The Oil Drum
DISCUSSIONS ABOUT ENERGY AND OUR FUTURE

Electricity - No Easy Answers

Posted by Gail the Actuary on April 21, 2009 - 9:52am
Topic: Demand/Consumption
Tags: electricity [list all tags]

Electricity is something we are coming to depend more and more on as liquid fuels become less certain. At the same time, big changes are planned for electricity, both in terms of fuel mix and in terms carbon treatment. In this post, I show a few graphs relating to US Electricity, and offer some comments on how what I see relates to the challenges at hand.

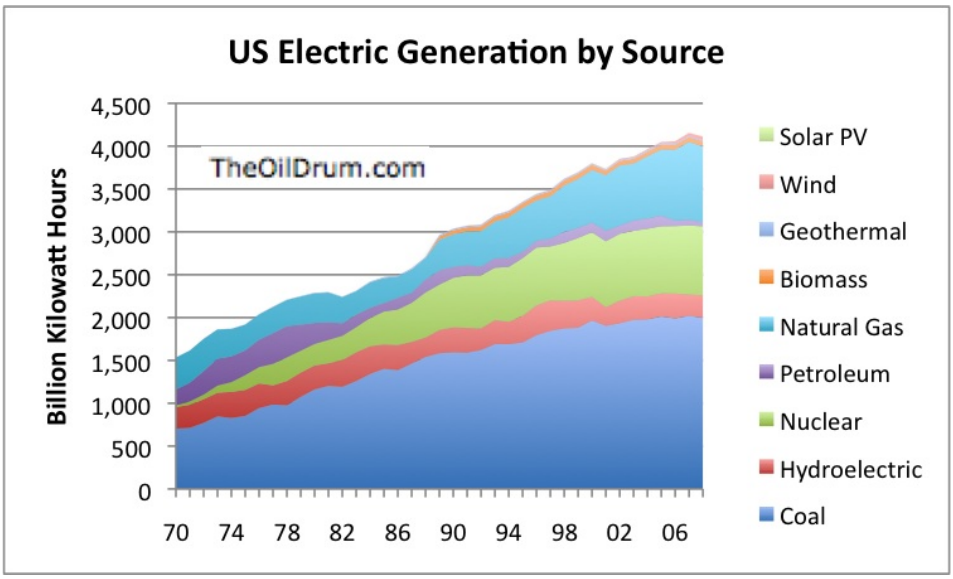

Figure 1

This graph shows that US electricity generation has been growing fairly steadily since 1970, unlike petroleum use. To the extent there was change from the long-term trend, it was between 1981 and 1990, when production from natural gas was lower due to a change in regulation. The other dip was in 2008, when net generation is down about 1%.

Figure 1 also shows that coal is the largest source of generation, and production as grown over the years. Natural gas and nuclear have been the big sources of electric growth over the years--natural gas because of building more plants, and nuclear because of running nuclear plants at closer to full capacity.

Graphs on the EIA website break down electricity growth into the various sectors - residential, commercial, industrial, and a tiny amount of transportation. (I think of commercial as office buildings and stores.)

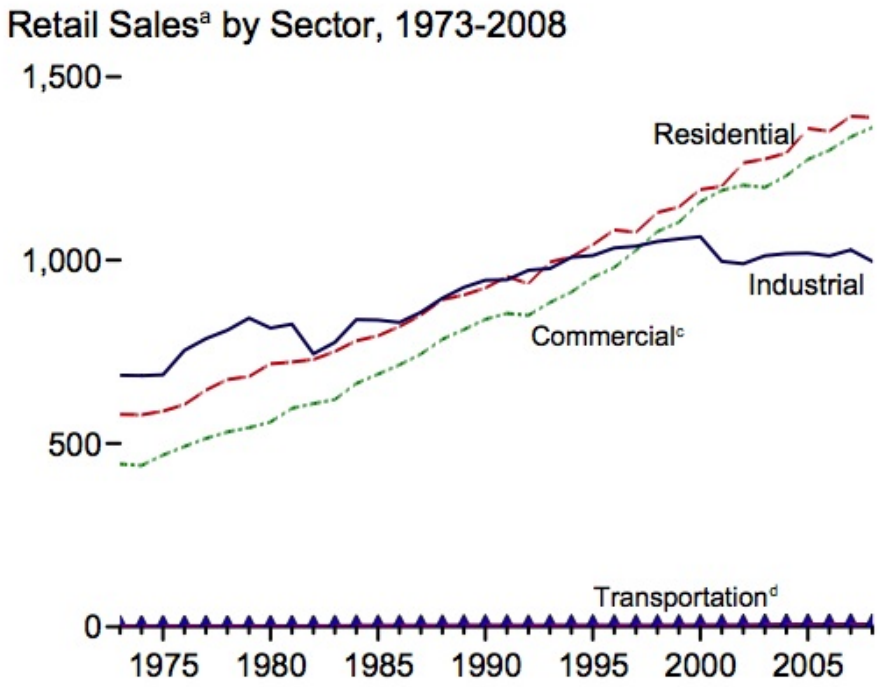

Figure 2 - From EIA website

One can see from Figure 2 that Residential and Commercial purchases of electricity has continued to grow, regardless of recessions or change in petroleum supply, since 1975. Industrial consumption has been pretty flat, regardless. In 2008, total consumption is down, but most of the decrease is in industrial.

