

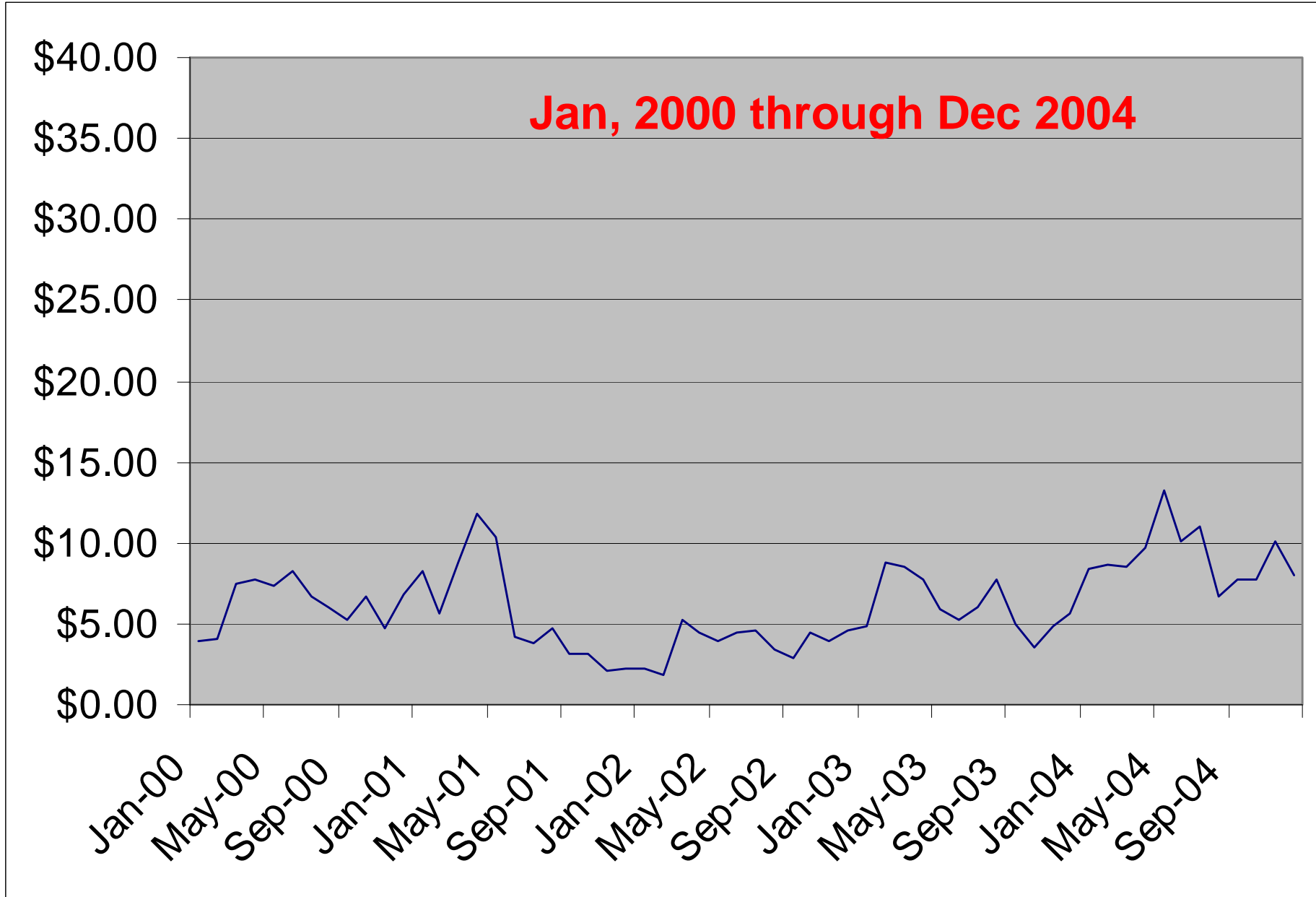
Impact of Shale Oil on USGC Refiners

Bob Kent - October 4, 2012

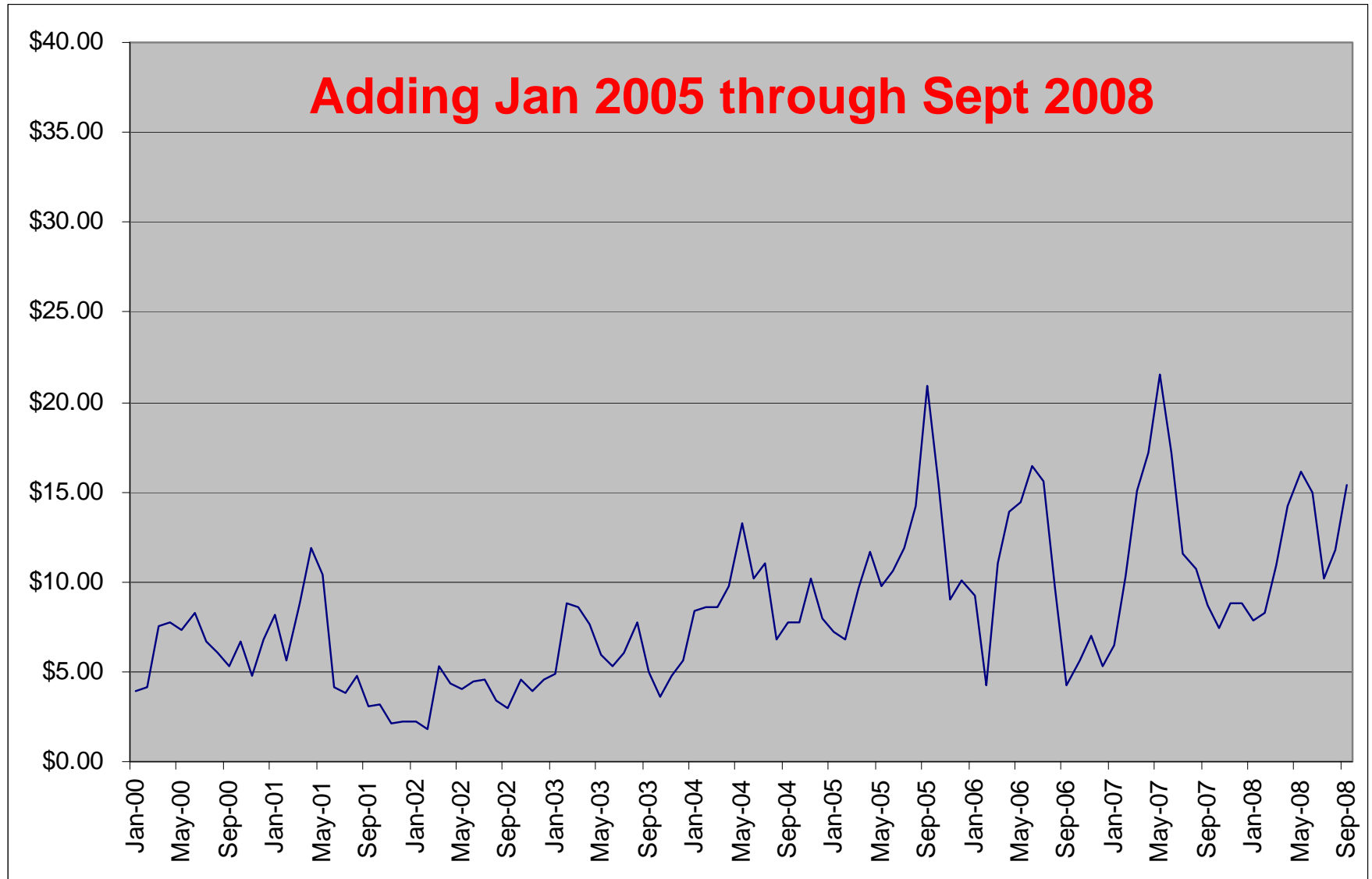
Agenda

- Some history
- Near future possibilities
- General view of the impact of shale oil
- A little closer to home - What Eagle Ford shale oil means to a heavy crude refiner in Corpus Christi.

