The Oil Drum
DISCUSSIONS ABOUT ENERGY AND OUR FUTURE

The Myth That the US Will Soon Become an Oil Exporter

Posted by Gail the Actuary on April 20, 2012 - 11:04am
Topic: Supply/Production
Tags: biofuel, ethanol, natural gas plant liquids, ngl, oil exports, oil imports, oil refineries [list all tags]

Countries trade crude oil and oil products back and forth. When all of these transactions are netted out, is the US close to becoming a "net" oil exporter?

With the recent increase in oil production (perhaps even exceeding that of Russia on a "barrels-per-day" basis), a person might think that US oil production problems are behind us. If we look at the data, though, it is very clear that the US is still a long way from becoming a net oil exporter.

There are several reasons for confusion. One is the fact that excess refinery capacity can lead to the ability to export both gasoline and diesel, even though the United States continues to import large amounts of crude oil. Another is that tight oil (extracted through "fracking") is growing from a small base, but can't necessarily ramp up very far, very quickly. Another source of confusion is with respect to how different types of liquids should be combined for comparison purposes.

In this post, I would like to explain why the idea that the US is about to become a net oil exporter is simply a myth.

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1. On what basis does the US Energy Information Administration (EIA) make forecasts of oil and other energy supplies?

When the EIA makes forecasts of oil and other supplies, as in its recently issued Annual Energy Outlook, Early Release 2012, it looks at future consumption and future supplies in terms of the amount of energy supplied in Btus. In doing this calculation, oil is combined with natural gas liquids. Biofuels (which in the case of the US are almost entirely corn ethanol) are treated separately, as part of "renewables".

It seems to me that the EIA's approach is about the only reasonable way of making comparisons, since it is energy value, and not volume (barrels-of-oil per day), that is important. Furthermore, if we are talking about oil imports and exports, we want to know about oil, perhaps including natural gas liquids (which are sort of like oil) by itself. Biofuels are a separate issue.

2. Where are we now, relative to being an oil exporter?

On a Btu basis, the US imported 58% of the oil it consumed in 2011. This percentage is down from a high of 67% in 2005 and 2006, but it is still very high.

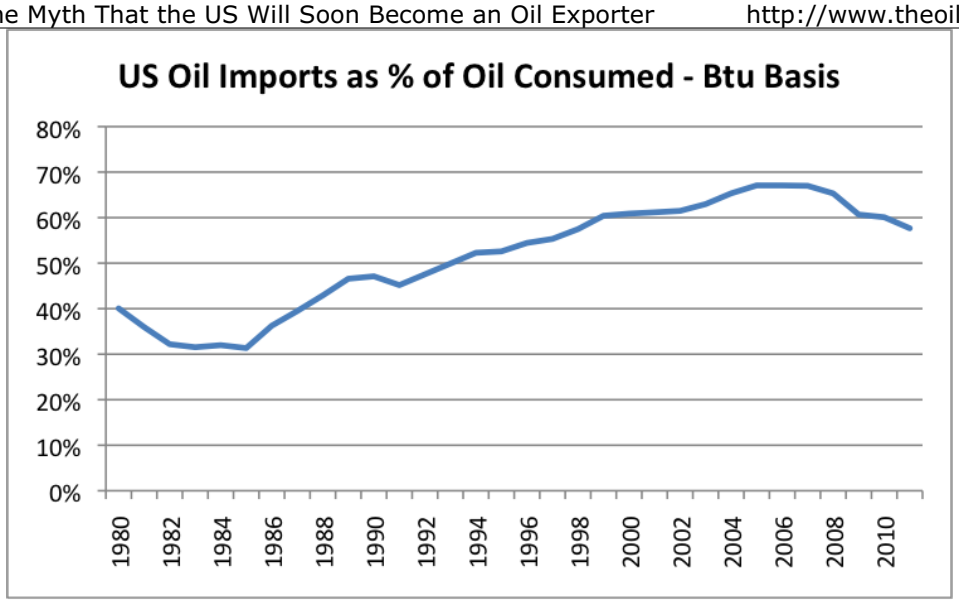

Figure 1. US oil imports as a percentage of the oil consumed in the US - calculated using EIA Btu amounts for oil and natural gas liquids.

If the US wants to become an oil exporter, it must first get its imports down from 58% to 0%, and then ramp up production by enough to have oil to export as well.

3. What does the US Energy Information Administration (EIA) forecast regarding oil imports/exports?

In EIA's Annual Energy Outlook 2012 Early Release, EIA gives the following forecast to 2035. (2010 and prior data are actual amounts.)

