

# Market Assessment Overview

- Overview of Trends
- Crude avails and logistics & implications for asphalt supply
- Asphalt Supply/Demand – key factors
- Resid alternatives & impacts for Asphalt
  - Coker alternative
  - Market fuel oil use (IMO specification change) implications – 2020
- Summary of implications for asphalt paving pricing

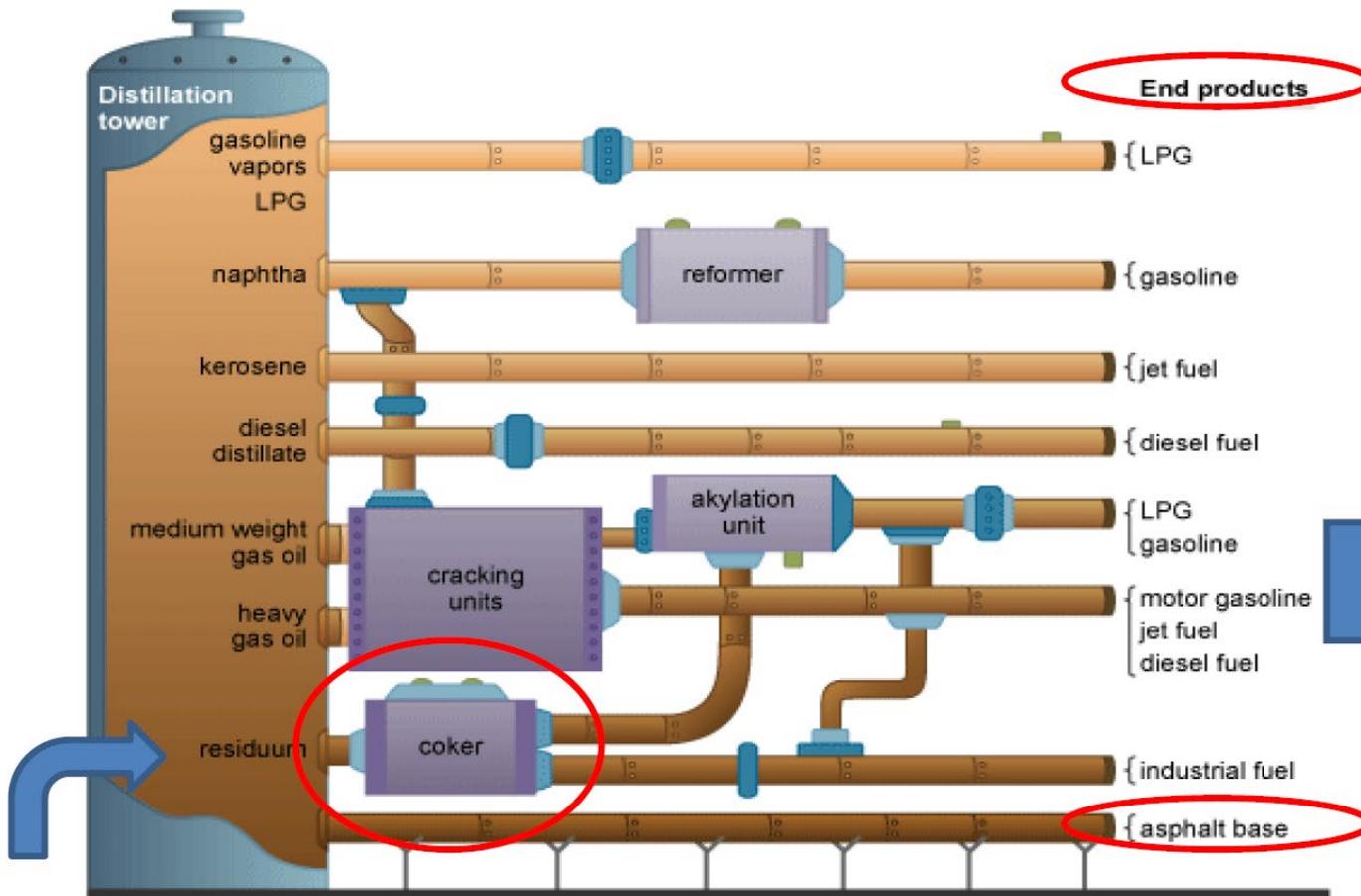
# Future Trends & Implications for Asphalt in North America

- Asphaltic crude avails will shift from Venezuelan to Canadian with shift occurring in the USGC
  - Reflected in current Canadian crude parity point of USGC
- Narrow light-heavy crude spread in NA (WTI-WCS) will pressure asphalt price
  - Plus shale oil avails, weak global crude price (WTI) and “fixed” heavy crude demand due to Coker needs , IMO demand & asphalt
  - IMO Sulphur change in 2020 creates shift to plus light crude processing (already occurring) & depressed resid (VTB) pricing (quality will be key for value as upgrade to coking or asphalt)
- Asphalt Demand continues to steady with Road Mtce techniques overtaking base hot mix construction
- Asphalt Supply/Demand balance continues to show East Coast net short & USGC net long, however;
  - Jones act limits efficient movement of bbls from USGC to US East Coast
  - Demand in South America attracts USGC bbls (replacing lost Venezuelan volumes)
- Asphalt base supply most reliable from intercontinental US or Canadian west
  - Ratable and shorter supply lines
  - Good base of quality heavy crude available for processing into base grade Asphalt
- Asphalt price movement reflects crude price changes with relative value more reflective of oil product alternatives (gasoline & diesel)

# Key historical trend: coker installations

- Installation of coking capacity has translated into less residual "bottoms" as refiners try to maximize profit from light ends

*This simplified drawing shows many of a refinery's most important processes.*



Source: EIA



## Typical yields

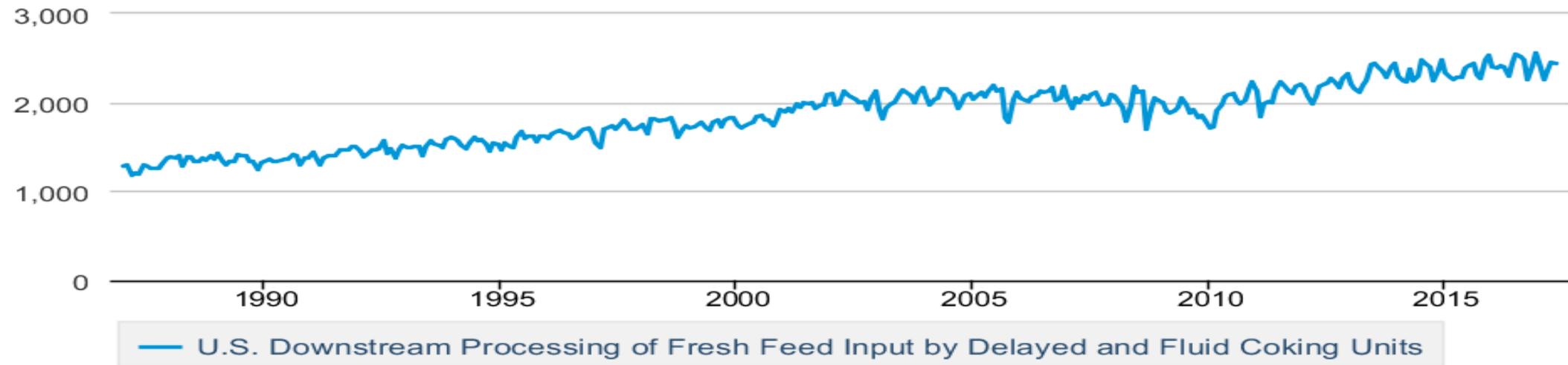
- Mogas 40 %
- Diesel 30 %
- Jet 10 %
- LPG 10 %
- Asphalt 8 %
- Misc. 2%

- Mogas/Diesel at 130 % of crude value
- Asphalt must compete with Mogas/Diesel value less Coking cost, so asphalt value of 100 to 120 % of Crude (heavy)

# US Coking Utilization

## U.S. Downstream Processing of Fresh Feed Input by Delayed and Fluid Coking Units

Thousand Barrels per Day



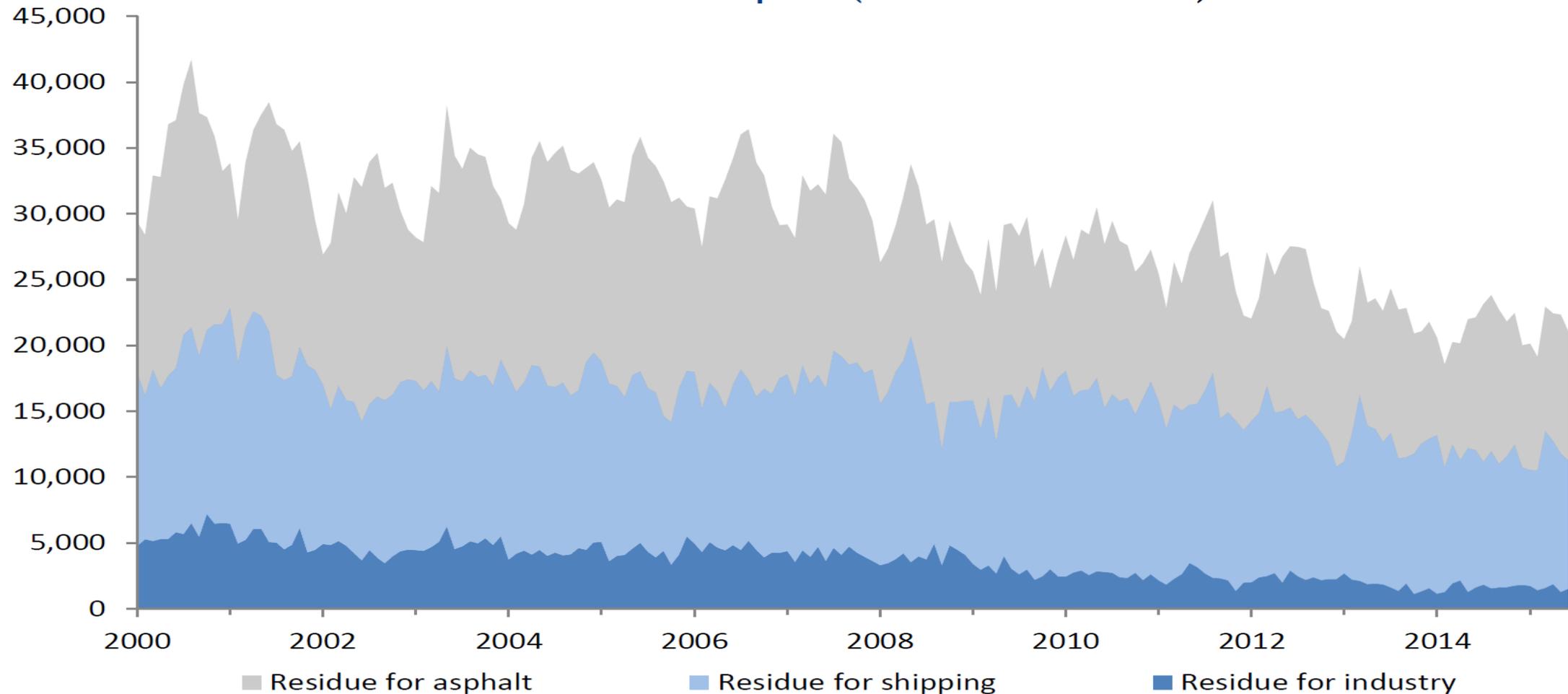
Source: U.S. Energy Information Administration

Website:

<https://www.eia.gov/dnav/pet/hist/LeafHandler.ashx?n=PET&s=MCRDFUS2&f=M>

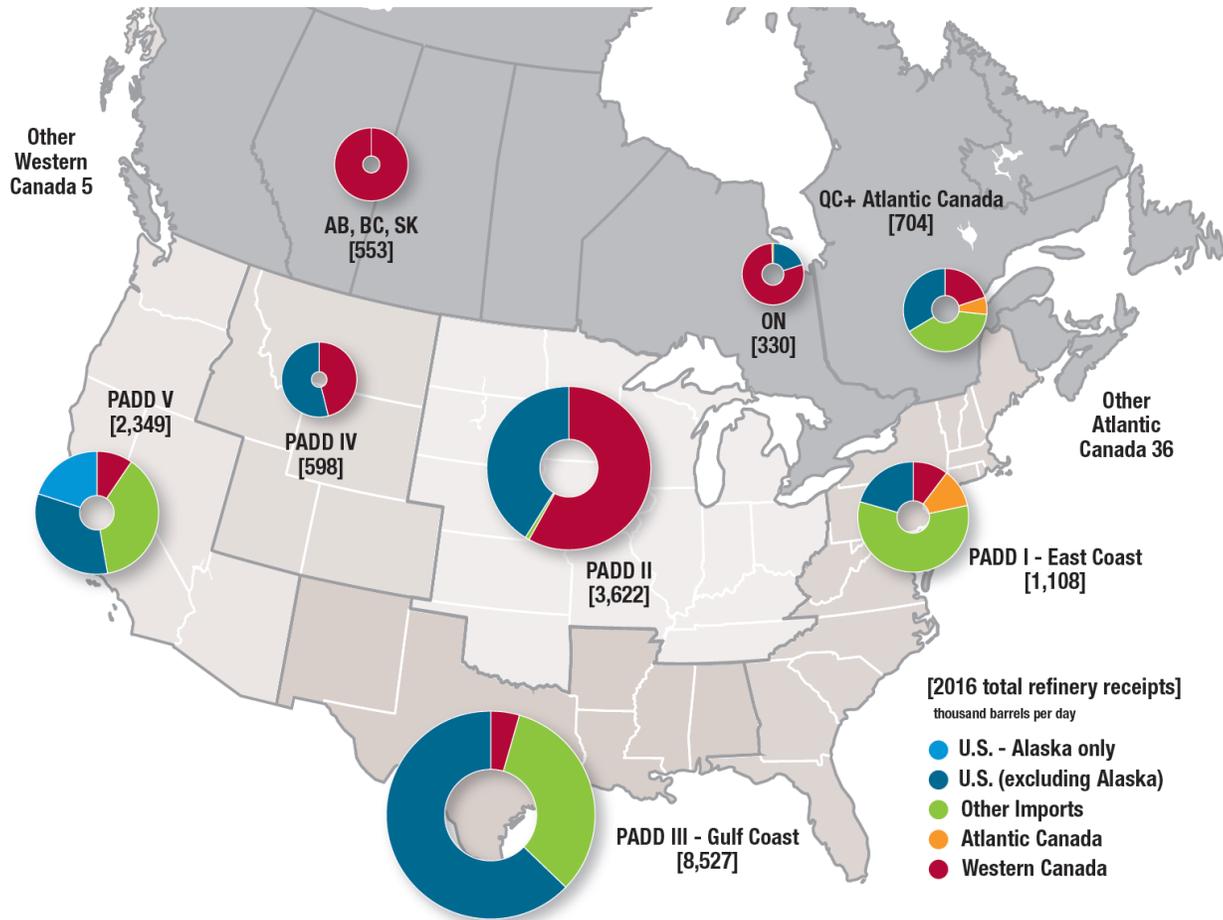
# The result: US refineries are producing less residuals

## Residual output ('000 bl/month)



# NA Crude demand profile

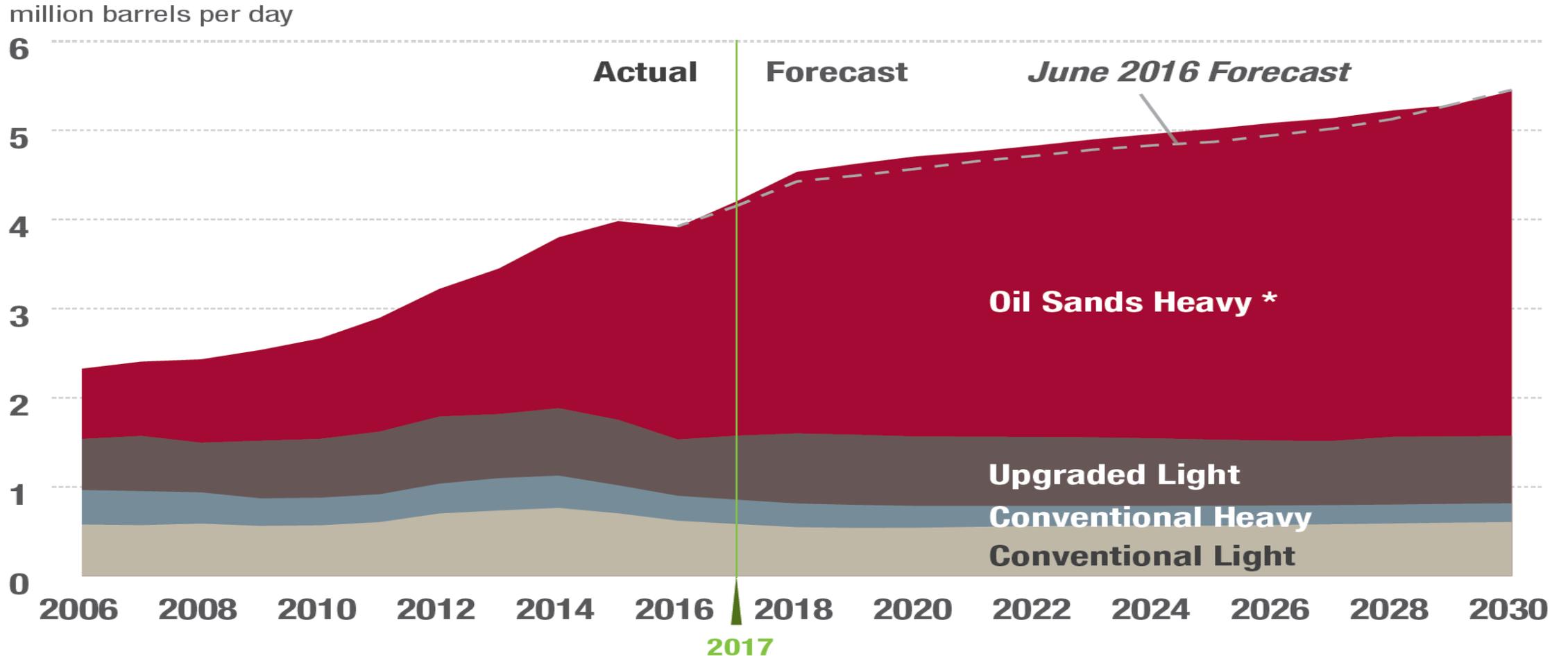
FIGURE 3.1 CANADA AND U.S.: 2016 CRUDE OIL RECEIPTS BY SOURCE



