Crude Oil and Petroleum Product Price Outlook

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Prepared by WTRG Economics

for
Energy Security Partners, LLC

Our purpose in this outlook is to provide price guidance regarding liquid fuels for Energy Security Partner's (ESP's) analysis of a natural gas to liquids (GTL) plant. Depending on the configuration of the plant, the primary products will be some combination of gasoline, diesel and jet fuel. The two major components of the products' prices are the price of crude oil and refinery margins, or the price spread between the price of crude oil and the wholesale price of the final product. While the proposed GTL facility will use natural gas as a feedstock, the price of its products (which are indistinguishable from those manufactured from crude oil) will be determined by supply and demand for petroleum products.

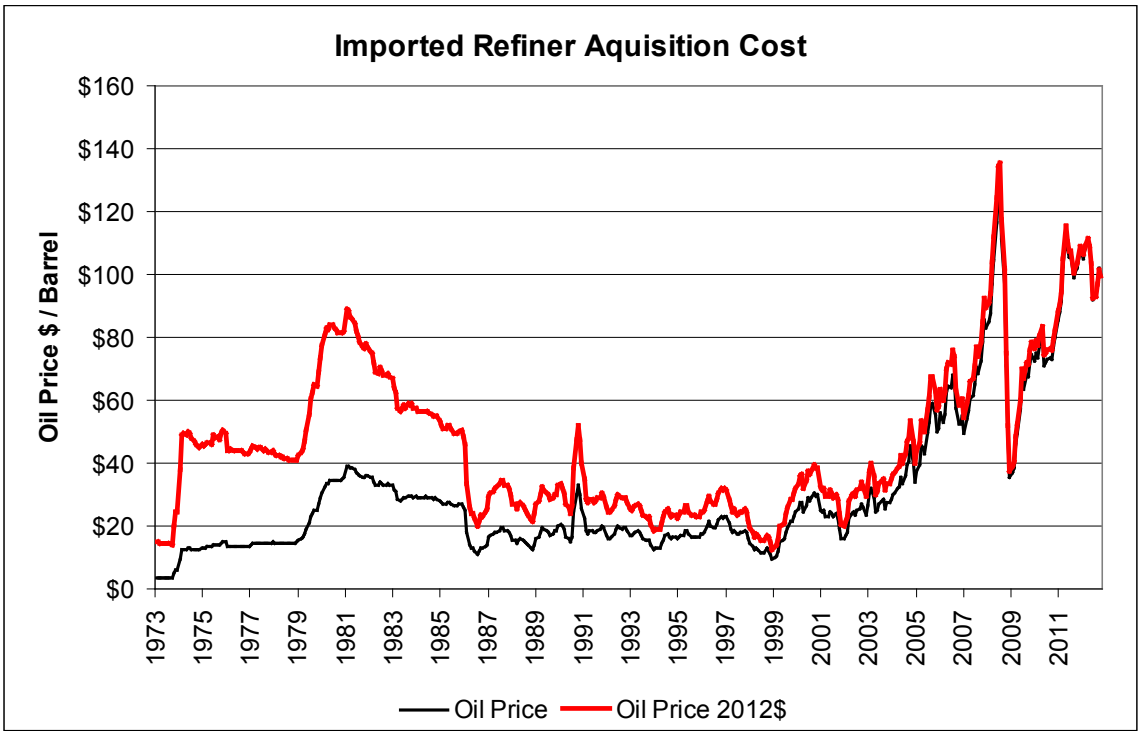
Background: Crude Oil Prices

The operational time horizon of a GTL plant will span decades. Therefore, we first examine oil prices over a long time horizon to garner insight for forward projections. History informs our view of the future. Nearly all of the spikes in price come from supply interruptions. In the post-World War II era prices were essentially stable near $2.50 per barrel until the 1970s. In the early 1970s, prices started to rise as producing countries began to wrest control of prices from the major oil companies (the Seven Sisters). OPEC was already in existence for a decade, but in reality was little more than a discussion group.

The first oil price shock came in October 1973. It was not a concerted action by OPEC but rather the reaction of several Middle East producers to the support of Israel during the Yom Kippur War by the U.S. and other Western powers. While often called an OPEC or Arab oil embargo it was neither. OPEC member Venezuela did not participate and Persian Iran did. The international price of crude increased from $3.50 to about $6.10 in less than a month. By early 1974, prices reached $12.50 and through 1978 showed only modest increases.

In 1978, oil prices jumped when the Iranian Revolution led to a major supply interruption. In a few months after two thirds of the production was restored, Iraq invaded Iran, taking production from both countries off the market. At that point, prices spiked again, eventually reaching $39.00 per barrel (about $90 in 2012 dollars) in early 1981. [See the Appendix for graphs depicting major supply interruptions.] The 1978 price spike is clearly evident in Figure 1.

Figure 1



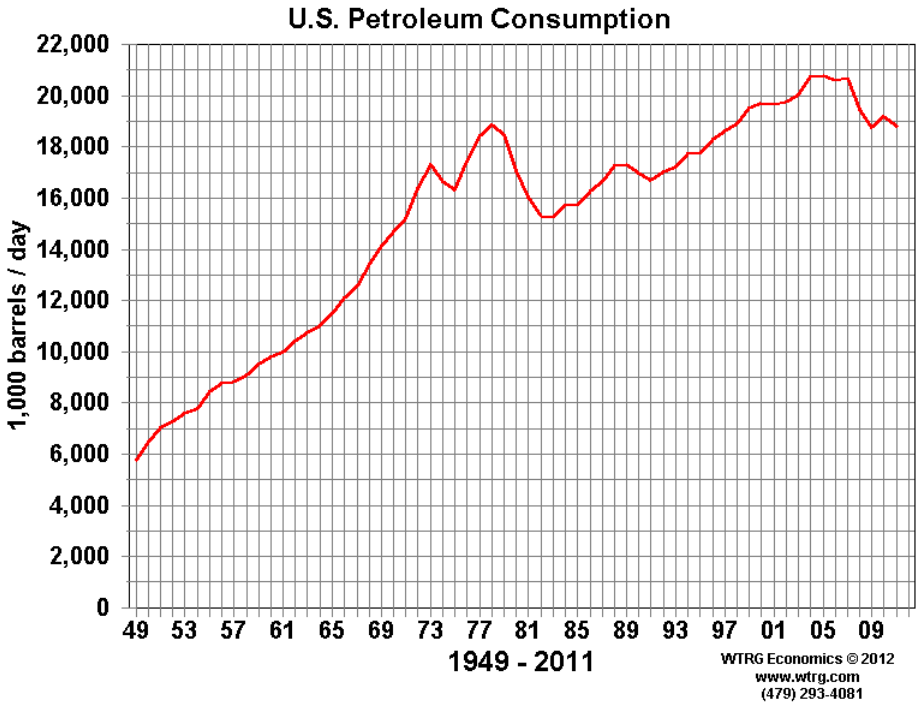
Source: WTRG Economics

High prices have consequences. These first two price spikes contributed to two recessions. The second in 1980 – 1981 was the worst economic downturn since the Great Depression.

The price run that started in 1978 and the ensuing recession is associated with a massive decline in consumption. Petroleum consumption in the U.S. peaked in 1978 and by 1983 was down almost 20 percent from almost 19 million barrels per day (bbl/d) to a little over 15 million bbl/d. While the simplest explanation is that it fell due to high prices in that period, the situation is more complicated and demonstrates an underlying principle of petroleum economics. A good portion of the decline that started in 1978 was associated with response to the price spike in October 1973. A simple example is automotive efficiency. The CAFÉ standard, requiring automobile manufacturers to make more efficient vehicles was enacted in response to the 1973 price increase, but did not take effect until 1978.

Fuel switching was also a factor as most of the use of petroleum for electric power generation switched to coal, nuclear and natural gas. Not only did consumption fall, but also the rate consumption growth was lower. It would be 20 years in 1998 before the U.S. used as much petroleum as it did in 1978. Peak consumption in the U.S. in 1978 is clearly shown in Figure 2.

