Granite Viewpoint

An independent voice, exploring happenings in New Hampshire and New England

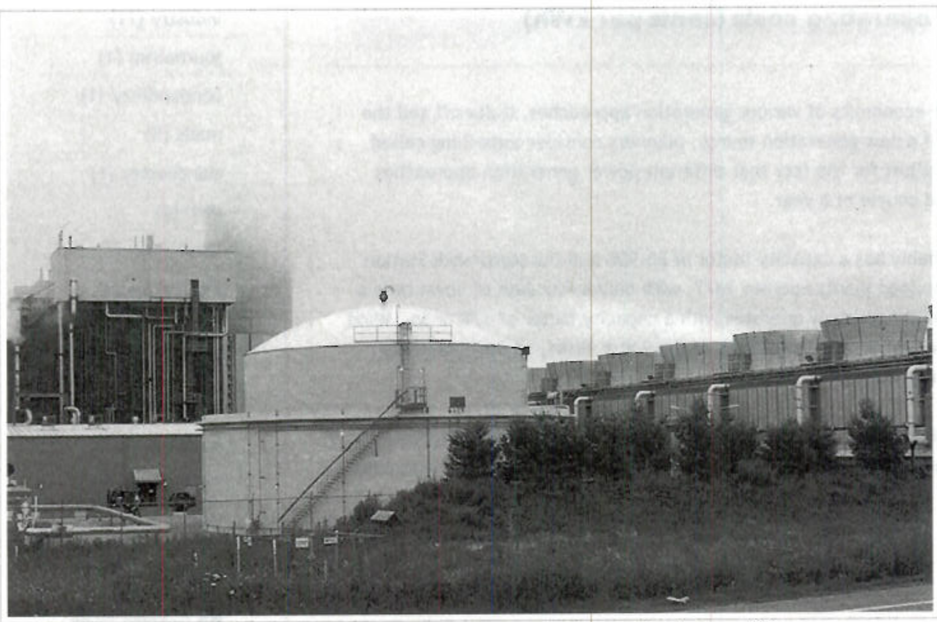
#110

THURSDAY, JULY 2, 2009

Electricity in NH - Power Generation Economics

New Hampshire is a net exporter of electricity, with over 50% of its electricity production consumed in other New England states. However, because the overall supply of electricity in New England is tight, and because electricity has no trouble crossing state boundaries, New Hampshire's electricity rates are heavily influenced by supply and demand factors all across New England. In addition, new state and federal regulations on power plant emissions and renewable energy generation are heavily influencing the economics of power generation in New Hampshire.

As a result of all this, NH has several new electricity generation projects in the works. Most of these new projects involve renewable energy such as wind and biomass and their success could help assure that New Hampshire has the electricity it needs to keep our homes comfortable and our industries vibrant. In each of these new projects, planners, developers, and regulators must correctly estimate and manage several economic variables that will make the difference between success and failure. Below I'll try to dig into the details of some of these factors.



Newington Energy's 606 MW Natural Gas Facility in Newington, NH

First, a caveat on this analysis and the charts and graphs I've made. I have a background in finance, but I'm not from the power industry and everything I know about electricity I learned from Google :) If you see something that doesn't make sense or doesn't look right, please use the comments to let me know.

Different electricity generation approaches have different tradeoffs, as can be seen in the graph below. The cost to build a new power plant, in $ per kW of capacity, is plotted on the y-axis, while the cost to operate the plant (including fixed, variable, and fuel costs) is plotted along the x-axis. You can get a good idea of the basic economic tradeoffs by comparing the positions of nuclear and natural gas. Nuclear power plants cost a lot to build, but because their fuel is inexpensive, they cost relatively less to operate. Natural gas plants are less expensive to build, but they burn more expensive fuel to generate power.

Other power plant operating costs can also be a big deal, especially in New Hampshire where property tax rates are high and variable. For example, the Newington Energy natural gas plant that's pictured above is

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With a focus on energy, finance, technology, and industry, this blog strives to provide analysis and insights on the issues of the day.