- Midwest processes 2.2 MBD of Hvy Cdn crude
- USGC crude processing is 0.7 MBD Ven, 0.6 MBD Mexican, 0.4 MBD Cdn
  - Total Hvy crude processing capacity of 2 MBD
- West target Cdn Hvy market
  - Process 0.4 MBD hvy today plus 0.5 MBD ANS (declining)
  - Supply to West is either rail (8 \$/B) or TMPL to West coast & ship (3 \$/B on TMPL, ship 3 to 6 \$/B)
- China crude demand growth of 4 MBD also serves as target market for Cdn Hvy crude
  - TMPL plus VLCC provides economic access
  - Infrastructure investment required to make efficient & is part of TMPL expansion in 2019-2020

# NA Heavy Crude Profile

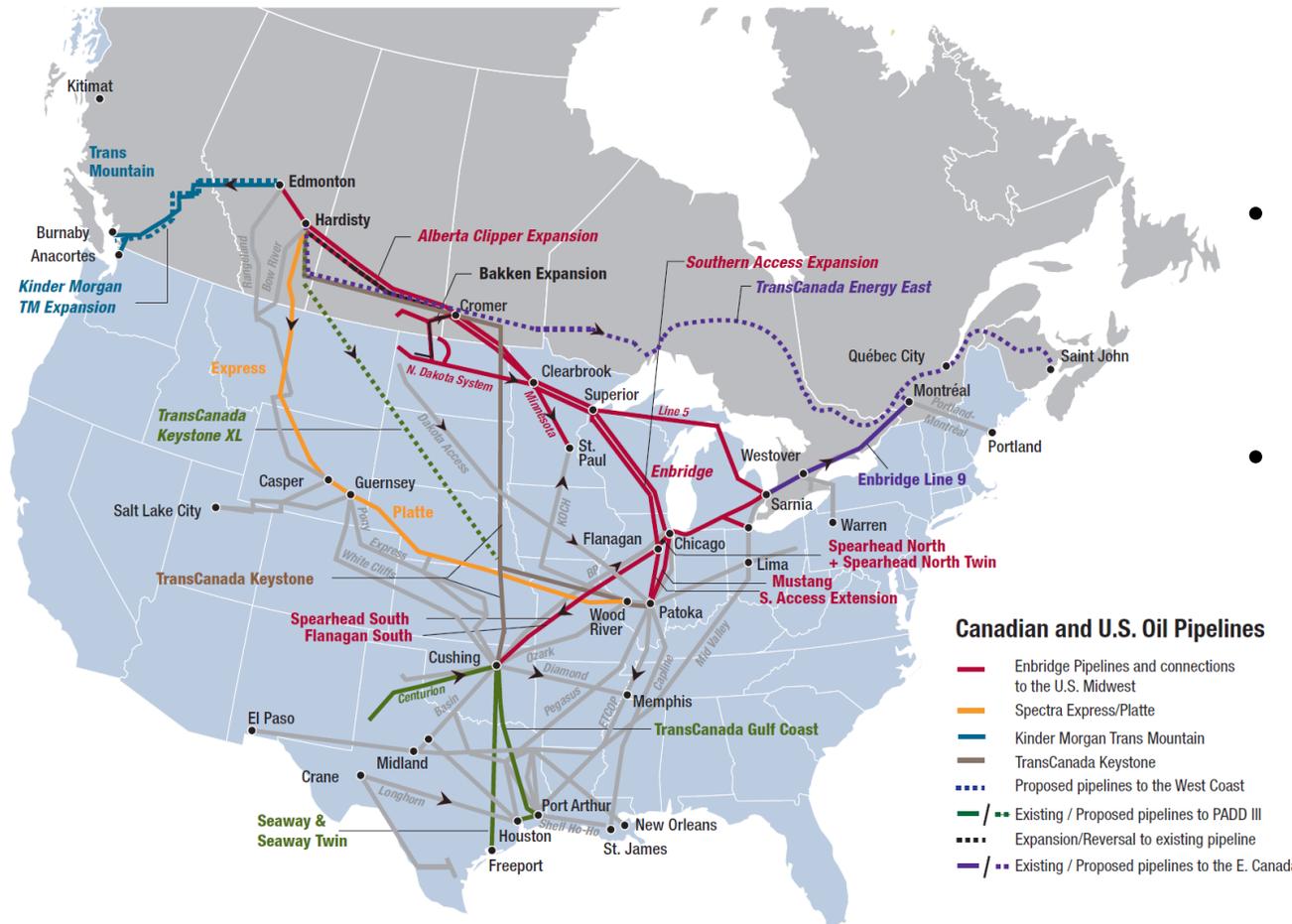
**FIGURE 2.6 WESTERN CANADA OIL SANDS & CONVENTIONAL SUPPLY**



- Cdn crude growth of 1.6 MBD 2016 to 2030
  - 1.4 MBD Cdn Hvy (1.0 MBD insitu) - asphaltic

# Crude NA Transportation

FIGURE 4.1 EXISTING AND PROPOSED CANADIAN & U.S. CRUDE OIL PIPELINES



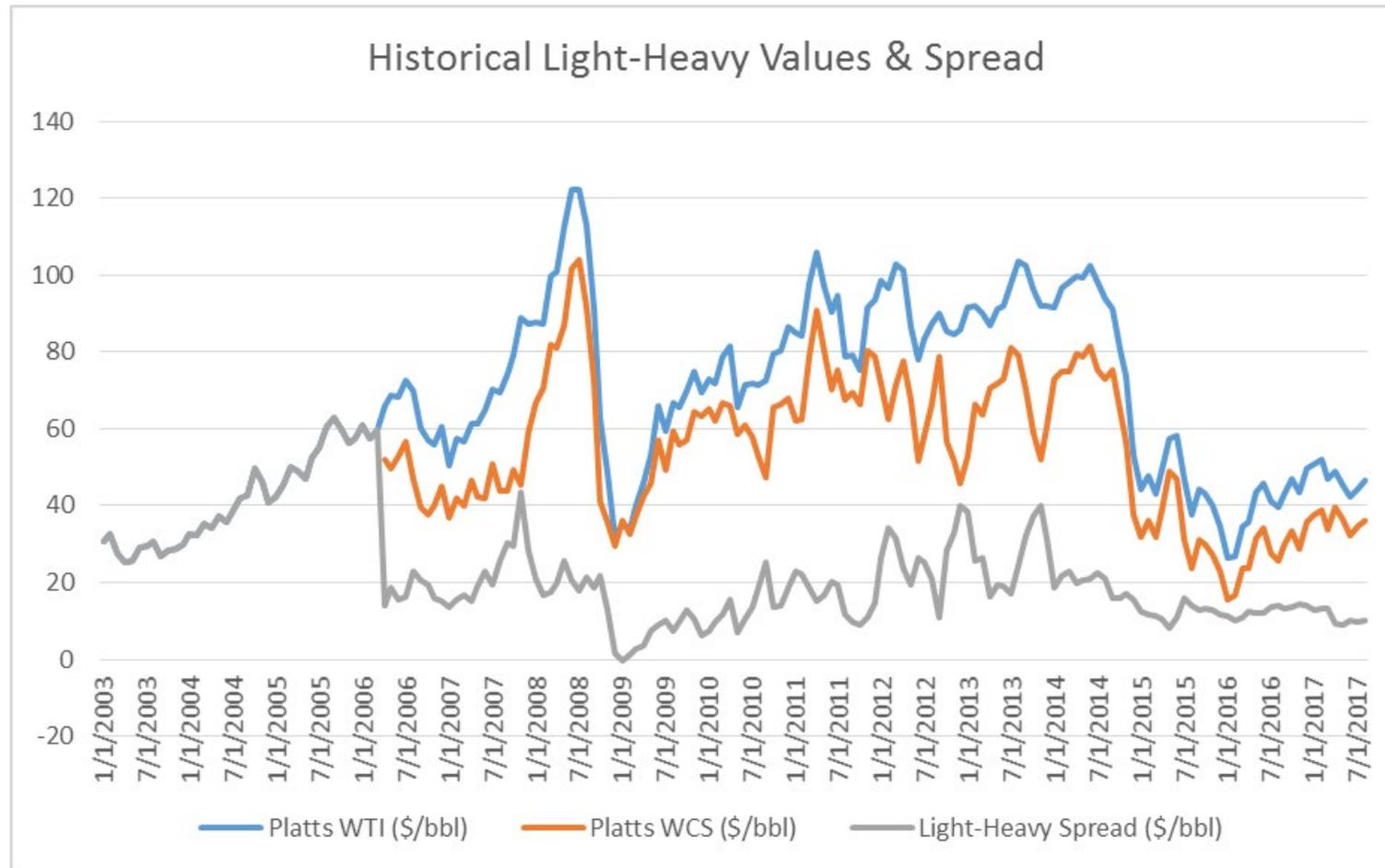
- Current Pipeline infrastructure of 4 MBD is full
- Expansion plans approved consist of;
  - Enbridge Line 3 restoration; +0.4 MBD in 2019
  - TransMtn expansion; +0.6 MBD in 2019
  - Keystone XL; +0.83 MBD in 2020
- Cdn crude expansion of 1.6 MBD covered, with crude by rail bridging to 2020
  - Canada Energy East low probability give length & permitting but would add 1.1 MBD of capacity
- Crude by rail capacity is 750 KBD, with 400 KBD in Edmonton/Hardisty

FIGURE 4.2 CANADIAN FUEL OIL AND CRUDE PETROLEUM MOVED BY RAIL: CAR LOADINGS & TONNAGE



Source: Statistics Canada; CANSIM table 404-0002.

# Crude Price History & Light-Heavy Spread

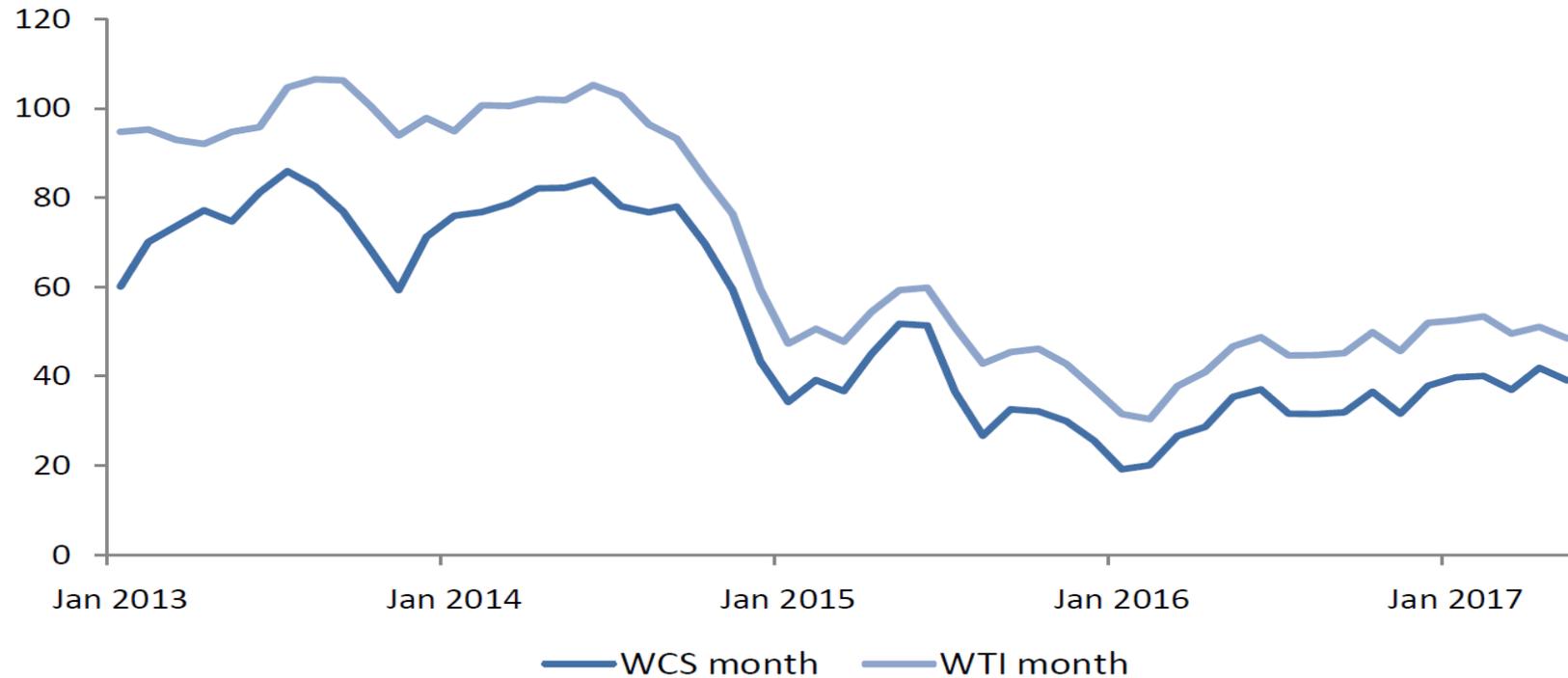


\*Data from Argus + Platts

# Crude: Heavy-light differentials narrow

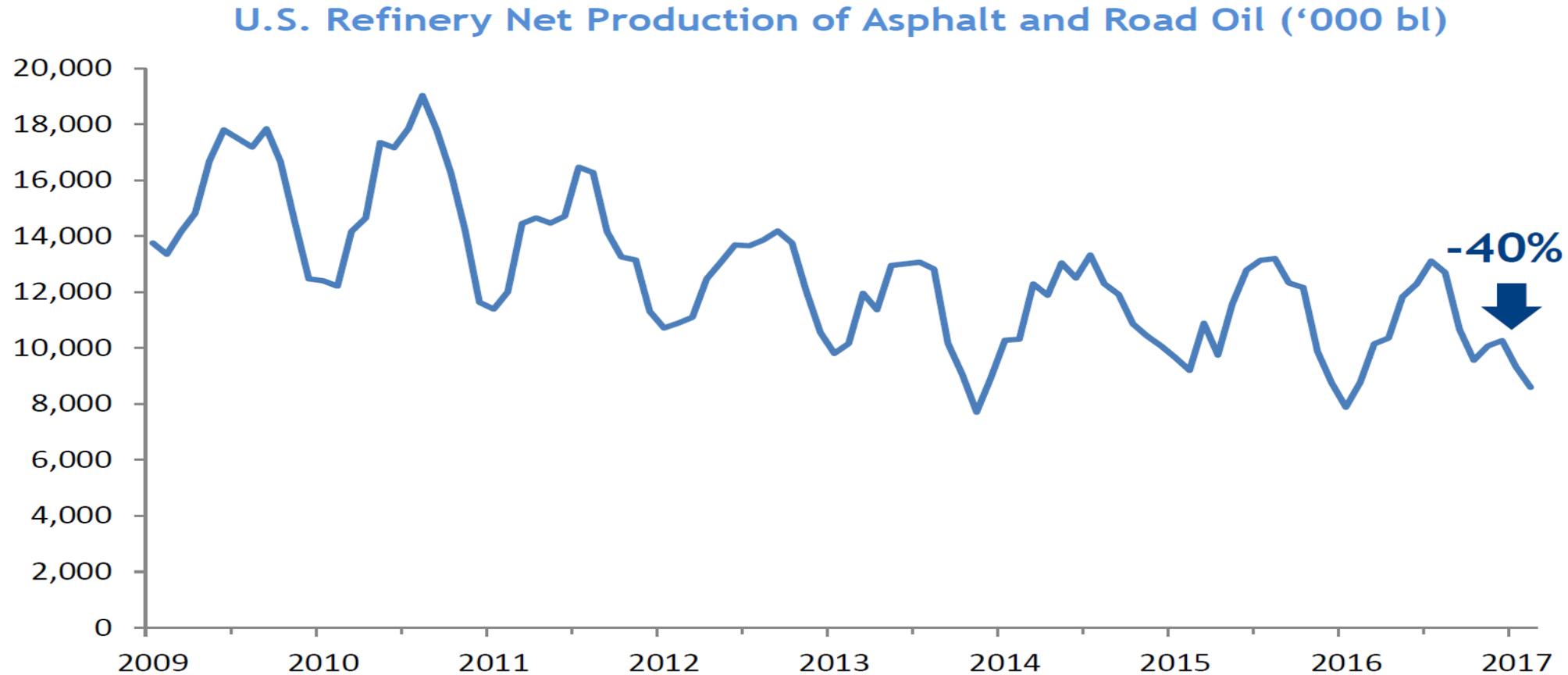
- Global crude oil price collapse in 2014: the outright cost of crude oil
- Increased distribution of heavy Canadian crude to USGC and elsewhere
  - Glut shrinks