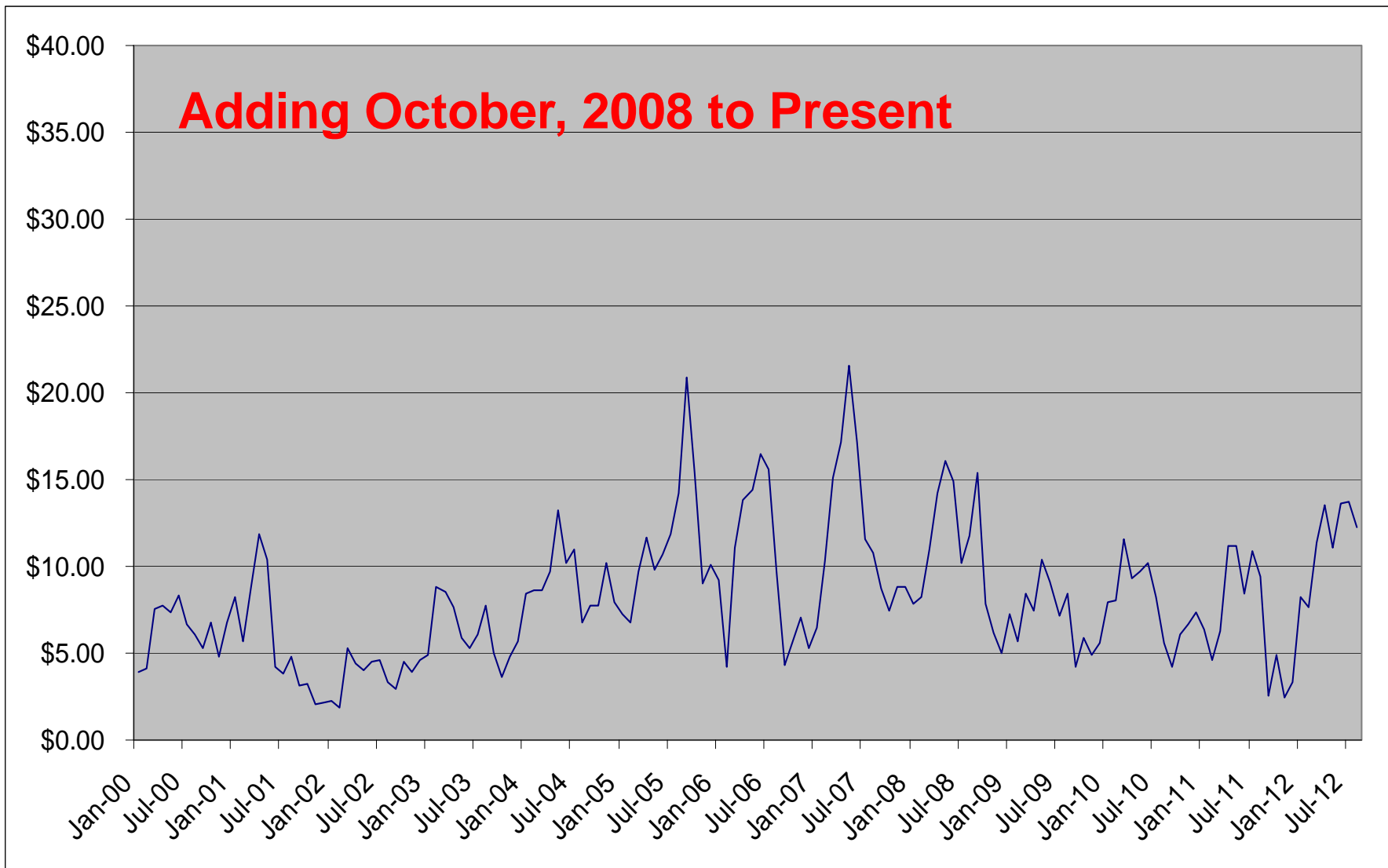
321 Crack using NYMEX products and Brent at USGC, \$/bbl



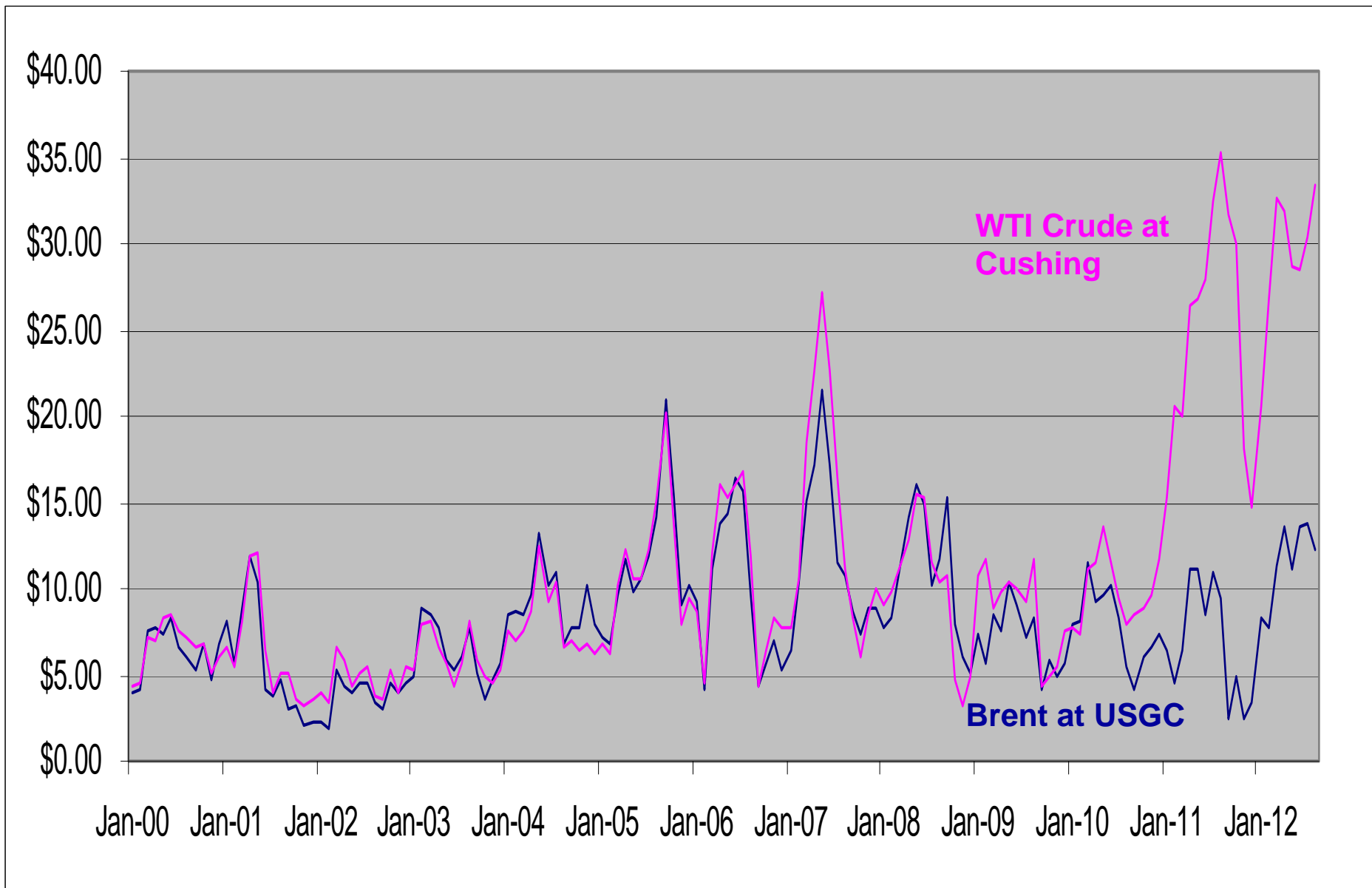
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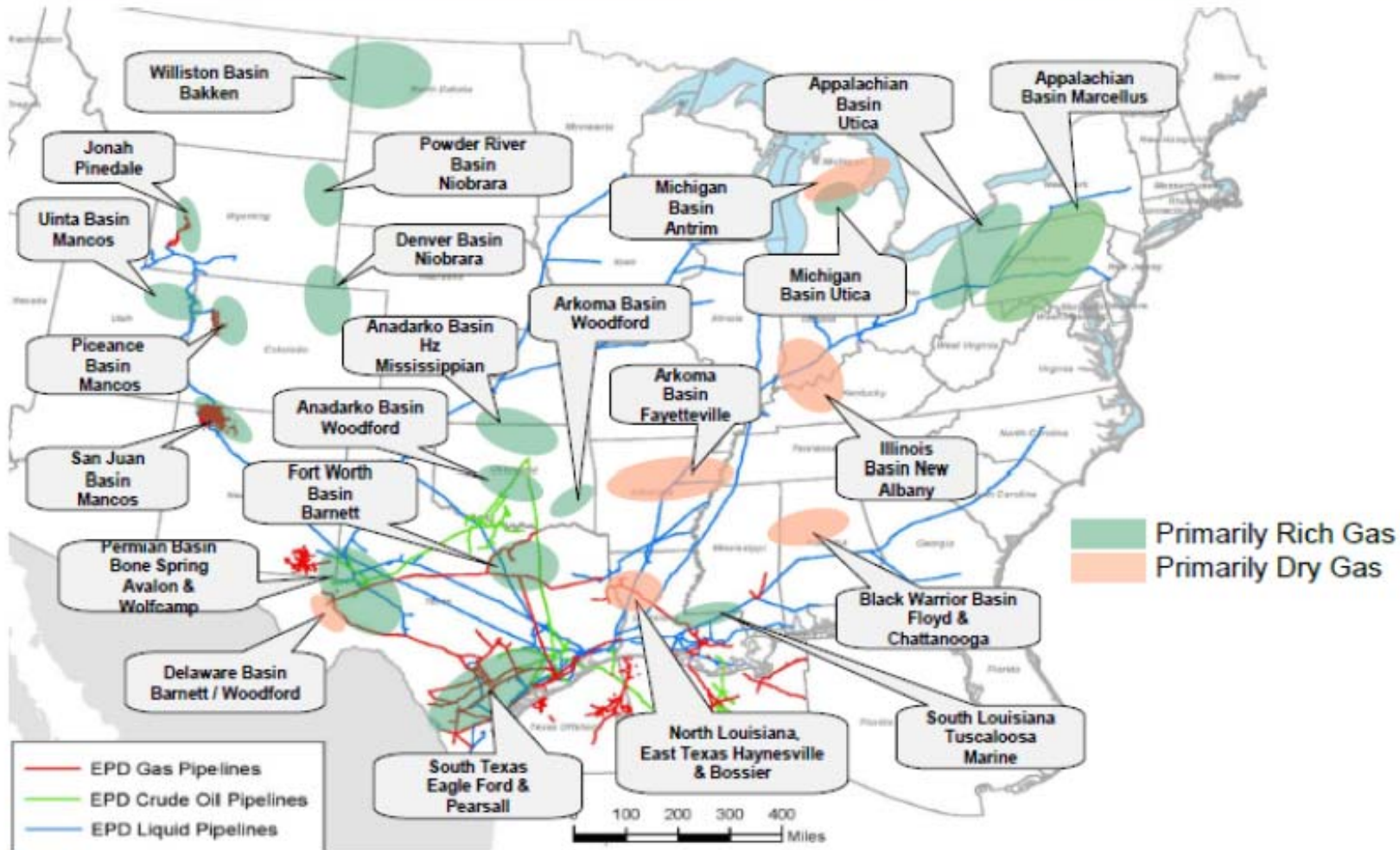
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321 Crack using NYMEX products, \$/bbl