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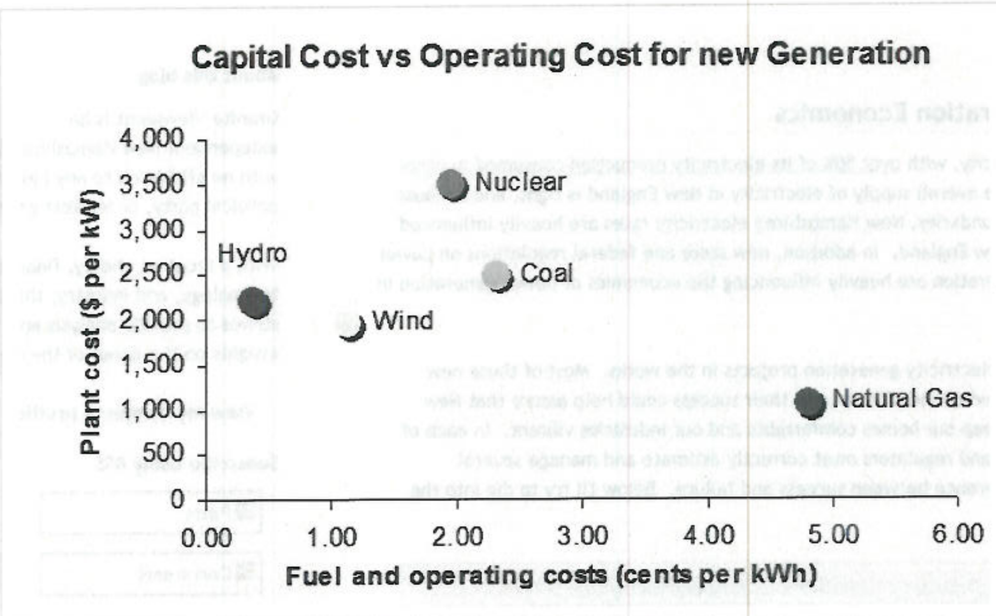
assessed at $256 million dollars and its owners pay around $2 million in annual property taxes. In Londonderry, the Granite Ridge facility is assessed at $235 million, but its owners pay over $4 million in annual property taxes. In both cases, property taxes will have a significant impact on the cost of the energy that these plants produce.



Although the graph above gives an idea of the economics of various generation approaches, it doesn't tell the whole story. When modeling the economics of a new generation source, planners consider something called the "capacity factor." This input helps them adjust for the fact that different power generation approaches can have vastly different productivity over the course of a year.

For example, the Seabrook Nuclear plant probably has a capacity factor of 85-90% and the Merrimack Station coal plant probably runs at 75-85%. These base load plants operate 24/7, with only a few days of down time a year. Conversely, the new Lempster Wind facility probably operates with a capacity factor of 37% or so. Wind and hydro power plants can only produce power when the wind blows or the water flows, so they generally have much lower capacity factors than fossil fuel or nuclear plants.

When you adjust the cost of building a new plant by its expected capacity factor, you get a very different graph, as seen below. Notice that nuclear and coal look much less expensive, while hydro and wind look more expensive.

Electricity in NH - Power Generation Economics
Greenland Mall Construction Update - #2
▶ June (17)

