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

By

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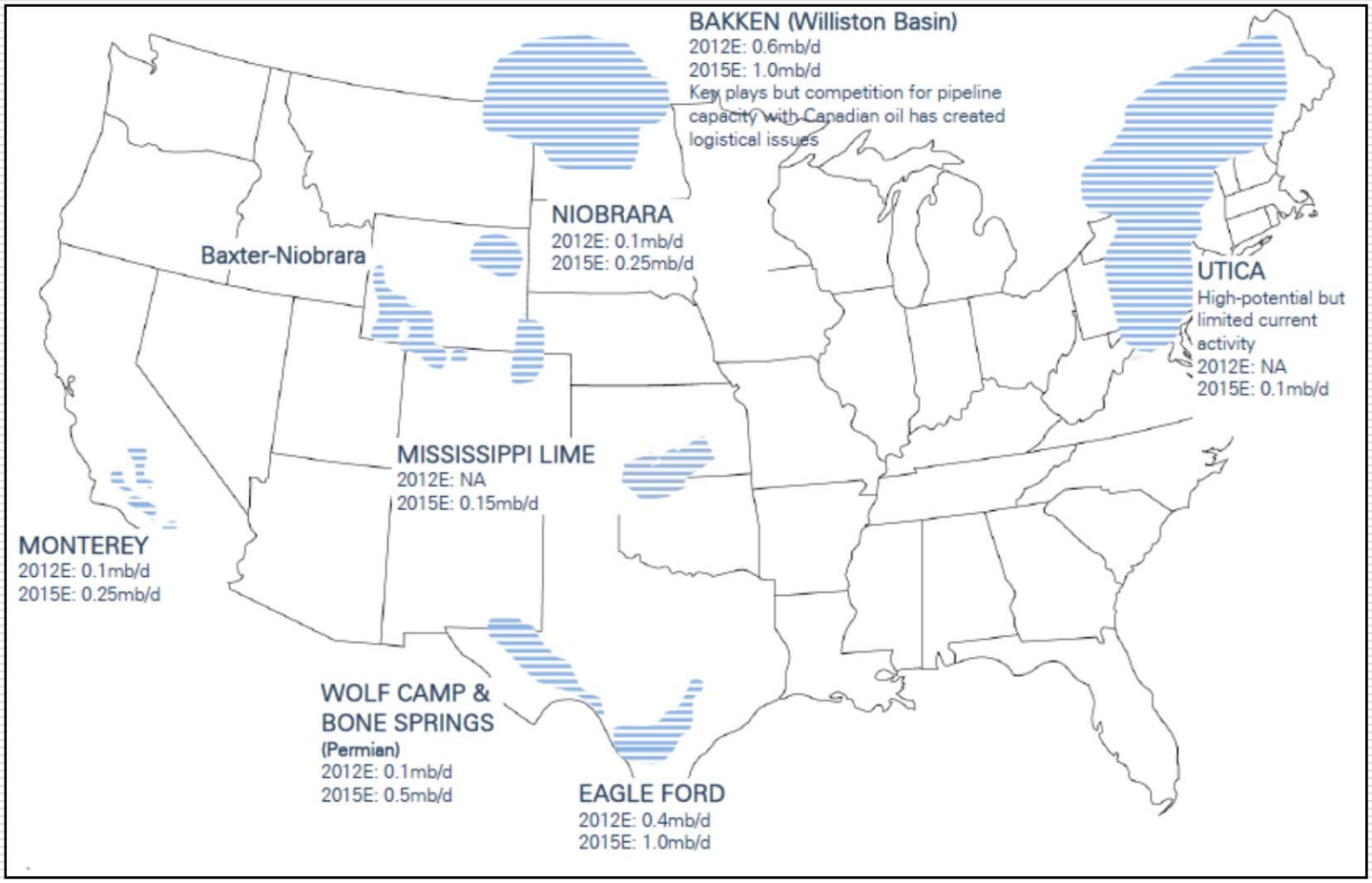
Understanding the Shale Revolution

- 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 mor 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

