VALERO
ENERGY CORPORATION

Delaware City Refinery Tour

August 27, 2007

Agenda

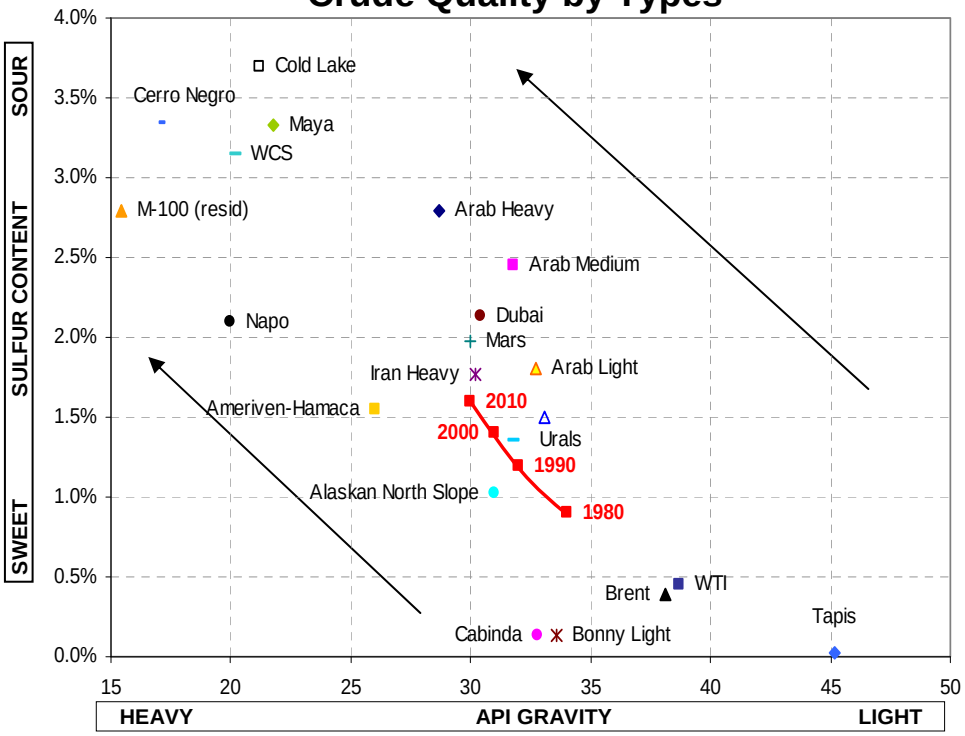
- Basics of Refining
- Desulfurization
- Hydrocracking
- Delaware City Refinery Operations
- Gasification Overview
- Q&A
- Plant Tour
- Concluding Remarks

Crude Oil Characteristics

- Crudes are classified and priced by density and sulfur content
- Crude density is commonly measured by API gravity
  - API gravity provides a relative measure of crude oil density
  - The higher the API number, the lighter the crude
    - Light crudes are easier to process
    - Heavy crudes are more difficult to process
- Crude sulfur content is measured as a percentage
  - Less than 0.7% sulfur content = sweet
  - Greater than 0.7% sulfur content = sour
  - High sulfur crudes require additional processing to meet regulatory specs
- Acid content is measured by Total Acid Number (TAN)
  - Acidic crudes highly corrosive to refinery equipment
  - High acid crudes are those with TAN greater than 0.7

Crude Oil Basics

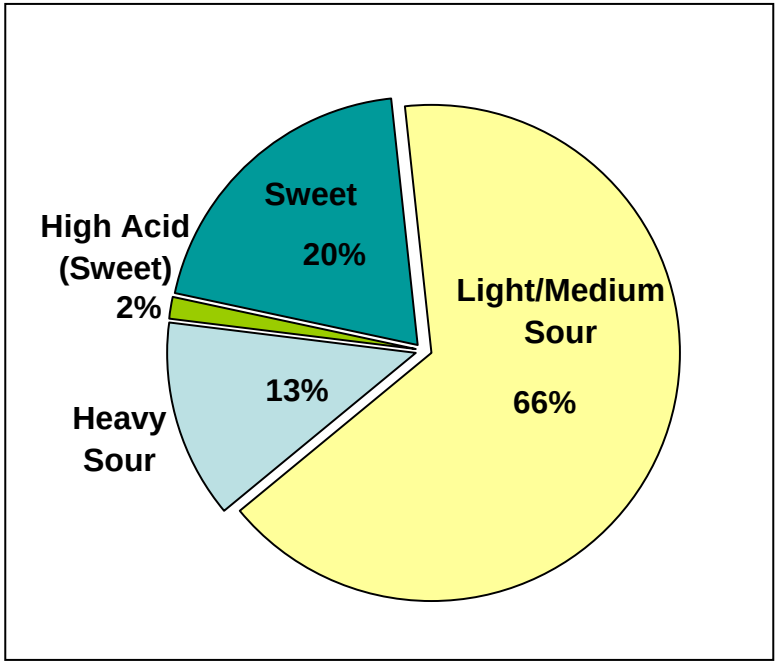
Crude Quality by Types



Source: Industry reports

NOTE: Red line represents the average crude quality by decade (actual and projected)

Estimated Quality of Reserves (2006)



Source: Oil & Gas Journal, Company Information

- **Majority of global reserves are light/medium sour**
- **Most quoted benchmark prices are light sweet crudes**
  - WTI (West Texas Intermediate), Western Hemisphere
  - Brent (North Sea Crude), Europe
- **Historical trend shows global crude supply becoming heavier and more sour**

What's in a Barrel of Crude Oil?

Crude Types	Characteristics	Yields
Light Sweet Crude (e.g. WTI, Brent, Saharan Blend)	> 34 API Gravity < 0.7 % Sulfur 35% Demand Most Expensive	3% 30% 34% 33%
Medium Sour Crude (e.g. Mars, Arab Light, Arab Medium, Urals)	24 – 34 API Gravity > 0.7 % Sulfur 50% Demand Less Expensive	3% 21% 26% 50%
Heavy Sour Crude (e.g. Maya, Cerro Negro, Cold Lake, Western Canadian Select)	< 24 API Gravity > 0.7 % Sulfur 15% Demand Least Expensive	1% 14% 22% 63%

