The Most Likely Futures for US Refining

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High level of uncertainty out 5-7 years

- **Oil prices**
  - Shale oil production trends
  - OPEC behavior
  - Asian and Latin American refined products demand

- **MARPOL VI effects**
  - Light-Heavy spread outlook

- **US refined products demand**
  - Domestic demand
  - Export demand
  - G/D demand ratio

- **RFS and CAFE regulations**
- **Border taxes**
- **New pipelines**
- **Alberta bitumen**
Oil prices: Long term oversupply is the issue

Early indications are that oil was in oversupply in Q1, 2017.
Most likely scenario: Sticking in the *shale band*

High probability that monthly average prices will remain volatile, and will stay within the *shale band*, until shale oil production can’t keep up with demand growth, or until the long-term effects of lower E&P investment take hold.
MARPOL VI

The 2020 global marine fuel sulphur cap is the latest of a series of regulations enforced by the IMO

Most likely scenario: Impact on US refining will be significant.
Unless a ship-based option is *widely* adapted, a significant portion of the ~3mn bpd of high sulphur resid used in bunker fuel will need to find a new home or be converted to low sulphur material.

- Demand for low sulfur distillate will, most likely, increase significantly.
**MARPOL VI: Most likely scenario**

- Regional delays in implementation, temporary exemptions, uneven enforcement
- Plan for multi-year widening of light-heavy spreads
- High-sulphur distillate will be an undesirable product
- ULSD distillate demand will increase
- ULSD prices will rise
- No significant pre-emptive conversion or desulfurization investment
- *Eventually, look for some additional resid conversion investment*
- *Slowly* growing shift to marine LNG

- **Wild cards:** Longer term L-H spread differentials*, prolonged phase-in for the regulations, uneven enforcement

* if this occurs, could incentivize major conversion investment
Initial switch will disrupt normal price relationships.
Creating a stronger incentive for investment in scrubbing.
Longer term, prices should return to pre-2020 basis once more vessels are scrubber ready, and as alternative fuel use grows.
No significant level of preemptive refinery investment, beyond the normal, but will see some additional desulfurization and conversion capacity. (If long term L-H spread diff, expect conversion investment.)
Light-heavy oil spread will widen, for a while

- But – most likely – not long enough to incentivize significant new US resid conversion investment
- Margins for refiners making HSFO will shrink
Marine demand to compete for low sulfur distillate

Breakdown of Current US Low S Distillate Use

- Trucks, Buses & Automobiles: 64.2%
- Residential: 6.5%
- Railroads: 6.0%
- Farms: 5.3%
- Commercial Use: 4.3%
- Bunkers: 4.0%
- Off-Highway: 3.3%
- Industrial Use: 3.3%
- Military: 0.2%
- Utilities: 0.9%
- Oil Firms: 1.9%
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Ship-board scrubbers

- Different options available
- Total installed costs ("TIC") probably more expensive than most current P50 estimates ($3m to $6m++ for new vessels, and $6m to $10m++ for retrofits)
  - High level of uncertainty with current TIC estimates.
- More likely on new ships versus retrofits
- Space requirement is significant, costing revenue
- Caustic storage (fresh and spent) and other waste will be a major technical issue.
  - Caustic disposal may be the key implementation-cost issue
- Can’t install fast enough to fit all large, viable ships
- If resid conversion or resid desulfurization investment is substantial, scrubber investors could be “burned”
US gasoline demand finally above 2007 levels

US - Yearly Domestic Gasoline Component Demand

- Ethanol used in gasoline
- Gasoline and blendstock imports
- US-produced oil derived gasoline for domestic use

Petroleum-derived gasoline demand not yet up to 2004 levels

Data from EIA. Calculations by Argus.
US gasoline output continues to grow

US- Yearly Refinery Gasoline Production

- Gasoline export growth has been accelerating the last 4 years
- **Most likely export demand scenario:** Demand growth rate will gradually shrink
- **Most likely US demand scenario:** RFS continues as is. Only moderate changes to CAFE policy. (“54.5 in 2025”). Demand growth shrinks and eventually disappears.

- Data from EIA. Calculations by Argus.
US gasoline inventories at all time highs

2016 and 2017 US Gasoline Inventory Levels

Million bbls

2001 - 2015 inventory range
2016 inventory levels
2017 inventory levels

This places downward pressure on gasoline prices (and oil prices)
US distillate demand dropped in 2016

US- Yearly Domestic Distillate Demand

- Data from EIA. Calculations by Argus.
US total distillate production dropped in 2016

- 2016 growth in distillate exports could compensate for loss in domestic demand.
- Most likely scenario: Flat to slowly declining demand, until MARPOL VI hits, then look for tight market to develop.

