Towards a Balance Amid Energy Turmoil

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• The world’s leading businesses, governments and institutions turn to us for data, analysis and insight (IOCs, NOCs, independents, energy consumers and financial entities)

• We help our clients achieve tangible results through informed strategic decision-making and implementation planning

• Key differentiators include
  – Global coverage with deep local knowledge
  – Integrated analysis across the entire energy value chain, including macro-level analysis (geopolitics, macro-economics, policies and regulations)

• Our research and consulting staff comprises professionals located on the ground in key global energy market centers

• Combined, our team brings over 500 years of combined energy industry expertise, including
  – Technical (Petroleum Engineers, Geologists, Process Engineers)
  – Economists
  – Political Scientists
  – Financial Analysts
Services, Consulting Engagements & Advisory Support

Subscription Services Form Basis for Consulting & Advisory Engagements

<table>
<thead>
<tr>
<th>Macro</th>
<th>Upstream</th>
<th>Midstream</th>
<th>Downstream</th>
<th>Fuel &amp; Transportation</th>
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<tbody>
<tr>
<td>Short-term Price Forecasting</td>
<td>Global Hydrocarbon Supply</td>
<td>Global Natural Gas Outlook</td>
<td>Base Petrochemicals</td>
<td>Global Biofuels Assessment</td>
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<td>Global Heavy Crude Outlook</td>
<td>Global LNG</td>
<td>Catalyst Market Outlook</td>
<td>Global Biofuels Outlook</td>
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<td>Global NGLs Outlook</td>
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<td>Global Transport Fuel Outlook</td>
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<td>Global Automotive</td>
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Regional Assessments- North America, Latin America, Europe, Russia and CIS, Middle East, Africa, Asia

Related Industries- Shipping and logistics, Heavy Industries, Power

Clients have access to world of energy insights and experienced professionals in Houston, New York, DC, Brussels, Mumbai, & Singapore
Agenda
Agenda

• Crude Oil Balances

• Produce Local, Sell Global

• Gray Swans

• Key Takeaways
Crude Oil Balance Fundamentals

Key Discussion Points

• Crude Oil Balances
• Supply Growth Will Moderate
• Demand Growth Exists But Mainly NGL
• Inventory to Stay Inline
• OPEC and OPEC+ Has Spare Capacity
• Crude oil price trends
We see Demand Growing ~1 MMbbl/year For Next 2 Years
We saw demand dropping below 1 MMbbl/d in late 2019
Non-OPEC Production Growth Drives Supply Upward

Our 3Q19 forecasts reflect lower OPEC supply, higher non-OPEC supply

<table>
<thead>
<tr>
<th>UPDATED</th>
<th>Reference Case</th>
<th>Last Quarter Forecast</th>
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<tbody>
<tr>
<td>Brent</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2019</td>
<td>$ 63.20</td>
<td>$ 67.78</td>
</tr>
<tr>
<td>2020</td>
<td>$ 58.09</td>
<td>$ 73.39</td>
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<tr>
<td>2021</td>
<td>$ 56.80</td>
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<tr>
<td>WTI</td>
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<tr>
<td>2019</td>
<td>$ 56.69</td>
<td>$ 59.70</td>
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<tr>
<td>2020</td>
<td>$ 53.86</td>
<td>$ 66.35</td>
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<tr>
<td>2021</td>
<td>$ 52.76</td>
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<tr>
<td>OPEC Total Supply</td>
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<td></td>
</tr>
<tr>
<td>2019</td>
<td>35.4</td>
<td>35.8</td>
</tr>
<tr>
<td>2020</td>
<td>35.0</td>
<td>36.2</td>
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<tr>
<td>2021</td>
<td>35.5</td>
<td></td>
</tr>
<tr>
<td>Non-OPEC Total Supply</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2019</td>
<td>62.2</td>
<td>61.9</td>
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<td>2021</td>
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- Our 3Q19 price deck includes significantly lowered prices for global oil benchmarks
- We gave our Brent 2020 prices saw a 21% haircut while WTI saw an 18% trim
- We now see OPEC production declining more strongly than our prior forecast, with 2020 output below 2019 and recovering to just above that level in 2021
- Non OPEC supply continues expansion and averages in 2021 at 2.3 MMbbl/d higher than 2019

