

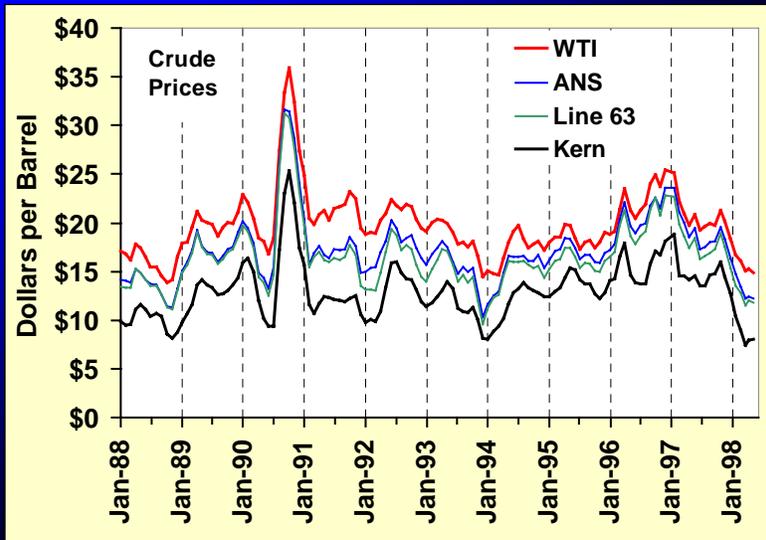
California Crude Oil Prices

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- ◆ In this presentation, crude oil prices will be discussed in two ways:
 - How average crude prices move up and down with the global supply/demand balance and world events; and
 - How the price of an individual crude varies because of its quality relative to other crude oils sold and as a function of the regional markets in which its sold.
- ◆ The values of different quality crudes vary over time based on the value the market places on such quality attributes. A heavy crude oil has more heavy, high-boiling point “bottoms” material that goes to residual fuel or asphalt, or can be cracked or converted to light products using downstream conversion process facilities.
- ◆ The remainder of this talk will focus mainly on the factors that have affected these quality differentials historically, and will look at what has been occurring recently. It will conclude with a short-term outlook.

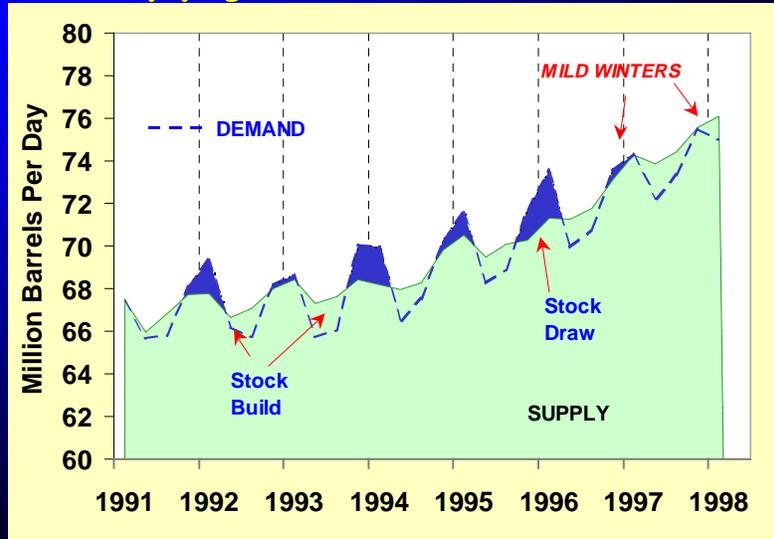
CA Crude Oil Price History



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- ◆ Crudes produced in California vary in quality as shown by the different price levels of Kern and Line 63.
- ◆ Alaskan North Slope (ANS) crude is used in California, along with the California-produced crudes, so it is also shown on this graph.
- ◆ In spite of the different price levels, the crude oils follow similar up and down patterns, which reflect world crude oil markets.
- ◆ Since 1997, crude oil prices have declined significantly.

World Petroleum Supply/Demand Balance



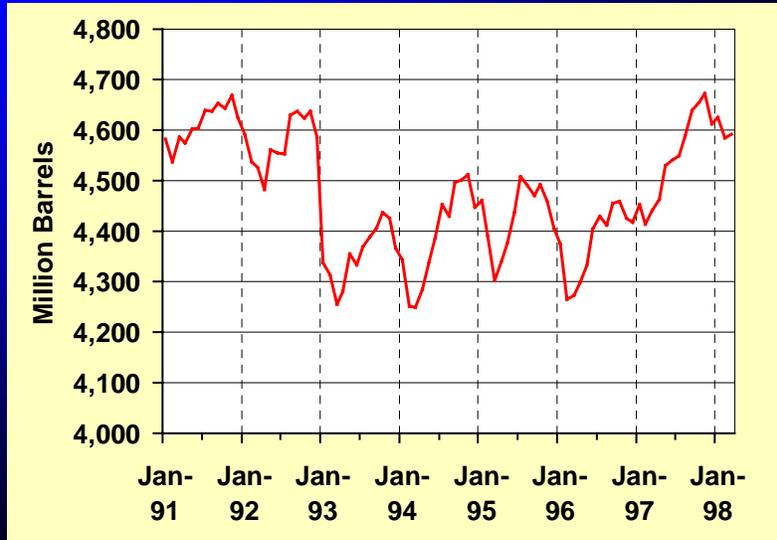
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◆ The downturn can be understood by going back to the world oil markets briefly and looking at what is happening to supply and demand.

