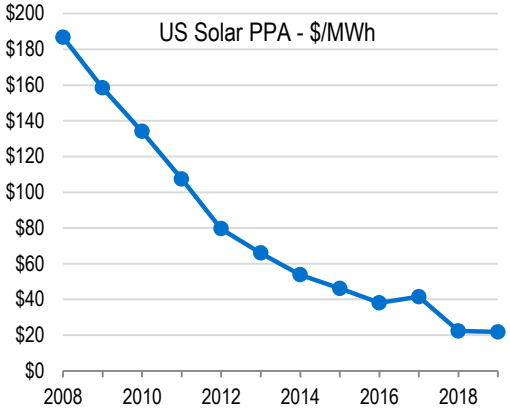
### Utility demand driven by RPS….




### … and declining installed cost…




### …results in lower solar PPAs

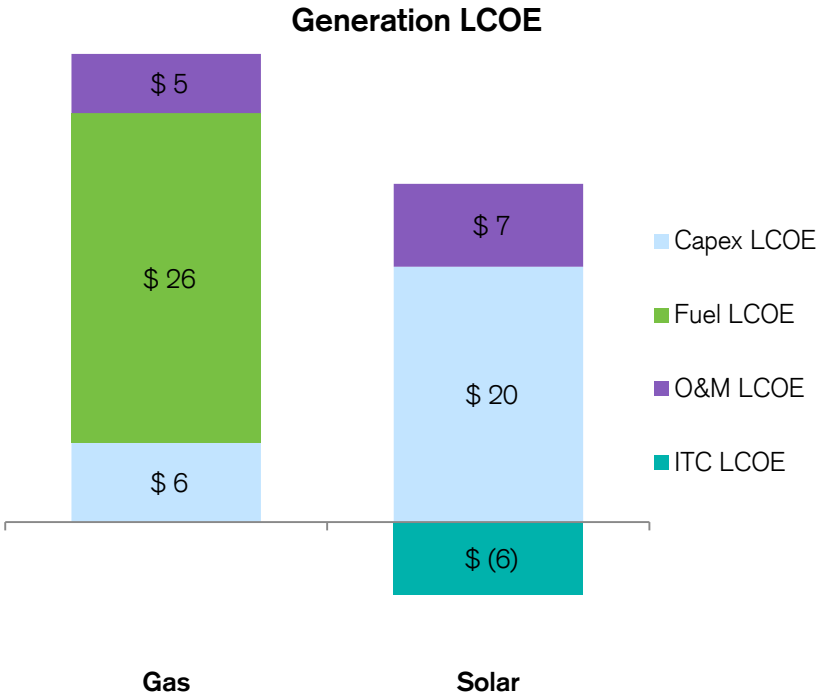


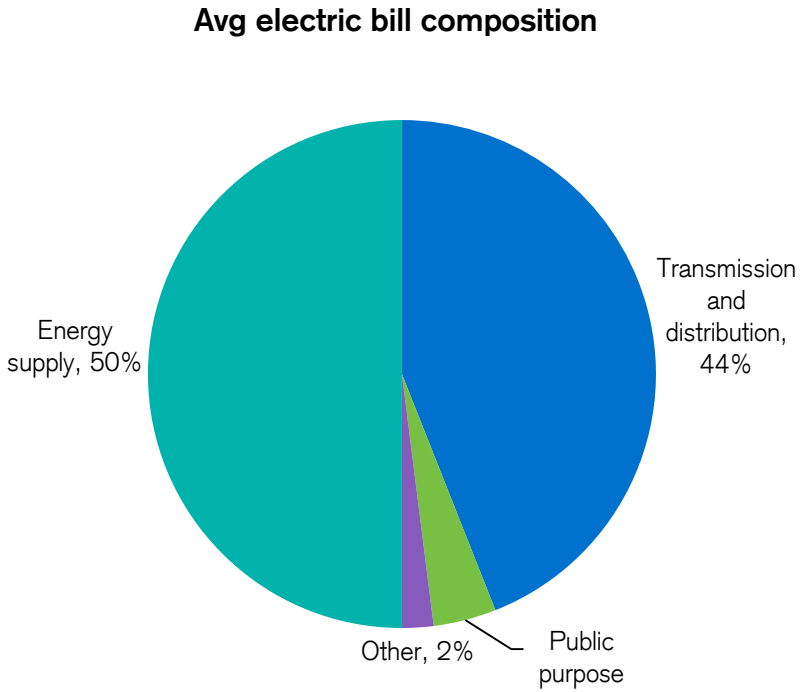

Source: Credit Suisse Renewables & Alternative Energy Equity Research, Company Data, DSIRE, Berkeley Lab, GTM

# Renewable Switching

## Utilities are incentivized to install renewables

- Renewables deliver 3-4x capex growth, but electric bills may remain steady or decline due to elimination of fuel charges
- Currently, ratebasing (i.e. installation by regulated utilities) adds to the cost though due to unfavorable treatment of tax credits, which will remain true through 2023
- However, post-2023 we expect strong renewable demand from regulated utilities



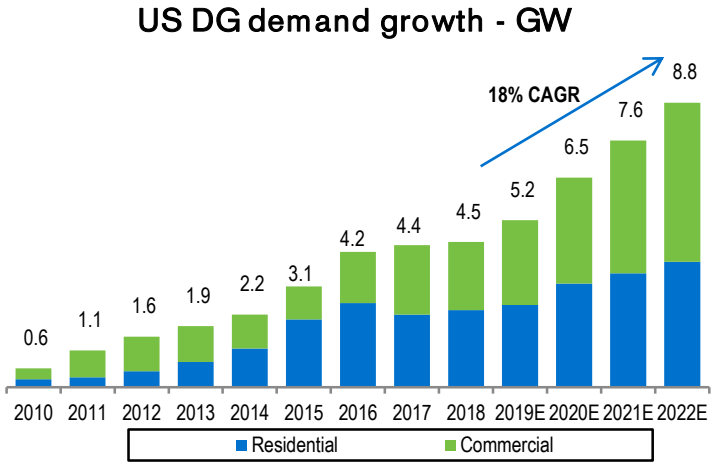



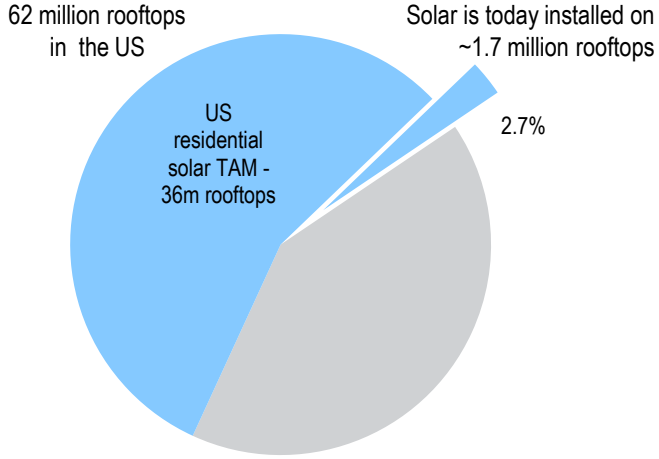

Source: Company data, Credit Suisse

# Distributed Generation (DG) Solar

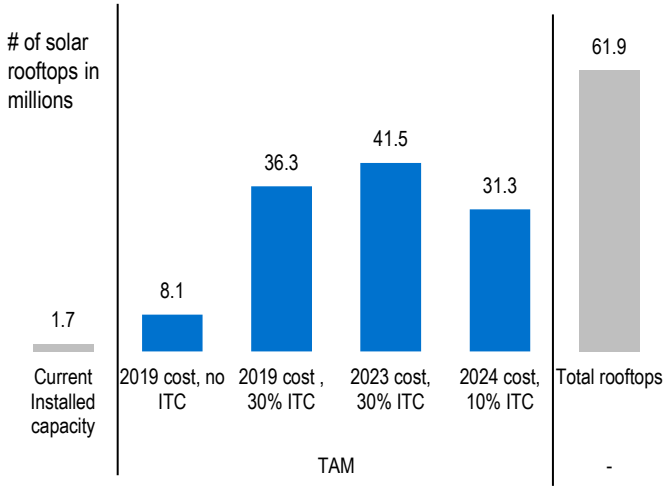
## Still in the Early Innings of Adoption

- DG solar is economic in 41 states today
- Residential DG penetration is still scratching the surface with ~3% penetration across available rooftops in the country.
  - Penetrations are notably higher in California (>5% of peak demand, breaching NEM 1.0 cap), and Hawaii (>20% of peak demand)
- We calculate solar TAM of 36m households (58% of total rooftops) today - taking credit rating, system economics, and physical restrictions (like shading) into account




Note: Assumes $2.8/w cost today, $2.40/w in 2018+. Subsidies include 30% ITC + state subsidies



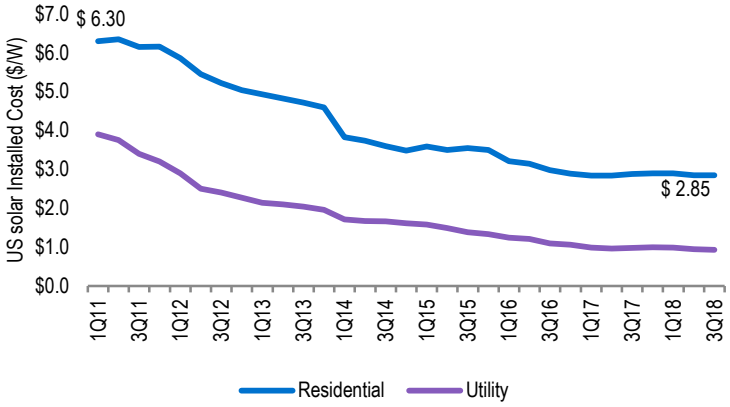

Source: Company data, Credit Suisse, GTM/SEIA, Census, EIA

# Distributed Generation (DG) Solar

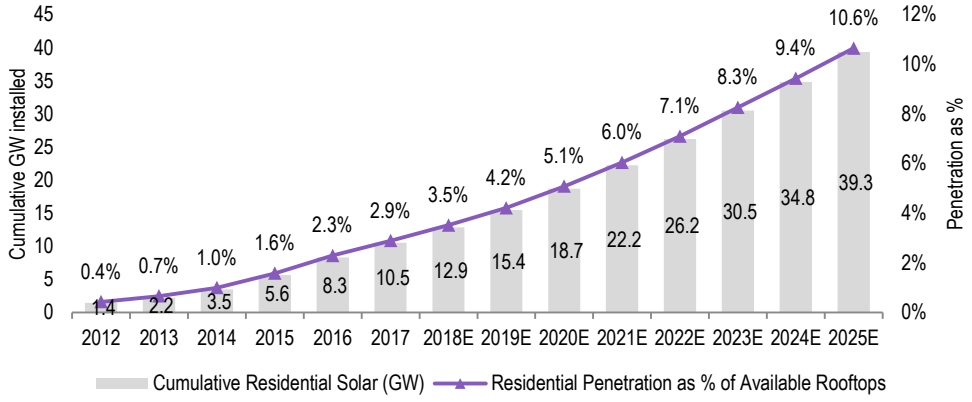
## Growth Driven by Declining Costs

- Residential solar system cost has declined >54% since 1Q11
  - Meaningful economies of scale pushed industry towards consolidation untll 2015
  - Market leaders lost market share in 2016/17 due to proliferation of loan products (for TSLA), a failed acquisition (VSLR), and focus on cash generation (for TSLA and VSLR)
- We estimate demand to grow at a CAGR of 18% through 2025 due to declining costs

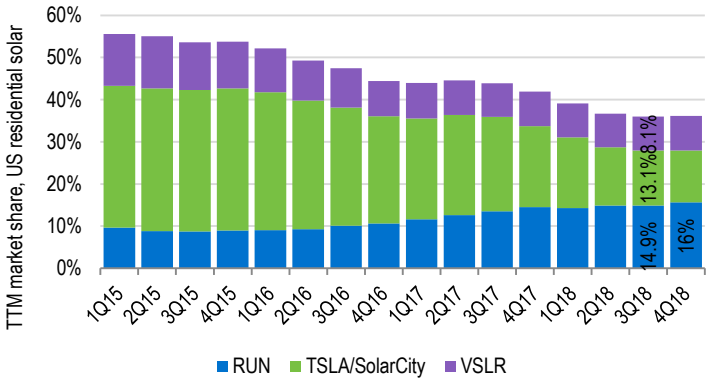
**Cost to Install Residential Solar System Has Declined >55% Since 1Q11**




