

Drivers Behind Growing U.S. Product Exports & Shrinking Light-Heavy Price Differences

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Joanne Shore
John Hackworth



U.S. Energy Information Administration
Independent Statistics and Analysis

- This presentation focuses on what is behind the recent growth in product exports, if they will persist, and what do they imply for U.S. refiners.
- At the same time, light-heavy price differences in both product and crude oil markets have been shrinking. One of the products that is showing increasing exports, residual fuel oil, provides some insights into this market dynamic, which will also be discussed.

Overview

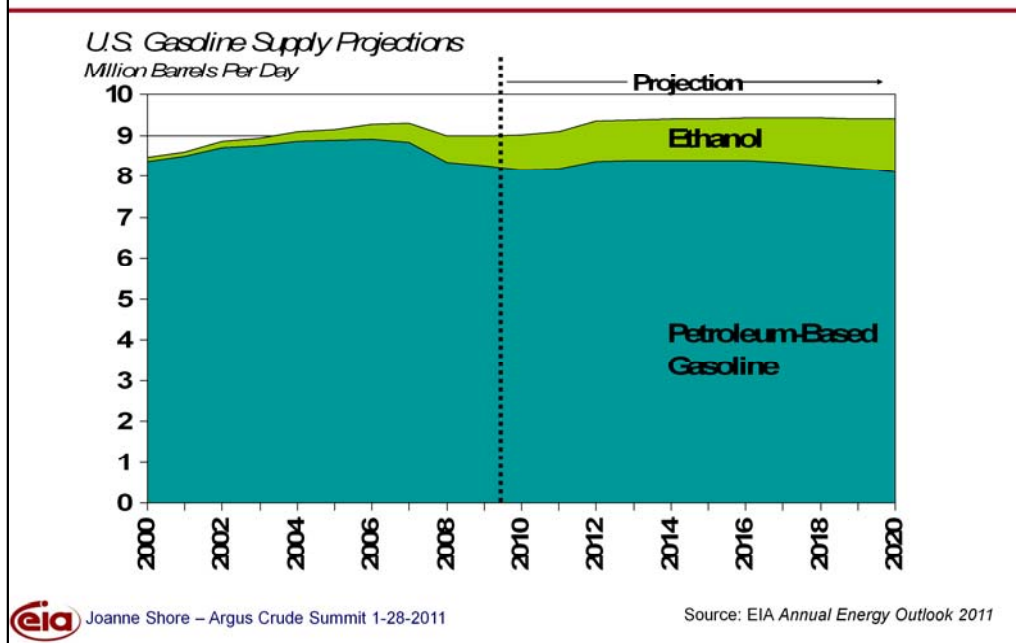
- Gasoline markets – U.S. regulations, foreign demand growth, and available refining capacity influencing imports and exports
- Middle distillates – U.S. switch to exporter as world market opportunities grow
- Residual fuel – Small U.S. product, but recent exports reflect resid's international market, which is important for light-heavy price differences and thus refiner profitability



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- Over the past several years, major changes in oil product markets worldwide are having significant impacts on U.S. refiners. The presentation will focus on two major products – gasoline and middle distillates (jet fuel, kerosene, diesel and heating oil) – as well as residual fuel oil, which plays a small role in the U.S., but a larger role internationally.
- The longer term outlook for U.S. gasoline markets moved several years ago from projections of continued growth to relatively flat demand due mainly to new regulations that have changed to need for refiners to supply petroleum-based gasoline.
- World growth in middle distillate fuels has kept upward pressure on distillate prices relative to gasoline. That, along with increasing interest in lower sulfur distillate fuels, has provided some attractive export opportunities for U.S. refiners.
- The last area for discussion is the recent changes in residual fuel exports, which reflect the international residual fuel market more than U.S. markets. While residual fuel is a byproduct, with U.S. refiners only turning out about 4% of their inputs into this product, it is produced and used more internationally, and is an important factor influencing light-heavy price differences.

U.S. future gasoline consumption needs less petroleum supply



- U.S. refiners have been dealing with a fall off in petroleum demand in the short term as a result of high oil prices and the economic downturn. The lower demand has resulted in the industry running at lower utilizations.

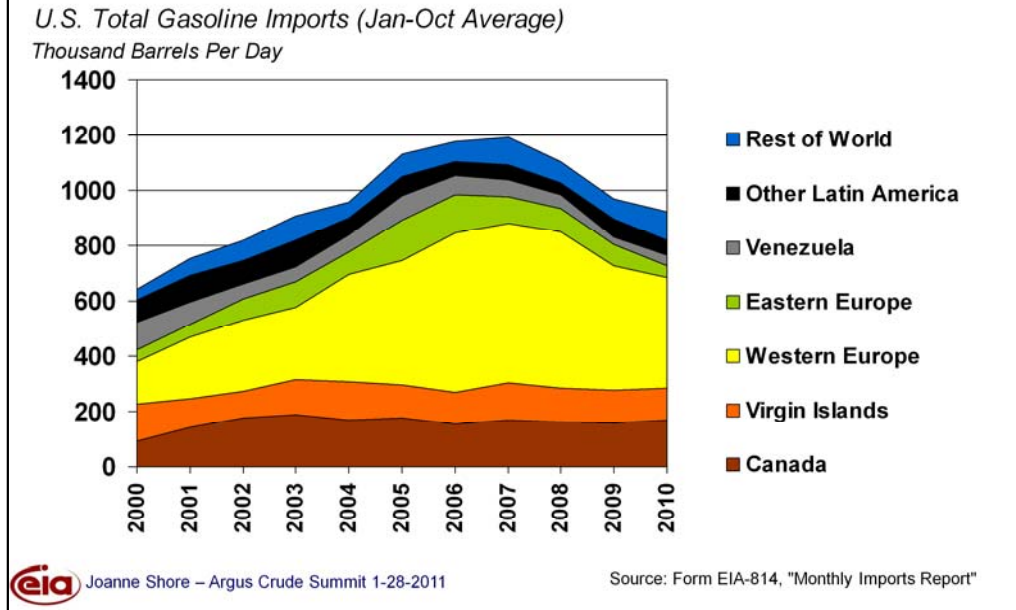
- Longer term, refiners are looking at a potentially declining petroleum-based gasoline market due to increasing use of ethanol and increasing light duty vehicle efficiencies. This downturn, in conjunction with a changing long-term outlook, has also resulted in several refinery closures.