Product	Characteristics	Sectors
Methane (C1)	Dry gas; calorific value only; Piped or LNG GTL feedstock	Power, heating, industry, GTL, methanol, urea/fertilizer
Ethane (C2)	Both dry gas & NGL; major value as petchem feedstock; needs pipelines, big gas output	As in methane; also petchem
Propane (C3/LPG)	Needs containment; generally stripped from gas; higher capex and opex in transport; safer than butane	Generally home & business; transport use; gas supplement
Butane (C4/LGP)	Containment needed; higher BTU value; like propane, high capex & opex	Mainly industrial; also in transport
Condensate (C5+)	Light, sweet crude lookalike; almost always > 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	Like crude, full range of products; strong impact on gasoline & petchems; can produce large volume of jet & ADO

Source: APEC

- Impact of condensate remains key to understanding crude

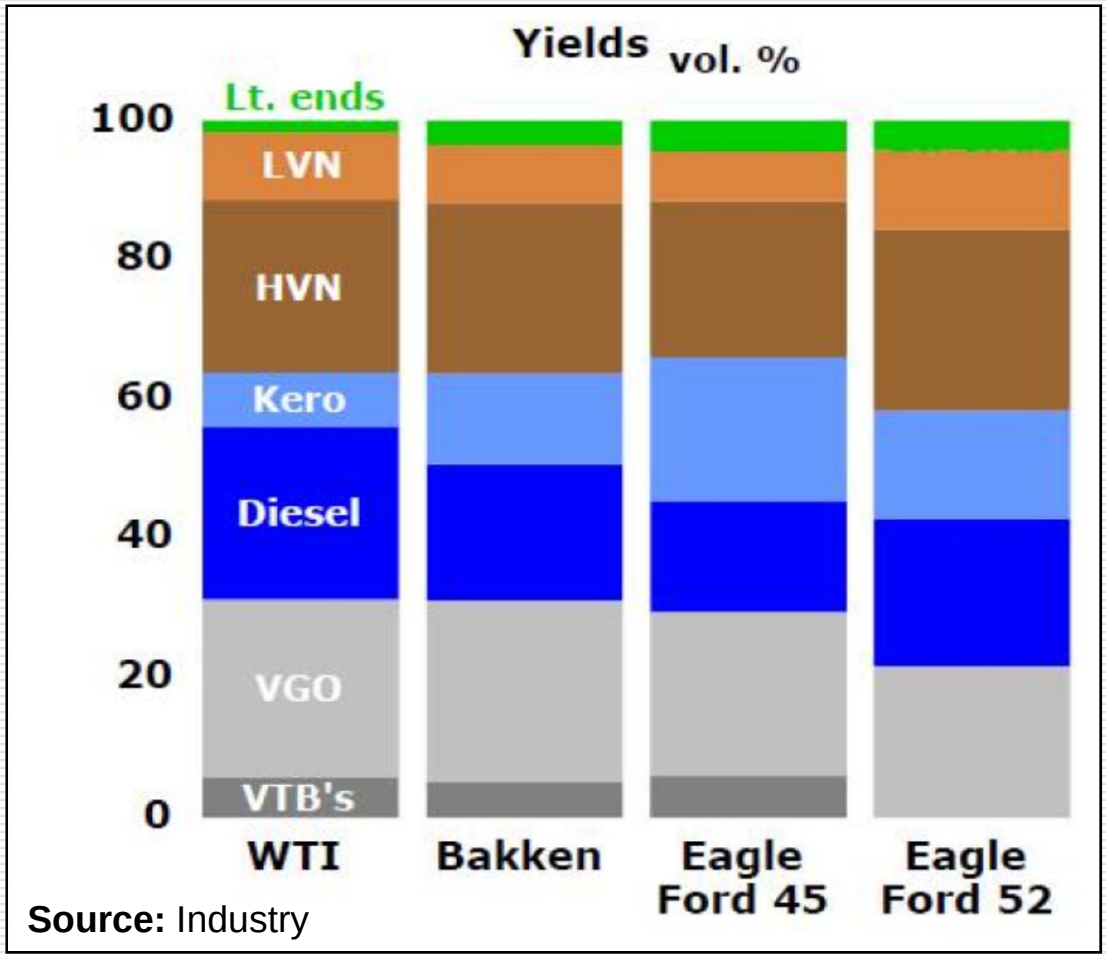
Tight Oil: The Nature of the Beast

- 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?

