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What the US Government (the EIA) is Forecasting with Respect to US Oil Production and Renewable Energy

Posted by Gail the Actuary on June 1, 2010 - 9:28am
Topic: Environment/Sustainability
Tags: eia, renewable energy [list all tags]

I thought new readers might be interested in what the US government--that is, the US Energy Information Administration-- has to say about future US oil production and future US renewable production. I have taken the forecast information from the Annual Energy Outlook 2010.

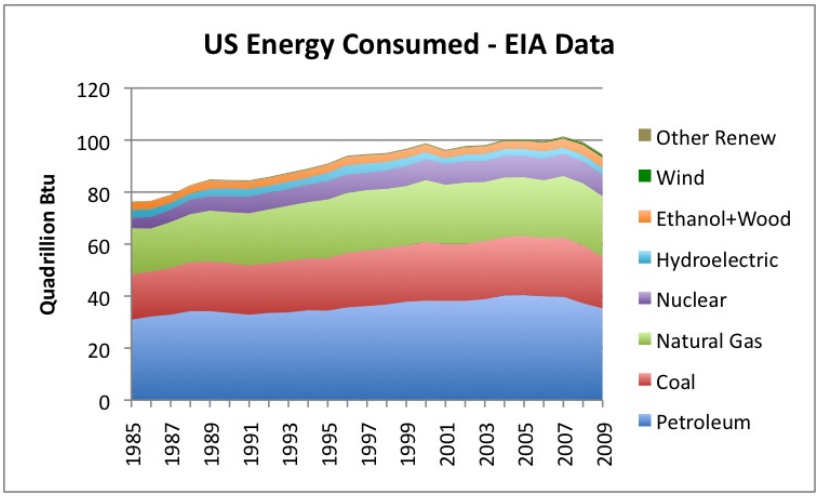


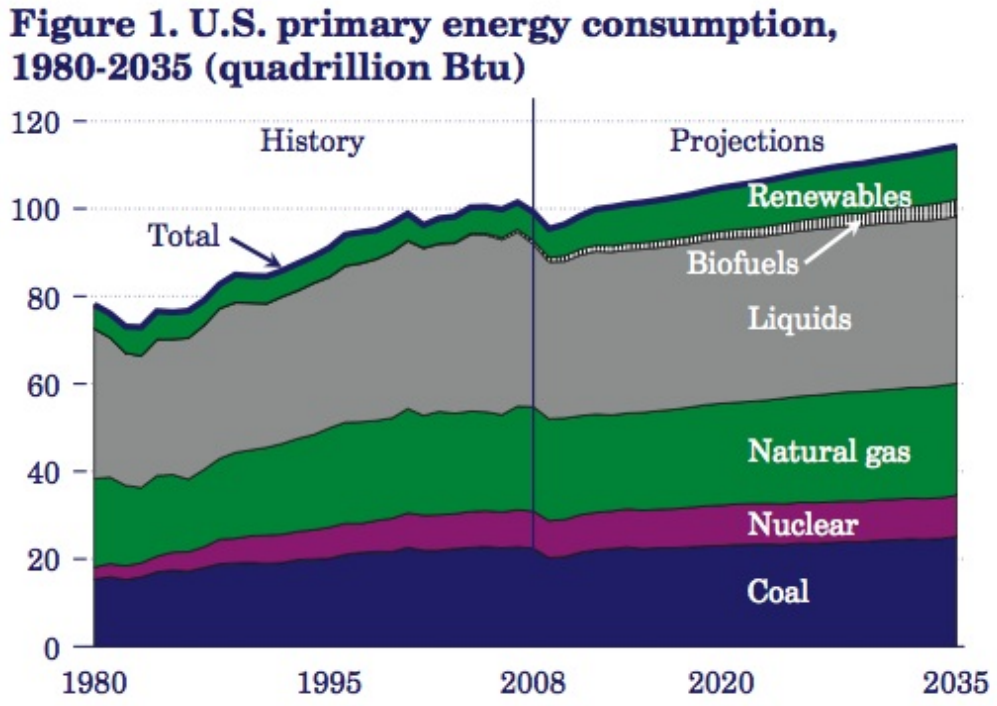
Figure A - Graph constructed from Table 1.3 of EIA's Monthly Energy Review

Figure A shows US historical energy consumption by source. One can see that the largest source of energy is petroleum. Natural gas and coal are close to tied for second place in US energy consumption.