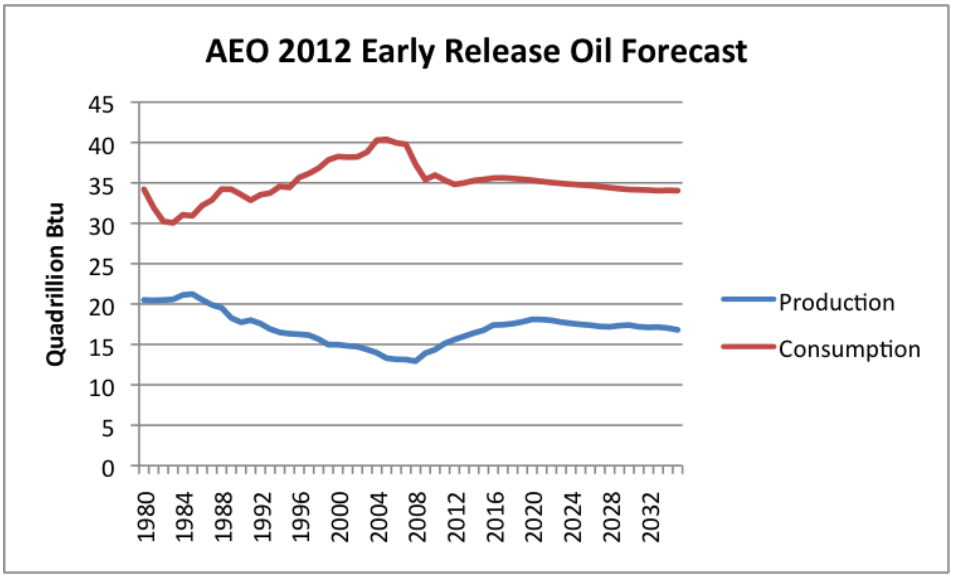

Figure 2. Comparison of forecast oil production (AEO Figure 12) and forecast oil consumption (AEO Figure 8), based on EIA's AEO 2012 Early Release.

We can use the forecast in Figure 2 to create a graph similar to Figure 1, but with the EIA's forecast included. Such a graph is shown as Figure 3 below.

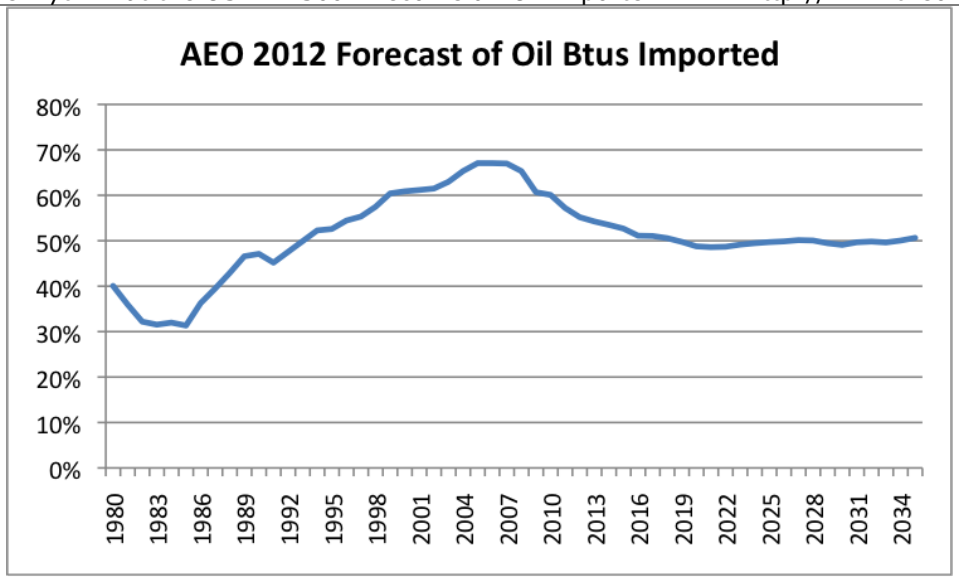

Figure 3. AEO 2012 Forecast of Percentage of Oil Btus Imported

This graph indicates that while percentage of oil imported will drop a little (from 58% down to about 50% or 51%), the United States will not become an oil exporter before 2035.

4. How about if we make our own forecast regarding when we will become a net oil exporter, based on how consumption and production have been trending recently?

Yes, we can do this. I do this in Figure 4, below.