Figure 2



Looking back at Figure 1 we notice the long decline in oil prices from 1981 to 1986. It would be tempting to attribute the entire price decline during this period to lower consumption in the U.S. (see figure 2) and other developed nations but that was only a portion of the reason. There were major changes on the supply side as well.

The supply side also exhibited a delayed response to price increases. Outside of OPEC countries there is little if any spare production capacity. Any increase in oil production means drilling new wells, and significant increases are usually associated with the discovery of new fields or formations.

At the time of the 1973 Embargo non-OPEC countries were producing about 25 million bbl/d. By 1987, the output rose to 38 million barrels per day. Additions to the production came from development of known fields and the employment of secondary recovery techniques, such as water and gas injection, but much of it came from new areas of exploration. The U.S. production in decline from 1970 reversed for a period as Alaskan North Slope production came online. Production in the North Seas went from zero to 2.5 million bbl/d by 1985. Norway was slower to develop its North Sea oil, reaching 3 million bbl/d in the mid-1990s. Mexico added 2 million bbl/d between 1973 and 1982. The USSR went from 8 million to about 12 million bbl/d in the same period. China added a million by 1978.

Rising non-OPEC production and declining consumption forced OPEC to cut production from over 30 million bbl/d to as low as 15 million bbl/d. Non-OPEC and OPEC production levels are presented in Figures 3 and 4, along with world crude prices. Note the changes during 1980-1985.

Figure 3

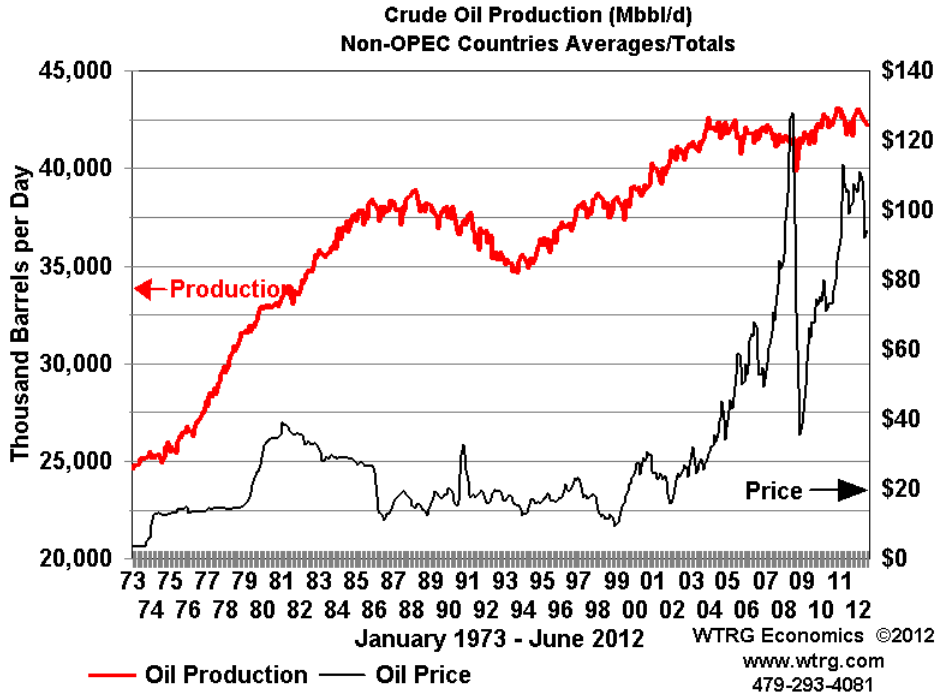
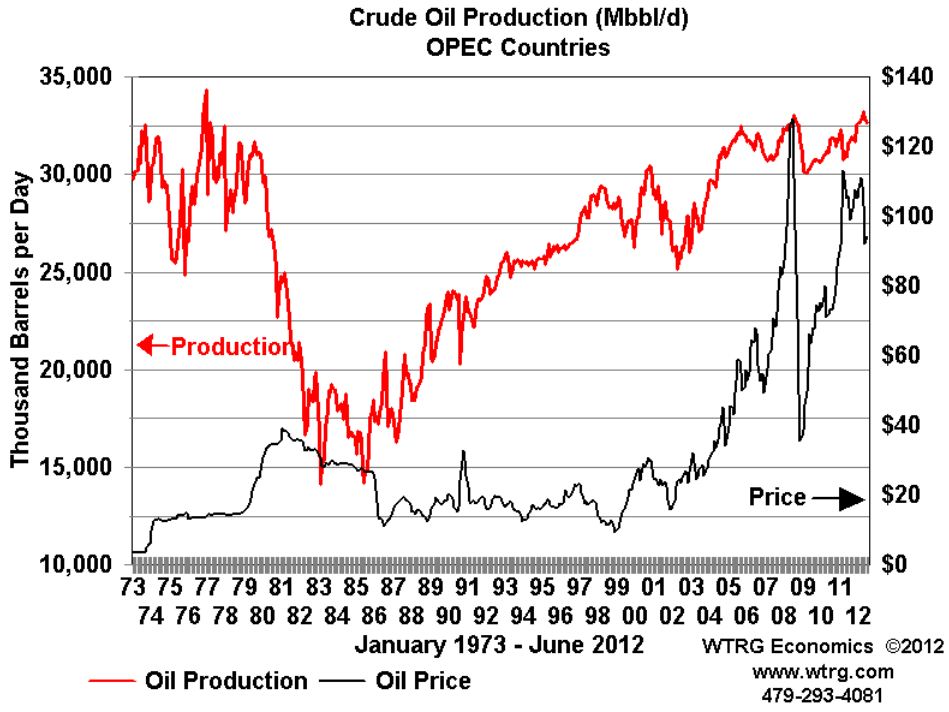
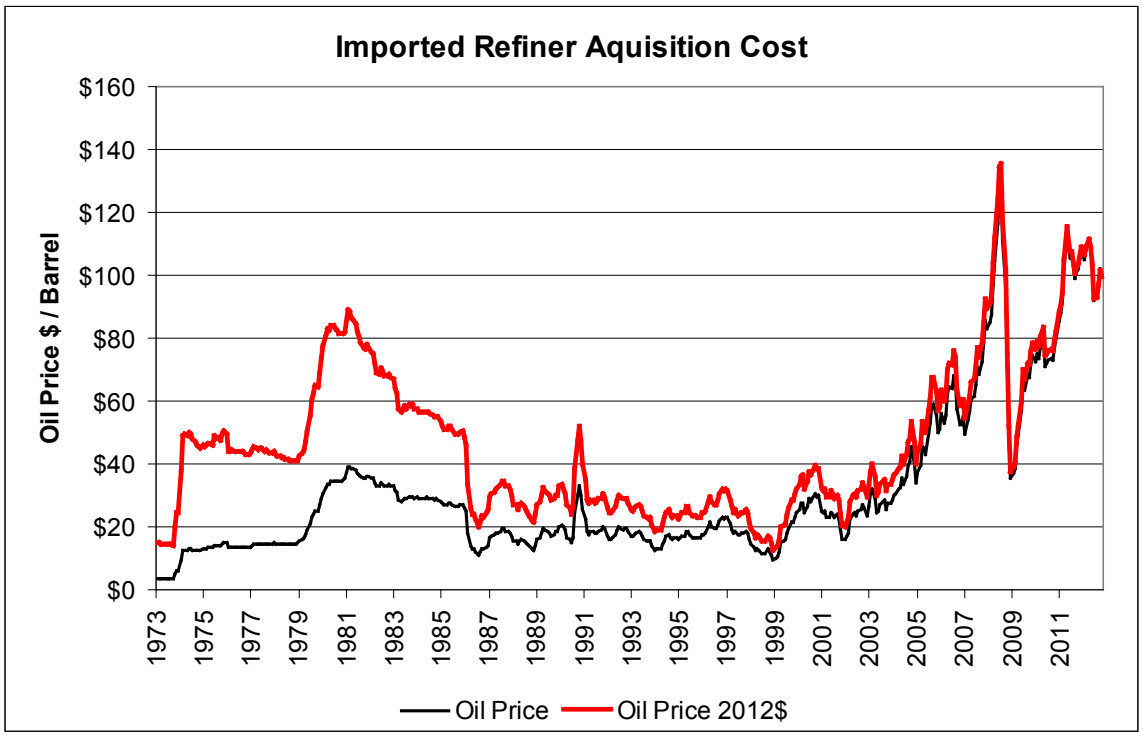


Figure 4



By the mid 1980s, we see several factors governing global crude oil prices: Supply interruptions causing higher prices, high prices leading to lower consumption, economic weakness, fuel switching and higher non-OPEC production. All of these factors can be identified in the 12 years following the 1973 Embargo. With most of the factors that move price identified we return to the price chart, which is re-presented in Figure 5.