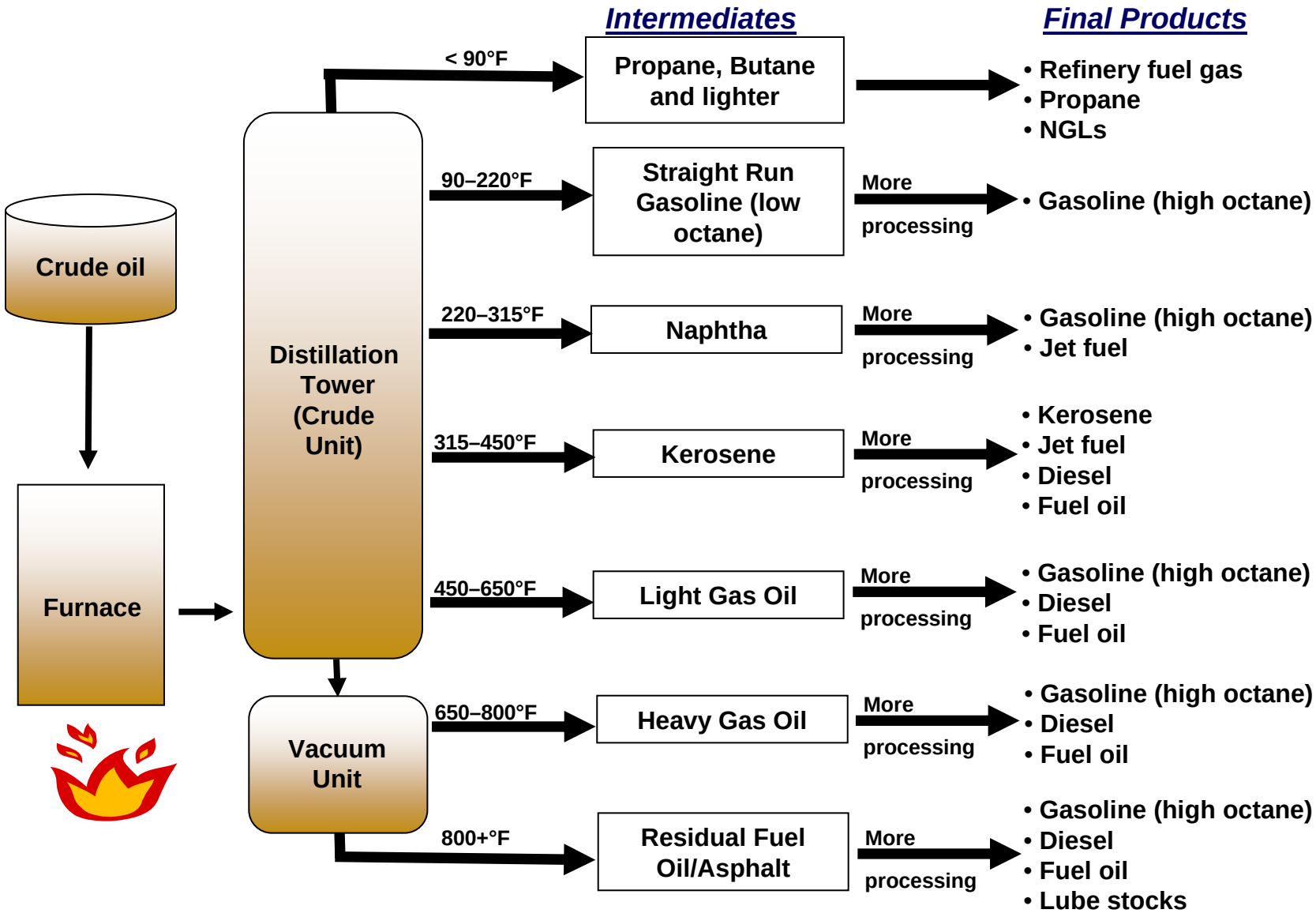
2005 U.S. Production

7%	Refinery Gases
50%	Gasoline RFG Conventional CARB Premium
33%	Distillate Jet Fuel Diesel Heating Oil
10%	Heavy Fuel Oil & Other