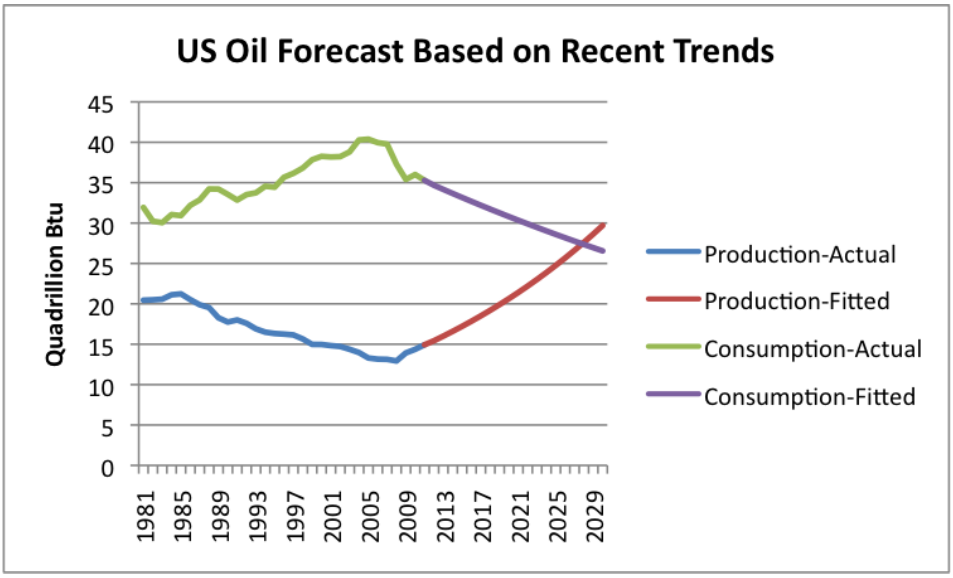

Figure 4. US oil production and consumption, based on recent trends. Historical data form EIA. Trends selected by author.

Based on this approach, if the US could keep up the current trend, we would become an oil exporter in 2028, which is 16 years from now. This result is better than the EIA's forecast, but is still a long ways away.

5. Isn't the production of tight oil, obtained by "fracking," doing very well?

Yes, it is. According to the EIA's This Week in Petroleum, a graph of tight oil production by play is

as shown in Figure 5, below. Tight oil is the oil that is typically extracted by horizontal drilling and hydraulic fracturing. It comes from shale and other very-low-permeability rocks.

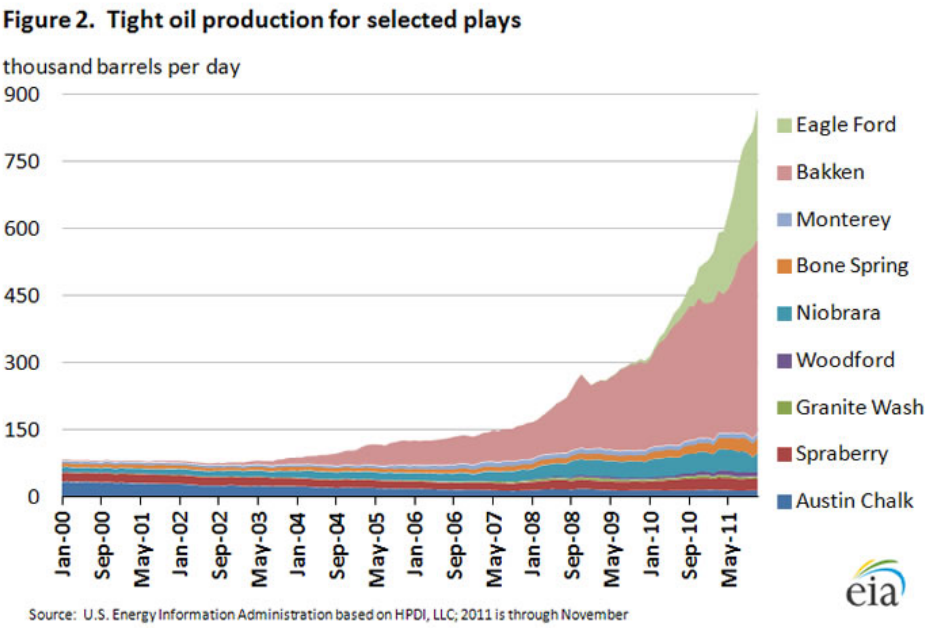

Figure 5. Tight oil production by play, from the EIA's publication, "This Week in Petroleum," March 14, 2012.