Figure 5



Source: WTRG Economics

The precipitous drop in 1986 was due to a dramatic increase in supply by Saudi Arabia, in large part because other OPEC members had not been participating proportionately in cuts to stem the drop in prices, and Saudi Arabia sought to bring discipline to the OPEC ranks. The next price spike comes in 1991 with Iraq's invasion of Kuwait and the Gulf War that followed. This resulted in the loss of 5 million barrels per day of production. Because there was sufficient spare capacity within OPEC the price increase was of short duration as other member countries replaced the lost production. Spare capacity is a buffer for a supply interruption. The next big price change—the decline in the late 1990s—was due to the Asian financial crisis. The price recovery that followed was due in part to OPEC cuts. Prices fell again during the 2001 recession but recovered on OPEC cuts. Beginning December 2002 the PDVSA strike in Venezuela followed by the Iraq War in March 2003 sent prices higher. These events underscore the price impacts of both supply controls (through production limits) and unplanned supply disruptions.

It is important to note the obvious. There are two components to spare capacity: Capacity and production. Sharp declines in capacity are usually due to war or revolution in an OPEC member country. These, in addition to planned OPEC changes, are the primary drivers of production. Figures 6 and 7 depict spare capacity and production within OPEC.

Figure 6

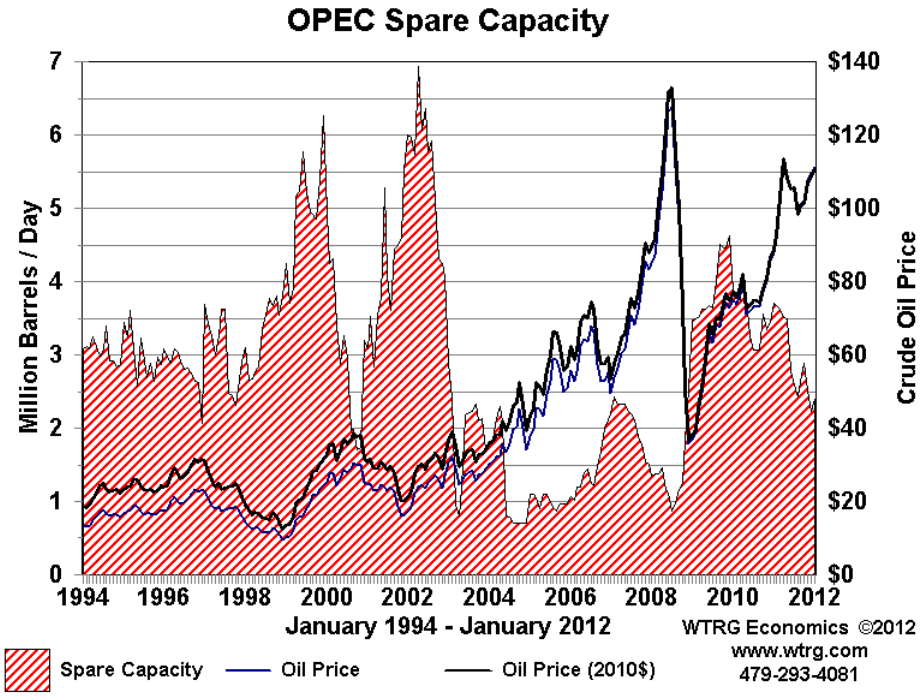
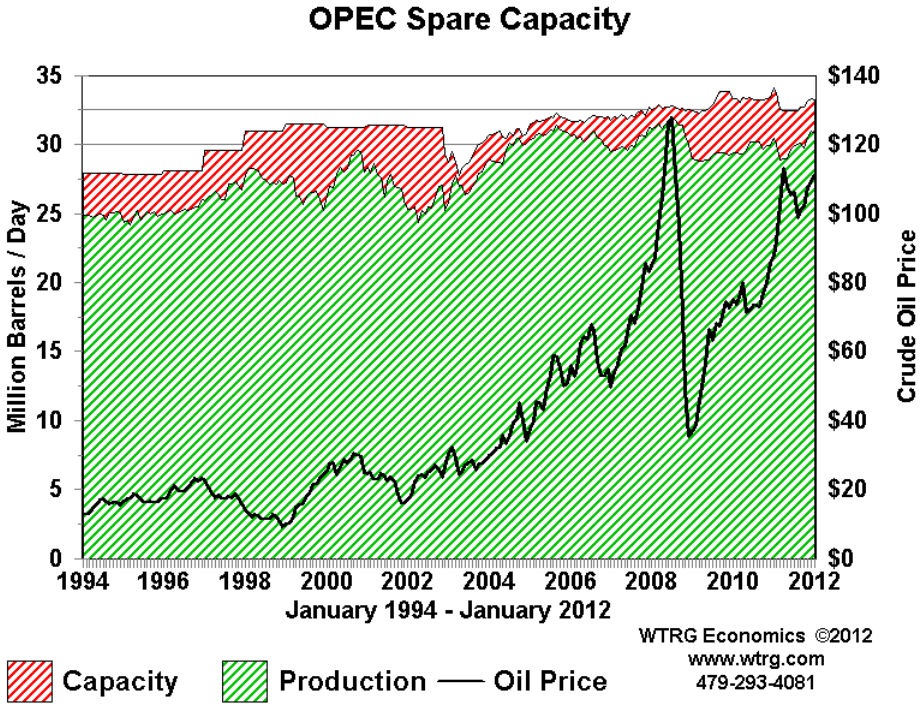
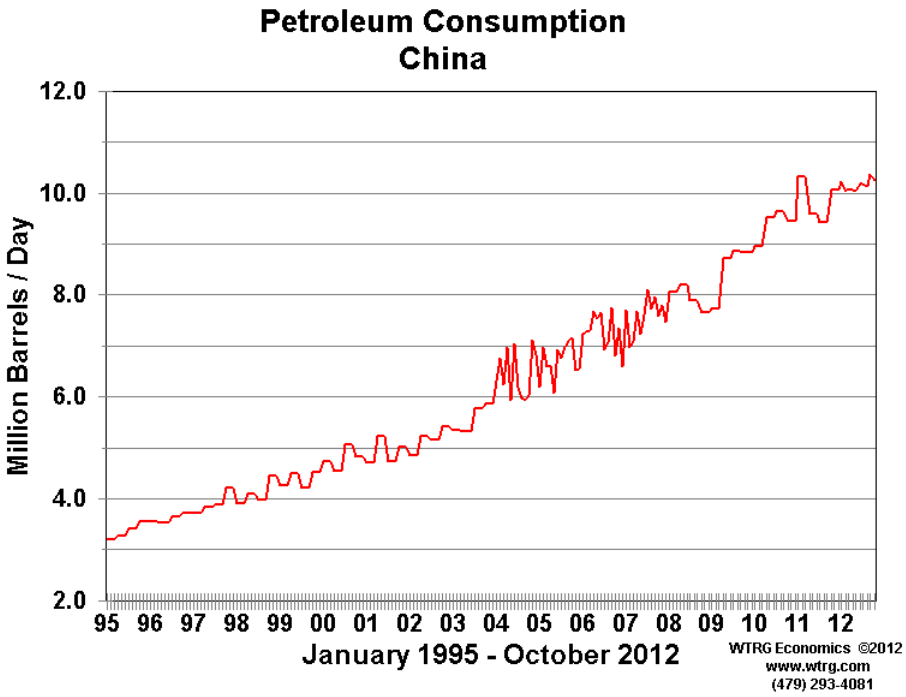


Figure 7



A supply interruption with less than 2 million bbl/d of spare capacity has a greater impact on price than it does when there is more capacity. From 2004 to 2008 rising Asian demand and limited investment in new capacity led to low spare capacity worldwide and additional risk premium in crude oil prices. China's consumption grows at a rate that doubles every decade. If the current pace is maintained then China will use more oil than the U.S. by 2020.

