PPHB
ENERGY INVESTMENT BANKING

MUSINGS FROM THE OIL PATCH

April 24, 2012

Allen Brooks
Managing Director

Note*: Musings from the Oil Patch reflects an eclectic collection of stories and analyses dealing with issues and developments within the energy industry that I feel have potentially significant implications for executives operating and planning for the future. The newsletter is published every two weeks, but periodically events and travel may alter that schedule. As always, I welcome your comments and observations.* Allen Brooks

Do Abundant Resources Equate To Energy Independence?

The overriding question is: Are we drawing correct conclusions about this newly found abundance of oil and gas resources?

If there is one belief dominating the discussion about energy in the United States right now it is that the natural gas glut and the surge in petroleum production have America on course to become energy independent. People then shift into a discussion about how impactful our changed role in global oil and gas markets will be in reshaping how they evolve in the future. The overriding question is: Are we drawing correct conclusions about this newly found abundance of oil and gas resources? Is the abundance as great as suggested by recent production trends and assessments of our potential natural resource base and our supposed ability to extract it in a profitable manner? If we suddenly have an abundance of a fuel resource, should that drive our thinking about how to develop our entire future energy supply mix to the exclusion of other, apparently less abundant or maybe just currently less profitable fuels?

But do we really have 200 years of supply?

Last week, the Federal Energy Regulatory Commission (FERC) that regulates natural gas pipelines approved the application of Cheniere Energy (LNG-NYSE) to build a facility to liquefy natural gas (LNG) for export to global markets. That approval will enable Cheniere to secure project financing to construct the facility after the company has worked diligently to secure off-take contracts for 2.1 billion cubic feet (Bcf) per day of gas to be shipped to customers in Europe and Asia. There are an additional four applications for LNG export facilities to be constructed in the United States, but exactly how many may be approved is a question mark. If we truly have not just 100 years, but rather 200 years of natural gas supply in the United States as Steve Farris, CEO of Apache (APA-NYSE) suggested at the recent CERA conference, then agreeing to export this resource may be appropriate from an economic perspective. But do we really have 200 years of supply? Moreover, do we have 200 years of supply at an economical cost?

On the crude oil front, the roaring success of the development of oil shale plays in the Bakken basin of North Dakota and Montana, the Niobrara formation in Colorado and the Eagle Ford region of South Texas has people justifiably excited. But is it appropriate to be extending the recent monthly gains in U.S. oil production due to these new fields into a long-term national growth trend?

Our purpose in posing these questions is not to challenge the success the domestic oil and gas industry has had in developing new, large quantities of crude oil and natural gas. Rather, our questions are designed to force a more serious examination of the sustainability of these recent production trends. Remember, the success of the Barnett gas shale trend in North Texas was initiated out of desperation by Mitchell Energy to tap new gas supplies needed to meet long-term supply contracts the company had entered into several years earlier. That success was assisted by $8 and $10 per thousand cubic foot (Mcf) gas prices, well above prices that existed when George Mitchell and his team first tackled the challenges of drilling and producing natural gas from this shale formation in the 1990s. While the industry has made giant strides in improving the horizontal drilling and hydraulic fracturing techniques necessary to tap these and other gas shale resources in America, they remain a costly undertaking and whether producers can make a reasonable return on their investment in an era of $2/Mcf gas prices remains to be seen.

Remember, the success of the Barnett gas shale trend in North Texas was initiated out of desperation by Mitchell Energy to tap new gas supplies needed to meet long-term supply contracts the company had entered into several years earlier

What we do know is that dry gas shale fields are being abandoned by producers in favor of liquids-rich and oil shale exploration areas due to the dismal economics from low gas prices. These new plays are helped by crude oil prices in the $100 per barrel range, but are those prices sustainable in a world of slowing economic growth and potentially less dangerous geopolitical conditions?

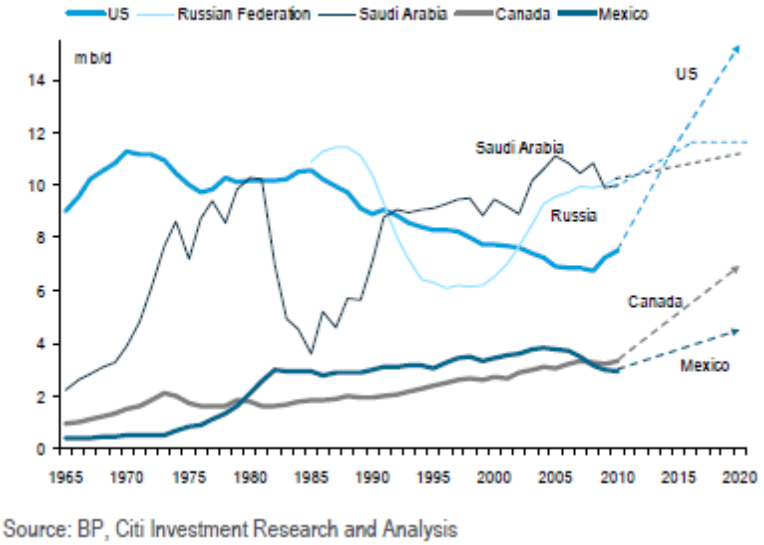
In recent weeks there have been two major reports by investment banking firms suggesting that the United States and/or North America has entered a new era. One report calls North America potentially the new Middle East, with the prospect that over the next decade this continent's oil production may more than double. The other report suggests that United States crude oil production will grow so rapidly over the next few years that the domestic E&P industry needs to utilize 250 fewer rigs in 2013 than forecasted to work during 2012, or roughly a 10% cutback in activity year over year. Both of these calls may prove prescient, but they may also prove to have been founded on assumptions that fail to materialize. If the assumptions prove incorrect, then the forecasts will be wide of the mark.

Both of these calls may prove prescient, but they may also prove to have been founded on assumptions that fail to materialize

In a recent report, Citibank's Global Commodity Group suggests that the U.S. could exceed the crude oil production of the world's two largest producing countries – Russia and Saudi Arabia – in a matter of a few years. Moreover, these analysts foresee an equally

impressive increase in oil production from Canada and Mexico; in the one case continuing Canada's recent output upturn, while in the case of Mexico reversing a serious five-year decline that has impacted the country's output.

Exhibit 1. A Future Based On Energy Abundance



Source: Citi Investment Research

Might Saudi Arabia be producing more oil into an environment marked by falling oil prices raising questions about the economic wisdom of that decision

It is instructive to see that Citi's analysts are projecting an increase in Saudi Arabia's production to a level the Kingdom has never before reached. While this production level would approach the theoretical threshold the Kingdom claims it is capable of producing, one has to question why it would do so unless it was to meet growing internal consumption needs. If the three North American countries are able to produce as much oil as projected, and with Citi's analysts' view there is a structural decline underway in oil demand in the U.S. and likely other developed economies, might Saudi Arabia be producing more oil into an environment marked by falling oil prices raising questions about the economic wisdom of that decision.

How will U.S. production grow? According to Citi's analysis, it can identify the increases in liquids production between 2011 and 2020 with the bulk of the gain coming from deepwater in the Gulf of Mexico and from shale oil resources onshore. By the end of the forecast, it is possible that shale oil in Alaska will be produced and that new exploration areas – possibly offshore - will result in increased traditional oil output.

