

Basics of Market Fundamentals

March 7, 2007



Crack Spreads Overview

■ Definition

- The price difference between a barrel of product and a barrel of feedstock
- Also called indicator margin, differential, crack, or spread
- Typically in \$/barrel (bbl), but sometimes in ¢/gallon (cpg)
- Convert at 1 barrel = 42 gallons

■ Often based on “benchmark” feedstocks and products

- Crude oil – WTI NYMEX contract based on WTI in Cushing, OK
- Gasoline – NYMEX contract based on reformulated gasoline blendstock for oxygenate blending (RBOB) in New York Harbor (NYH)
- Diesel – NYMEX contract based on #2 heating fuel oil in NYH, which is essentially high sulfur diesel (HSD)



Crack Spreads Details

- **Gas crack = 1 bbl gasoline minus 1 bbl crude oil**
 - Use RBOB or conventional gasoline depending on location, but use CARBOB gasoline on the West Coast
 - WTI is most popular crude oil, but common to use Brent for East Coast and ANS for West Coast
- **Heat crack = 1 bbl #2 heating oil minus 1 bbl crude oil**
 - Important to evaluate low sulfur diesel (LSD) or ultra low sulfur diesel (ULSD) crack in most locations due to premium to heating oil
 - Use CARB diesel on the West Coast
- **Feedstock sour and heavy spreads**
 - Difference between WTI and cheaper feedstocks that trade at a discount
 - For example: WTI minus Maya
 - Examples of cheaper feedstocks include WTS, Mars, ANS, resid, and many others
- **Total refining gross margin = product cracks + sour and heavy spread**

Indicator Margins

- **A ratio of cracks representing approximate refinery yields**
 - Can make any mix you want by changing the proportions
 - Representative of relative profitability
- **Example**
 - WTI 3/2/1 = 3 bbls of WTI make 2 bbls of gasoline (67%) and 1 bbl of diesel (33%)
 - If WTI is trading at \$60/bbl, gasoline at \$75/bbl, and diesel at \$71/bbl, then
 - Gas crack = \$75 minus \$60 = \$15/bbl
 - Diesel crack = \$71 minus \$60 = \$11/bbl
 - 3/2/1 crack = \$15 x 67% + \$11 x 33% = \$13.66/bbl
- **Other examples**
 - 5/3/2 = 60% gasoline, 40% diesel
 - 6/3/2/1 = 50% gasoline, 33% diesel, 17% residual fuel oil

Fundamental Data

■ Key data sources

- U.S. Department of Energy's Energy Information Administration (<http://www.eia.doe.gov/>)
- Weekly Petroleum Status Report on Wednesdays at 10:30am ET

■ Supply data points

- Stocks, production, imports, operable capacity, and utilization

■ Demand data points

- Product supplied and exports

■ Days of supply

- Combines supply and demand data
- Computed as: stocks divided by trailing 4-weeks average demand

■ Mid-cycle

- Many data points (pricing and fundamentals) are evaluated in terms of historical five-year averages and ranges

■ Industry Fundamentals and Pricing

- <http://www.valero.com/Investor+Relations/Industry+Fundamentals/>
- Key Commodity Prices and Differentials – schedule of historical feedstock and product prices by region plus relevant Bloomberg tickers
- Gasoline Fundamentals – charts of historical DOE supply and demand data plus Gulf Coast margins
- Distillate Fundamentals – charts of historical DOE supply and demand data plus Gulf Coast margins
- Crude Oil Fundamentals – charts of historical price differentials to WTI
- Basics of Refining – presentations explaining refining units and processes

■ Valero Operating Details

- <http://www.valero.com/Investor+Relations/Financial+Reports+and+SEC+Filings/Quarterly+Operating+Highlights/>
- Operating Highlights – summary of margins, throughput volumes, and financial results earned by VLO on a quarterly and regional basis
- Charges and Yields – summary of feedstocks consumed and products produced by VLO on a quarterly and regional basis



Key Prices Schedule Available on Valero Website

KEY COMMODITY PRICES AND DIFFERENTIALS

(Dollars per Barrel, Unless Otherwise Noted)