◆ As the figure shows, stocks are usually built in the second and third quarters, and drawn down in the fourth and first quarters (winter), when demand is high. In years when crude supply is in surplus of demand, there is a net stock build. (Compare the dark areas where demand exceeds supply and stocks are being drawn down to the areas where the dotted demand line runs below the supply and stocks are being built.)

◆ Starting in 1997, production has been in surplus and prices have fallen under the weight of excess volumes available for sale.

World Commercial Petroleum Stocks



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◆ World stocks reflected the tight markets seen in 1996 followed by the growing oversupply situation that has resulted in today's very low crude oil prices.

Light-Heavy Price Difference Varies

- ◆ Function of Crude Market Factors
- ◆ Function of Conversion Capacity
- ◆ Function of Product Market Factors

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◆ The light-heavy crude oil price differential is not constant, and depends on many market factors that derive from the crude market, from the refining market (which connects the crude and product markets), and from the product market.

Crude Market Impacts on Diff

<i>Crude Market Factor</i>	<i>Change in Market Factor</i>	<i>Change in Lt-Hvy Crude Diff</i>
<i>Lt Crude Supply</i>	+	-
<i>Hvy Crude Supply</i>	+	+
<i>Crude Price</i>	+	+

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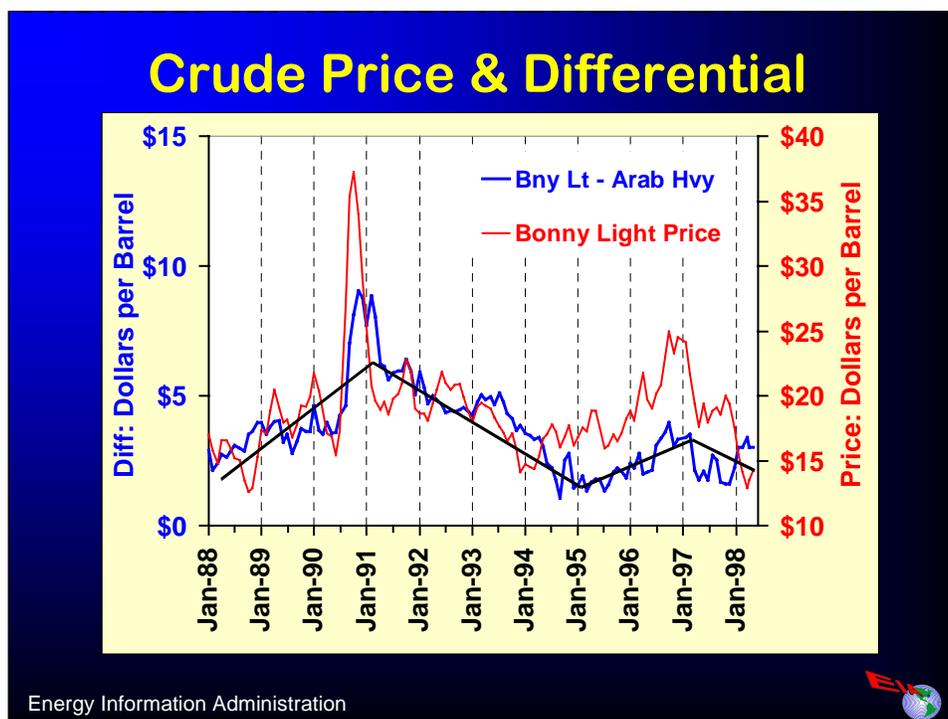


Crude Market Factors

◆ If light crude supply is increasing relative to heavy crude supply, it tends to contract the differential.

◆ On the other hand, if heavy crude supply is increasing relative to light crude supply, the extra heavy supply tends to expand the differential. Generally refiners with the ability to upgrade the heavy ends of the barrel run their downstream upgrading units (e.g., cokers) at or near capacity. If additional heavy crude oil comes on the market, refiners that buy the crude oil can't run more heavy ends through their upgrading equipment, so they just produce more residual fuel. Unless demand for residual fuel is increasing, they will oversupply the residual market and not get good prices for the fuel. Thus, they will want to pay less for more heavy crude oil, thereby depressing its price relative to lighter crudes. If this continues over the long term, the depressed price provides an incentive for refiners to add more upgrading equipment in order to make use of the "cheaper heavy crude oil" and decrease residual fuel production. But note the irony. If enough refiners add upgrading, the "cheap" crude will no longer be so cheap.

◆ Finally crude price changes can also affect the difference. When crude prices move, the light, higher valued crudes tend to move more -- both up and down -- which will be discussed more on the next slide. Thus, tightening markets with price increases -- all else being equal -- would tend to increase price differences, and falling crude price markets would tend to decrease differences. But frequently, all else is not equal. One factor does not change alone.



◆ As this figure shows, when crude prices have increased, the light-heavy crude price differentials have expanded, and when crude prices declined, the differential contracted.

–Note the different scales: the price scale is 2 times the difference scale.

◆ To understand the price and differential relationship, consider what happens when crude prices fall.

–First, from the heavy side, the lower crude price reduces the price of residual fuel, making it more competitive with other boiler fuels, and the price of residual fuel relative to crude oil increases. Thus, both the light-heavy product difference and the light-heavy crude difference contract.

–Second, in the surplus market that brings downward pressure on crude oil prices, light product markets often are in surplus, which weakens light product prices, reducing the difference further from the light side. Usually the heavy side movement is more dominant.

◆ Because of other factors affecting these differentials, on a short-term basis, there is not a perfect correlation between price and differential movement. For example, crude prices started moving up early in 1994, but the differential continued its slide through much of the year.