Exhibit 2. Sources Of New Oil Production

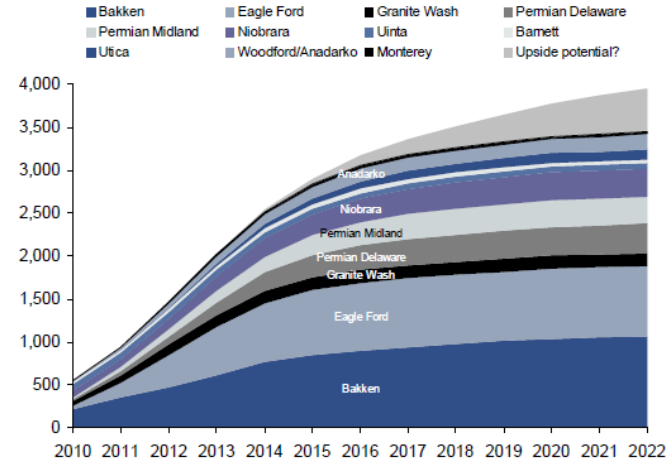
m b/d	2011A	2015E	2020E
Deepwater	1.3	2.0	3.8
Shale oil	0.7	2.1	3.0
Alaska	0.6	0.7	1.1
Other conventional/heavy	3.2	2.7	2.3
Oil	5.8	7.5	10.2
NGLs	2.3	3.0	3.8
Total petroleum	8.1	10.5	14.1
Biofuels	0.9	1.1	1.5
(Mandated)	*0.9*	*1.3*	*2.0*
Total liquids	**9.0**	**11.6**	**15.6**

Source: Citi Investment Research

Citi's analysts expect significant growth in both crude oil and natural gas liquids (NGLs)

It is clear from the table in Exhibit 2 that Citi's analysts expect significant growth in both crude oil and natural gas liquids (NGLs) production between 2011 and 2020. In the case of oil shales, the Citi analysts believe the U.S. could see an additional 2 million barrels per day (mmb/d) from these formations that they have identified by basin in the chart in Exhibit 3.

Exhibit 3. 3.5 MMB/D Of New Oil Supply Sources



Source: Citi Investment Research and Analysis

Source: Citi Investment Research

Just as many of the early assumptions about how gas shale formations would be produced proved inaccurate, the assumptions that underlie these projections could also be wrong

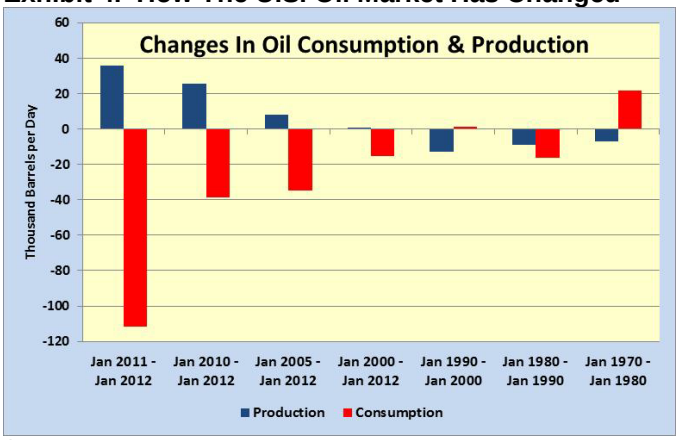
The projection of these totals is based on the expected estimated ultimate recovery (EUR) from wells drilled in these formations. But many of these formations are still in their early stages of development, and just as many of the early assumptions about how gas shale formations would be produced proved inaccurate, the assumptions that underlie these projections could also be wrong. Admittedly, forecasters projecting such a dramatic change in the

outlook for U.S. crude oil production are in uncharted waters. We thought it would be interesting to examine how significant and dynamic the recent growth in oil output has been since U.S. domestic production peaked at the beginning of the 1970s.

The growth in average monthly production has increased reflecting the faster production growth rate in recent months

Exhibit 4 shows the annual average change in crude oil production and petroleum product supplied in various time periods. If the chart is read from left to right, we go from measuring the average annual production increase against the decline in consumption for the last year. (The EIA web site only had monthly data through January 2012 when we accessed it, but the point can still be made.) The next set of columns shows the annual average change in production and consumption over the past two years. We then move to the last six years and the period from the turn of the century until now. What this set of columns demonstrates is how recent the upturn in U.S. average monthly production has been; and how significantly the production has increased. If one tracks the three sets of columns going from right to left, the growth in average monthly production has increased reflecting the faster production growth rate in recent months. This same set of columns shows just how demand has been fallen during the same time periods. These contrasting trends go a long way to explaining why U.S. oil imports have been declining.

Exhibit 4. How The U.S. Oil Market Has Changed



Source: EIA, PPHB

The rate of monthly decline was accelerating from the 1970s through the 1990s, but reversed in the most recent period

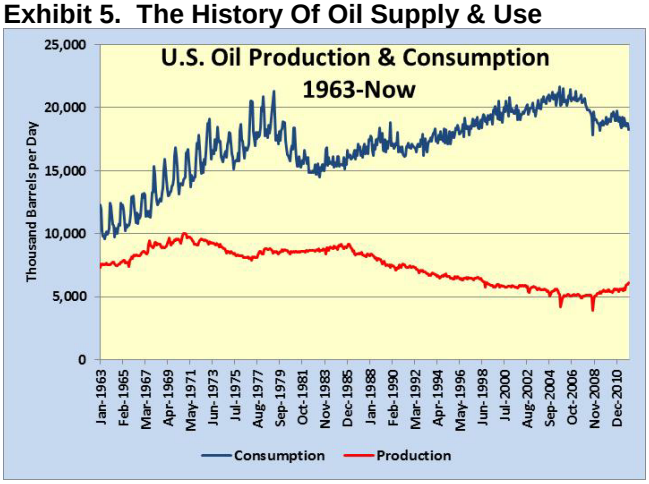
The remaining three sets of columns located on the right side of the chart show the average annual decline in production and rise in consumption during the 1970s, 1980s and 1990s. As can be seen when examining the four sets of columns, from right to left, the change in average monthly oil production has experienced a dramatic reversal in the most recent decade compared to the established trends of the prior three decades. The blue bars representing changes in production in these four column sets, shows how the rate of monthly decline was accelerating from the 1970s through the 1990s, but reversed in the most recent period when oil

production rose. On the other hand, if one follows the trend of the red columns – average monthly change in petroleum consumption – the good times of the 1970s were followed by the recessionary era of the 1980s and then the good times of the 1990s and the recessionary years of the 2000s.

By the mid-1980s, oil consumption was growing again, but it took a full decade before oil use reached the pre-1981 recession demand level

To place into perspective the challenge for forecasters and the risk to their projections, if we look at the history of monthly oil production and petroleum consumption since 1963, we see clearly the long-term trends that have dominated the domestic oil business and our energy policy. From 1963 to 1979, oil consumption grew rapidly. It then began a steep decline due to the recession of 1980-81 and the subsequent 1983 recession due to the impact of high oil prices on domestic consumption. By the mid-1980s, oil consumption was growing again, but it took a full decade before oil use reached the pre-1981 recession demand level. Consumption continued to grow in the 1990s following a brief dip for the 1990 recession and again in 2000. Consumption peaked immediately before the onslaught of the financial crisis in 2007 and fell precipitously during 2008. After recovering in 2009, petroleum consumption rose slightly in 2010 before beginning the slide that is marking the current demand pattern.