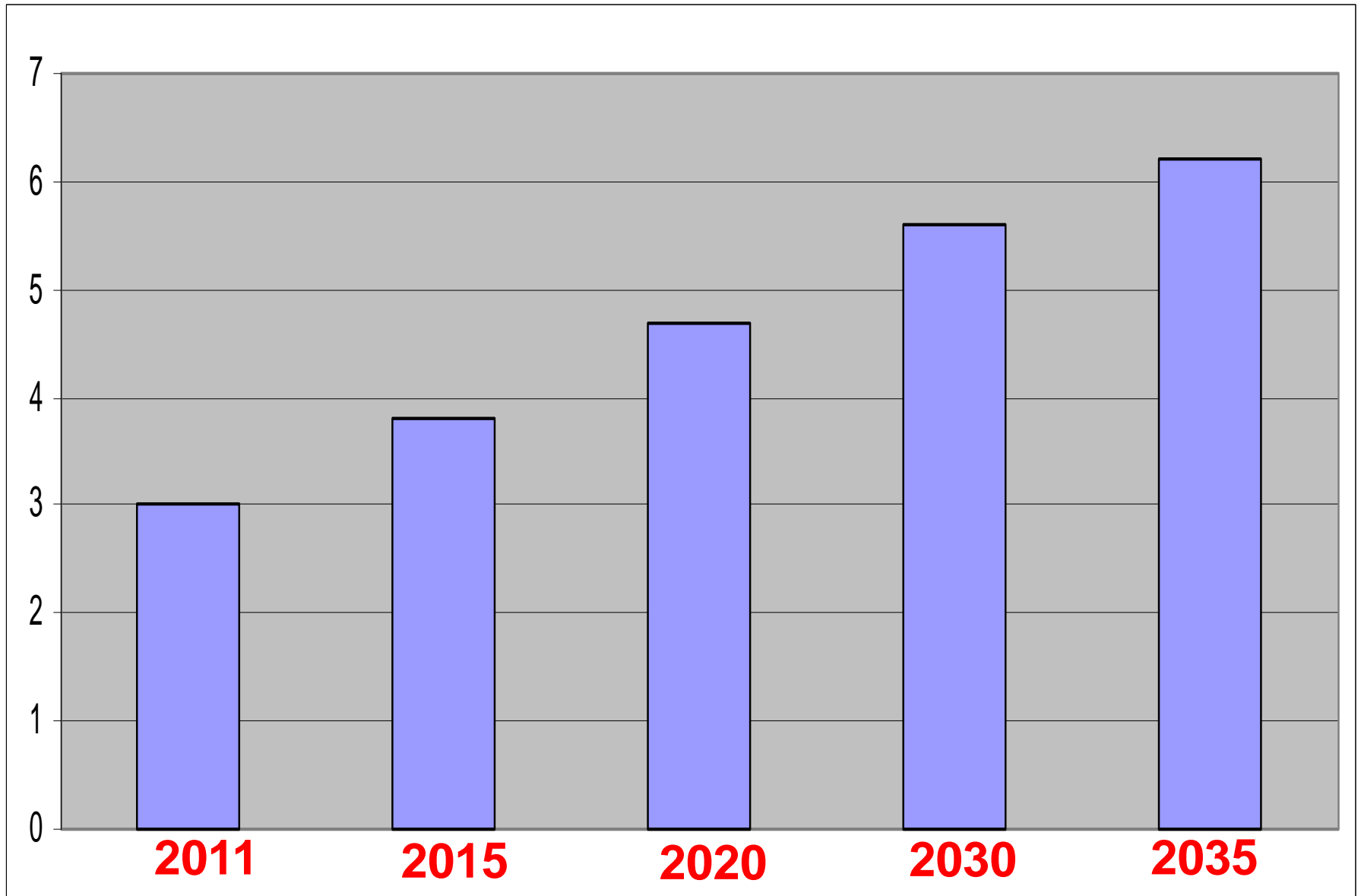


US Shale plays



Source: Enterprise

Canadian Crude oil Production, MMBPD – per CAPP



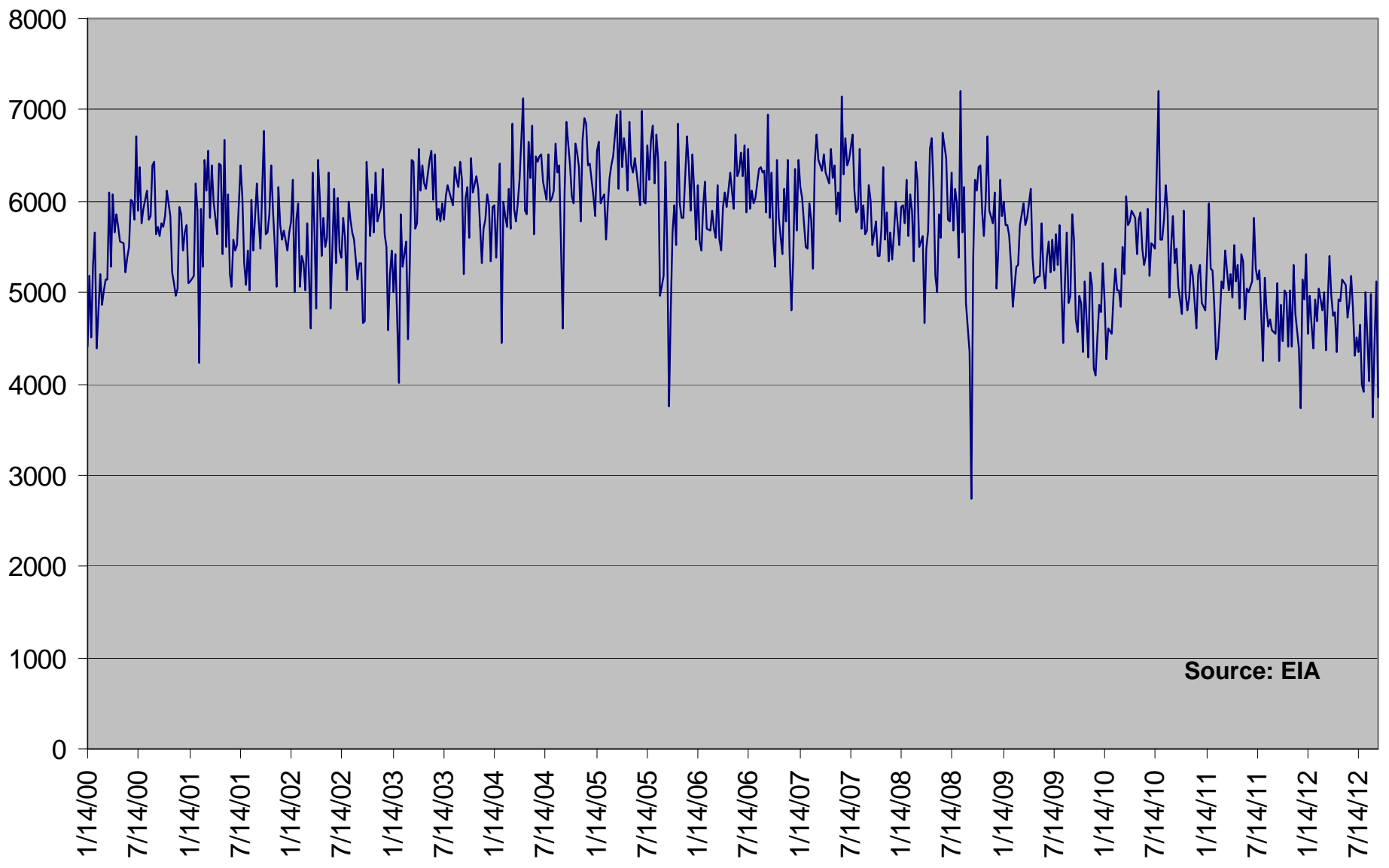
Agenda

- So what might happen in the future?

