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Oil Sand Imports to PADD III, WTI Discounts and Logistics, and Rising US Production

How does the lack of clarity in Washington create distortions and uncertainty in oil markets and logistics in the United States?

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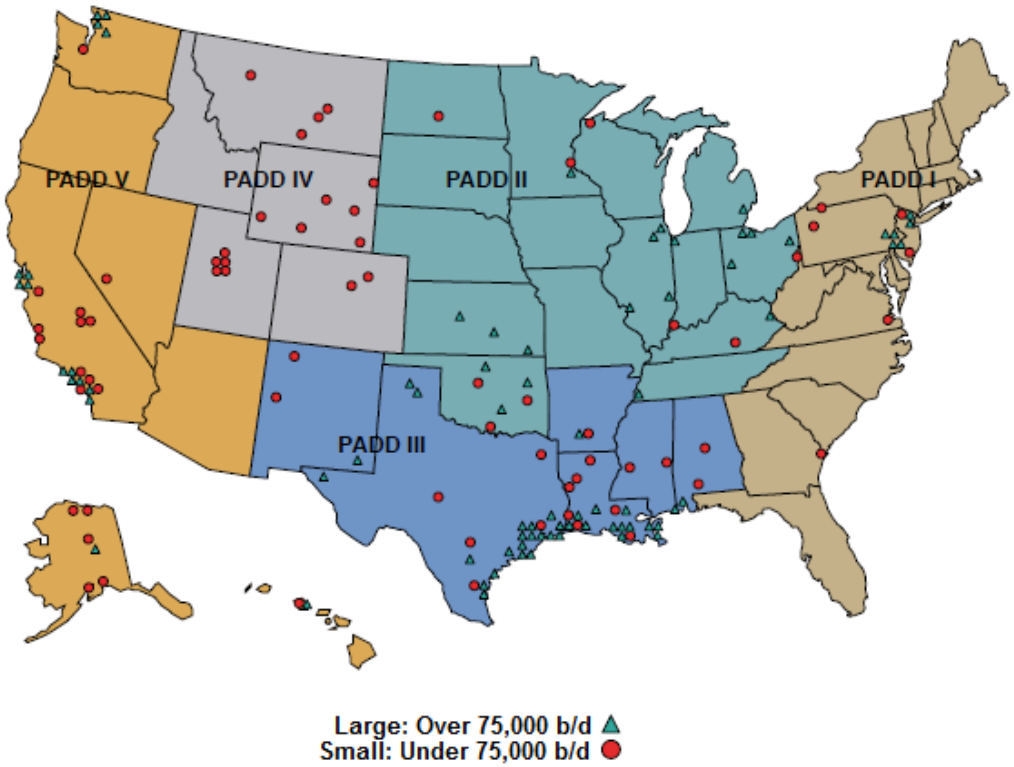
Calgary, Alberta

- Nature of the US refining sector and increased heavy processing capacity
- Keystone XL and the potential for increased quantities of diluted bitumen into PADD III
- Rising production from the Bakken shale formation in North Dakota and Rocky Mountains and the lack of take-away infrastructure
- Logistical problems of WTI, its connection to rising Bakken production and increased Canadian imports - need for projects like Keystone XL

Overview of the U.S. Refining Sector



Source: Map from NPRA United States Refining and Storage Capacity Report, August 2010.

- End of price controls removed small inefficient refineries in favor of expansion of existing refineries
- As heavy imports have grown, refineries have invested in heavy processing capacity – U.S. has among the highest refining complexity in the world with PADD III higher than average in the US

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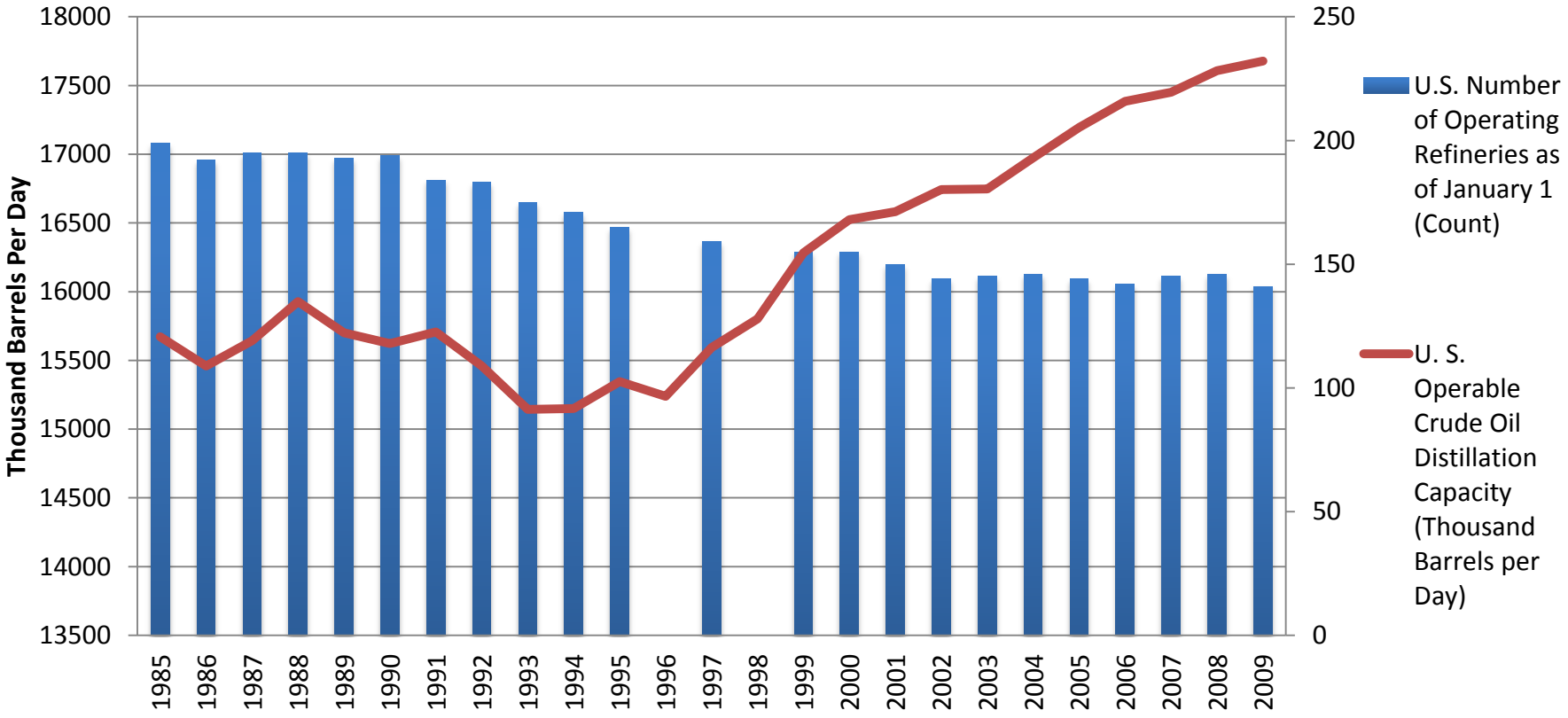
Refinery Capacity vs. Number of Operating Plants



Source: EIA Data

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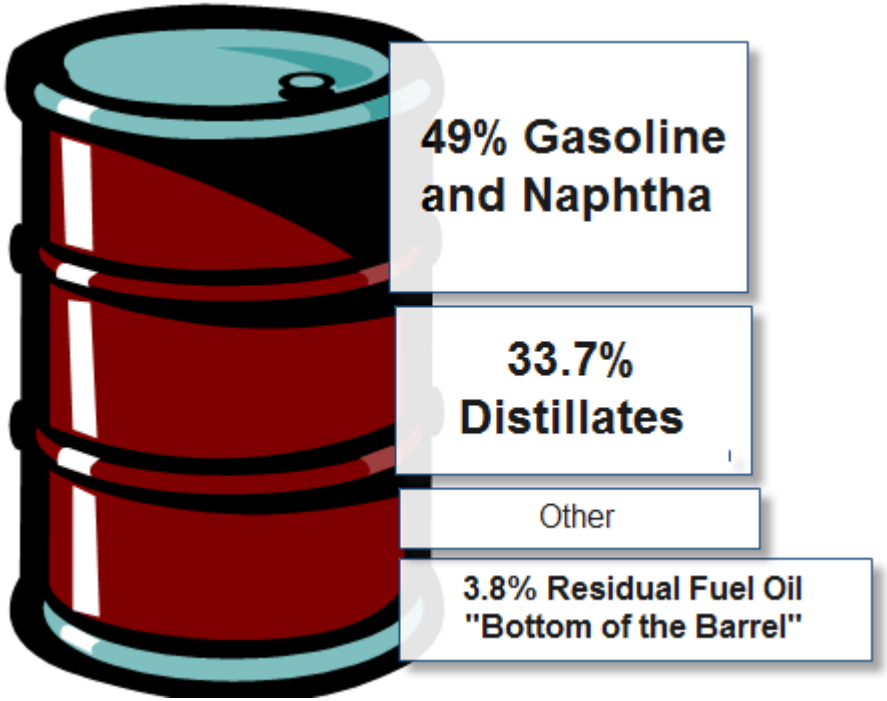
Refining Basics

- The higher the API gravity, the lighter the crude→ easier to refine, greater proportion of higher quality products such as transportation fuels

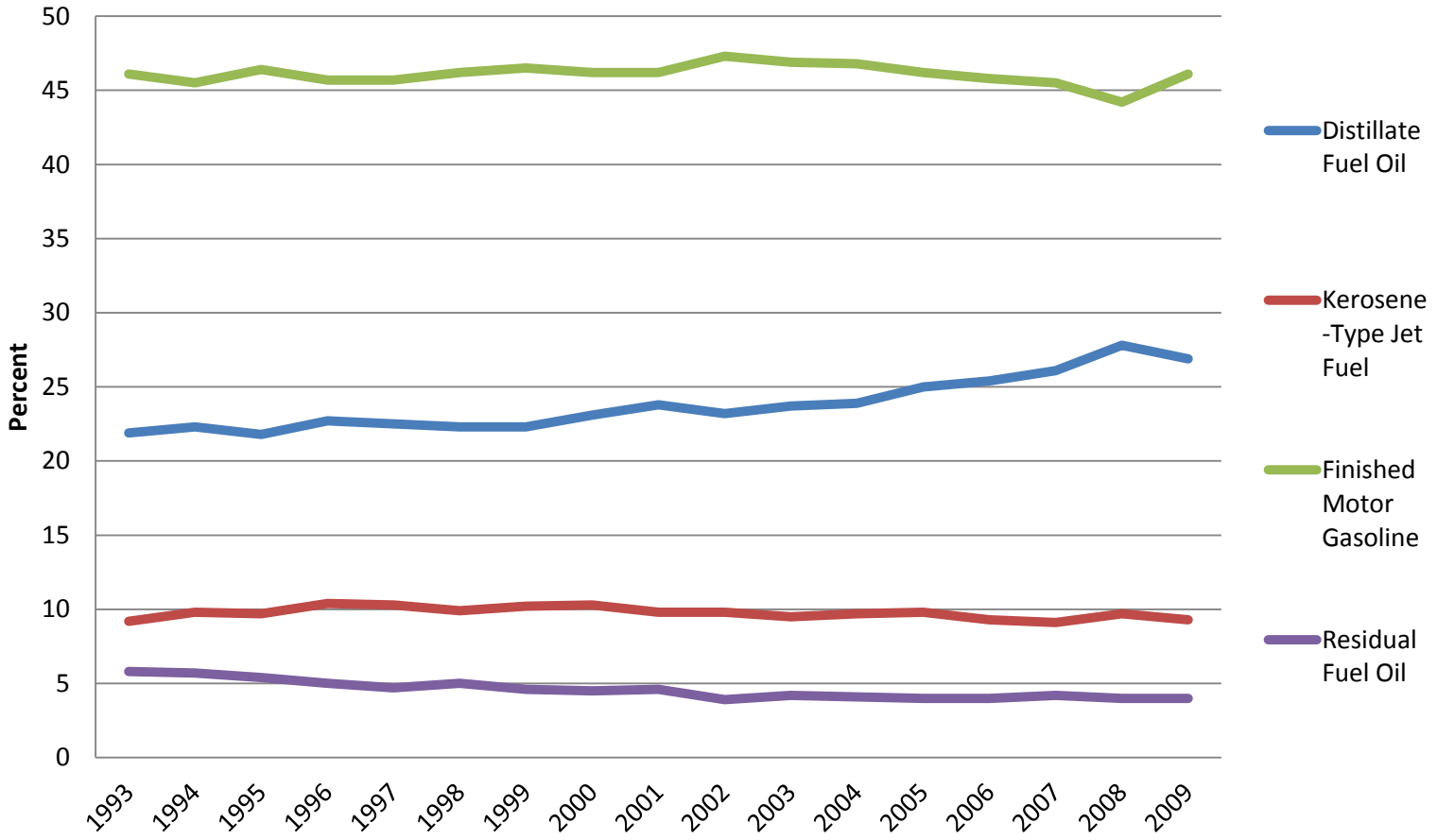
- Heavy Crude 18 degrees
- Light Crude 36 degrees
- Gasoline 60 degrees