Exhibit 5. The History Of Oil Supply & Use



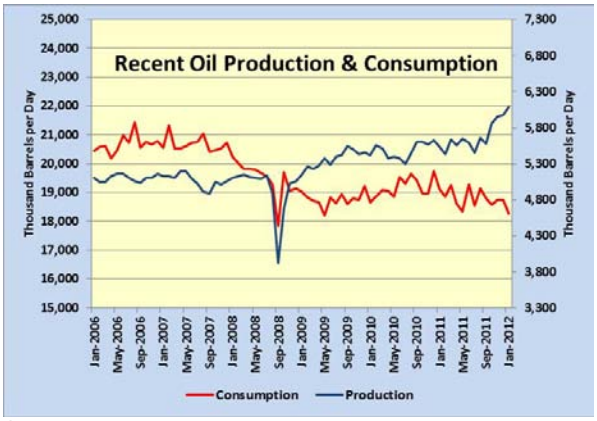
Source: EIA, PPHB

Production rose slowly until the mid-1980s when the collapse in global oil prices undercut oil company cash flows and drilling and production activity was reduced drastically

On the production side of the ledger, it is clear that domestic output peaked in 1971 and then began to decline until bolstered by higher prices following the early 1970s oil embargo and OPEC's seizure of control over world oil markets. Production rose slowly until the mid-1980s when the collapse in global oil prices undercut oil company cash flows and drilling and production activity was reduced drastically. From that point forward, oil production in the United States began a slow, steady slide downward. The slide ended in 2009 when oil prices bounced back following the financial crisis and resulting global recession. From that point forward we have seen steady gains in oil production due to the oil shale revolution. Notice,

however, how small the upturn has been and how short the length of the upturn in this nearly 50-year history.

Exhibit 6. Oil Production Is On The Rise

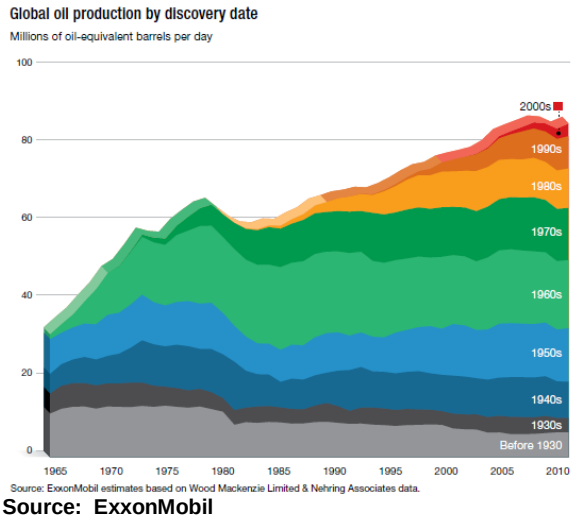


Source: EIA, PPHB

Do the results of this past year constitute a new sustainable trend for production growth, or does it merely reflect a surge that will settle back?

For a more recent perspective, we have produced the chart in Exhibit 6 showing oil consumption and production since 2006. What becomes clearer is the steady slide in oil consumption and the flat oil production experienced from 2006 until the 2008 economic collapse. We then see a slow, steady increase in production with a spike up beginning last spring. This spike reflects the huge increase in activity in the Bakken formation and the explosion in activity in the Eagle Ford formation. Other oil production successes in the Niobrara and the Permian have added to U.S. oil growth. Do the results of this past year constitute a new sustainable trend for production growth, or does it merely reflect a surge that will settle back, or maybe we will be reaching a peak level of production in the near future?

Exhibit 7. World Relies On Aging Production



Source: ExxonMobil

Global, as well as U.S. oil production is being sustained by many old fields

Having been in the forecasting business, we are loath to cast stones on the forecasts of others. That said, however, we want to point out that euphoria and a desire to stand out from the pack (i.e., conventional wisdom) can produce projections that rely on assumptions that are less than robust. It may be a little early to assume that these new shale formations, along with the deepwater-fields of the Gulf of Mexico, will produce at rates similar to the most recent successes and on the development timetables set forth in these analyses. In Exxon Mobil's (XOM-NYSE) annual energy outlook to 2040, the company presents a chart of the history of crude oil production and the vintage of the fields from which the production is derived. Global, as well as U.S. oil production is being sustained by many old fields. Fighting the production decline rates from these old fields, which tends to increase with age, will consume a meaningful amount of new oil output that may limit the contribution from these new exploration and development projects. We will monitor the performance of these basins and fields against the optimistic forecasts currently being made.

Do People Believe Climate Change Or Is It A Media Creation?

We were intrigued by an article in *The New York Times* last week reporting on a survey conducted for Yale University and George Mason University on the link between global warming and extreme weather events. The survey results were published in a report titled "Extreme Weather, Climate & Preparedness in the American Mind" published by the Yale Project on Climate Change Communication.

The first part of the statement is accurate – scientists are hesitant about linking weather extremes with global warming because they haven't been able to establish any

The newspaper story opened with the following statement: "Scientists may hesitate to link some of the weather extremes of recent years to global warming – but the public, it seems, is already there." The statement is quite telling about the motivation of the reporter and possibly the Yale Project. The first part of the statement is accurate – scientists are hesitant about linking weather extremes with global warming because they haven't been able to establish any. Given that fact, the second half of the statement reflects the effort by climate change promoters to mislead the public's understanding of weather and climate change by playing off the often over-the-top media coverage of weather events.

As we covered in a recent *Musings*, the rash of tornadoes in North Texas that did extensive damage in the Dallas-Ft. Worth Metroplex prompted a former Weather Channel meteorologist and a CNN weather anchorman at the time to comment on the storms being directly related to climate change and global warming. Those statements were in direct conflict with the recent 592-page report, "Special Report on Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation," issued by the United Nations' Intergovernmental Panel on Climate Change (IPCC) last month. In the *Musings*, we quoted the main conclusions, which

reflected only medium confidence in projections about weather events.

The IPCC press release announcing publication of its study cited three examples of where "the report also provides improved differentiation of observed and projected changes in extremes of temperatures, precipitation and drought across the continents of the globe." These examples were:

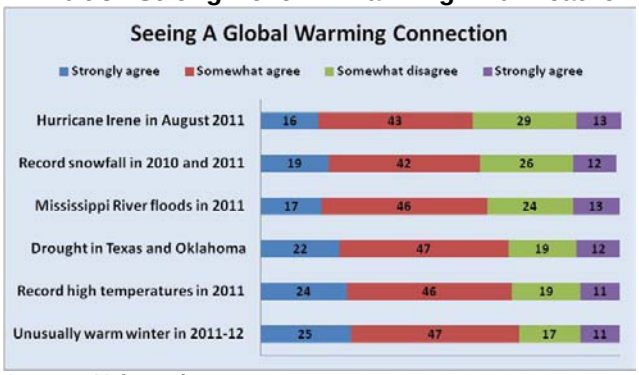
- "While there is high confidence that heat waves have become more severe in southern Europe and the Mediterranean, the scientists have reported less confidence in changes observed in central and northern Europe.
- "Similarly for projected changes in heavy precipitation in Africa, the scientists have assessed with high confidence that heavy precipitation will increase in East Asia, but report low confidence in projected changes in southern Africa and the Sahara.
- "The assessment of projected changes in dryness across South America indicates medium confidence that dryness will increase in northeast Brazil, while confidence is low in all other regions of South America."

A majority of them agreed that global warming made recent weather events worse

It struck us that *The New York Times* article wasn't breaking any new ground but rather was sensationalizing the media's impact on the lack of scientific understanding about weather events among the general population. There was a chart of responses from the Yale/George Mason survey that accompanied the article. We have recreated the principal point of that graphic in Exhibit 8 (Page 10). The people surveyed responded to a series of questions about climate change and extreme weather events and their responses showed a majority of them agreed that global warming made recent weather events worse. As shown in the exhibit, the survey picked recent weather events that received extensive media coverage and asked whether those surveyed either experienced these events, knew a relative that suffered from them and whether they believed that these events were made worse by global warming.