Renewables make up only a small part of US energy supply. If you define renewables broadly (including hydroelectric (blue); ethanol + wood (orange); wind (tiny green line) and other renewables (invisible)), then renewable energy consumption has been close to flat since 1985. If you define renewables as only the newer renewables (wind and solar), then renewable energy supply is tiny, but growing rapidly from a small base.

Note: In the sections that follow, the figures numbered with numbers are from the Annual Energy Outlook 2010. Figures B and C (as well as Figure A above), are ones I constructed, using EIA data.

Forecast of US Total Energy Consumption



According to Figure 1, the EIA expects coal, nuclear, natural gas, and liquids to remain close to flat to 2035, with renewables providing the majority of growth. ("Liquids" is a new word that energy organizations have come up with, now that world crude oil production is flat. It includes substitutes of various kinds--including ethanol, coal to liquid, and natural gas liquids.)

We will see from later graphs that not all of these estimates seem reasonable. Clearly, if there are big cut-backs in fossil fuels because of carbon dioxide concerns, or because of issues with deepwater oil production, then EIA's forecasts are not correct.

Notice that the green renewables category shown at the top of own at the top of Figure 1 defines renewables broadly. Thus, if one compares to Figure A above, it includes the blue hydro-electric line, plus the orange ethanol + wood line, plus the green wind line, plus the invisible other renewables line. According to Figure 1, production of renewables has changed very little since 1980. Going forward, the EIA expects the renewable band to grow, but still to remain small compared to fossil fuels.

Breakdown of US Liquids Fuels Supply

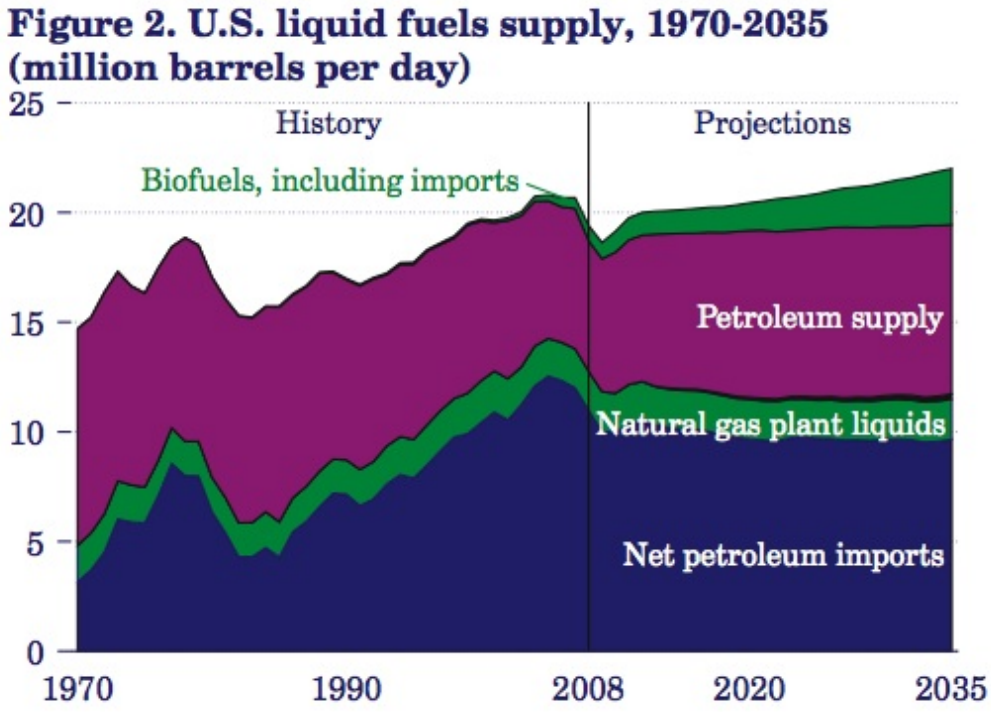


Figure 2 shows where liquid fuels are expected to come from. Biofuels (the green band) are expected to grow from a tiny amount historically (invisible until recently), to a big band by 2035.

The purple band represents US's own domestic oil production. It has been declining (so the band is getting narrower). Growing forward, this band is to increase slightly in width--as we will see below, because of more deep-water oil production. Petroleum imports (dark blue) are expect to remain flat, and natural gas plant liquids (a lower energy product) are expected to grow.