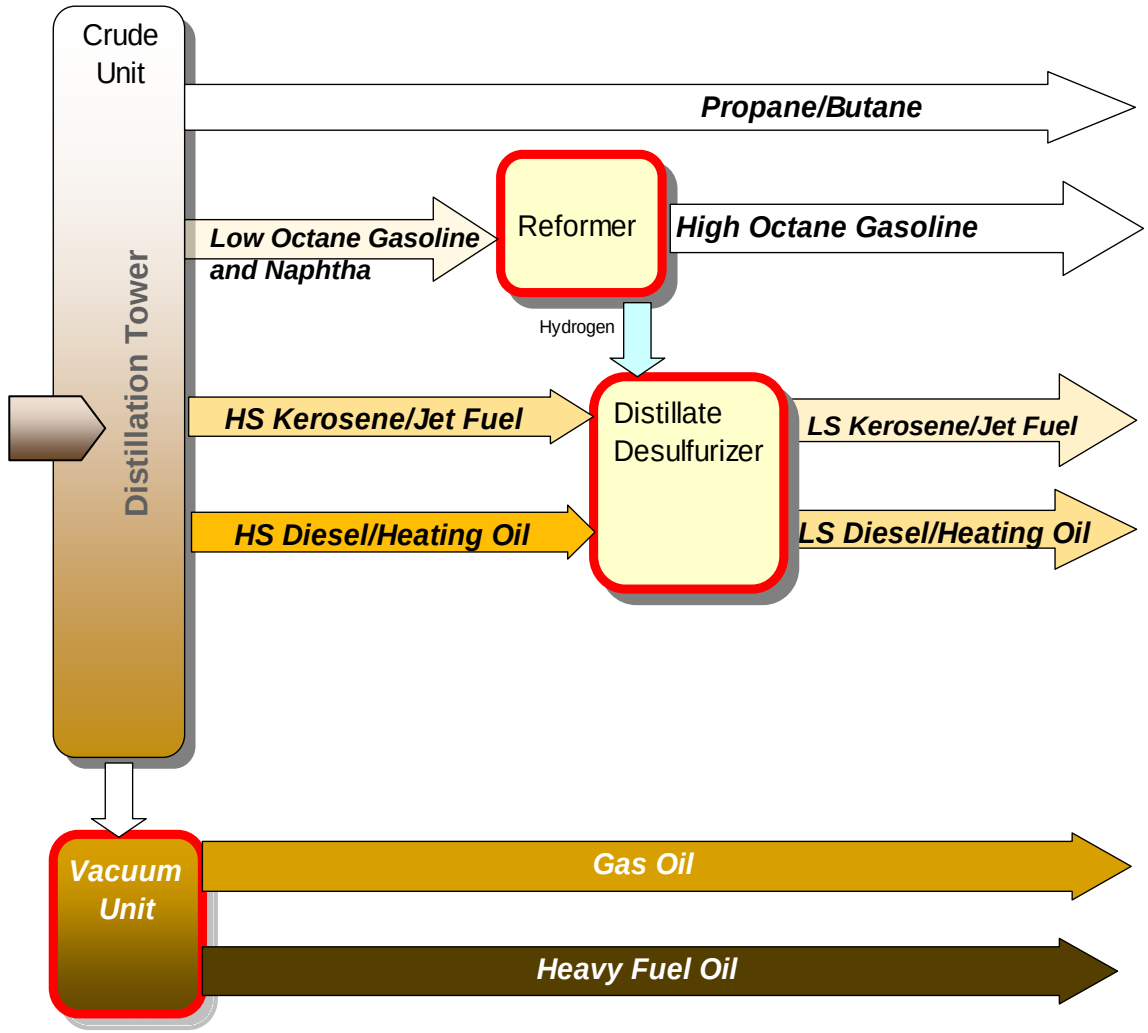
Source: EIA Refiner Production

Refineries upgrade crude oil to higher value products

Basic Refining Concepts



Hydroskimming / Topping Refinery



4% Propane/ Butane

30% Gasoline
RFG
Conventional
CARB
Premium

34% Distillate
Jet Fuel
Diesel
Heating Oil

32% Heavy Fuel Oil & Other

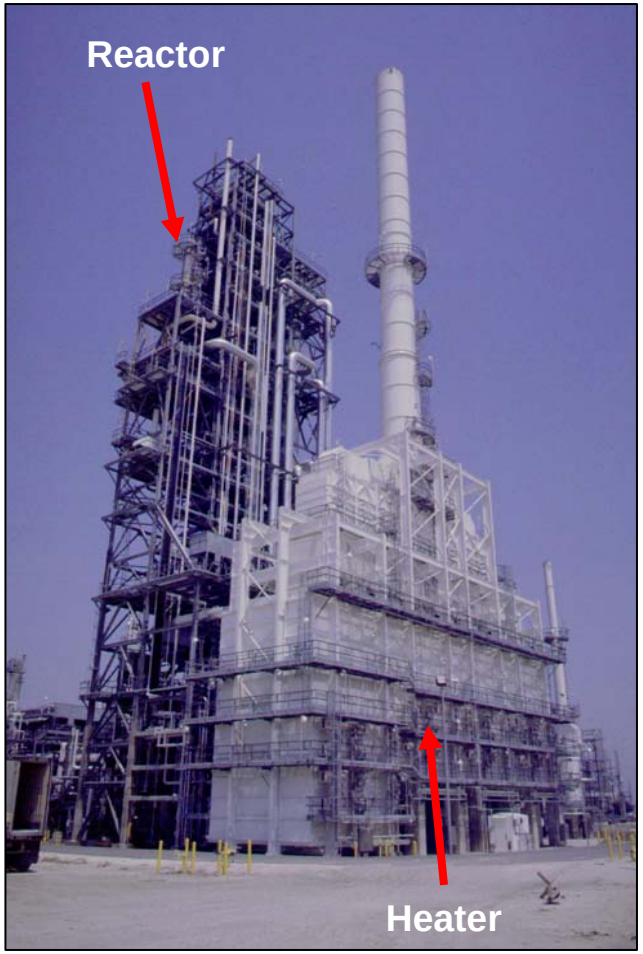
100% Total Yield

Simple, low upgrading capability refineries run sweet crude

Crude and Vacuum Towers

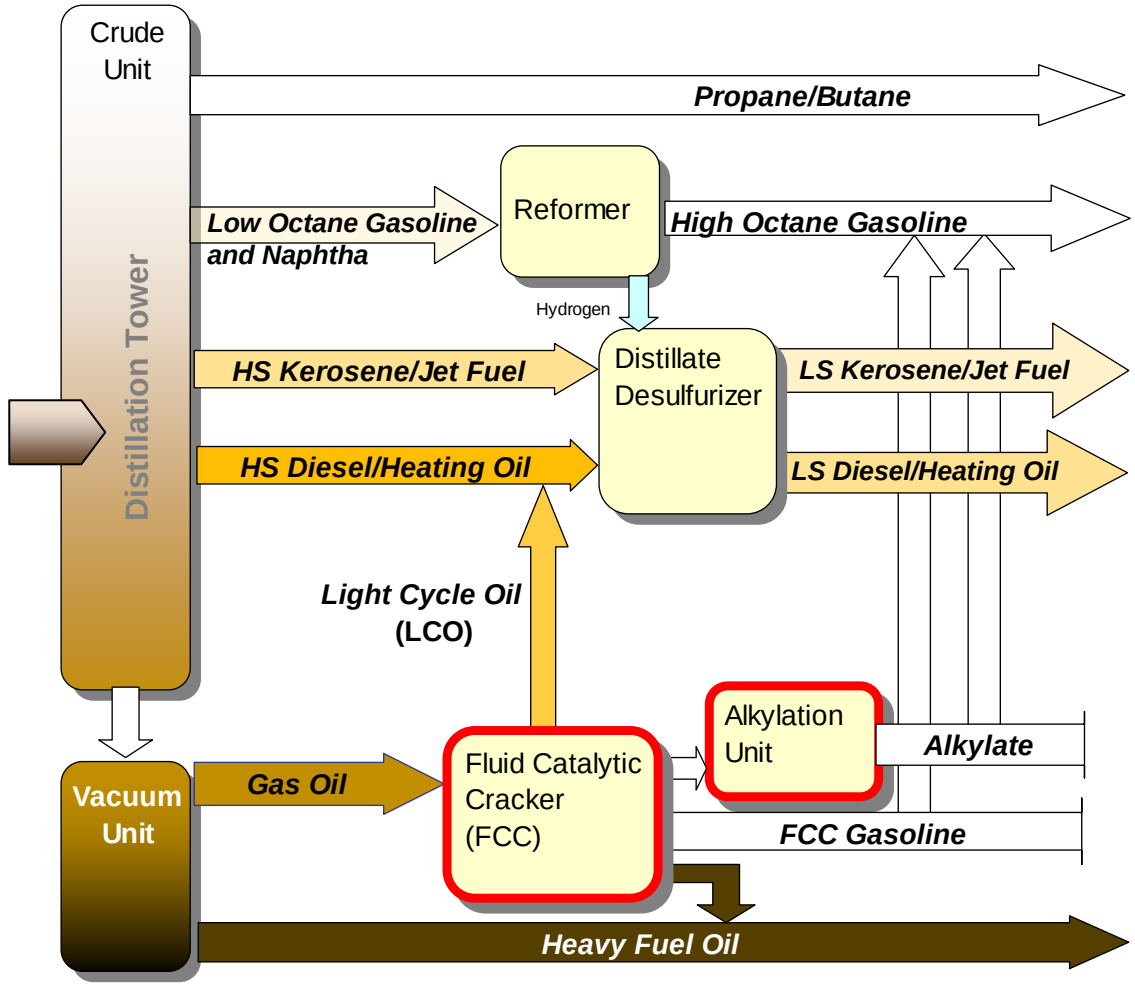