To better understand the methodology employed by the Yale Project, we went through the complete study. The New York Times writer made a point of praising the efforts of Knowledge Networks, who conducted the online poll, to overcome the problem of many online polls as "not being representative of the broad public." The poll was conducted of 1,008 American adults by computer in the last half of March. According to the writer's interpretation of the data and his interview with one of the study's researchers, when people were

Exhibit 8. Strong Belief In Warming And Weather



Source: Yale Project, PPHB

asked whether they attributed specific events to global warming, recent heat waves were most often cited. According to the writer, scientists claim their statistical evidence support increases in heat waves. It is interesting that the IPCC report cites specific examples of where the scientists have more confidence of heat waves occurring while in the same region they have considerably less confidence in forecasting heat waves.

The latest storm statistics did not support the idea that a reversal of the declining trend since the 1970s in the number of tornadoes has occurred

We covered the Dallas-Ft. Worth tornadoes and showed that the latest storm statistics did not support the idea that a reversal of the declining trend since the 1970s in the number of tornadoes has occurred. Likewise, we showed that the data demonstrates there have been tornadoes in that area in every month of the year throughout history, so a claim by some global warming proponents that these tornadoes developed earlier than usual was not factual. Lastly, we pointed out that the media was intent on highlighting the damage caused by the tornadoes through the use of pictures of damaged buildings and repetitious showing of a video of tractor-trailers being tossed hundreds of feet into the air. Besides these visual images, the media repeated that 600 buildings had been destroyed, when the reality was that this number represented the total number of damaged units – whether they had only a couple of roof tiles blown off or the building was totally destroyed.

If "extreme" is never defined, then the magnitude of the event becomes highly judgmental

A major problem with the Yale Project survey was that the terminology used was never defined. People surveyed were asked to comment on events with no reference to commonality among the respondents. Other than tornadoes, floods, hurricanes, wildfires and drought, the other events those surveyed were asked to comment on – high winds, rainstorms, heat waves, cold temperatures and snowstorms – were labeled "extreme." If "extreme" is never defined, then the magnitude of the event becomes highly judgmental.

One weather event we personally experienced last year was Hurricane Irene that swept up the East Coast at the beginning of September causing extensive damage and taking a handful of lives.

While Hurricane Irene was an expensive storm due to property damage, we have personally witnessed equally as devastating storms in the same region

The storm roared into New England and created most of its damage due to the volume of water dumped on New Hampshire. We were saddened by the flooding damage. It made us recall the destruction in 1955 of downtown Torrington, located in the Naugatuck Valley of Connecticut, caused by Hurricanes Connie and Diane. So while Hurricane Irene was an expensive storm due to property damage, we have personally witnessed equally devastating storms in the same region. Those storms 55 years ago were not as costly as Hurricane Irene due to inflation and population growth in the region.

These outages were due to the absence of hurricanes in recent years, which function as Nature's way of trimming trees of dead and weak limbs

Besides the flooding caused by Hurricane Irene, there were major swaths of Southern New England that suffered extended power outages. To a large degree these outages were due to the absence of hurricanes in recent years, which function as Nature's way of trimming trees of dead and weak limbs. The length of these power outages was a function of both the magnitude of the tree limb problems and the amount of underestimation of the extent of possible damage by the electric utility companies. Maybe these utilities need more frequent storms in order to improve their emergency response programs.

He argued that incredibly active hurricane years such as 2005 would become the norm in the future

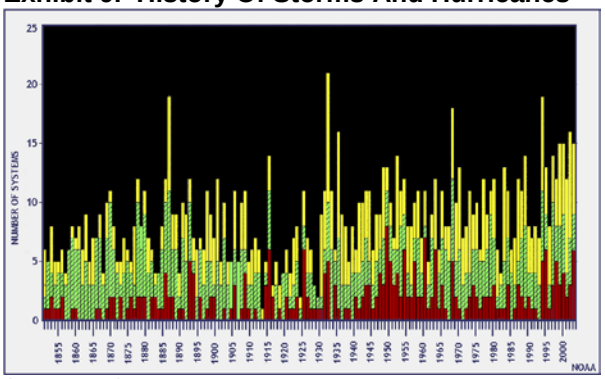
The response of those surveyed for the Yale Project with respect to the linkage of global warming to Hurricane Irene brought back memories of the horror scenarios put forth by climate experts following the uptick in the number of major hurricanes in 2004 and 2005 that made landfall in the United States. Merely three weeks before Hurricane Katrina blasted New Orleans and Mississippi, Massachusetts Institute of Technology (MIT) climate scientist and hurricane expert, Kerry Emanuel, published a paper in *Nature* magazine that concluded that a key measurement of the power dissipated by a storm during its lifetime had risen dramatically since the mid-1970s. As a result, he argued that incredibly active hurricane years such as 2005 would become the norm in the future.

Based on the records associated with hurricanes and their formation, the North Atlantic Basin has been in an active period for the climatic forces creating them since 1995

Based on the records associated with hurricanes and their formation, the North Atlantic Basin has been in an active phase for the climatic forces creating them since 1995. This is consistent with their cyclical pattern. The chart in Exhibit 9 shows the number of tropical storms in yellow, hurricanes in green hatch and major hurricanes in red for the North Atlantic Basin from 1886 to 2004. While the period since 2000 showed a large number of storms each year, there were past periods when more storms were counted and certainly there were periods when the number of hurricanes exceeded those of the modern period. Despite this history, Dr. Emanuel's thesis became immediately accepted as the norm.

When the storm count is shown only since 1970, it makes 1995-2005 look much worse. What Dr. Ryan Maue of Florida State University observed was that since 2007, global tropical cyclone activity has decreased dramatically and has continued at near-historical low levels. Indeed, only 64 tropical cyclones were

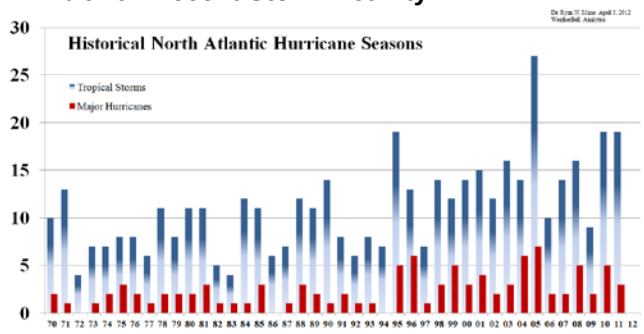
Exhibit 9. History Of Storms And Hurricanes



Source: NOAA

observed globally in the 12-months from June 2010-May 2011, nearly 23-storms below average and obliterating the previous record low set in 1977. Dr. Maue pointed out that the 2007 and 2008 hurricane seasons had the least tropical activity in the Northern Hemisphere in 30 years.

Exhibit 10. Recent Storm Activity



Source: Dr. Maue

Dr. Emanuel's revised model suggests global warming may be a factor, but not the primary or even the most important factor in predicting hurricane activity

In 2008, Dr. Emanuel developed a new forecasting model in response to the failure of his earlier model to accurately predict the level of storm and hurricane activity. His new model attempts to drop "seeds" of tropical storms via computer code into climate models in order to see how or if the storms develop and what then happens to the weather. The result of this new forecasting tool that Dr. Emanuel used to predict storm activity two centuries into the future is his forecast of an overall decline in the global number of hurricanes but a heightening of intensity in some geographic regions. In the case of the North Atlantic Basin, two of his models show a decline in intensity of hurricanes while the other five models showed an increase. Other storm experts suggest that this new model is an improvement, but its results reflect the lack of real understanding of the workings of all the forces that create tropical storms and strengthen them into hurricanes. Dr. Emanuel's revised model suggests global warming may be a factor, but not the primary or even the most important factor in predicting hurricane activity.