WCS-WTI crude (USD/bl)





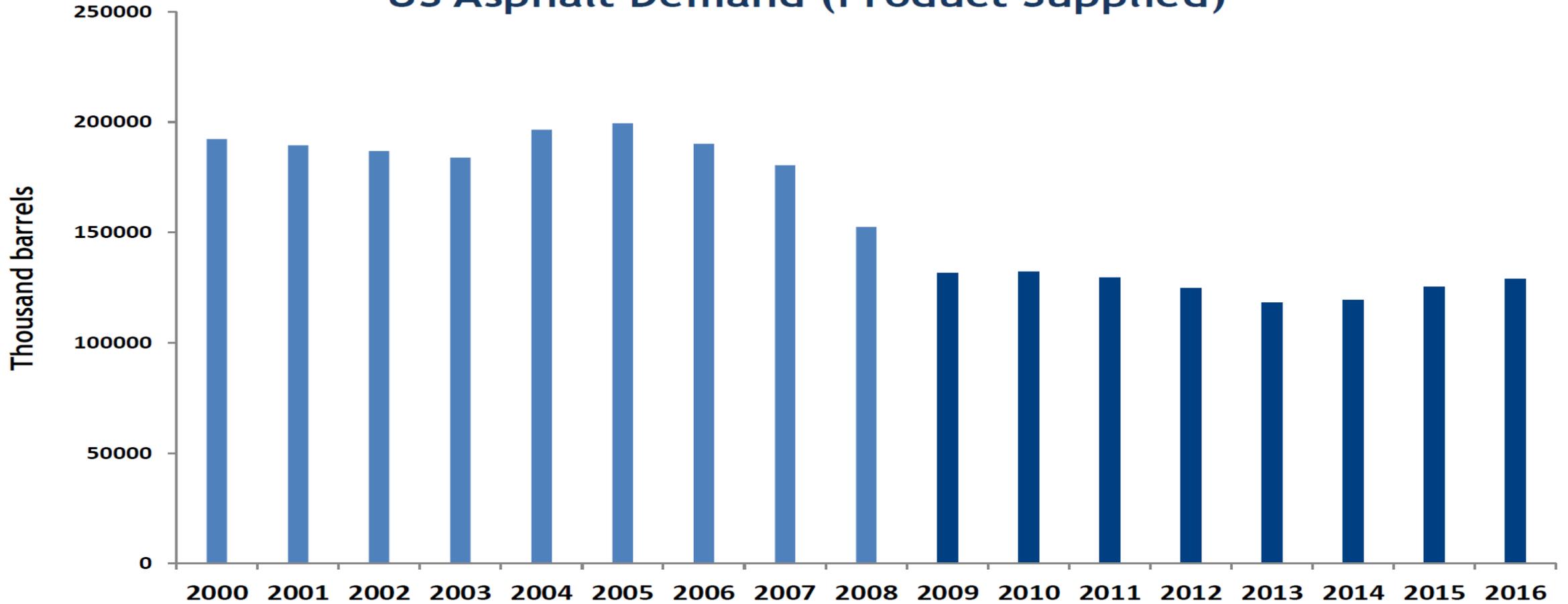
# US asphalt production has been steadily declining



Source: EIA

# US demand: On a slow upswing? Or stagnating?

## US Asphalt Demand (Product Supplied)



Source: EIA

# 2016 US Demand was Higher Overall...

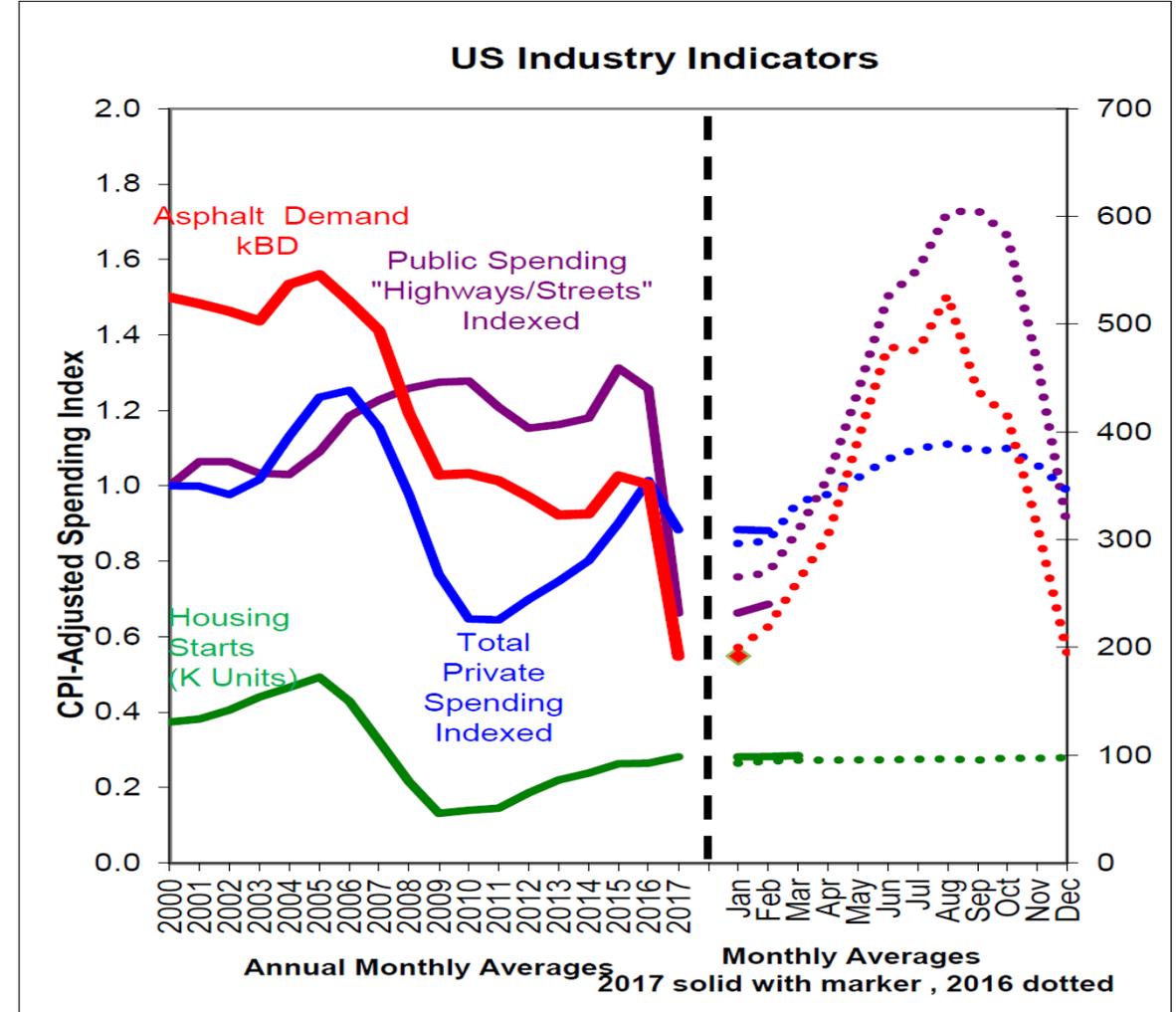
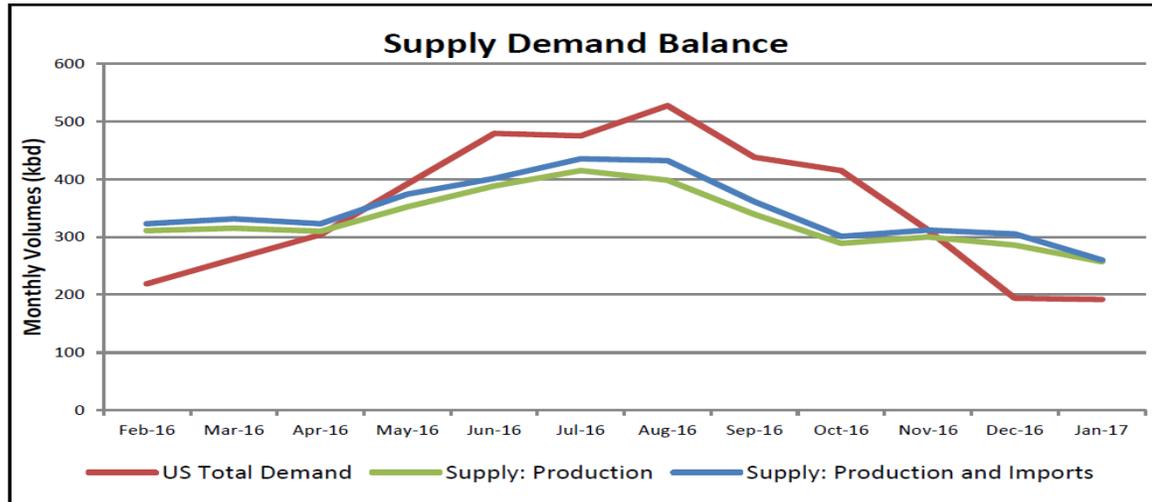
## US Asphalt R12 assessment

(Jan'17 R12 vs. Jan'16 R12)

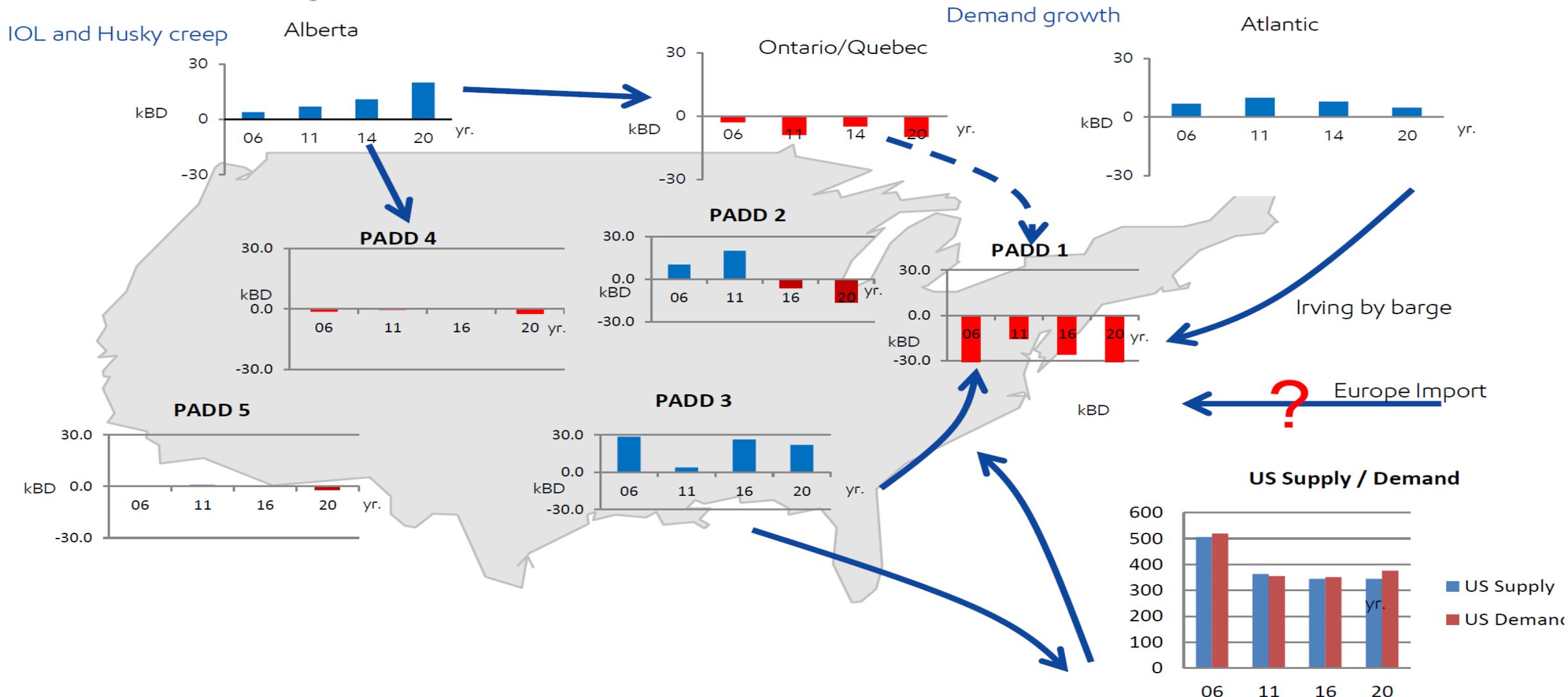
- Demand is up **+8 kbd at 351 kbd**
- Supply is down **-8 kbd at 330 kbd**
- US Net imports equivalent to **17 kbd (up 5 kbd)**

### Oct YTD AVG vs. PYTD AVG

- Total Public Spend -13% of \$4B (Fed+ State, Highway & Street)
- Total Private Spend +4% of \$60B
- *Housing Starts (units)* +6%



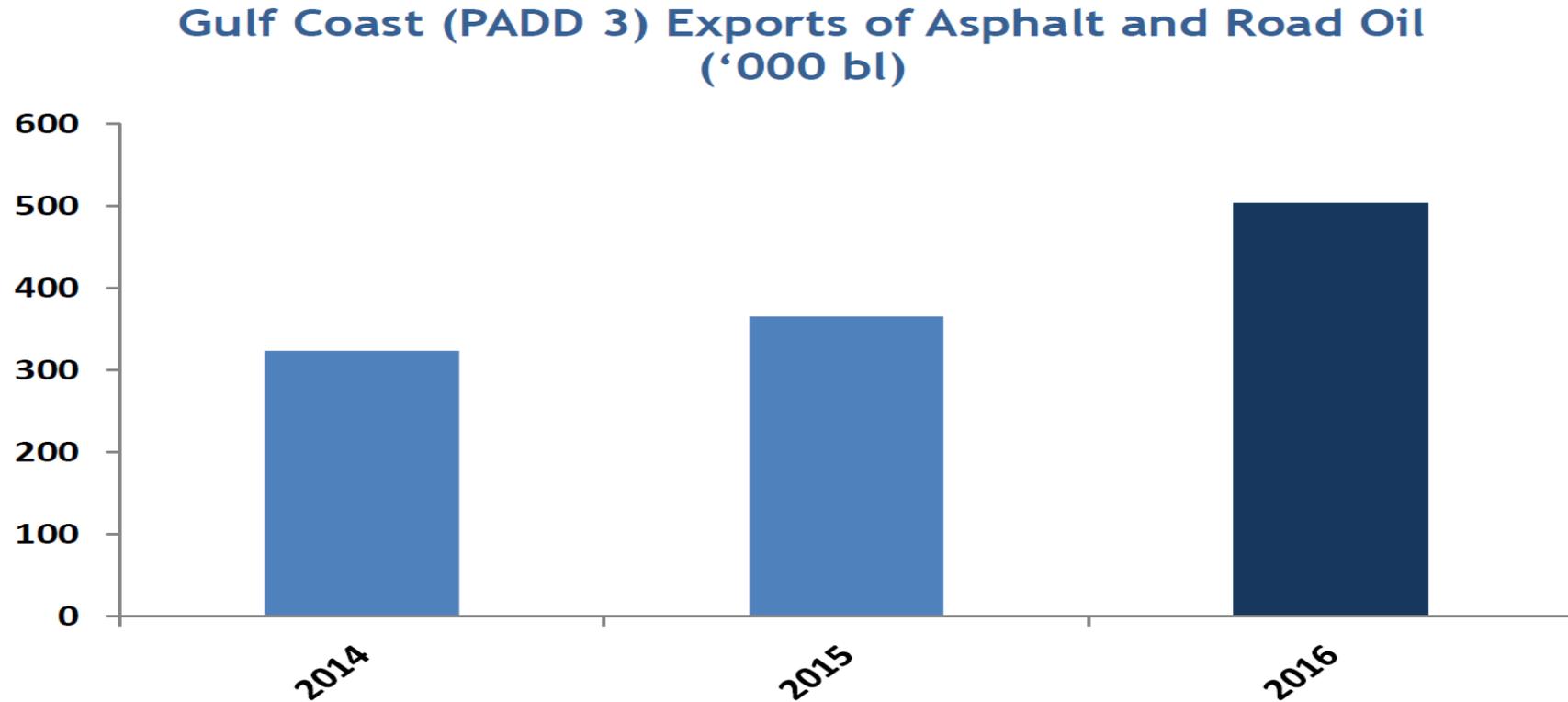
# NA Supply Flows



- 2013-14 European Imports replaced by PADD 3 and Latin America length
- 2016-17 European Imports supplementing VZ reliability, UGC maintenance, Axeon S/D