- Increased efficiency of new light duty vehicles is a big factor impacting the need for light duty transportation fuel in the future. The 2007 Energy Independence and Security Act (EISA) requires an average of 35 mpg in 2020. The light duty vehicle stock is projected to increase 14.6% in efficiency between 2010 and 2020, moving from 20.8 mpg to 23.9 mpg. EIA's Reference Case shows relatively flat transportation fuel needs through 2020 as efficiencies improve.

- In addition, the renewable fuel standard within EISA is reducing the need for gasoline from petroleum. The EIA Reference Case shows the need for petroleum-based gasoline declining from its peak in 2006 at 8.9 million barrels per day by 9 percent (almost 800 thousand barrels per day) to 8.1 million barrels per day in 2020.

- This long-term view of a declining need for petroleum-based gasoline is accompanied by a forecast for growth in distillate fuels from petroleum. This presents a challenge to refiners to produce more distillate while pulling back on gasoline. While exports of gasoline present a potential opportunity for some refiners, refinery changes can also help to meet this changing product slate, which will be mentioned later.

U.S. benefitted from growth in excess gasoline from Europe – but U.S. need is declining



▪With weaker demand in the short run, the U.S. has needed less gasoline import volumes. The United States has depended on gasoline imports for some time. Most of those imports go into the East Coast, where they supply about 25 percent of East Coast gasoline demand.

▪Much of the growth in imports through 2007 came from Western Europe, which produces surplus gasoline at a competitive price to the U.S.

-Europe has been encouraging the use of distillate fuel in its light-duty fleet, and, as a result, has developed an imbalance between what its refineries produce and what that region needs.

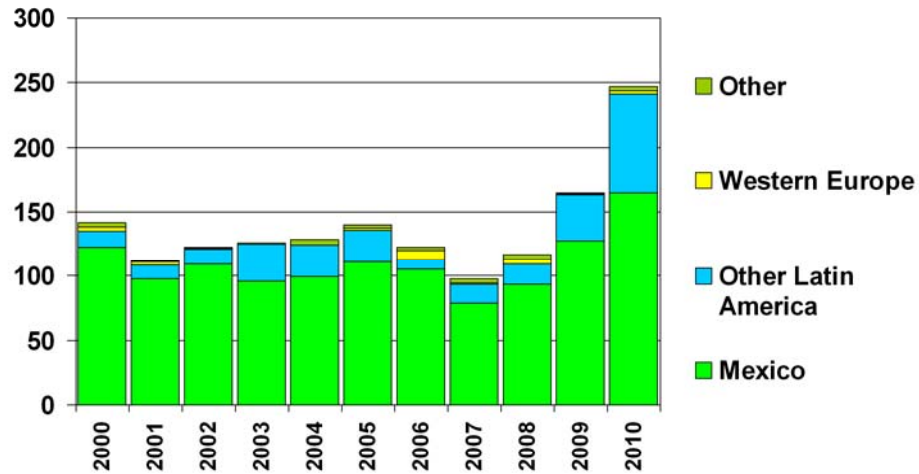
-Europe is a net importer of middle distillate fuels, and a net exporter of gasoline. Those gasoline export volumes have been growing as more of Europe's light-duty fleet converts to diesel.

▪As U.S. gasoline demand dropped following the high prices and the economic downturn, imports fell back, with Europe absorbing the brunt of the reduction.

-Europe's export gasoline volumes have been finding increased use in Mexico, Africa and the Middle East.

With surplus capacity, U.S. refiners are finding gasoline export opportunities

PADD 3 Total Gasoline Exports (Jan-Oct Average)
 Thousand Barrels Per Day



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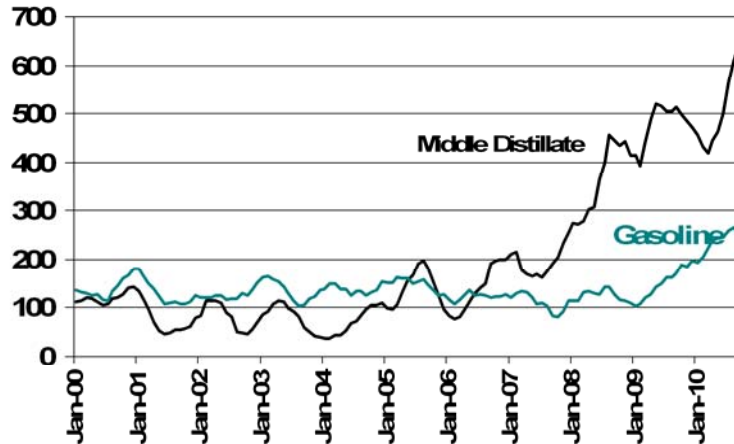
Source: EIA Petroleum Supply Monthly

▪While the U.S. need for gasoline production and imports declined, domestic refiners found some opportunities for exports, despite strong availability of gasoline on the export market from areas like Europe and Asia. (Reliance’s Jamnagar refinery in India began full operation in 2010. It is an export refinery, and the U.S. has been one of the recipients of its products.)

▪Gasoline exports leave the U.S. mainly from refineries on the Gulf Coast. It is not surprising that most of the opportunistic growth was in Mexico and other Latin American countries that lie in close proximity to U.S. Gulf Coast facilities, since this location gives Gulf Coast refiners some competitive advantage over European volumes that must travel further.

Distillate exports exceed those for gasoline and may have better long-term opportunities

PADD 3 Gasoline and Middle Distillate Exports (6-Month Moving Average)
Thousand Barrels Per Day



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Source: EIA Petroleum Supply Monthly

- But distillate exports have been an even bigger export opportunity to U.S. refiners than gasoline. Unlike gasoline, many of the distillate-fuel export opportunities are for power generation, although diesel fuel use in transportation is also growing and being supplied by U.S. refiners.