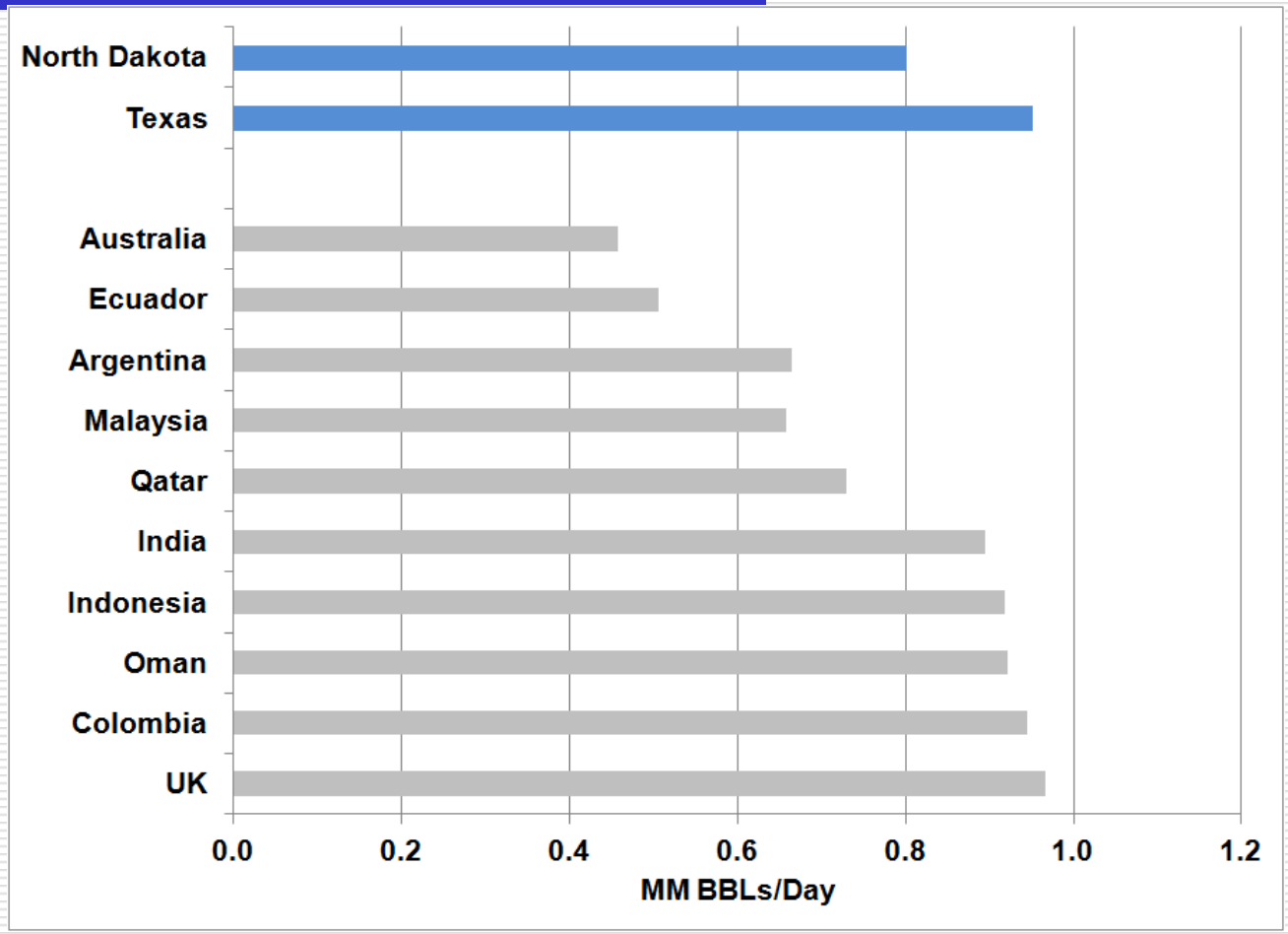
A Condensate Primer/1

- 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

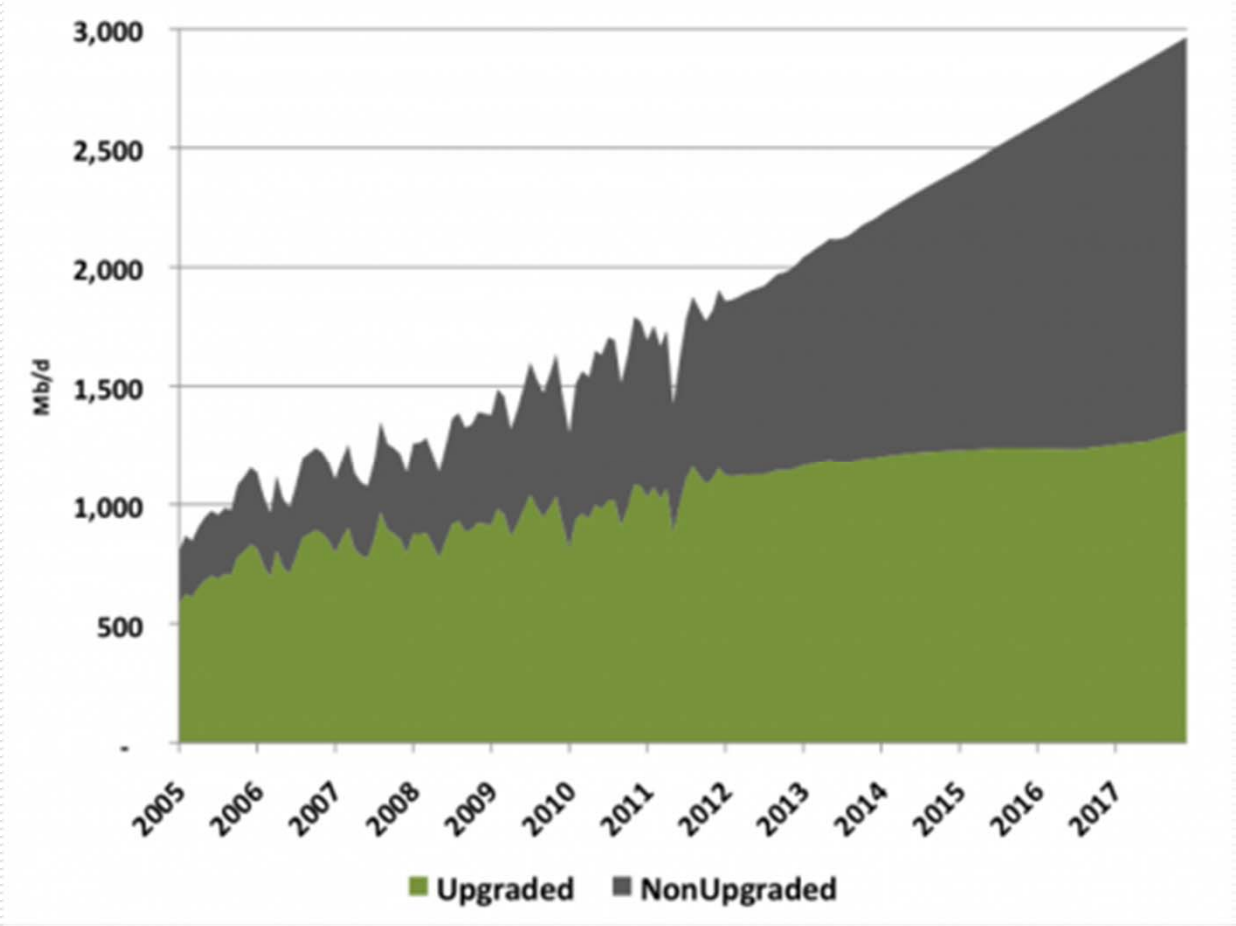
	Operating Plants	Capacity MM B/D	%Share of PADD-3 Base
PADD-3 Base Capacity	54	8.55	
of which: Texas	*6*	*4.66*	*54.5%*
Of which: Complex Coastal Refiners	*21*	*6.38*	*74.6%*