Many Oil Drum readers (and staff members) would say that all of the EIA forecasts for 2035 are likely high. We have seen how the estimates by government agencies of the oil spill proved to be too low. Here, the government has a real desire to show a high number (so that no one is too concerned about the future), so a person wouldn't be too surprised if there is a little (or lot of) fudging on the high side.

Breakdown of Biofuels

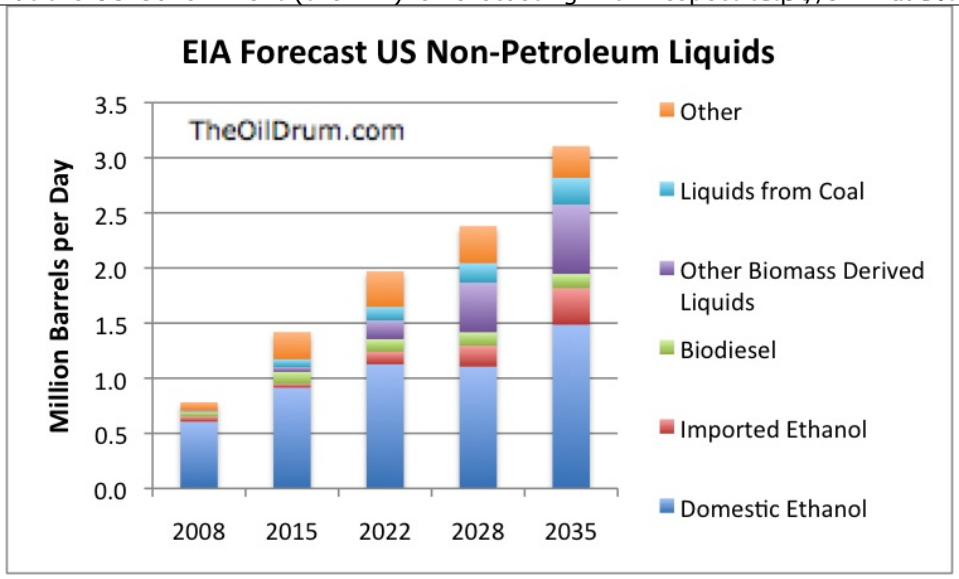


Figure B. Graph I prepared of EIA projections, using reference case backup tables, from the Annual Energy Outlook Forecast 2010

To understand better where the increase in "biofuels" shown in EIA figure 2 is coming from, I put together Figure B, above, using backup data. According to this data, biofuels are expected to increase from 0.78 barrels per day in 2008 to 3.11 barrels per day in 2035, a more than three-fold increase (but not enough to make a big dent in the 19 million barrels a day of oil the US currently uses).

The biggest category both in 2008 and 2035 is US-produced ethanol. The forecast is that production will continue to increase, presumably mostly from cellulosic ethanol. Another major source of growth is "Other biomass derived fuels", which includes fuels created using pyrolysis or using gasification.

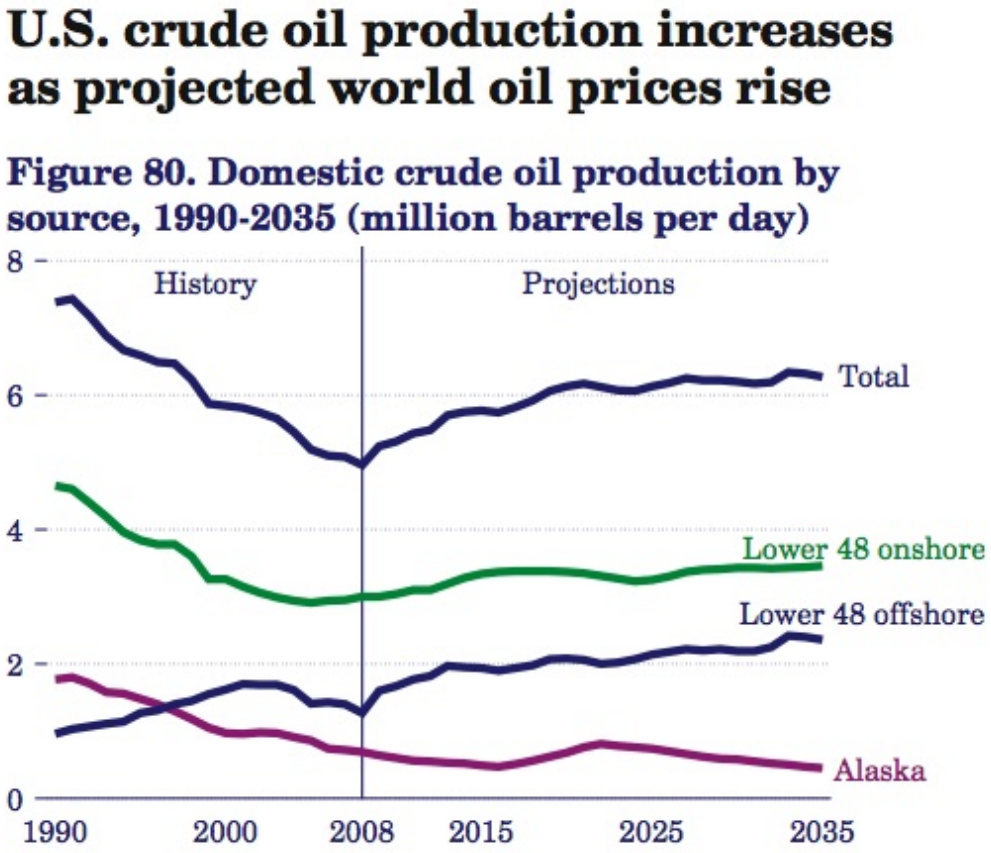
A question a person might reasonably ask is whether there really is enough biomass to be making all of the liquid fuels from it (some as cellulosic ethanol; some using pyrolysis or gasification). Another question is whether the cost of these processes can be brought down to levels similar to the price of gasoline. These processes are currently very expensive.