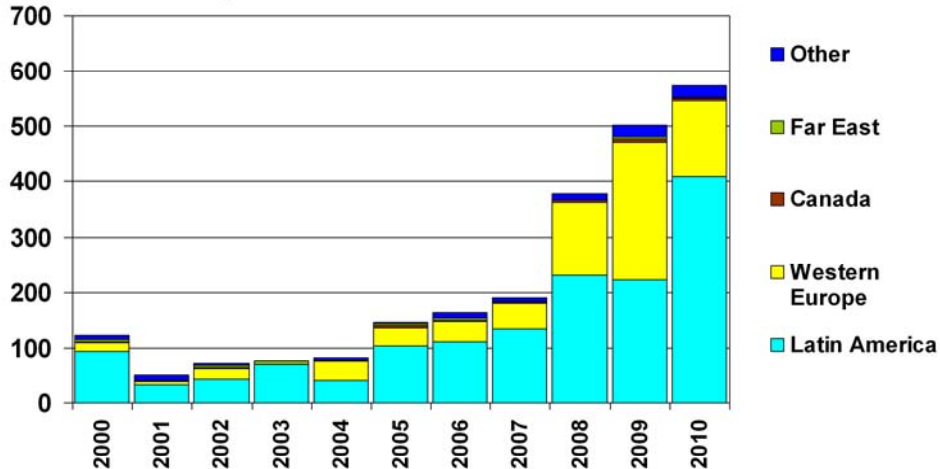
- To put this in perspective, middle distillate exports of about 600 thousand barrels per day represent about 12 percent of U.S. middle distillate consumption 2009 or about 9 percent of middle distillate production. Gasoline exports of 250 thousand barrels per day represent about 2.8 percent of U.S. gasoline consumption and 3.3 percent of refinery production.

- World need for distillate is expected to grow faster than that for gasoline, which can present continuing opportunities for U.S. middle distillate fuel exports for some time.

Recent middle distillate export increases mainly went to Europe and Latin America

PADD 3 Middle Distillate Exports (Jan-Oct Average)

Thousand Barrels Per Day



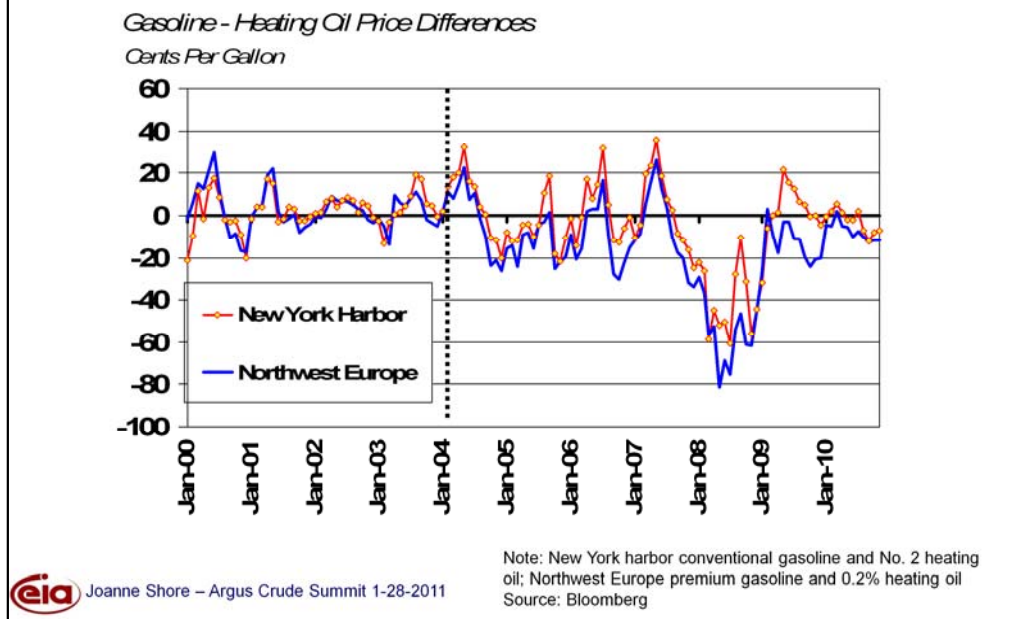
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Source: EIA Petroleum Supply Monthly

- As with gasoline, Latin America has been an important export market for U.S. middle distillate fuel.

- Western Europe has also been a growing export destination for U.S. distillates. Europe uses ultra-low sulfur diesel (ULSD), which the U.S. produces. Being able to supply ULSD gives U.S. refiners some advantage over countries like Russia that export high sulfur distillate fuel to Europe, although Europe has imported higher sulfur volumes from the U.S. as well as ULSD.

Distillate's contribution to margins grew since 2004 relative to gasoline



- In the United States, gasoline is the largest volume product produced in refineries, and up until relatively recently, had higher per-gallon margins than diesel fuel.

- Strong world demand growth in distillate fuels has manifested itself in a changing price relative to gasoline. This chart shows the difference between gasoline and heating oil prices for both Europe and the U.S. U.S. and European prices for distillate and gasoline tend to move together as a result of the close trading relationship.

- Prior to 2004, distillate prices (and hence margins) were generally less than those for gasoline, except during some of the cold winter months when heating oil prices pulled distillate prices up over those for gasoline.

- Distillate has continued to show more strength relative to gasoline than it did prior to 2004. The year 2008 was highly unusual in that a number of world issues came together to stress distillate markets. World distillate demand was still relatively high going into 2008 before petroleum prices spiked. But demand pressures increased due to a number of events that required increased use of distillate for power generation. These included a loss of hydropower from a drought and a shortfall in natural gas for power in Latin America, as well as an earthquake and the Olympics in China – both of which resulted in increased imports of distillate to that region.

- Even though world petroleum consumption fell in 2008 and 2009, upward pressure remained on distillate relative to gasoline, but not to the degree seen in 2008.