- Data from EIA. Calculations by Argus.
US distillate inventories near all time highs

2016 and 2017 US Distillate Inventory Levels

This places downward pressure on distillate prices (and oil prices)
G/D demand ratios have stopped dropping

US - Yearly US G/D Demand Ratios

Most likely scenario: This ratio will head back to lower levels once MARPOL VI takes effect

-Data from EIA. Calculations by Argus.
US refined products exports are still growing

Most likely scenario: This will continue, but expect decelerating growth
Export product growth rates are variable

US- Export Growth Trends for Distillate and Gasoline are On Different Tracks (Rolling CAGRs)

Distillate NGLs & LRGs Gasoline & blendstocks Pet. coke Resid fuel oil

RFS and CAFE, most likely scenarios

- **RFS**
  - RFS stays at current levels
  - RINS policy does not change

- **CAFE Standards**
  - No significant change
  - CARB has “clout.”
  - Car manufacturers do not want to build multiple vehicle types.
Border taxes

- Most likely scenario: Minor, measured changes

- Trump administration appears to be listening to US industry leaders

- Regardless, high level of uncertainty
New Crude Oil Pipelines

- Both Dakota Access and Enbridge’s Keystone XL have new life
- Govt. of Canada has approved KM’s Trans Mountain pipeline twinning
- Govt. of Canada has approved Enbridge’s Line 3 “replacement” (enlargement)
- Probability of completion, for all 4 pipelines, within 2-4 years, higher than in 2016
- But numerous lawsuits and hearings are obstacles on the paths to completion
Keystone XL, Enbridge Line 3 and Alberta bitumen

- Still face hurdles
  - Hearings at *Nebraska Public Services Commission*
  - Likely lawsuits: Sierra Club, NRDC and others
- Start of construction for KXL could be months or years off
- KXL less critical than when first envisioned
  - Other pipelines and rail transport have filled the gap
- Alberta Dilbit and Synbit will get to the USGC, regardless
- Supply of Alberta bitumen will continue to grow, slowly
- Most Alberta bitumen majors are in the business for long term
  - SAGD operations cannot easily be turned on and off
  - Despite the flight of foreign capital, ~$14 billion in oil sands spending is forecast for 2017
  - Recent permitting requests for multiple new SAGD projects
Alberta heavy oil import growth continues

- Majority of Canadian import growth is Alberta bitumen
- Alberta bitumen import growth will compensate for the loss of Mexican and Venezuelan imports
Today, most Alberta bitumen heads to US PADD 2

Canadian heavy sour crude shipments into US

- Data from EIA. Calculations by Argus.

- PADD 2 demand grew slightly. PADD 3 demand dropped.
However, PADD 3 represents the largest opportunity.

- Note the relative stability of PADD 3 heavy sour import levels, since 2009.
- PADD 2 demand growth is probably close to its peak demand level.
There is room for additional Canadian bitumen in PADD 3

Much of the Venezuelan heavy sour crude is high TAN and is an obvious candidate for “replacement.”
US refinery crude API to slowly drift lower

US Average Refinery Crude Oil Input Density and Sulfur Content

....... as US oil logistics systems become less constrained, and as US light oil finds it way to additional export markets.
Conclusions

- **Oil Prices:**
  - Most Likely in shale band for multiple years
  - Expect volatility
  - *Wild cards:* Supply disruption, demand surprises, or OPEC successfully managing long-term production cuts

- **MARPOL VI:**
  - Plan for multi-year widening of light-heavy spreads
  - High-sulphur distillate will be an undesirable product
  - ULSD distillate demand will increase
  - ULSD prices will rise
  - No significant preemptive conversion of desulfurization investment
  - *Wild cards:* Long term L-H spread differentials (if they materialize, could incentivize major conversion investment), prolonged phase in for the regulations
Conclusions, continued

- **US Gasoline Demand**
  - Most likely that export demand growth rate will gradually shrink
  - Most likely that US domestic demand growth shrinks and eventually disappears
  - Wild cards: CAFE 54.5 disappears, RFS diminished, RFS increases

- **US Distillate Demand**
  - 2016 growth in distillate exports was not enough to compensate for the loss in domestic demand
  - Most likely scenario: Flat to slowly declining domestic + export demand, until MARPOL VI hits, then look for tight market to develop
  - Wild Cards: Marpol timing delays, major jump in GDP growth rates in developing or developed countries
Conclusions, continued

- **Pipelines & Alberta Bitumen**
  - DAPL, KXL, Trans-Mount. twinning & Enbridge Line 3 all have new life
  - Most likely years of lawsuits and hearing for some of these
  - Additional Alberta bitumen will come into PADD 3 regardless (and a small additional amount into PADD 2)
  - Although the game has changed, Alberta majors are in the game for the long run
  - *Wild cards*: Successful law suits, major spills, technology breakthroughs
Conclusions, continued

- **RFS and CAFE Standards**
  - Most likely, RFS stays at current levels
  - Most likely, RINS policy does not change
  - Most likely, CAFE policy sees no significant change
  - *Wild cards*: Near-term political-control shifts in DC, Trump administration policy shifts

- **Border Taxes**
  - Most likely scenario: Minor, measured changes
  - Trump administration appears to be listening to US industry
  - Regardless, high level of uncertainty
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