**U.S. Residential Solar Market to Grow at a 18% CAGR Reaching ~10.6% Penetration Rate by 2025**




**Top 3 Continue to Hold >35% Market -trailing 12month market share**

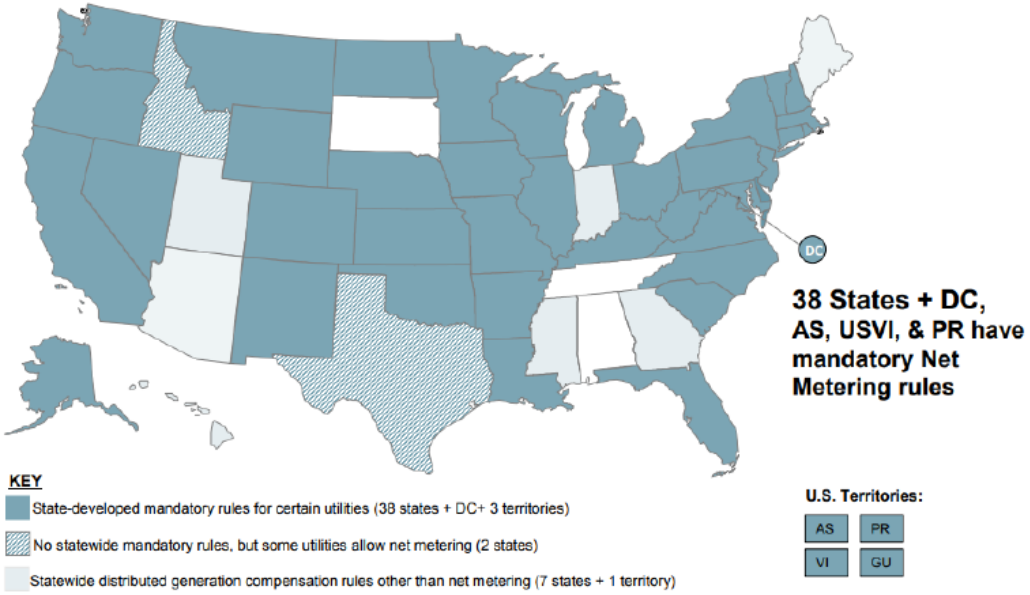


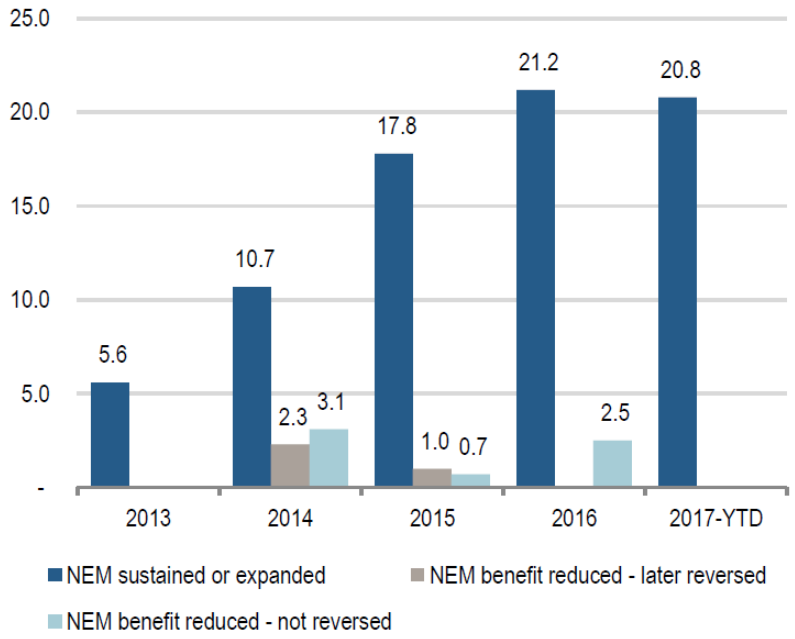

Source: Credit Suisse Renewables & Alternative Energy Equity Research, Company Data, GTM/SEIA

# Distributed Generation (DG) Solar

## Net Metering Policy (risk to rooftop solar)

- Displacing Incumbent Utilities = Regulatory Risk for Distributed Generation:
  - Net metering rules in 45 US states allow solar owners to receive a utility credit at retail rates for their excess electricity production during the day, and consume those credits at night, enabling "free storage" and distorted cost allocation of distribution infrastructure investments
  - Utilities or regulators in California, Nevada, Arizona, Texas, Hawaii, Utah, Kansas, Idaho, Indiana, Illinois, New Hampshire, South Carolina and Florida have asked for changes to net metering rules
  - Do not expect any intervention from the federal government on NEM, as intra state electricity sales are regulated by state utility commissions.



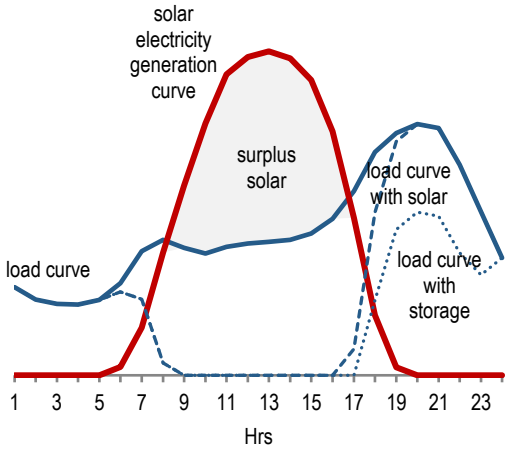

Source: DSIRE, Company data

# Distributed Generation (DG) Solar

## Utility Rate Reform

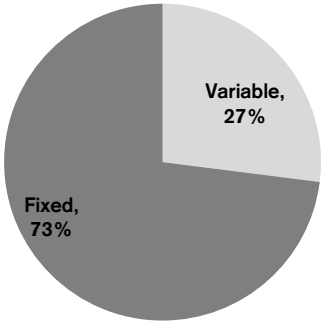
- Utilities may implement regulatory rate changes to counter solar net metering (NEM) by imposing minimum fixed fee/surcharge, or reducing net metering rates
- Prior NEM rulings were not so punitive ultimately
  - CA NEM 2.0 was very positive for solar
  - NV - initially reduced NEM tariffs and removed grandfathering in 2015, but both reinstated by legislators in 2017
  - AZ – regulators established solar export tariff at $0.129/kWh, much higher than the utility's demand of $0.03/kWh (wholesale rates)
- Lower-cost battery storage helps homeowners offset adverse NEM changes

**Net Metering Example—Average Daily Electricity Consumption and Solar Generation for a House in LA**

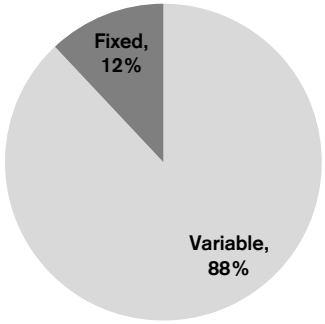



**Variable vs. fixed and how cost allocation is approached**

**How Costs are Incurred**




**How Revenues are Collected**




**Potential impact on value/customer if fixed NEM charges are imposed**

| $/month charge | Levered NPV/watt | | Unlevered IRR | |
|---|---|---|---|---|
| $ - | $ 1.27 | | 15.1% | |
| $ 5 | $ 1.14 | (10.0)% | 14.0% | -110 bps |
| $ 10 | $ 1.02 | (20.0)% | 12.9% | -214 bps |
| $ 15 | $ 0.89 | (30.0)% | 11.9% | -315 bps |
| $ 20 | $ 0.76 | (40.0)% | 11.0% | -412 bps |
| $ 25 | $ 0.64 | (50.0)% | 10.0% | -505 bps |
| $ 30 | $ 0.51 | (60.0)% | 9.1% | -596 bps |
| $ 35 | $ 0.38 | (70.0)% | 8.2% | -685 bps |
| $ 40 | $ 0.25 | (80.0)% | 7.4% | -772 bps |
| $ 45 | $ 0.13 | (90.0)% | 6.5% | -858 bps |

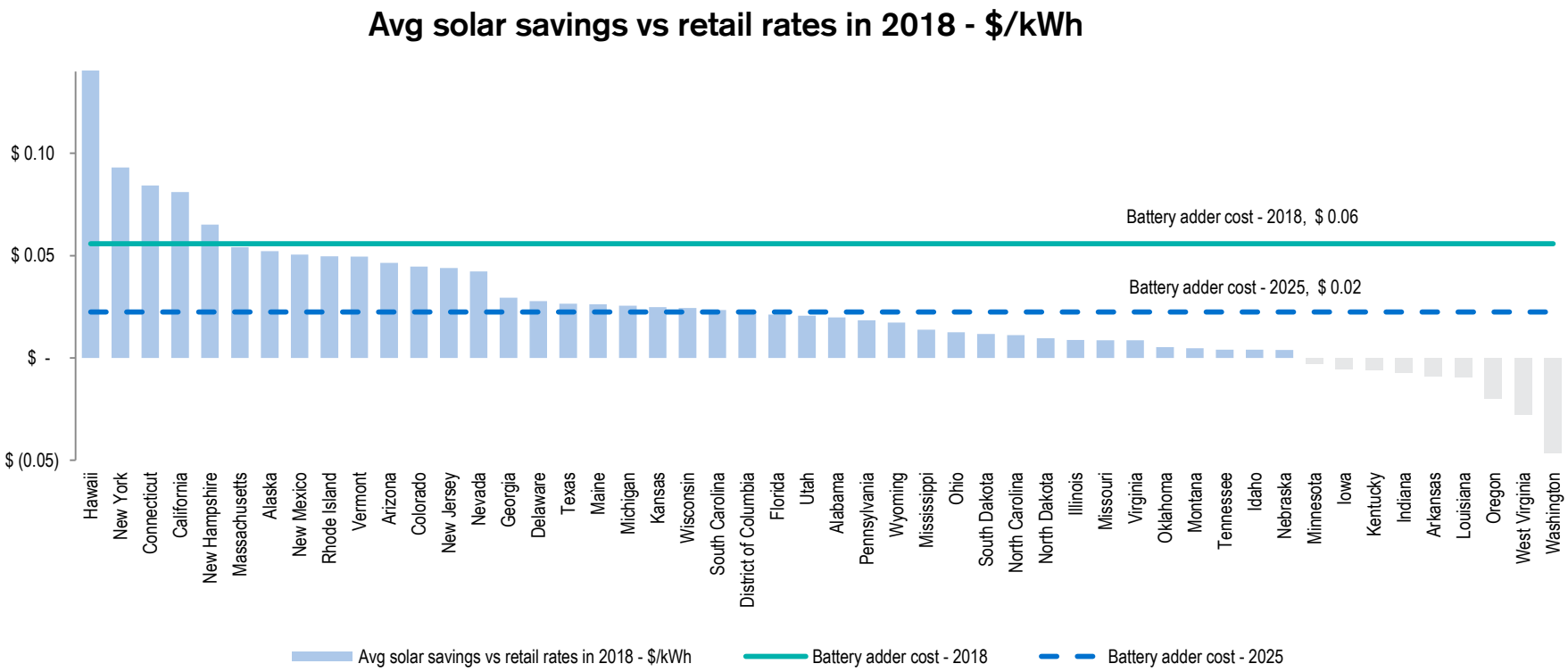
Key assumptions: charge borne by leasing company, total cost of $2.75/watt, pricing of $0.13/kwhr with 2.2% escalator, ITC of 30%, no SRECs

Source: Credit Suisse, SRP, NREL, Openei.org, Company Data

# Distributed Generation (DG) Solar

## Storage Increasingly cheaper

- Residential solar is economical in 41 states with net metering in 2018
- Solar+storage is economical in 5 states without net metering in 2018, increasing to 22 states by 2025 due to reduction in battery pack and system capex




Source: Credit Suisse, Company data, EIA, BNEF

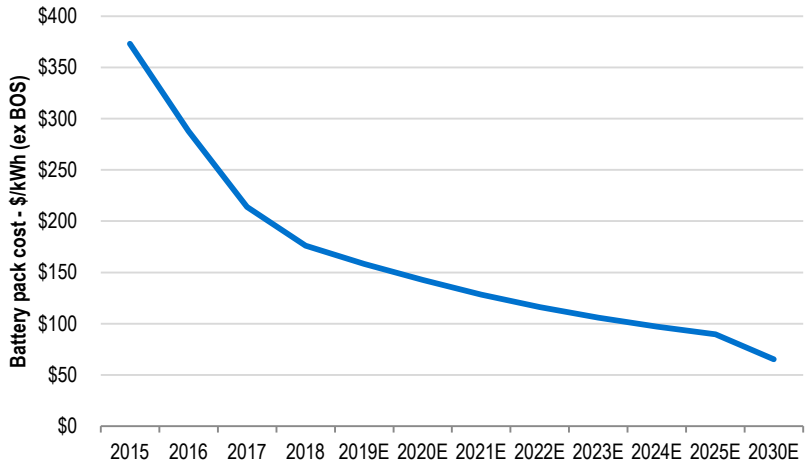
# Solar + Storage Economics

## Cheaper than you thought

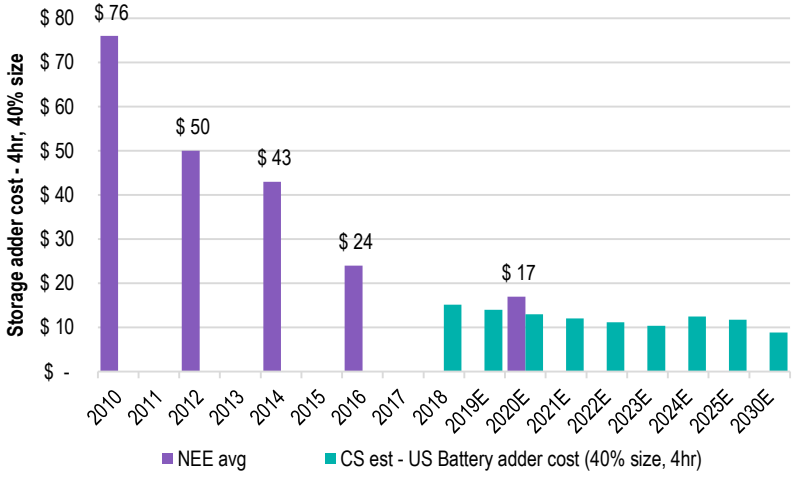
- **Solar is not dispatchable**
  - This is problematic at higher levels of penetration as it cannot be depended upon during peak periods (if cloudy, etc) and traditional power plants must still be on "standby".

