Condensate in the Cockpit: The Pivotal Role of NGLS in the Emerging Shale Revolution

By

AI Troner
ASIA PACIFIC ENERGY CONSULTING
Houston, Texas, USA
Phone: +1-281-759-4440
Email: apenergy@apecconsulting.com

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Understanding the Shale Revolution

- Like the blind Hindu wise men meeting an elephant on the road
- Each describes the beast by the part they can feel; None sees the whole animal
- The Shale Revolution consists of a triad of change: For Gas, Natural Gas Liquids (NGLs) and Oil
- NGLs are the only grouping that impacts all three hydrocarbon groups, Tight Oil as much as Shale Gas
- Condensate is the pivotal NGL for relationship of black oil to gas liquids
- It impacts Canada as much as US
“The Future is Now”

- Shale development spreading across US
- Started as gas focus; shifted to liquids
- LNG, then crude, were the focal points
- NGLs will impact markets as much as crude
- Eagle Ford, Bakken, Permian, Marcellus/Utica main upstream points of focus
- Longer Term: Uinta, Niobrara, Cana-Woodford, Monterey (California), Montnay (Canada) basins
US Tight Oil – Key Plays in the Lower 48

Source: Deutsche Bank, Integrated Oils: Oil & Gas for Beginners, p.264
How Big is Big? First Crude

- Tight oil rather than shale oil
- Recoverable reserve estimates remain loose; many basins still uncatalogued
- Eagle Ford (E.F.), Bakken & Permian now mainstays – Plateau at minimum 3.6 MM B/D
- Total US some 4.5 MM B/D by 2020
- EIA well behind on forecasts; overcompensation?
- North Dakota oil output alone same as Malaysia; with Texas more than UK
“Begin at the Beginning” - Definitions

- Gas began the Shale Revolution; liquids sustain it
- Liquids, both Black Oil & NGLs; each shale basin differs
- Focus on NGLs
- NGLs: Liquid molecules suspended in sub-surface gas reservoirs
- They precipitate or are stripped from gas
- Need specialized containment; Ex: Condensate
## NGLs Defined – A Summary

<table>
<thead>
<tr>
<th>Product</th>
<th>Characteristics</th>
<th>Sectors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Methane (C1)</td>
<td>Dry gas; calorific value only; Piped or LNG GTL feedstock</td>
<td>Power, heating, industry, GTL, methanol, urea/fertilizer</td>
</tr>
<tr>
<td>Ethane (C2)</td>
<td>Both dry gas &amp; NGL; major value as petchem feedstock; needs pipelines, big gas output</td>
<td>As in methane; also petchem</td>
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<tr>
<td>Propane (C3/LPG)</td>
<td>Needs containment; generally stripped from gas; higher capex and opex in transport; safer than butane</td>
<td>Generally home &amp; business; transport use; gas supplement</td>
</tr>
<tr>
<td>Butane (C4/LGP)</td>
<td>Containment needed; higher BTU value; like propane, high capex &amp; opex</td>
<td>Mainly industrial; also in transport</td>
</tr>
<tr>
<td>Condensate (C5+)</td>
<td>Light, sweet crude lookalike; almost always &gt; 50% naphtha; Can be naphthenic or paraffinic; Moderate mid-distillate; once a liquid, remains a liquid; from wellhead or gas processing; some output sold as naphtha</td>
<td>Like crude, full range of products; strong impact on gasoline &amp; petchems; can produce large volume of jet &amp; ADO</td>
</tr>
</tbody>
</table>

**Source:** APEC

- Impact of condensate remains key to understanding crude
Tight Oil: The Nature of the Beast

- Different production profiles
- Many wells, high-pressure, lumpy supply, limited life
- Even *Dry* shale basins have *Wet Spots*
- Tight Oil usually contains large percentage of field condensate
- Therefore light – varying from 37-50 API; Sweet < 0.25%S
- All assays have big light-end yield
- Crude blends yet to stabilize
Snapshot/1: USGC End-2013