◆ Over the first few months of 1998, crude prices have continued to slide, but the differential bumped up. It would appear this is a temporary situation, which will be discussed later in more detail.

Refinery Impacts

<i>Market Factor</i>	<i>Change in Market Factor</i>	<i>Change in Lt-Hvy Crude Diff</i>
<i>Avail Conversion Capacity</i>	+	-

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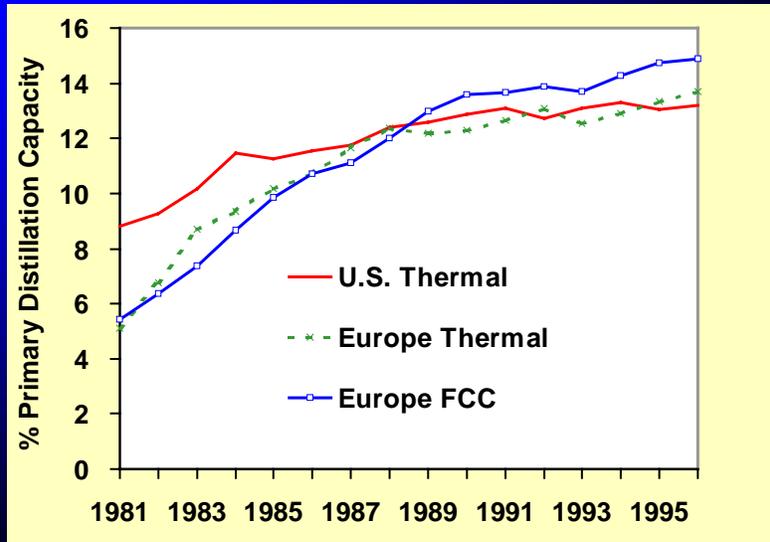


Refinery Capacity Factors

◆ The industry's bottoms conversion capacity available to convert the heavier parts of crude oil (bottoms) to lighter, more higher valued products also can affect the light-heavy crude oil differential. Bottoms conversion capacity reduces the production of residual fuel oil.

◆ If the industry's ability to upgrade heavy crudes is increasing, and heavy crude supply is not increasing as rapidly, refiners produce less residual fuel and more light products. Lower residual production reduces the volume of residual fuel on the market, and gives residual fuel a higher market value relative to light products. This, in turn, improves the value of heavy crude oil relative to light crude oil, i.e., narrowing the light-heavy crude oil differential.

Share of Conversion Capacity



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◆ In the early to mid 1980's, Atlantic Basin refiners rapidly expanded their conversion capacity as a consequence of the belief that world crude production would get heavier, and residual fuel oil demand would decline.

◆ What actually happened was:

- Crude supplies did not get heavier
- And the additional conversion capacity actually helped to reduce the light-heavy crude differential.

◆ Since the late 1980's, conversion capacity additions have slowed. European and U.S. refiners have increased coking capacity, which is part of the "thermal capacity" shown in the figure. These additions occurred when light crude oil supply was increasing. This seemingly uneconomic capital expansion makes sense when we note that much of the coking capacity expansion was associated with refiners connected with producing countries that have heavy crude oil to sell.

–In the U.S., these producing countries wanted to assure that they would have a market for their heavy crudes. These heavy crudes also have a high sulfur content, and without conversion capacity to upgrade the bottoms, high sulfur residual fuel would be produced. But the U.S. has very little market for high sulfur residual fuel.

Product Market Impacts

<i>Market Factor</i>	<i>Change in Market Factor</i>	<i>Change in Lt-Hvy Crude Diff</i>
<i>Resid Demand</i>	+	-
<i>Lt Prod Demand</i>	+	+

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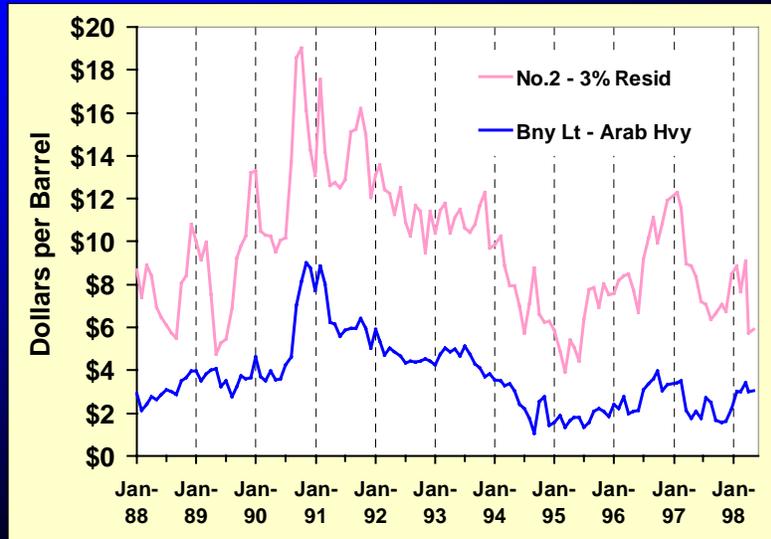
Product Market Factors

◆ All else staying fixed, if residual demand increases, the price of residual fuel would increase, and refiners would be willing to pay a higher price for heavier crudes that produce more residual fuel, thereby causing the light-heavy crude oil differential to contract.

◆ At the other end of the spectrum, if all else stays fixed, and the demand for light products increases, refiners can get higher prices for light products and will put a premium on lighter crudes, increasing the differential.