# Trade flows: US Gulf coast exports on the rise

- Latin American demand, infrastructure projects
- Increased heavy crude processing
- Rising coker unit installations



# PADD 1 more reliant on foreign imports for supply

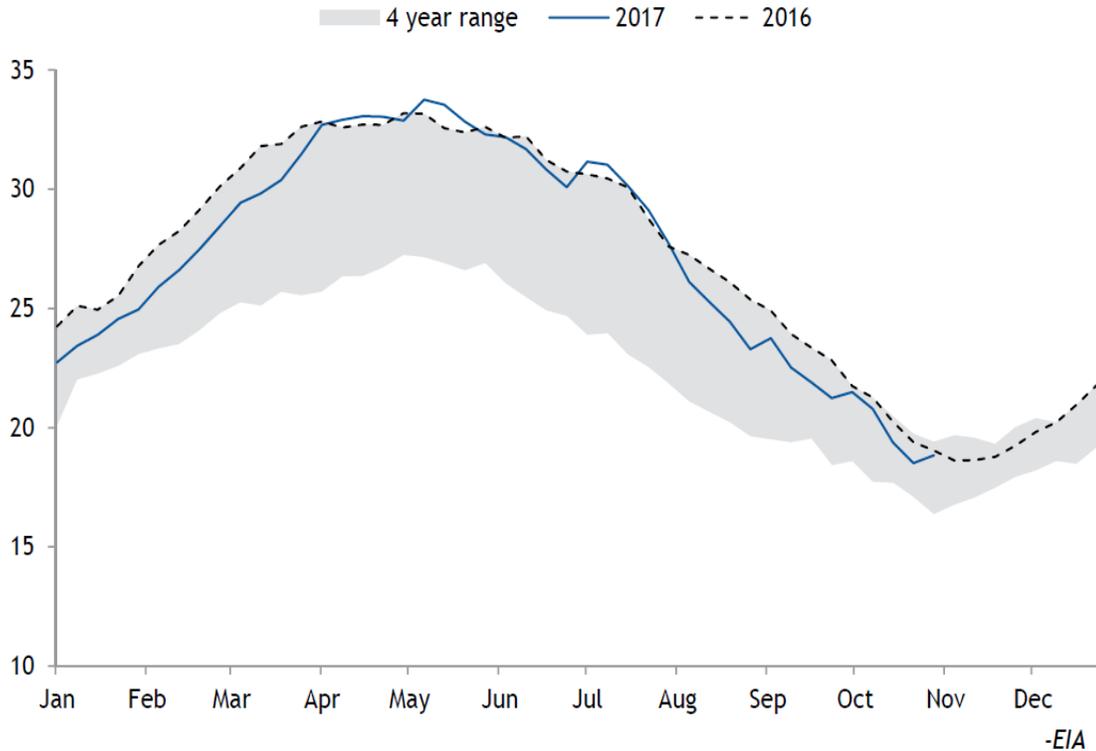
East Coast (PADD 1) Imports of Asphalt and Road Oil ('000 bl)



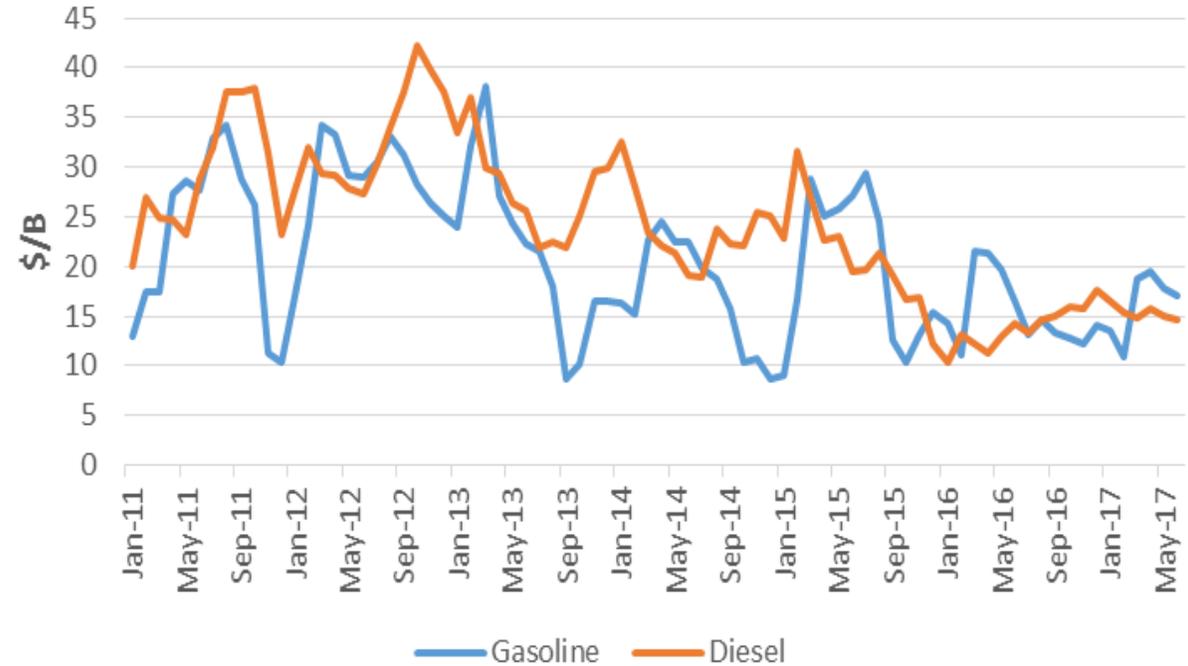
# Asphalt Inventories Cap Price Gains

## US asphalt stocks

mn bl



## Clean Product Crack Spreads



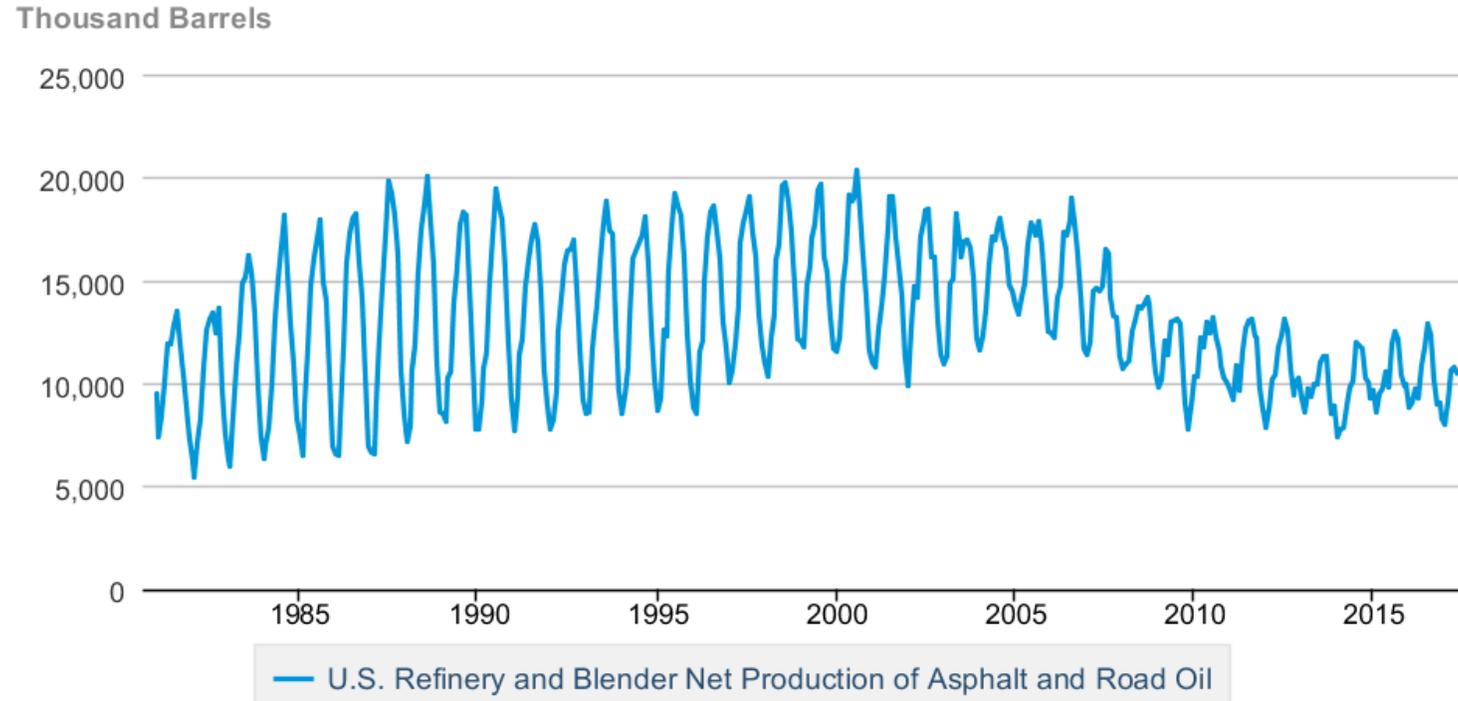
**2011-2014; mogas 25 \$/B, Diesel 32 \$/B**

**2015-2017; mogas 17 \$/B, Diesel 16 \$/B**

- Ongoing high asphalt inventories keep downward pressure on retail asphalt price
  - Cheaper priced inventory allows for “sell forward” lag
  - Retail-Wholesale spread collapses from traditional 70-100 \$/T to 25-50 \$/T
- Wholesale upward price pressure driven by narrow light-heavy crude spread & weakened gasoline/distillate crack spreads

# Asphalt Production in The US

## U.S. Refinery and Blender Net Production of Asphalt and Road Oil



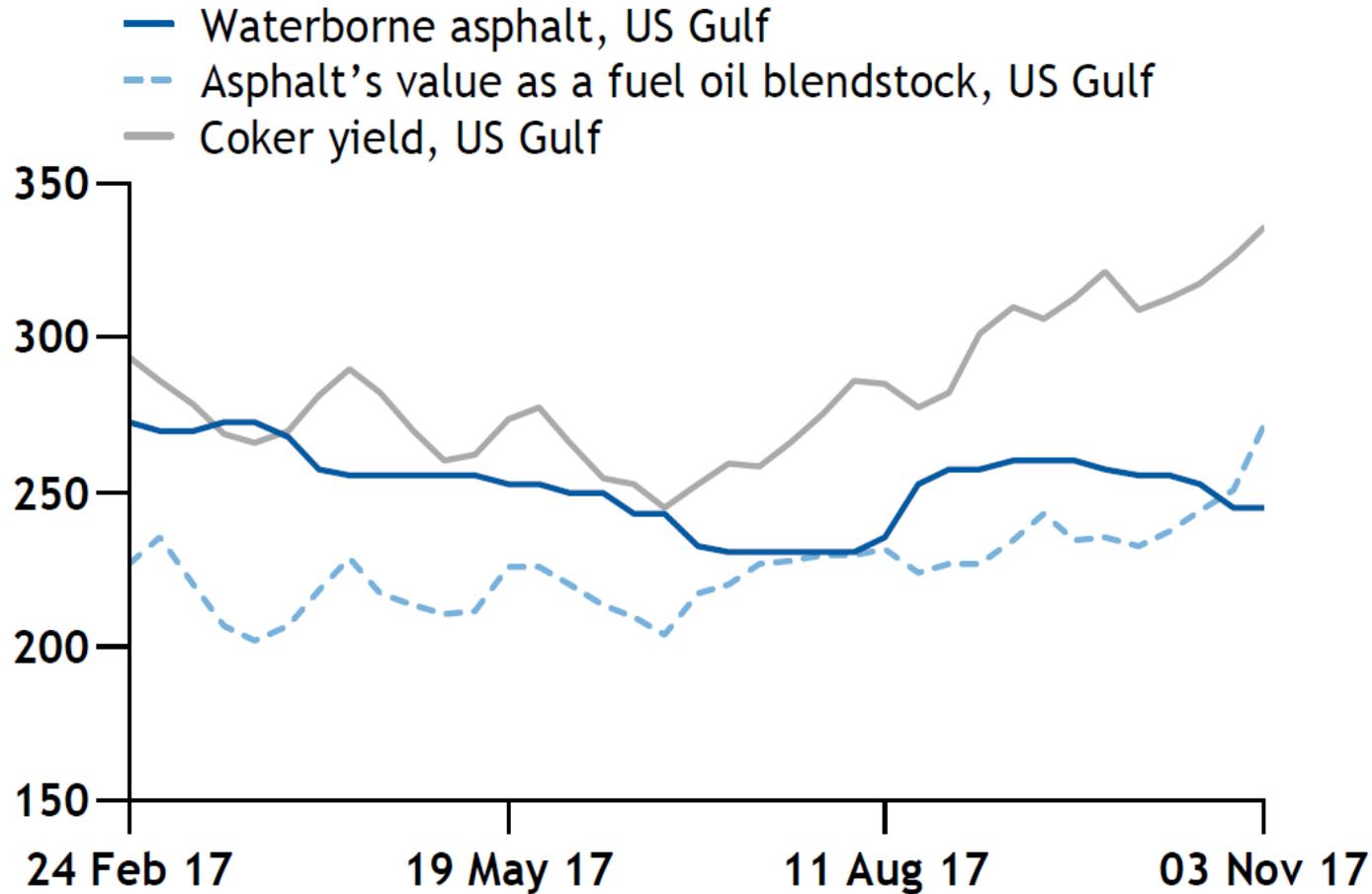
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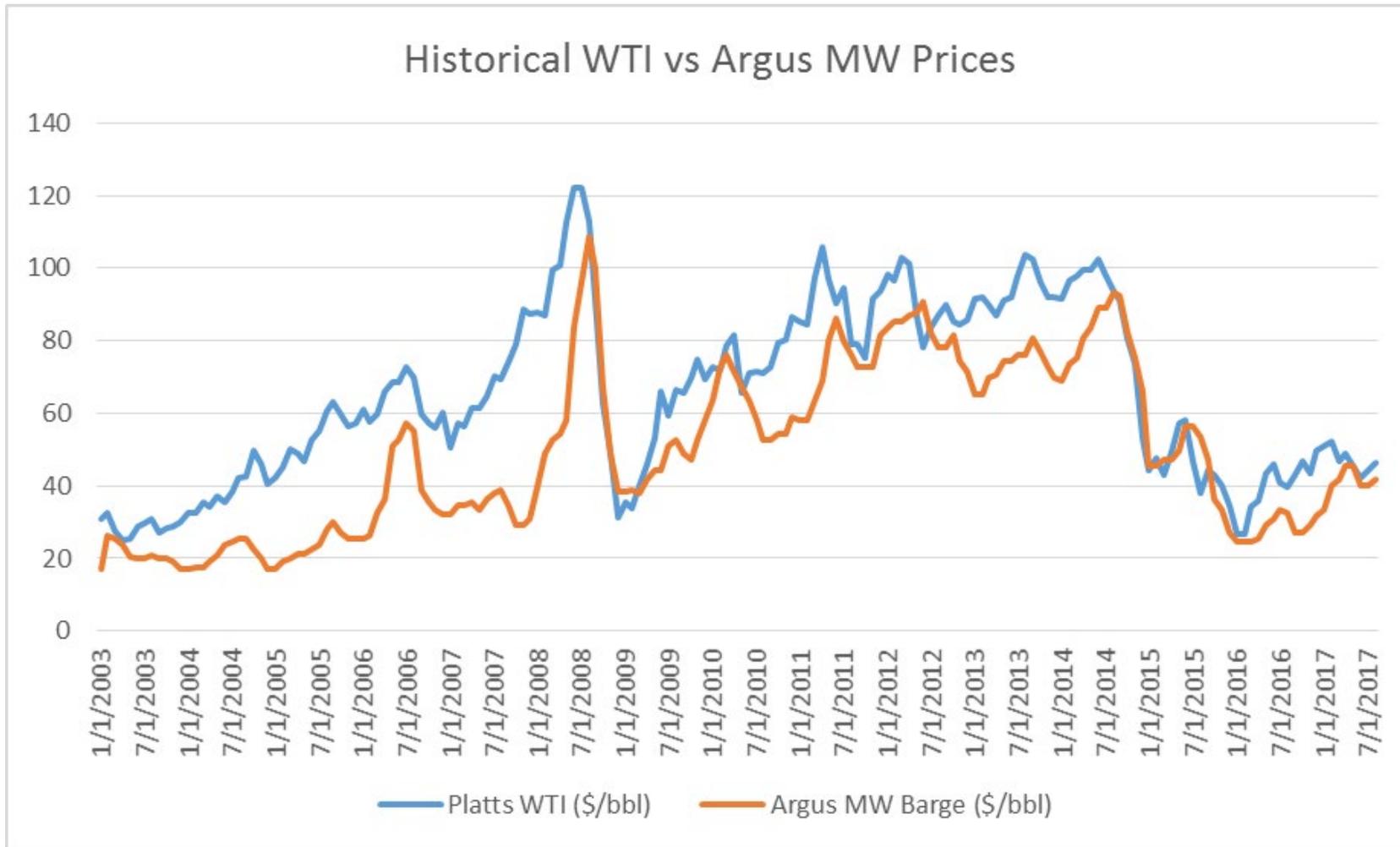
# Asphalt Price Driven by Alternative Molecule Use