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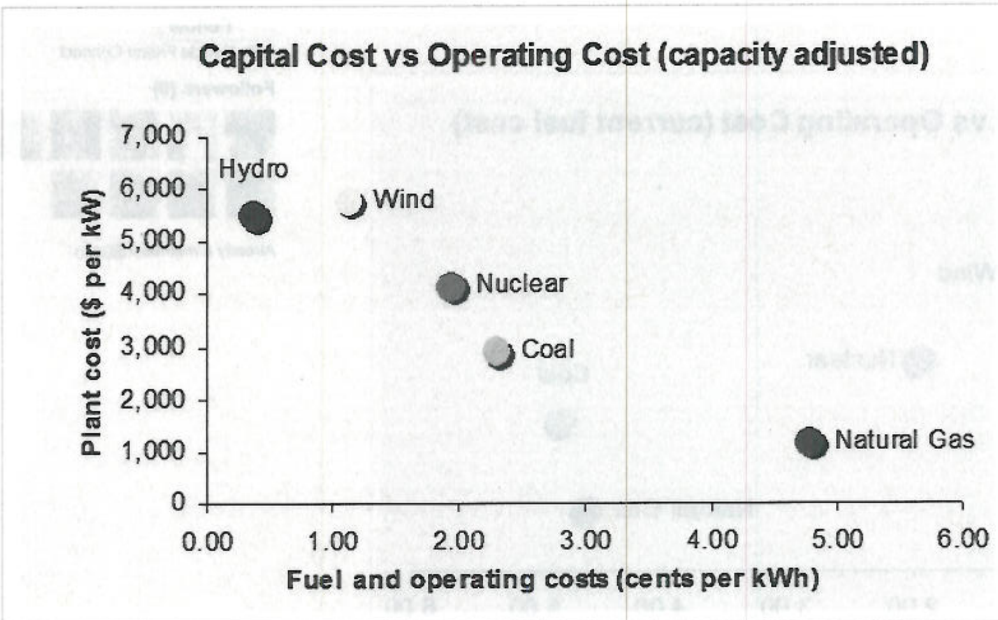
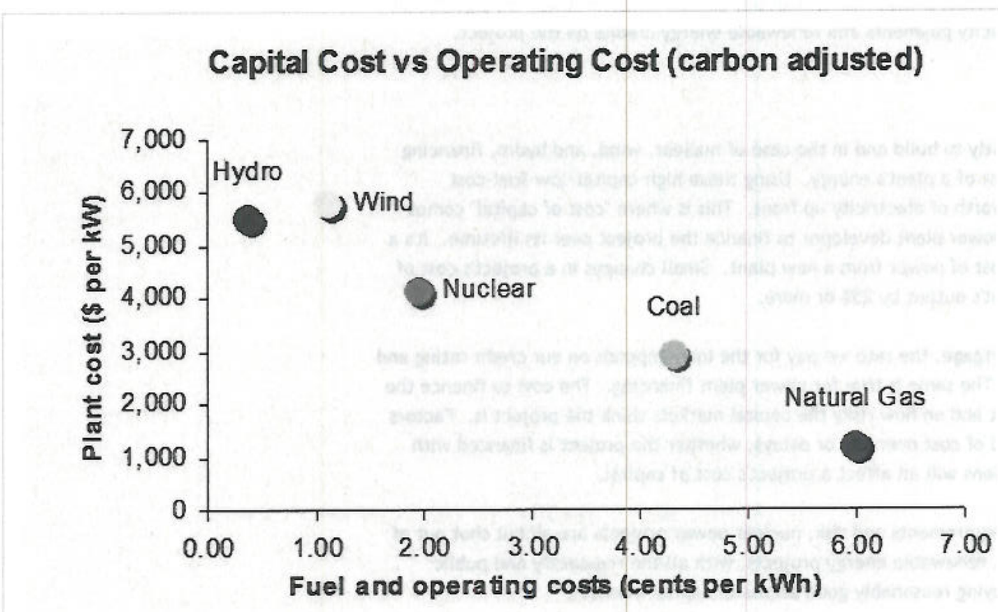


Next, it's only fair to adjust the graph above to compensate for the costs of the emissions released by the various generation technologies. I touched on the costs of emissions last week when I posted about the recently proposed cap-and-trade energy bill.

For the chart below, I priced carbon emissions at $20 per ton of instead of the $28 that I discussed in the cap-and-trade post. The true cost of power plant emissions is a hotly debated subject, but $20 is certainly enough to drive home how much emissions costs can impact the economics of power generation. You'll notice that both coal and natural gas become more expensive when emissions costs are added in, while hydro, wind, and nuclear remain unchanged.



I made one more graph to show how the vagaries of the market can toss a monkey wrench into the best laid plans of power plant developers. Recently, the relative costs of coal and natural gas have moved in opposite directions and if the new relationship persists, it will have a big impact on the economics of power generation. The cost of natural gas went from $6.53 per million Btus (mmBtu) last year to as low as $4.30 recently. Meanwhile, the delivered cost of coal has increased from under $2.00 to over $2.50. Most economists expect the costs to reset back to their historical relationship, but the graph below shows what the economics looks like if they don't. You can see that with these prices, it finally looks like a good time to own a

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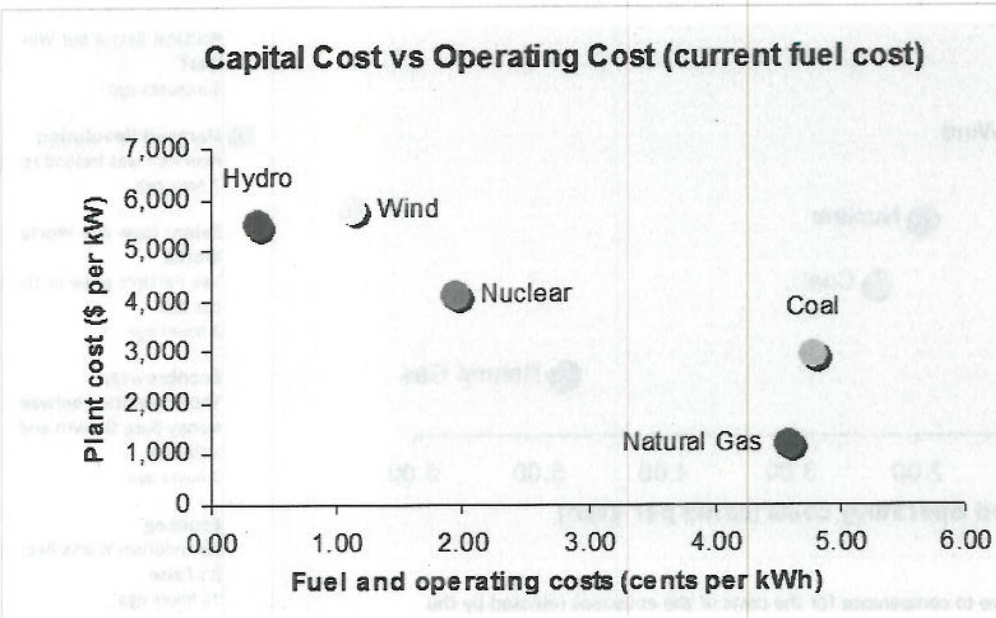