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

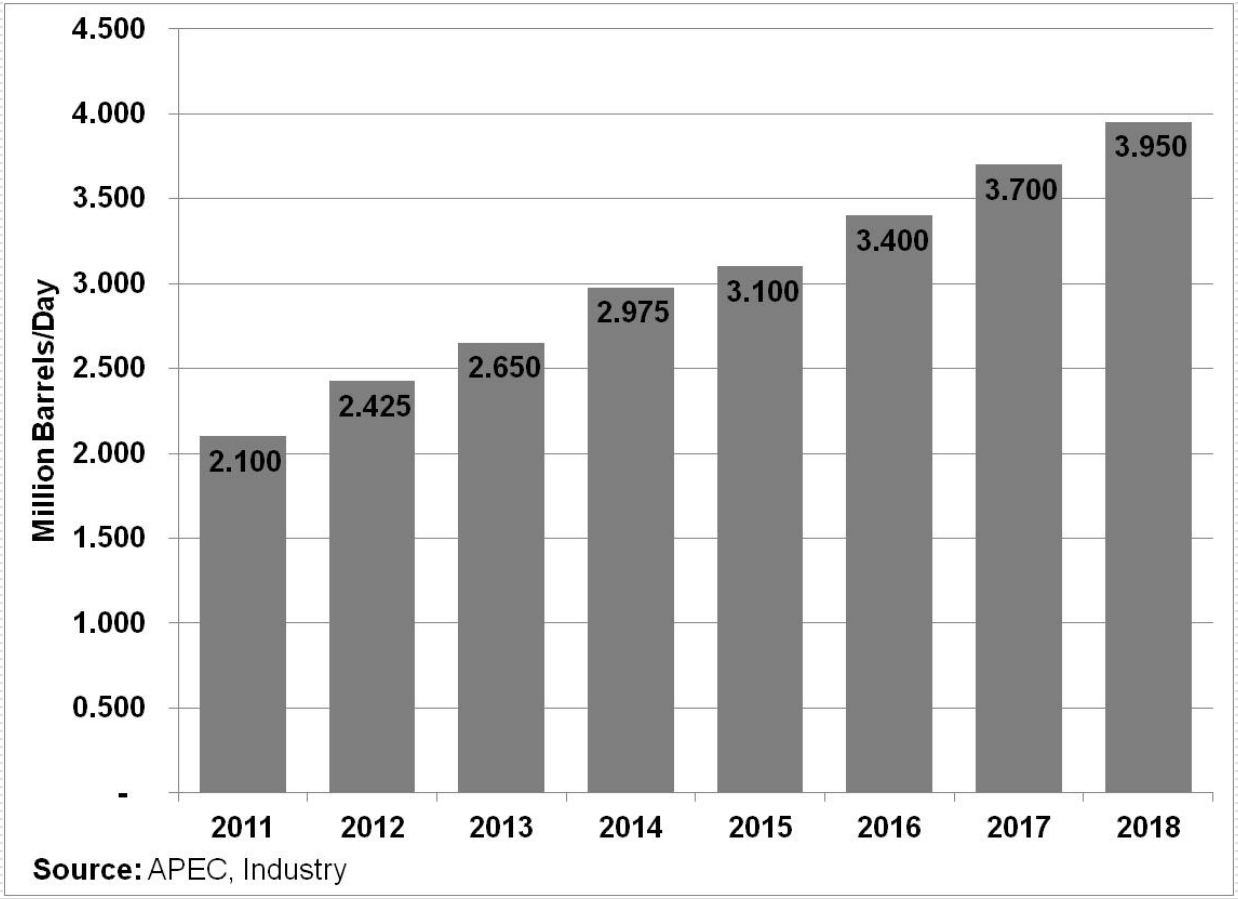
Crystal-Ball Gazing/Crude (In MM B/D)

	2013	2014	2015	2016	2017	2018	2019	2020
Total US Crude (w/Field Cond.)	8.40	8.75	9.00	9.20	9.45	9.90	10.25	10.40
North Dakota (Est. Field Cond.)	0.81	0.87	0.95	1.05	1.20	1.30	1.40	1.45
Texas (Est. Field Cond.)	2.85	3.10	3.30	3.50	3.60	3.80	3.95	4.10