U.S. refiners have capability to take more advantage of distillate export opportunities

- Historically, U.S. has seen a steadily increasing middle distillate yield, but in summer 2008, middle distillate yield jumped 3.4 percentage points over prior summer
- EIA analysis indicates future potential middle distillate yield increases:
 - Short term: increases of 3 to 5 percentage points over a base of 35 percent (no or small investments)
 - Long term: Increases of 4 to 8 percentage points (with planned hydrocracking additions)
- Paper: *Increasing Distillate Production at U.S. Refineries – Past Changes and Future Potential*
http://www.eia.gov/pub/oil_gas/petroleum/feature_articles/2010/distillateprod/distillateprod.pdf



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▪With future U.S. product mix being projected to shift to more distillate relative to gasoline, and with potentially growing distillate export opportunities, the question arises as to how U.S. refineries can handle this shift to more distillate and less gasoline before significant investments are needed.

▪Annual middle distillate yields at U.S. refineries have steadily risen from 31.9 percent in 1995 to 35.4 percent in 2007. The summer of 2008 was unusual in the United States. Typically gasoline margins exceed distillate margins during the summer months, but the reverse occurred in 2008. Middle distillate yields during the summer jumped 3.4 percent over summer of 2007.

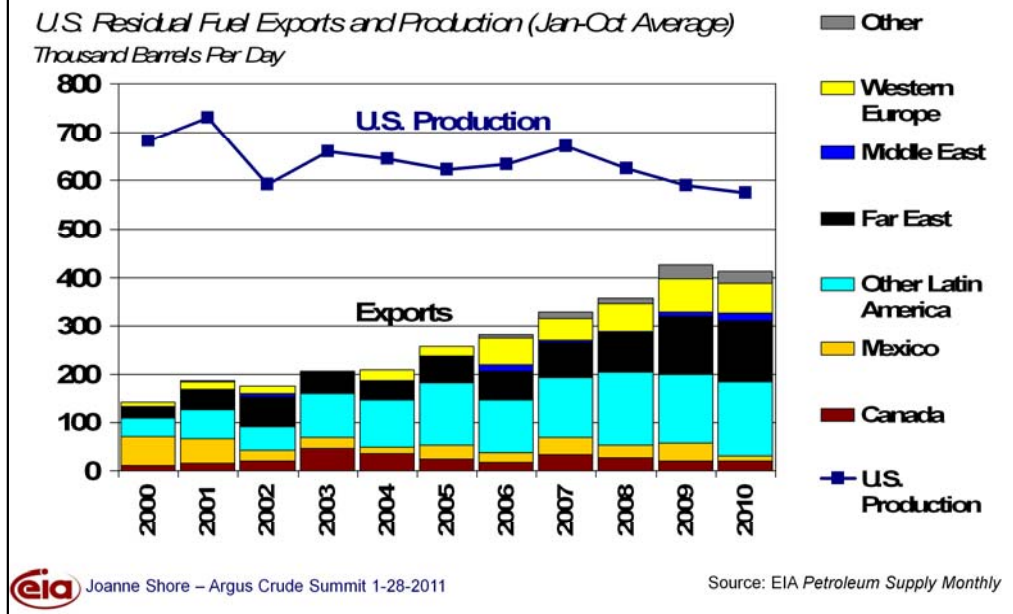
▪EIA did an analysis of the potential for U.S. refinery middle distillate yield increases. The study looked at reported refinery production, consulted with refiners and process experts, and used refinery modeling.

-The results show the U.S. refineries have the ability to increase annual average distillate yields on crude and unfinished oil inputs 3 to 5 percentage points with no or small investments for distillation improvements

-When planned hydrocracking increases are taken into consideration (e.g., Motiva's expansion), the increase could be around 4 to 8 percentage points.

▪Given the current slowly increasing distillate consumption outlook, the potential yield increases will enable U.S. refiners to increase distillate exports when the economics are attractive. It appears that U.S. refiners' export volumes will be market bound between now and 2015, rather than bound by their ability to produce more distillate.

Residual fuel exports grew, but resid's importance is indicator of light-heavy price differences



▪The last product with a change in exports for discussion is residual fuel oil. This product is a relatively small volume product in the United States, with yields typically averaging about 4 percent. U.S. consumption in 2010 was around 500-600 thousand barrels per day, versus world consumption of about 9 million barrels per day.

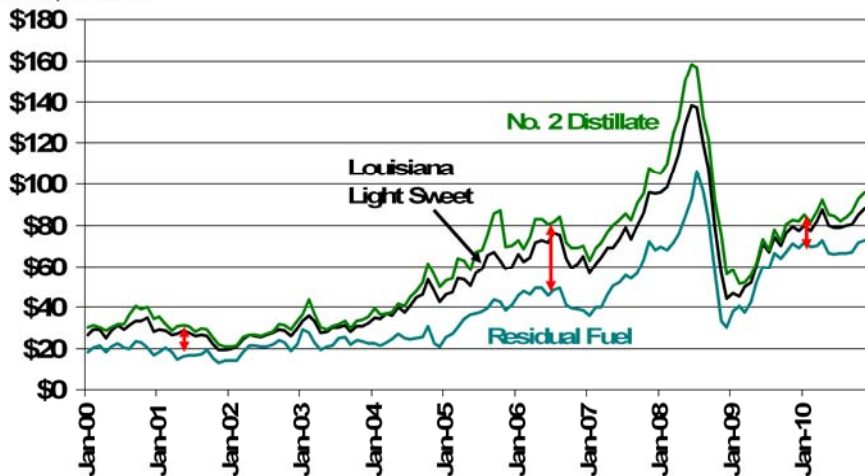
▪Exports of residual fuel from the United States have been increasing. The U.S. also imports residual fuel, and was a net importer until 2008, when exports barely exceeded imports. But in 2009, exports averaged 84 thousand barrels per day more than imports.

▪This chart also shows that while exports have been increasing, production has been declining. This fuel has gradually been backing out of the power generation market in the United States by fuels such as natural gas, which is relatively inexpensive and has better environmental qualities.

▪Residual fuel's price is influenced by international markets, where refiners in other countries produce much more residual fuel than in the United States. The U.S. shift from net importer to net exporter reflects stronger prices abroad, and leads us to talk about the most important aspect of residual fuel to U.S. refiners – which is its role as an indicator of light-heavy price differences.