Source: Stratas Advisors
U.S. Crude Production Drives Non-OPEC Growth

- US crude production is on pace to set a new record in 2019
- Majority of the production coming from the Permian
- U.S. crude supply is currently higher than U.S. demand
- This means export demand markets are needed if production is to keep growing
Total US Crude and Field Condensate to Flatten post-2024

Our Shale 3.0 forecasts are based on well-up forecasting and “fullstream” analyses

- We see the current oil era as “Shale 3.0” and we forecast continued growth under Shale 3.0 until the middle/latter 2020s
- We see consolidators and deep-pocketed majors driving disciplined growth in world class liquids fields (Permian, Bakken, others to be determined by economics)
- We see larger producing entities having the cash flows, the deep bench, and the wide integrated portfolio to optimize US unconventional activity in a slower growth petroleum world
- ExxonMobil and Chevron typify the new players. XOM has re-integrated via partnership and investment to drive fullstream cash flows from source to sink (Permian drill bit to expanding Beaumont refinery connected by water to global markets)
Balance During Next Two Years Looks Best of Recent Periods

- The last two years showed a surplus of 540 Mbbl/d on average
- By the end of the current year, we expect the average 2019 petroleum balance to show a surplus of 180 Mbbl/d
- By 2020, we show the full erosion of that surplus and a slight deficit of 25 Mbbl/d
- After that, we see 2021 recovering some length to a 280 Mbbl/d average surplus
- For the next two years, the average length is 120 Mbbl/d
Current Price Outlook vs Actuals

Prices showing negative drift driven by an amply-supplied balance (with limited demand visibility)

Brent

WTI

Source: Stratas Advisors
Produce Local, Sell Global
Produce Local, Sell Global

Key Discussion Points

• From Importer to Export Leader
• US Must Export All Hydrocarbon Types
  – Crude
  – Natural Gas
  – Refined Products
  – NGL
• Infrastructure Implications
US New Must Remain Net Exporter of Hydrocarbons

As US has emerged as a net exporter, global markets now more directly affect US petroleum activity.

More than 50% of U.S. field production is exported in one form or another in 2018.
US Becoming a Net Petroleum Liquids Exporter

Crude exports nearing 4 MMbbl/d, NGL+Product exports at 5 MMbbl/d and just 8.1 MMbbl/d of imports

- Crude exports reaching 4 MMbbl/d of high-value light oil while largest import stream is deeply discounted heavy Canadian crude oil largely delivered via secure pipeline to ideally configured complex US refineries

- Net product exports reaching 3 MMbbl/d comprising both refined fuels and NGL processing plant output from wet field gas production

- With net crude imports at just 2.17 MMbbl/d and net product exports at 2.795 MMbbl/d, the nation was a net petroleum exporter by 621 Mbbl/d

Table 1. U.S. Petroleum Balance Sheet, Week Ending 13/16/2019

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Source: EIA with annotations by Stratas Advisors
US Crude Export Growth Follows US Oil Production Growth

Producers need more market capacity than offered by the US (and Chinese) refining industry

Source: Stratas Advisors
With high utilization at existing refineries already happening, the crude heading to the coast has to likely go offshore.

- Texas and other US refiner expansion projects (field skid units, Exxon Beaumont, Limetree Bay) may absorb up to 800 MMbbl/d of incremental production growth but that will be exceeded by light oil production growth.

- The Gulf Coast has about 5 MMbbl/d of crude oil export capacity along its shores.

- Traffic congestion in Houston Ship Channel and Corpus Christi will limit exports. Combined the two regions have about 62% or 3.1 MMbbl/d of export capacity.

- Deepwater exports are needed, but not all those proposed!