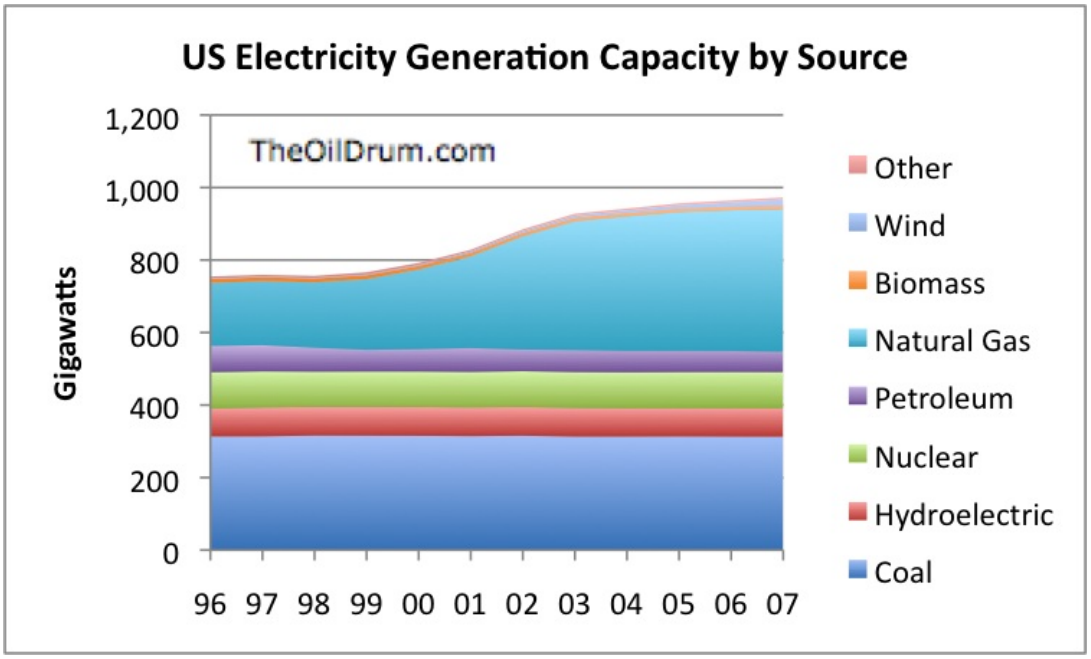

Figure 3

Figure 3 shows recent growth in US electricity generation capacity, based on EIA data. Electricity and nuclear have been absolutely flat in terms of capacity. Growth in production shown in Figure 1 came from greater use of existing capacity, rather than more capacity.

There has been a huge ramp-up of natural gas capacity in recent years. When this capacity was built in the early 1990s, natural gas was thought to be cheap (and it is looking increasingly that way now, again, but cheapness has bad implications for long term supply). While gas prices were high, electricity from natural gas was expensive, so much of the additional capacity is not used very heavily. Part of the low usage is by design as well-to add temporary higher capacity when needed. If necessary (and adequate is available), considerably more electricity could be generated using natural gas without building more plants.

Wind capacity can be barely be seen near the top as a thin blue line, next to the top. It clearly has a long way to go, to replace any substantial amount of the other fuels. Solar is not shown separately on the graph. It is part of "Other".