## Monetizing vacuum residue



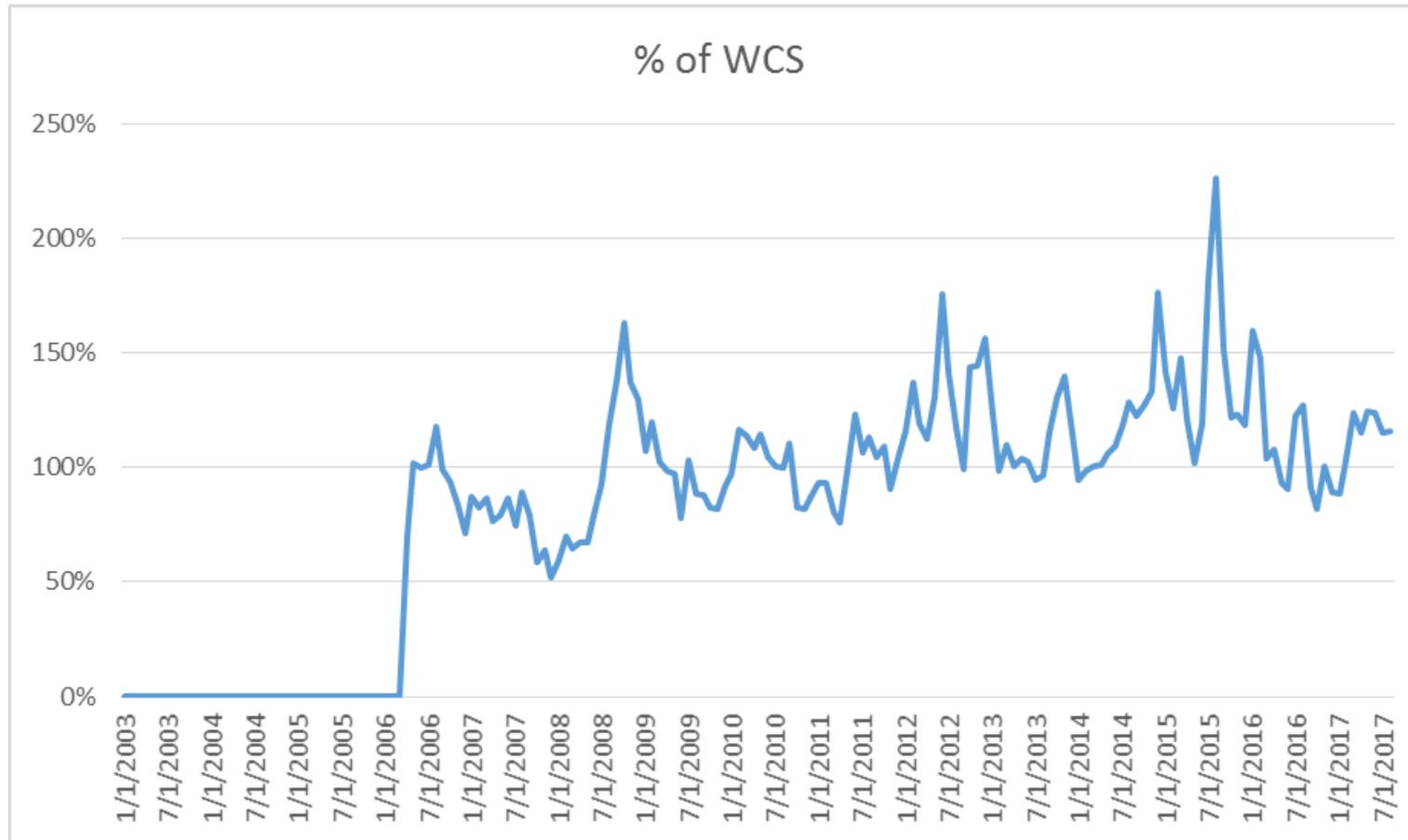
- Asphalt value to producer has floor of 80 to 90 % of heavy crude or 170 to 190 \$/T
- Asphalt value in line with gasoline/diesel at 130 % of crude, or 273 \$/T

# Asphalt Price vs Crude



\*Data from Argus + Platts

# Asphalt Prices as a Percent of Heavy Crude



\*Data from Argus + Platts

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- Asphalt base supply most reliable from intercontinental US or Canadian west
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  - Good base of quality heavy crude available for processing into base grade Asphalt
- Asphalt price movement reflects crude price changes with relative value more reflective of oil product alternatives (gasoline & diesel)
- Road Paving using asphalt as a key component will reflect volatility in price & higher prices than historical
  - Greater implication on Hot Mix vs Emulsion products given asphalt reliance as core component

# BACK UP

## ASPHALT MARKET CONDITIONS



# Imports are Significantly Increasing putting Additional Pressure on Inventory Levels & Prices

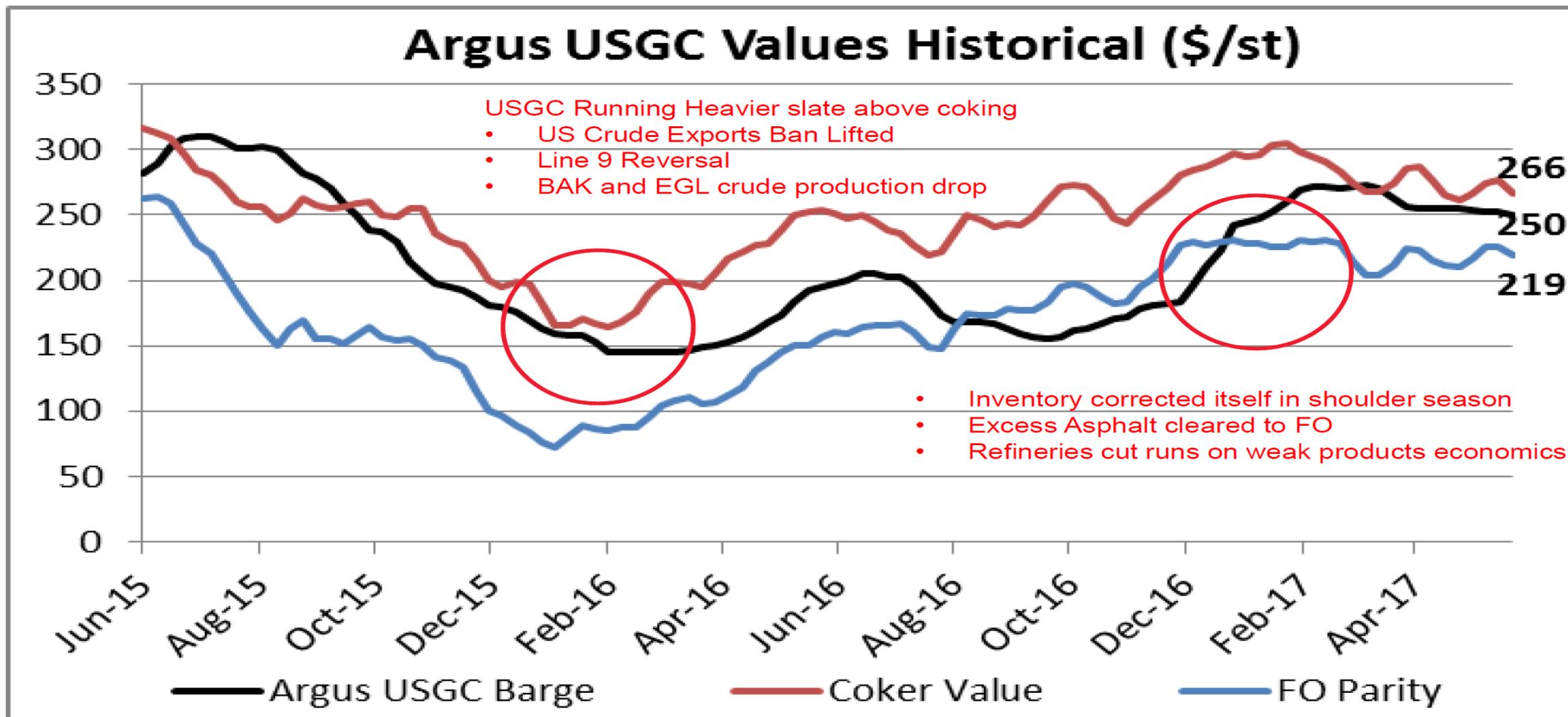
East Coast (PADD 1) Imports of Asphalt and Road Oil (Thousand Barrels)								
Year	Jan	Feb	Mar	Apr	May	Jun	Jul	YTD Thru July
<b>Avg 2010-2014</b>	231	205	231	377	580	634	543	2799
<b>2015</b>	377	371	713	496	545	1,008	782	4292
<b>2016</b>	387	612	752	661	841	1,011	798	5062

PADD 1 Imports from Venezuela								
Year	Jan	Feb	Mar	Apr	May	Jun	Jul	YTD Thru July
<b>Avg 2010-2014</b>	54	54	52	103	54	56	42	415
<b>2015</b>	160	87	89	157	33	145	37	708
<b>2016</b>	33	87	173	191	167	112	154	917

PADD 1 Imports from Canada								
Year	Jan	Feb	Mar	Apr	May	Jun	Jul	YTD Thru July
<b>Avg 2010-2014</b>	181	155	183	281	530	554	436	2320
<b>2015</b>	188	284	525	339	480	630	465	2911
<b>2016</b>	354	462	515	440	600	763	545	3679

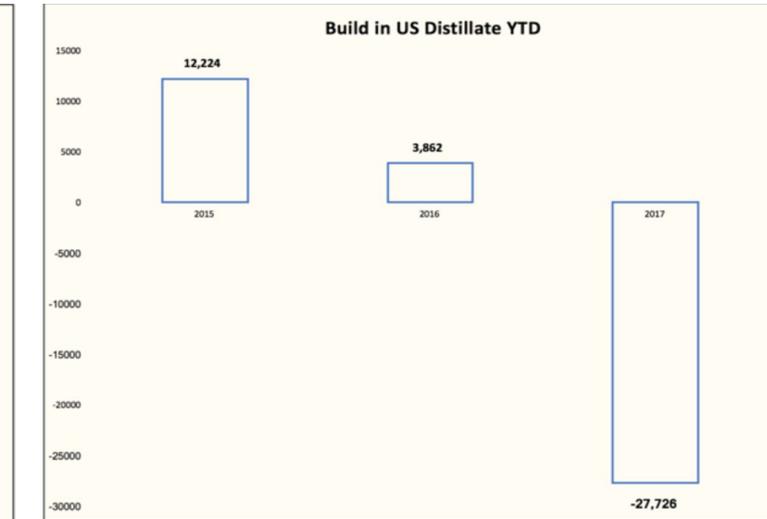
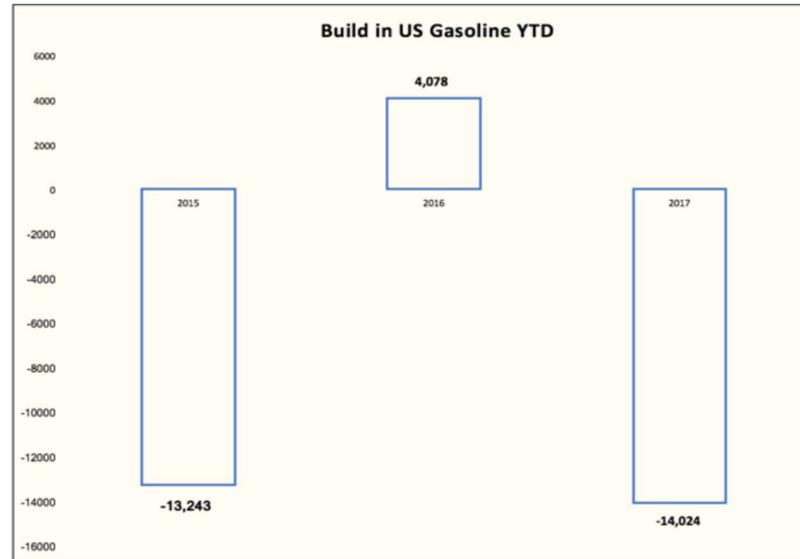
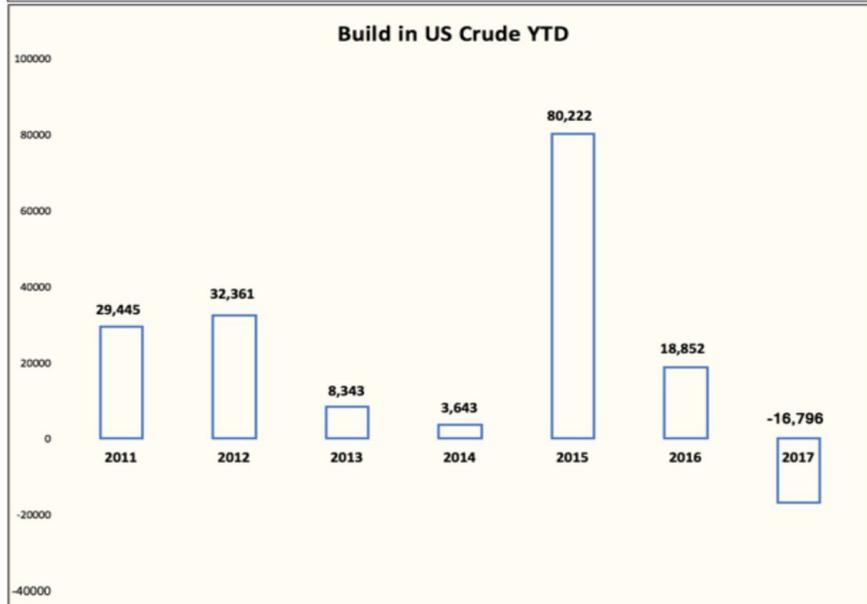
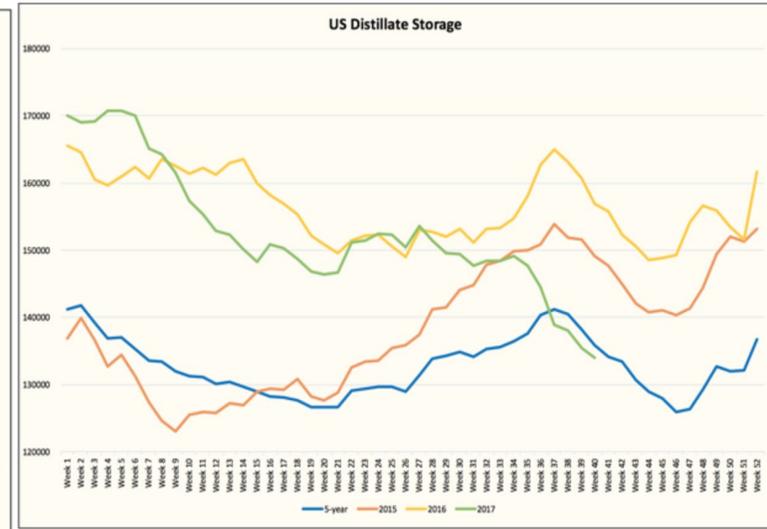
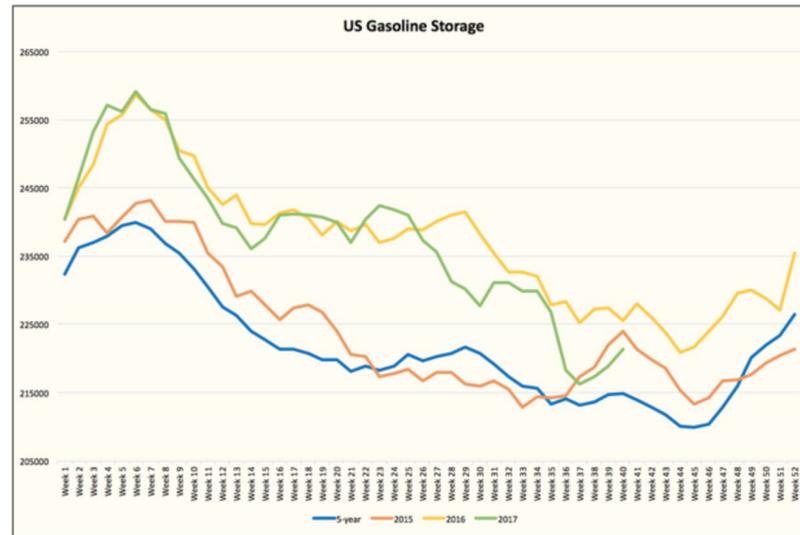
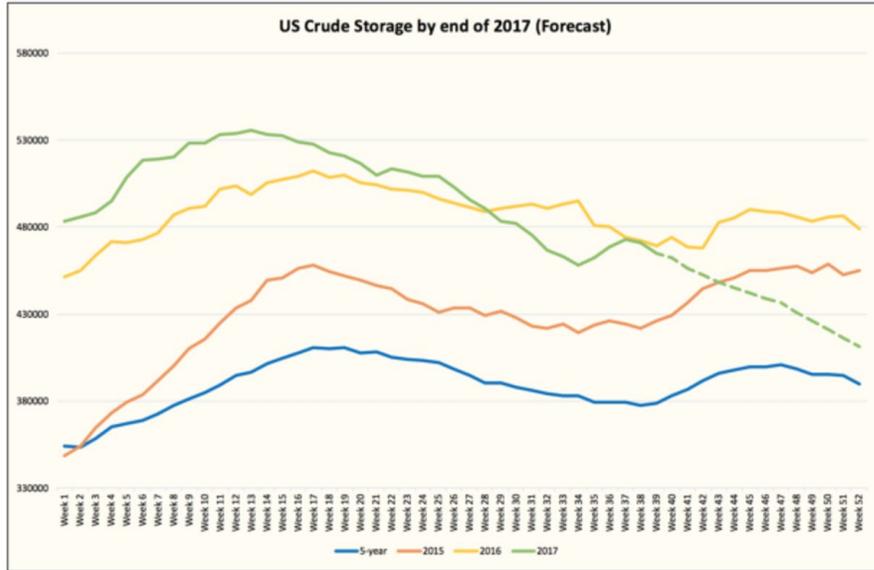
- Imports up almost 20% vs. same period LY & +80% vs. 5 yr avg
- Venezuelan bbls are heavily discounted & up 30% vs. same period LY and 2x 5 yr avg
- Canadian bbls up ~25% vs LY & ~60% vs 5yr avg
- Similar pace for the balance of the year will result in a Yr over Yr increase of ~240kt into PADD I
- Increase in imports offsetting PADD I demand growth