Key Pipeline Expansions from mid-Continent to USGC

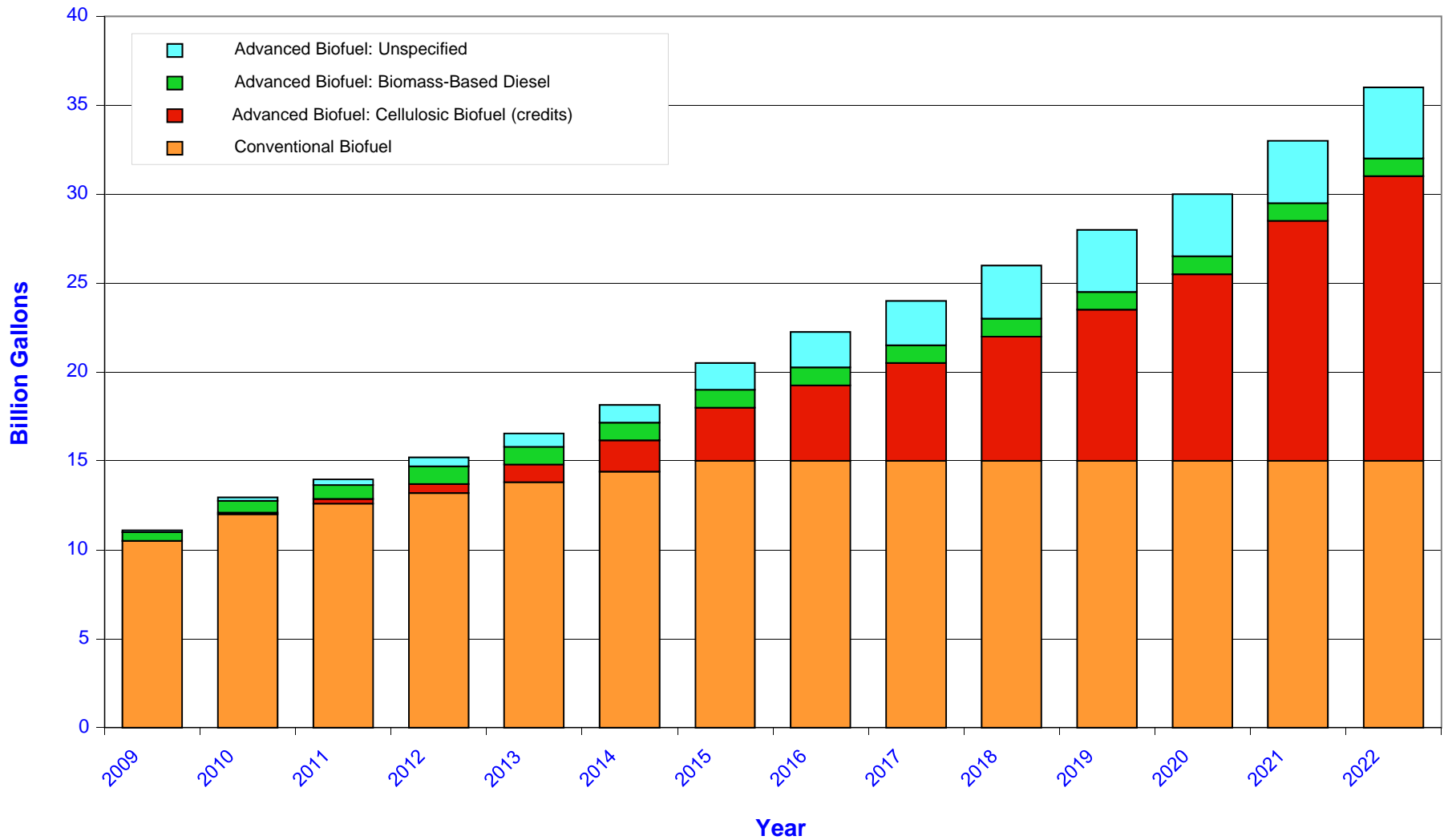
- May 17, 2012 Seaway start up (Cushing to USGC) at 150 MBPD
- 1Q 2013 – Seaway Gulf Coast Project (Southern leg of Keystone XL expansion from 150 MBPD to 400 MBPD)
- Mid-to-late 2012 – 700 MBPD from Cushing to USGC)
- Mid-2014 – Seaway expansion from 400 MBPD to 850 MBPD
- Wildcard - 300 MBPD growth in North Dakota rail transportation