Figure 8



Again referring back to Figure 1, the 2008 recession, which exceeded that of 1980-1981, resulted in reduced demand and collapsed prices. After reaching $145 per barrel on NYMEX trading in July, 2008, prices crashed below $40 per barrel by December of the same year. Despite an anemic recovery in the West and continuing recession conditions in most of Europe, the price moved back up and remains high by historical standards. The revolutions in Egypt and Libya were recent factors but rising Asian demand and the increased use of crude futures as an asset class are underlying fundamentals.

Outlook: Crude Oil

Over the horizon of ESP's GTL plant, every member of OPEC, including Saudi Arabia, is a potential source of supply interruption and corresponding price spike. The breakeven budget for most OPEC countries now requires a price of Brent near $100 per barrel or higher. Saudi Arabia's breakeven is about $80. The risk of civil unrest leading to a supply interruption becomes higher with lower prices, including in Saudi Arabia.

For our outlook, we present three scenarios. We use the composite refiner acquisition price for crude oil as the price indicator. The composite price is the weighted average cost to refiners of domestic and imported crude oil. Historically, in the 1973 – 1981 periods this was lower than the

imported refiner cost because of price controls on domestically produced oil. Today, they are roughly the same. We use composite because it was necessary to use the actual cost to refiners to analyze product margins, which are discussed in the next section.

Our base case has prices rising at an annual rate of 1.5% above the inflation rate. This posits slow recovery and growth in the developed nations and more moderate growth in Asia and Middle East demand than experienced in the last decade.

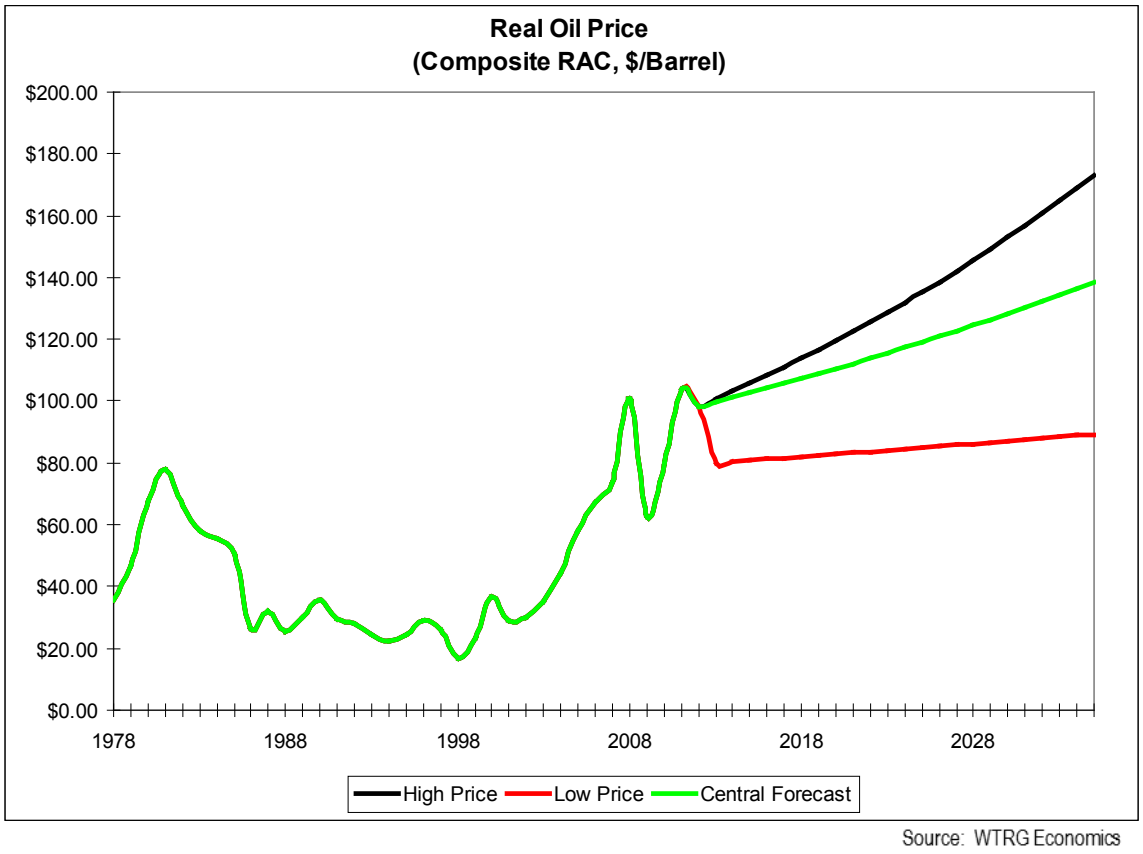
The low price scenario assumes a weaker Western Economy in 2013, slow growth in the long term for the OECD countries and much slower growth in Asia and in the less developed nations. After falling to $80 per barrel in 2013, prices grow at an annual rate of 0.5% above inflation. We think this is the minimal growth rate and price that can maintain stability in the Middle East. It is essentially the lowest price in the long-term that can sustain the Saudi economy and social stability unless there is a dramatic drop in its population growth rate.

While there was an extended period of low prices in today's dollars in the mid 1980s and 1990s, we do not anticipate any long period at comparably low prices in the future (i.e., in the $20 - $40 range). Spare production capacity is lower globally and, outside of OPEC, the cost of production is higher. In the medium to long term, the high cost producer sets the minimum price. Considering known technologies, high cost production will come from oil sands and tight formations with low porosity. Those production costs are generally in excess of $60 per barrel and are much higher than the costs for finding and producing gas in the U.S. on a Btu basis. Natural gas is profitable for most producers at $4.50 per MMBtu; even at $5.00 per MMBtu the equivalent oil price is only $29 per barrel on a Btu basis.

The high price case increases oil price at a 2.5% annual growth rate above inflation and is consistent with continued growth in Asian and Middle East demand. If the U.S. does not solve its debt crisis, the high price case would also be consistent with an extended period in which the dollar weakens. Note that a sharply weaker dollar can provide insulation for the GTL project from lower oil prices…it raises the cost of oil relative to natural gas, which is for all practical purposes a North American commodity with prices determined on the North American continent. A weaker dollar means higher prices for dollar denominated oil and improves the domestic spread between crude (and crude-derived transportation fuels) and natural gas.

Figure 9 depicts the three oil price projections used for this analysis (central forecast, high oil prices, and low oil prices). As with all projections, none of the foregoing cases will prove exactly correct, as there will be certainly be wide unanticipated variations around any future projection due to supply interruptions and periods of growth and recession in various locations around the world. Thus, supply interruptions and/or strong economic growth should widen the spread between oil and natural gas prices within the U.S. Only recession on a global scale can be expected to lower these spreads. Every time there is a major crude supply interruption GTL margins for ESP's facility located within the U.S. will likely increase.