# Asphalt Relative Value in USGC

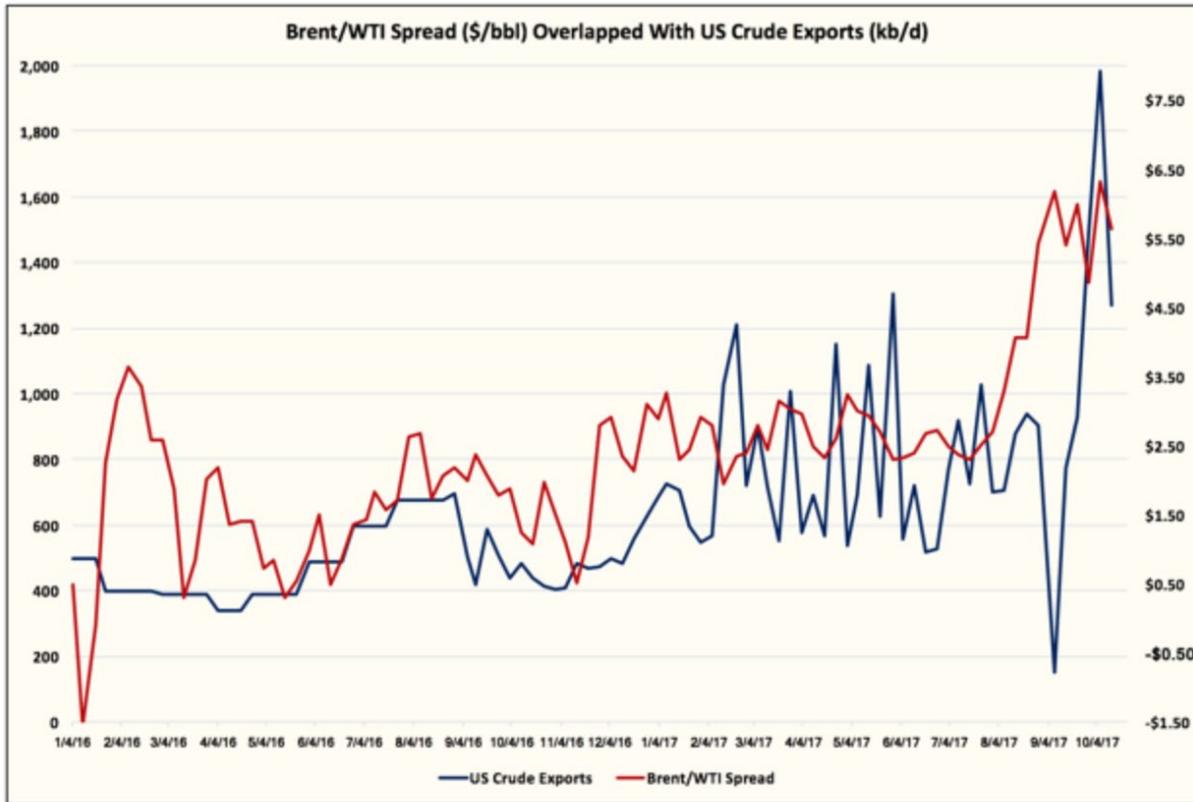


- **Supply length reduces Asphalt Prices to below FO alternate disposition**

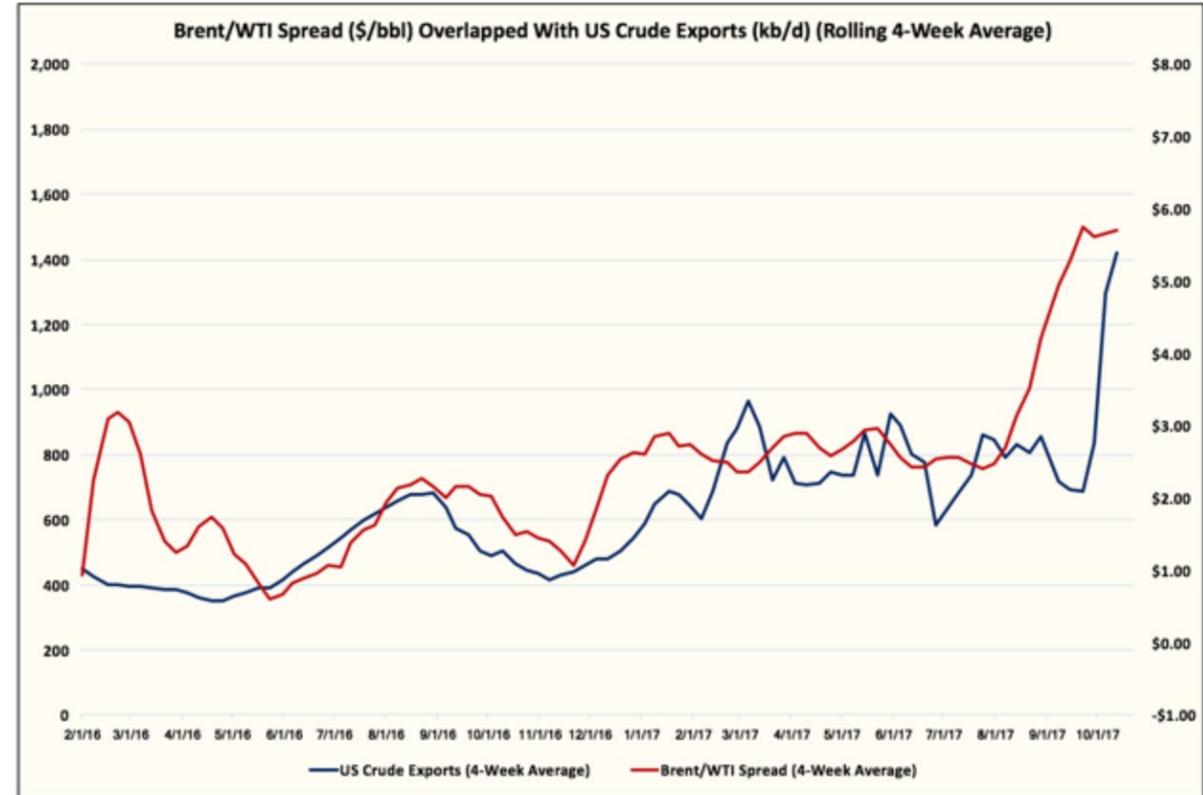
# Inventory Positioning per EIA



# Crude Movements



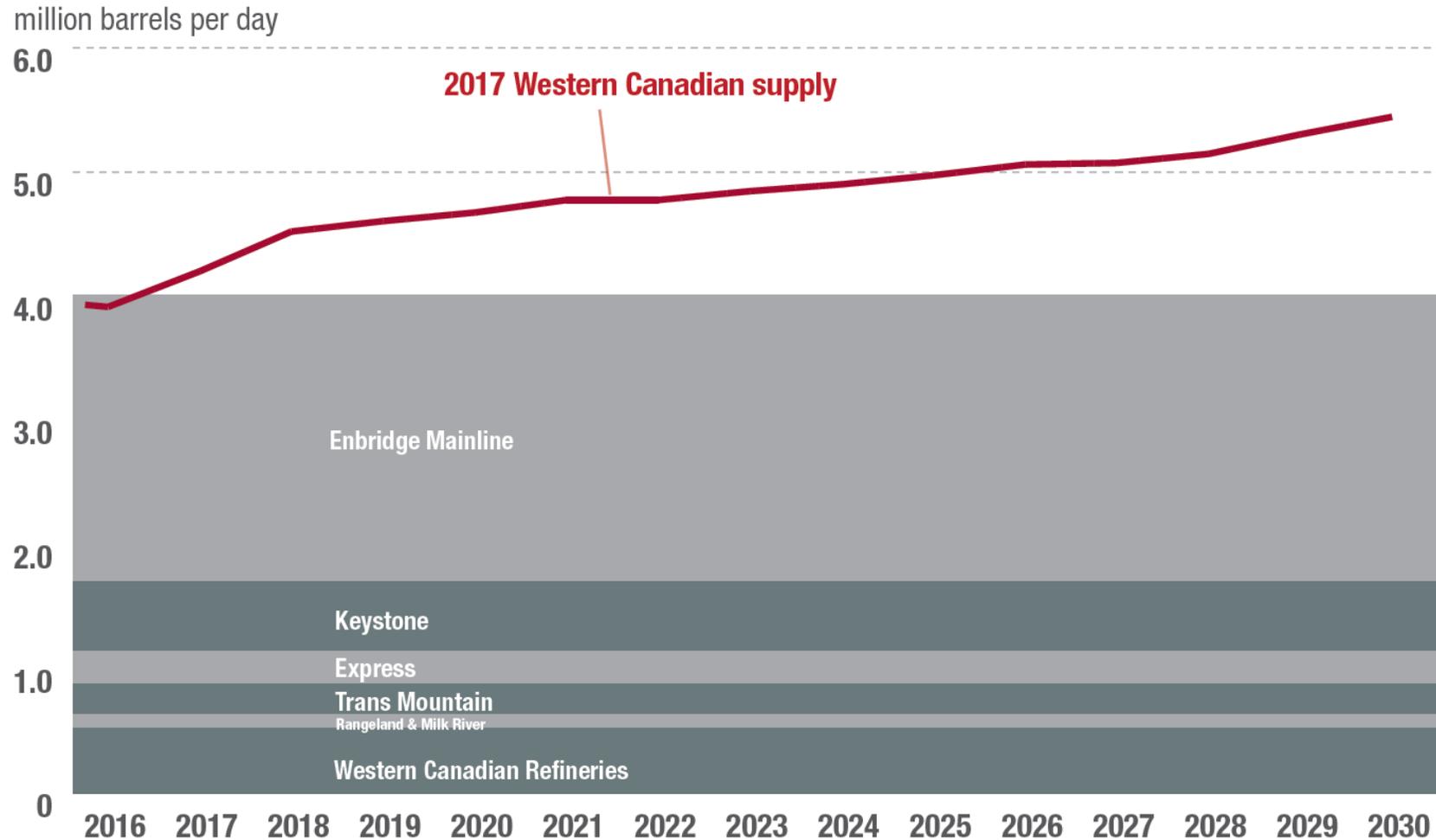
Source: EIA, HFI Research



Source: EIA, HFI Research

# Canadian Crude Transportation Balance

**FIGURE 4.4 EXISTING TAKEAWAY CAPACITY FROM WESTERN CANADA VS. SUPPLY FORECAST**



Capacity shown can be reduced by any extraordinary and temporary operating and physical constraints.

- Planned Oil Sands expansions in 2018 plus 2017 recover post Ft. Mac fire covered by 0.5 MBD crude by rail
- With crude by rail incremental transport cost is 4 to 6 \$/B
- Base pipeline transportation is
  - 3-5 \$/B to Midwest
  - 5-8 \$/B to USGC

# Canadian and U.S. Crude Oil Pipelines and Refineries - 2017



CANADA'S OIL & NATURAL GAS PRODUCERS

FOR INFORMATION CONTACT: (403) 267-1141 / CAPP.CA

2016 CANADIAN CRUDE OIL PRODUCTION		
	000 m <sup>3</sup> /d	000 b/d
British Columbia	10	61
Alberta	457	3,066
Saskatchewan	73	461
Manitoba	6	40
Northwest Territories	1	9
<b>Western Canada</b>	<b>578</b>	<b>3,637</b>
Eastern Canada	34	213
<b>Total Canada</b>	<b>612</b>	<b>3,850</b>

NEWFOUNDLAND & LABRADOR	
Silver Range (Come by Chance)	115

### PIPELINE TOLLS FOR LIGHT OIL (US\$ PER BARREL)

Route	Toll
Edmonton to	
Burnaby (Trans Mountain)	2.00
Anacortes (Trans Mountain/Puget)	2.30
Sarnia (Enbridge)	4.50
Montréal (Enbridge)	6.10
Chicago (Enbridge)	4.10
Cushing (Enbridge)	5.25*-6.50
Wood River (Enbridge/Mustang/Capwood)	5.25
USGC (Enbridge/Seaway)	6.30† - 8.85§
Hardisty to	
Guernsey (Express/Platte)	3.20*
Wood River (Express/Platte)	4.90*
Wood River (Keystone)	4.40** - 5.30
USGC (Keystone/Gulf Coast Ext.)	7.15§ - 11.55
USEC to Montréal (Portland/Montréal)	0.50
St. James to Wood River (Capline/Capwood)	1.30

### PIPELINE TOLLS FOR HEAVY OIL (US\$ PER BARREL)

Route	Toll
Hardisty to:	
Chicago (Enbridge)	4.30
Cushing (Enbridge)	5.45*-6.70
Cushing (Keystone)	6.10** - 6.85
Wood River (Enbridge/Mustang/Capwood)	5.85
Wood River (Keystone)	5.05** - 6.00
Wood River (Express/Platte)	5.50*
USGC (Enbridge/Seaway)	7.00† - 9.05§
USGC (Keystone/Gulf Coast Ext.)	7.80§ - 12.55

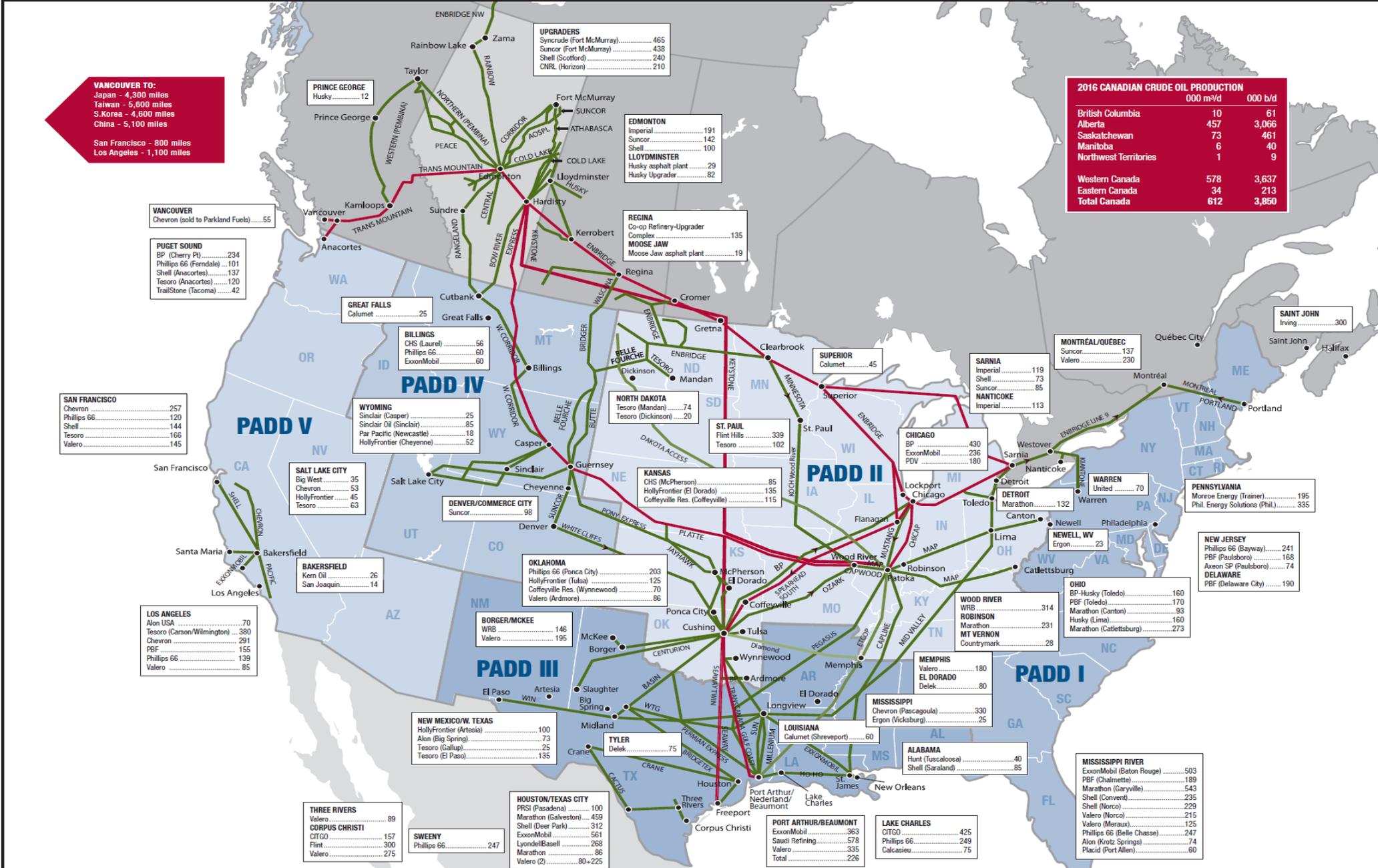
Notes: 1) Assumed exchange rate = 0.73 US\$ / 1CS (May 2017 average)  
 2) Tolls rounded to nearest 5 cents  
 3) Tolls in effect July 1, 2017  
 \* 10-year committed toll  
 \*\* 20-year committed toll  
 † First Open Season, 15-year, 50,000+ b/d committed volumes  
 § International Joint Toll