Weathermen have been a target of climate change proponents because they have not fallen in line supporting the linkage of global warming and extreme weather

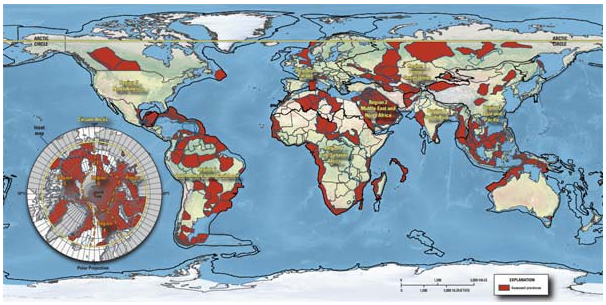
We found the final section of the Yale Project survey interesting as it focused on people's preparation, which tends to be nearly non-existent and explains the mad rush by citizens to the stores when hurricane warnings are posted. This section also focused on weather information sources. Weathermen have been a target of climate change proponents because they have not fallen in line supporting the linkage of global warming and extreme weather. Those polled were asked how often they had heard weather forecasters talking about global warming in the past 12 months. But the telling question was how many of these respondents (58%) wanted to hear from their favorite TV weathercaster about global warming. Based on these survey results and the slanted reporting of *The New York Times*, the rhetoric linking global warming to extreme weather events will continue despite what the facts are.

More Gas And Fewer Oil Resources Match Pricing Trends

This increase in the number of areas assessed is partially the explanation for the growth in natural gas resources

While the United States Geological Survey (USGS) world petroleum assessment report for 2012 shows that outside of the United States there is 20% more natural gas than estimated in 2000, the report also shows that there is 13% less crude oil. The report, Oil and Gas Resources of the World, 2012, assessed 171 geological provinces worldwide, up from 128 assessed in 2000. This increase in the number of areas assessed is partially the explanation for the growth in natural gas resources. The natural gas supply was helped by the inclusion of two new areas – the Arctic region offshore North America and East Africa – where the bulk of the resources are natural gas.

Exhibit 11. More Basins In 2012 Assessment



Source: USGS

According to the USGS, there are 5,606 trillion cubic feet (Tcf) of natural gas technically recoverable conventional natural gas that has yet to be discovered in the world excluding the United States. This estimate compares with the 4,669 Tcf of natural gas estimated in 2000. As for crude oil, the estimate is 565 billion barrels (Bbls) of conventional oil technically recoverable. That estimate is down from the 649 Bbls estimated in 2000. The USGS also says there are 167 Bbls of natural gas liquids (NGLs) still to be discovered compared to 207 Bbls estimated in the prior survey.

Of the yet-to-be-discovered crude oil resources, 75% are in four geographic regions – the Arctic region of North America (61 Bbls), South America and the Caribbean (126 Bbls), sub-Saharan Africa (115 Bbls) and the Middle East and North Africa (111 Bbls). Nearly half of the South American and Caribbean oil resources are located offshore Brazil. Coupled with the 27 Bbls of oil and 388 Tcf of natural gas onshore in the United States and in State waters along with the 81 Bbls of oil and 398 Tcf of natural gas resources on the Outer Continental Shelf, the Arctic and South American resources make the Western Hemisphere an attractive focus for the search for additional oil and gas.

Northeast Gasoline Market At Risk With Refinery Closures

This regional drama portends higher and more volatile petroleum prices ahead for the populous and prosperous residents of the Eastern seaboard states, especially those in the mid-Atlantic and New England regions

A drama has been playing out in the eastern portion of the United States at a time when the nation has been primarily focused on the dramatic rise in national gasoline prices and the political hunt for oil speculators. This regional drama portends higher and more volatile petroleum prices ahead for the populous and prosperous residents of the Eastern seaboard states, especially those in the mid-Atlantic and New England regions. The drama arose from decisions by ConocoPhillips (COP-NYSE) and Sunoco Inc. (SUN-NYSE) to close and/or sell their refineries located in the Philadelphia, Pennsylvania area. Those two companies own three refineries in the region, two of which were shut down last fall. The three refineries accounted for roughly 40% of the U.S. East Coast refining capacity as of last summer. The single refinery still operating is Sunoco's Philadelphia plant with 335,000 barrels of capacity per day, representing roughly 24% of the region's 2011 total capacity. The industry also had previously shut down two small refineries in Virginia and New Jersey during 2010 so capacity was already tight.

Exhibit 12. Refining Capacity Status In PADD 1

Owner	City	State	Operating Crude Unit Capacity (bbl/calendar day)	Percent of Region	Status
Operating and Idled Refineries					
ConocoPhillips	Linden	NJ	238,000	17%	Operating
PBF Energy Co. LLC	Delaware City	DE	182,200	13%	Operating
PBF Energy Co. LLC	Paulsboro	NJ	160,000	12%	Operating
United Refining Co.	Warren	PA	65,000	5%	Operating
American Refining	Bradford	PA	10,000	1%	Operating
Ergon-West Virginia	Newell/Congo	WV	20,000	1%	Operating
Hess Corp.	Port Reading	NJ	0*	0%	Operating
Sunoco Inc.	Philadelphia	PA	335,000	24%	Operating, For Sale
Sunoco Inc.	Marcus Hook	PA	178,000	13%	Idled 12/2011, For Sale
ConocoPhillips	Trainer	PA	185,000	13%	Idled 9/2011, For Sale
Total Operating and Idled			1,373,200	100%	
Recently Shut Refineries					
Western Refining	Yorktown	VA	66,300		Shut 9/2010
Sunoco Inc.	Eagle Pt/Westville	NJ	145,000		Shut 2/2010

*Hess Port Reading has a production capacity of 70,000 bbl/calendar day but no crude unit capacity.

Notes: Yellow shading indicates operating refineries for sale and at risk of shutdown. Orange shading indicates idled refineries for sale and at risk of shutdown. Red shading indicates shut refineries. Total refinery capacity excludes two refineries that primarily produce asphalt, as well as the Yorktown VA and Eagle Point refineries that were shut down in 2010.

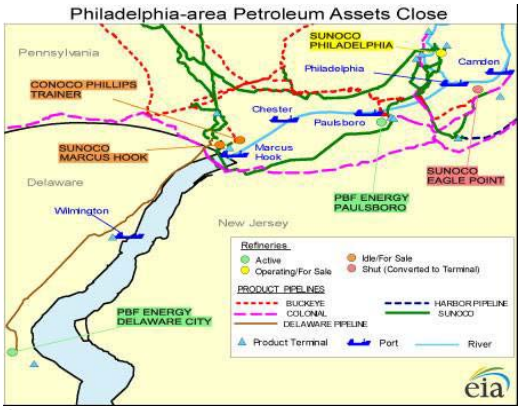
Source: U.S. Energy Information Administration.

Source: EIA

The Northeast refineries have supplied about 40% of the gasoline, 60% of the ultra-low sulfur diesel (ULSD) and 45% of the home heating oil consumed in the region in recent years with the balance

of supply coming from the Gulf Coast. The Energy Information Administration (EIA) prepared a study of the impact of the closure of these refineries on the supply situation for these petroleum products in the region. The EIA has continually updated the study as events have transpired, probably because there is the potential that these refinery shutdowns will impact Washington, D.C., the site of our politicians, government workers and importantly EIA employees.