Crude Atmospheric Tower

Vacuum Tower



Reformer

Medium Conversion: Catalytic Cracking



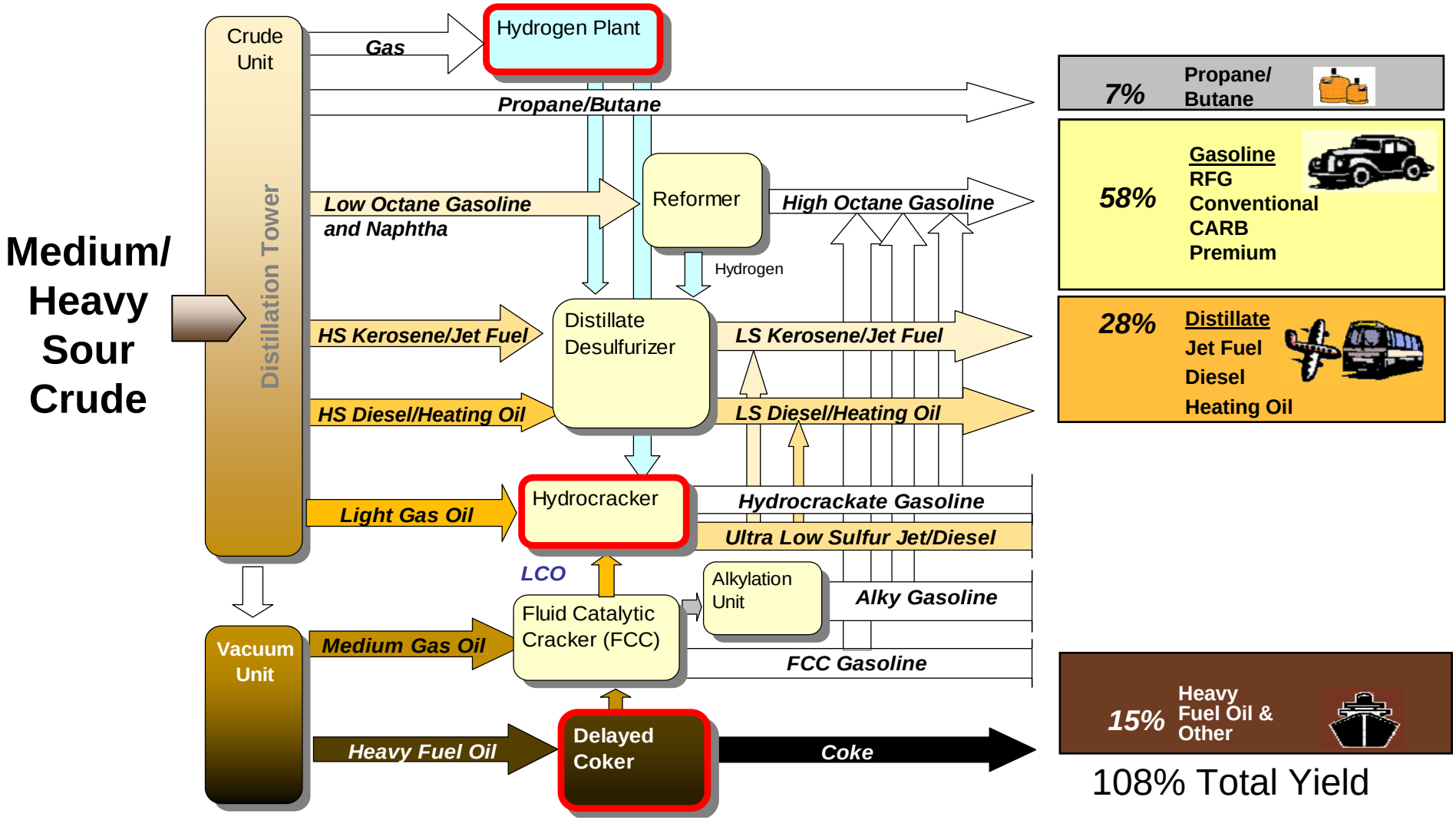
Light Sour Crude

8%	Propane/ Butane
45%	Gasoline RFG Conventional CARB Premium
27%	Distillate Jet Fuel Diesel Heating Oil
24%	Heavy Fuel Oil & Other

104% Total Yield

Moderate upgrading capability refineries tend to run more sour crudes while achieving increased higher value product yields and volume gain

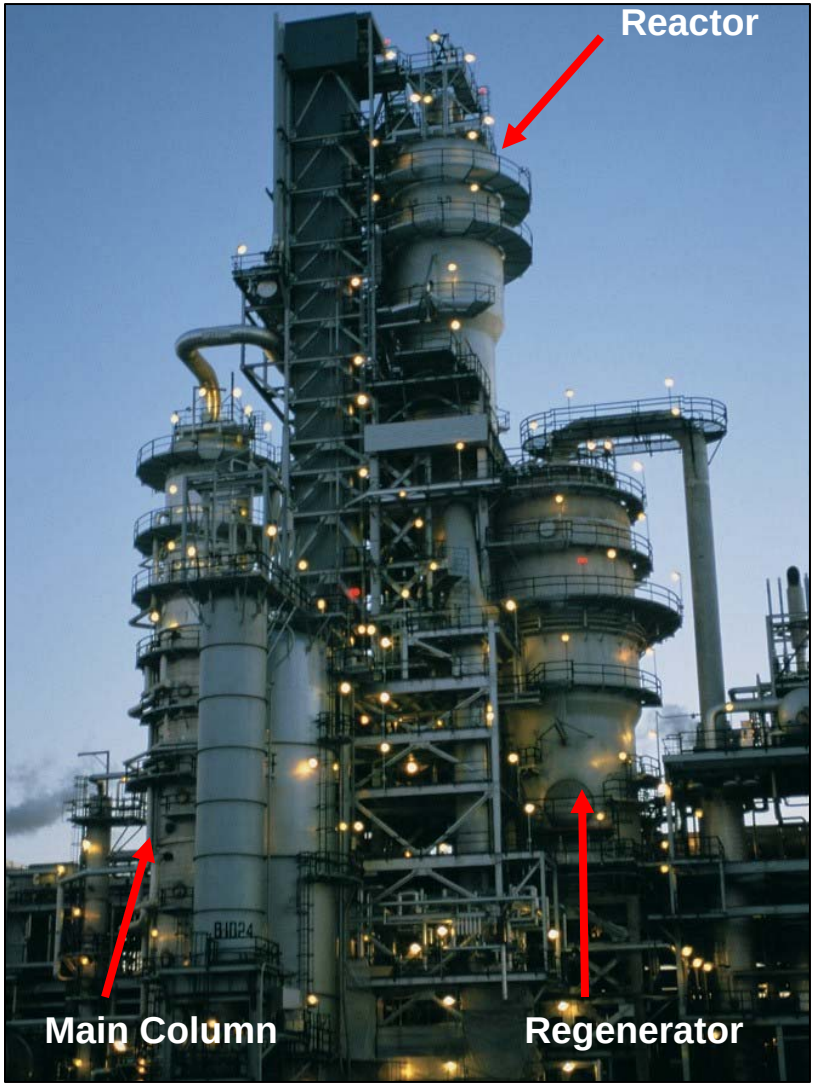
High Conversion: Coking / Resid Destruction