- Processing heavy crudes requires significant capital investment



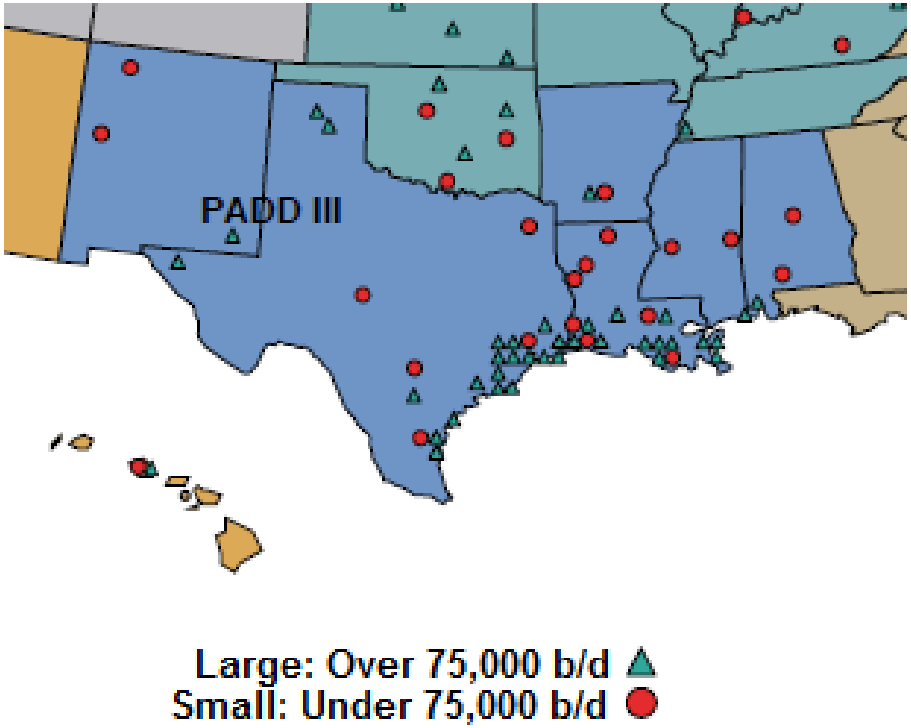
Source: 2006 Refinery Output Shares, EIA Presentation sourced with Purvin and Gertz and GPMO Service

U.S. Refinery Yield



Source: EIA Data

PADD III

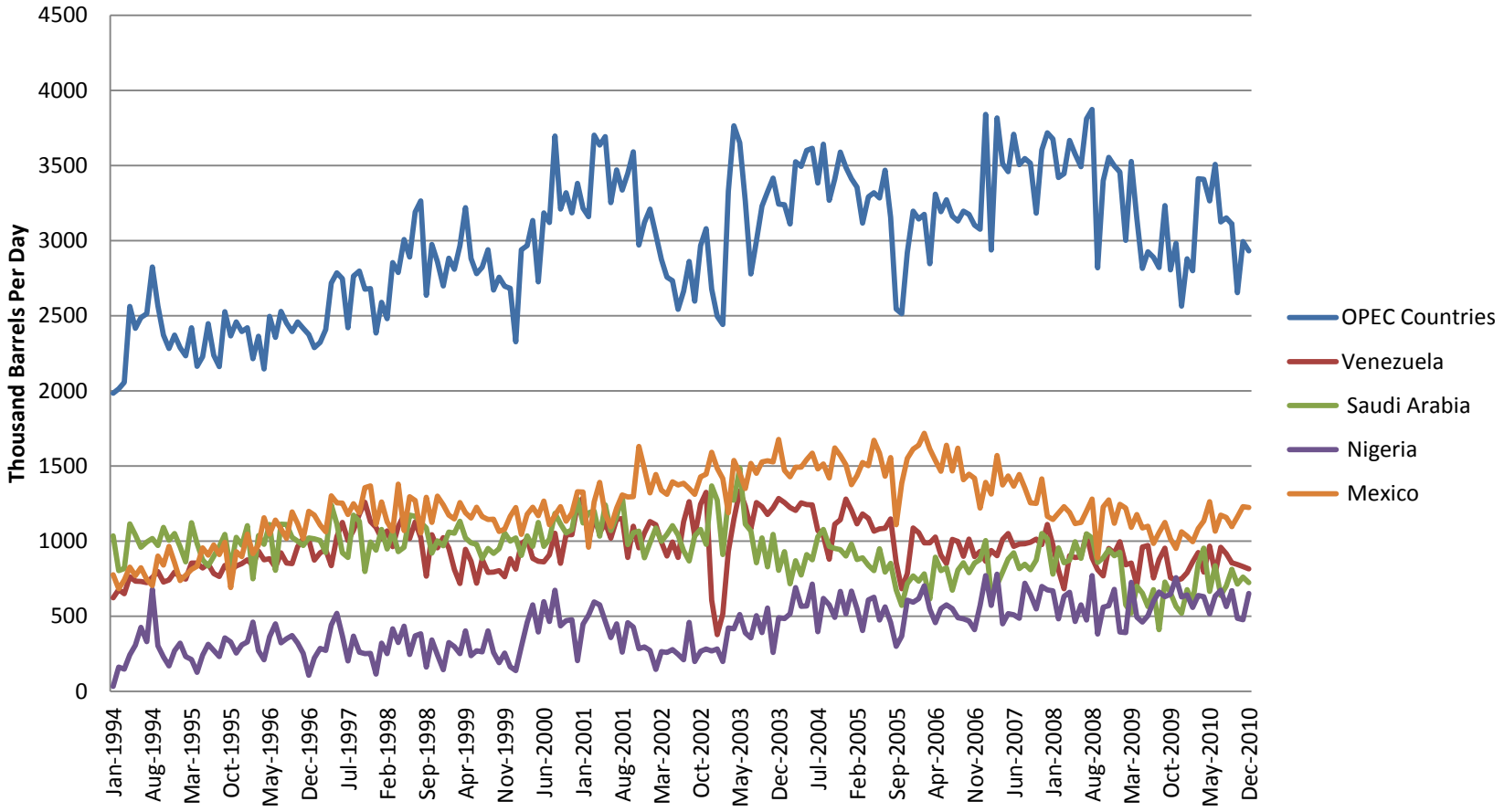


Source: Map from NPRA United States Refining and Storage Capacity Report, August 2010.

- Most densely populated refinery district in the US
- 57 refineries
- Over 8.5 million b/d capacity
- 3 million b/d heavy capacity and growing
- Addition of cokers in recent years to expand heavy oil refining capacity
- Currently underutilized by 20% (some analysts currently suggesting)

- Examples include : WRB Borger 25,000 b/d expansion of heavy oil capacity; Navajo Refining Artesia, N.M. 40,000 b/d expansion; Motiva (Saudi Aramco Shell joint venture) 325,000 b/d capacity expansion-medium and heavy sour crude processing

Gulf Coast PADD III Imports by Country



Source: EIA Data

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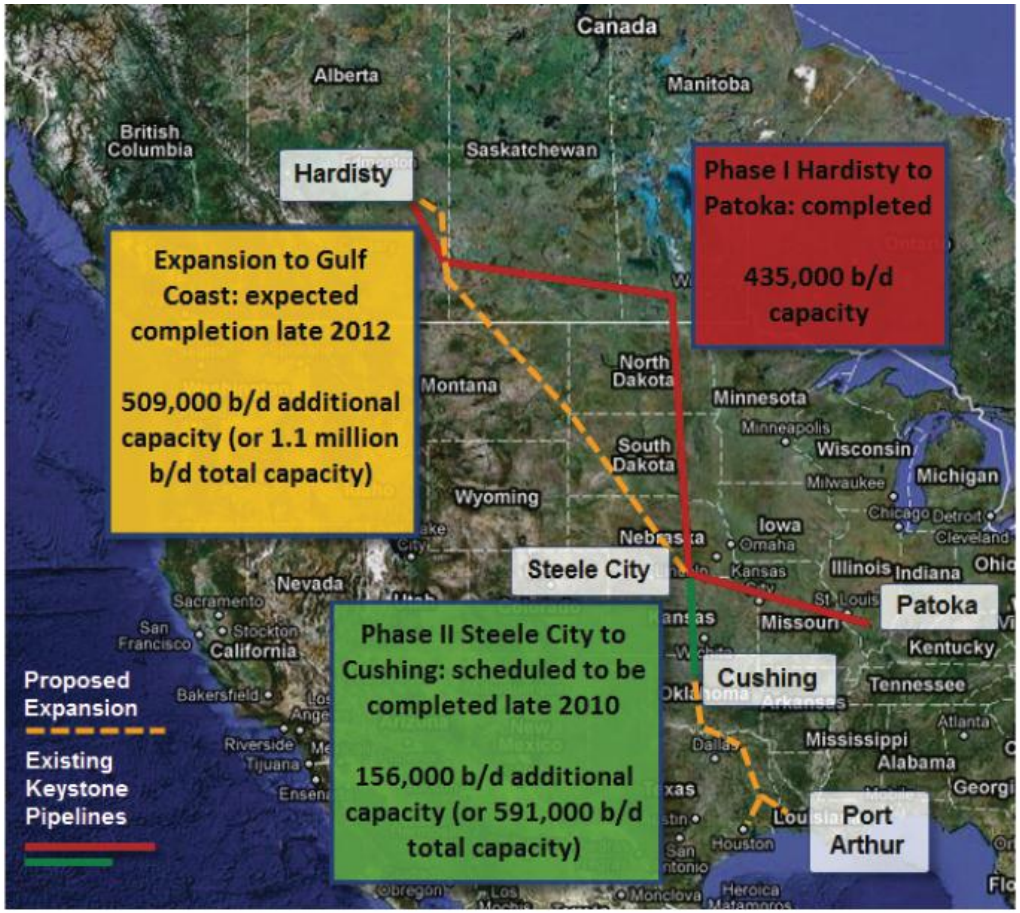
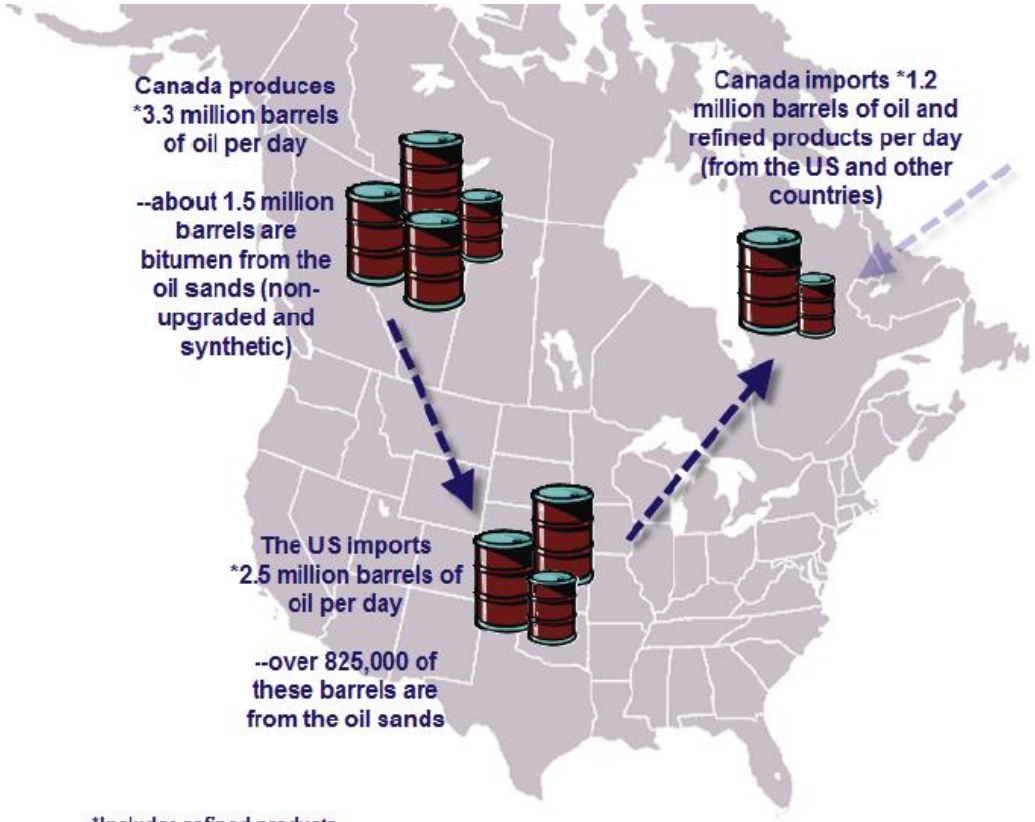
TransCanada's Keystone Expansion Pipeline