Cellulosic ethanol goals to date have been missed. The advanced biofuel mandate for 2010 was 100,000,000 gallons, but this was reduced to 6,500,000 gallons (**less than 10% of the original**), because of insufficient progress to date. Robert Rapier of The Oil Drum points out that the technology for cellulosic ethanol is more than 100 year old. In his view, lack of success is not from lack of funding. The reason for the lack of success is instead,"fundamental based on physics, chemistry, and the nature of biomass"--in his view, producing cellulosic ethanol in quantity cheaply can't be done!

Coal-to-liquids are included with biofuels, but even in 2035, are expected to be small (0.24 barrels per day).

Breakdown of US Crude Oil Production

We can also look at some detail behind the second category in Figure 2 above--namely forecast US crude oil production.



One can see from EIA's Figure 80 that historically, US domestic crude oil production has been in steep decline. The forecasts is for an increase to a little over 6 million barrels a day. This is still low in comparison to US oil consumption of 19 million barrels a day, and in comparison to historical US crude oil production, which has been as high as 9.6 million barrels a day in 1970.

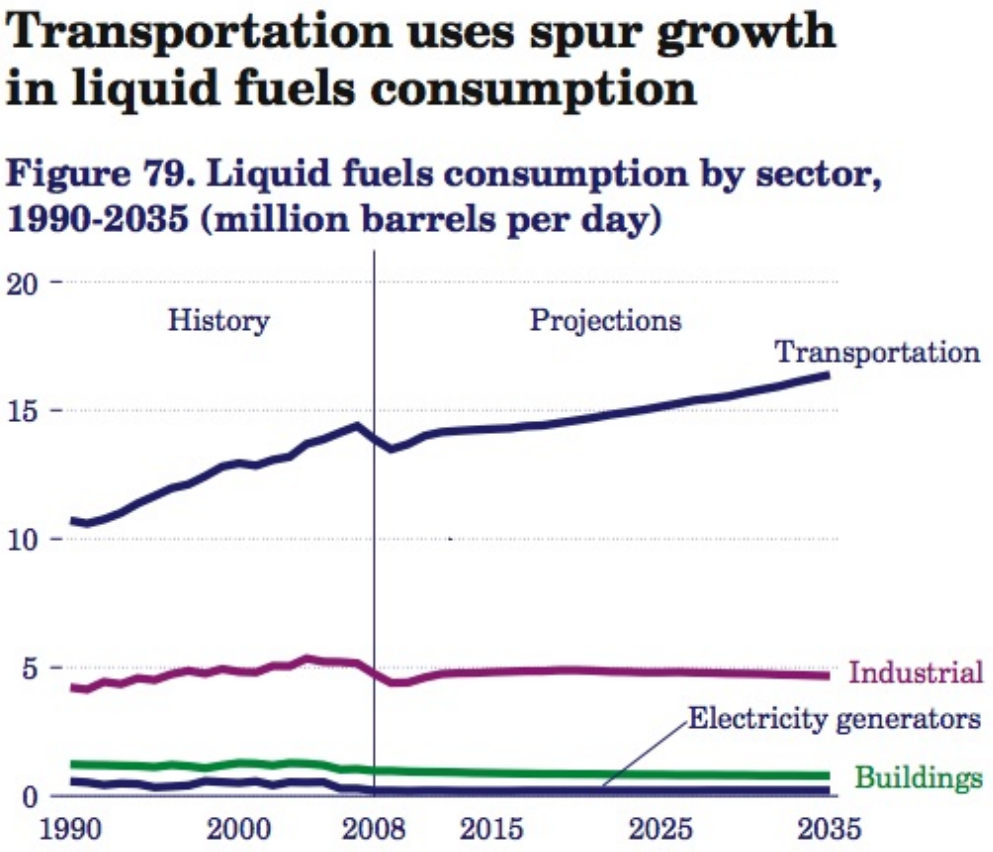
The text (page 75) indicates that a significant share of new production relates to deepwater. It also seems to reflect offshore locations recently added, which are now under a moratorium.