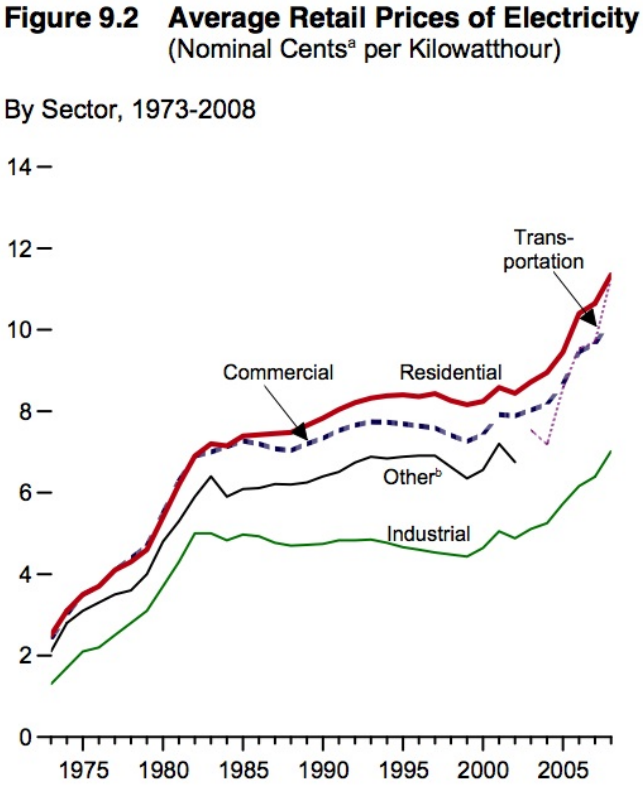

Figure 4 - From EIA Website

Figure 4 shows that electricity prices ramped up steeply in the 1973 to 1983 period, then were fairly flat until 2003 or 2004. After that they started ramping up again, as natural gas prices rose. If a person compares Figure 4 with Figure 2, it appears that the price of electricity is almost immaterial to residential and commercial consumers, when it comes to the amount of electricity purchased. The growth in demand is almost the same when prices were increasing rapidly as when they were flat. This makes one wonder how much difference carbon tax or cap and trade legislation will have on electricity usage, at least in the short term for residential and commercial consumers. More likely, a high price will result primarily in a drop in the purchase of other goods--perhaps restaurant meals, or a drop in new hires at a commercial establishment. Over the long term there may be a change in behavior because of higher prices, but short-term price-sensitivity seems to be quite low.

The only type of electrical demand which has not been growing is industrial use. It was growing very little, even when electricity prices were flat. Thus, it doesn't seem to be all that dependent on the price of electricity either. It may depend on other factors--cheaper labor overseas, or a

general recession.

A cap and trade program or a carbon tax would likely raise the price of electricity, but it is not clear whether the higher price would have much impact on total electrical consumption, except perhaps in the very long run. Short run demand seems very inelastic. If the price of electricity rises, consumers are likely to reduce the purchase of something else, rather than the electricity. Total electrical consumption will likely depend more on how the economy as a whole is doing. If families move in together, and stores close, consumption will be down. Thus, it seems like the big impact of a cap and trade program or carbon tax will be on the rest of the economy (unless they are somehow revenue neutral), not on electricity usage per se.

What happens to total electricity demand going forward?

In 2008, we are seeing a dip in demand, particularly for industrial use. If the recession gets worse, we could see this dip in demand continue, as families move in with each other, stores close, and industrial demand worsens. This scenario may actually be fairly likely, if the economy begins to contract significantly.

On the other hand, what most forecasters are expecting is that electricity use will continue to escalate in the years ahead, especially for residential and commercial users. In addition, if transportation is increasingly fueled by electricity, this will further add to demand. Because of this, they believe that total generation will need to continue to increase.

It seems to me that there are likely to be problems, regardless of whether total electricity use contracts or expands.

If demand contracts

If electricity demand contracts, electricity prices are likely to start increasing. One reason this happens is that a significant share of electricity costs are fixed, and do not decrease, even if the amount of electricity sold decreases. Also, new electricity generation will overlap with existing capacity, and the cost of renewable generation will be doubly high. This is the situation is already happening, as described in this article quoted in yesterday's Drumbeat.

> In Arizona, Tucson Electric Power in January raised rates 6%, or $4.29 a month for an average customer, to fund new solar power to meet state quotas. Solar is pricey, costing more than twice as much as natural-gas-fired electricity. And since Arizona has surplus natural-gas power, the solar energy is not replacing generators that would be built otherwise, says the utility's Joe Salkowski.

One issue is that utilities generally finance new capacity. They will need to pay the cost of this capacity, whether or not something else (like wind) replaces its production, so their costs don't necessarily go down, except by the price of the fuel they no longer need, which is only a small share of total costs.

If demand rises

If, on the other hand, electrical consumption continues to rise, it is hard to see where the necessary capacity will come from, especially if fossil fuels are out of favor. It will take a huge capital expenditure to provide enough wind capacity to compensate for growth. If wind or solar is

expected to replace coal or natural gas, or nuclear, that will be an additional challenge. If transportation is to be increasingly powered by electricity, this makes keeping up with demand all the more difficult. One can see from Figure 1 what a low percentage of electricity generation now comes from wind and solar.

On this site, we have been looking at the peak oil problem. If one talks to people in the electricity sector, their problems are almost as insurmountable, but for different reasons. It seems like every rock a person turns over reveals new problems.