Source: EIA, Stratas Advisors
Currently only one terminal, the LOOP, can fully load VLCC exports

A VLCC can carry up to 2 MMbbl of crude oil in one shipment

If all projects come online, the Gulf Coast region will have more than 20 MMbbl/d of VLCC loading capacity by 2024

This will greatly exceed expected exports and even current U.S. crude oil production

We expect only two to three projects to come online
Six Gulf Coast Medium Size Crude Export Terminals

- If all projects are constructed, partial loading terminals would have a 4,980 Mbbl/d loading capacity
- This would still require reverse lightering in transshipment zones
- We believe that the partial loading terminals could be utilized for petroleum product exports due to the possibility of being under-utilized once a cheaper alternative like fully loading VLCC terminals come online.

Source: Stratas Advisors, company information
Lower 48 Onshore Residue Gas to Soon Top 100 bcf/d

Incentivized to spend to grow, much of the upstream does despite decaying prices...capital markets changing this.

Source: Stratas Advisors 2Q19
Last year, we saw 2020 having 10.8 bcf/d of pipeline expansion followed by 1.4 bcf/d in 2021.

This year, we see a front loading of expansions in 2020 by 13.5 bcf/d then a 2021 increase of 0.8 bcf/d.

We are now initiating 2022 with takeaway from these plays flat with the prior year.
US LNG Supercycle

May be too much of a good thing…. FIDs and groundbreakings are crawling along given slow global uptake
U.S. Field Supply of Potentially Recoverable NGL Still Growing

Key Producing Regions are Texas, Oklahoma, Rockies and Appalachia

This year we raised our estimates of potential NGL production to nearly 9.8 MMbbl 5 years from now.

But we cut our recovered NGL forecasts by 5%.... Meaning, rejection has expanded.

Rejection means too much NGL is being produced to make it to market profitably.

Source: Stratas Advisors NGL Service
Over this decade, the US emerged as a net exporter of commodities ranging from the lightest gas to the lightest crudes.

Not many industries use significant quantities of U.S. propane.

A primary growth driver is petrochemical manufacturing which uses propane as a feedstock in dehydrogenation plants and crackers that produce propylene. We see about 75 Mbbl/d of propane petchem use between 2018 and 2022.

An even larger demand comes from overseas importers. The exportation of US propane is set to grow by 425 Mbbl/d by 2022.

Source: Stratas Advisors TEXIS Service
The shale revolution would not have happened without unregulated ability to export excess propane NGL.

US New Must Remain Net Exporter of NGL

New and Planned NGL Export Projects

North American NGL Marine Export Terminals

Source: Stratas Advisors TEXIS Service
Produce NGL Local, Market Global

Our forecasts of trade flows within the Global NGL Service shows that the key producing nations are not necessarily key exporting nations.

Significant NGL supply growth in certain nations will be met with significant in-border demand growth.

Ethane to remain stranded (rejected) since most difficult to move, unload, and utilize.
Gray Swans
A Menagerie of Likely Swans

Key Discussion Points

In a grey zone, these risks are not exactly a sure thing, but not exactly unexpected either

• OPEC and Middle East risks

• Trade and global economic risks

• Alternative Threats to the Natural Gas Thesis

• Higher Uncertainty, Lower Investability
OPEC Risk a Toss Up Between Bulls and Bears?

If tanker takings and export plant attacks don’t cause long term upside, what will?

**Bullish Risks – Supply oriented**

- OPEC over-compliance
  - Likely would be caused by outages
- Disruptions in Strait of Hormuz
- Sanctions against Iran
- Outages possible in Libya, Nigeria, Algeria
- Declines in Venezuela

**Bearish Risks – Demand oriented**

- OPEC under-compliance
- OPEC follows through with current schedule
- Will Aramco IPO materially add to coffers?
- OPEC Makes only meager adjustments
  - Market could sell the fact after buying the rumors of longer or deeper curtailments
OPEC+ Have Finite Spare Capacity

About 900 Mbbl/d of crude production could be brought online if needed, in the OPEC and Alliance countries according to our analysis.
Mid East Crude Output Growth Certainly Possible

Main options to grow Middle East crude production come from Iraq and Saudi Arabia.
Venezuelan Crude Production

We expect output to be down and out for some time

Source: Stratas Advisors
Venezuelan Heavy Oil Was Most Sought and Now Most at Risk

Dispersed workforce and economic ruin means heavy oil output has nowhere but down in the near term.
# Global Economic Risks Swinging to the Downside?