Crude oil imported to US Gulf Coast, MBPD

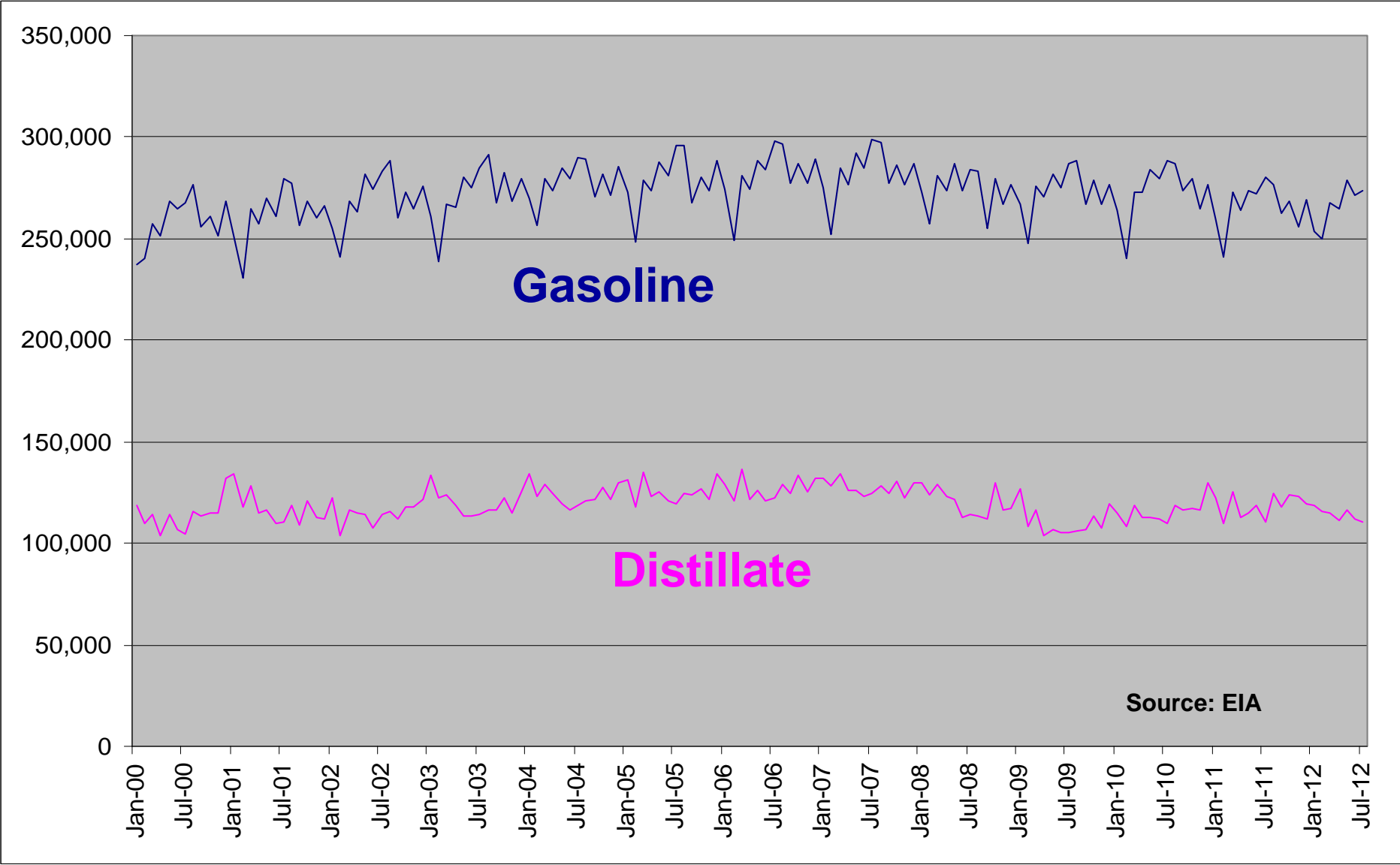


Source: EIA

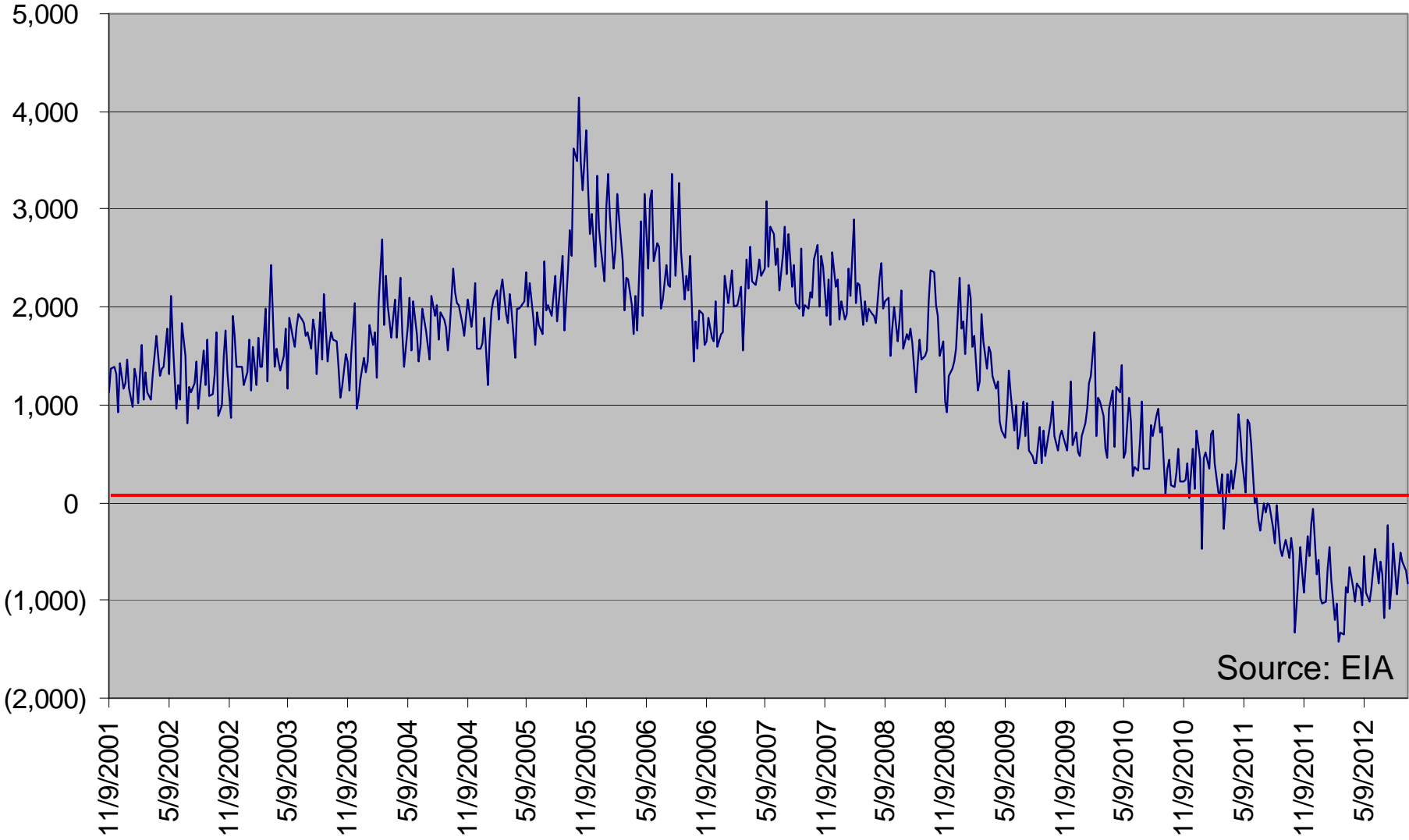
Renewable Fuel Volume Changes over time



Product Supplied to US, MB per month



Net Product Imports (Exports) from the US, MBPD



Source: EIA

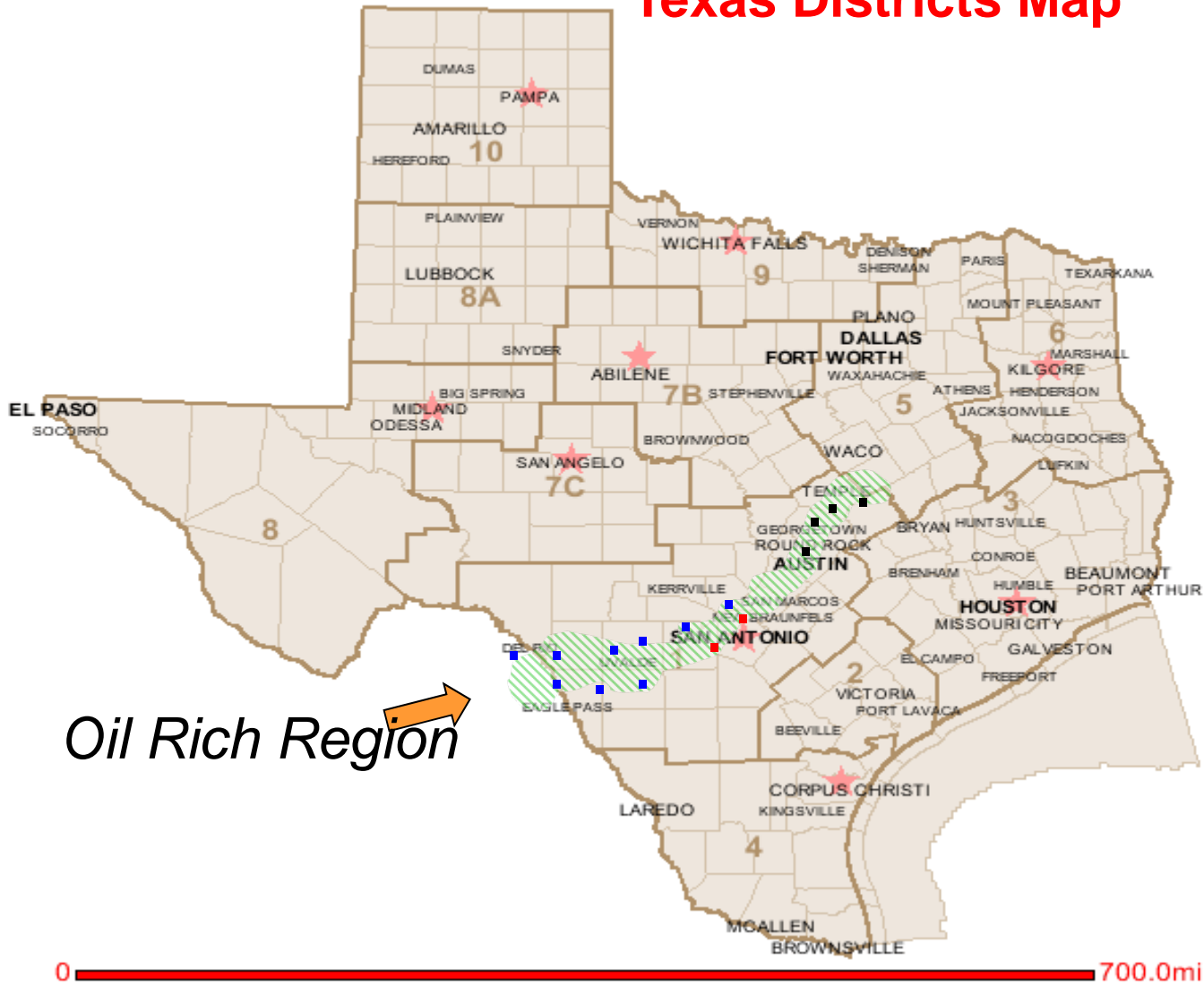
So, in Summary

- As domestic and Canadian production continue to increase, imports to the US via the USGC will continue to decrease.
- Currently, exporting domestic crude oil is prohibited, other than for a special situation in Alaska.
- Therefore one might expect US crude prices to be advantaged to domestic refiners
- Crude quality to the USGC refiners will likely evolve
- But, domestic demand for products is declining
- US has trended from a net importer to a net exported of products