Source: APEC, Industry

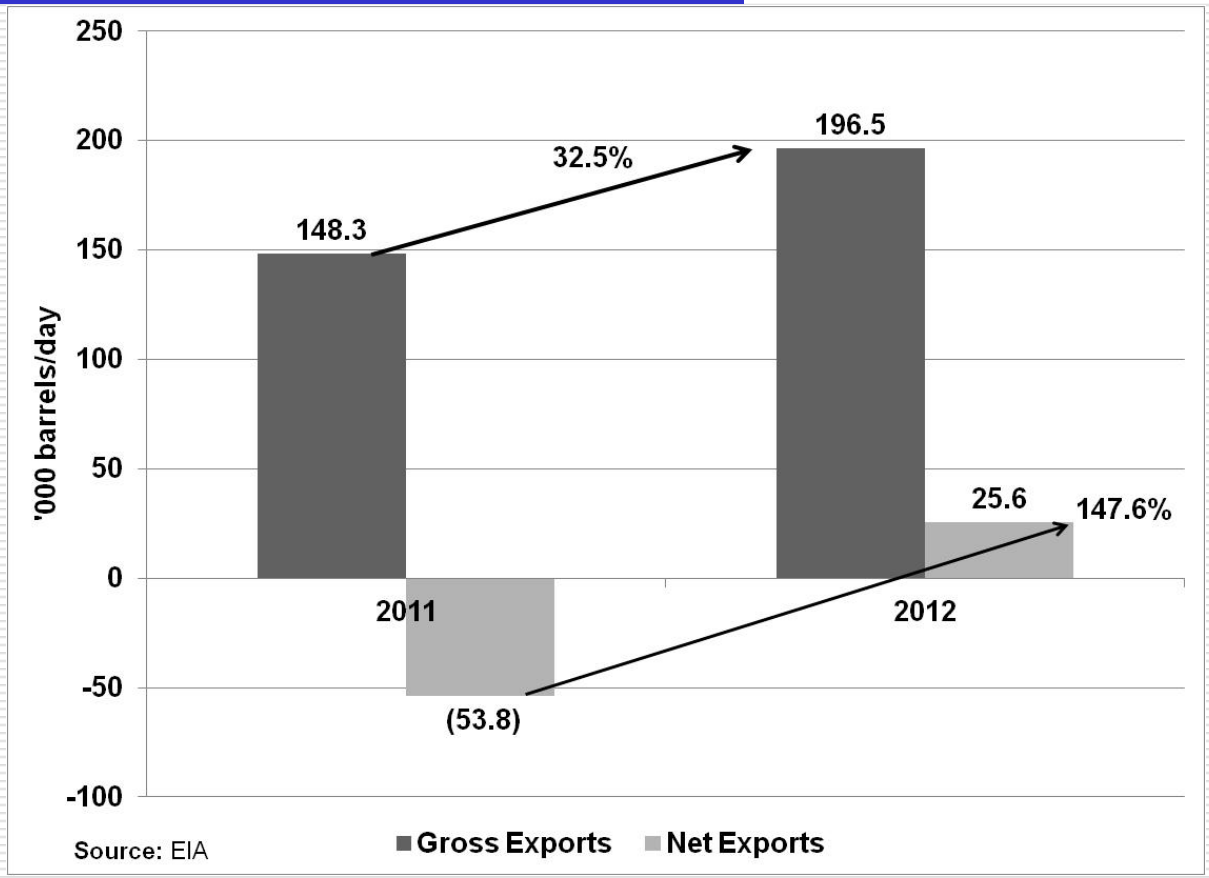
- Even conservative outlook underpinned by 10 MM B/D+ US crude

Crystal-Ball Gazing/All NGLs



- While NGLs will rise by about 1.3 MMM B/D, much of it in Texas

Crystal-Ball Gazing/LPG



- Despite ballooning LPG exports, a supply overhang

Crystal-Ball Gazing/Plant Condensate (In MBD)