- **Adding storage makes solar dispatchable**
  - Solar+storage is economical than residential solar in Hawaii and California today, and vs gas peaker plants in South West US
  - The combined Solar + Storage resource could also replace **conventional base load** power generation sources, **but costs would need to fall** >50% for economics to be viable (likely by mid 2020s)

### Li-ion battery costs ~$273/kWh in 2016, forecasted to reach $65/kWh by 2030




### Battery adder cost $/MWh is declining for projects (spread between solar+storage and solar PPAs)




Source: NextEra Energy, BNEF, Company data, Credit Suisse

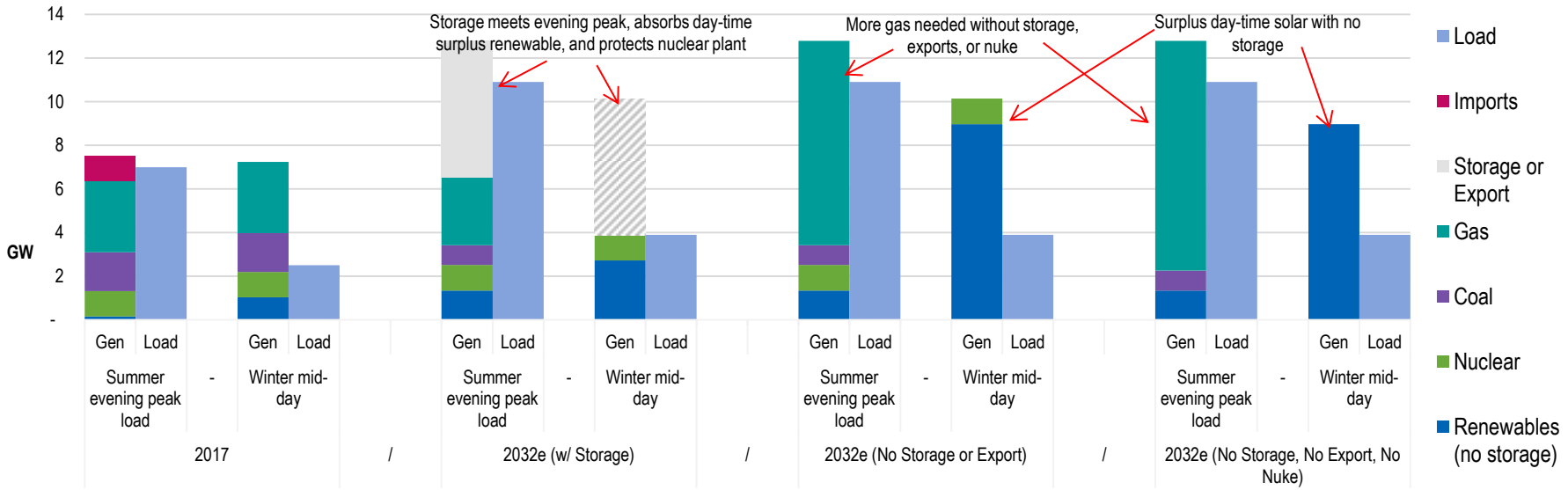
# "Silicon+Lithium" for Fuel

## Higher Renewable Penetration Needs Storage

- Many US states now support a >50% renewable portfolio standard (RPS). But higher solar energy generation in daytime would require battery storage to (i) absorb surplus solar production, and (ii) meet evening peak

- For e.g. proposed 50% RPS in AZ in 2018 ballot (later defeated) would have required 6+ GW of solar and an equally sized energy storage capacity

**50% RPS Paved with Storage (e.g. Arizona Public Service)**




Source: Credit Suisse, Company data

# YieldCo 101

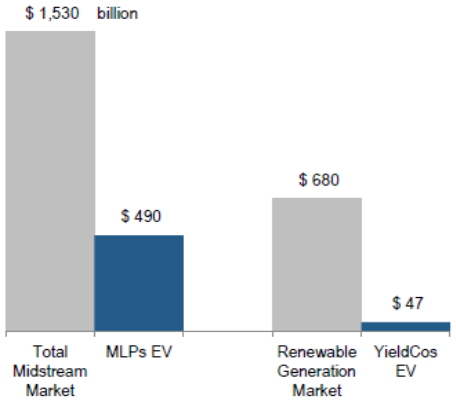
- **Heavily contracted** dividend growth vehicles taxed as 1099 C-corps
  - Long-term, low-risk cash flows generated by portfolios of contracted energy infrastructure assets
  - Share attributes with, but are not structured as Master Limited Partnerships (MLPs)
- Formed for investors seeking stable and growing dividend income from a diversified portfolio of cash flowing assets to take advantage of trends in power generation through a **lower cost of capital** than that of traditional developers and Independent Power Producers
- **Dividend growth is paramount** and financially engineered
  - Dividend accretion through acquisition is the name of the game in the short-term
  - Advantaged cost of capital drives longer term value creation
  - Temporary tax protection through depreciation benefits (MACRs)
- The right investors: **long-term investment horizon**, real asset/cash flow/yield oriented, looking for income and capital appreciation. Traditionally a lot of cross over with utilities, power, MLPs, REITs
- Primary sector **opportunities**: large and growing TAM in a sector ripe for consolidation with a long history of capital indiscipline, predictable cash flows, limited energy commodity price exposure, visible growth opportunities, and limited political risk to tax benefits
- Primary sector **risks**: limited organic growth, interest rates and capital availability, stock price sensitivity to MLP valuation and energy commodity prices, financial health/viability of sponsor, leverage, corporate governance, conflicts of interest, renewable energy policy and disclosure
- **Differentiating** factors: corporate structure and incentive fees, asset types and geographies, sponsor entities, disclosure, growth visibility, and dividend growth targets

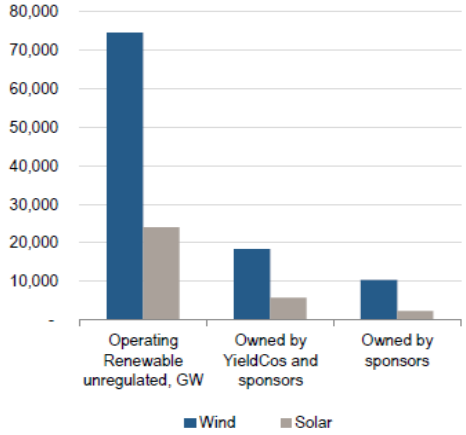
Source: Credit Suisse Research

# YieldCo Market

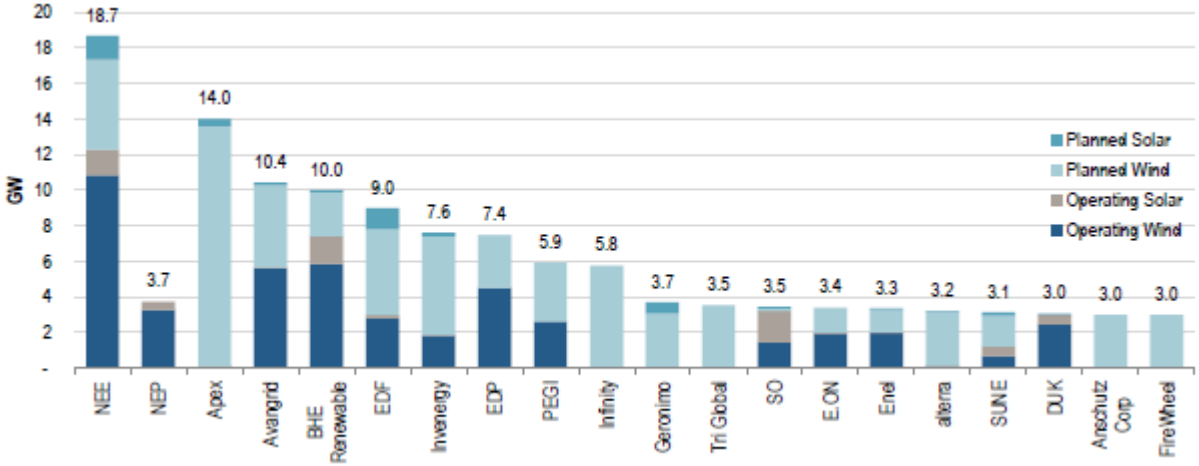
## Large, fragmented, and underpenetrated TAM

### Market for Yieldcos, Compared with MLPs




### Solar and wind ownership is particularly fragmented

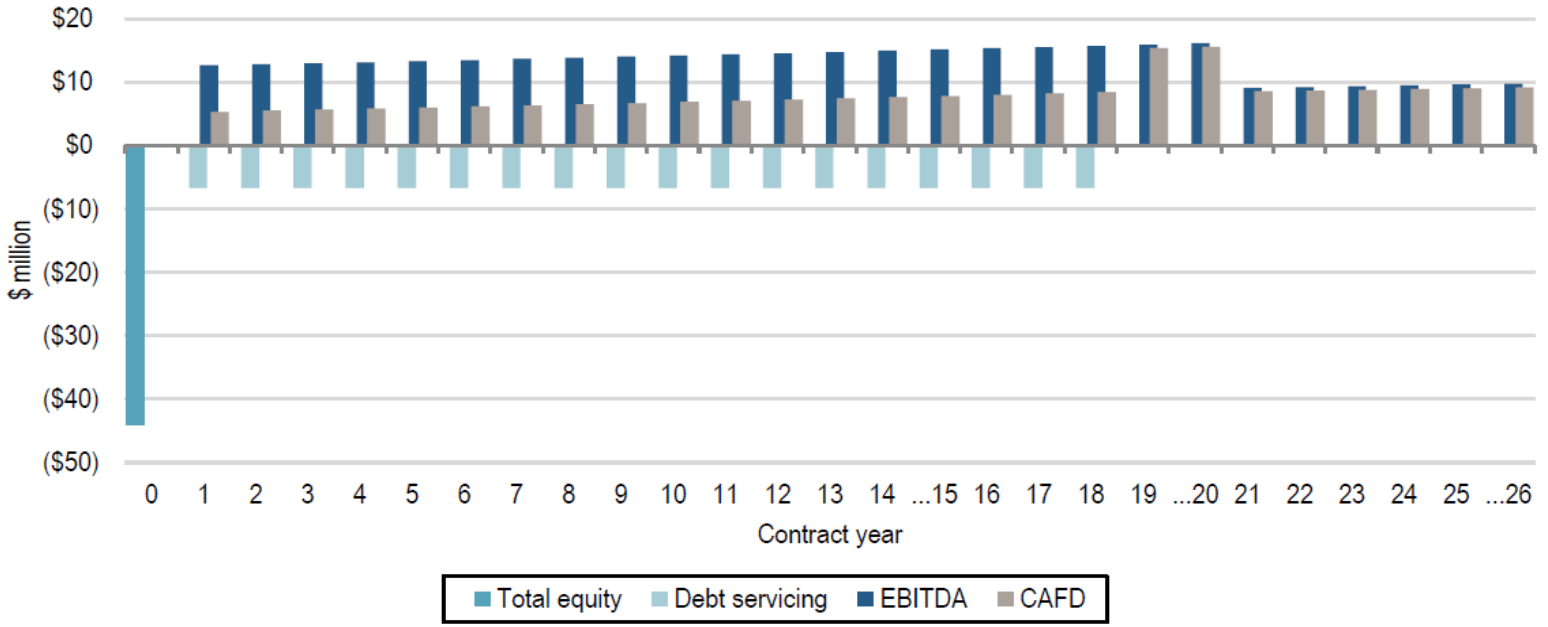



Source: Credit Suisse Estimates, I/B/E/S Estimate for all consensus numbe company reports