◆ As light and heavy product demands shift, so do their prices. Usually both are moving. The relative price of heavy products versus light is generally what one looks at to see the impact on light-heavy crude oil differences. It is the relative price of heavier products like residual fuel to light products like gasoline or distillate that impact a refiner's willingness to pay relatively more or less for a heavy crude than for a light crude oil.

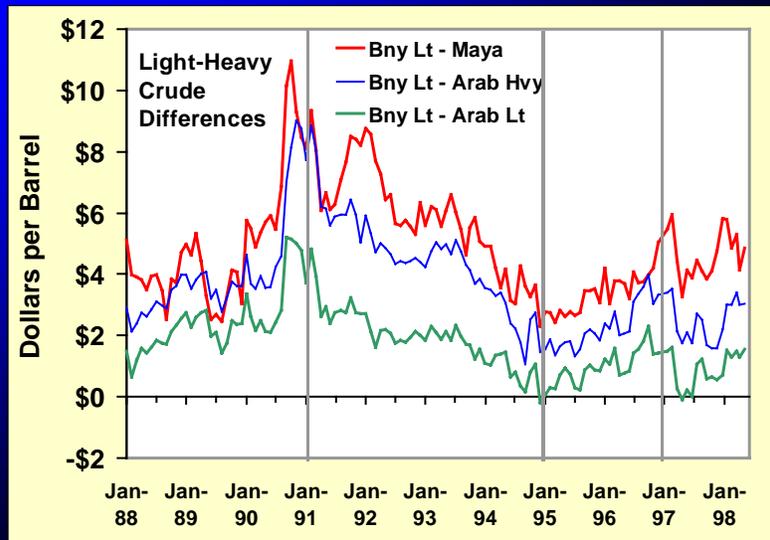
Light-Heavy Crude & Product Price Differences



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- ◆ Similar light-heavy price difference trends are seen in both the crude oil and the product markets.
- ◆ However, there are some short-term product market changes that are not reflected in the crude oil market.
- ◆ Is it the crude oil market or the product market that is the primary driver behind the light-heavy differences? Differentials can be driven by changes from either the crude oil or the product side. For example, a lot of light crude oil supply shrinks the differentials, and a decline in heavy product supply (i.e., residual fuel) also narrows the differences.

Four Time Periods



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- ◆ The next series of slides focuses on four historical time periods in more detail to better understand what has driven the differential in the past.
- ◆ The first time span begins after the large drop in crude oil prices in 1986 and goes through the Gulf War. Even ignoring the Gulf War time period, differentials were increasing through the late 1980's.
- ◆ The second period goes from the Gulf War through 1995. Differentials fell considerably during this time.
- ◆ But in late 1994, the differentials turned around and began to increase again until 1997.
- ◆ We combined 1997 and 1998 because we feel that we will be seeing a downward trend in differentials as time moves on. We expect the recent upturn in the light-heavy differentials to be short-lived.

1986-1990

- ◆ Rising differentials
- ◆ Major Factors
 - Rising crude oil prices (+)
 - Light product markets strong (+)
 - Slight decline in residual fuel demand with increasing production (+)
 - Slight increase in bottoms conversion capacity (0 to –)

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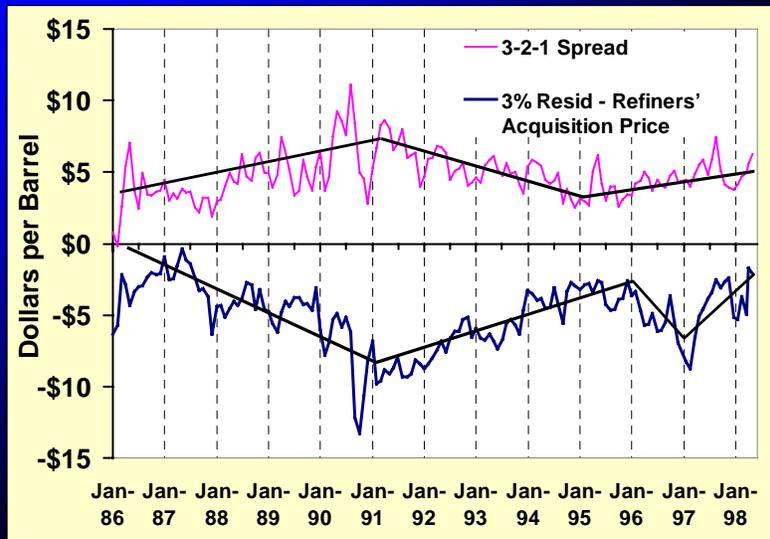
◆ A tightening crude market with rising crude oil prices contributed to the expansion of the differential in the late 1980's. Light crude oil prices were rising faster than the heavy oil prices.

◆ The economy was strong, and light product prices were improving, tending to move the crude price differential up.

◆ Residual oil demand had been falling rapidly since the crude oil price increase in 1979, but the decline almost stopped after the crude oil price collapse in 1986. However, "inadvertent" production of residual fuel oil increased as crude input to refineries increased to meet growing demand for light products, and the net result tended to widen the differential.

◆ Conversion capacity increased somewhat during this period, but it probably had little influence on the light-heavy differential.