> In the short term, a vast majority of the increase comes from deepwater offshore fields. Fields that started producing in 2009 or are expected to start in the next few years include Great White, Norman, Tahiti, Gomez, Cascade, and Chinook. All are in water deeper than 800 meters, and most are in the Central Gulf of Mexico. Production from those fields, combined with increased production from fields that started producing in 2007 and 2008, contributes to the near-term growth in offshore production. Over the longer term, production from the continued development of other recent discoveries, as well as new discoveries, offsets production declines in older fields, resulting in an increase in production through 2035 (Figure 80).
>
> Removal of the Congressional moratorium on drilling in the Eastern Gulf of Mexico, Atlantic, and Pacific regions of the Outer Continental Shelf also allows for more crude oil production from offshore areas in the Pacific after 2016, in the Atlantic after 2021, and in the Eastern Gulf of Mexico after 2025 [86]. In 2035, U.S. crude oil production includes 0.4 million barrels per day from the Pacific offshore, 0.2 million from the Atlantic offshore, and 0.1 million from the Eastern Gulf of Mexico. Lower 48 onshore production of crude oil continues to increase through 2035, primarily as a result of wider

application of CO 2 EOR techniques. EOR makes up 37 percent of total onshore production in 2035, up from 12 percent in 2008. Continued exploitation of the Bakken shale formation and the startup of oil shale liquids production after 2023 also contribute to the growth in onshore oil production.

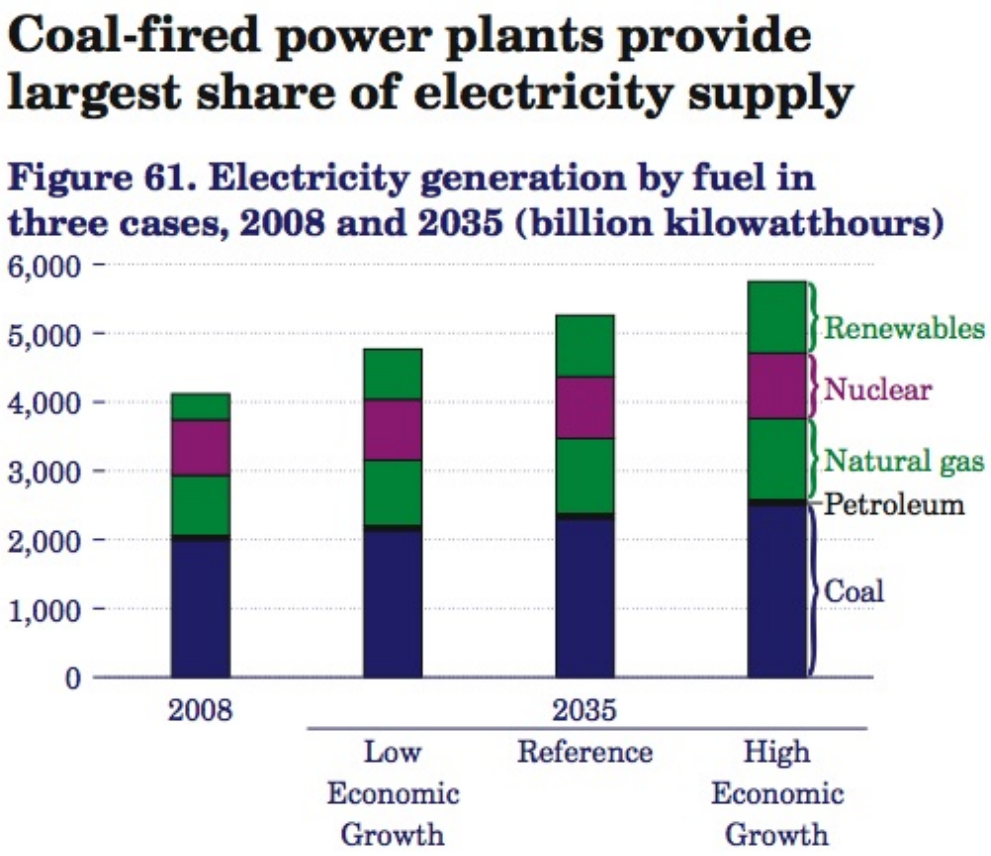
Clearly, if deepwater production is scaled back, this will have an impact on future US crude oil production.