Agenda

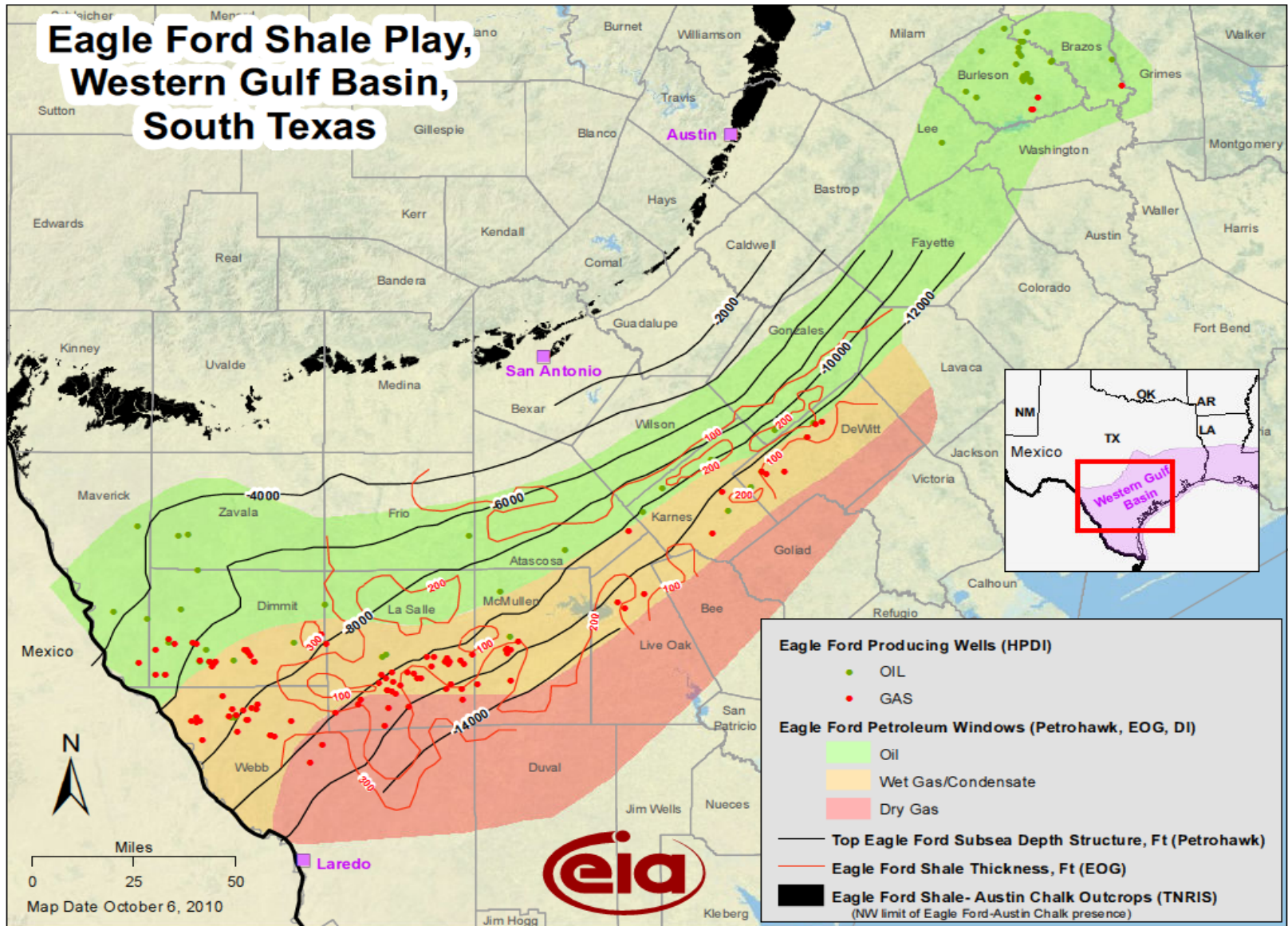
- A little closer to home - What Eagle Ford shale oil means to a heavy crude refiner in Corpus Christi.

Texas Districts Map



Eagle Ford Shale Oil Expected in Districts 1, 2, and 3 Primarily

Eagle Ford Formation

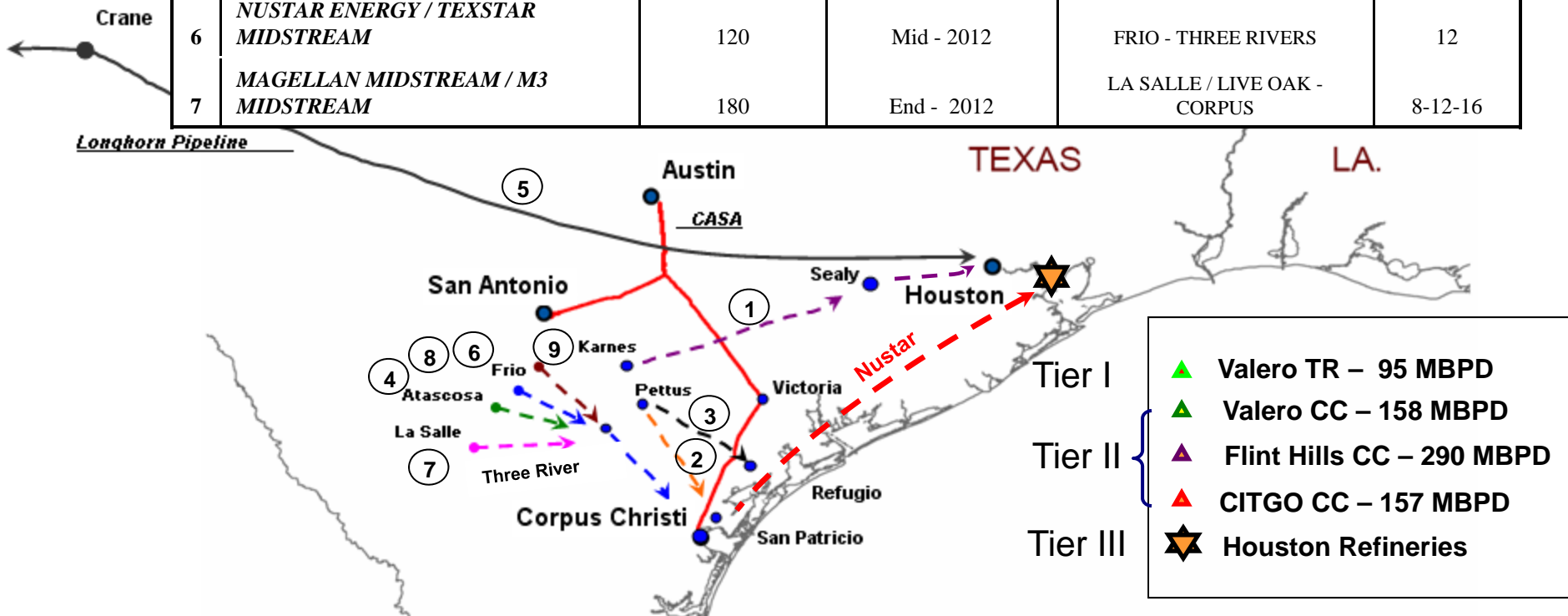


Major Eagle Ford Shale Players

	Acres	Comments
EOG Resources	590,000	520,000 acres in mature oil window, 26,000 acres in wet gas window and 49,000 wet gas. Total: 590,000 acres.
Chesapeake Energy	445,000	(partner CNOOC): 445,000 net acres. Potential net unrisked, undrilled wells: 5,540.
Newfield Exploration	335,000	(85% working interest), 335,000 acres. Mostly in Dimmit and Maverick counties.
Apache Corporation	450,000	450,000 acres mixed oil and gas windows.
Petrohawk Energy	347,600	224,000 acres (Hawkville field), 73,600 acres (Black Hawk field), 50,000 acres (Red Hawk field). Total: 347,600 acres.
Pioneer Natural Resources	310,000	310,000 acres.
Anadarko Petroleum	300,000	300,000 + net acres. (Mostly in wet gas and condensate windows.)
Conoco Phillips	300,000	
St. Mary's Land And Exploration	250,000	250,000 acres. (Consists of 165,000 acres, 100% working interest in wet gas window and 85,000 acres in wet gas and oil windows, JV with Anadarko.)
Forest Oil	105,000	105,000 ares, primarily in Gonzales, Wilson, DeWitt and Lee counties.
Swift Energy	89,000	89,000 acres in Eagle Ford shale and 113,000 in Olmos formation with some overlapping acreage.
Other Players	100,000	Talisman Energy, Hess Energy, StatOil, Rosetta Resources, Exxon Mobil, Goodrich Petroleum, Penn Virginia, Petro Quest, Crimson Exploration and Carrizo Oil and Gas.
Total	3,621,600	

Eagle Ford Shale Pipeline Expansion Projects

#	Company	Capacity (MBPD)	Completion Date	Route	Diameter (Inch)
1	<i>ENTERPRISE CRUDE PIPELINE LLC</i>	350	Mid 2012	KARNES – SEALY-HOUSTON	24
2	<i>FLINT HILLS RESOURCES</i>	250	Mid 2012	PETTUS – CORPUS	20
3	<i>FLINT HILLS RESOURCES</i>	200	Mid 2012	PETTUS - REFUGIO- GC	16
4	<i>KOCH / ARROWHEAD PIPELINE</i>	50 / 90	End 2011 / Mid 2012	ATASCOSA/LIVE OAK – THREE RIVERS	12
5	<i>MAGELLAN MIDSTREAM (Longhorn)</i>	225	Mid 2013	CRANE - HOUSTON	18-20
6	<i>NUSTAR ENERGY / TEXSTAR MIDSTREAM</i>	120	Mid - 2012	FRIO - THREE RIVERS	12
7	<i>MAGELLAN MIDSTREAM / M3 MIDSTREAM</i>	180	End - 2012	LA SALLE / LIVE OAK - CORPUS	8-12-16