This graphic indicates that tight oil provided about 850,000 barrels a day of oil, as of November 2011. The United States consumes a little under 19 million barrels a day–lets say 18.5 million barrels a day. The 850,000 barrels a day of tight oil amounts to a little less than 5% of the 18.5 million barrels a day we consume, so is only a small fraction of what we use today.

If we look at a graph of recent US crude oil production by area, this is what it looks like:

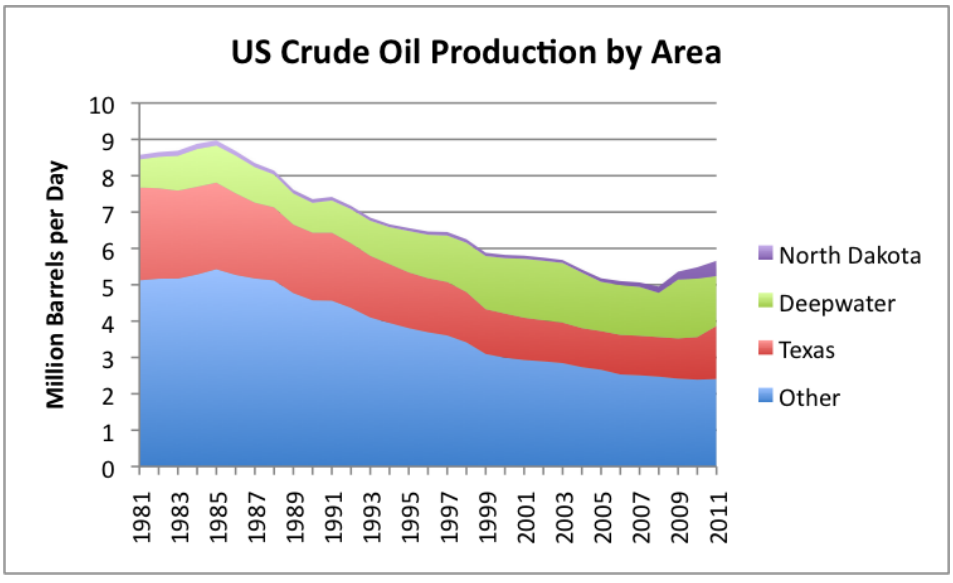

Figure 6. US crude oil production by area, based on EIA data.

Bakken tight oil is in North Dakota, which corresponds to the purple area in Figure 6 above. The Eagle Ford play (as well as some of the smaller plays) are in Texas, which is shown in red. At the

same time these two sources of production increased, deepwater production decreased, so the total increase in US crude oil production was less than the increase in tight oil production.

We have a long-term problem with declining oil production on older fields (illustrated in Figure 6), so we can expect that such declines will continue. As a result, whatever new production we gain from tight oil or other new sources is likely to be offset by declines elsewhere. It is only to the extent that new production is greater than these declines that overall US production will rise.

6. Can't we just keep ramping up the tight oil production, by drilling more?

We can probably ramp up production by drilling some more wells, but at some point we start running into limits of suitable horizontal drilling rigs and of trained workers.