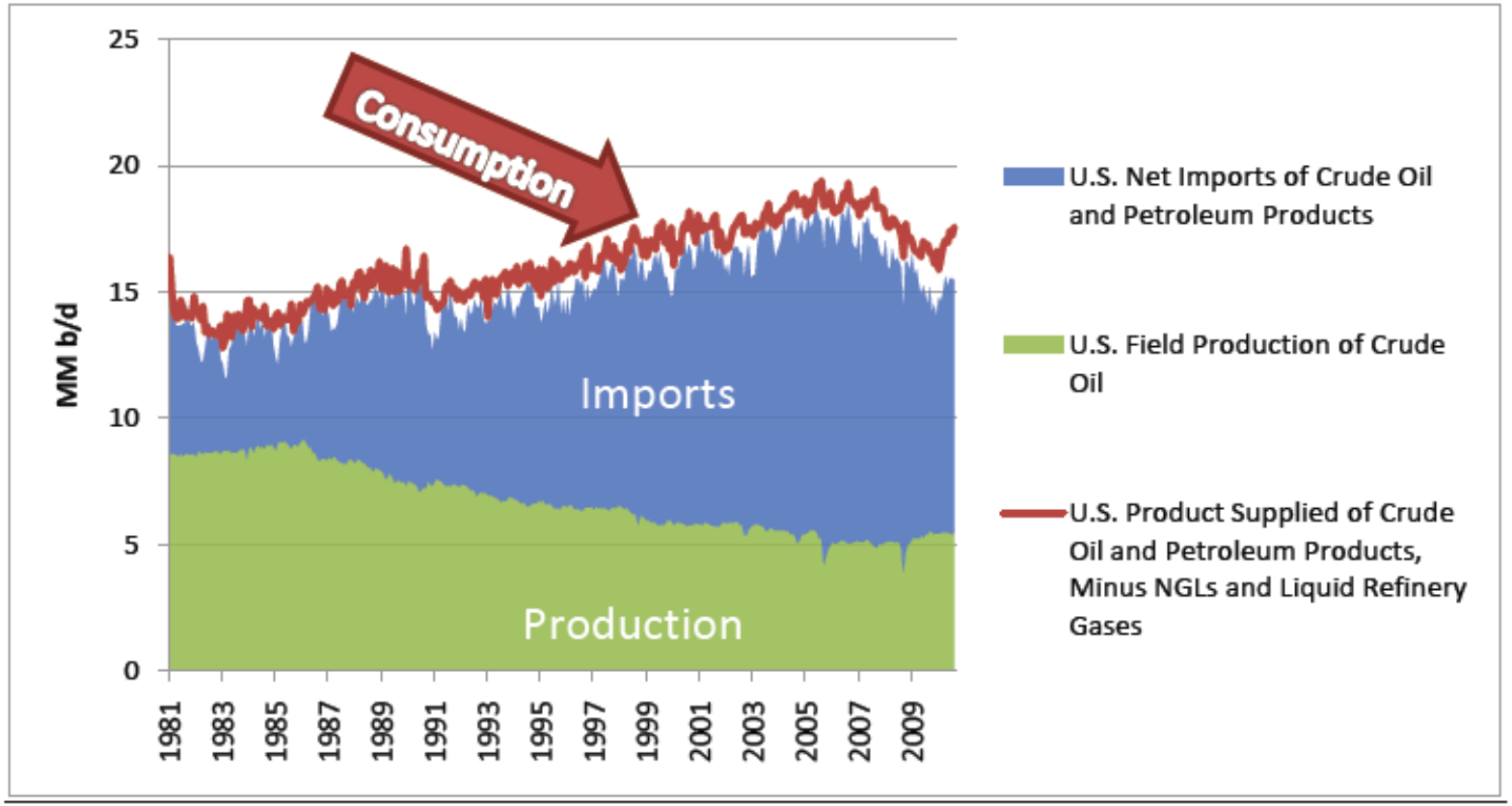


Source: EPRINC Design, using Google Maps, and TransCanada information

Canada's Net Oil Imports and Exports to the United States



Why it Matters…. U.S Production, Consumption, and Imports



Source: EIA Data. Excludes NGLs, associated liquids and refinery gain.

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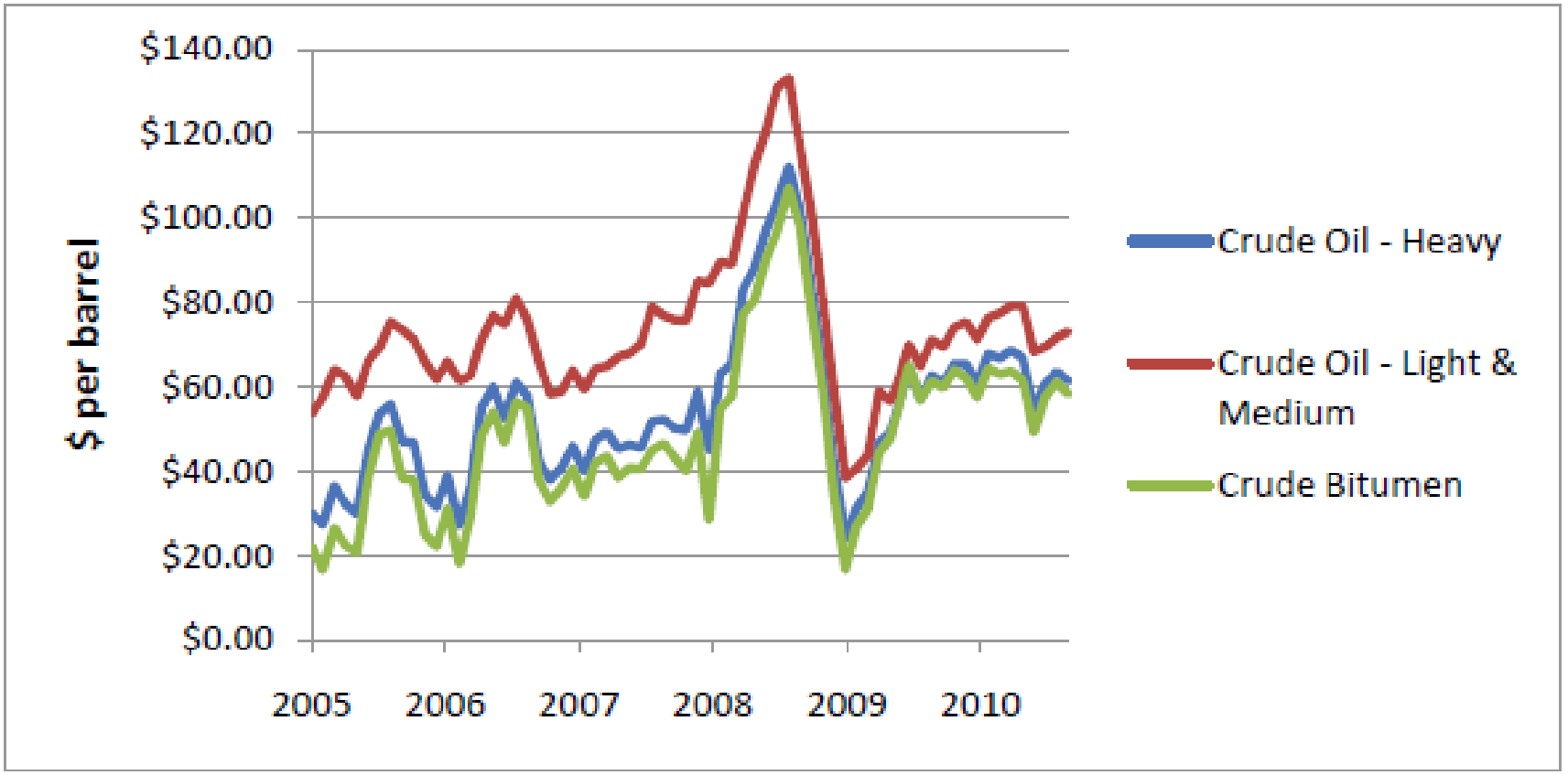
Back to Refining….Prices for Light-Medium, Heavy, and Bitumen Crude Oils



Source: Energy Resources Conservation Board (ECRB) Data and EPRINC Calculations (converting to barrels)

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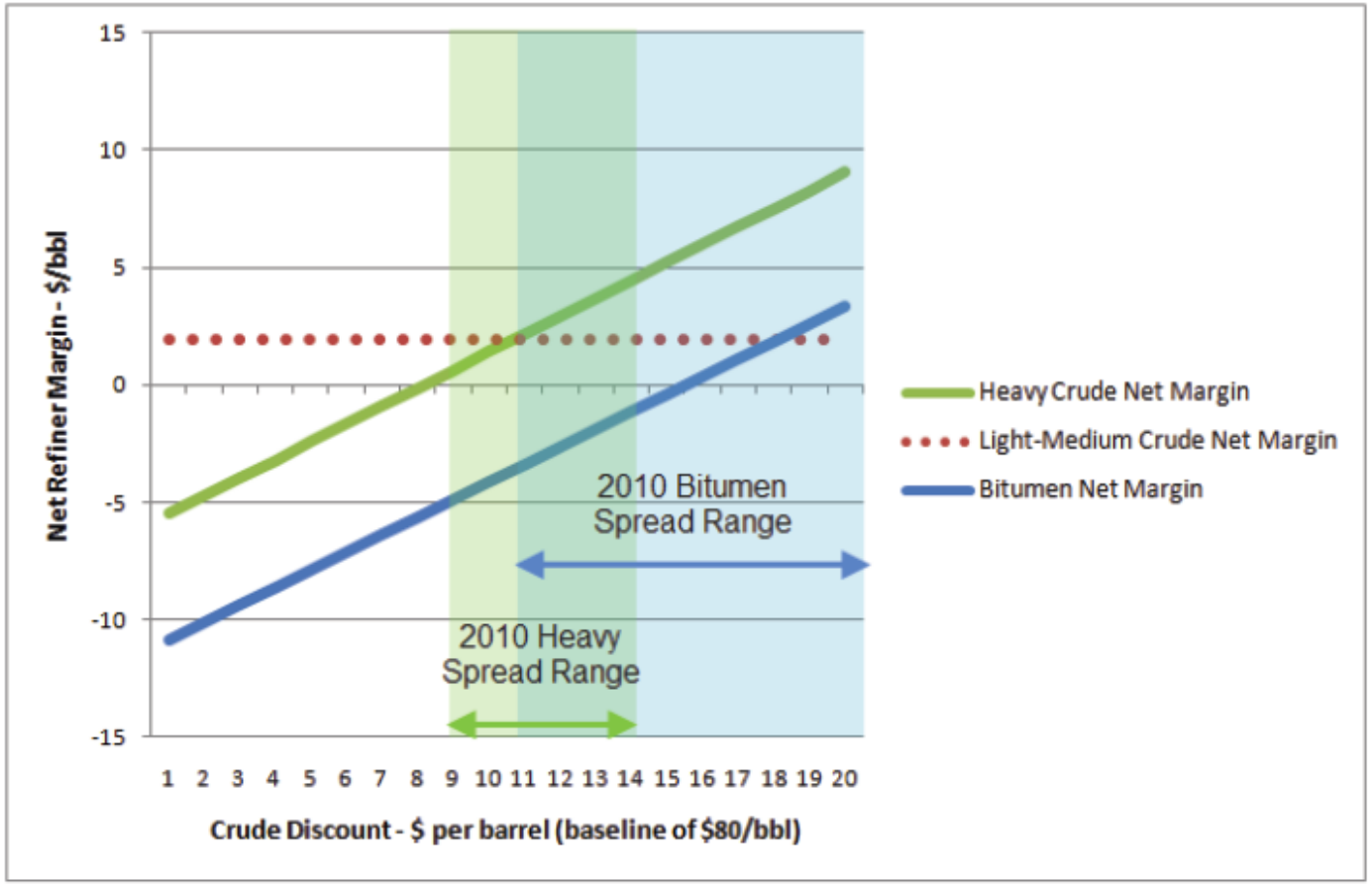
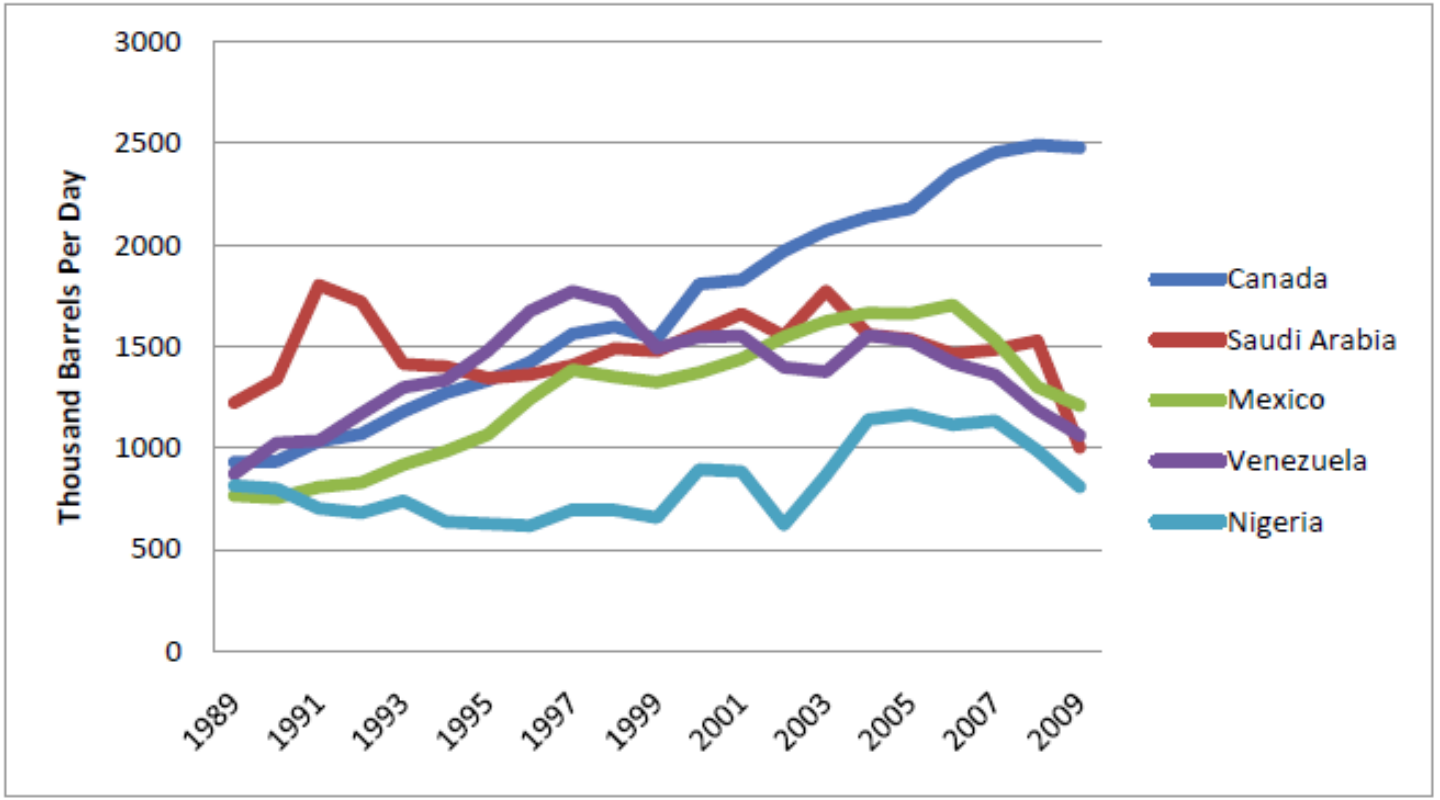
The Crude Spread and Refinery Profitability