Light & Heavy Product Price Differences



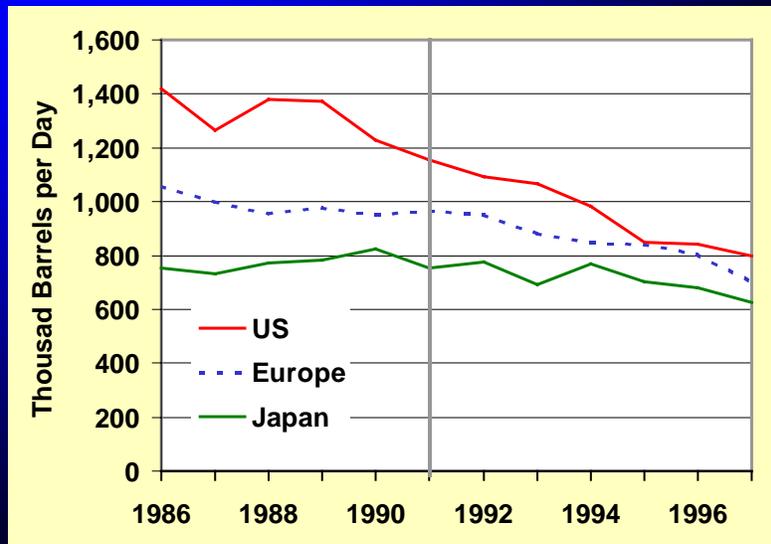
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◆ This figure shows how light and heavy products were moving relative to crude oil. The top line is the 3-2-1 spread that captures the margins of gasoline and distillate over crude oil. The bottom line is the comparison of residual fuel oil price to crude oil. The product prices are compared against refiners' average crude oil acquisition cost so as to minimize any light or heavy crude oil bias in the chart.

◆ The light-heavy product difference in the 1986 to 1991 period expanded because of movement both from the light and heavy product sides.

◆ A growing economy prior to the Gulf War helped support light product prices, so light product prices (gasoline and distillate) rose relative to crude oil during the late 1980's, while the price of residual fuel fell relative to crude oil (i.e., became less desirable, expanding in a negative direction).

Residual Fuel Demand



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- ◆ In the 1986 to 1991 period, residual fuel oil demand declined only slightly both in absolute and as a percent of total product demand. While not shown, residual fuel demand had declined very rapidly during the first half of the 1980's.
- ◆ The slower decline in the second half of the 1980's happened because residual fuel prices are partially determined by the prices of competing fuels such as natural gas. Crude oil prices fell dramatically in 1986, bringing residual fuel prices down as well. Thus, residual fuel oil became more competitive with natural gas in the late 1980's than it had since the large price increase in 1979. Still, residual fuel prices relative to crude oil weakened.
- ◆ As crude prices began to rise again after 1986, residual fuel prices did not rise as much, staying lower to maintain market share. As petroleum demand rose world wide after the 1986 price decline, the volume of residual fuel produced also rose, so the lower residual fuel price relative to crude oil helped residual fuel to clear the market.

1991-1994

- ◆ Declining Differentials
- ◆ Major Factors
 - Crude prices fell as crude surplus developed (–)
 - Atlantic Basin light crude production increased (–)
 - Bottoms conversion capacity increased (0 to –)

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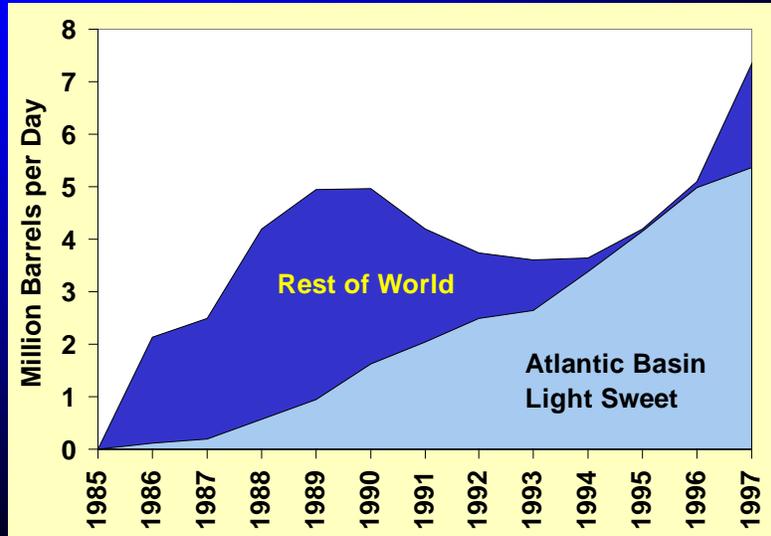
◆ After the Gulf War, the differential began to tumble.

◆ A weak economy in the early 1990's held back world demand, but crude oil supply grew, putting downward pressure on prices. Declining crude prices tended to pull the light-heavy crude differential down.

◆ But the major factor at play seemed to be an increasing supply of light sweet crude oils -- particularly in the Atlantic Basin, which is a principal supply source for Europe and the U.S. Those differentials reached incredible lows in 1995 before picking up.

◆ Even bottoms conversion capacity worked to depress the differential during these years; although, its impact was probably small.

Cumulative Crude Production Additions (Annual)



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- ◆ This graph shows the cumulative growth of the Atlantic Basin light sweet crude oil production relative to the growth in crude oil production from the rest of the world. Most of the world's light sweet crude oil production is concentrated in the Atlantic Basin, so the rest of the world represents a heavier crude oil slate.
- ◆ In the 1986 through 1990 period, demand for petroleum products grew and much of the supply increase to meet the growth came from the heavier crude producers of the Persian Gulf.
- ◆ The situation shifted dramatically in the 1990's as increases in crude production in the Atlantic Basin not only filled new demand, but displaced some heavy production. Thus, the world crude oil quality level was lighter, especially in the strong, light-product markets of the Atlantic Basin (mainly Europe and the U.S.).
- ◆ A lighter supply barrel combined with weak light-product markets and modest growth in conversion capacity to shrink the light-heavy crude and product differentials during the 1991-1994 period.
- ◆ Looking ahead to the next time period, heavy crude production picked up in 1996 and outstripped light crude production in 1997.