Exhibit 13. Oil Infrastructure In Mid-Atlantic



Source: EIA

The Jones Act transportation restrictions involved in moving additional domestic oil and/or refined petroleum product from the Gulf Coast to the Northeast by sea will complicate and add costs to the supply effort

The refinery shutdowns are highlighting various challenges the energy industry confronts and will continue to have to deal with as it faces shrinking oil processing capacity in the region. The first challenge is how to deal with the shifting product mix that will occur as the various states in the Northeast implement their mandated shifts to ULSD for heating oil use. This will add meaningful demand to a market that is already supply-challenged. The issue is further compounded by the seasonal nature of heating oil demand, which exaggerates the level of demand and as a result will strain the petroleum storage and distribution system throughout the region. A second challenge will be how to get additional supply either from domestic or international sources into the region. The Jones Act transportation restrictions involved in moving additional domestic oil and/or refined petroleum product from the Gulf Coast to the Northeast by sea will complicate and add costs to the supply effort. Importing more international oil will create transportation challenges and add more expensive foreign oil to the supply mix boosting consumer prices.

In order to manage limited refined petroleum supplies during World War II, the federal government grouped states together and created the Petroleum Administration for Defense Districts (PADD) for ease of regulation and control. All the states along the Atlantic Seaboard, with the addition of Pennsylvania and West Virginia, were grouped into PADD 1. In turn, that region was subdivided into three geographic regions – New England, Central Atlantic and Lower Atlantic. Each of these sub-regions have their own unique supply

As of July 2011, the estimated population of the states comprising PADD 1 is 116.1 million, which represents over 37% of America's total residents

and demand dynamics. As of July 2011, the estimated population of the states comprising PADD 1 is 116.1 million, which represents over 37% of America's total residents. The refining capacity in PADD 1 is 1.4 million barrels per day, which includes the two refineries that have already been shut, but falls short of meeting the region's consumption. The closed refineries had a total capacity of 363,000 barrels per day, or about 26% of the region's total capacity.

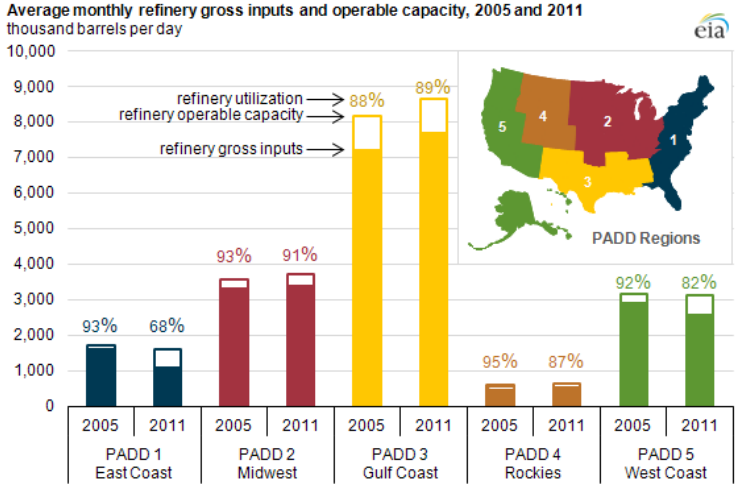
Exhibit 14. PADD System Regulates Oil Industry

Source: EIA

PADD 1 is the only region in the country that has lost refinery capacity over the six-year span 2005 to 2011

The EIA publishes data on the operating capacity of refineries by PADD, their gross inputs and their utilization. As shown in Exhibit 15, PADD 1 is the only region in the country that has lost refinery capacity over the six-year span 2005 to 2011. Last year, PADD 1 had the lowest utilization of any region in the country and had experienced the largest utilization decline during the six-years. These statistics demonstrate that the Northeast refineries are experiencing challenging economics despite being situated in the midst of over a third of the nation's population.

Exhibit 15. Refining Performance By PADD



Source: EIA

Most people are focused on the impact the possible shutdowns of these refineries will have on the supply and price of gasoline. To understand the outlook for this fuel, we turn to the historical data for gasoline supply and demand in the region and the forecast the EIA has prepared. The forecast is derived from the short-term outlook report prepared quarterly by the EIA.

Exhibit 16. Gasoline Outlook For PADD 1

(Thousand bbl/d)
(Rounded to closest 10,000 bbl/d)

	2007	2008	2009	2010	2011*	2012 Outlook	2013 Outlook
Consumption	**1,660**	**1,630**	**1,620**	**1,610**	**1,540**	**1,540**	**1,540**
Supply	**1,660**	**1,630**	**1,620**	**1,610**	**1,540**	**1,380**	**1,300**
In-Region Production (+)	750	710	640	560	580	420	350
Ethanol Inputs (+)	100	120	140	150	150	150	150
Net Receipts from Other Regions (+)	120	120	200	270	270	250	250
Imports (+)	720	700	630	610	560	560	550
Exports (-)	20	20	–	–	–	–	–
Stock Decrease (+) / Increase (-)	–	-10	–	10	–	–	–
Surplus (+) / Gap (-)	–	–	–	–	–	**-160**	**-240**

*Data through November 2011.

Notes: Projected consumption is based on data from EIA's *Short-Term Energy Outlook*. Projected production is based on assumed yields and the capacity of remaining refineries. Sunoco Philadelphia is assumed to close in July 2012. Projected imports are 3-year historical averages adjusted down by U.S. Virgin Islands contributions. Historical net receipts are estimated. Projected net receipts are 3-year historical averages. The Surplus/Gap indicates the under- or over-supply needed to meet consumption.

Source: U.S. Energy Information Administration.

Source: EIA

The closure of the refineries will result in a deficit of gasoline supply for 2012 and an even larger deficit in 2013

The closure of the refineries will result in a deficit of gasoline supply for 2012 and an even larger deficit in 2013. The challenge will be how the industry can eliminate this shortfall. Getting more supply into the region is the primary goal, but if additional supply is not available, or cannot be secured in a timely manner, the gap between supply and consumption will be closed through sharply higher retail gasoline prices. In order to assess the capability of the current regional petroleum distribution system to bring in additional supplies, it helps to understand what resources are available and what hurdles they face. Exhibit 17 shows a graphic from the EIA's website that locates the ports, pipelines, product terminals, refineries and ethanol facilities located east of the Mississippi River, which is a larger area than PADD 1.

Exhibit 17. Eastern U.S. Petroleum Infrastructure

Source: EIA

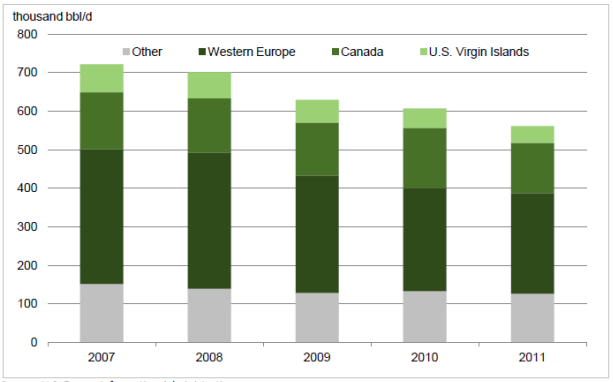
The question is whether, given the sharply reduced refinery output due to the planned closure of the three local refineries, additional gasoline supplies can be moved from other areas of the country, notably the Gulf Coast, to offset the output cut

The EIA's PADD 1 gasoline supply and demand forecast calls for consumption to decline by about 120,000 barrels per day (b/d) while refinery output is projected to decline by 170,000 b/d. The shortage has been offset by increased movement of supplies into the region from other areas of the country. The question is whether, given the sharply reduced refinery output due to the planned closure of the three local refineries, additional gasoline supplies can be moved from other areas of the country, notably the Gulf Coast, to offset the output cut. Or will the industry need to ramp up imports? As Exhibit 18 shows, gasoline imports into PADD 1 have declined since 2007 with the major reduction being Western European imports. A meaningful amount of imports come from Canada and from refineries in the U.S. Virgin Islands. The complicating factor at the present time is that a major refinery in the Virgin Islands has recently been closed.