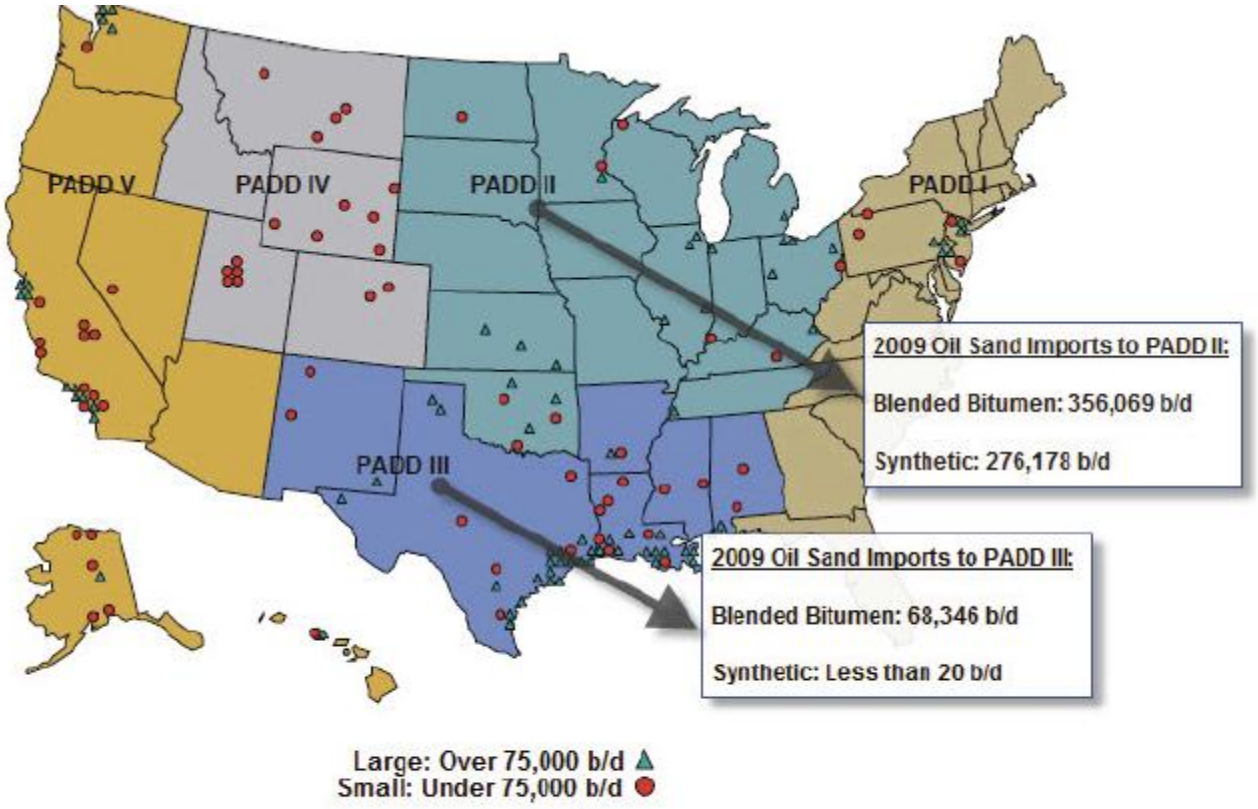
Source: IEA, EIA, and ERCB Data with EPRINC Calculations

U.S. Imports of Crude Oil and Petroleum Products by Country



Source: EIA Data

Oil Sand Imports to PADD II and PADD III



Source: Map from NPRA United States Refining and Storage Capacity Report, August 2010. EPRINC additions of oil sand import info from NEB

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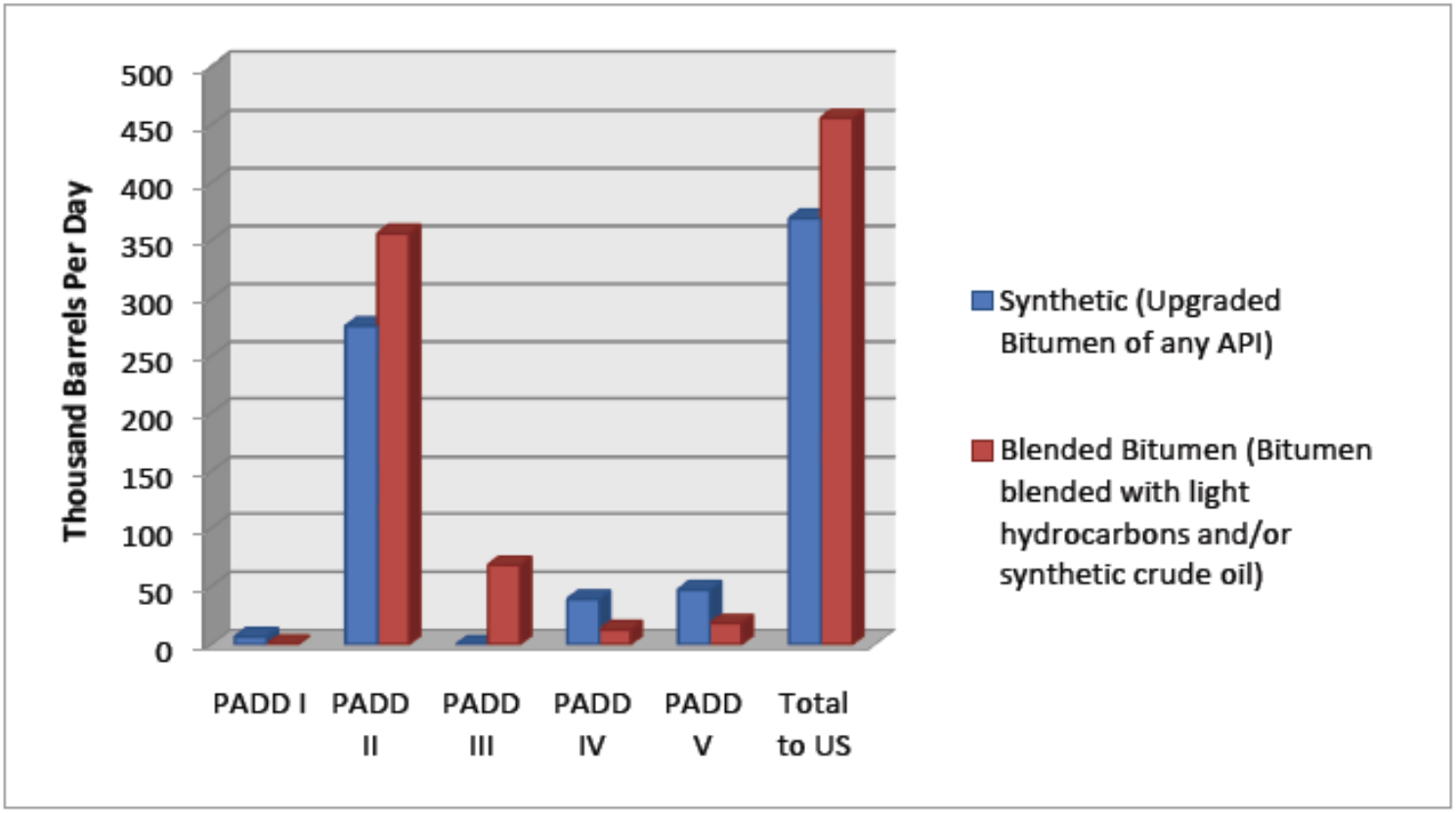
Oil Sand Exports to U.S. by Type and Destination



Source: National Energy Board, Canadian Energy Overview 2009, EPRINC conversions from cubic meters

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EPRINC's Estimation of Economic Benefits to Bakken Producers and Keystone Refiners- Annual

	Bakken Efficiencies ($ million)	Refining Margin Improvements ($ million)		Total ($ million):	
Bakken Low Range - 50,000 b/d into Keystone XL at a savings of $2 a barrel	36.5	Low Range - Heavy Crude Discount Increases $1 a barrel, 200,000 b/d sent to Gulf	73	Low Estimate	*109.5*
Bakken High Range - 100,000 b/d into Keystone XL at a savings of $4 a barrel	146	High Range - Heavy Crude Discount Increases $3 a barrel, 400,000 b/d sent to Gulf	438	High Estimate	*584*