Average Market Reference Prices as of 3/02/07	Feedstocks at U.S. Gulf Coast, except as noted					U.S. Gulf Coast ²					U.S. Mid-Continent ²		U.S. Northeast ²			U.S. West Coast ²	
	WTI Crude Oil (Cushing)	WTI less Sour Crude Oil ¹	WTI less Maya	WTI less Mars	WTI less ANS (US West Coast)	Conv 87 Gasoline less WTI	No. 2 Fuel Oil (heating) less WTI	Low Sulfur Diesel less WTI	Ultra-Low Sulfur Diesel less WTI	Residual 3% #6 Fuel Oil less WTI	Conv 87 Gasoline less WTI	Ultra-Low Sulfur Diesel less WTI	Conv 87 Gasoline less WTI	RBOB 87 Less WTI	No. 2 Fuel Oil (heating) less WTI	CARBOB 87 Gasoline less ANS	Ultra-Low Sulfur Diesel less ANS
Week Ended																	
2/2/07	57.03	5.60	12.43	5.14	2.63	4.94	10.33	14.19	14.21	(17.91)	6.50	15.90	5.52	4.95	11.73	23.66	33.02
2/9/07	58.99	7.10	12.58	5.26	2.51	5.40	9.74	14.21	13.65	(18.43)	7.75	16.39	6.00	5.96	12.25	25.75	33.23
2/16/07	58.35	7.10	12.86	5.98	2.42	7.88	8.75	13.64	14.80	(18.61)	10.39	17.04	9.18	8.98	11.16	27.47	33.23
2/23/07	59.37	7.10	13.06	6.54	2.15	11.96	9.93	15.66	18.16	(19.19)	14.70	20.23	13.50	13.25	11.97	32.40	29.95
3/2/07	61.51	6.28	13.38	5.46	2.03	14.90	11.07	17.36	19.21	(20.81)	16.87	22.41	17.82	16.95	12.93	32.86	27.50
Month																	
Feb-06	61.57	7.83	15.51	8.18	2.32	3.11	7.36	12.76	-	(14.90)	4.98	12.99	1.58	1.34	7.29	10.64	20.28
Mar-06	62.82	8.15	13.81	7.86	2.22	14.55	11.53	15.90	-	(16.14)	14.79	16.63	11.35	11.41	11.84	21.26	22.33
Apr-06	69.46	8.40	14.02	5.87	1.84	23.60	13.63	18.80	-	(18.73)	20.64	20.19	19.34	22.00	13.69	32.44	26.53
May-06	70.92	7.20	15.63	7.04	1.63	16.97	11.95	17.46	19.18	(20.99)	16.74	19.16	15.32	25.33	11.81	36.54	30.01
Jun-06	70.88	6.08	17.38	7.16	1.44	19.40	9.69	19.32	19.37	(24.47)	19.67	22.80	16.12	24.52	9.64	30.35	26.39
Jul-06	74.38	6.43	16.37	6.67	1.28	22.14	7.38	19.27	19.55	(24.83)	23.26	24.87	19.90	24.89	6.33	29.27	19.87
Aug-06	73.01	6.25	14.11	7.69	1.27	12.29	11.48	20.12	20.39	(23.42)	18.27	30.05	12.55	13.43	10.20	20.01	28.60
Sep-06	63.74	5.75	14.07	8.14	1.74	1.58	8.09	10.86	11.28	(21.95)	4.01	13.74	3.03	2.51	7.36	11.15	20.19
Oct-06	58.82	6.60	12.44	7.01	4.46	4.45	10.45	13.13	16.09	(18.56)	6.05	17.42	5.08	4.59	10.21	15.26	21.28
Nov-06	59.03	6.90	12.63	6.05	4.94	6.49	10.18	14.51	16.48	(19.43)	7.50	20.17	7.76	7.22	10.28	19.83	25.67
Dec-06	61.96	6.50	14.05	6.74	3.89	5.06	8.13	13.00	13.20	(22.53)	5.45	15.38	7.87	7.40	8.50	17.70	26.39
Jan-07	54.14	5.60	12.58	5.96	2.84	4.69	8.84	13.13	14.21	(17.73)	4.63	16.65	5.59	5.30	9.63	20.54	28.99
Feb-07	59.20	7.10	13.38	5.77	2.34	8.70	9.79	14.72	15.72	(18.96)	11.13	18.15	9.93	9.66	12.00	28.07	31.81
Mar-07	61.68	5.05	13.18	5.22	1.94	16.22	11.07	17.95	19.68	(21.02)	17.56	23.20	20.13	19.29	12.84	35.07	26.36
Quarter																	
1Q 05	49.88	8.06	17.11	7.01	4.82	5.97	7.44	8.27	-	(21.58)	7.36	9.33	4.99	4.50	9.41	19.16	18.91
2Q 05	53.08	6.71	13.04	5.60	2.99	9.61	9.62	12.35	-	(16.69)	10.40	13.68	7.89	11.30	10.61	21.42	20.98
3Q 05	63.18	5.26	15.48	6.16	2.27	19.46	13.46	16.19	-	(22.77)	17.59	16.32	16.08	16.49	12.45	25.60	25.64
4Q 05	60.01	7.50	16.75	7.11	2.12	7.57	15.88	19.55	-	(19.25)	6.50	23.02	7.04	6.38	14.03	11.61	20.89
1Q 06	63.29	7.98	15.61	7.70	2.41	8.39	9.01	12.91	-	(16.83)	8.46	13.44	7.07	6.99	9.19	15.56	20.12
2Q 06	70.46	7.23	15.68	6.72	1.62	19.83	11.68	18.52	19.71	(21.51)	18.95	20.75	16.82	24.05	11.63	33.14	27.70
3Q 06	70.44	6.14	14.85	7.52	1.42	11.85	9.13	16.87	17.19	(23.38)	15.20	23.20	11.73	13.42	8.10	19.99	23.21
4Q 06	59.90	6.20	13.54	6.61	4.43	5.31	9.62	13.53	15.28	(20.12)	6.32	17.65	6.84	6.34	9.68	17.52	24.34
1Q 07	56.85	6.27	13.38	5.83	2.56	7.11	9.39	14.10	15.18	(18.46)	8.27	17.66	8.31	8.00	10.88	24.74	30.17
Year																	
2002	26.16	2.53	5.27	2.49	1.36	4.18	1.47	2.25	-	(5.38)	5.64	3.67	4.17	-	2.39	10.04	6.77
2003	31.07	3.39	6.86	3.60	1.47	5.52	2.71	3.32	-	(7.07)	7.49	5.15	5.97	5.97	4.44	14.32	8.93
2004	41.49	5.31	11.43	6.18	2.53	7.72	3.96	5.43	-	(16.71)	8.58	6.96	8.12	8.94	5.41	19.43	16.39
2005	56.59	6.88	15.59	6.46	3.03	10.73	11.62	14.12	-	(20.06)	10.53	15.60	9.06	9.75	11.63	19.51	21.64
2006	66.02	7.00	14.82	7.12	2.45	11.40	9.88	15.49	17.68	(20.45)	12.28	18.78	10.66	12.76	9.68	21.60	23.86
2007	56.85	6.27	13.38	5.83	2.56	7.11	9.39	14.10	15.18	(18.46)	8.27	17.66	8.31	8.00	10.88	24.74	30.17
Bloomberg Tickers (most relevant data points available on Bloomberg)																	
CL1 Comdty	(CL1 Comdty) - (PCRALUS Index + PGRAMUS Index)/2	(CL1 Comdty) - (LACRMA US Index)	(CL1 Comdty) - (USCRMA RS Index)	(CL1 Comdty) - (USCRANS W Index)	(MOIGC87 P Index * 42) - (CL1 Comdty)	(NO2IGCPR Index * 42) - (CL1 Comdty)	(DIEIGCPR Index * 42) - (CL1 Comdty)	(DIEIGULP Index * 42) - (CL1 Comdty)	(N6GF3.0 Index) - (CL1 Comdty)	(G3OR87PC Index * 42) - (CL1 Comdty)	(G3ORUTLS Index * 42) - (CL1 Comdty)	(MOINY87P Index * 42) - (CL1 Comdty)	(RBOB87P M Index * 42) - (CL1 Comdty)	(NO2INYPR Index * 42) - (CL1 Comdty)	(MOGSC85P Index * 42) - (USCRANS W Index)	(DIEISCAM Index * 42) - (USCRANSW Index)	