Forecast Use of Liquid Fuels by Sector



When one looks at consumption by sector, it is pretty clear that the EIA is not expecting a big increase in electric cars. Instead, transportation use of oil is expected to grow, even with planned efficiency improvements.

Electricity Generation by Fuel



The EIA expects that in 2035, the vast majority of electricity generation will be from coal and natural gas, with increases in production taking place in both.

Renewables are expected to grow by 2035, but here again renewables are defined broadly, and the big piece - hydroelectric- has not been growing historically.

Renewable Generation Growth

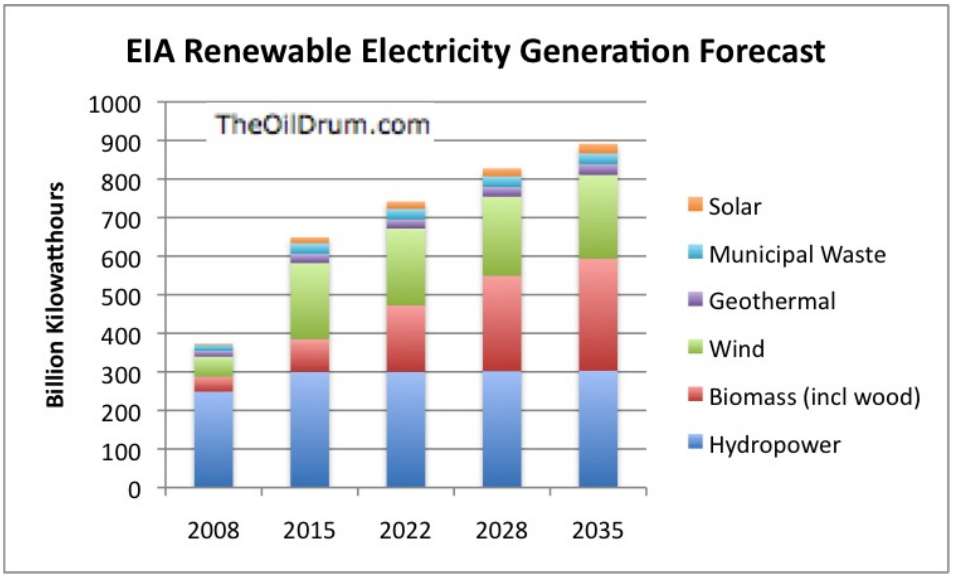


Figure C - Expected electricity generation by fuel source, for renewable fuels, based on downloaded reference case forecasts.

Here, I have put together a graph of expected generation by renewable source, based on EIA forecasts. Hydroelectric is the largest, but is not expected to increase much. The biggest growth is expected to be in biomass. It would seem as though the large increase here would conflict with the large increase in biomass used for biofuels shown above.

Wind is expected to roughly increase to four times its 2008 amount by 2035. At this level, it would still provide less generation than hydropower does today.

Summary

The EIA in its forecasts is expecting very large growth from renewables, but even with this growth, fossil fuels are expected to continue to provide the vast majority of energy supply to 2035. The "new" renewables are expected to grow rapidly, but the "old" renewables are expected to grow much more slowly.

There is good reason to suspect EIA forecasts are too high, both for renewable energy and for other energy sources. The "new" renewables show very large increases. It is not clear that they are attainable. Also, if there is a conscious effort to scale back fossil fuel usage, this may reduce fossil fuel use going forward. If renewable energy sources are already estimated optimistically, total fuel use may drop by more than the forecasts would suggest.