Complex refineries can run heavier and more sour crudes while achieving the highest light product yields and volume gain

FCC and Hydrocracker Reactors

Fluidized Catalytic Cracker



Hydrocracker Reactors

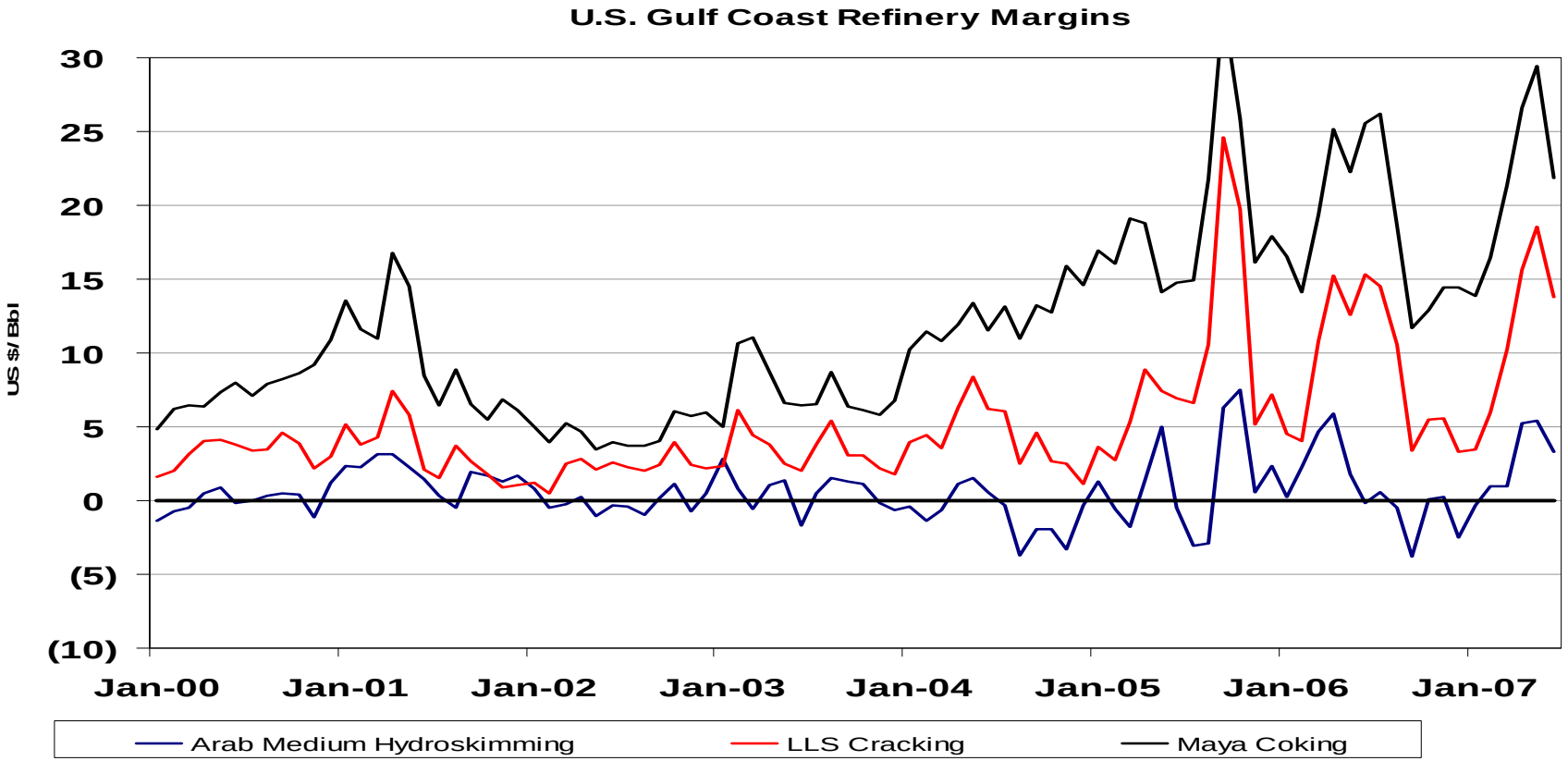
Cokers

Delayed Coker

Superstructure holds the drill and drill stem while the coke is forming in the drum