Appendix



Major Refining Processes – Topping

■ Definition

- Separating crude oil into different hydrocarbon groups
- The most common means is through distillation

■ Process

- Desalting – Prior to distillation, crude oil is often desalted to remove corrosive salts as well as metals and other suspended solids.
- Atmospheric Distillation – Used to separate the desalted crude into specific hydrocarbon groups (straight run gasoline, naphtha, light gas oil, etc.) or fractions.
- Vacuum Distillation – Heavy crude residue (“bottoms”) from the atmospheric column is further separated using a lower–pressure distillation process. Means to lower the boiling points of the fractions and permit separation at lower temperatures, without decomposition and excessive coke formation.



Major Refining Processes – Cracking

■ Definition

- “Cracking” or breaking down large, heavy hydrocarbon molecules into smaller hydrocarbon molecules thru application of heat (thermal) or through the use of catalysts

■ Process

- Coking – Thermal non-catalytic cracking process that converts low value oils to higher value gasoline, gas oils and marketable coke. Residual fuel oil from vacuum distillation column is typical feedstock.
- Visbreaking – Thermal non-catalytic process used to convert large hydrocarbon molecules in heavy feedstocks to lighter products such as fuel gas, gasoline, naphtha and gas oil. Produces sufficient middle distillates to reduce the viscosity of the heavy feed.
- Catalytic Cracking – A central process in refining where heavy gas oil range feeds are subjected to heat in the presence of catalyst and large molecules crack into smaller molecules in the gasoline and surrounding ranges.
- Catalytic Hydrocracking – Like cracking, used to produce blending stocks for gasoline and other fuels from heavy feedstocks. Introduction of hydrogen in addition to a catalyst allows the cracking reaction to proceed at lower temperatures than in catalytic cracking, although pressures are much higher.