1995-1996

- ◆ **Differential Bottomed Late 1994 and Began Upturn**
- ◆ **Major Factors**
 - Increasing crude price (+)
 - Asian demand for Atlantic Basin light crudes increased (+)
 - New interest in heavy oil production (+)

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◆ The turnaround in the light-heavy crude oil differential in 1995 seems to have been due mainly to light West African crudes finding a new market in Asia. The quality price difference had dropped so low in 1994 that Asia found it economical to import West African crude oils. Thus, demand for the light crude oils increased, raising their price relative to the heavy crude oils.

◆ Rising crude oil prices also contributed to the turnaround in 1996 -- recalling that light crude prices generally move more than heavy.

◆ The small differential and an outlook for increasing prices spurred new interest in heavy oil production, which also tended to push the differential up.

W. Africa Crude Destinations

<i>MMB/D</i>	<i>1993</i>	<i>1994</i>	<i>1995</i>	<i>1996</i>
<i>US & Canada</i>	1.4	1.3	1.3	1.2
<i>S. & Cen. America</i>	0.2	0.3	0.3	0.3
<i>W. Europe</i>	0.9	1.0	0.9	1.0
<i>Asia</i>	0.1	0.1	0.3	0.4
<i>Other</i>	0.0	0.0	0.1	0.0

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◆ In the 1995-1996 period, light-heavy crude oil differentials expanded as the light crude surpluses in the Atlantic Basin began to move to the Asian market, which was unprecedented. This new market for the Atlantic Basin light sweet crude oils gave them new price support.

–Although not shown, early reports indicate that West African flows in early 1997 were as high as 1 million barrels per day, and averaged about 0.7 million barrels per day for the year.

–However, with the Asian crisis, first quarter 1998 flows may be less than 0.3 million barrels per day.

◆ In 1995-1996, a growing world economy was rapidly removing the crude oil surplus that had occurred in the early 1990's, and crude oil prices rose. Light product markets were strengthening with the economy, and new heavy crude oil production was entering the market (see earlier slide).

◆ All of these factors tended to widen the light-heavy differentials.

1997-1998

◆ Differential Turns Down

◆ Major Factors

- Crude price declined (–)
- Increased price of resid relative to crude (–) despite poor demand
- Asian demand for lights fell late in 1997 and averaged low in early 1998 (–)
- Increased production of heavy crudes, e.g. Iraq (+)
- Strong light product market (+)

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◆ Differentials clearly fell during 1997, and we expect the general trend over the course of 1997 and 1998 to be down, in spite of a brief upturn in early 1998.

◆ Crude prices have fallen dramatically, which tends to pull the light-heavy quality differential down.

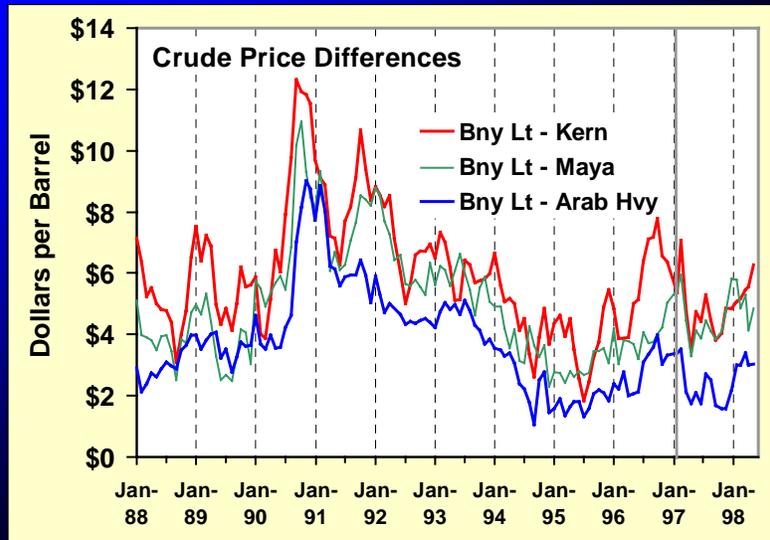
◆ Residual fuel prices have moved closer to crude oil prices (with a brief backslide this last winter due to warm weather and high stocks). Residual fuel prices moving towards crude oil prices also tends to contract the differential.

◆ Asian demand for light products fell back in 1997 and remains low in 1998, which should narrow the differential as the prior Asian volumes flow back into the Atlantic Basin markets.

◆ But the world is experiencing a large supply of heavy crude oils relative to light, which expands the differential.

◆ Also, light product prices are showing unusual price strength in this weak crude market -- as a result of a good economy and high refinery capacity utilization. This light product market strength also tends to expand the differential.

CA Following World Prices



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◆ In 1997, with the return of Iraq to the crude markets and other world supply sources growing rapidly, a crude oil surplus began to develop, and crude prices fell. A large part of the crude supply growth in 1997 was from the heavier crudes.

◆ With falling crude oil prices, we expected light product markets to weaken and residual fuel oil prices to move closer to crude oil, both of which would cause the light-heavy difference to contract.

–Light product markets did not weaken, as the world economy grew and growing high refinery utilization struggled to keep pace with demand.

–Residual demand was weak, suffering at least in part from a warm winter in 1996/97, but it still managed to move closer to crude oil in price as expected since natural gas prices remained high.

–Light-heavy crude differentials fell and stayed down until the later part of 1997.