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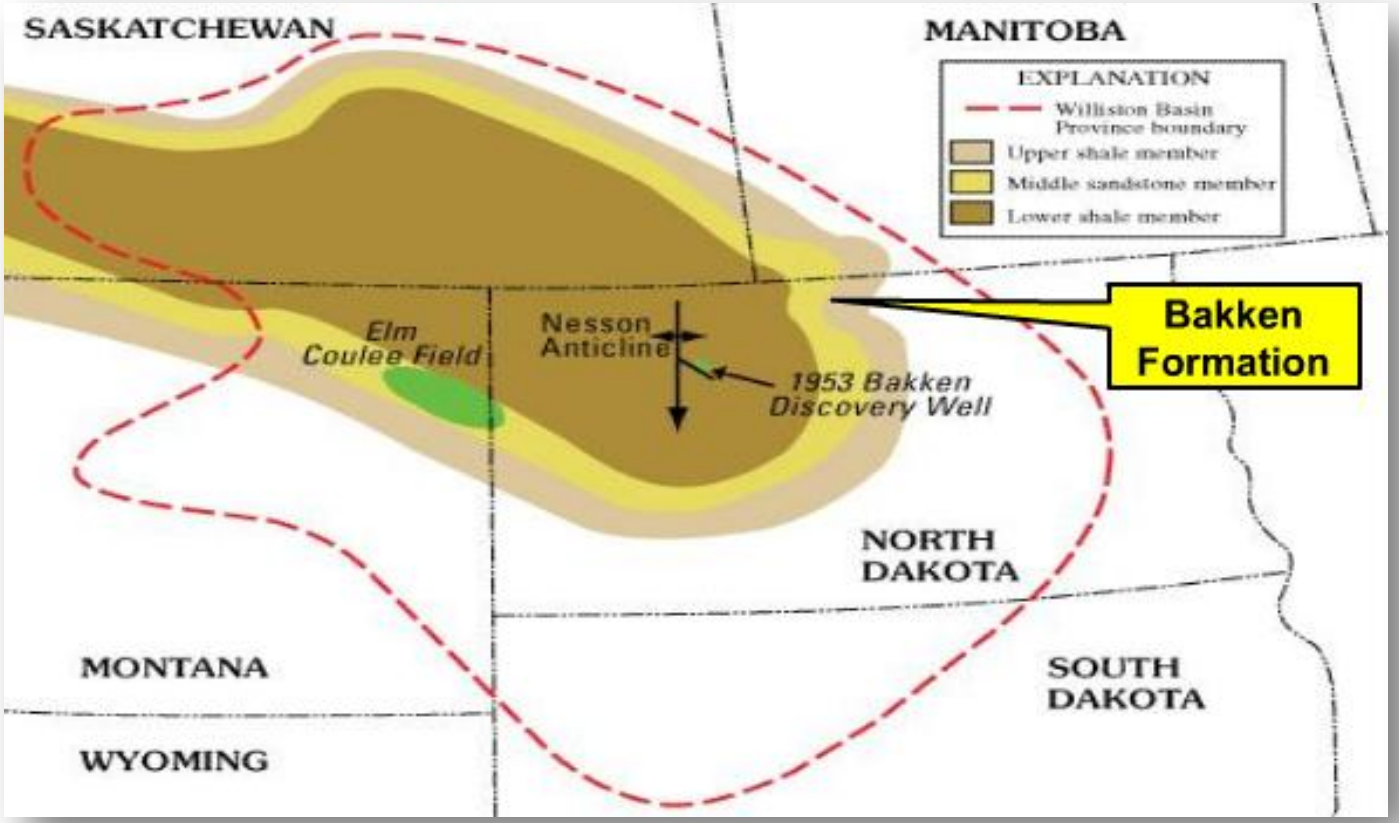
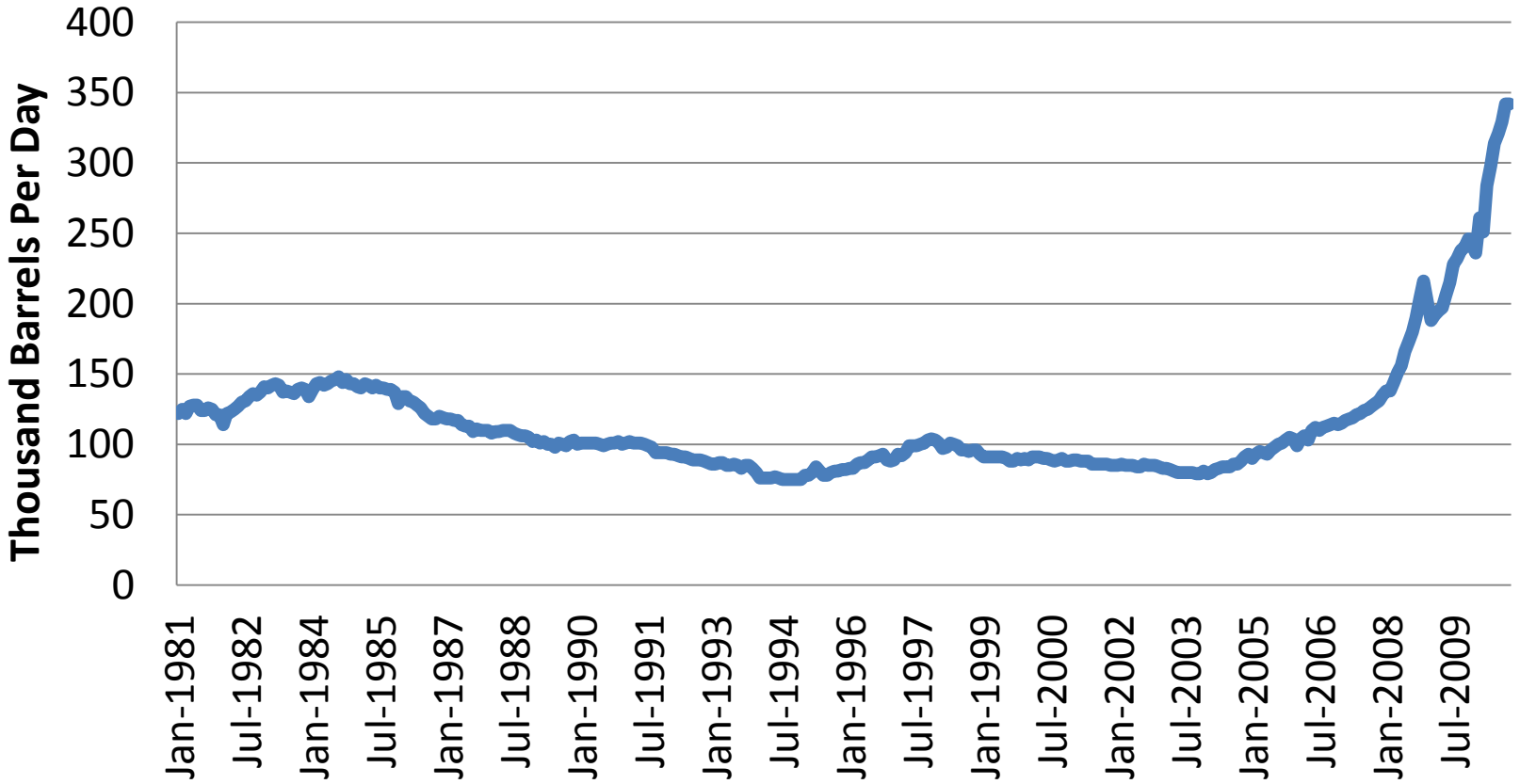
Williston Basin and Bakken and Underlying Three Forks Formation



Source: USGS

North Dakota Oil Production



Source: EIA Data

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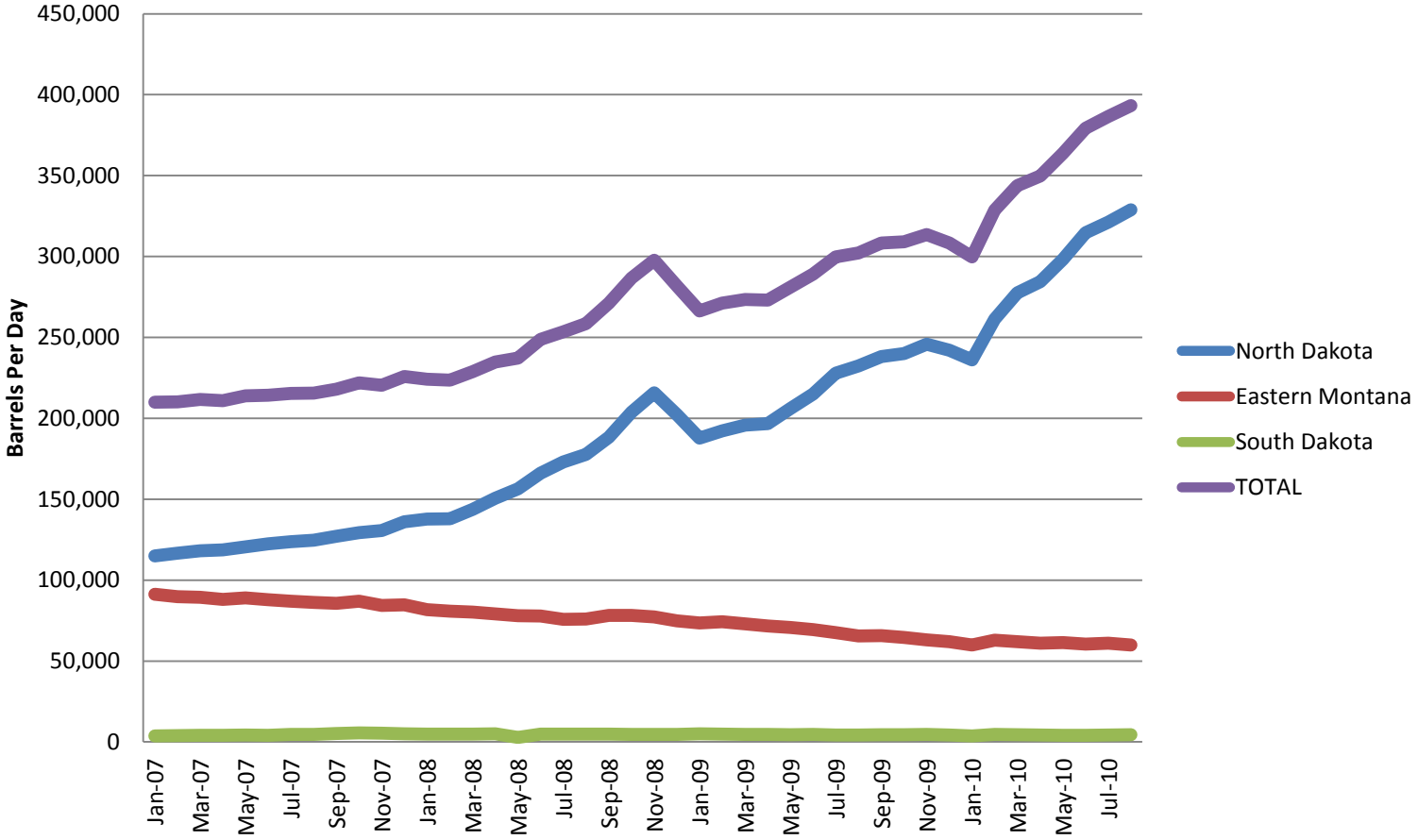
Williston Basin Production



Source: North Dakota Pipeline Authority

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Bakken Take-away Capacity

Transportation System Capacity, Barrels Per Day	2007	2008	2009	2010
Pipeline Transportation				
Butte Pipeline	92,000	104,000	118,000	118,000
Enbridge North Dakota	80,000	110,000	110,000	161,500
Tesoro Mandan Refinery	58,000	58,000	58,000	58,000
Pipeline Only Total	**230,000**	**272,000**	**286,000**	**337,500**
Rail Transportation				
Various Sites including: Minot, Dore, Donnybrook, Stampede	-	30,000	30,000	30,000
EOG Rail, Stanley, ND (Up to 90,000 BOPD)	-	-	65,000	65,000
Dakota Transport Solutions, New Town, ND	-	-	-	20,000
Rail Only Total	**-**	**30,000**	**95,000**	**115,000**
Pipeline and Rail Combined Total	**230,000**	**302,000**	**381,000**	**452,500**

Source: North Dakota Pipeline Authority

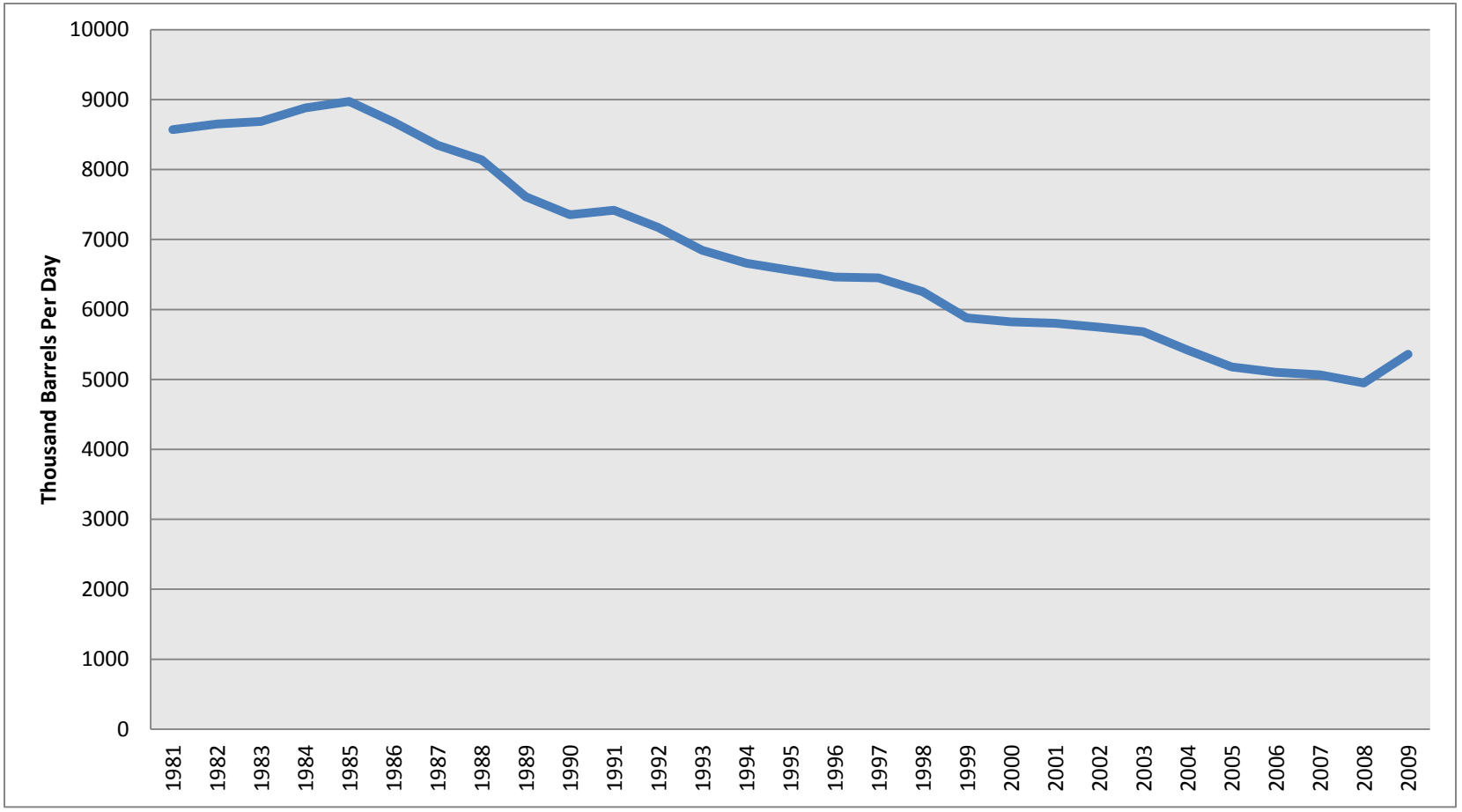
Planned Capacity

Transportation System Capacity, Barrels Per Day	2007	2008	2009	2010	2011	2012	2013
Pipeline Transportation							
Butte Pipeline	92,000	104,000	118,000	118,000	118,000	118,000	118,000
Enbridge North Dakota	80,000	110,000	110,000	161,500	161,500	161,500	161,500
Tesoro Mandan Refinery	58,000	58,000	58,000	58,000	58,000	58,000	58,000
Enbridge Sweet Only	-	-	-	-	23,500	23,500	23,500
Enbridge Bakken Expansion	-	-	-	-	25,000	25,000	145,000
Butte Pipeline Expansion*	-	-	-	-	32,000	32,000	32,000
Butte Loop*	-	-	-	-	-	50,000	50,000
Plains Bakken North*	-	-	-	-	-	50,000	50,000
Keystone XL Interconnect*	-	-	-	-	-	-	100,000
Pipeline Only Total	**230,000**	**272,000**	**286,000**	**337,500**	**418,000**	**518,000**	**738,000**