Figure 9



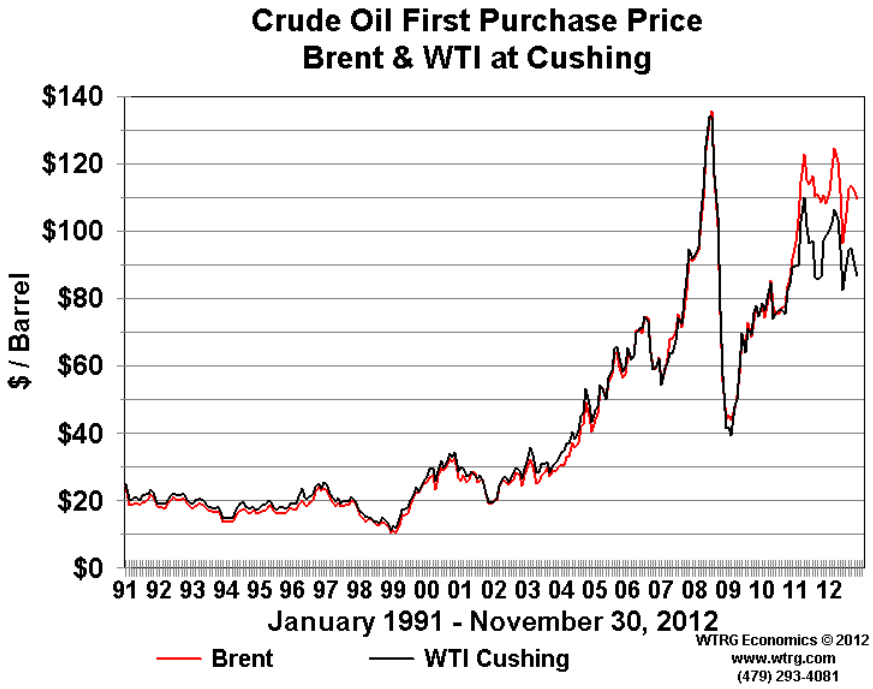
Source: WTRG Economics

Refiner Margins

The reason for using composite refiner acquisition cost instead of more common markers such as Brent or WTI is that composite RAC is the average price that U.S. refiners actually paid for the oil they refine. The composite RAC price is the weighted average of imported and domestic crudes. Both the imported and composite RAC prices include oil of varying quality. They vary in both API gravity and sulfur content. API gravity and sulfur content and location are the major factors that explain price differences in refiner's oil purchase prices.

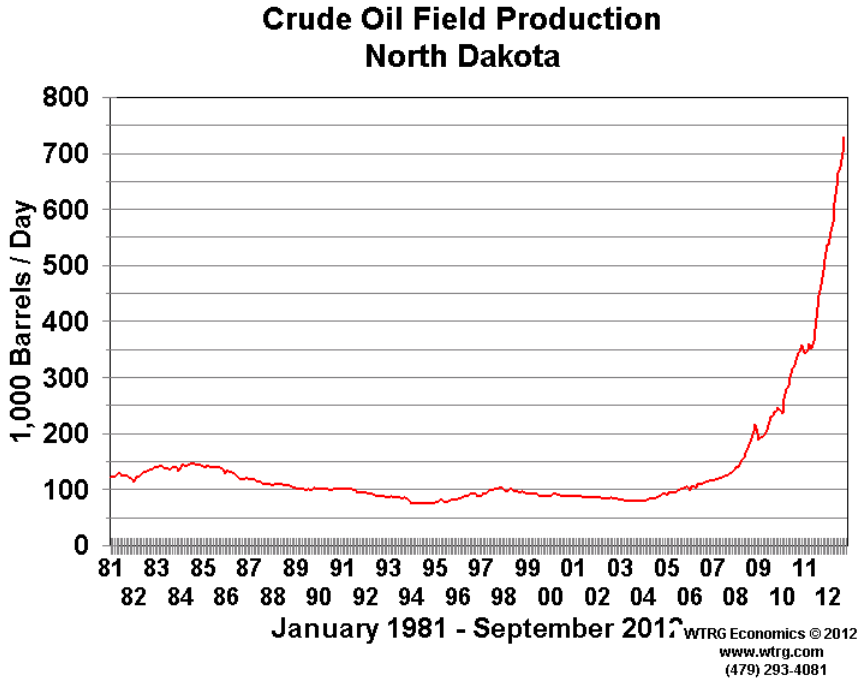
WTI or Light Sweet Crude for delivery at Cushing, Oklahoma is defined by NYMEX with an API gravity range of 37º to 42º and sulfur content less than 0.42% by weight. Brent is 38º API gravity with about 0.38% sulfur content, which is at the low end of the WTI quality range. Historically, Brent sold at a $1 - $3 discount to WTI reflecting the transportation cost from the UK to the US. Figure 10 compares historic prices of Brent and WTI. Note how closely the two prices tracked during the past twenty years, until recently.

Figure 10



In the last few years, the prices of WTI and Brent diverged, as more oil was produced in areas upstream from Cushing than the refineries connected by pipeline to Cushing could process. North Dakota provided most of the increase.

Figure 11



Even though, on average, the quality of WTI is slightly superior to Brent, the stock build at Cushing caused WTI to sell at a discount to Brent. The discount is close to the transportation cost by truck or rail from Cushing to Gulf Coast refineries. Figure 12 shows recent price divergence between Brent and WTI compared to inventory buildup at Cushing. Figure 13 shows the difference between WTI and Brent during the past 20 years, but also shows the composite price.

Figure 12

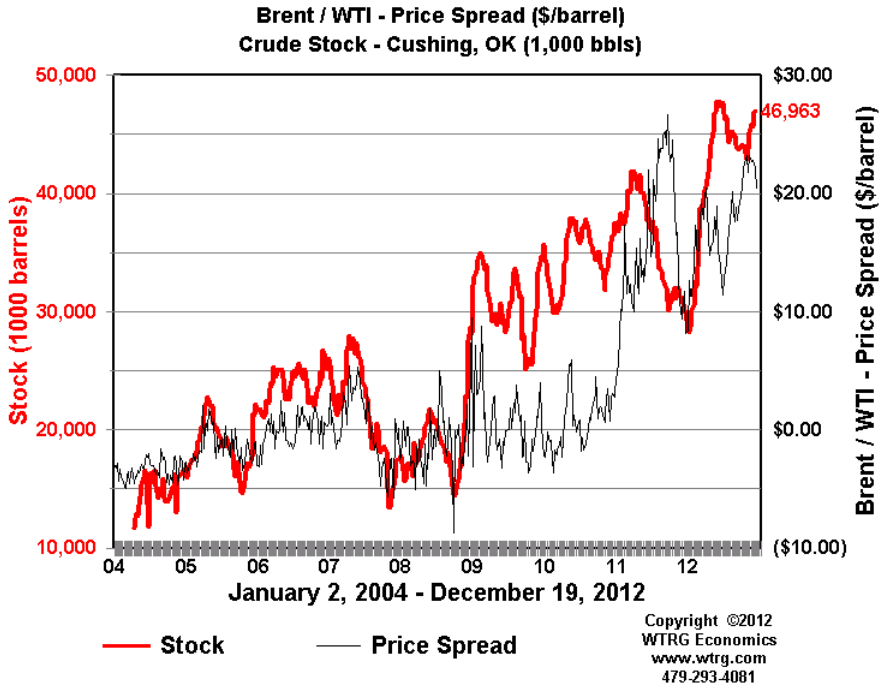
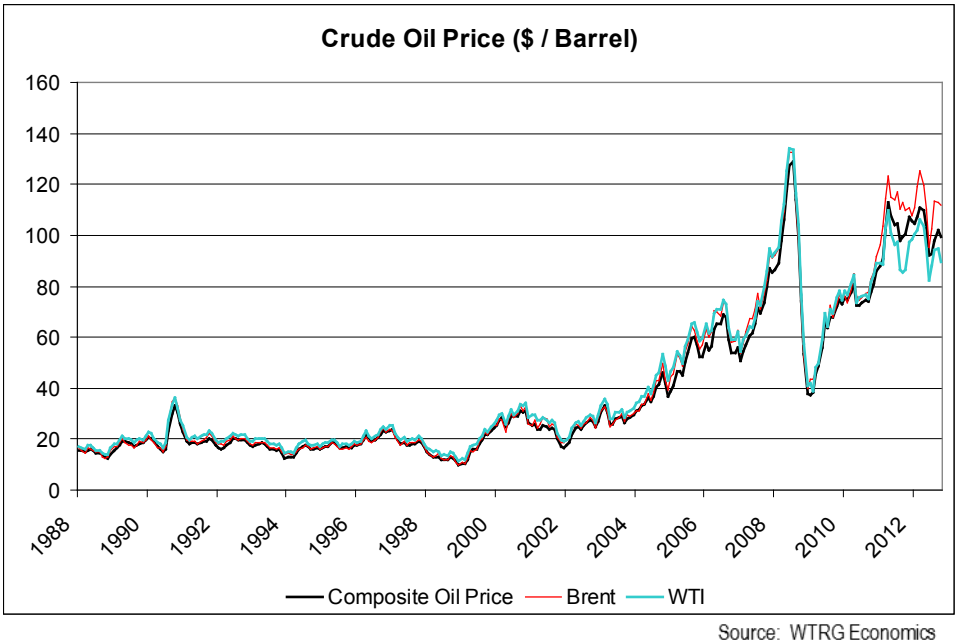