The Jones Act mandates that vessels operating in U.S. trade be built in U.S. shipyards, be owned by U.S. companies and be operated by U.S. crews

Securing increased gasoline supplies, along with other petroleum products, from the Gulf Coast will require that these supplies be moved in tankers or barges that meet Jones Act requirements. The Jones Act regulates maritime commerce in U.S. waters and between U.S. ports. The Jones Act mandates that vessels operating in U.S. trade be built in U.S. shipyards, be owned by U.S. companies (they cannot have more than 25% ownership by non-Americans) and be operated by U.S. crews. According to MARAD, there are only 56

Exhibit 18. Gasoline Imports By Source



Source: EIA

Jones Act tankers representing four million deadweight tons available. These tankers and their capacity represent less than 1% of the world's tanker fleet. In response to this situation, the coastal barge industry has stepped up with claims that it can help meet the transportation needs for this region. Of course, vessels that operate under the Jones Act are more expensive, which will boost the cost of petroleum products that move into PADD 1.

These tankers and their capacity represent less than 1% of the world's tanker fleet

In the case of ULSD, demand in the region will be boosted by the mandated use of this fuel for home-heating oil in various states. Beginning this year, New York State is the first of five Northeastern states to require ULSD be used for space heating replacing higher-sulfur distillate fuels. This phase-out of higher-sulfur distillate in favor of ULSD will expand in 2014 to Massachusetts, New Jersey and Vermont and to Maine in 2016. The EIA estimates that this switch will increase ULSD consumption in the Northeast by 20%.

Beginning this year, New York State is the first of five Northeastern states to require ULSD be used for space heating replacing higher-sulfur distillate fuels

Exhibit 19. ULSD Outlook For PADD 1

(Thousand bbl/d)
(Rounded to closest 10,000 bbl/d)

	2007	2008	2009	2010	2011*	2012 Outlook	2013 Outlook
Consumption	340	360	340	360	360	380	430
Supply	340	360	340	360	360	290	250
In-Region Production (+)	250	250	200	210	220	150	110
Net Receipts from Other Regions (+)	–	30	90	70	100	90	90
Imports (+)	90	80	60	70	70	50	50
Exports (-)	–	–	–	–	30	–	–
Stock Decrease (+) / Increase (-)	–	–	-10	10	–	–	–
Surplus (+) / Gap (-)	–	–	–	–	–	-90	-180

*Data through November 2011.

Notes: Projected consumption is based on data from EIA's *Short-Term Energy Outlook*. It includes a switch in consumption from heating oil to ULSD of an additional 70,000 bbl/d beginning in July 2012, based on New York's requirement that heating oil move to ULSD specifications. Projected production is based on assumed yields and the capacity of remaining refineries. Sunoco Philadelphia is assumed to close in July 2012. Projected imports are 3-year historical averages adjusted down by U.S. Virgin Islands contributions. Historical net receipts are estimated. Projected net receipts are 3-year historical averages. The Surplus/Gap indicates the under- or over-supply needed to meet consumption.

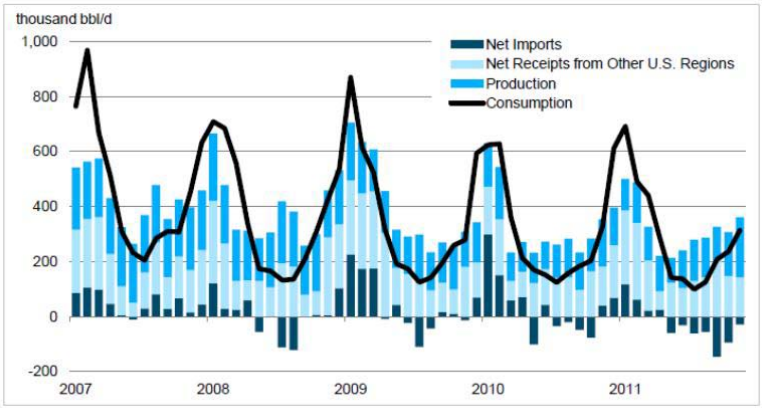
Source: U.S. Energy Information Administration.

Source: EIA

The complicating factor of the switch to ULSD is the seasonal nature of heating oil demand. The peaks and valleys of heating oil demand mean that supply volumes need to be brought in during the low

demand period and stored in order to meet the peaks of winter consumption. This seasonality will tax the existing terminal facilities in the region. The volatility of demand is shown in Exhibit 20.

Exhibit 20. Seasonal Supply Trend For ULSD



*Net imports represents gross imports minus gross exports.
Source: U.S. Energy Information Administration.

Source: EIA

The final petroleum fuel market is regular heating oil. As shown in the supply/demand analysis prepared by the EIA along with its forecast (Exhibit 21), the in-region supply decline will be offset by the elimination of heating oil exports.

Exhibit 21. PADD 1 Home Heating Oil Market Outlook

(Thousand bbl/d)
(Rounded to closest 10,000 bbl/d)

	2007	2008	2009	2010	2011*	2012 Outlook	2013 Outlook
Consumption	**470**	**370**	**360**	**310**	**290**	**310**	**280**
Supply	**470**	**370**	**360**	**310**	**290**	**340**	**310**
In-Region Production (+)	210	190	160	140	140	120	100
Net Receipts from Other Regions (+)	180	170	170	140	160	160	160
Imports (+)	80	70	100	80	60	60	50
Exports (-)	40	60	50	50	80	–	–
Stock Decrease (+) / Increase (-)	40	–	-20	–	10	–	–
Surplus (+) / Gap (-)	–	–	–	–	–	**30**	**30**

*Data through November 2011.
Notes: Projected consumption is based on data from EIA's *Short-Term Energy Outlook*. It includes a switch in consumption from heating oil to ULSD of an additional 70,000 bbl/d beginning in July 2012, based on New York's requirement that heating oil move to ULSD specifications. Projected production is based on assumed yields and the capacity of remaining refineries. Sunoco Philadelphia is assumed to close in July 2012. Projected imports are 3-year historical averages adjusted down by U.S. Virgin Islands contributions. Historical net receipts are estimated. Projected net receipts are 3-year historical averages. The Surplus/Gap indicates the under- or over-supply needed to meet consumption.
Source: U.S. Energy Information Administration.

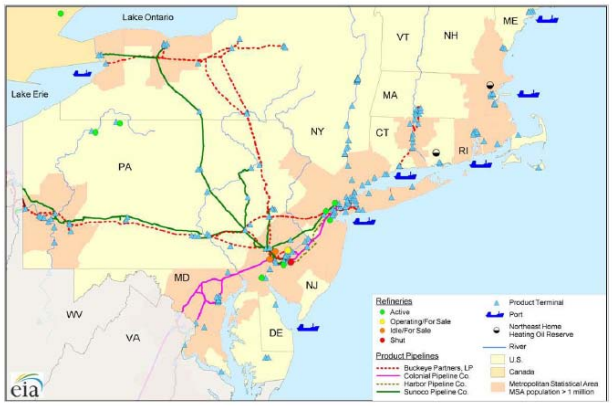
Source: EIA

Significant infrastructure changes will be necessary to deal with the permanent closure of the three Philadelphia refineries

When we focus on the petroleum infrastructure in PADD 1A and 1B, it becomes clearer that significant changes will be necessary to deal with the permanent closure of the three Philadelphia refineries. Those refineries have been the primary source of supply for the region, especially for areas such as Pittsburgh and central Pennsylvania as well as western New York State. It is possible that those product pipelines that serve those areas now may eventually need to be reversed in order to haul refined product from Canada

and the Midwest to the demand centers in the mid-Atlantic and Northeast states.