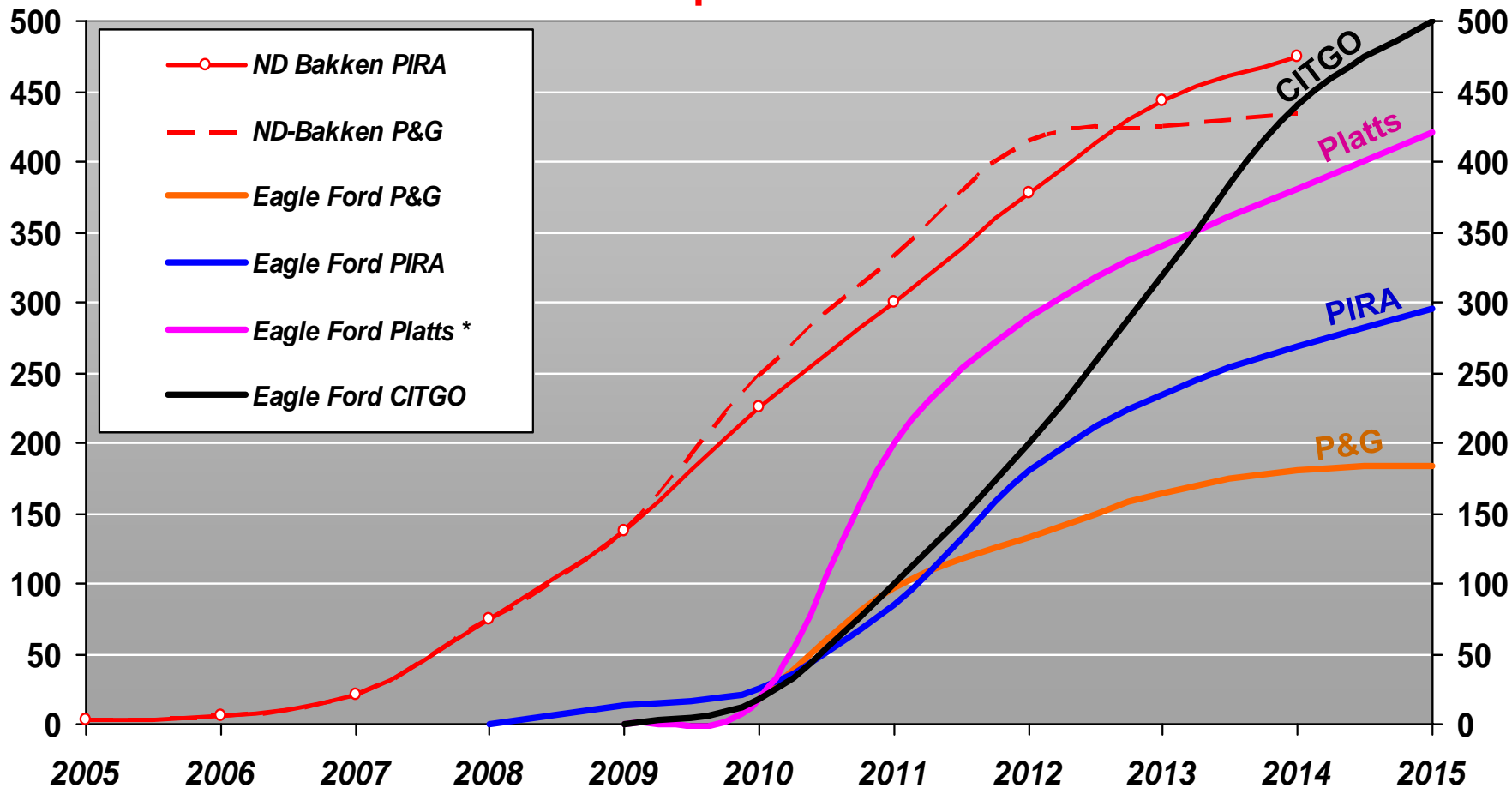


Other Projects

#	Company	Capacity (MBPD)	Completion Date	Route
8	<i>PLAINS ALL AMERICAN PIPELINE LP</i>	300	End - 2012	ZAVALA - CORPUS
9	<i>KINDER MORGAN</i>	300	Mid - 2012	DE WITT - CORPUS

Eagle Ford Oil / Condensate Production Forecast, MBPD

April 2011

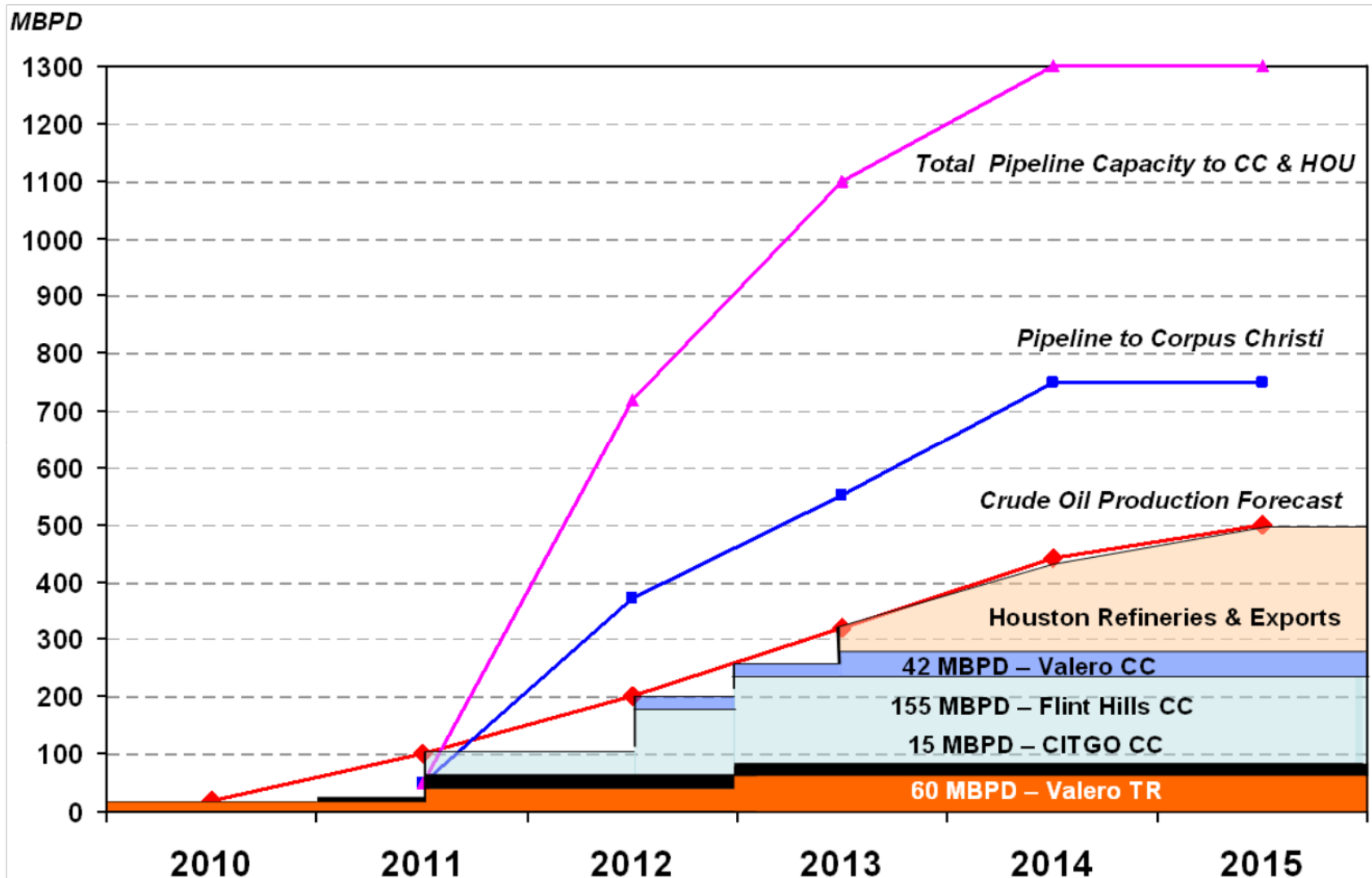


* (Bentek Energy Group)

2010 Eagle Ford Production

- Texas RRC – 16 MBPD
- Purvin & Gertz – 18 MBPD
- EIA – 22 MBPD

Eagle Ford Oil Supply Placement



- Some speculation that production may reach 1 MMBPD by 2015

South-Western Texas Refinery Capacities (MBPD)

Source: PIRA

			Distillation Capacity		Conversion Capacity			Others																							
			ADU	VDU	Coking	FCC		Hydrocracking	Reformer	Hydrotreating							Alkylation	Polymerization	Aromatics-BTX	Hydrode-Alkylation	Cyclohexane	Cumene	C4 Isomerization	C5 C6 Isomerization	Oxygenates	Hydrogen (MMSF /D)	Lube Oil Plant	Coke (000 T/D)	Sulfur (000 mt/D)		
						Fluid Cat Cracking	Resid Cat Cracking			Cat Reformer Feed HDT	Distillate Hydrotreating	Mercox Treater	Vacuum Gasoil HDT	Kero/Jet HDT	Aromatics Saturation - Distillate	Lube Oil HDT														Resid Desulphurization	Cat Gas HDT
Texas South-West	Corpus Christi	Citgo	157	74	38	73		46	47	0.1	4	57						72	18		13	3	4	11			4			2	0.3
		Flint Hills Resources	290	83	13	96		13	63	73	48		45	13			41	34	13		31			14						1	0.5
		Valero	158	88	20	0	92	48	50	67	14		30	12			148	58	55	31	2	22				16	0	2	157	1	0.8
	Three Rivers	Valero	95	32		24		30	34	22	0	12	11	20	2			20	6		19						16	3		0.1	
Total			605	266	70	169	92	61	159	188	62	4	132	25			148	99	161	62	2	66	3	4	25	16	0	17	237	4	1.6

Typical Crude Oil Run by Refinery

	Crude Slate	API	
CITGO CC	Mesa	30.0	Heavy
	Marlim	20.5	
	Urals	31.8	
	Saharan Blend	44.2	
	Leona	22.0	
Flint Hills CC	Cabinda	32.5	Light
	Saharan Blend	44.2	
	Brent	38.0	
	WTI	39.0	
	Bonny Light	35.4	
Valero CC	Bonny Light	35.4	Intermedia
	Arab Medium	30.8	
	Kirkuk	33.9	
	Kuwait	30.9	
	Maya	21.0	
Valero TR	Kirkuk	33.9	Light
	Kuwait	30.9	
	Arab Extra Light	32.7	
	Mesa	30.0	
	WTI	39.0	