Persistent fears about demand are muting the impact of everything

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<th>Bullish Risks – Supply oriented</th>
<th>Bearish Risks – Demand oriented</th>
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<td>• Strong US consumer demand</td>
<td>• Global recession</td>
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<tr>
<td>• Surprise trade deal between US and China</td>
<td>• US-China trade war drags on</td>
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<td></td>
<td>• IMO 2020 costs may be more than expected</td>
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<td></td>
<td>• Oversupply of refined products</td>
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<tr>
<td></td>
<td>– Appearing in Asia</td>
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<tr>
<td></td>
<td>• Oversupply of crude on US production growth</td>
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<td></td>
<td>• Hedge funds continue cutting bullish positions</td>
</tr>
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Will Natural Gas Become the New Coal?

New gas fired generators now must compete for share against zero-fuel cost renewables

- The power buildout of gas fired generation is slowing and underperforming our prior forecasts
- The 41.7 bcf/d of new gas projects we anticipated to come online by 2021 is not going to be met
  - We see just 41 bcf/d in 2022 and 41.5 bcf/d in 2025
- Solar and Wind generation taking significant share from all other generation types including “clean” natural gas
- Biogas will be another threat to the sustainability of U.S. shale gas
- Next threat will be hydrogen electrolyzed from excess renewable power and stored long term as gas in the gas pipeline grid
Poor US Gas Demand Impacting US Crude Supply Economics

Worker availability and complexity and overall economic uncertainty slowing industrial demand for gas

- We see slower demand across the world for a variety of internationally traded commodities.
- We see lower demand holding back utilization in existing assets and operations that are gas intensive (industries such as fertilizer, steel, chemicals, and more)
- Furthermore, we have taken down our forecasts for new projects out into the future. We now see just 5.6 bcf/d of new gas consuming projects being completed by 2022. That’s down from 7.9 bcf/d.
- We downwardly revised estimates for 2019 gas consumption at existing industrial plants to just 0.3 bcf/d from last year’s forecast of 0.35 bcf/d
- We expect the Gulf Coast to host most of the growth. We see this region as advantaged by plentiful gas and ready dock space for exporting in bulk
No Country for Old Pipelines

Does industry and society have cash and will to replace aging gas pipelines today?

- Significant portions of the U.S. gas pipeline transmission and distribution assets went into service before 1970
- More than 70,000 miles highly aged
- In two of the most populous and energy consuming states, 42% of the pipeline network is pre-70’s.

Source: Stratas Advisors North American Natural Gas Service
Low Prices and Energy Investment

Energy sector capital investment hindered by poor demand visibility, strong supply competition

- The “2nd wave” of energy infrastructure may just be a slow ripple
- Field bottlenecks accompanying US shale boom are effectively being alleviated but now demand needs to be uncorked here or globally to keep chain
- 2018’s energy builds were delayed by weather into 2019
- We expect 2020 energy investment to be below 2019’s peak
- FID’s have been slow in coming, and that influences 2022 and forward
- LNG may be glutted until mid-decade
- Too many crude export terminals on the project rolls….will need to combine/cancel

Completed+Announced U.S. Infrastructure Capital Expenditures
($ Billions)

Source: Stratas Advisors North American Shale Infrastructure Service
Key Takeaways
Key Takeaways

• Field petroleum production supply growth will continue under Shale 3.0 era but at a slower pace
• Petroleum demand growth exists (mainly in NGLs for petchem)
• Monetizing US output to increasingly rely on logistics aimed for export markets
• Low prices & poor visibility/investability to slow logistics investment
• While OPEC has spare capacity, we expect renewals of cuts in future meetings
• Global economic energy demand could weaken
• Biogas and renewable H2 will begin challenging natural gas & the entire US shale oil/gas sector
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