Figure 13

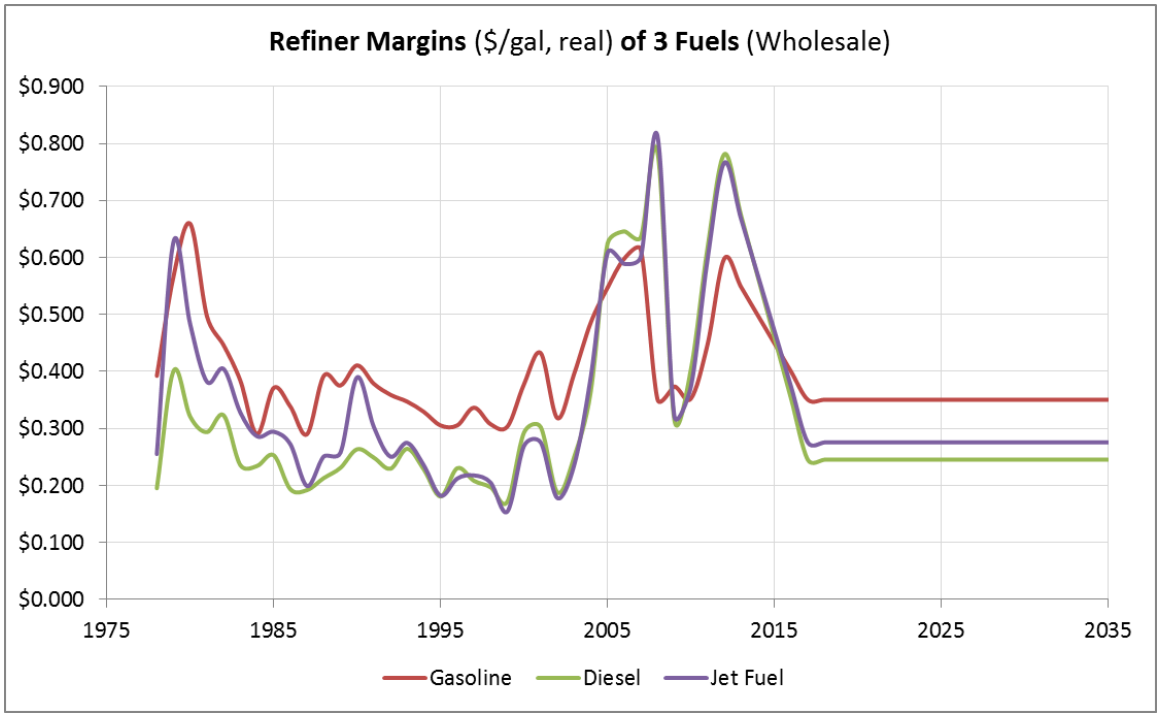


Source: WTRG Economics

Over the next 3-5 years, the spread between WTI and Bent should narrow to the point it is negligible. The timing depends upon the completion of sufficient pipeline capacity from the Bakken formation in North Dakota to refineries on the Gulf Coast. For example, capacity of the Seaway pipeline from Cushing to the Gulf was just completed raising capacity from 150,000 bbl/d to 400,000 bbl/d and an additional 450,000 bbl/d should be online in early 2014.

Our analysis of refiner margins leads to what may be a somewhat conservative forecast of product prices relative to crude oil prices. Over the long term, we anticipate that in 2012 dollars wholesale gasoline will sell at a $0.35 per gallon premium to the composite RAC price of crude oil. Jet fuel and diesel should sell at premiums of $0.276 and $0.245 respectively. We base this on the real median margin from 1983 to present. We chose the median over the average because the average is skewed higher by two factors. First, the high margins from 2004 to 2007 are the result of legislation requiring a switch from MTBE to ethanol as an oxygenate in gasoline; and, second, from the switch to ultra low sulfur diesel (ULSD) for over-the-road vehicles. Both factors required refiners to modify their operations. The modifications meant longer downtime for refiners, resulting in tighter supplies and higher than normal margins.

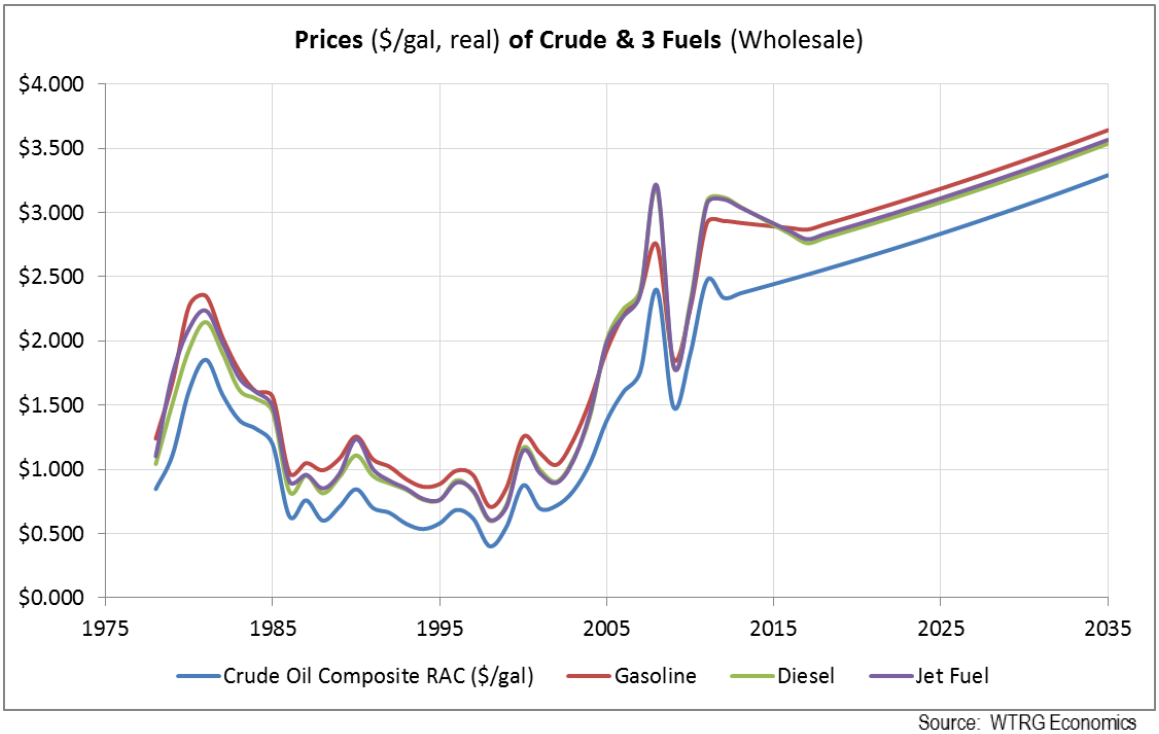
Figure 14



Source: WTRG Economics

Recent high margins are due to the increased participation of Gulf Coast refiners in the international market, because offshore refiners have higher production costs and, therefore, product prices because of less efficient refineries. However, numerous new and more efficient refineries are under construction in the Middle East and Asia; as they are completed, margins should return to historical norms. The greatest uncertainty in forecasting liquid fuel prices comes from the uncertainty in future crude oil prices, since the price of oil represents most of the product price. The final graphs show the central forecasts for product prices in 2012 and nominal dollars.