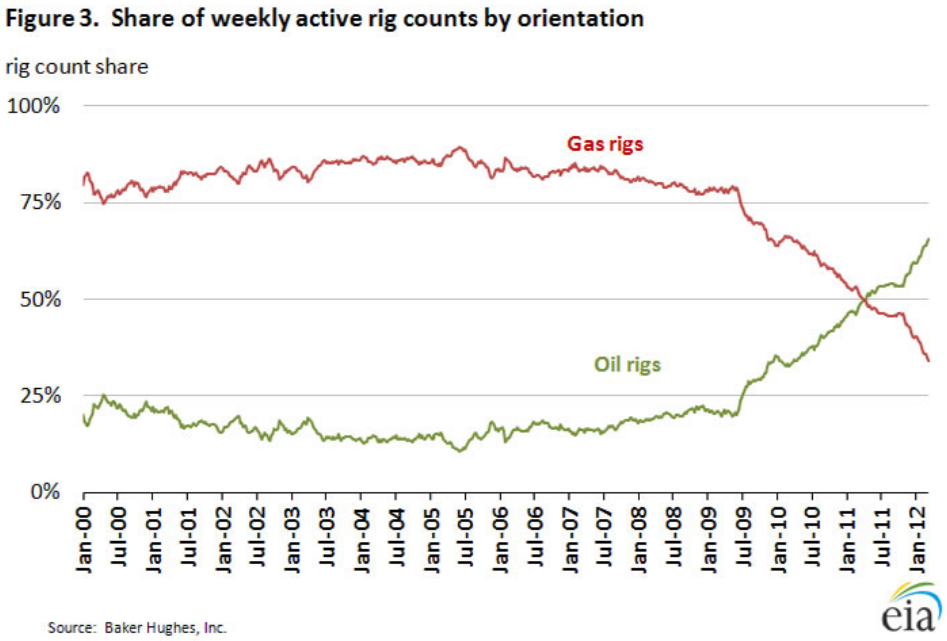

Figure 7. EIA exhibit of rig counts by orientation, based on Baker-Hughes data. Exhibit from This Week in Petroleum, March 14, 2012.

The figure above shows that there has been a big shift in use of drilling rigs from gas to oil. Current Baker Hughes data shows that as of April 13, 2012, 32% of drilling rigs (vertical and horizontal combined) were gas and 68% were oil. At some point not too far in the future, we end up being maxed out on how many horizontal drilling rigs can reasonably be transferred from gas to oil. More horizontal drilling rigs can be built, but this takes time and investment capital.

One characteristic of wells in tight formations is that production starts out very high, and then drops off quickly. Because of this, it is necessary to keep drilling new wells, or total production in an area is likely to drop off very quickly. New fracking techniques may help make the drop-off problem less severe, but it is hard to imagine that it will go away completely. If we want production to keep rising, this means that we are likely to need more and more horizontal drilling rigs, more and more fracking equipment, and more and more capital. These considerations help put a lid on how quickly and how high production can be ramped up.

7. How much tight oil does the EIA forecast can be extracted?

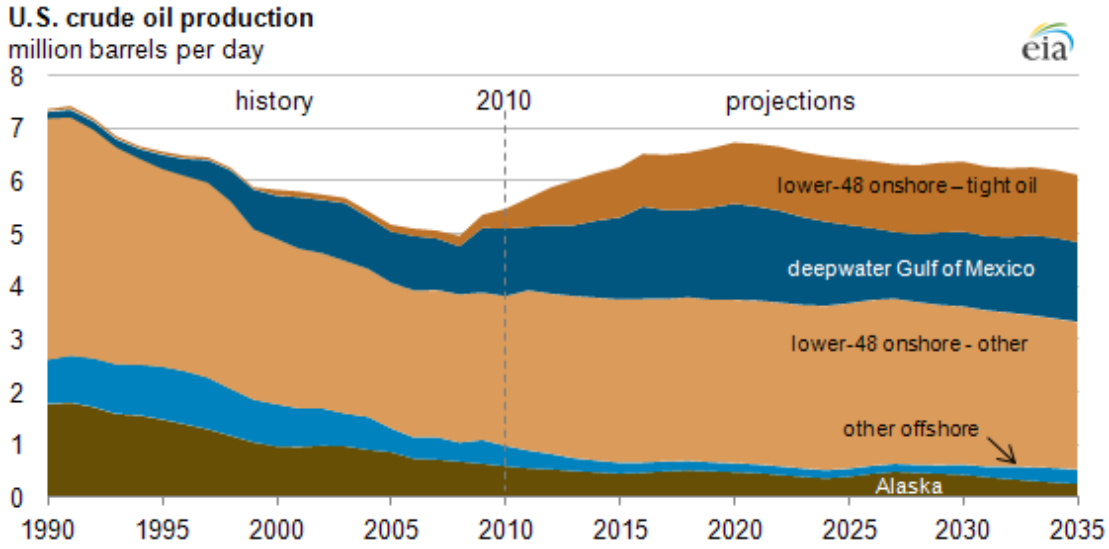

Figure 8. The brown layer on top represents the EIA's forecast of future tight oil production. Graph by EIA, from AEO 2012.

The EIA forecasts that tight oil will max out at 1,325,000 barrels a day in 2030. The EIA does not have a good track record of foreseeing changes before they happen, and the chart above shows production already at 850,000 barrels a day. Suppose the US really produces five times as much as the EIA forecasts, or 6,625,000 barrels a day. This increase will still not be enough to cause the US to become a net oil exporter, especially if other sources of oil continue to decline. (This is not to say that I think that production can really be ramped up this much. We would likely run into a number of bottlenecks before reaching this volume–drilling rigs, workers, fracking equipment, capital, etc.)

8. Haven't we been reading about exporting gasoline and other oil products recently? Does't that mean we are becoming a net oil exporter?