Crude Refining Capacities as at June 1, 2017 (thousand barrels per day)

**PADD** Petroleum Administration for Defense District

**Major Existing Crude Oil Pipelines carrying Canadian crude oil**

**Selected Other Crude Oil Pipelines**



UPGRADERS	
Syncrude (Fort McMurray)	465
Suncor (Fort McMurray)	438
Shell (Scotford)	240
CNRL (Horizon)	210

EDMONTON	
Imperial	191
Suncor	142
Shell	100
LLOYDMINSTER	
Husky asphalt plant	29
Husky Upgrader	82

REGINA	
Co-op Refinery-Upgrader	135
MOOSE JAW	
Moose Jaw asphalt plant	19

NORTH DAKOTA	
Tesoro (Mandan)	74
Tesoro (Dickinson)	20

KANSAS	
CHS (McPherson)	85
HollyFrontier (El Dorado)	135
Coffeyville Res. (Coffeyville)	115

OKLAHOMA	
Phillips 66 (Ponca City)	203
HollyFrontier (Tulsa)	125
Coffeyville Res. (Wynnewood)	70
Valero (Ardmore)	86

BORGER/MCKEE	
WRB	146
Valero	195

NEW MEXICO/W. TEXAS	
HollyFrontier (Artesia)	100
Alon (Big Spring)	73
Tesoro (Gallup)	25
Tesoro (El Paso)	135

HOUSTON/TEXAS CITY	
PRSI (Pasadena)	100
Marathon (Galveston)	459
Shell (Deer Park)	312
ExxonMobil	561
LyondellBasell	268
Marathon	86
Valero (2)	80+225

PORT ARTHUR/BEAUMONT	
ExxonMobil	363
Saudi Refining	578
Valero	335
Calcasieu	75
Total	226

LAKE CHARLES	
Phillips 66	425
Phillips 66	249
Valero	86
Calcasieu	75

MISSISSIPPI RIVER	
ExxonMobil (Baton Rouge)	503
PBF (Chalmette)	189
Marathon (Garyville)	543
Shell (Convent)	235
Shell (Norco)	229
Valero (Norco)	215
Valero (Meroux)	125
Phillips 66 (Belle Chasse)	247
Alon (Krotz Springs)	74
Placid (Port Allen)	60

VANCOUVER TO:	
Japan	4,300 miles
Taiwan	5,600 miles
S.Korea	4,600 miles
China	5,100 miles
San Francisco	800 miles
Los Angeles	1,100 miles

VANCOUVER	
Chevron (sold to Parkland Fuels)	55

PUGET SOUND	
BP (Cherry Pt.)	234
Phillips 66 (Ferndale)	101
Shell (Anacortes)	137
Tesoro (Anacortes)	120
TrailStone (Tacoma)	42

SAN FRANCISCO	
Chevron	257
Phillips 66	120
Shell	144
Tesoro	166
Valero	145

SALT LAKE CITY	
Big West	35
Chevron	53
HollyFrontier	45
Tesoro	63

BAKERSFIELD	
Kern Oil	26
San Joaquin	14

LOS ANGELES	
Alon USA	70
Tesoro (Carson/Wilmington)	380
Chevron	291
PBF	155
Phillips 66	139
Valero	85

THREE RIVERS	
Valero	89
CORPUS CHRISTI	
CITGO	157
Flint	300
Valero	275

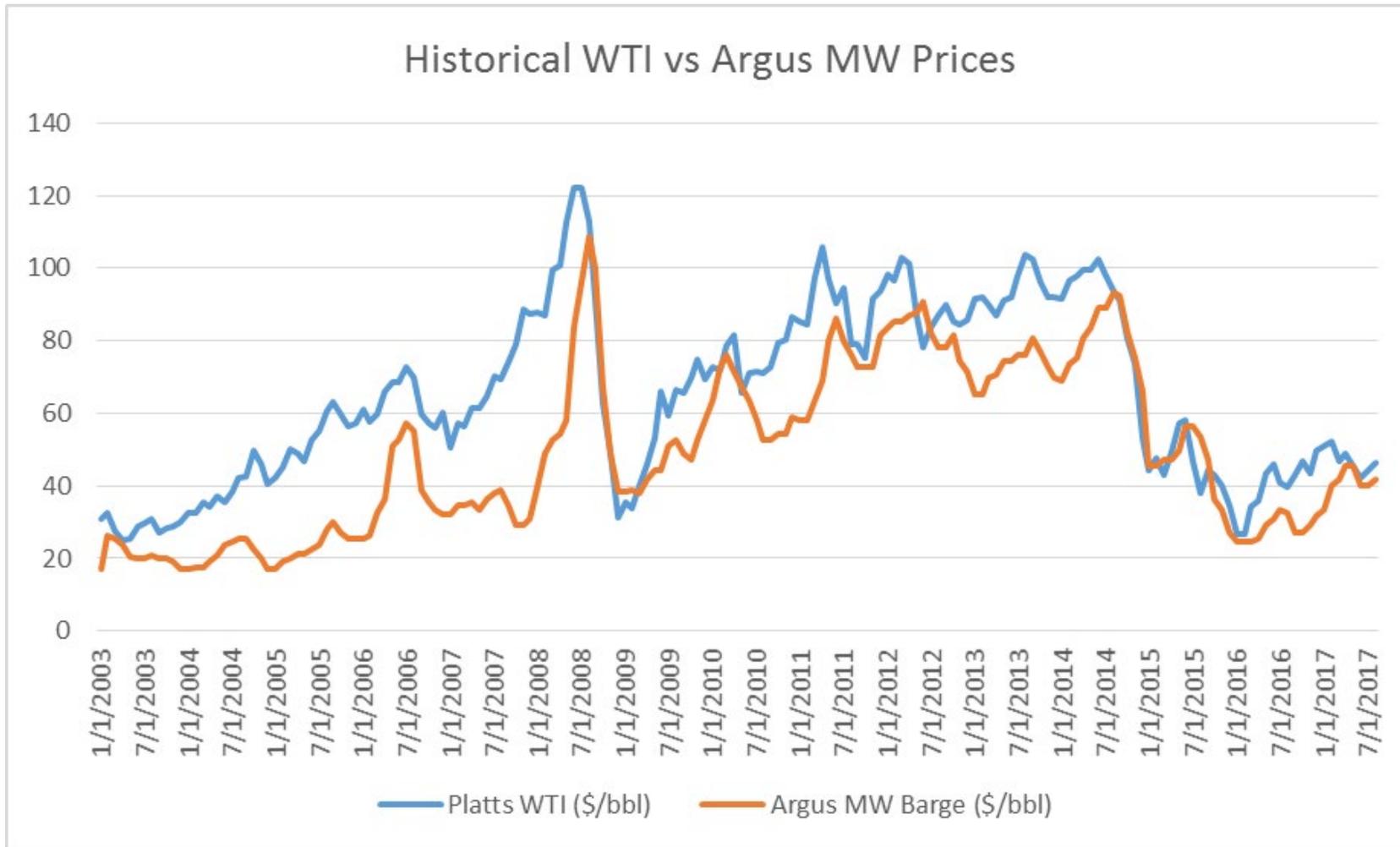
SWEENEY	
Phillips 66	247

# BACK UP

ASPHALT MARKET CONDITIONS

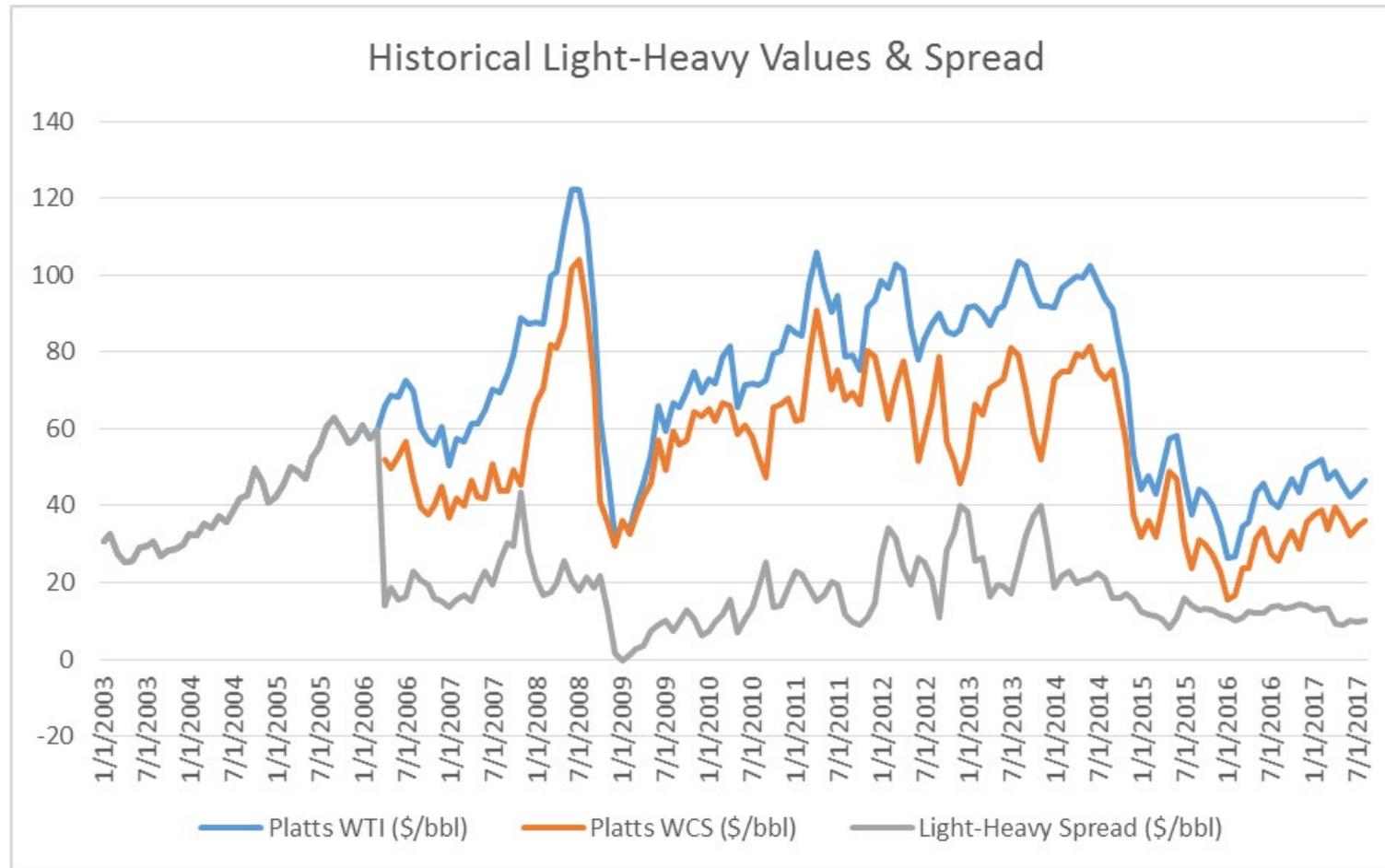
ExxonMobil slide update (Argus base)