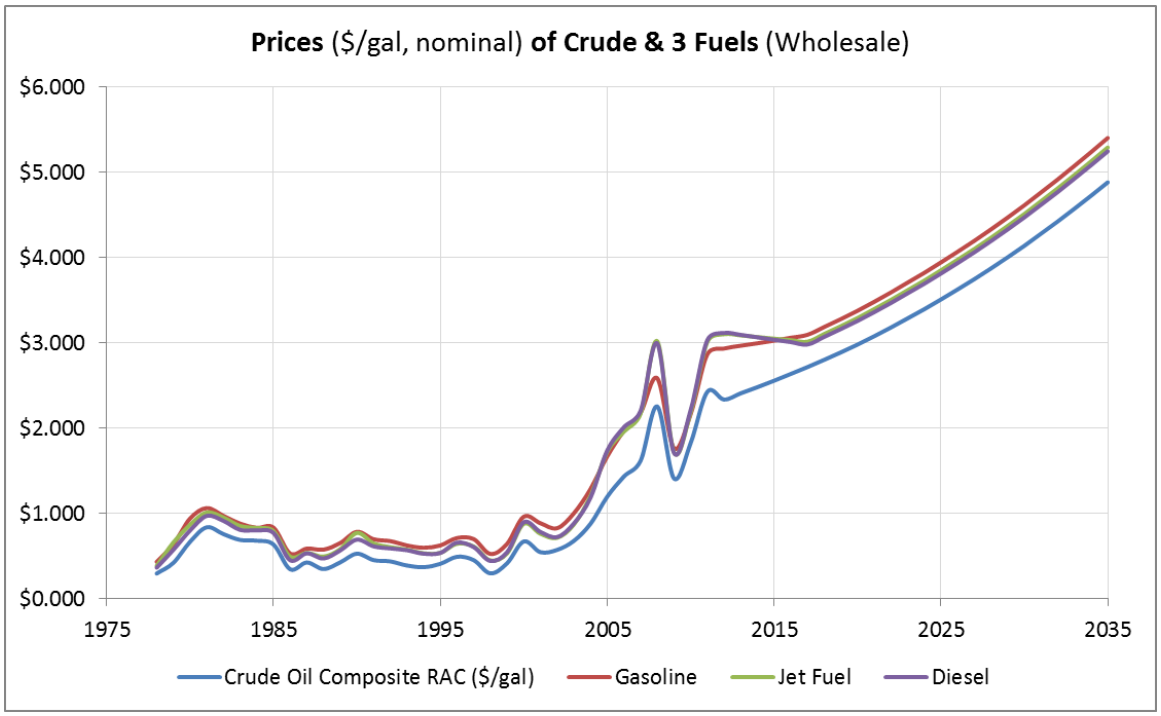
Figure 15



Source: WTRG Economics

For projections of product prices for ESP's GTL plant, we recommend using nominal prices, as they should reflect actual sales. For sensitivity analysis, we recommend concentrating on the price of crude oil, as the variation in crude oil price will drive product prices.

Figure 16



Source: WTRG Economics

Summary

Historic crude oil prices show large variations due to OPEC supply controls, unanticipated supply interruptions, and increasing global demand. Price spikes are generally due to supply interruptions in OPEC member countries, whereas price dips are usually associated with economic downturns such as recessions in Western economies and the Asian financial crisis. Upward price movements are more sensitive when spare capacity is low. Rapid growth in energy consumption in Middle Eastern and Asian economies has contributed to upward price pressure over the last decade.

Brent and WTI prices historically move in sync, with WTI trading at a premium to Brent reflecting transportation costs of Brent to the United States and slightly higher quality of WTI. However, WTI in recent years has traded at a sharp discount to Brent because of logistical constraints into and out of Cushing, Oklahoma, (and corresponding inventory buildups). As new pipelines are constructed over the next few years to transport domestic crude into Cushing and to move crude from Cushing to the Gulf Coast, these temporary constraints will be eliminated and WTI and Brent prices should re-converge.

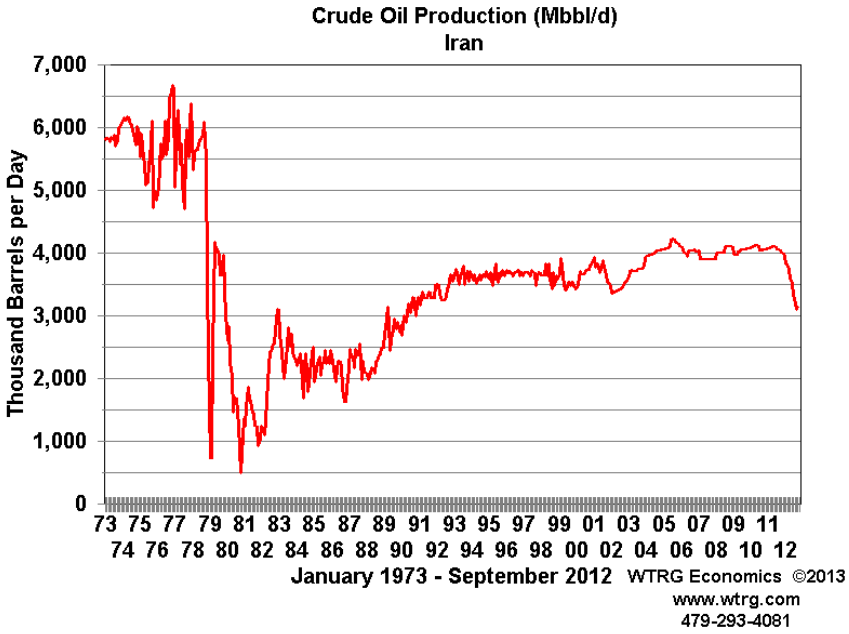
Refiner margins vary widely on a month-to-month basis and have exhibited spikes due to (i) mandated changes in product specifications requiring refinery upgrades, and (ii) exposure to international product markets in more recent years; however, we anticipate a return to "normal" product price spreads with the construction of more refineries in Asia and the Middle East. For the long term, we recommend using refiner margins of $0.350, $0.276 and $0.245 in 2012$ for gasoline, jet fuel and diesel, respectively. Since stocks of products typically do not exceed 25 days' consumption, with crude stocks at about the same level changes in oil prices are rapidly reflected in product prices. Typically, a change in oil price is reflected in product prices within days or at most 2-3 weeks. This means the lag between changes in product prices vs. crude oil prices can be ignored when considering price projections on an annual basis.

While we used real prices in our historical analysis (adjusted to 2012 dollars using actual historical inflation rates), we recommend that financial projections for ESP's GTL operation use nominal prices since investments, feedstock purchases, costs of operations, and product sales will all be in nominal dollars. Because the GTL operation will use natural gas produced within North America, the company's natural gas prices are insulated from global crude oil price variations for the foreseeable future. Furthermore, spikes in global crude oil prices that can be expected (but not predicted) to occur from time to time should translate into higher product margins for a U.S.-based GTL facility.