*Project still in the proposed or internal review phase

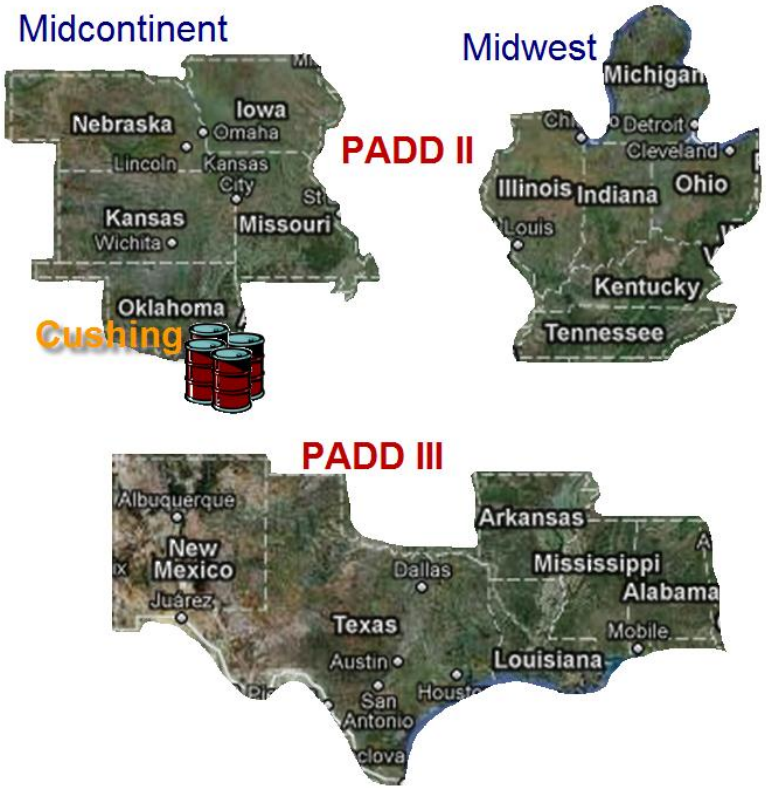
Source: North Dakota Pipeline Authority

U.S Field Production of Crude Oil



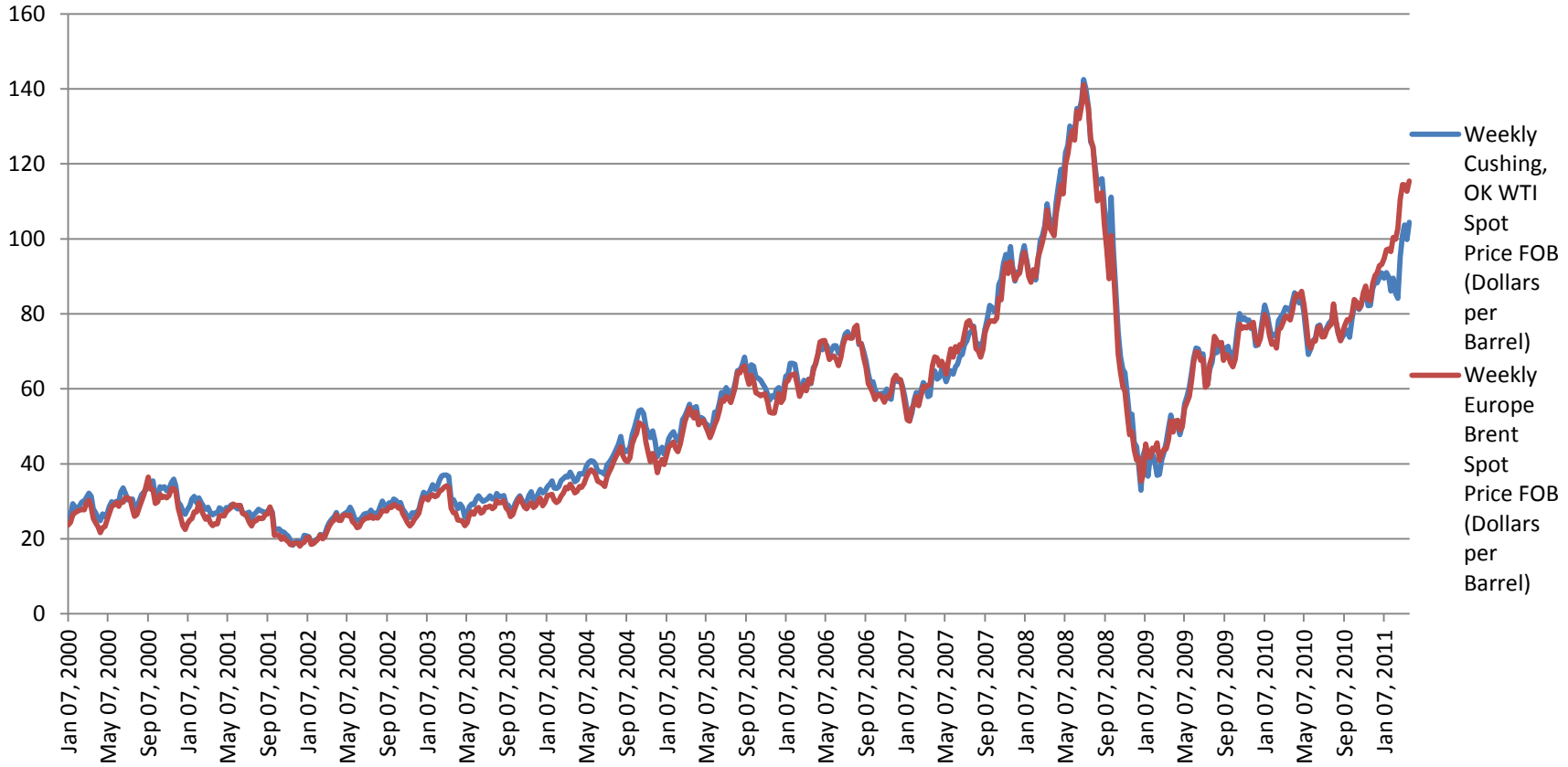
Source: EIA Data

WTI Discount and Cushing Dilemma



- This year has been punctuated with widening price differentials between North Sea Brent and WTI
- Light Louisiana Sweet (LLS) is run in several Gulf refineries and has been trading closer to Brent, putting it at a premium to WTI
- Refiners in PADD II, the Midwest, are seeing good refining margins, benefiting from their geographic position and the WTI discount
- For producers, well-head values are suffering and this is impacting the legitimacy of WTI as a global benchmark

WTI Brent Discount



Source: USGS

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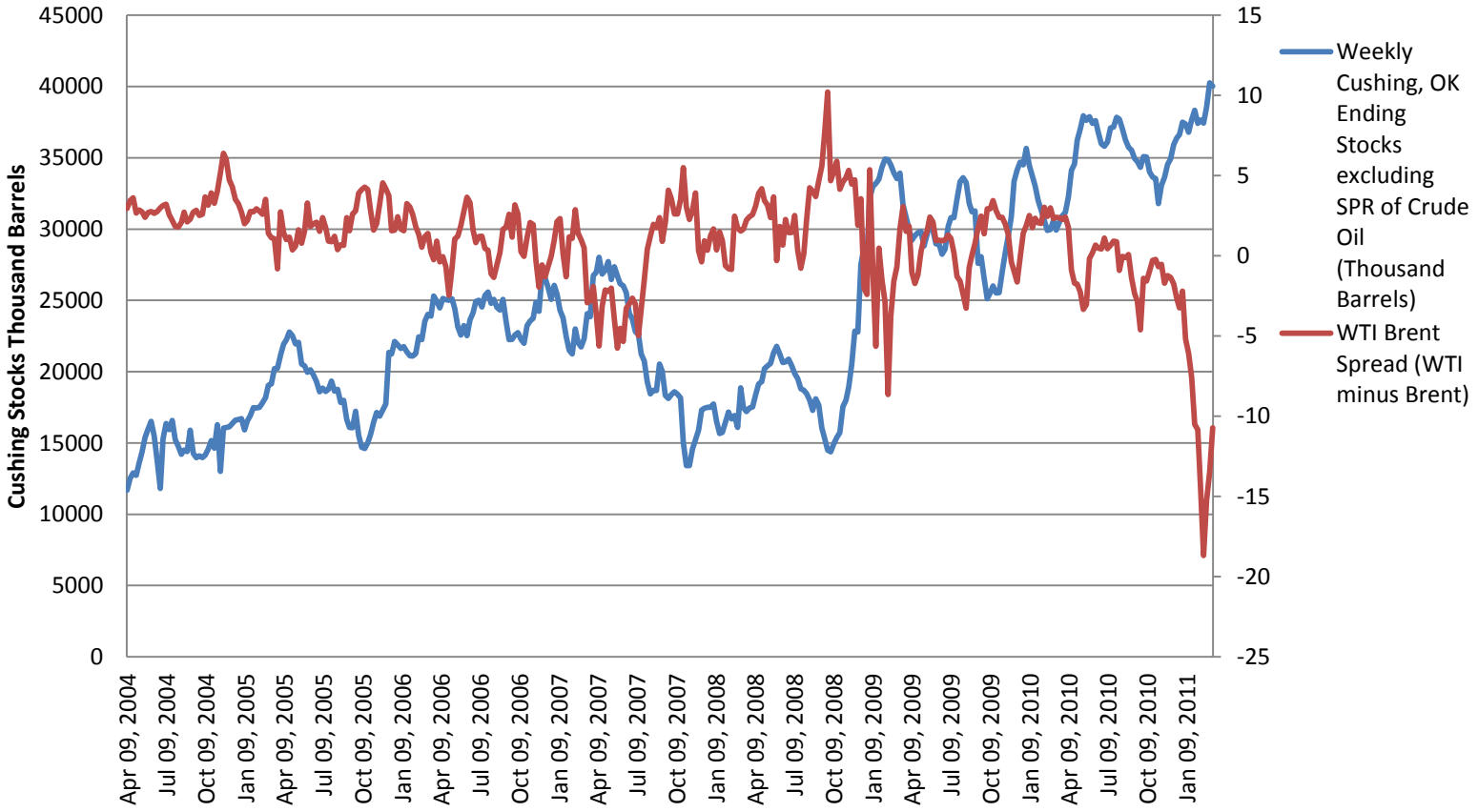
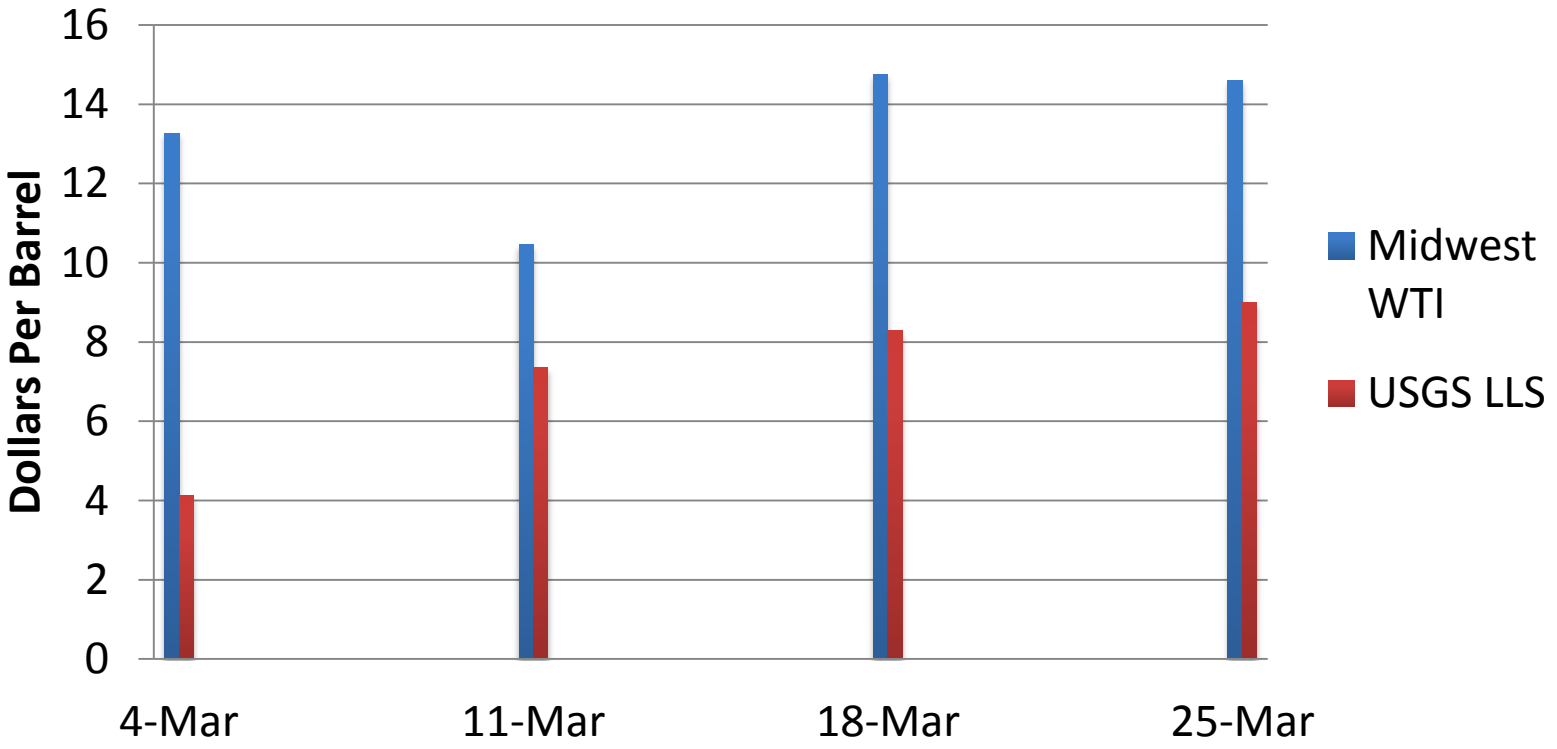
Cushing Stocks and WTI Discounts→ "Cushing Dilemma"