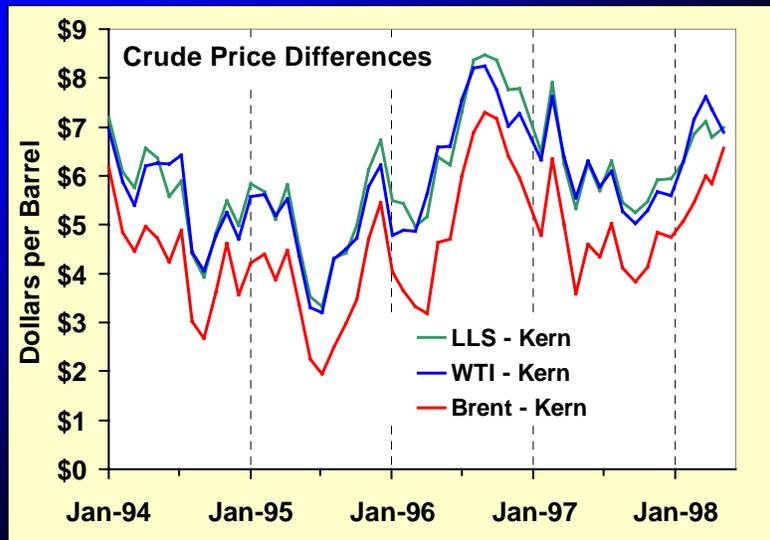
◆ Crude prices continued to weaken, but the light heavy difference expanded in late 1997 and early 1998 -- worldwide as well as in California.

–Light product markets weakened over the winter, but showed renewed strength in the spring, which is unusual in a weak crude market, but we have never had such high refinery utilizations with weak crude oil prices.

–Residual fuel prices gave way over the warm winter, but sprang back in April when Mexico and Venezuela started buying the fuel.

–The major factors pulling differentials apart first quarter 1998 seem to be the weak resid price, increased supply of heavy crude oils that has been occurring since 1997, and the unusually strong light product market.

More CA Crude Comparisons



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- ◆ There are further indications that California was experiencing the same market pressures as the rest of the world. This chart shows Kern crude price behavior relative to several crude oils. It is important to point out that any one crude oil can move slightly differently at any point in time. WTI is well known for its variations due to pipeline problems, and more recently some storage limitations.

- ◆ But as a whole, the behavior of Kern relative to other crude oils has been consistent.

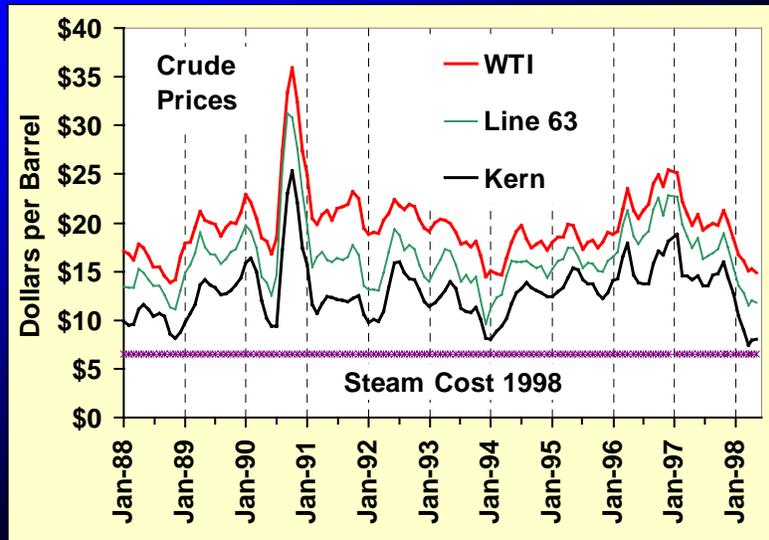
- ◆ Towards the end of 1997, the world was seeing a growing glut of all kinds of oil, but heavy crude in particular. California was not immune.

- Preliminary data indicate California saw an increase in heavy crude imports of about 50 thousand barrels per day (MB/D) in the third quarter over the first six months -- most of which came from Mexico and South America other than Venezuela. Fourth quarter increased about 60 MB/D from first half -- with about 3/4 of the increase coming from Mexico and South American countries other than Venezuela. Canada and Venezuela accounted for most of the remainder of the fourth quarter increase. (Total imports for the year averaged about 170 MB/D.)

- Reports indicated heavy Canadian crude oil was pushing Mexican, Venezuelan, and Saudi crudes out of PADD 2. These volumes had to find another home and some found buyers in California. But with the falling crude market, warm weather, and more heavy crude oil, California residual prices dropped below the weak resid market of the Gulf Coast.

- ◆ The good news is that the Mexicans are trying to raise the value of their Mayan crude oil by purchasing residual fuel, which is an important element of the Mayan pricing formula. This has helped to lift heavy prices in general.