Major Refining Processes – Combination

■ Definition

- Linking two or more hydrocarbon molecules together to form a large molecule (e.g. converting gases to liquids) or rearranging to improve the quality of the molecule

■ Process

- Alkylation – Important process to upgrade light olefins to high-value gasoline components. Used to combine small molecules into large molecules to produce a higher octane product for blending with gasoline.
- Catalytic Reforming – The process whereby naphthas are changed chemically to increase their octane numbers. Octane numbers are measures of whether a gasoline will knock in an engine. The higher the octane number, the more resistance to pre or self-ignition.
- Polymerization – Process that combines smaller molecules to produce high octane blending stock.
- Isomerization – Process used to produce compounds with high octane for blending into the gasoline pool. Also used to produce isobutene, an important feedstock for alkylation.



Major Refining Processes – Treating

■ Definition

- Processing of petroleum products to remove some of the sulfur, nitrogen, heavy metals, and other impurities

■ Process

- Catalytic Hydrotreating, Hydroprocessing, sulfur/metals removal – Used to remove impurities (e.g. sulfur, nitrogen, oxygen and halides) from petroleum fractions. Hydrotreating further “upgrades” heavy feeds by converting olefins and diolefins to parafins, which reduces gum formation in fuels. Hydroprocessing also cracks heavier products to lighter, more saleable products.



List of Refining Acronyms

- **AGO – Atmospheric Gas Oil**
- **ATB – Atmospheric Tower Bottoms**
- **B–B – Butane–Butylene Fraction**
- **BBLS – Barrels**
- **BPD – Barrels Per Day**
- **BTX – Benzene, Toluene, Xylene**
- **CARB – California Air Resource Board**
- **CCR – Continuous Catalytic Regenerator**
- **DAO – De–Asphalted Oil**
- **DCS – Distributed Control Systems**
- **DHT – Diesel Hydrotreater**
- **DSU – Desulfurization Unit**
- **EPA – Environmental Protection Agency**
- **ESP – Electrostatic Precipitator**
- **FCC – Fluid Catalytic Cracker**
- **GDU – Gasoline Desulfurization Unit**
- **GHT – Gasoline Hydrotreater**
- **GOHT – Gas Oil Hydrotreater**
- **GPM – Gallon Per Minute**
- **HAGO – Heavy Atmospheric Gas Oil**
- **HCU – Hydrocracker Unit**
- **HDS – Hydrodesulfurization**
- **HDT – Hydrotreating**
- **HGO – Heavy Gas Oil**
- **HOC – Heavy Oil Cracker (FCC)**
- **H₂ – Hydrogen**
- **H₂S – Hydrogen Sulfide**
- **HF – Hydroflouric (adic)**
- **HVGO – Heavy Vacuum Gas Oil**
- **kV – Kilovolt**
- **kVA – Kilovolt Amp**
- **LCO – Light Cycle Oil**
- **LGO – Light Gas Oil**
- **LPG – Liquefied Petroleum Gas**
- **LSD – Low Sulfur Diesel**
- **LSR – Light Straight Run (Gasoline)**
- **MON – Motor Octane Number**
- **MTBE – Methyl Tertiary–Butyl Ether**
- **MW – Megawatt**
- **NGL – Natural Gas Liquids**
- **NO_x – Nitrogen Oxides**
- **P–P – Propane–Propylene**
- **PSI – Pounds per Square Inch**
- **RBOB – Reformulated Blendstock for Oxygen Blending**
- **RDS – Resid Desulfurization**
- **RFG – Reformulated Gasoline**
- **RON – Research Octane Number**
- **RVP – Reid Vapor Pressure**
- **SMR – Steam Methane Reformer (Hydrogen Plant)**
- **SO_x – Sulfur Oxides**
- **SRU – Sulfur Recovery Unit**
- **TAME – Tertiary Amyl Methyl Ether**
- **TAN – Total Acid Number**
- **ULSD – Ultra–low Sulfur Diesel**
- **VGO – Vacuum Gas Oil**
- **VOC – Volatile Organic Compound**
- **VPP – Voluntary Protection Program**
- **VTB – Vacuum Tower Bottoms**
- **WTI – West Texas Intermediate**
- **WWTP – Waste Water Treatment Plant**



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Statements contained in this presentation that state the Company's or management's expectations or predictions of the future are forward-looking statements intended to be covered by the safe harbor provisions of the Securities Act of 1933 and the Securities Exchange Act of 1934. The words "believe," "expect," "should," "estimates," and other similar expressions identify forward-looking statements. It is important to note that actual results could differ materially from those projected in such forward-looking statements. For more information concerning factors that could cause actual results to differ from those expressed or forecasted, see Valero's annual reports on Form 10-K and quarterly reports on Form 10-Q, filed with the Securities and Exchange Commission, and available on Valero's website at www.valero.com.