Getting Along Without Pilgrim Nuclear

September 26, 2015 | by Brian E. Boyle, Ph.D.

Some people raise concerns about what would happen to the electric grid without Pilgrim Nuclear Power Station's electricity generation. It is often referred to by the nuclear industry as critical to the grid.

The reality is quite the opposite. **Pilgrim is just one of many electricity generators. In fact Pilgrim represents just 2% of total grid capacity.**

New England Electrical Grid

The electricity used in Massachusetts is primarily drawn from an integrated New England electrical network of 350 generating plants and sources. ISO New England, the independent non-profit entity created in 1997, is responsible for making sure that the grid operates efficiently, and for keeping electricity flowing across the six-state New England region: Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, and Vermont[1].

ISO-NE also runs the billion-dollar markets where wholesale electricity is bought and sold. The local power companies are responsible "downstream" for distributing that wholesale electricity to 6.5 million households and business users of electricity.

Capacity of the Grid

The 350 generating plants have a total capacity of approximately 31,000 MW (million or mega-watts).

The grid is designed to have excess capacity to handle peak loads typically caused by unusually hot days when air conditioners are operating. The all-time peak demand record was on August 2, 2006, when the temperature in Boston reached 98°F and 28,130 MW of capacity was used. The 10th highest day on July 19, 2005 needed 26,736 MW. The highest winter day needed 22,818 MW[2].

Pilgrim Nuclear has a theoretical capacity of 685 MW, and averages about 90% operational, so that's an effective capacity of about 616 MW. 616 MW Pilgrim effective capacity / 31,000 MW total capacity = 0.020.

So Pilgrim Nuclear represents just 2.0% of total grid capacity.

Pilgrim Nuclear's Size

Pilgrim is a relatively small nuclear reactor that was built inexpensively with an early General Electric "Mark I" Boiling Water Reactor design that has proven to not be able to withstand certain external events, such as occurred at Fukushima in Japan. Pilgrim is the smallest of the four nuclear reactors in the ISO-NE grid, about two-thirds the size of the other reactors, and about the same size as the Vermont Yankee reactor retired last year. Yet because of its location and an accumulation of 40-plus years of spent nuclear fuel, it has the potential to create a disaster way beyond its size.

Nuclear Power Is Waning

According to ISO-NE's 2015 Regional Electricity Outlook:

> "New England has long relied on its nuclear plants to help supply baseload power (the region's minimum electricity needs). But the 2014 closing of the Vermont Yankee Nuclear Power Station is another example of how interrelated market and policy forces are shaping the region's generating fleet. Energy prices in the wholesale electricity markets may be too competitive for some nuclear resources because of the shale gas boom— particularly those facing rising operating and capital costs related to age and Nuclear Regulatory Commission requirements. And the building of new nuclear resources in the region is unlikely."[3]

New Generation Capacity

Investment in about 15,000 MW of new, efficient, low-carbon-emitting generation has been brought in since 1997 when ISO-NE began operations[4].

About 9,500 MW of new generation projects were being proposed as of January 2015, with over 25% situated close to load centers, which helps reduce the need for transmission system improvement[5]. Natural gas and wind power dominate new resource proposals in the ISO-NE queue. It is important that the 30% of these projects estimated to come to fruition indeed do so, and also be located within New England where transmission capacities exist in order to keep the grid balanced while meeting demands in the various cities and other load regions.

Looking ahead, "the long-term forecast for electricity use from 2015 to 2024 projects that energy usage will remain flat in New England and peak demand will grow slowly."[6] Included in that forecast are important energy efficiency measures and load reductions from the future installations of solar PV facilities[7]. Distributed solar facilities help offset the electricity usage locally, and reduce the need to transmit electricity over the high-voltage network. 73% of New England solar PV installed capacity is in Massachusetts, and that capacity is forecasted to double by the year 2022.

Got Along Without Pilgrim Nuclear in the Past

Those who can remember back to the summer of 1972 can recall that we all had electricity that worked just fine every day. There was no Pilgrim Nuclear then, as the reactor construction hadn't yet been completed. In addition to numerous shutdowns of several days to several weeks, Pilgrim was shutdown over management problems for almost three years in 1986-1988, which spanned three peak-load summer seasons[8].

Can Get Along Without Pilgrim Nuclear in the Future

Since then the grid has grown and matured, and ISO-NE has taken on the added responsibility of "planning to make sure New England's electricity needs will be met over the next 10 years[9]." **Capacity several times that of Pilgrim Nuclear is already in the works**. That said, ISO-NE foresees a number of generator retirements in the future, making its strategic planning efforts as well as generator replacements important to maintaining the integrity of the grid. With renewables still a relatively small fraction of the mix, the retirement of older oil and coal-fired plants are being replaced with increasing reliance on natural gas-fired plants.

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[1] Prior to 1997, the energy industry was more regulated and less competitive, and each local power company typically owned its own generating plants.

[2] ISO New England website http://www.iso-ne.com/about/what-we-do/key-stats ISO New England also maintains a reserve of about 2,000 MW at any given time to be able to quickly replace the output of the largest electricity generators, in case of its failure.

[3] ISO New England 2015 Regional Electricity Outlook http://iso-ne.com/static-assets/documents/2015/02/2015_reo.pdf

[4] That would equate to the capacity of about 24 Pilgrim Nuclear reactors.

[5] ISO New England 2015 Regional Electricity Outlook http://iso-ne.com/static-assets/documents/2015/02/2015_reo.pdf. That would equate to the capacity of about 15 Pilgrim Nuclear reactors. However, according to ISO-NE about 70% of projects in the queue do not get implemented for one reason or another. Also, there are other plants that are planning to be retired in the future. By 2018, 10 percent of the region's non-gas power generation capacity will retire.

[6] ISO New England newswire, May 5, 2015, *Long-term forecasts: electricity usage will remain flat and peak demand is expected to grow slowly.* *http://isonewswire.com/updates/2015/5/5/long-term-forecasts-electricity-usage-will-remain-flat-and-p.html*

[7] ISO New England, *Final 2015 Solar PV Forecast Details* http://www.iso-ne.com/static-assets/documents/2015/04/2015_solar_forecast_details_final.pdf

[8] New York Times, Jan 1, 1989, *Pilgrim Reactor Restarted After 3-Year Shutdown* http://www.nytimes.com/1989/01/01/us/pilgrim-reactor-restarted-after-3-year-shutdown.html The hottest day in Boston during that shutdown period was July 11, 1988 with a high temperature of 98°F, the same high temperature on the all-time peak demand record day August 2, 2006.

[9] ISO New England website http://www.iso-ne.com/about/what-we-do/three-roles