Yes, indeed, we are exporting gasoline and other **oil products** to a greater extent than we have in the past. But we continue to import crude oil, so, on balance, we are still a net oil importer.[1]

What has happened is that we have continued to add to our refinery capacity:

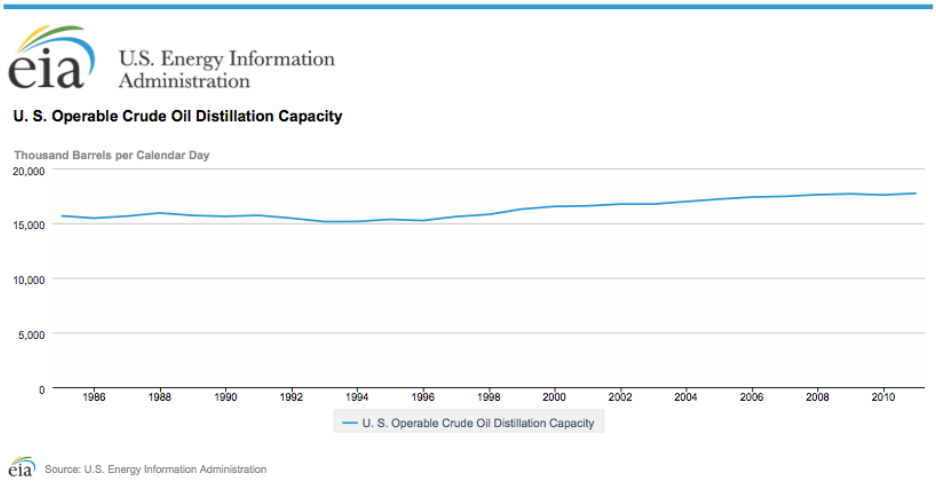

Figure 9. Operable crude oil refinery capacity. Chart by EIA.

At the same time, we have reduced our own need for gasoline and other products. One of the

ways we have done this is by ramping up corn ethanol production. We are now producing so much ethanol that we are exporting some of it (Figure 10, below).

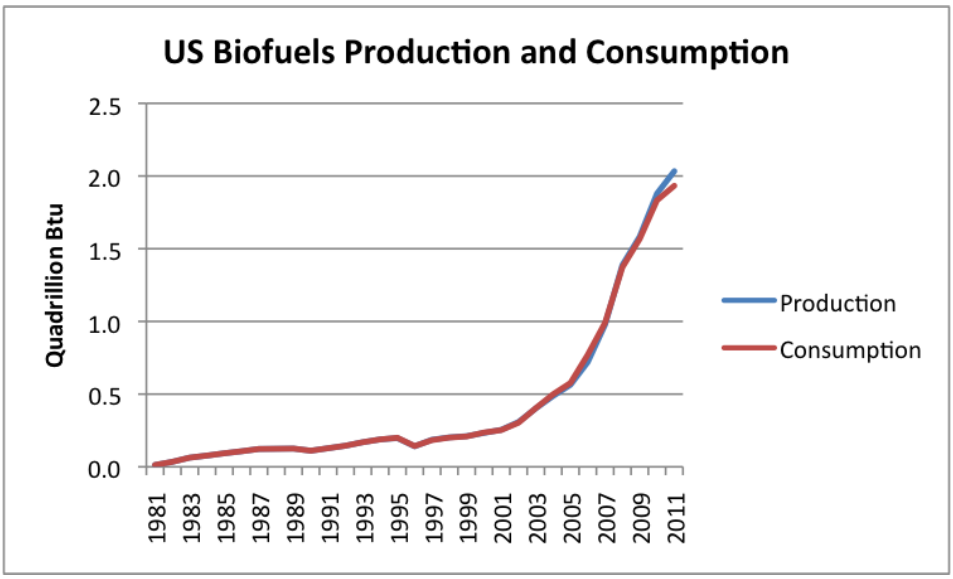

Figure 10. US Biofuels (nearly all ethanol) production and consumption, based on EIA data.

The other way consumption has been reduced by reducing the miles driven per capita (Figure 11, below).