Fluid Coker - Benicia

Conversion Economics

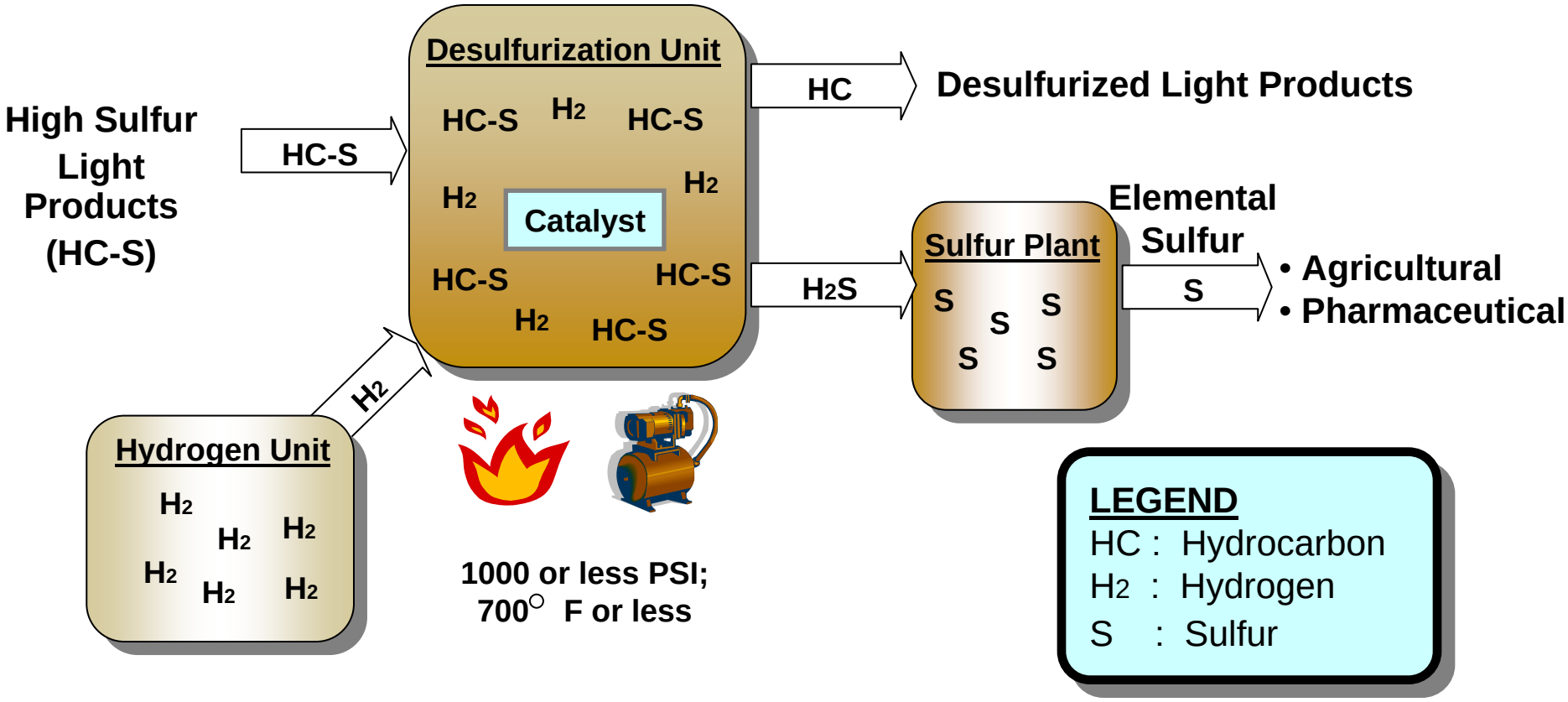


- **Need conversion capacity to capitalize on sour crude discounts**
  - Hydroskim – Breakeven or moderate margins; High resid yield
    - When margins are positive – increase crude runs
    - When margins are negative – decrease crude runs
  - Cracking – Better margins; Lower resid yield
  - Coking – Best margins; Lowest resid yield
    - Maximize heavy crudes

Desulfurization Basics

Objective

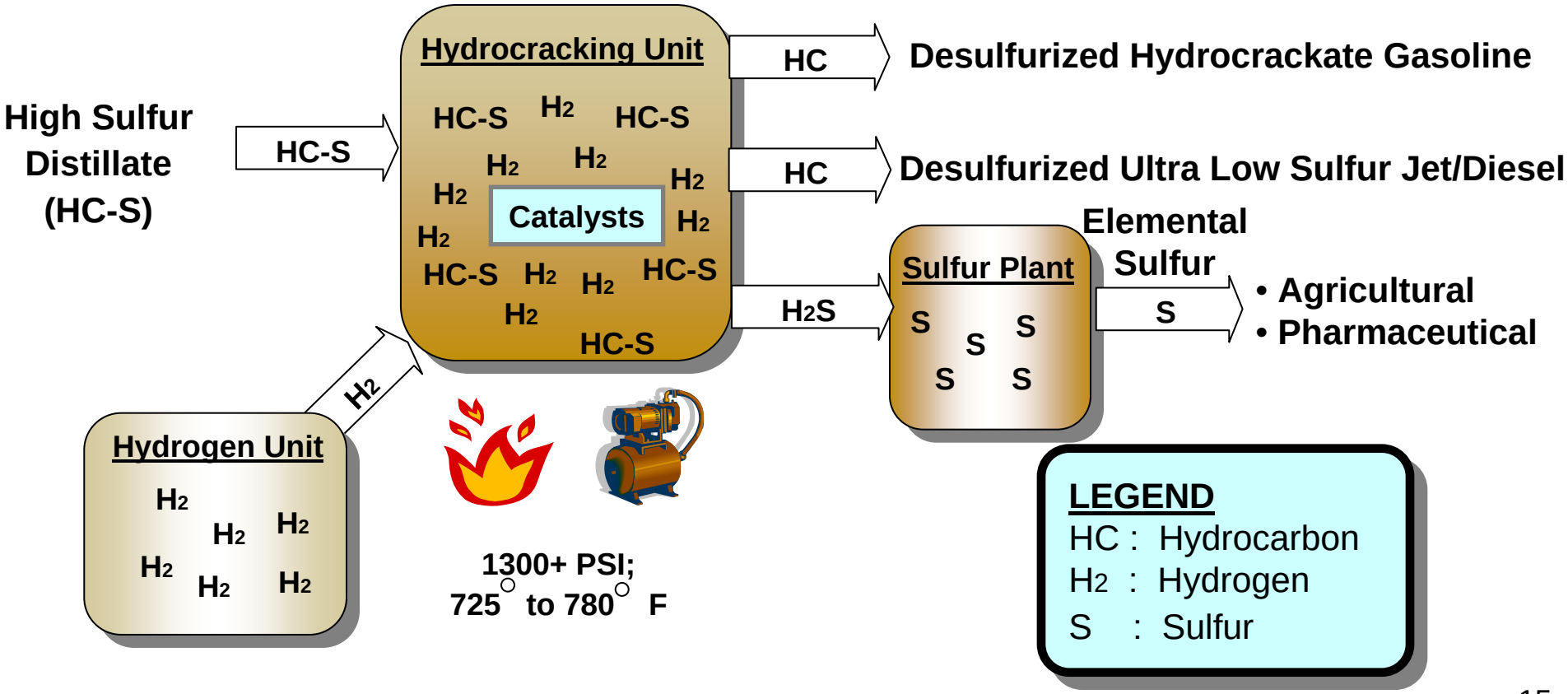
- Remove sulfur from light products (gasoline or diesel) to meet air quality requirements for clean burning fuels



Hydrocracking Basics

Objective

- Value added upgrading of high sulfur distillates to low sulfur gasoline and ultra low sulfur jet/diesel to meet air quality requirements for clean burning fuels



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Andrew Kenner

Vice President and General Manager

Delaware City Refinery

Valero Delaware City Refinery

- Built by Tidewater Oil Company in 1957
- Acquired by Valero in 2005
- Since commissioning, Valero and previous owners have made significant modifications and environmental upgrades
- Total throughput of 191,000 bpd
- High conversion operation
  - 60%+ gasoline yield
- Staffed by more than 700 full-time employees
- Located on 5,000 acres, some of which is leased to local farmers, preserving our buffer zone
- Seeking OSHA VPP Star Status

Delaware City Products and Crude Slate

Typical Product Slate

Product	BPD	%
Gasoline	85,000	50
Distillates	65,000	38
Propane	7,500	4
Alkylate	5,000	3
6 Oils	4,500	3
Benzene	1,500	1
Pet coke	1,900	1
Sulfur	300	< 1
Total	170,700	100