# YieldCo

## A sound structure to own renewable assets

- Capital costs all upfront, which public markets should efficiently supply
- Contracted, high credit, and long duration cash flows that market should efficiently value
- Unlevered IRRs 6-8% through contract period
- ~10% of acquisition NPV derived from assumptions regarding post contract period
- Cash available for distribution (CAFD) = EBITDA less total debt service and maintenance capex

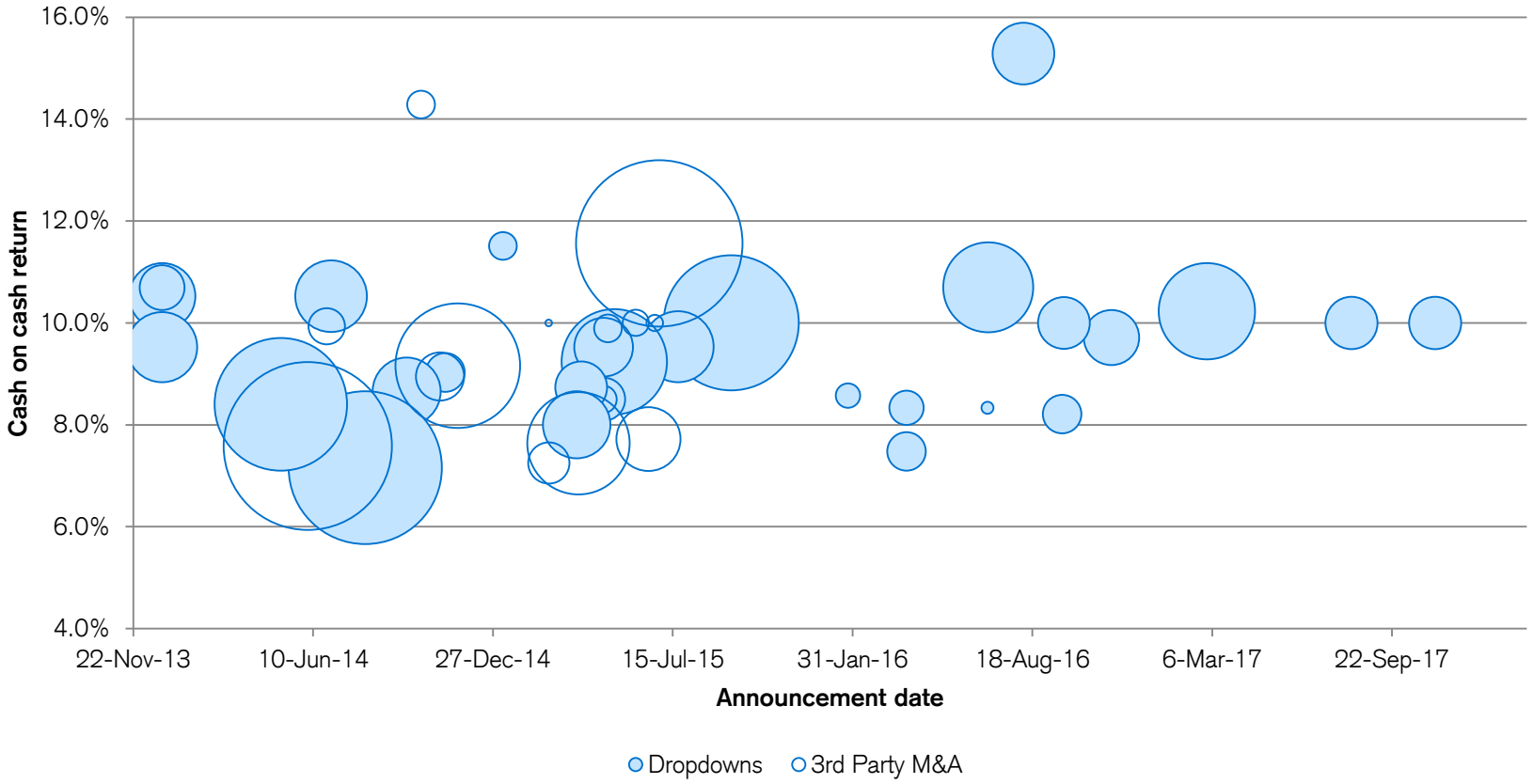



Source: Credit Suisse Estimates, I/B/E/S Estimate for all consensus numbers, Thomson, SNL, company reports

# YieldCo Deal Comps

## Accretion through acquisition

Growth is financially engineered, but sustainable in this market given size




Source: Company data, Credit Suisse

Credit Suisse Equity Research
Americas/United States

# Latin America Oil and Gas

**April 2019**


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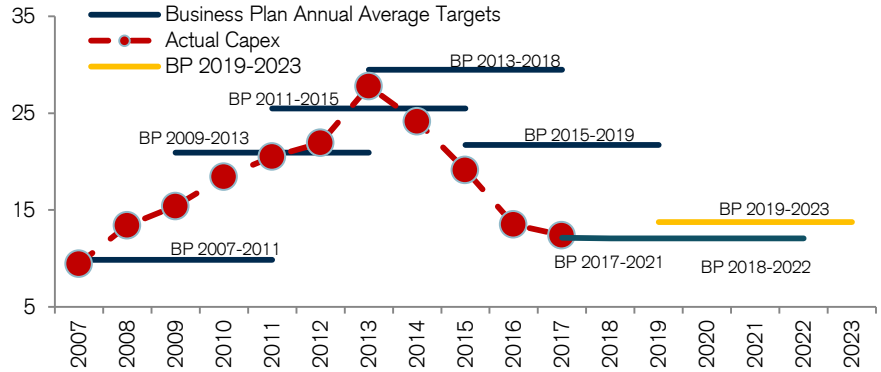



# Petrobras (PBR, Outperform, US$21/ADR)

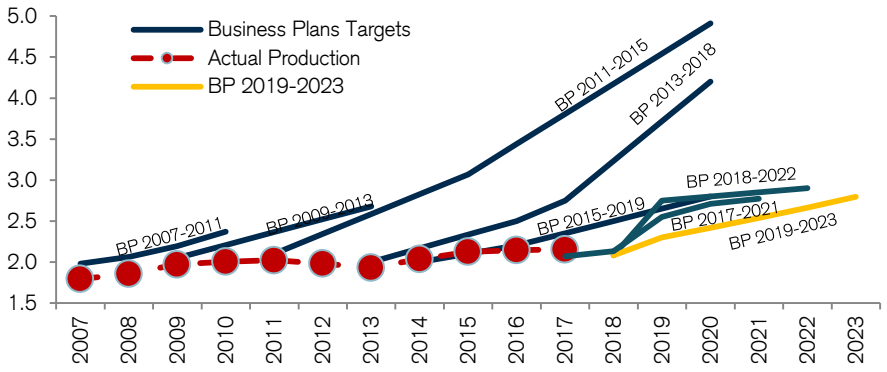
## Discipline to Carry Out a Major Turnaround

- **Deleverage and Focus on Capital Allocation.** Ever since the announcement of the pre-salt discovery in the Brazilian coast in 2007, Petrobras's investment case has been focused on production growth. As time passed by, the company increased financial leverage to deliver the capex plan, a task in which it was unsuccessful. For a long time, the company's EV remained roughly stable while indebtedness grew. Late 2014 brought a perfect storm where oil prices collapsed and Operation Car Wash became public, wracking the company into a severe crisis now largely over. Under the new administration, the company started to focus in reducing operating costs and deleveraging through capital discipline and divestments.

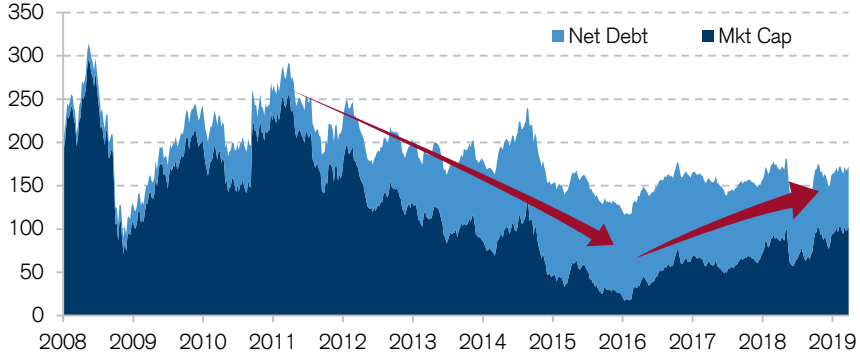
**Historical Five-Year Capex Plans** (USD bn)



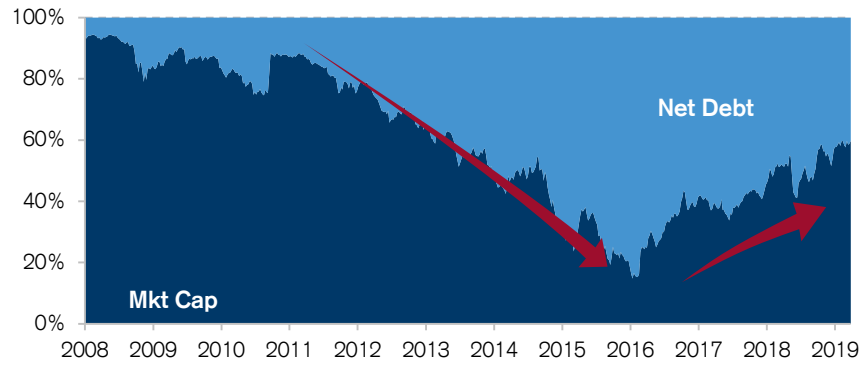

**Brazil's Historical Oil Production Targets** (Mbpd)




**Petrobras's Enterprise Value** (USD bn)




**Breakdown of Petrobras's Historical EV**



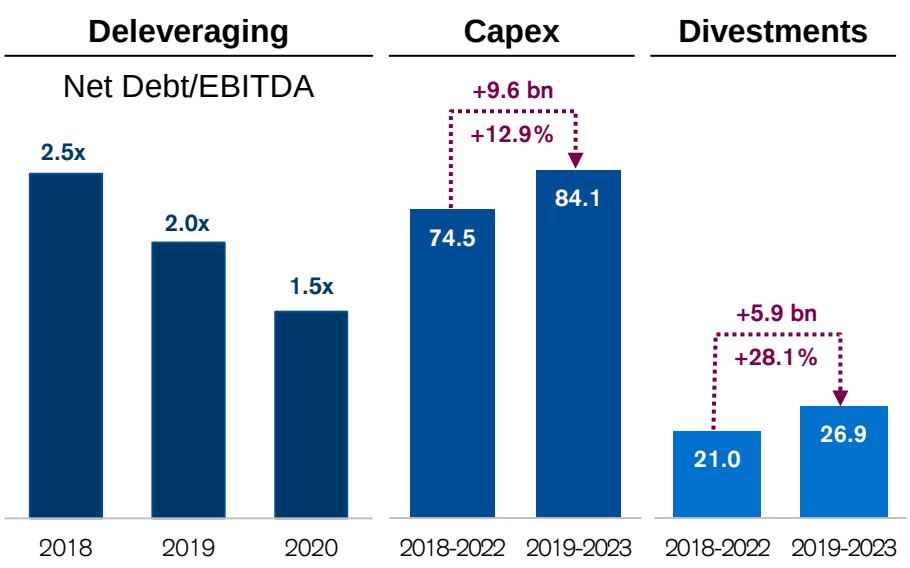


Source: Bloomberg, Company data, Credit Suisse estimates

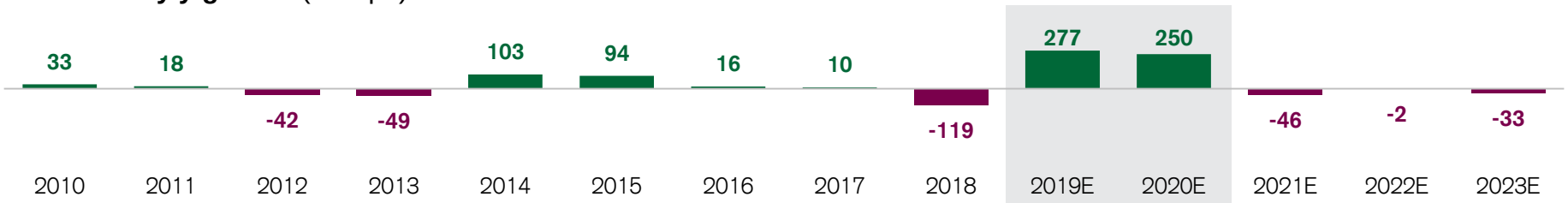
# Petrobras (PBR)

## Focus on Optimal Capital Allocation and Reducing Financial Leverage

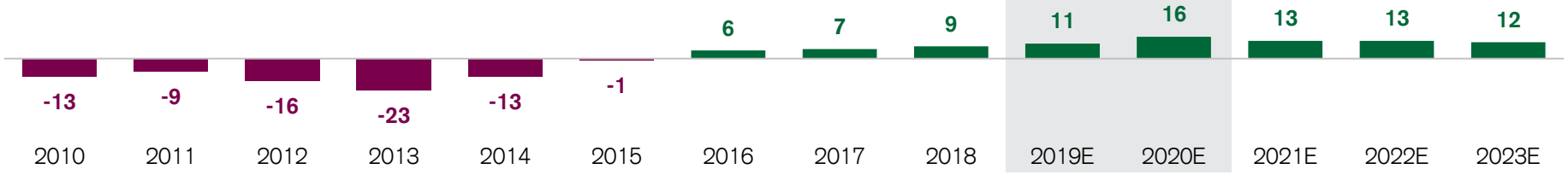
- **Improving Capital Allocation and Reducing Financial Leverage** are key mandates in Petrobras's 2019-2023 Business and Management Plan. The company relies on better portfolio management, improved operational efficiency and lower cost of capital to i) reduce financial leverage to 1.5x ND/EBITDA in 2020, and ii) increase ROCE to above 11% in 2020.
- **Momentum call.** Production is set to increase substantially with relatively low execution risk due to the ramp-up of 7 FPSOs added over LTM. As capex should remain at low levels and Brent prices relatively high at c.USD68/bbl, PBR's cash generation is set to reduce leverage — a rather straightforward way for minority shareholders to capture value.