	2013	2014	2015	2016	2017	2018
Plant Condensate	340	370	410	450	500	560
US Crude (w/Field Cond.)	8,400	8,750	9,000	9,200	9,450	9,900

Source: APEC, Industry

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

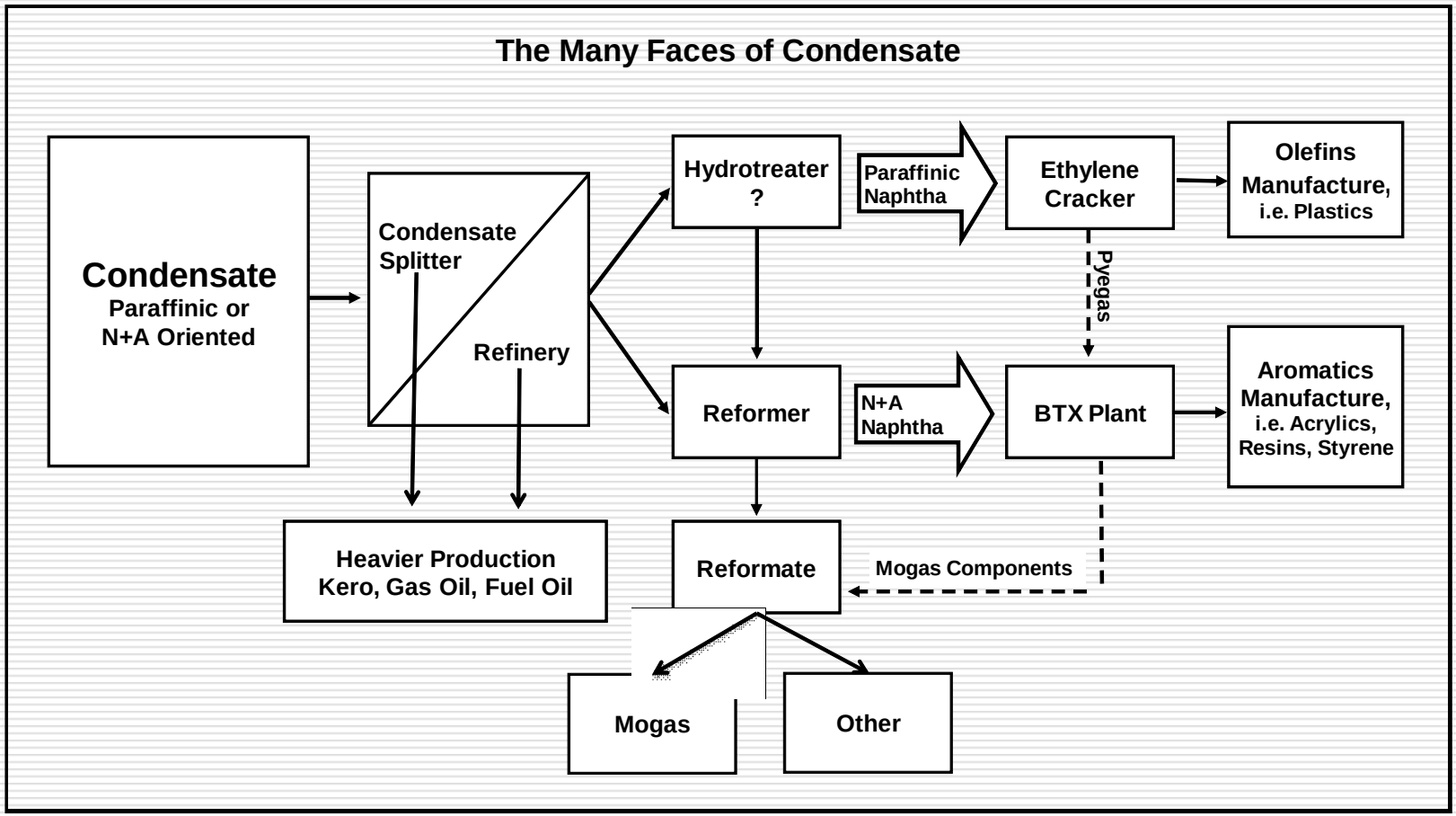
Condensate Concerns

- 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



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