- US cannot export crude
- Yet sharply increasing tight oil production pushes out imports
- Backed-out barrels mainly light, sweet
- Houston more storage than Cushing; Tight Oil mainly E.F., Permian, Bakken
- How relevant is WTI?; Fragmentation of US prices?
Yield Comparison

Source: Industry
Snapshot/2: USGC End-2013

- Almost all light crude has been backed out of USGC
- USAC will follow by end-year
- Yet condensate volume averaging 45% + in E.F. offered USGC buyers
- At what point does EF become unusable for USGC?
A Condensate Primer/1

- Usually 50 API or lighter; sweet < 0.25%S; majority naphtha yield
- Liquids molecules suspended within gas
- Wellhead (lease) condensate precipitates naturally; Plant condensate (natural gasoline) stripped
- Wellhead accounted crude; export banned
- US crude restrictions warp world market
- No restrictions on Canadian, Mexican crude exports
A Condensate Primer/2

- Despite similarities condensate is not light, sweet crude
- E.F. *black oil* actually at least 45% condensate, but hidden
- As IEA recommended, crude export ban will eventually handicap US Tight Oil output
- Yet lifting crude export ban politically unacceptable
- Why not simply define lease condensate for what it is, condensate, not crude
- Discussion with EIA so far unpromising
Shale Oil Has Revived US Crude Output

Source: BP Statistical Review of World Energy June 2013; APEC
Yet US Tight Oil Already Reshaping Global Crude

- Clemenceau: “Generals always fight the last war”
- Obama administration caught in *shortage mentality*
- US Tight Oil resulting in avails too light for domestic refining
- Plant condensate considered *product* – can and will increasingly export
- Where can extra crude go – Canada – or less known - Mexico (NAFTA)
- Impact on Europe: Price pressure on light, sweet crude
- And then there is Canada …
## PADD-3 Base Refining Capacity

- Gulf dominates US refining/petchems
- Bigger, sophisticated plant
- Top-quality products
- Operationally efficient

<table>
<thead>
<tr>
<th>Operating Plants</th>
<th>Capacity MM B/D</th>
<th>%Share of PADD-3 Base</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>PADD-3 Base Capacity</strong></td>
<td>54</td>
<td>8.55</td>
</tr>
<tr>
<td>of which: Texas</td>
<td>6</td>
<td>4.66</td>
</tr>
<tr>
<td>Of which: Complex Coastal Refiners</td>
<td>21</td>
<td>6.38</td>
</tr>
</tbody>
</table>

**Source:** APEC
Current Canadian Cannards

- Canadian bituminous crude output will rise smoothly upward
- Canadian bituminous crude costs are almost equal to Tight Oil
- If Keystone XL remains blocked, crude will remain trapped in Canada
- Developers’ tolerance for escalating capex limitless
- Canada will continue to absorb most US plant condensate (diluent)
- LNG & Tight Oil are completely separate sectors
- For all of the above: “It ain’t necessarily so”
Canadian Oil Sands Output Forecast

Source: RBN; Chart based on CERI production forecast
Canadian Crude: Square Peg, Round Hole

- Obama stonewalling forces Canadians to seek alternative markets
- Unforeseen – first pipelines from Alberta east to Atlantic, not west to Pacific
- Gas development for LNG will cap and then back out US condensate import
- Canadian crude producers will continue to limit exposure to Washington’s whims
While Back in the USGC

- Condensate bottlenecks base capacity
- Secondary needs feedstock to crack
- In particular cokers top priority
- Can costly secondary be left idle?
- Or opportunity crude refused?
- Refining Divided: Simple/complex; coker/non-coker; new/depreciated
- Or is Asia the natural condensate outlet?
Why USGC Refiners Cautious on Forecast Transport Fuels

- US mogas demand (5-year) uncertain; likely short-term decline
- Worries of paraffinic naphtha (petchem feedstock) disposal
- Keystone XL uncertainty; if approved, when does syncrude arrive?
- NGLs will add to gasoline supply; backing out petchem feedstock
- Washington may back transport fuel rivals (CNG/LNG/LPG)
- Biofuels, EPA regulations increasingly onerous
- Current refining alone could produce product overhang
### Crystal-Ball Gazing/Crude (In MM B/D)