**Production y/y growth** (in kbpd)




**FCFE ex-divestments** (in USD bn)





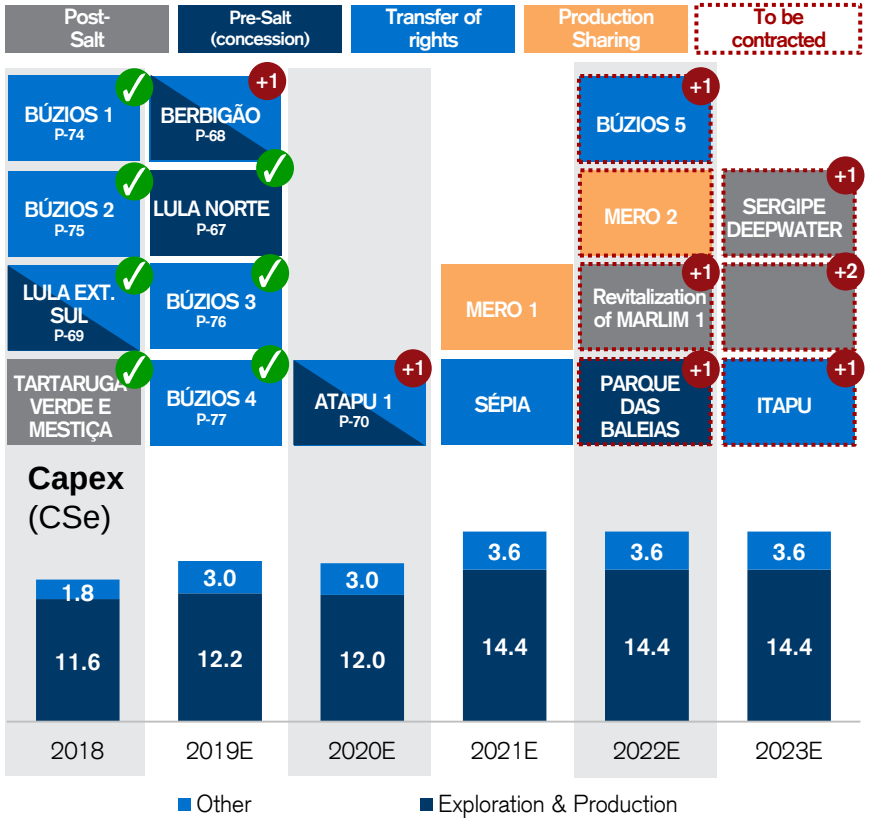
Source: Bloomberg

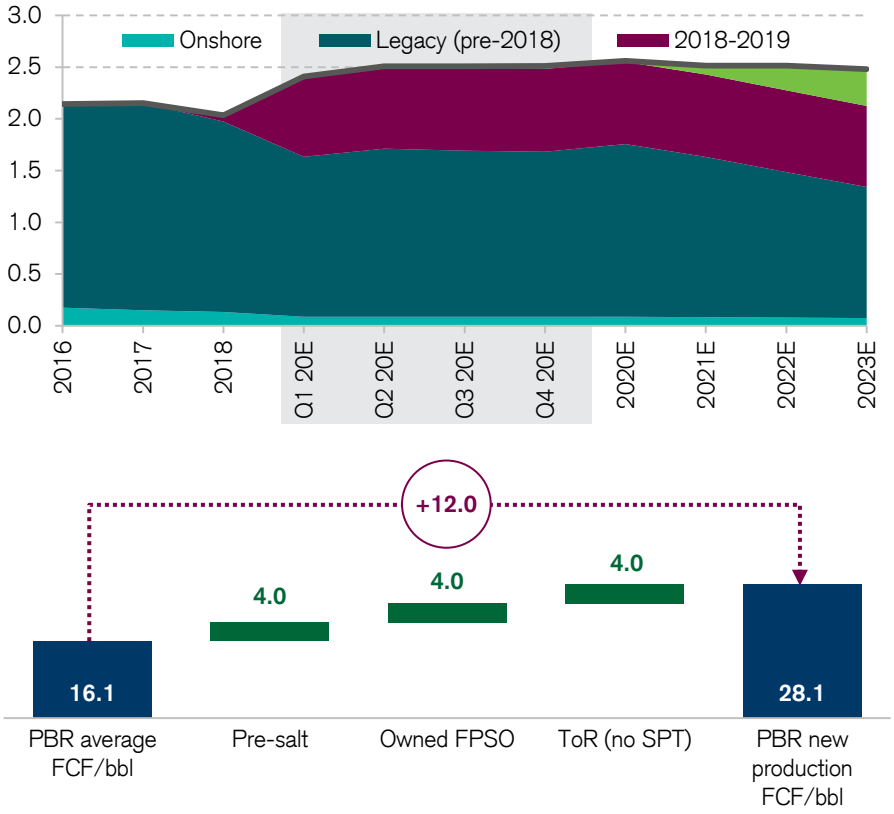
# Petrobras (PBR)

## Capex Efficiency Is Key for Success

- **Production Should Grow Substantially in 2019-2020** despite all the divestments and capex reduction. As result of delays in the execution of past business plans, in the last twelve months Petrobras have put in production 7 FPSOs that should more than offset the production loss caused by divestments in non-core assets such as shallow-water and onshore fields. To the extent that this production ramp-up should come at low execution risk, we forecast total production to peak by 2019YE. On top of that, new production will come from owned FPSOs installed in pre-salt areas, helping boost FCF generation in the short term. On the other hand, the lower short-term capex is likely to come at the cost of a flatter production curve in 2021-2023 — an effect that could be magnified as platforms scheduled to ramp-up in these years are not yet contracted.

**2019-2023 business plan FPSO schedule**




Source: Company data, Credit Suisse estimates

# Petrobras (PBR)

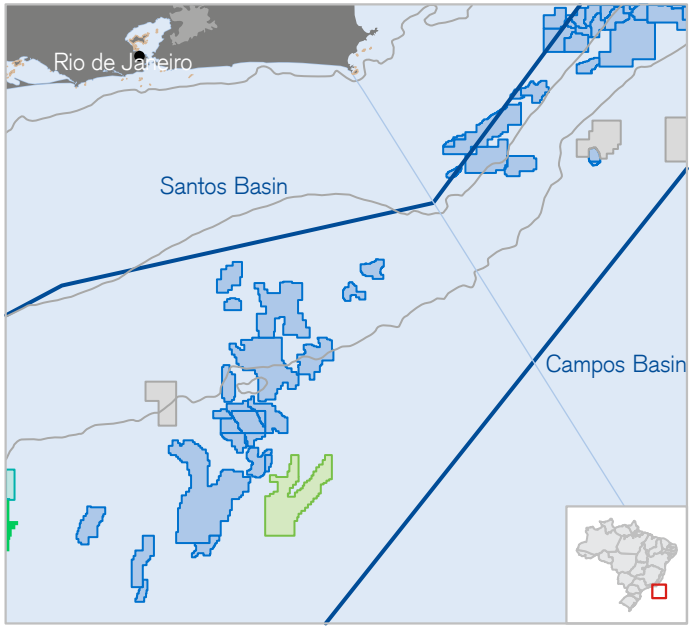
## Opportunities in Bidding Rounds and PBR Divestments

- **Apple of the industry's eyes.** The Brazilian E&P industry is living a substantial increase in the level of activity and number of operators as a result of Petrobras's divestment plan as well as the schedule of pre-salt bidding rounds. Many IOCs and NOCs have joined the Brazilian scene in search of low-risk volume plays to replenish its portfolios. We expect the c.10bn boe bidding round for the Surplus Volumes of Transfer of Rights (SVToR) to attract additional pre-salt projects as well.

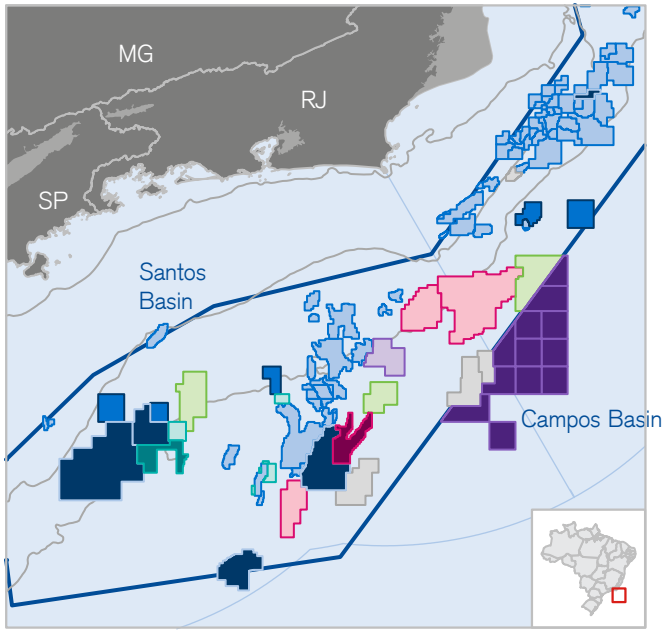
- **Then…** Following the announcement of the pre-salt discovery along the Brazilian coast in 2007, bidding rounds were halted while the country discussed a new E&P regulatory framework that would put Petrobras at the center of the pre-salt development. Despite the set-up of the Production Sharing Contracts (PSC) in 2010, Libra was the only block awarded in the pre-salt polygon under this system until 2016.

- **Now…** Over the past three years there have been four pre-salt bidding rounds and other exploratory rounds. As a result, exploratory activity is expected to increase in areas of the Brazilian offshore pre-salt, potentially leading to discoveries by PBR and the various IOCs operating in the offshore province. The pre-salt round covering the SVToR area is scheduled for October 28, 2019.