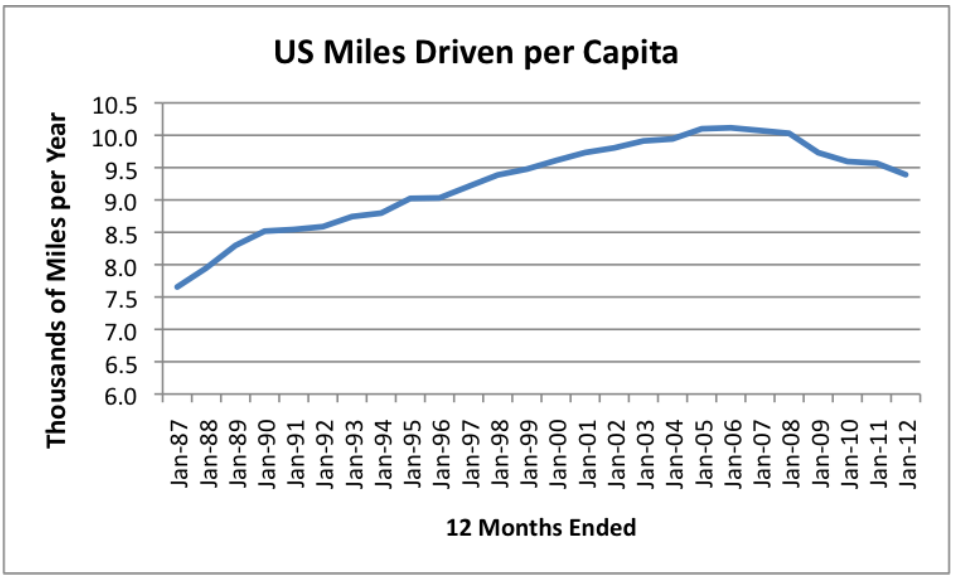

Figure 11. US miles driven per capita, calculated by dividing Federal Highway Administration estimates of vehicle miles traveled (both cars and trucks) by US population.

The peak year for vehicle miles traveled per person was the year ended January 2006. (All of the data in the chart is for years ended January 20xx.) Since then, per capita vehicle miles driven have dropped each year, and are now 7.2% below their peak.

Total miles driven for the entire US population has also dropped. The peak year for total vehicle miles driven was the year ended January, 2008.

There may be other changes that affected oil use, but I don't have data for them. For example, transferring heavy industry offshore would tend to reduce oil use; an increase in average miles

per gallon for vehicles on the road would also tend to reduce oil use.

The net effect of all of the changes is that US oil consumption is down significantly since its high point in 2005. Figure 12, below, shows an enlarged view of recent oil consumption.

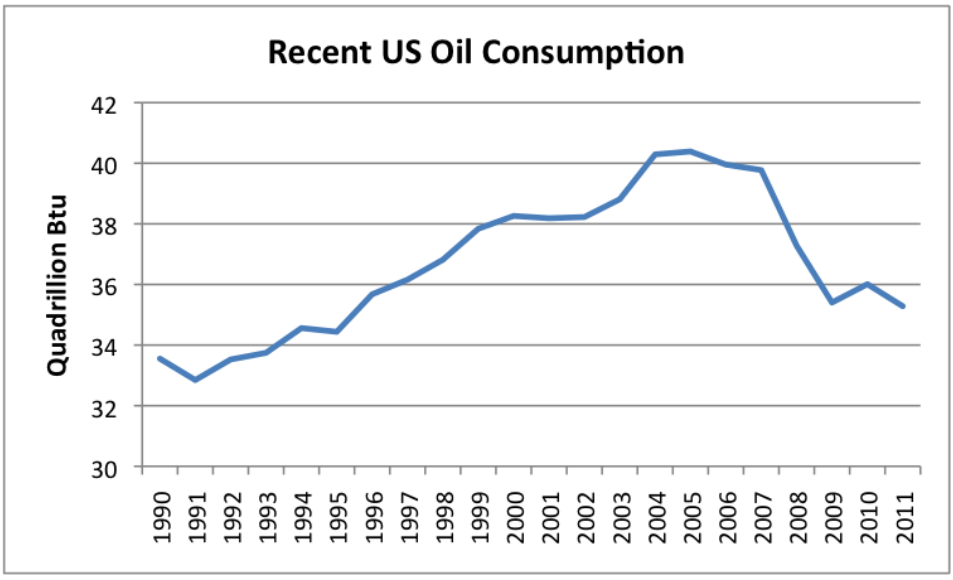

Figure 12. Recent US oil consumption, in Btus. Amounts graphed are the same as are shown in Figure 4 above.

A comparison of Figures 9 and 12 shows that refinery capacity was increasing at the same time that US oil consumption was decreasing. If we have more refinery space than we need, refiners can import crude oil, refine it, and sell the products as exports. That is pretty much what has been happening recently.