Exhibit 22. Regional Supply System Needs Revamp



Source: EIA

An educated public, however, will greatly assist the debate about what changes society is willing to accept, since each choice will carry a cost

The recent news reports suggest that the ConocoPhillips Trainer, Pennsylvania refinery, currently shut down, may be sold to a group headed by Delta Air Lines Inc. (DAL-NYSE) and restarted. The news reports also suggest there is a local buyer for the Sunoco Philadelphia refinery. If both of these transactions occur, then the crisis scenario outlined by the EIA's report may be avoided. While that would be good news for PADD 1, it does not eliminate the structural challenges the domestic petroleum industry is facing and will continue to face in the future as demand trends and supply sources shift. We suggest readers of the *Musings* should go to the EIA web site (www.eia.gov) and read the series of reports dealing with this Northeast refining capacity issue. The reports are instructive in educating people about the challenges the public and the petroleum industry will confront in the future, and what the options are to overcome them. The challenges and obstacles for resolving the issues are many and often subtle. An educated public, however, will greatly assist the debate about what changes society is willing to accept, since each choice will carry a cost.

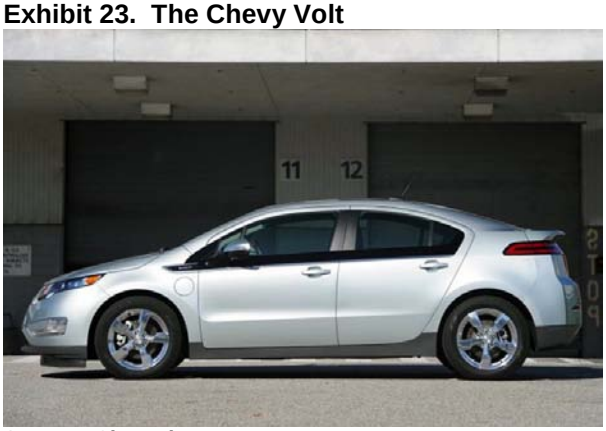
Chevy Volt Sales Rally As Gasoline Prices Rise

The Volt sales surge came at the same time their manufacture was halted to bring inventories back in line with sales expectations

Sales of the Chevy Volt electric hybrid car that has been the subject of much derision over the past year due to its high cost and battery fires test vehicles experienced have suddenly surged. In March, 2,289 Volts were sold, more than double the number sold in the prior month and nearly four times the volume sold in January. Interestingly, the sales surge came at the same time their manufacture was halted to bring inventories back in line with sales expectations. The manufacture of Volts was stopped for five weeks in late March, although there have been rumors that the shutdown might be ended a week early following the latest sales figures. The

industry talk about extending the normal two-week manufacturing shutdown for Volts this summer by a week has also been muted lately.

Exhibit 23. The Chevy Volt



Source: Chevrolet

In that month, the first for Toyota's new Prius Plug-In Hybrid model, 891 units were sold, or 3% of all the 28,711 Prius cars sold company-wide

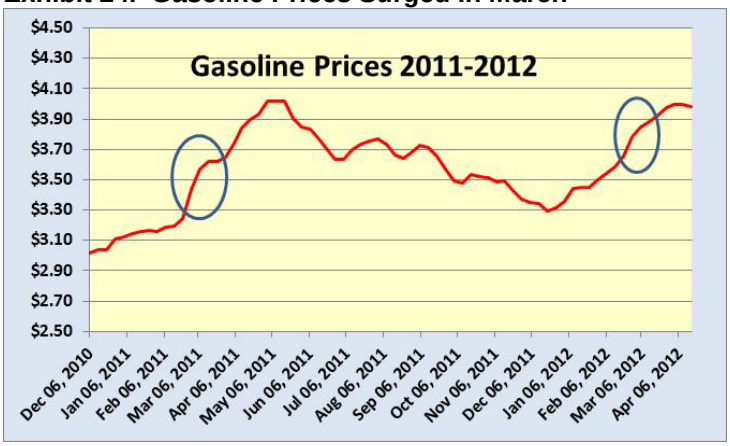
It is interesting to examine these electric vehicle sales figures. Chevy has sold 3,915 Volts during the first three months of 2012 compared to only 1,210 in the same period of 2011. In contrast, the Nissan Leaf electric vehicle sold only 1,733 units this first three-month period compared to 452 in 2011. In March, 579 Leafs were sold. Surprisingly, in that month, the first for Toyota's new Prius Plug-In Hybrid model, 891 units were sold, or 3% of all the 28,711 Prius cars sold company-wide.

The primary difference this year is that gasoline prices started their seasonal climb earlier than normal

So what has driven Volt's sales in recent weeks? It would appear that the absence of media coverage of the battery fires and the issuance of the clean bill of health for the car by the National Transportation Safety Administration has helped its public image. According to one auto news web site we checked, only 7% of March's Volt sales were to fleets. We had suspected initially fleet sales to have been a much higher figure. Our last thought about the stimulus behind Volt sales is that it was the rise in gasoline prices. We have been treated to many auto sales stories about how Americans have been scooping up high-mileage vehicles as pump prices have been climbing. The chart in Exhibit 24 shows retail gasoline prices since December 2010 when the nationwide price broke through the $3 per gallon level. What we know about gasoline prices is that they actually went through a similar price surge during the spring of 2011 just as they have been doing this year. The primary difference this year is that gasoline prices started their seasonal climb earlier than normal. Was that a function of the warm winter weather or just the impact on oil prices of the Iranian nuclear energy tensions?

To examine the pricing issue, we focused on the two relevant March months (in ovals). The rise in pump prices was sharper in March

Exhibit 24. Gasoline Prices Surged In March



Source: EIA, PPHB

It is quite possible that people bought Volts because they sensed gasoline prices soaring to levels they could not afford with their existing vehicles

2011 than in March 2012, but the starting and ending points in 2012 were higher than in 2011. The last factor influencing prices is difficult to measure. It was the steady drumbeat of projections this year that we were heading for pump prices above $4 per gallon and more likely to hit $5. It is quite possible that people bought Volts because they sensed gasoline prices soaring to levels they could not afford with their existing vehicles.

Since the average income of Volt buyers was reported as $176,000, these buyers have not been your typical middle class consumer

What happens now that gasoline prices appear to be peaking as Iranian geopolitical pressures ease and gasoline demand falls? Will Volt sales fall off in April or May? There is also the possibility there was something in the March sales figures we don't know about that helped drive them up sharply. For a $40,000 vehicle, even after a $7,500 tax credit, which you have to wait a year to collect on, the Volt is an expensive purchase for the typical American family given the availability of a growing number of high-mileage alternative vehicles at a fraction of the cost of the Volt. Since the average income of Volt buyers was reported as $176,000, these buyers have not been your typical middle class consumer. Chevy is now talking about Volt sales this year being somewhere in the 24,000-36,000 unit range. That is down from the 60,000 unit initial projection, and the revised 45,000 target following the disastrous sales performance of 2011. Get ready for lots of talk about the Volt and its monthly sales results as the presidential election season heats up.

Contact PPHB:
1900 St. James Place, Suite 125
Houston, Texas 77056
Main Tel: (713) 621-8100
Main Fax: (713) 621-8166
www.pphb.com

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