Residual fuel: Critical product to understanding light-heavy price differences

Crude, Heating Oil, and Residual Fuel Prices (Monthly Average Spot)
Dollars per Barrel

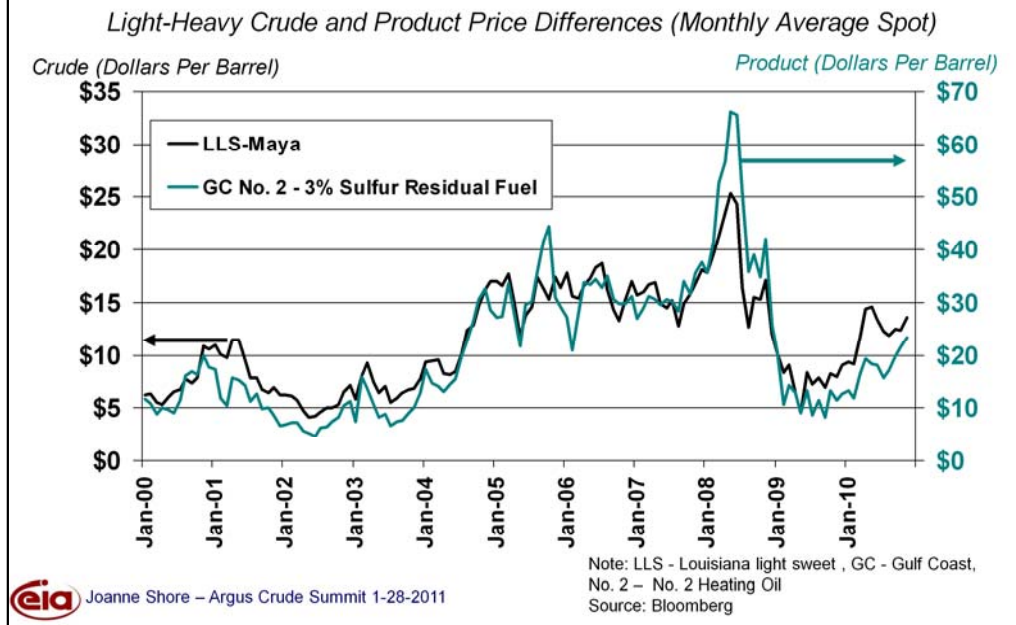


Note: Louisiana light sweet, Gulf Coast No. 2 heating oil, Gulf Coast 3% sulfur residual fuel
Source: Bloomberg

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- This chart displays the relationship between a light product (distillate fuel oil), crude oil, and residual fuel prices. Light products tend to follow lighter crude prices such as Louisiana Light Sweet, Brent or WTI crude oils.
- Residual fuel sells for less than the price of crude oil, and does not generally rise as fast as the price of crude oil. The main reason in the short run is that residual fuel competes with other boiler fuels – mainly natural gas – which tends to keep residual fuel prices down.
- The graph shows the slowly rising residual fuel price as crude prices increased from 2004, and the resulting widening of the light-heavy product price difference. In fact, it is residual fuel's variation from crude price that accounts for the majority of the variation in light-heavy product price differences. Light product prices do not vary as much from crude price as does residual fuel.
- But during 2008, as crude prices dropped quickly, residual fuel prices did not drop back to levels seen at the same crude prices when prices were increasing, which will be discussed.

Light-heavy product and crude price differences are closely related



- This chart illustrates how light-heavy product prices and light heavy crude prices are very closely related as mentioned with the last slide.

- The strong correlation between light-heavy product prices and light-heavy crude oil prices should not be surprising.

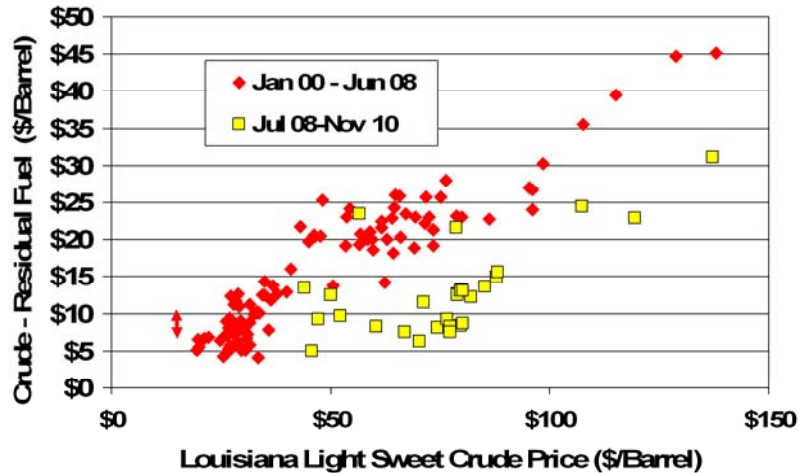
- The relative value that refiners place on a heavy crude oil compared to a light crude oil is based on the value of the set of products that a refinery can produce from each of the crude oils.

- While U.S. refiners produce only a very small fraction of their crude input as residual fuel oil, that is not the case for many refiners in other world regions. These regions that lack the heavy bottoms conversion capability of U.S. refiners are where the price of residual fuel is determined and the relative price of light-heavy crude oils are set.

- But, we are seeing a shift in the last two years.

Residual fuel price moved closer to crude price after June 2008

Crude - Gulf Coast Residual Fuel Price vs. Crude Price



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Note: Louisiana light sweet, Gulf Coast 3% sulfur residual fuel
Source: Bloomberg

- This scatter plot of crude price versus the difference between crude price and residual fuel price highlights an apparent change in the relationship since the crude oil price peak in June 2008.
- The data points from January 2000 to June 2008 show residual fuel prices moving with crude oil prices with a modest amount of scatter. But the data points since June 2008 appear to be on a completely different line.
- The changes in the world residual fuel market over the last several years have been dramatic. Residual production and use has been declining steadily for several decades worldwide, but from 2007 to 2009 it dropped more in 2 years than in the prior 10 years.
- Clearly we need to look beyond crude price at the other factors that impact residual fuel production and market prices.