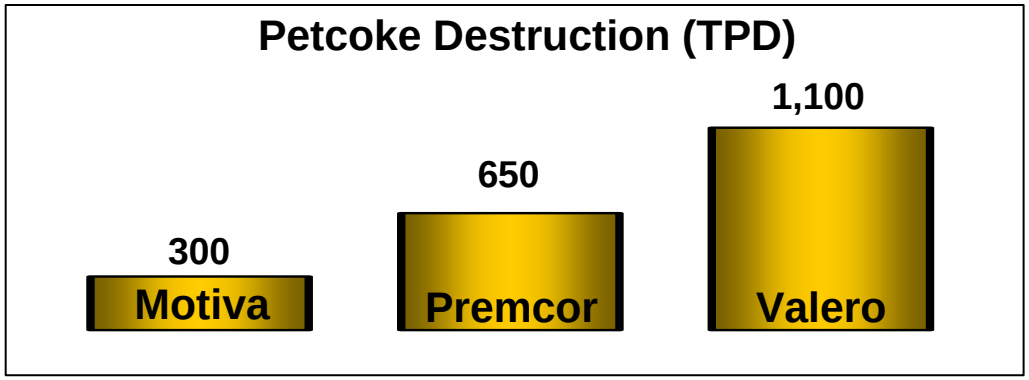
Typical Crude Slate

Crude	S % / API	BPD	%
Arab Heavy	2.7 / 29	75,000	45
M-100	2.7 / 16	45,000	26
Hamaca	1.6 / 26	35,000	20
Opportunity Crudes		15,000	9
Total		170,000	100

- Provides approximately 70% of all gasoline sold in Delaware
- Flexible light-ends system
- Produces petrochemical grade Benzene for sales into local market.

Delaware City Capital Investments

- $456 MM invested in capital improvements and $97 MM for turnaround maintenance at Delaware City since Valero's acquisition
  - Major plant turnaround completed in 4Q05
- Fluid Coker Flue Gas Scrubber - $200 MM
- Fluid Catalytic Cracking Unit Flue Gas Scrubber - $200 MM
- Cracked Naphtha Hydrotreating Unit expansion project commissioned in 4Q05
- Sulfur Plant O2 enrichment and reliability projects - $25 MM
- Took over operations of Gasifier/Power Plant and have improved on-stream reliability and throughput dramatically



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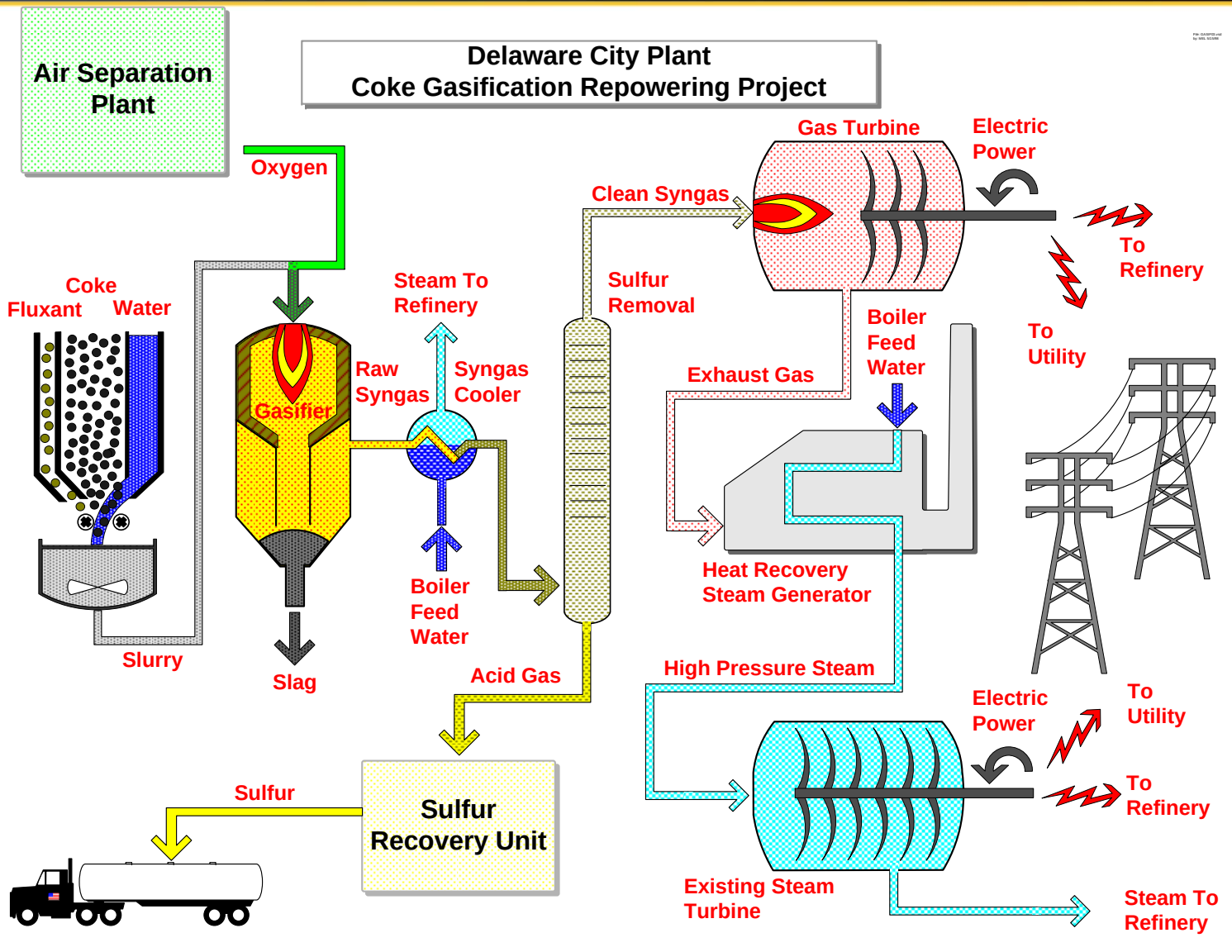
Gasification Overview