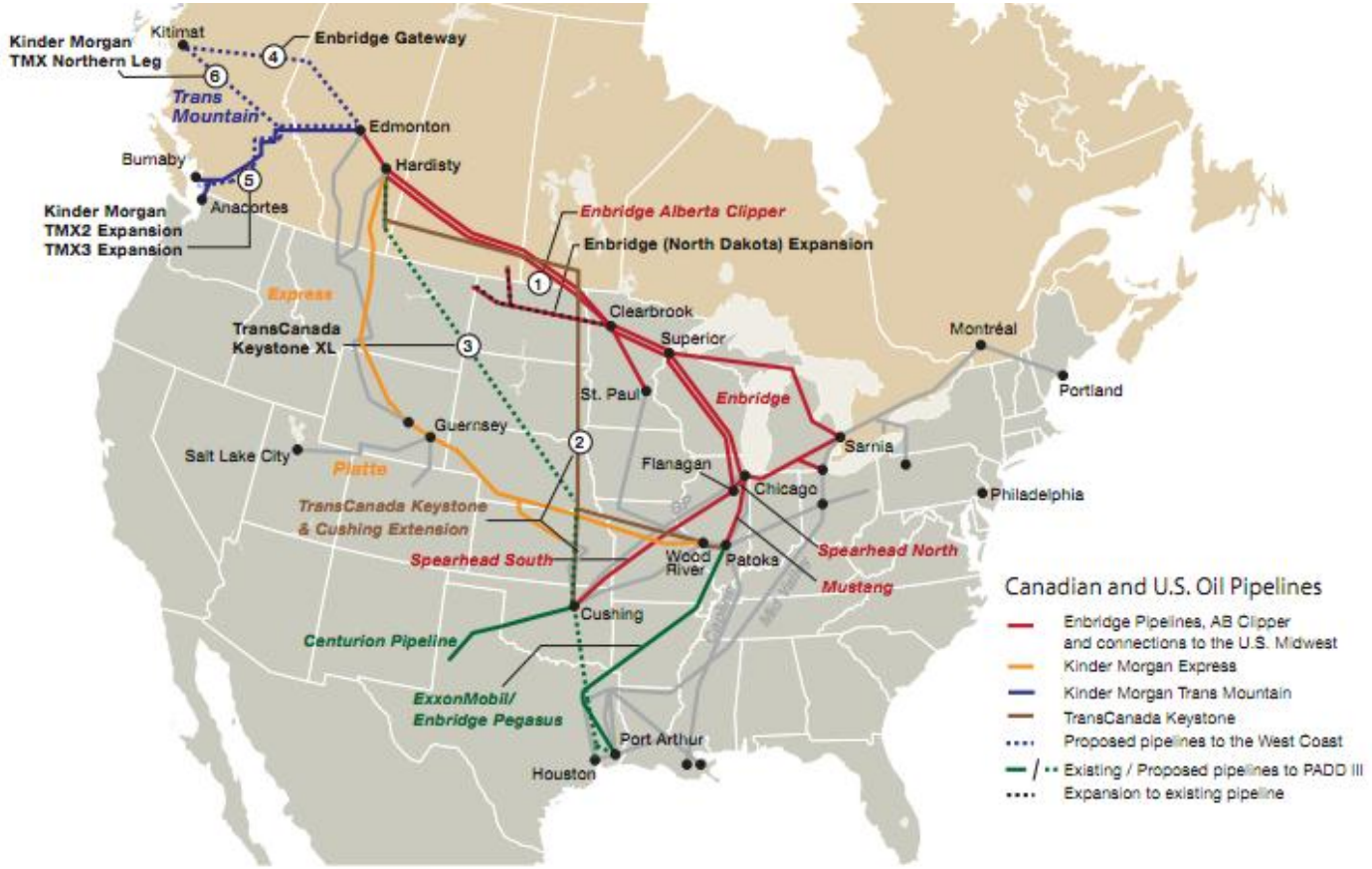
Source: EIA Data

US Cracking Margins



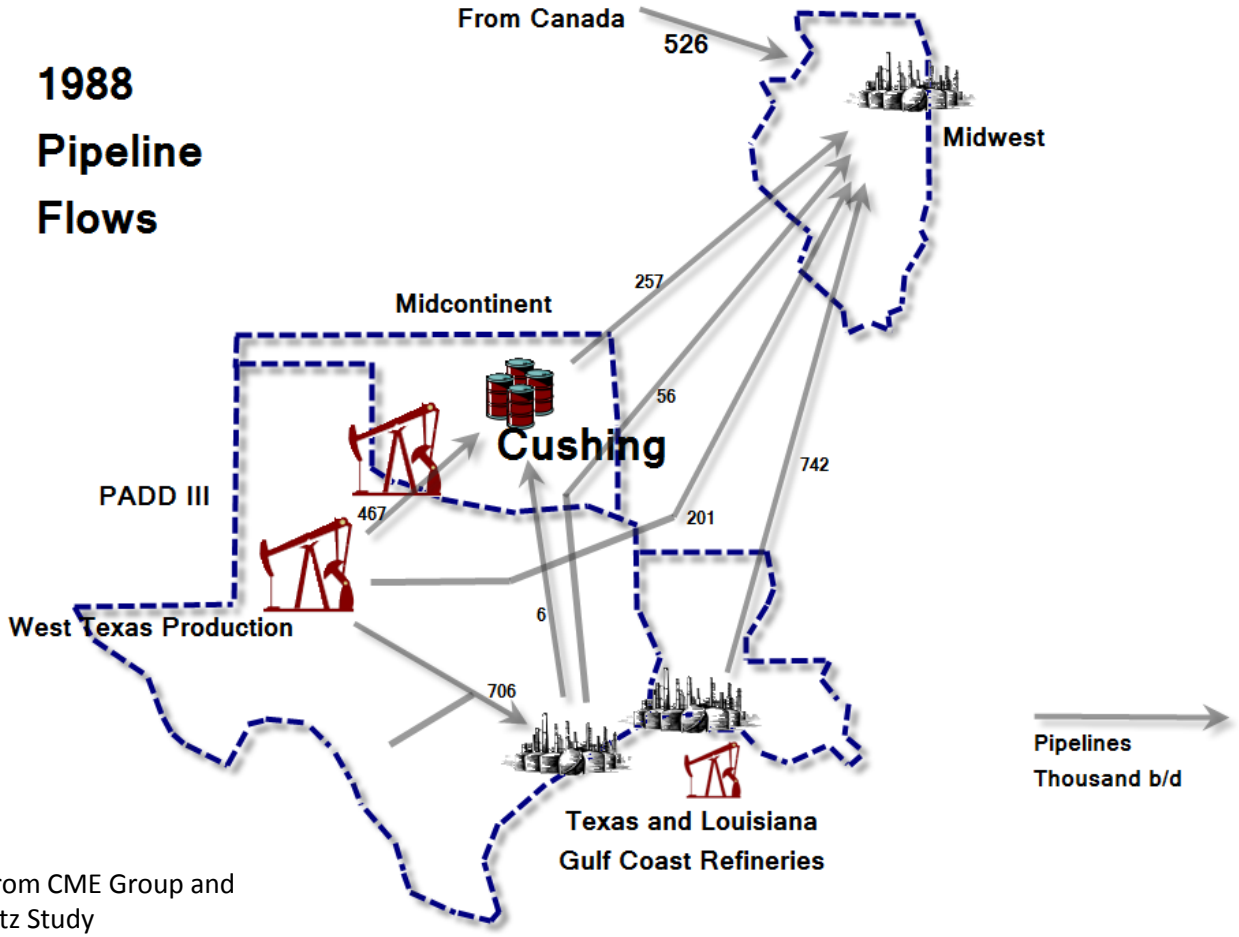
Source: Platts Oilgram News

U.S. and Canadian Pipelines



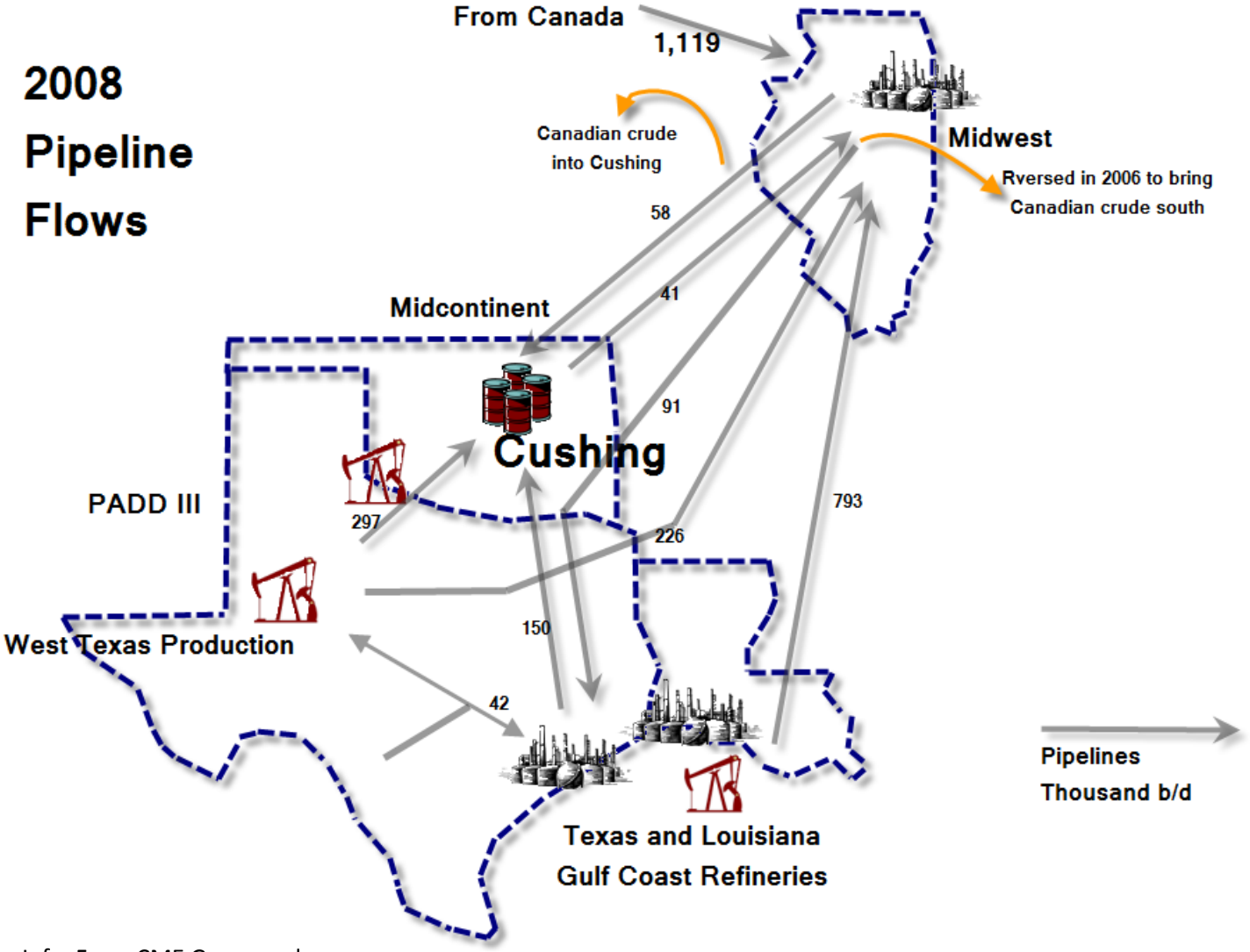
Source: CAPP

Pipeline Evolution



Source: Info. From CME Group and Purvin and Gertz Study

2008 Pipeline Flows



Source: Info. From CME Group and Purvin and Gertz Study

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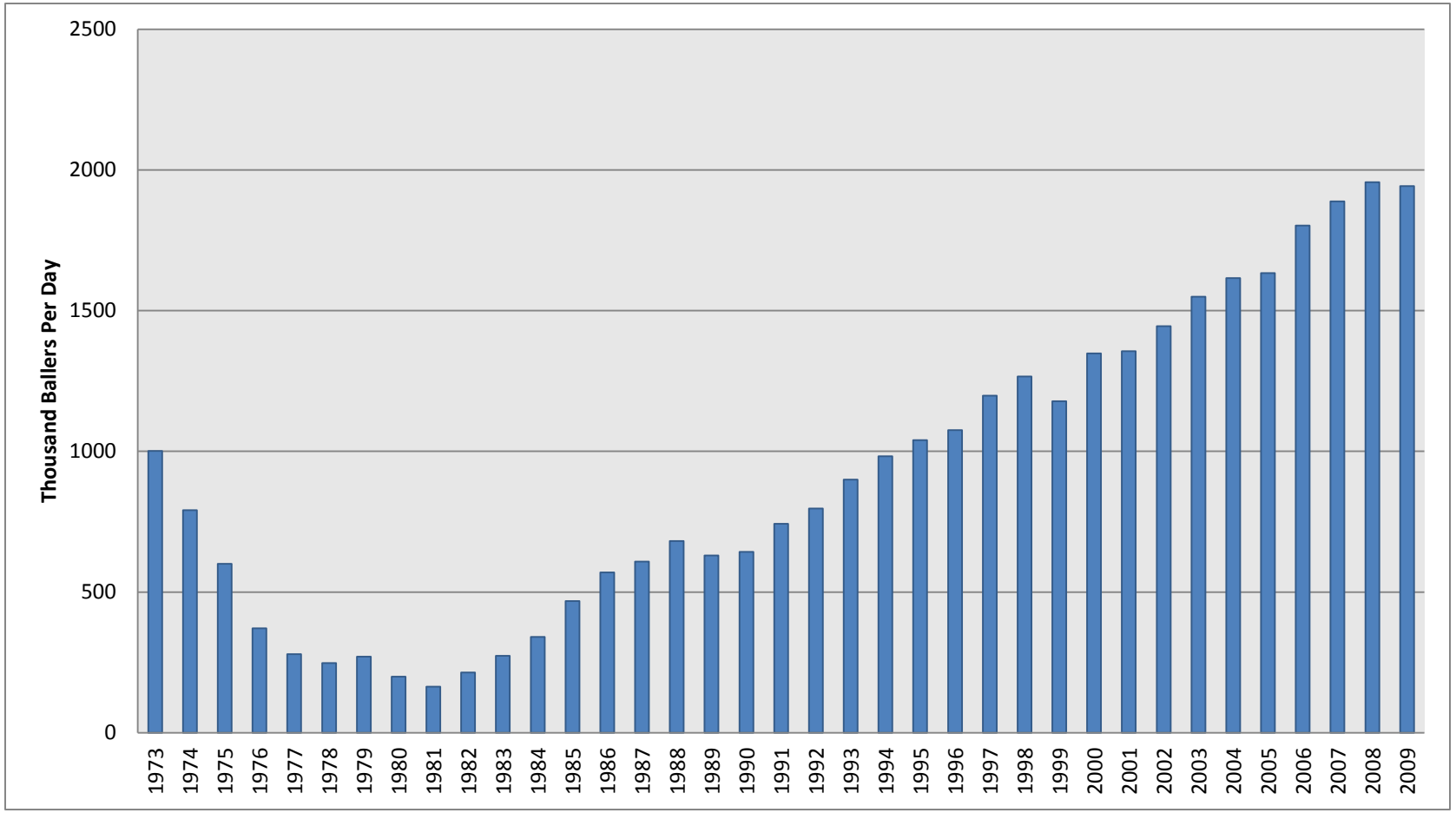
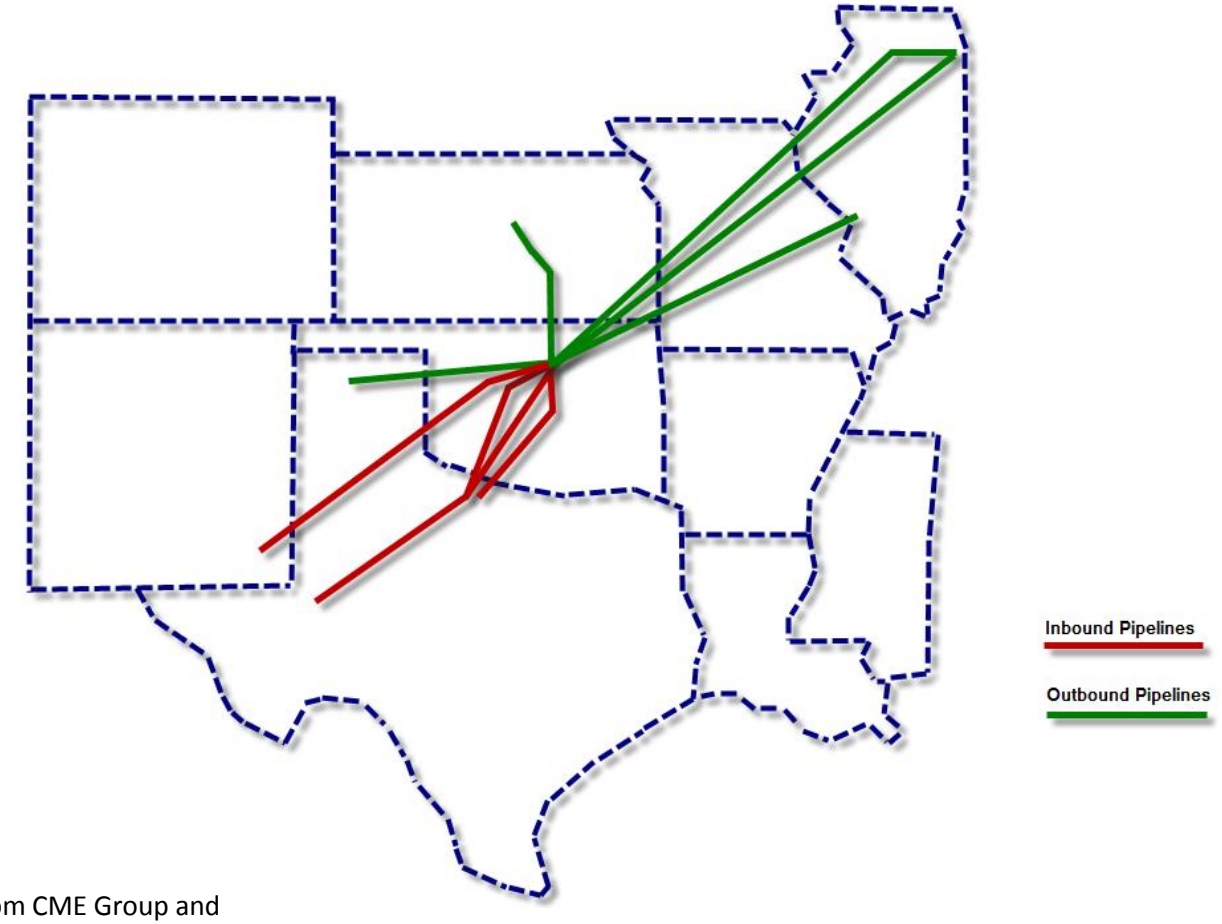
U.S. Imports from Canada of Crude Oil



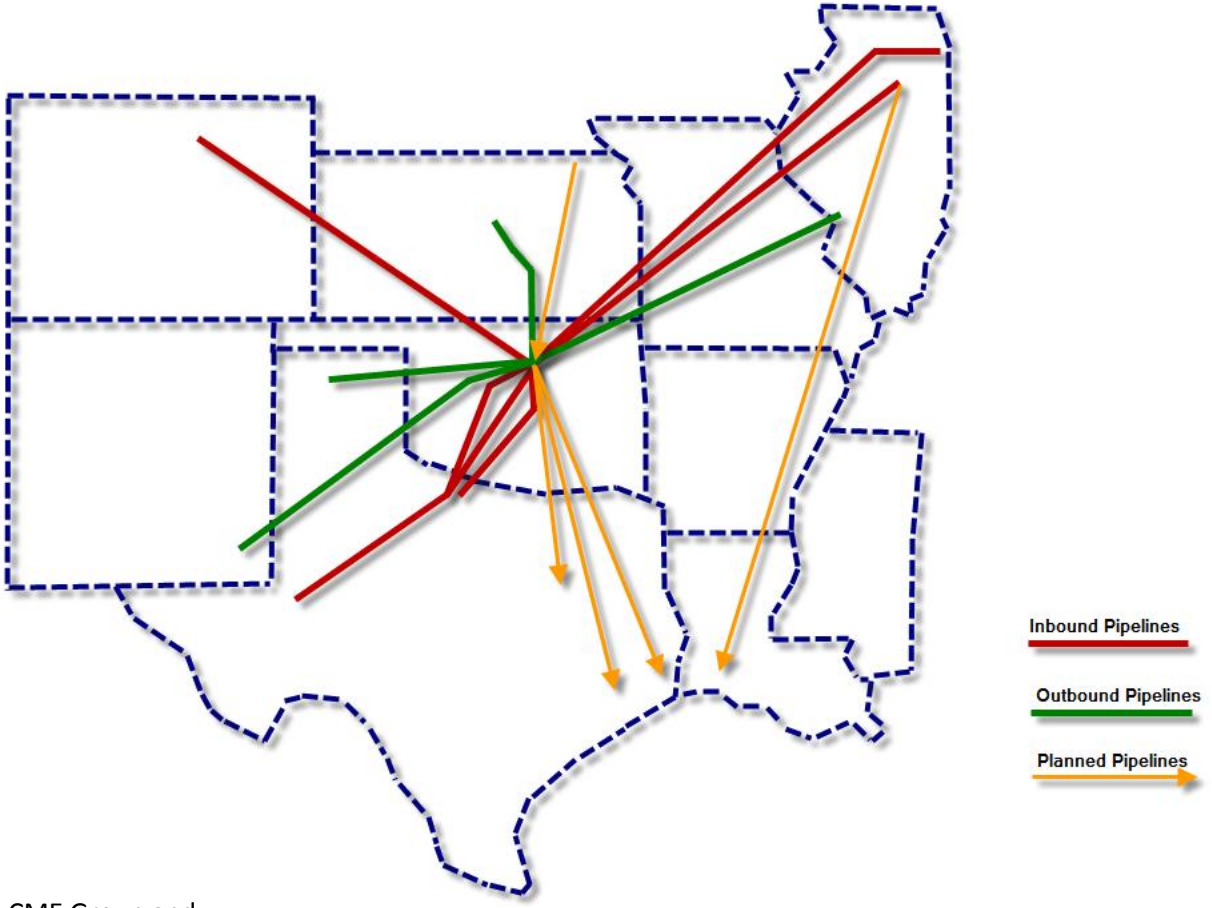
Source: EIA Data

Pipelines In and Out of Cushing 1988



Source: Info. From CME Group and
Purvin and Gertz Study

Pipelines In and Out of Cushing 2009



Source: Info. From CME Group and Purvin and Gertz Study

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Bringing it all together….Concluding Remarks

- **Bringing Canadian Oil Sands into PADD III as proposed by projects such as Keystone XL represents a significant policy issue that has systemic impacts**
- The complex nature and capacity to refine heavy crudes in PADD III make it a strong match for oil sands bitumen (as it is in PADD II)
- The expansion pipeline has the ability to carry Bakken crude, offering producers needed take-away capacity and increased efficiency via higher well-head values
- With increased supplies coming from the North (Canada and Bakken) the U.S. needs to adjust its crude oil transportation to avoid bottlenecks and maximize efficiency
- The Cushing bottleneck is not simply a local dislocation issue, but one that is impacting the legitimacy of WTI as a global crude benchmark. The discount has made Brent priced markets the favorite for exporters and the bottleneck prevents the U.S. from maximizing the efficiency of its refining capacity.