Short-term residual fuel price relative to crude is function of tightness in supply and price competition

Supply Factors

- Refinery operations
 - **Refinery throughputs** (function of total petroleum demand) affect supply of residual fuel
 - **Conversion capability** (mainly coking) – destroys residual fuel supply
- Feedstock: Production mix of heavy crude versus light crude

Product Market Factors

- Crude Oil Price
- Residual fuel consumption for bunkers and power
- Prices & availability of alternative fuels (natural gas/LNG)



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▪ This last part of the presentation will focus on why residual fuel price had risen closer to crude oil price in the last few years. Residual fuel price is influenced by the availability of the product and by the prices of fuels with which it competes. The major factors affecting this balance are summarized on this slide as supply and market factors.

▪ On the supply side, one of the reasons this market tightened is that production of residual fuel oil decreased about 1 million barrels per day from 2007 to 2009, roughly a 10% drop.

-Residual fuel is produced as a byproduct of refining. It is the result of refining decisions focused on higher valued products and crude feedstock optimization.

-Residual fuel production is affected by changes in refinery throughputs and changes in conversion capacity available to “destroy” residual fuel in order to make higher valued products. Increases in conversion capacity decrease the yield of residual fuel from a barrel of crude oil.

-Also, the world mix of crude oil types being produced and run in refineries affects residual fuel production. If the world mix of crude oils becomes lighter, residual fuel oil production declines. A lighter crude slate with no other changes would result in a lower yield of residual fuel.

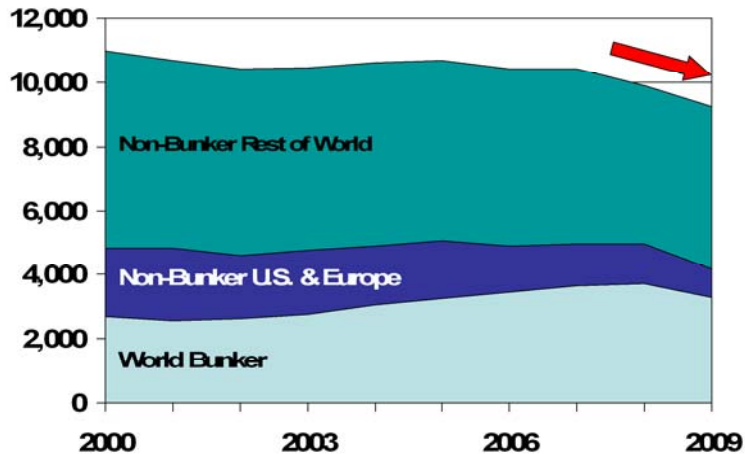
▪ Turning to the market side, an earlier slide showed when crude price increases, residual fuel price does not move up as fast as crude oil price, mainly because residual fuel competes with other fuels such as natural gas, mainly in the power sector. The prices of competitive fuels are important to understanding where residual fuel price may settle.

▪ But if there is a significant drop in the volume of residual fuel placed on the market, with all other competitive prices the same, then residual fuel will be priced relatively higher.

▪ The next slides will look at the roles these factors played in the past few years.

Residual consumption fell with supply from 2007

*Annual World Residual Fuel Consumption
Thousand Barrels per Day*



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Source: Purvin & Gertz, GPMO 2010

▪ If refiners produce less residual fuel, less will be consumed. During economic growth periods, decreases in supply and consumption would generally occur in the power and other stationary use sectors, where most fuel substitution takes place. The slide shows that Europe and the United States represent a relatively small part of that world market.

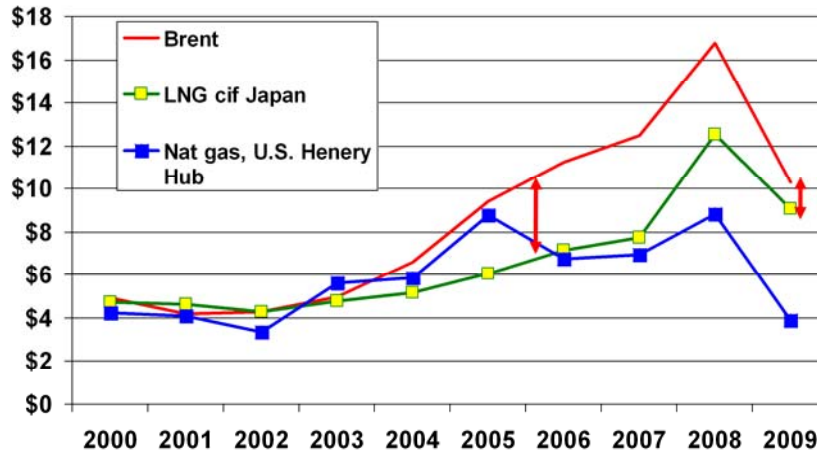
▪ This slide shows that bunker fuel use had been growing for a number of years with economic growth, but fell with the recent economic downturn. Less crude oil was shipped by marine tankers, and container shipping was down. While bunker volumes have historically increased with shipping growth, bunker fuel sulfur content requirements could affect those volumes around 2015.

▪ As residual fuel supply falls in the non-bunker fuel market, there are other fuels that fill in the gap such as natural gas, LNG and coal. Availability of these substitutes can vary based on logistics such as pipelines and terminals.

LNG price gap to crude oil narrows in 2009, allowing higher international residual fuel prices

Crude, LNG Japan, Natural Gas U.S. Prices

\$/Million Btus



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Source: BP Statistical Review of World Energy 2010

- With residual fuel prices being set in areas with less conversion capacity than in the United States., LNG prices can provide some insight into fuel price competition and thus pressures on residual fuel price from this fuel.
- LNG in Japan (and similarly in Europe) rose slowly with crude oil through 2007, but grew closer to crude price in 2008 and very close in 2009.
 - Japan has been a large LNG importer for decades, and prices of LNG are linked to imported crude oil prices.
 - But the price link relationship to crude oil price has been adjusted over time.
- The smaller price differential between LNG and crude oil in Japan and in other Asian locations has helped to support a smaller differential between crude oil and residual fuel oil in 2009 compared to 2007.
- The lower Henry Hub U.S. natural gas price illustrates one of the reasons behind the export opportunities for residual fuel from the U.S. The value of residual fuel is higher in areas abroad without access to cheap natural gas.