CA Problem is Price



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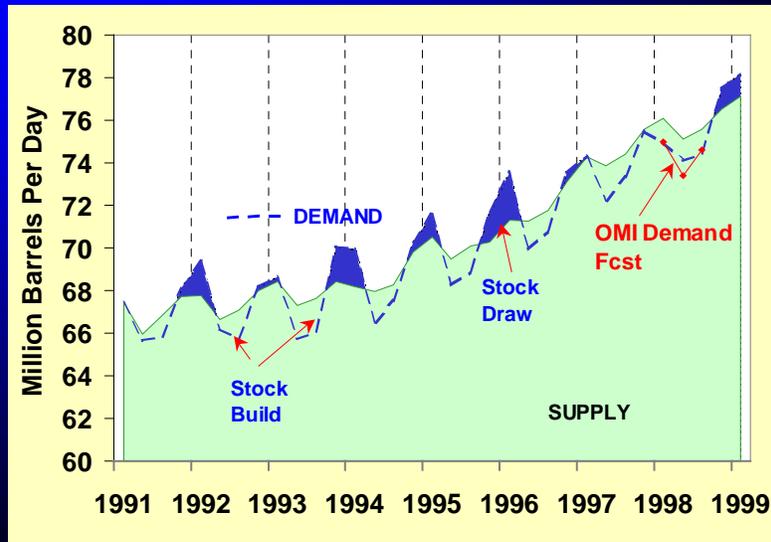
◆ The basic California problem concerning heavy crude oil is price. With the reported cost of the natural-gas-fueled steam for extracting the crude sometimes being as high as \$6.50/barrel in today's market (PIW - 3/16/98), total variable costs of production for some producers may be higher than the going market price for the heavy crude oil.

◆ If the price of heavy crude oil increases for whatever reason, it will ease the crude producers' dilemma considerably.

◆ A decrease in the differential alone may not solve the problem. For example, the differential could fall as a result of light sweet crude oils losing value relative to the heavy crude oils. The price of the heavy crude oils might not change much in that case, even though the differential would narrow.

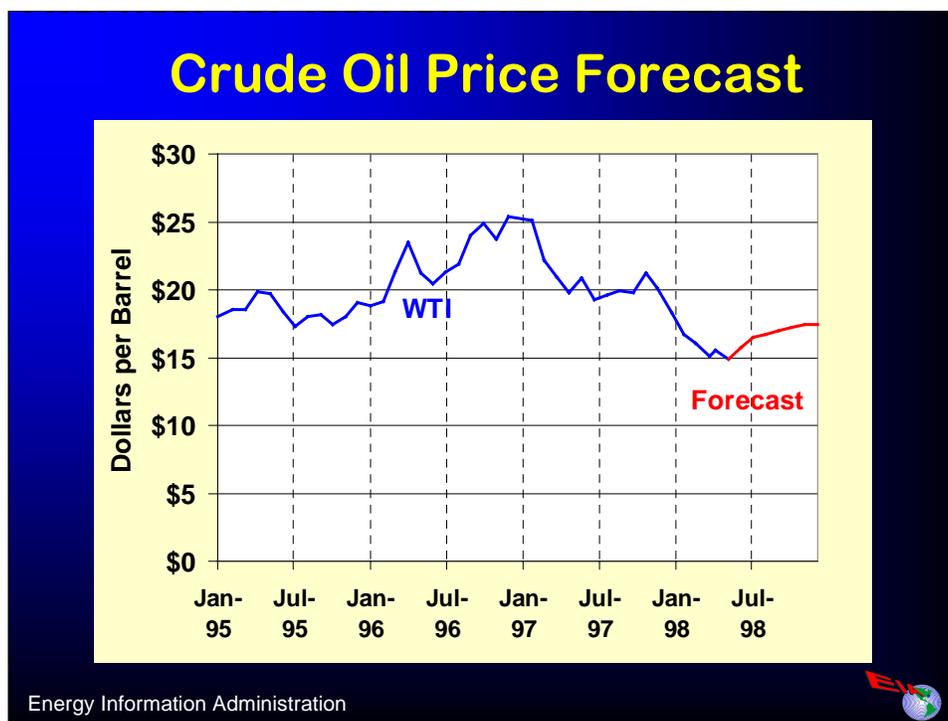
◆ In conclusion, California prices are behaving similarly to world oil prices, but the very low quality of some California crudes like Kern makes them more vulnerable in this low-price environment.

World Petroleum Supply/Demand Forecast



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- ◆ With the major problem being price, what does EIA expect for the rest of this year?
- ◆ After two relatively mild winters with growing crude oil supplies and the Asian financial crises crippling demand in that part of the world, we are awash in excess crude oil.
- ◆ EIA's forecast is shown from the second quarter 1998 through the first quarter 1999. EIA is expecting some pull back in supply from selected OPEC and non-OPEC countries, but the amount is uncertain. Over the summer, EIA is expecting a more typical stock build, but this is on top of an unseasonal build in stocks over the fall and winter quarters.
- ◆ Asian demand is also a large unknown.
- ◆ EIA is forecasting less surplus supply over demand for spring and summer quarters compared with some other forecasters such as Oil Market Intelligence, but no one is expecting a large price comeback in the near future.



◆ We believe crude oil prices will strengthen somewhat, but prices will rise much more slowly than they fell, and they are expected to remain lower in 1998 than in recent prior years.

- Cuts in production by some producing countries will help to slow the supply surplus.

- However a large overhang in stocks and slowed demand growth from the Asian situation will keep a strong price increase out of the picture.

◆ We also expect the light-heavy differential to contract somewhat.

- The loss of the Asian market for West African sweet crude oils will put downward pressure on the differential.

- Cutbacks in heavy crude oil production targeted by Mexico, Saudi Arabia and to some degree Venezuela should help narrow the differential.

- The residual fuel market should improve if crude prices stay down.

◆ As our prior slides have shown, the factors affecting the differentials are diverse and hard to predict on a short-term basis. The market can reverse itself fairly quickly, but our best guess is that the differentials should be shrinking as the year progresses, rather than growing.

◆ In conclusion, the bad news for the California producers is that crude prices are not likely to rebound strongly in the near future. The good news is that they are expected to increase somewhat over today's low levels by year end, and the differential should shrink somewhat as well.