# Asphalt Price vs Crude



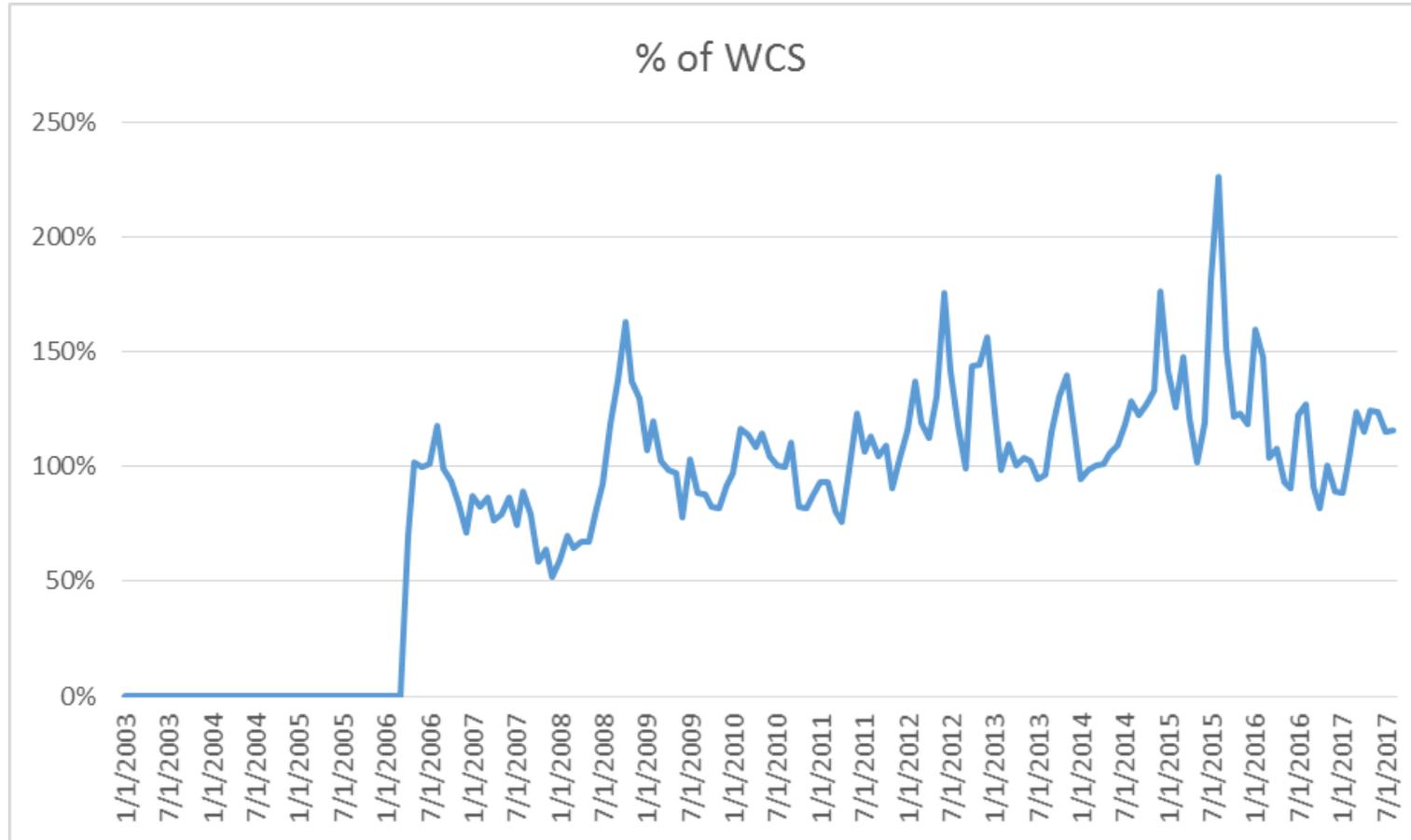
\*Data from Argus + Platts

# Light Heavy Spread



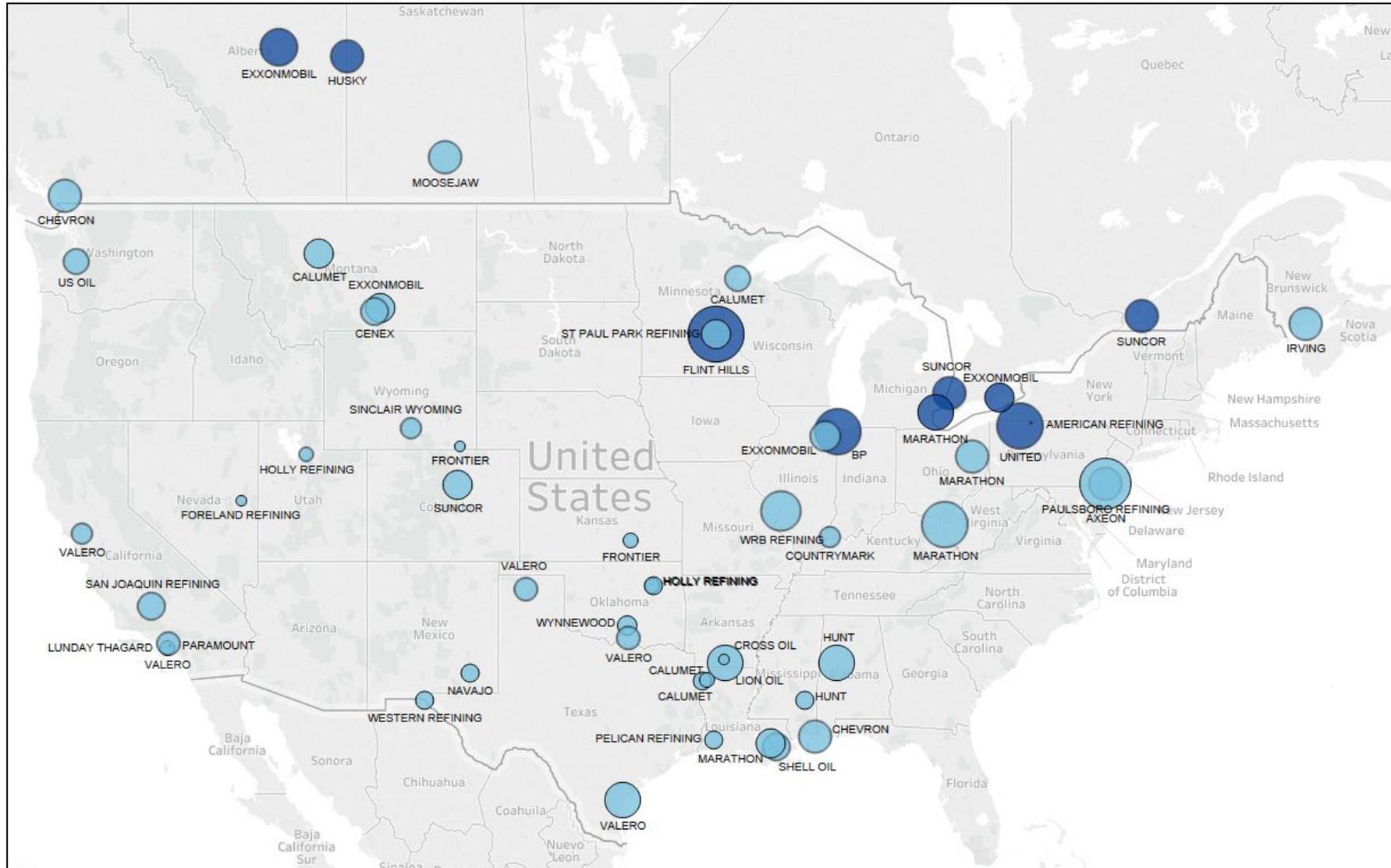
\*Data from Argus + Platts

# Asphalt Prices as a Percent of Heavy Crude



\*Data from Argus + Platts

# Americas Asphalt Suppliers



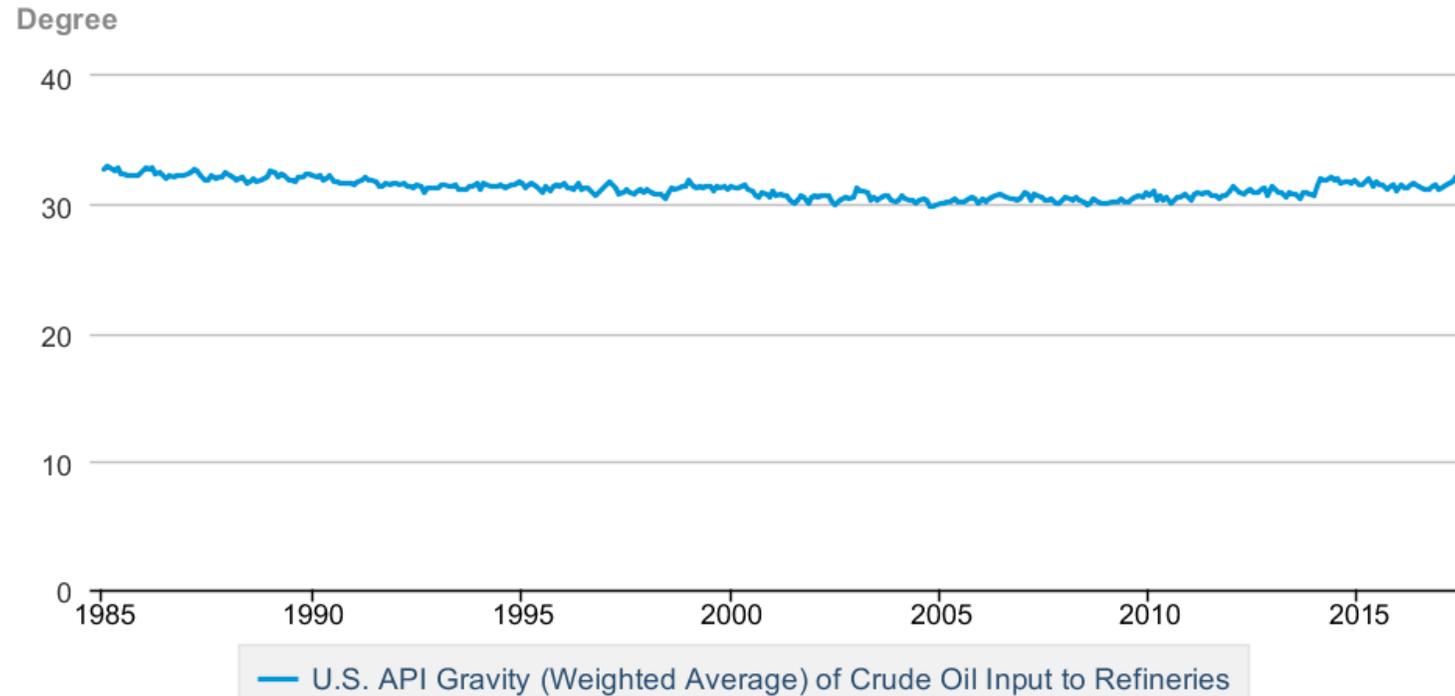
# American Asphalt Refinery Network



— Argus Consulting

# API of crude processed in US refineries

U.S. API Gravity (Weighted Average) of Crude Oil Input to Refineries



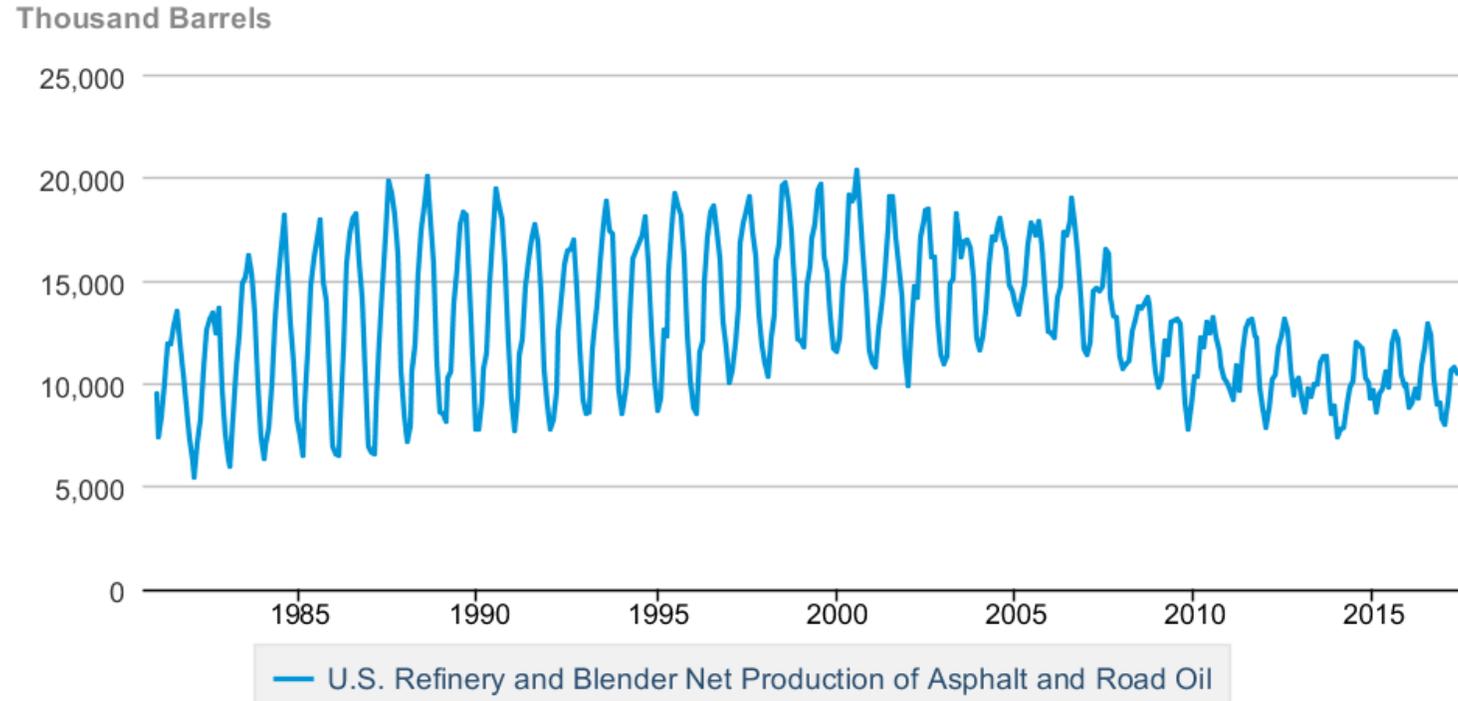
 Source: U.S. Energy Information Administration

Website:

<https://www.eia.gov/dnav/pet/hist/LeafHandler.ashx?n=PET&s=MCRAPUS2&f=M>

# Asphalt Production in The US

## U.S. Refinery and Blender Net Production of Asphalt and Road Oil



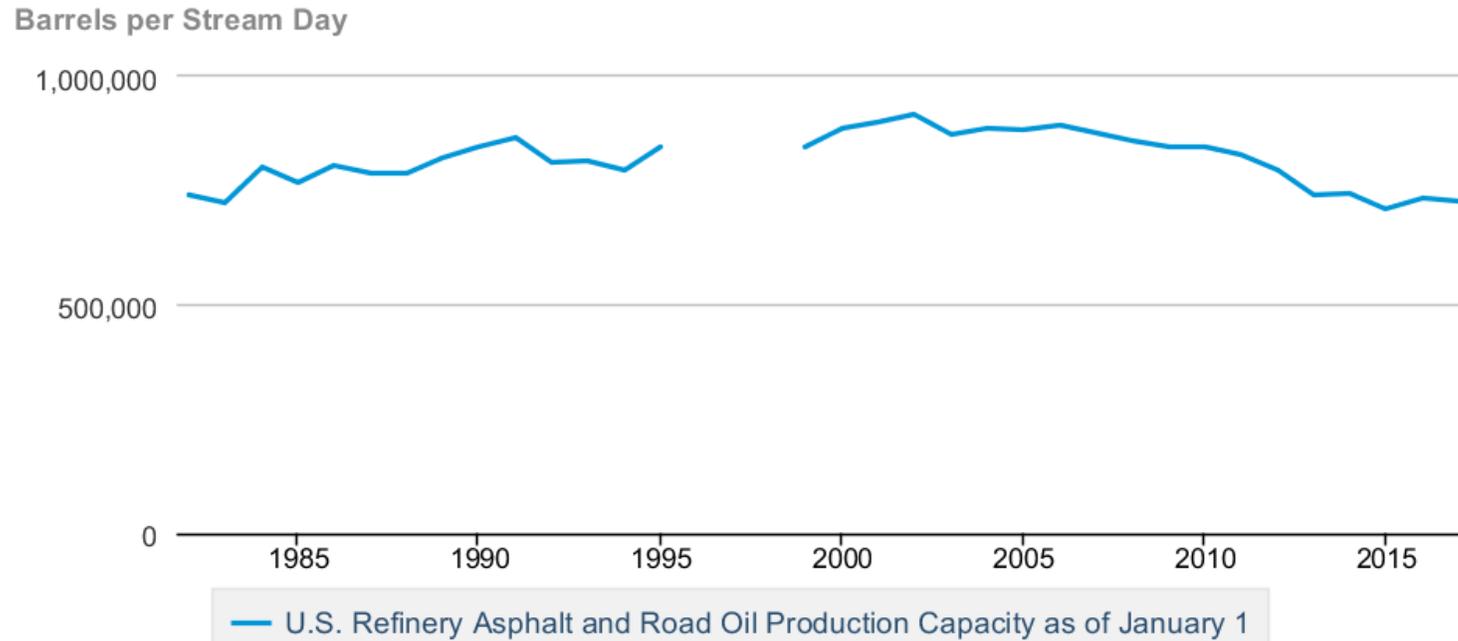
 Source: U.S. Energy Information Administration

Website:

<https://www.eia.gov/dnav/pet/hist/LeafHandler.ashx?n=PET&s=MAPRPUS1&f=M>

# Asphalt Production Capacity (b/d)

U.S. Refinery Asphalt and Road Oil Production Capacity as of January 1



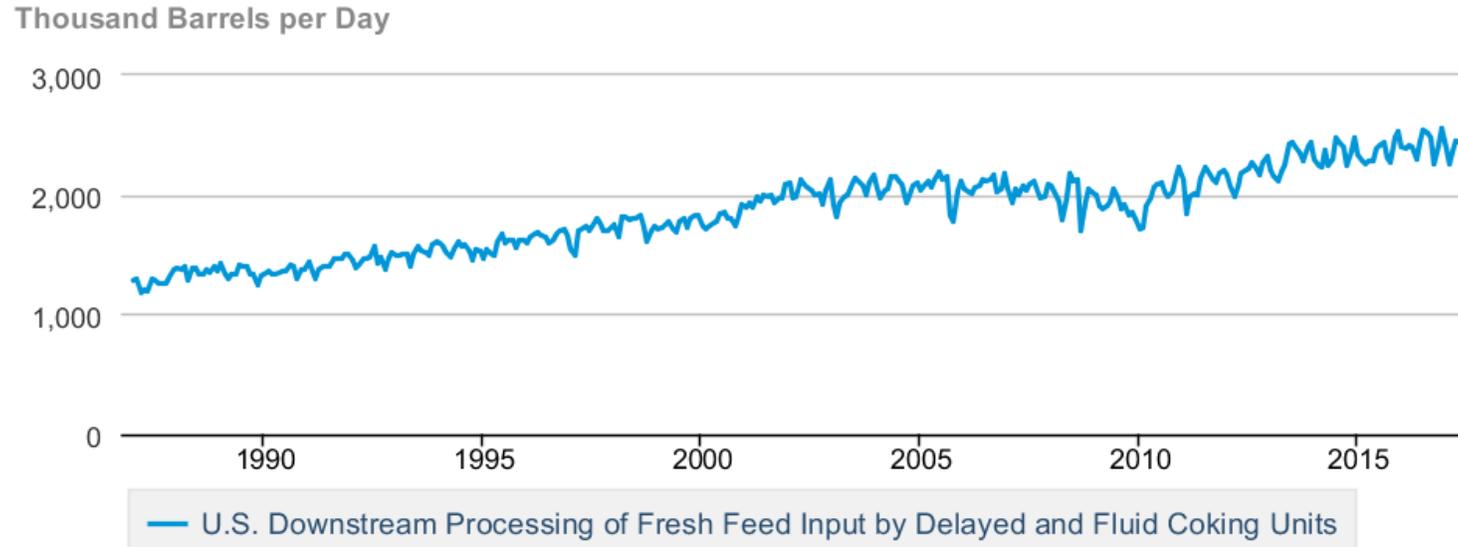
Source: U.S. Energy Information Administration

Website:

<https://www.eia.gov/dnav/pet/hist/LeafHandler.ashx?n=PET&s=8 NA 8PP NUS 5&f=A>

# US Coking Utilization

## U.S. Downstream Processing of Fresh Feed Input by Delayed and Fluid Coking Units



Source: U.S. Energy Information Administration

Website:

<https://www.eia.gov/dnav/pet/hist/LeafHandler.ashx?n=PET&s=MCRDFUS2&f=M>