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</thead>
<tbody>
<tr>
<td>Total US Crude (w/Field Cond.)</td>
<td>8.40</td>
<td>8.75</td>
<td>9.00</td>
<td>9.20</td>
<td>9.45</td>
<td>9.90</td>
<td>10.25</td>
<td>10.40</td>
</tr>
<tr>
<td>North Dakota (Est. Field Cond.)</td>
<td>0.81</td>
<td>0.87</td>
<td>0.95</td>
<td>1.05</td>
<td>1.20</td>
<td>1.30</td>
<td>1.40</td>
<td>1.45</td>
</tr>
<tr>
<td>Texas (Est. Field Cond.)</td>
<td>2.85</td>
<td>3.10</td>
<td>3.30</td>
<td>3.50</td>
<td>3.60</td>
<td>3.80</td>
<td>3.95</td>
<td>4.10</td>
</tr>
</tbody>
</table>

**Source:** APEC, Industry

- Even conservative outlook underpinned by 10 MM B/D+ US crude
While NGLs will rise by about 1.3 MMM B/D, much of it in Texas
Despite ballooning LPG exports, a supply overhang
### Crystal-Ball Gazing/Plant Condensate (In MBD)

<table>
<thead>
<tr>
<th></th>
<th>2013</th>
<th>2014</th>
<th>2015</th>
<th>2016</th>
<th>2017</th>
<th>2018</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plant Condensate</td>
<td>340</td>
<td>370</td>
<td>410</td>
<td>450</td>
<td>500</td>
<td>560</td>
</tr>
<tr>
<td>US Crude (w/Field Cond.)</td>
<td>8,400</td>
<td>8,750</td>
<td>9,000</td>
<td>9,200</td>
<td>9,450</td>
<td>9,900</td>
</tr>
</tbody>
</table>

**Source:** APEC, Industry

- Forecast excludes petrochemical back-out – making export avails even higher
Condensate Concerns

- API is a loose and flexible hurdle; 50 API international norm, 45 API in US
- Remains a liquid once becomes a liquid WITHOUT CONTAINMENT – unique among NGLs
- Whole condensate almost always produces 50%+ naphtha
- Only NGL to yield all products
- Utilizes ordinary oil infrastructure
- Splitter purpose-built distillation; cut points & overheads for light ends
- Splitter can use both, field and plant condensate
NGLs, Petchems & Transport Fuels

- NGLs considered *petrochemical feedstock*
- Yet their transport sector impacts at least as great
- Condensate a major source gasoline
- Can maximize jet or road diesel
- Feedstock for reformate
- Butane (isomerate), iso-butane (alkylate) can produce components
Condensate Flow

The Many Faces of Condensate

Condensate
Paraffinic or N+A Oriented

Condensate Splitter

Refinery

Hydrotreater
Paraffinic Naphtha

Ethylene Cracker

Olefins Manufacture, i.e. Plastics

Reformer
N+A Naphtha

BTX Plant

Aromatics Manufacture, i.e. Acrylics, Resins, Styrene

Reformate

Heavier Production
Kero, Gas Oil, Fuel Oil

Mogas

Other

Mogas Components

27
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Panama Canal & New Horizons

- Revamped canal will handle up to 160,000 DWT products
- Currently can move crude in VLCC/ULCC lots
- NGLs – including condensate – do not boil off – like LNG
- USGC condensate has **BOTH** Atlantic and Pacific Basin markets
Conclusions

- We expected limited US DOE reform to reshape condensate definitions/trade
- Federal inflexibility will provide opportunities for those who understand the nature of condensate
- The misunderstanding surrounding condensate allows for the creation of new export markets
- It is important not to limit our vista solely to the Atlantic Basin
- Asia Pacific likely to continue to lead global demand growth through 2020
- PADD-3 producers should grab a piece of this expected expansion of marketing opportunity