Crude Imported (MBPD) / API (°)

	2008	2009
CITGO CC	139.00 / 24.1	136.52 / 23.6
Flint Hills CC	155.42 / 36.4	136.87 / 36.0
Valero CC	164.15 / 29.6	134.16* / 31.3
Valero TR	35.53 / 33.1	50.42 / 36.8

Vol (MBPD)	
Heavy	21.12
Intermedia	92.70
Light	20.34
Total	134.16

Recent Announcement

Flint Hills Resources' West Refinery in Corpus Christi is getting \$250 million in upgrades. The improvements will allow the company to process more Eagle Ford crude and reduce emissions. **The upgrades wouldn't add capacity, but would allow the company to process more South Texas crude.**

Flint Hills operates two Corpus Christi refineries. The West Refinery that will be upgraded refines 230,000 barrels of oil per day and the East Refinery refines 70,000 barrels per day. Currently, only 50% of the crude processed in the West Refinery is sourced from the Eagle Ford, but additional processing facilities will allow Flint Hills to maximize the use of local supply. The expansion will not be noticeable to the untrained eye and will add 1,000 jobs at the peak of construction

Impact of Lighter Crude to a Heavy Crude Refiner

- Replace any light crude that is currently imported
 - Relatively modest amounts – 10,000 to 20,000 BPD
- Run volumes of Eagle Ford in addition to displacing imports
 - Will likely hit physical constraints that will impact overall rate
 - Based on relative crude prices and economics
 - Flexible and short term
- Target a blend – 21 to 23 API
 - Light crude could enable a heavy refiner to bring in super heavy crudes (13-16 API) and then blend with light, local crude to produce a blends suitable for the refinery.
- Modify existing assets or add additional investment to handle the lighter crude oil
 - Need a longer term perspective on volume and relative price due to time needed to make the investments and earn a payout.

Factors Impacting Value of Light Crude Oil

- Aren't lighter (higher API) crude oils always worth more to a refiner?
 - To a point – yes
 - Resids (1000 F) are usually the lowest valued fraction.
 - Past that point, the higher API crudes will decrease in value
- Why?
 - Once the resid yield is essentially nil, the crude value will be impacted by the relative percentages of what is left.
 - Generally jet and diesel (350 F to 700 F) are the most valuable
 - World-wide, diesel is the preferred fuel over gasoline
 - The Atlantic basin is short diesel and long gasoline
 - Typically gas oil (700 F to 1000 F) is the next most valuable
 - FCC or Hydrocracker feed
 - Dense, so more pounds per barrel – when cracked, will yield more than 1 bbl for each bbl of feed.

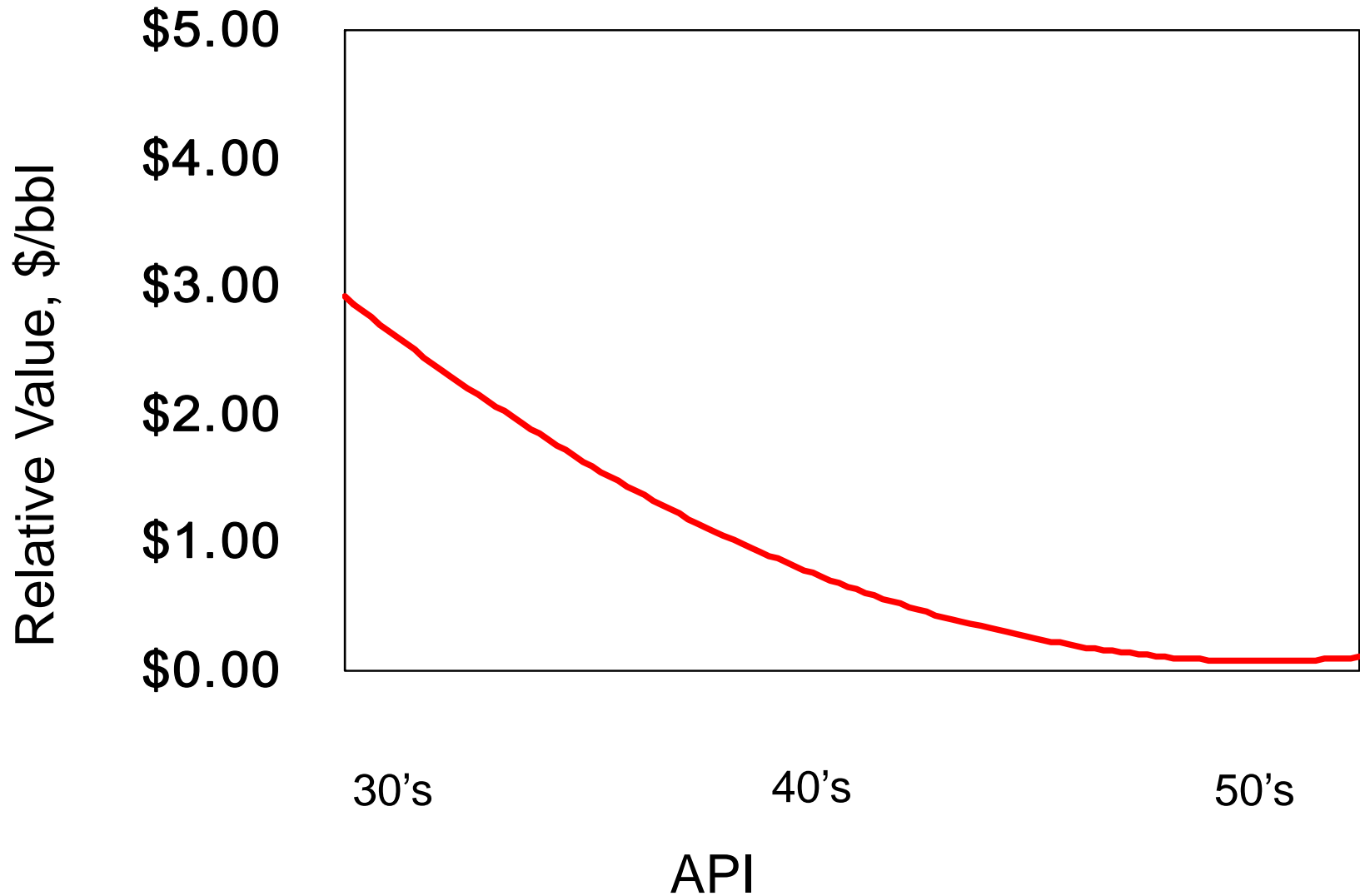
Factors Impacting Value of Light Crude Oil

- Next most valuable is Naphtha (170 F to 350 F)
 - Gasoline precursor
 - Typically have some shrinkage when processed
 - Demand for hydrocarbon flat to down – efficiency, biofuels
- Of much lower value is the LPG (less than 170 F)
 - Pentanes can likely be blended into gasoline
 - Butanes are balanced to long for most refiners
 - As gasoline RVP regulations trend downwards, butane is forced out.
 - Alternative may be as Steam Cracker feed – competing against ethane – lower value than gasoline.
 - Propane yield is typically small
 - Recovered and sold – prices between natural gas and crude oil
 - As crude API goes above 40, the LPG content increases significantly

Other Factors Impacting Value of Light Crude Oil

- BS&W
 - Less is better – too much can impact unit reliability.
- RVP
 - Typically not a concern with heavier crudes
 - Stored in floating roof tanks – Max True RVP – 11.0 psia
- Sulfur
 - Levels are low enough, that it is typically not a concern for CITGO, although lower is better.
- Typical Specs CITGO might request;
 - API Gravity (43 and 53 seem to be typical) , possibly a distillation curve or percentages at certain boiling points.
 - BSW – 0.25% maximum
 - H₂S content in product – 2 ppm maximum (safety)
 - Benzene – 3% maximum (environmental permit limitation)
 - RVP – max 11.0 psia (environmental permit limitation)
 - Sulfur – report

Relative Value of Eagle Ford Crude



Quality impact on Reliability

- Maintaining high reliability is key to a successful refinery
 - Avoids abnormal operating conditions
 - Margins only count if you're producing
- An important driver to refinery reliability is feedstock quality
 - Eliminate “surprises” and sudden shifts in crude API
 - Eliminate non-standard streams that may find their way into a crude stream or truck station
- Due to growth rate and large number of producers, the Eagle Ford crude quality is variable.
 - Will a standard blend emerge?
 - Will several standard blends emerge?
 - The more consistent and predictable the quality, the greater value to a refiner.

Summary

- Growth in Eagle Ford production presents a great opportunity to area refiners.
- For a heavy crude refiner, the Eagle Ford crude is significantly different than their historical crude diet.
- Economics (price of crude relative to other crudes) will dictate their volumes and strategy.
- Logistics from the wellhead to the refinery are limiting and complex now, but will likely evolve to pipelines.
- Consistent and predictable crude quality is important to refineries.