**Pre-Salt Areas Until 2015**




**Pre-Salt Areas Currently (Includes 6th Pre-Salt Round)**



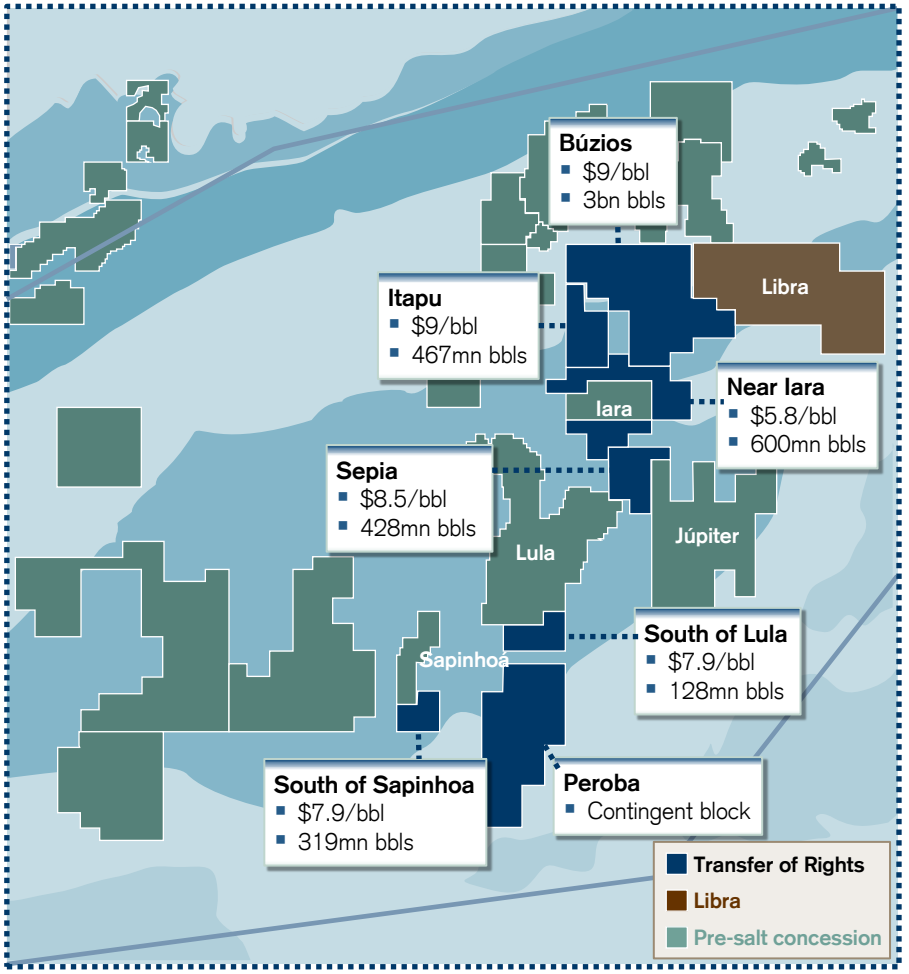

Source: Company data

# Petrobras (PBR)

## Expectations High for the Surplus Volumes of ToR (SVToR) Bidding Round

- **Back in 2010** Petrobras conducted a c.USD70bn capitalization, of which USD42.5bn was used as an "oil for shares" mechanism whereby Petrobras acquired from the Brazilian Federal Government the right to produce up to 5bn boe from certain pre-salt blocks (Transfer of Rights, or ToR).
- **As exploration in the area evolved**, Surplus Volumes of the Transfer of Rights (SVToR) were discovered and a new discussion started regarding whether an eventual bidding round for these volumes would affect Petrobras's net production curve, thus putting the company in a situation which would require reimbursements.
- **The ToR renegotiation.** The original ToR contract stated that the original valuation of USD42bn (c.USD8.50/boe) would be renegotiated after the declaration of commerciality of the blocks in a process that started in late 2014 and is still pending. On April 9, 2019, the Brazilian government announced that it reached a final agreement with Petrobras for the renegotiation of the ToR original volumes. If approved, PBR will receive c.USD9bn in a single installment, contingent on the signing bonus for the SVToR bidding round.
- **Giant bidding round for surplus volumes?** Settling the ToR renegotiation process has become a big priority for the government, which scheduled the SVToR bidding round for December 2019. We believe the surplus bidding round could raise up to the tone of USD25bn to USD30bn in signing bonus for the c.10bn boe surplus volume. Further details are discussed in our report: *ToR: USD9bn — It's official now. What's next?*.

**Transfer of Rights Maps and Key Metrics**





Source: Company data, Credit Suisse estimates

# Petrobras (PBR)

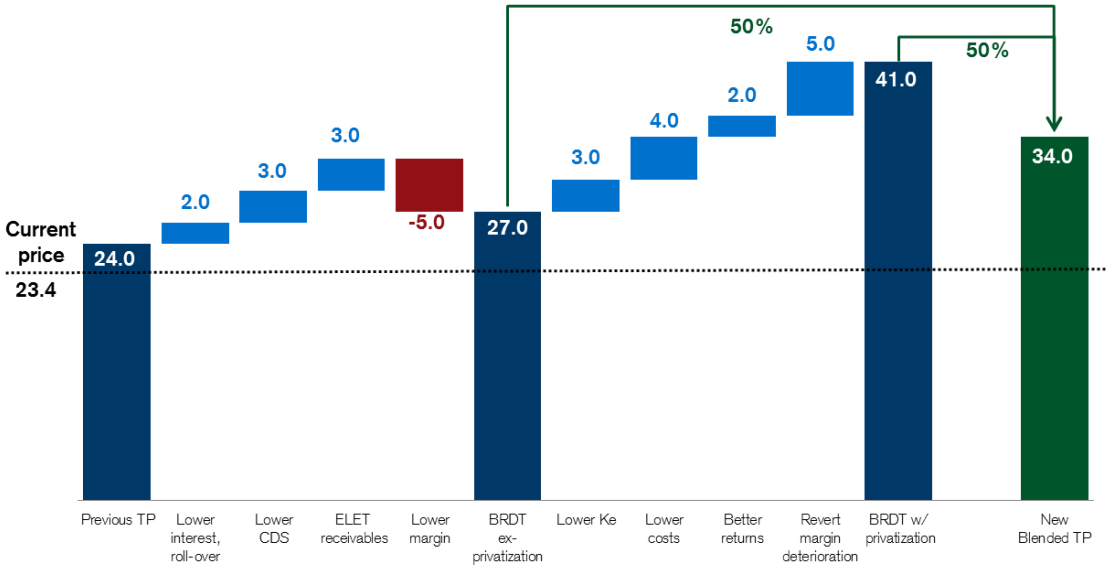
## A Major Strategic Move Could Break PBR's Quasi-Monopoly in Refining

- **Downstream divestments can be transformational.** In downstream, Petrobras reiterated its plans to break its quasi-monopoly. The company was considering partners to buy stakes in the NE and S regional clusters of refineries and logistics, what in our view could positively impact Petrobras's investment case by: (i) reducing pricing policy risk and (ii) mitigating the burden of having "mandatory" capital to increase supply and meet demand at all times and in all regions of the country (for more on that, see our report *Petrobras (PBR): Looking for Downstream Partners*). On the other hand, we highlight that Petrobras has since decided to revisit the original format to divest entire stakes instead of creating regional monopolies, thus making a new announcement related to refining assets unlikely in the very short term.
- **BRDT privatization.** Petrobras's management intention to free up capital from non-core assets could lead to divesting a further stake in BR Distribuidora (BRDT), what in our opinion could significantly reduce equity risk premium as well allow for new value levers that could reduce costs and improve operational efficiency. Further details are discussed in our report: *Overcoming the endowment effect — Upgrade BRDT to Outperform*.

**Infrastructure for Oil Supply Corridors**



**BRDT target price reconciliation** (BRL/share)



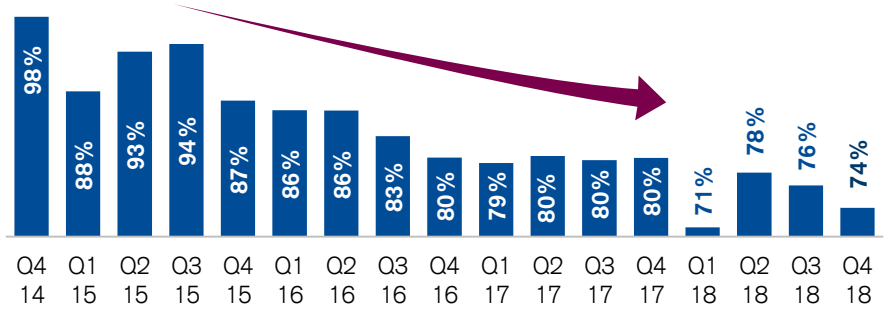

Source: Company Data

# Petrobras (PBR)

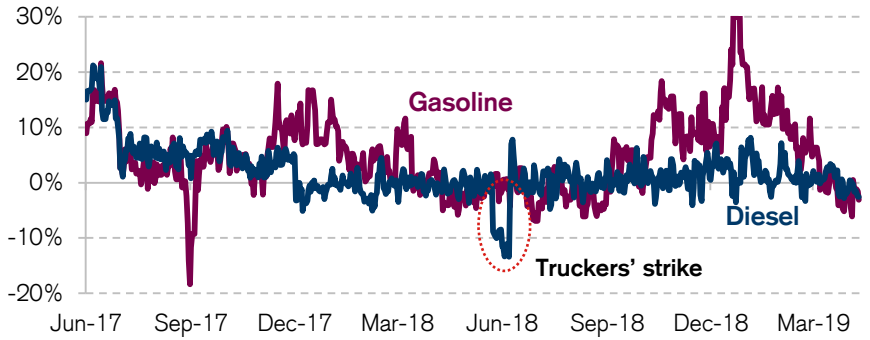
## Pricing Policy Is Strategic For The Company

- **A Learning Process.** Opening up the market to other participants mitigates risks of interference in the company's pricing policy and waives PBR from the obligation of investing in new refining capacity. That means importers are welcome. However, imports have gone too far in the last few years, as they have quickly taken a significant share of the total market, as a result of attractive import parity premiums, which Petrobras now seeks to calibrate in order to reclaim market share.
- **Pricing policy dilemma.** PBR company's quasi-monopolistic position gives it great pricing power in downstream. It's not by chance that Petrobras has been able to sustain premiums throughout most of 2015–2017. But being the sole supplier also amplifies the risk of domestic prices decoupling from import parity (to the downside), as happened in 2011–2014. Therefore, pricing policy is an important risk to PBR's investment case. Market pressures (e.g., the truckers' strike in May 2018) also cause price fluctuations, and PBR is a state-owned company, adding more complexity to the pricing policy strategy.

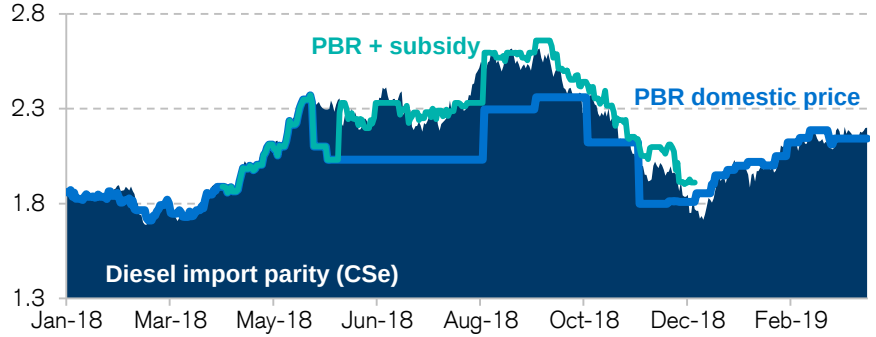
**Refineries Market Share Loss — Utilization Rate** (In %)



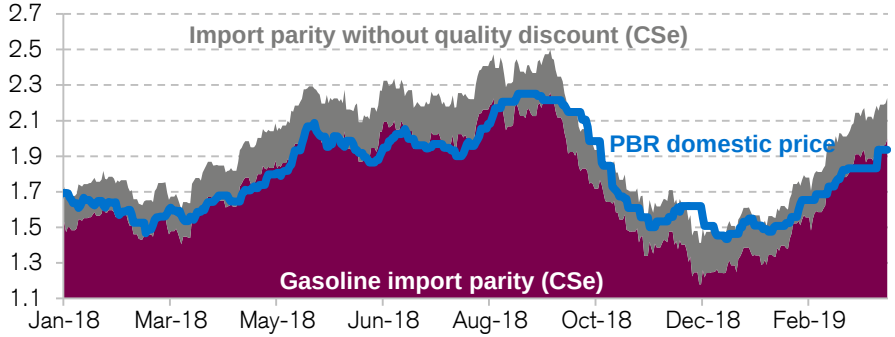

**Import Parity Price** (In %)




**Domestic Price of Diesel and Import Parity Price** (BRL/liter)




**Domestic Price of Gasoline and Import Parity Price** (BRL/liter)



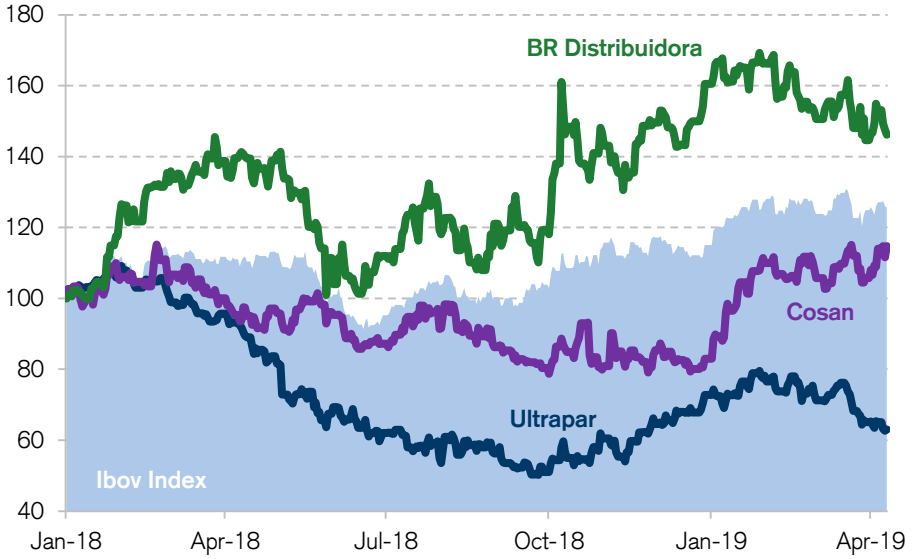

Source: ANP, Credit Suisse. Note: Plural represents the three listed distribution players (BRDT, CSAN, UGPA).