A few things have happened in the past few years that have made US refinery capacity especially attractive:

1. The US has a good supply of "complex" refineries that can process heavy sour crude oil. There is relatively more heavy sour crude being produced now, than previously, raising demand for these refineries.

2. The US has a low price for natural gas, compared to the rest of the world. Natural gas is used in refining heavy, sour crude oil, so our cost of refining has been relatively lower than other locations with similar facilities.

3. The amount of sulfur that is permitted in diesel and other fuel is being regulated in the US and elsewhere, to control pollution. If a country wants to have at least some fuel that meets international regulations, it now needs to find a refinery with complex capacity to remove the sulphur from its crude oil. Many countries do not have such refineries of their own. For example, Mexico sends us oil to refine, and we send oil products back to Mexico.

9. Why do I keep reading so much about "barrels of liquids," when talking about US oil supply?

The US government likes to talk about "barrels of liquids" because comparisons with other countries are more favorable on this basis than they are using Btus, or considering crude oil only. If we look at a breakdown of US "liquids" production through 2011, this is what we see:

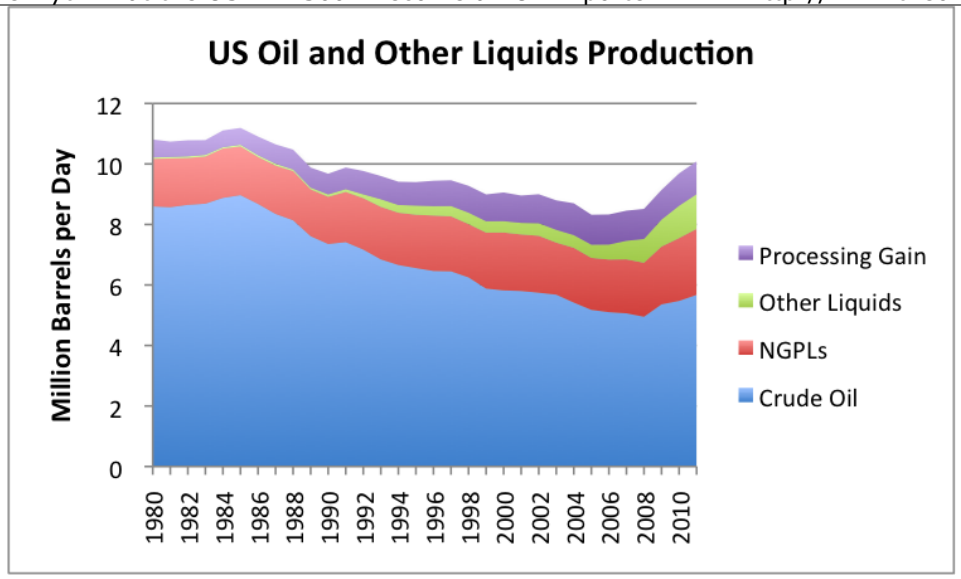

Figure 13. US oil and other liquids production, based on EIA data.

I noted above that US oil consumption is approximately 18.5 million barrels a day. If liquids production is about 10 million barrels a day (shown in Figure 13 above), then a comparison of production on this basis would leave a shortfall of "only" a little more than 8 million barrels a day. So even on this basis, we are still a long way from being a net oil exporter.

The problem in making a comparison on a volume (barrels-per-day) basis is that very dissimilar liquids are being combined. Both NGPLs (natural gas plant liquids) and "other liquids" (mostly ethanol) have only 60% to 70% of the energy content of crude oil. It is doubtful that "refinery gain" adds much energy content at all. The EIA has made adjustments for differences in energy values in its calculations on a Btu basis.

For those interested in finding data on a Btu basis, the Total Energy section of EIA reports gives data on this basis. They are also available (with a lag) in International Energy Statistics.

Note:

1. It is easy to confuse "net oil exporter" with "net oil product exporter". We can think of net oil exports as the combination of the following four items:

a. Crude oil imports
b. Crude oil exports (virtually zero in the case of the US)
c. Oil product imports (like gasoline and diesel)
d. Oil product exports (like gasoline and diesel)

Net product exports reflect only the combination of Items c and d, omitting consideration of Items a and b.

In 2011, the US became a net ***oil product*** exporter. This means that when Items c and d were combined (in other words, omitting consideration of crude oil imports), we exported more oil products than we imported. This situation can happen very easily, if we are importing a lot of crude oil, and have excess refinery capacity.

This post originally appeared on Our Finite World.