Residual fuel production declines affected mainly by yield declines

- To help understand the recent declines in residual production, separate impact of yields from crude inputs

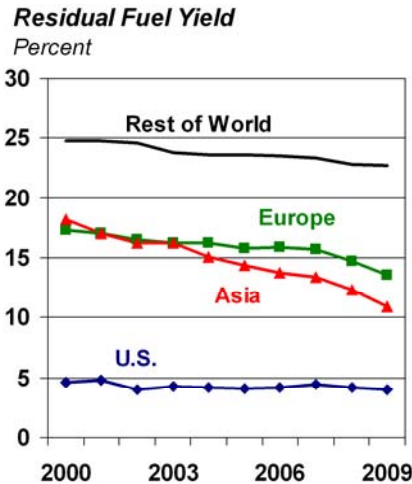
$$\text{Residual Production} = \text{Yield} \times \text{Refinery Inputs}$$

- Crude throughputs declined with petroleum demand and accounted for about 20-25% of residual fuel production decline
- Yield declines had the largest impact

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- A large part of the upward price pressure on residual fuel came from the drop in residual fuel production, which fell about 1 million barrels per day from 2007 through 2009.
- Recognizing that residual fuel production is the product of crude input times yield, we try to separate the impact of these two factors.
- Crude input fell about 2 million barrels per day, and by itself (i.e., assuming no yield change), only accounted for about 20-25% of the residual fuel production decline.
- Yield decreases accounting for the majority of the change. Yields declines can come from a number of factors that are not as easy to separate.

Residual yields have been declining, but fell off more steeply since 2007



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Source: Purvin & Gertz, GPMO 2010

- Yield declines due to:
 - Increased conversion capacity
 - Different mix of refinery capacity being used
 - Change in crude type mix
- Conversion capacity
 - Increased substantially in Asia
 - Low utilization resulted in effective conversion increase
- Crude mix:
 - OPEC cut back on its heavier mix
 - U.S. lost Mexican heavy volumes
 - But heavy, high-tan crudes increased

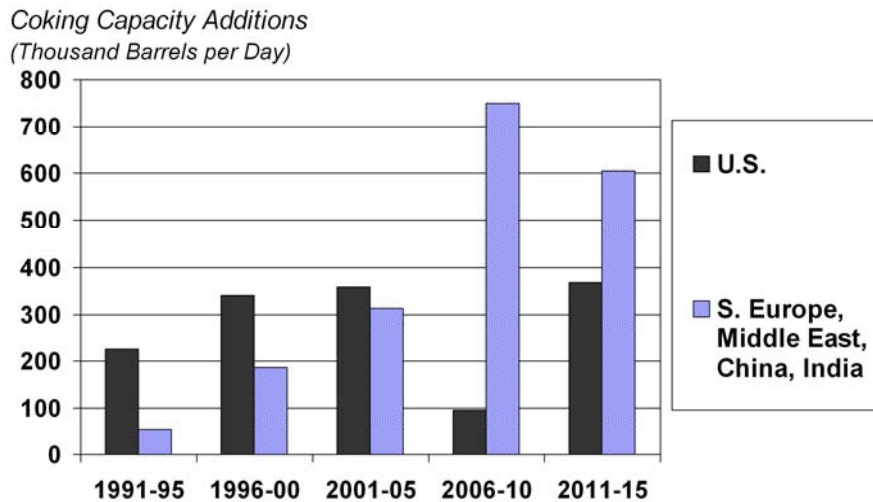
▪Yield declines are not just a recent event. Consumption has been declining with supply. Residual fuel is not attractive to refiners and its poor environmental characteristics have helped to reduce its demand. The yield of residual fuel as a percent of crude oil refinery inputs has been declining in almost all world refining areas since about 1980, mainly the result of reductions in residual fuel production from increases in cracking and bottom conversion capacity relative to distillation capacity.

▪But yield declined more steeply since 2007, due in part to increases in conversion capacity, which will be shown on the next slide.

▪The yield declines also appear to be falling due to lower world refinery utilization rates, which allowed proportionally more heavier crude oils to flow to higher conversion capability. Looking ahead, the economic recovery and increased consumption and crude runs may not simply reverse this trend. The world's largest petroleum demand growth is occurring in regions where bottoms capacity is growing, which will help to keep yields declining as refinery crude runs increase.

▪The mix of light versus heavy crude oils produced from 2007 through 2009 would appear to have had only a small impact on yield change and thus residual fuel supply. While supplies of heavy crude oil from Mexico declined, and OPEC's reductions pulled heavier-than-world-average crudes off the market, increases in production of heavy, high-tan crude oils countered much of those other heavier crude losses. Our estimates indicate that world crude mix change was a minor factor in the reduction of residual fuel production from 2007 through 2009.

U.S. has about 44% of world's coking capacity, but large additions growing outside of U.S.



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Source: Purvin & Gertz, GPMO 2010

- This chart illustrates changes in the additions to coking capacity, the most common bottoms conversion processing unit. As recently as 2005, the United States had 50% of the world's coking capacity. That is changing with new additions in Southern Europe, China, India, and the Middle East.

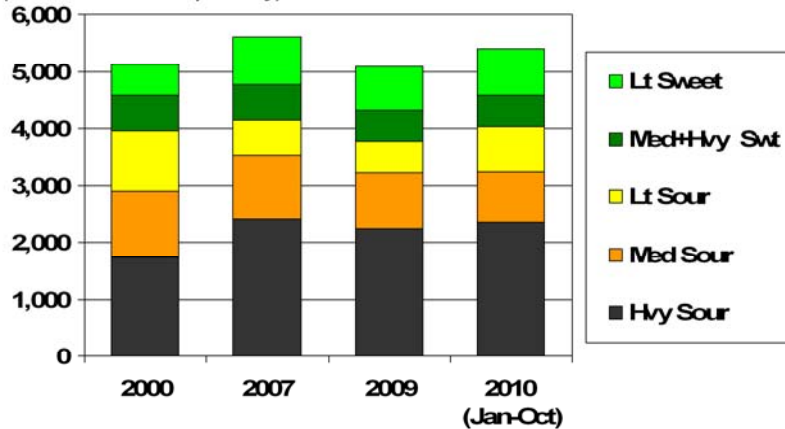
- Refining capacity in general is increasing most rapidly in China, India and the Middle East - areas in which petroleum demand is growing most rapidly. This new refining capacity includes coking capacity additions as shown in the chart. The additional coking capacity means that, as demand grows and more crude oil is run, the additional crude volumes will not produce much additional residual fuel.