# Fuel Distribution (BRDT, CSAN and UGPA)

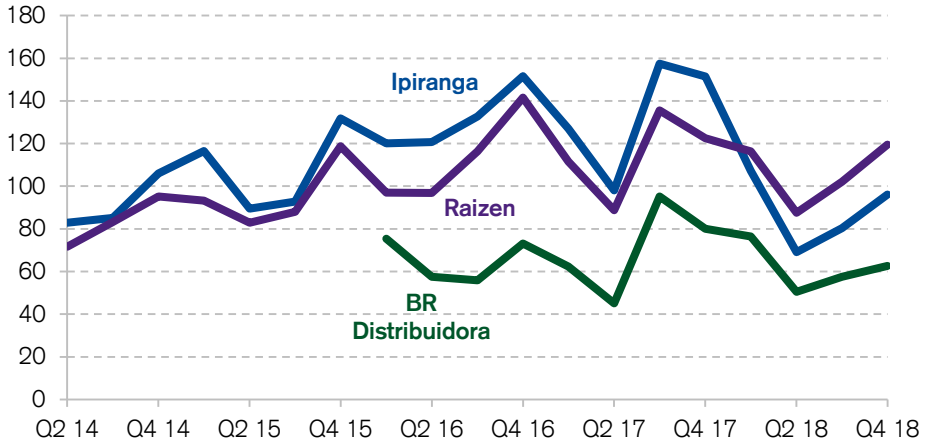
## Margins Recovery Over Market Share

- **Fiercer competition, margins recovery.** The past years in the fuel distribution sector were marked by intense competition, with unbranded distribution companies capturing substantial market share from branded players (BRDT, CSAN, and UGPA). In our view, the increased competition was fueled by cost advantages from imports. In mid-2018, margins were compressed due to the effects of the truckers' strike. Then, the companies adopted the strategy of recovering margins, despite losing some market share for unbranded players.
- **Valuation snapshot.** Market participants are asking whether the worst is behind them with the expected economic recovery in 2019. In our view things will improve, but UGPA's valuation seems slightly undervalued. CSAN is the most discounted. Finally, BRDT has become a privatization call with potential upside.

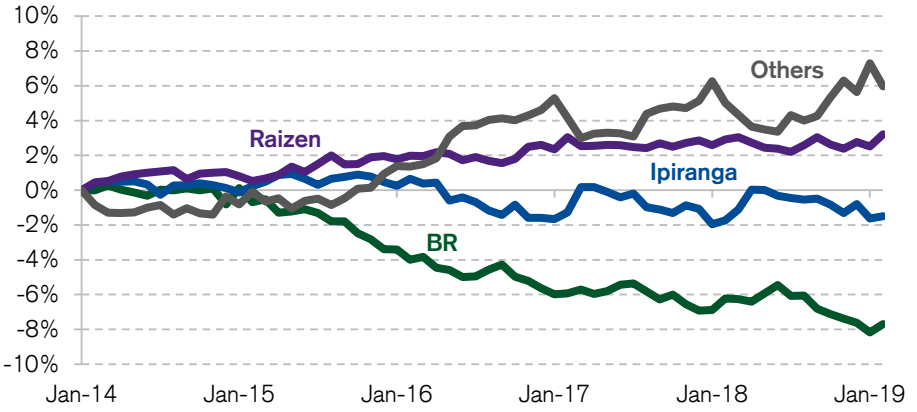
**YTD Share Price Performance** (index 100)




**EBITDA Margin** (BRL/m3)




**Cumulative Change in Market Share, all Fuels, Brazil** (since 2014 in pps)




Source: Brazilian Petroleum Agency (ANP), Plural, Credit Suisse estimates

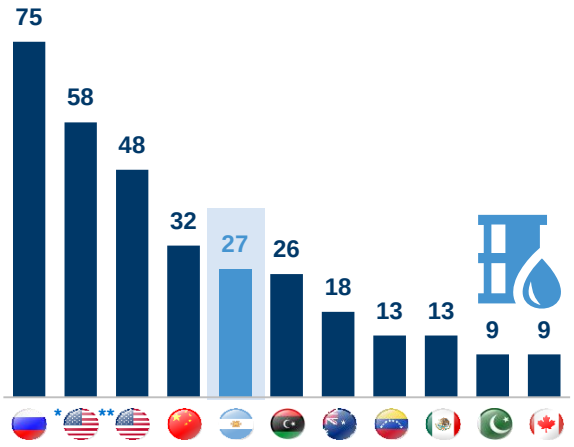
# LatAm Oil & Gas — Argentina

## It's All About Vaca Muerta

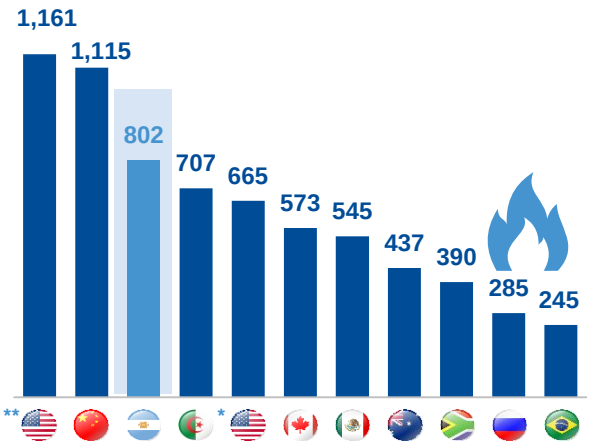
- **One of the top countries in shale resources.** In 2011, EIA published a report in which it estimated Argentina's technically recoverable tight gas and oil resources as some of the largest in the world. Vaca Muerta, located in the Neuquén basin, is considered the most prominent shale play in the country and is home to shale operations by YPF and Vista.
- **Unconventionals, the name of the game.** Argentina is one of the most prominent shale frontiers outside the United States. The size of Argentina's unconventional resources isn't big only in comparison to other countries' unconventionals, but also relative to its own conventional resource base. Indeed, unconventional oil resources are six times the size of resources from conventional sources. These are estimates of technically recoverable resources, about which no judgment on commercial viability is made; nevertheless, even if only a fraction of this potential effectively materializes, it should mean significant upside for the companies with operations in Vaca Muerta. Some volatility is expected due to the elections this year. However, industry-specific issues (e.g., gasoline, diesel prices) have already started to improve and the regulatory agenda is positive.

### EIA's Assessment of Argentina's Unconventional Potential

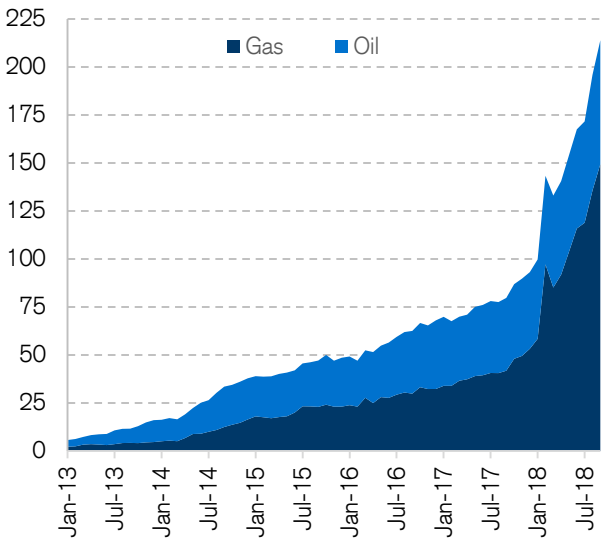
**Top countries with technically recoverable shale oil resources** (bn bbls)




**Top countries with technically recoverable shale gas resources** (TCF)




### Vaca Muerta Production Profile (kboed)



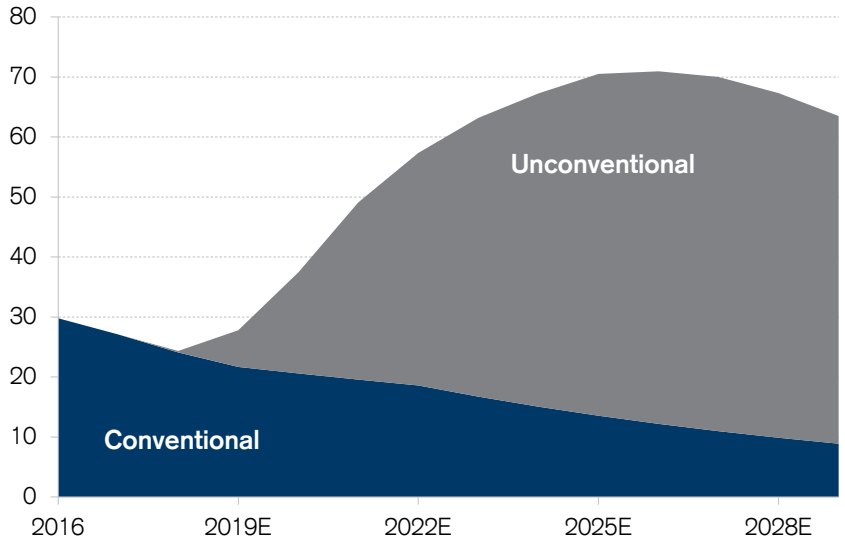

Source: Woodmackenzie, EIA/ARI "Technically recoverable shale oil and shale gas resources: An assessment of 137 shale formations in 41 countries outside the United States", June 2013. Notes: * U.S estimates based on the EIA. **U.S. estimates based on ARI. INDEC – Argentina

# YPF and Vista

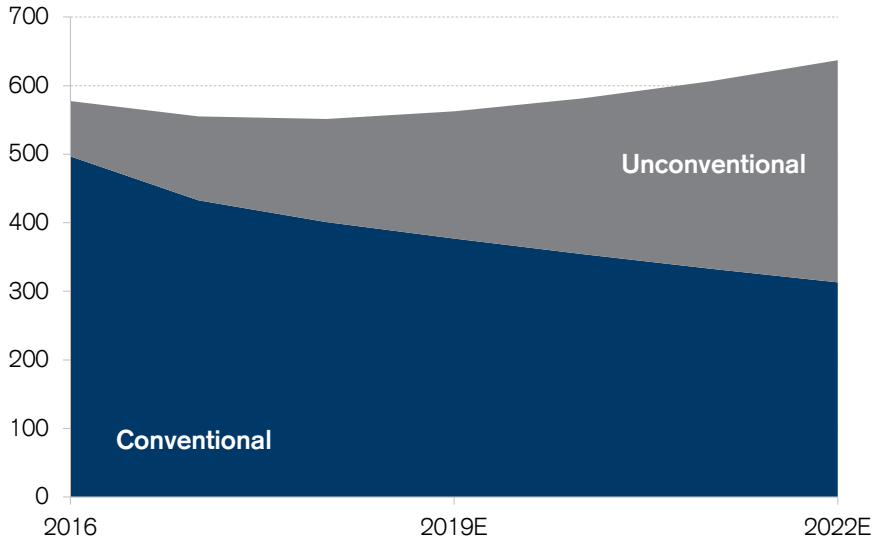
## Value Call Despite Short-Term Uncertainty

- **YPF: Giant resource base and upside from monetization.** YPF has shifted in recent years from a company with declining mature E&P assets to a holder of massive shale resources with world-class geological quality. YPF produces nearly as much oil as natural gas. Moreover, on the liquids side, the company is integrated in terms of upstream production, refining, marketing and fuel distribution. Going forward, we expect the company to focus on gas, based on production growth from unconventional plays. YPF is a major acreage holder in Vaca Muerta, and the sale of acreage and formation of JVs can be important ways to unlock value from unconventional resources, which could represent substantial upside to shareholders.
- **Vista: Pure E&P Latam company.** Through Vista investors add exposure to oil and Vaca Muerta shale play, without adding exposure to the many risks, such as governance and fuels prices, that are typically associated with integrated NOCs. Vista is an independent E&P company with substantial exposure to Argentina's Vaca Muerta shale oil and the management team is experienced in developing unconventional resources. The company supports an investment plan to deliver c.30% CAGR in production in 2018-2022.