Source Data for the charts above:

- Table 8.2 from this Department of Energy EIA report
- Tables 1a and 1b from this ethree.com California PUC report (30. New generation summary)
- Summary data used to produce graphs 1-3
- Summary data used to produce graph 4

We've touched on the basic economic considerations of electricity generation, but I've left out a few other important factors. The main ones are the power plant's cost of capital, the tax treatment and tax benefits of a project, and finally, the impacts of capacity payments and renewable energy credits on the project.

Cost of Capital

Power generation facilities can be very costly to build and in the case of nuclear, wind, and hydro, financing costs represent a huge part of the total cost of a plant's energy. Using these high-capital/low-fuel-cost approaches is like prepaying for 20 years worth of electricity up front. This is where "cost of capital" comes into play. Cost of capital is the cost to a power plant developer to finance the project over its lifetime. It's a crucial factor in determining the overall cost of power from a new plant. Small changes in a project's cost of capital can easily impact the cost of a plant's output by 25% or more.

When you or I apply for a car loan or a mortgage, the rate we pay for the loan depends on our credit rating and on how risky the bank considers the loan. The same is true for power plant financing. The cost to finance the project depends on who's doing the project and on how risky the capital markets think the project is. Factors such as the technology used, the likelihood of cost overruns or delays, whether the project is financed with debt or equity, and general market conditions will all affect a project's cost of capital.

Currently, because of their large capital requirements and risk, nuclear power projects are all but shut out of the capital markets in the US. Conversely, renewable energy projects, with all the regulatory and public attention they are getting lately, are enjoying reasonably good access to capital markets.

Tax Benefits

The tax treatment of a project's capital costs can also have a significant impact on the cost of the energy that a plant produces. The quicker a plant owner can write-off their capital outlays, the more economical the plant will usually be. Capital costs for most power plants are depreciated over a 15 year period, however wind, solar, and some other renewable energy sources are allowed to depreciate their capital outlays over 7 years. Faster depreciation lets plant owners offset profits from other projects and pay less taxes, which boosts their overall profits and cash flow.

Capacity Payments (updated)

Electricity generators in deregulated electricity markets may receive payments called "Capacity Payments" from a capacity auction process or from sales of their capacity to utilities . Capacity trading systems are designed to encourage the construction of new generation capacity and to assure a reliable power grid. In their 2007 Least Cost Integrated Resource Plan (fig G-14), PSNH estimated capacity costs to be in the range of $3,000-4000 per month per megawatt of generation capacity. This payment is based on the unforced or available capacity that a generator promises to bring to market.

Renewable Energy Credits

There are several state and federal regulations that provide tax credits for renewable power generation. There are also regulations that provide for penalty payments if a utility doesn't get enough of their power from renewable sources. These incentives, which can be as high as $30 per MWh of energy produced, can allow otherwise marginal renewable projects to become economically feasible. The idea is that the subsidies will cause these new energy sources to be developed more quickly, which will reduce our dependence on foreign energy sources and benefit the environment.

Wrapping up

I've presented the basic economics underpinning electricity generation and have hopefully at least touched on the major factors. What I've learned is that you can't just look at fuel cost or the construction costs when considering the economics of a generation source.

The ethree.com report that I linked to above pulls all these cost factors together pretty nicely. They list something called the "Busbar Levelized Cost of Energy" for each generation source (in $/MWh), and then add in some other interconnection and transmission costs to come up with a final estimate. Although this analysis was done for California, and it modeled generation sources coming online in 2020, the results are still interesting.

Their final cost estimates are shown in the last column of table 4b and are given as ranges that vary widely. For me, working through the details of this report, then noticing the wide ranges in their final estimates, really drove home the difficulty in predicting future energy costs in the face of so many complex and uncertain factors.

Posted by Granite Viewpoint at 2:30 PM

Labels: electricity, finance, Londonderry, Newington

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