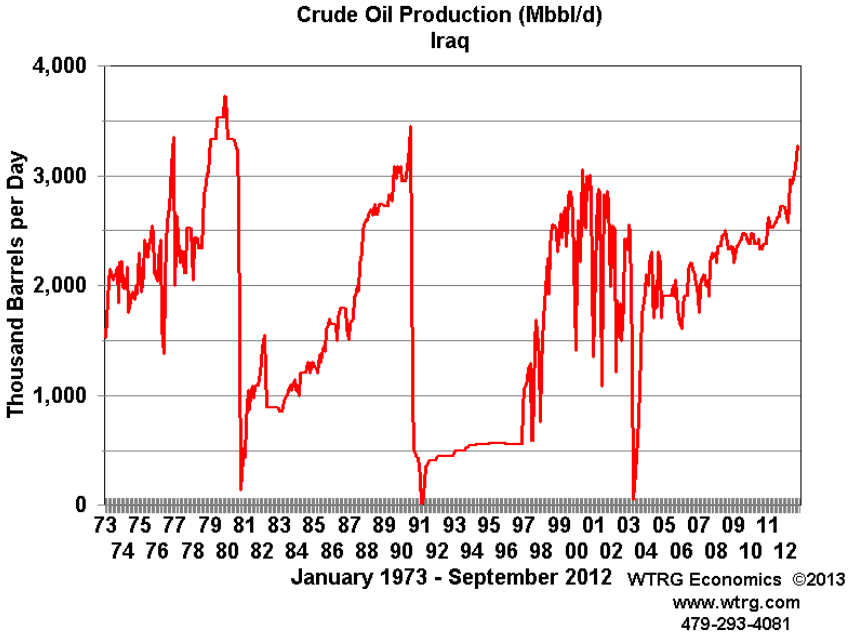
Appendix

Major Supply Interruptions

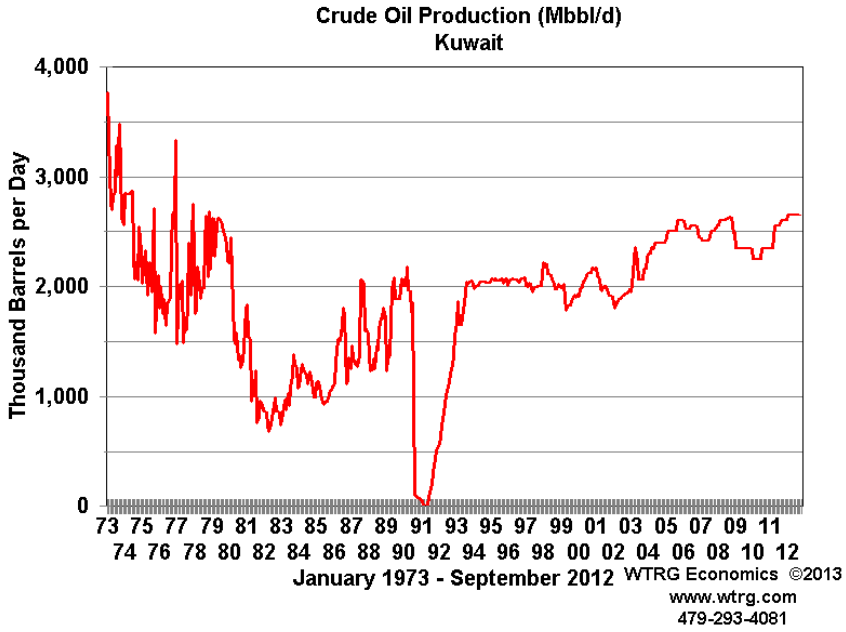
Iranian Revolution and Iraq-Iran War



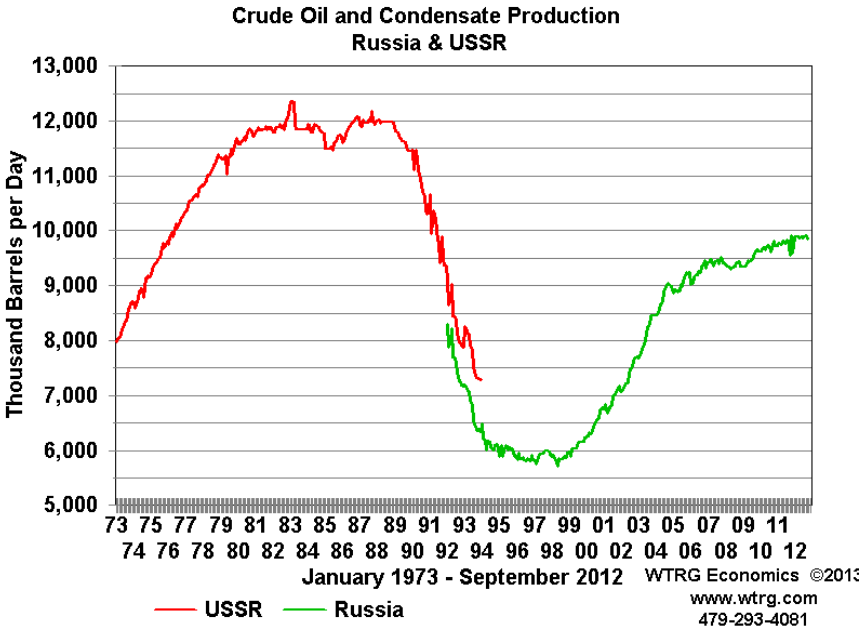
Iraq-Iran War, Gulf War, Iraq War



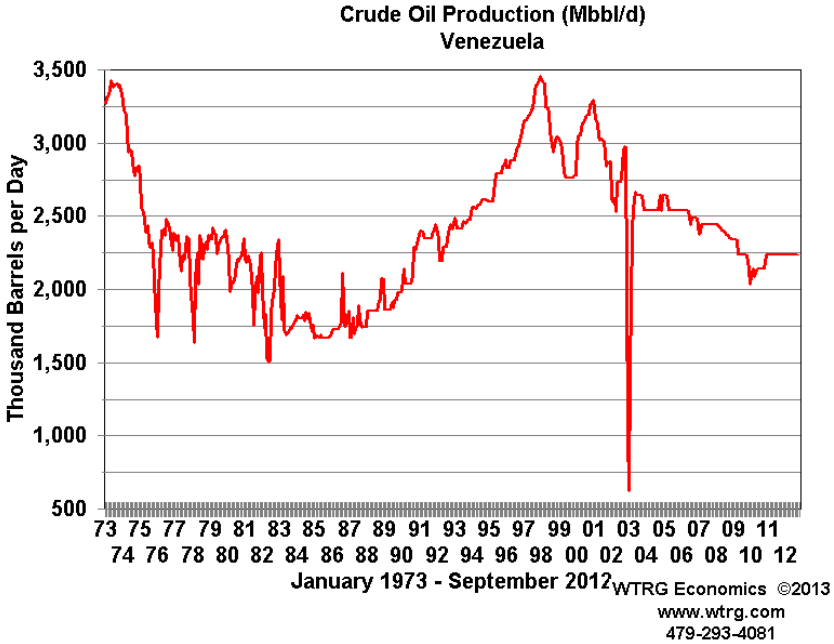
Iraq Invasion of Kuwait-Gulf War



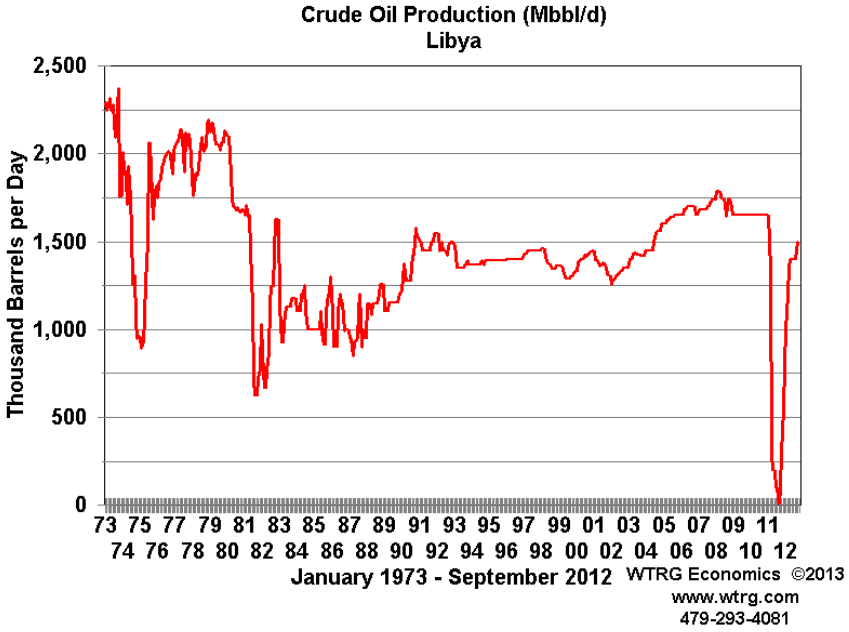
Collapse of Soviet Union



PDVSA Strike



Libyan Revolution



Nigeria – Military Coups, Recurring Internal Strife