- From 2007 to 2009 all the market forces worked to reduce the price differential between residual fuel oil and crude oil. Looking forward we see oil product demand growing again, but at a slower rate than historically, and more heavy crude will be processed with more residual material to be converted. Both these factors will create pressure to expand the crude oil – residual price differential. But as the chart above shows, additional bottoms conversion capacity will be available in those regions where crude inputs will increase the most. That means that residual fuel production will most likely be relatively flat. LNG production is also expected to increase, which could further weaken residual fuel price relative to crude oil .

- Together these factors would imply that the residual fuel to crude price discount will expand some from where it has been recently, but that we should not expect it to return to the deep discounts seen prior to June 2008. And thus, light-heavy crude price differences should also increase modestly.

U.S. PADD 3 crude quality mix did not change 2007-2009; other Latin crudes made up for loss of Mexican

*PADD 3 Crude Imports by Quality
(Thousand Barrels per Day)*



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Source: Form EIA-814, "Monthly Imports Report"

- We have more detailed data for the United States than other world regions, so we can explore it further for insights into some of the dynamics of this 2007 through 2009 market.

- During the 2007 to 2009 period, some trade press reports indicated U.S. refiners taking coking units offline due to poor economics stemming from the shrinking light-heavy crude price difference. The EIA data indicate that coking unit utilization in the United States declined about the same as distillation unit utilization.

- Availability of heavy crude to U.S. refiners was an especially important issue with the 500 thousand barrel per day decline of Mexican heavy crude oil production between 2007 and 2009, since U.S. refiners are the main recipients of this crude oil.

- Crude import data for PADD 3 indicate that U.S. refiners were successful at finding substitute heavy crude oils.

- Total PADD 3 crude inputs were down in 2009 relative to 2007 over 500 thousand barrels per day, but the mix of crude types remained much the same as in 2007, with greater imports of heavy crude oil from other Latin American countries making up the difference.

- With petroleum demand increasing in 2010, PADD 3 is running more crude oil. Its share of heavy sour is holding constant, with some shift away from medium sour to light sour crude oils. Since both light sour and medium sour crudes have fairly significant bottoms content, the impact on residual fuel production is expected to be small from that factor. PADD 3 refiners could run more heavy crude oil if product demand increased to provide the incentive for refiners to increase utilization.

Summary: Export opportunities growing for middle distillate fuels

- Gasoline
 - Short-term opportunities during demand downturn
 - But growth and perhaps sustainability of export opportunities limited with strong world competition
- Distillate
 - 2008 demonstrated large export potential
 - Exports helped refiners during the recent demand downturn
 - Longer term opportunities remain



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▪The United States is seeing a significant shift in petroleum product demand both short and long term. In the short term, the recent decline in overall petroleum demand lowered refinery utilization and profitability. At the same time, world markets presented some opportunities for exports; however not all of these export opportunities may be sustainable.

▪Gasoline exports increased, mainly due to surplus U.S. refining capacity and the need for gasoline in markets close to the United States such as Mexico and other Latin American countries.

▪However, with U.S. demand for gasoline recovering in the short term from its 2008 low point, and increasing competition with foreign export refineries in areas like Europe and Asia, it is not clear these export market opportunities will grow or even be sustainable.

▪Distillate, on the other hand, is expected to continue to be a large growth market worldwide. In 2008, a jump in world distillate demand produced high distillate prices relative to gasoline, and U.S. refiners changed operations to produce more distillate without producing more gasoline, demonstrating the potential for significant distillate volume increases.

▪The price for distillate has remained attractive on world markets, encouraging continued exports. Since U.S. refiners produce ultra-low sulfur diesel, they can take advantage of import markets like Europe that require the low sulfur fuels.

▪We expect the distillate market to provide some sustained opportunities for U.S. refineries.

Summary: Residual fuel important to watch, not for exports, but for light-heavy price implications

- Exports increased
 - World markets setting price higher than U.S. value
- Residual fuel price implications for light-heavy price differences
 - Light-heavy product prices tied to light-heavy crude prices
 - Residual fuel price changes relative to crude oil are main determinant of light-heavy product price changes (and thus light-heavy crude oil)
 - Unusual high residual fuel price relative to crude oil due mainly to residual fuel production declines from refinery yield reductions
 - Yield reductions due mainly to increased conversion use (not change in world crude production mix)
 - Differentials should widen somewhat



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▪Residual fuel exports also grew, shifting the U.S. from being a net importer to a net exporter in 2009. Although this product sells for less than the price of crude and is not a large volume product in the U.S., it is a critical product to watch for the implications on light-heavy product differences.

▪Because light-heavy product prices and light-heavy crude prices are so closely connected, we gain insights into both light-heavy price differences by looking at the light-heavy product price differences, which change mainly as a result of changes in residual fuel price relative to crude oil price.

▪After mid 2008, both light-heavy price differences changed as the residual-crude price differences changed significantly. Residual fuel prices were much closer to crude oil prices than usual, and light-heavy price differences had narrowed significantly.

▪Even though high LNG prices relative to crude in 2009 helped to keep residual fuel price elevated, the largest factor adding to residual fuel price strength likely was the large decline in residual fuel production from 2007 through 2009.

-The supply loss was mainly due to declines in refinery yield, with decreases in crude inputs only accounting for about 20-25% of the production decline.

-The yield changes were due mainly to increased use of conversion capacity to run the heavy crude oils.

-In hindsight, the mix of crude oil types being produced did not change much, indicating crude mix had little impact on residual fuel production and the light-heavy price difference.

▪Looking ahead, that light-heavy price difference should widen some from levels seen recently, but will not likely return to levels seen as crude price increased from 2004 into 2008.