**Vista's Production Build-Up** (kboed)




**YPF's Production Build-Up** (kboed)




Source: Company data

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**Acadian Timber Corp.** (ADN.TO, C$15.75)
**Acciona SA** (ANA.MC, €103.0)
**Aker Solutions** (AKSOL.OL, Nkr44.88)
**Alliant Energy** (LNT.N, $44.88)
**Altus Midstream Company** (ALTM.OQ, $5.85)
**Ameren** (AEE.N, $71.98)
**American Electric Power** (AEP.N, $84.15)
**Anadarko Petroleum Corp.** (APC.N, $61.78)
**Andeavor Logistics LP** (ANDX.N, $34.75)
**Antero Midstream Corporation** (AM.N, $14.27)
**Apache Corporation** (APA.N, $36.5)
**Apergy** (APY.N, $41.42)
**Atlantica Yield** (AY.OQ, $20.13)
**Avista US** (AVA.N, $41.46)
**Azure Power Global Limited** (AZRE.N, $11.92)
**BP Midstream Partners LP** (BPMP.N, $15.36)
**BR Distribuidora** (BRDT3.SA, R$22.0)
**Baker Hughes Inc.** (BHGE.N, $26.38)
**Black Hills Corp** (BKH.N, $72.92)
**Black Stone Minerals L.P.** (BSM.N, $17.86)
**Bloom Energy** (BE.N, $12.39)
**Bristow Group Inc.** (BRS.N, $1.17)
**Brookfield Asset Management** (BAM.N, $47.42)
**Brookfield Business Partners LP** (BBU.N, $39.79)
**Brookfield Infrastructure Partners LP** (BIP.N, $41.44)
**Buckeye Partners LP** (BPL.N, $34.0)
**C&J Energy Services** (CJ.N, $15.49)
**CARBO Ceramics** (CRR.N, $3.41)
**CGG** (GEPH.PA, €1.745)
**CMS Energy Corp** (CMS.N, $54.98)
**CSI Compressco** (CCLP.OQ, $2.94)
**Cabot Oil & Gas Corporation** (COG.N, $27.3)
**Cactus, Inc.** (WHD.N, $37.38)
**Callon Petroleum Company** (CPE.N, $8.21)
**Canadian Natural** (CNQ.TO, C$39.76)
**Canadian Solar** (CSIQ.OQ, $18.82)
**Canadian Utilities Limited** (CU.TO, C$36.65)
**Capital Power Corporation** (CPX.TO, C$31.38)
**Cenovus Energy** (CVE.TO, C$13.19)
**Centennial Resource Development, Inc.** (CDEV.OQ, $9.63)
**Cheniere Energy** (LNG.A, $67.51)
**Cheniere Energy Partners LP** (CQP.A, $42.82)
**Chesapeake Energy Corporation** (CHK.N, $3.17)
**Chevron Corporation** (CVX.N, $119.76)
**Cimarex Energy Co.** (XEC.N, $70.83)
**Clairvest Group** (CVG.TO, C$48.0)
**Concho Resources Inc.** (CXO.N, $113.89)
**ConocoPhillips** (COP.N, $67.37)
**Consolidated Edison** (ED.N, $84.55)
**Continental Resources, Inc.** (CLR.N, $49.08)
**Core Laboratories** (CLB.N, $70.88)
**Cosan** (CSAN3.SA, R$44.04)
**Covanta Holding Corp** (CVA.N, $17.57)
**Covia Holdings Corp** (CVIA.N, $5.81)
**DCP Midstream LP** (DCP.N, $32.85)
**DTE Energy** (DTE.N, $124.42)
**Daqo New Energy** (DQ.N, $35.08)
**Delek Logistics Partners LP** (DKL.N, $32.76)
**Delek US Holdings** (DK.N, $39.12)
**Devon Energy Corporation** (DVN.N, $33.48)
**Diamond Offshore Drilling, Inc** (DO.N, $11.49)
**Diamondback Energy, Inc.** (FANG.OQ, $106.28)
**Dominion Energy** (D.N, $76.44)
**Dril-Quip, Inc.** (DRQ.N, $45.3)
**Duke Energy** (DUK.N, $90.45)
**EDF** (EDF.PA, €12.115)
**EOG Resources, Inc.** (EOG.N, $105.31)
**EQM Midstream Partners LP** (EQM.N, $45.99)
**EQT Corporation** (EQT.N, $21.33)
**Ecolab** (ECL.N, $185.09)
**Edison Intl** (EIX.N, $67.13)
**El Paso Electric** (EE.N, $60.4)
**Emera Inc.** (EMA.TO, C$50.44)
**EnLink Midstream LLC** (ENLC.N, $12.63)
**Enbridge Inc.** (ENB.TO, C$49.93)
**Enbridge Income Fund Holdings** (ENF.TO^K18)
**Enbridge Income Fund Holdings** (ENF.TO^K18)
**Encana Corp.** (ECA.N, $7.57)
**Energy Transfer LP** (ET.N, $15.55)
**Enphase Energy** (ENPH.OQ, $9.93)
**Ensco Plc.** (ESV.N, $15.76)
**Entergy Corp** (ETR.N, $95.24)
**Enterprise Products Partners LP** (EPD.N, $29.5)
**Equitrans Midstream Corporation** (ETRN.N, $21.3)
**Exelon Corporation** (EXC.N, $49.7)
**Exterran Holdings** (AROC.N, $10.33)
**Extraction Oil & Gas, Inc.** (XOG.OQ, $5.12)
**ExxonMobil Corporation** (XOM.N, $80.92)
**FTS International, Inc.** (FTSI.N, $10.9)
**Falcon Minerals** (FLMN.OQ, $9.27)
**First Solar** (FSLR.OQ, $60.18)
**FirstEnergy Corp** (FE.N, $41.37)
**Fortis Inc.** (FTS.TO, C$50.0)
**Forum Energy Technologies, Inc.** (FET.N, $5.49)
**Frank's International** (FI.N, $6.44)
**General Electric** (GE.N, $9.0)
**Gibson Energy Inc.** (GEI.TO, C$23.66)
**Gt Plains Energy** (GXP.N^F18)
**Gt Plains Energy** (GXP.N^F18)
**Gulf Island** (GIFI.OQ, $8.95)
**Gulfport Energy Corp.** (GPOR.OQ, $7.74)
**Halliburton** (HAL.N, $31.33)
**Hansen Technologies** (HSN.AX, A$3.02)
**Helix Energy Solutions** (HLX.N, $7.95)
**Helmerich & Payne, Inc.** (HP.N, $60.32)
**Hess Corporation** (HES.N, $66.1)
**Hess Midstream Partners LP** (HESM.N, $21.94)
**Hi-Crush Partners, LP** (HCLP.N, $4.3)
**Holly Energy Partners LP** (HEP.N, $27.59)
**HollyFrontier Corporation** (HFC.N, $50.25)
**Hornbeck Offshore** (HOS.N, $1.48)
**Husky Energy** (HSE.TO, C$14.16)
**Hydro One Limited** (H.TO, C$21.28)
**ITC** (ITC.NS, Rs305.75)
**Iberdrola** (IBE.MC, €7.754)
**Imperial Oil** (IMO.TO, C$38.77)
**Jagged Peak Energy, Inc.** (JAG.N, $10.98)
**Jinko Solar** (JKS.N, $17.71)
**Keane Group Inc** (FRAC.N, $11.88)
**Key Energy Servs** (KEG.N, $3.7)
**Keyera Corp.** (KEY.TO, C$32.73)
**Kimbell Royalty Partners** (KRP.N, $17.65)
**Kinder Morgan Canada Limited** (KML.TO, C$15.59)
**Kinder Morgan Inc.** (KMI.N, $19.82)
**Kirby Corporation** (KEX.N, $77.85)
**LONGi Green Energy Technology** (601012.SS, Rmb27.09)
**Laredo Petroleum, Inc.** (LPI.N, $3.2)
**Liberty Oilfield** (LBRT.N, $16.25)
**MPLX LP** (MPLX.N, $32.75)
**Maersk** (MAERSKa.CO, Dkr8040.0)
**Magellan Midstream Partners LP** (MMP.N, $63.0)
**Magnolia Oil & Gas** (MGY.N, $13.66)
**Marathon Oil Corporation** (MRO.N, $17.76)
**Marathon Petroleum Corporation** (MPC.N, $61.59)
**McDermott International** (MDR.N, $9.0)
**Mercer International Inc.** (MERC.OQ, $14.75)
**NGL Energy Partners LP** (NGL.N, $14.07)
**NRG Energy** (NRG.N, $42.27)
**Nabors Industries, Ltd.** (NBR.N, $3.72)
**National Oilwell Varco** (NOV.N, $26.87)
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**Newpark Resources, Inc.** (NR.N, $9.09)
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**NextEra Energy Inc.** (NEE.N, $190.85)
**NextEra Energy Partners** (NEP.N, $47.51)
**Nine Energy Service, Inc.** (NINE.N, $22.23)
**Noble Corporation** (NE.N, $2.95)
**Noble Energy, Inc.** (NBL.N, $26.87)
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**Nordex** (NDXG.DE, €14.34)
**NorthWestern Energy** (NWE.N, $69.66)
**OCI Company Ltd** (010060.KS, W96,200)
**OGE Energy** (OGE.N, $42.16)
**ONEOK Inc** (OKE.N, $70.6)
**Oasis Midstream Partners LP** (OMP.N, $20.32)
**Oasis Petroleum Inc.** (OAS.N, $6.62)
**Occidental Petroleum Corporation** (OXY.N, $65.33)
**Oceaneering Intl, Inc.** (OII.N, $16.82)
**Oil States International** (OIS.N, $18.2)
**Ormat Tech** (ORA.N, $56.71)
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**PBF Logistics, LP** (PBFX.N, $21.22)
**PDC Energy, Inc.** (PDCE.OQ, $44.24)
**PG&E Us** (PCG.N, $23.08)
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**Pattern Energy** (PEGI.OQ, $22.68)
**Patterson-UTI Energy, Inc.** (PTEN.OQ, $15.2)
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**Pepco Holdings Inc.** (POM.N^C16)
**Petrobras** (PBR.N, $14.94)
**Petroleum Geo Services** (PGS.OL, Nkr20.76)
**Phillips 66** (PSX.N, $97.17)
**Phillips 66 Partners LP** (PSXP.N, $51.05)
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**Plains GP Holdings LP** (PAGP.N, $25.01)
**Portland Gen Ele** (POR.N, $51.76)
**PrairieSky** (PSK.TO, C$19.23)
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**Range Resources Corporation** (RRC.N, $10.32)

**Renewable Energy** (REC.OL, Nkr0.694)
**Rowan Companies** (RDC.N^D19)
**Rowan Companies** (RDC.N^D19)
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**Saipem** (SPMI.MI, €4.694)
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**Suncor Energy** (SU.TO, C$44.22)
**Sungrow** (300274.SZ, Rmb12.17)
**Sunoco LP** (SUN.N, $30.91)
**Sunrun** (RUN.OQ, $15.68)
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**Suzlon Energy Ltd** (SUZL.BO, Rs7.2)
**TGS-NOPEC Geophysical** (TGS.OL, Nkr233.8)
**TPI Composites** (TPIC.OQ, $29.19)
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**Targa Resources Corp** (TRGP.N, $40.11)
**TechnipFMC** (FTI.N, $24.67)
**Tellurian Inc.** (TELL.OQ, $10.32)
**Tenaris** (TS.N, $28.37)
**TerraForm Power** (TERP.OQ, $13.56)
**Tesla Inc** (TSLA.OQ, $267.7)
**Tetra Technologies, Inc.** (TTI.N, $2.52)
**Tidewater** (TDW.N, $24.55)
**Timken** (TKR.N, $47.72)
**Tongwei** (600438.SS, Rmb12.56)
**TransAlta Corporation** (TA.TO, C$9.8)
**TransCanada Corp.** (TRP.TO, C$62.05)
**Transocean Inc.** (RIG.N, $8.82)
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**Vestas** (VWS.CO, Dkr594.0)
**Viper Energy Partners LP** (VNOM.OQ, $34.0)
**Vista Oil Gas** (VISTAA.MX, MXN174.0)
**Vivint Solar, Inc.** (VSLR.N, $5.43)
**WEC Energy** (WEC.N, $77.82)
**WPX Energy Inc.** (WPX.N, $14.31)
**Wacker Chemie** (WCHG.DE, €81.44)
**Weatherford International, Inc.** (WFT.N, $0.5758)
**Weir** (WEIR.L, 1749.0p)
**Western Midstream Partners LP.** (WES.N, $34.93)
**Whiting Petroleum Corp.** (WLL.N, $30.35)
**Williams Companies Inc** (WMB.N, $28.94)
**Winergys** (026260.KQ, W104)
**Xcel Energy** (XEL.N, $104)
**Xinte Energy** (1799.HK, HK$7.5)
**YPF Sociedad Anonima** (YPF.N, $14.74)
**Ørsted** (ORSTED.CO, Dkr503.4)

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