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Appendix

Delaware City Refinery Flow Diagram

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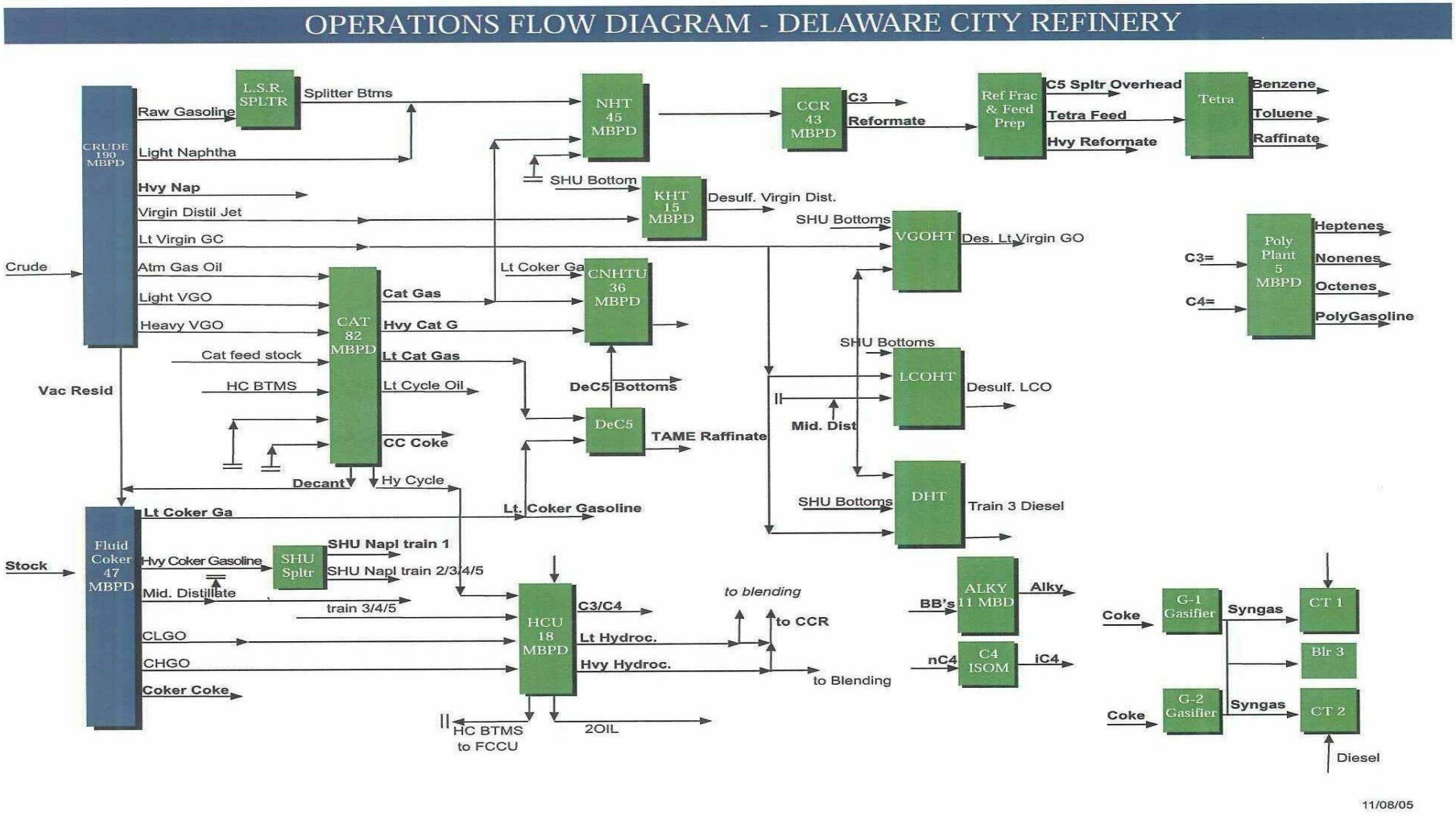
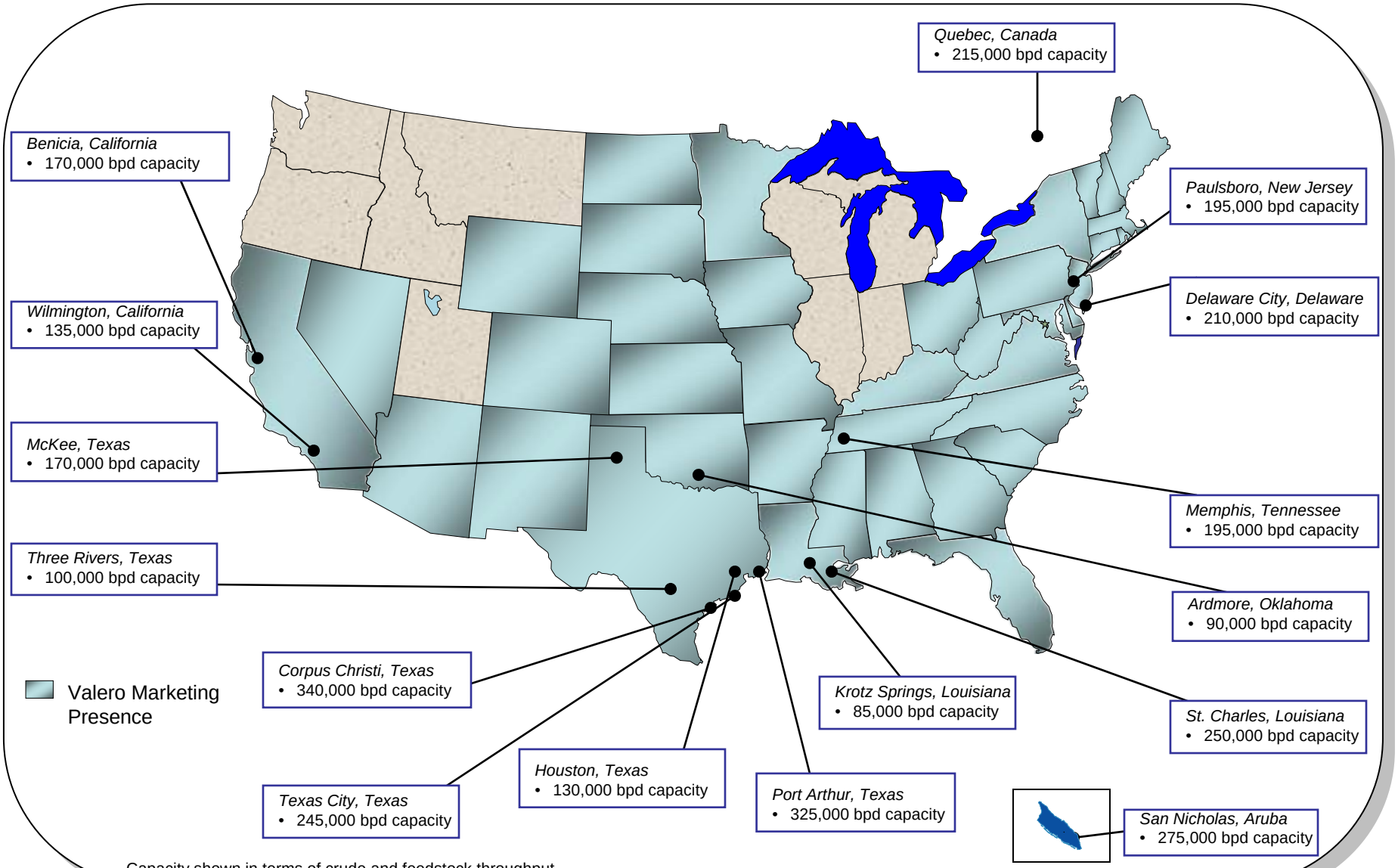


Map of Valero Refineries



Capacity shown in terms of crude and feedstock throughput

Major Refining Processes – Crude Processing

- **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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