Natural Gas in Connecticut

Assessing the state's options for a clean energy future

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Along with the rest of New England, Connecticut is seeing its energy industry begin to transform. Demand for electricity has flattened as a result of energy efficiency. Numerous nuclear plants have retired or announced their impending closure. Renewable additions have accelerated. And perhaps most controversially, natural gas has grown more prominent than ever.

New England stands at an energy crossroads: should it double down on natural gas infrastructure? Or should it embrace its legally required clean energy future and adopt reasonable alternatives?

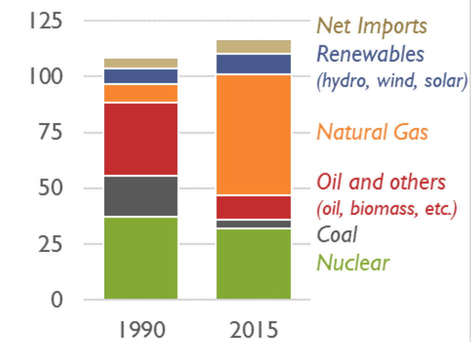
A Changing Energy Sector

For much of the 20th century, it was thought that demand for electricity and end-use energy would continue to steadily increase into the future. Our experience of the past 25 years shows otherwise: energy efficiency efforts and changing economies have caused electric sales in New England to remain essentially flat since 1990, growing at just one-half a percent per year, while demand for fuels to heat spaces and water in homes and businesses has decreased by over 5 percent compared to 1990.

At the same time, the composition of the fuels we use to power and heat our homes has changed: the use of oil for electricity generation and end uses in the residential, commercial, and industrial sectors has decreased by 93 percent compared to 1990. Coal use has also dropped dramatically. Coal-fired generation is down by 80 percent across New England, and all but two of New England's remaining coal power plants are slated to be retired by 2017. Nuclear generation has also decreased: since 1995, New England has seen the closure of two nuclear plants, with a third to shut down by 2019.

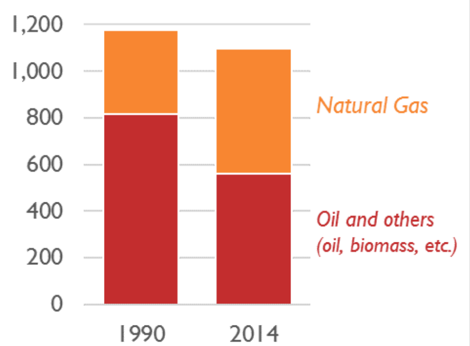
Meanwhile, the demand for natural gas in Connecticut and New England has skyrocketed. In part because of the Connecticut state government efforts to switch consumers from oil to natural gas, natural gas consumption in the state has doubled since 1990. Electricity production encompasses 40 to 50 percent of this gas use. Total gas consumption in Connecticut has increased by 3.5 percent per year compared to the average increase in the other New England states of 2.9 percent per year. While the use of wind and solar has also grown at a rate of nearly 50 percent per year over the past five years, these resources still represent just 6 percent of the region's overall electricity mix. Indisputably, our region has become dependent on natural gas.

Fig 1. Electricity production in New England by fuel type (TWh)



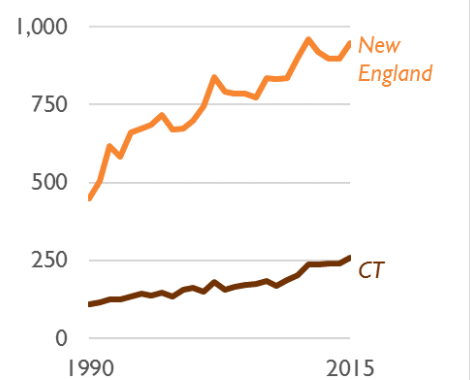
Source: EIA

Fig 2. New England residential, commercial, and industrial fuel use (trillion Btu)



Source: EIA

Fig 3. Natural gas consumption (trillion Btu)



Source: EIA

The Risks of Dependence

This over-dependence on natural gas raises questions about New England's energy future. Over the past several years, energy prices have spiked during the winter, largely attributable to constraints on the natural gas system. Average natural gas prices have remained low for several years, but the volatile prices of the fuel in years past weigh heavily on many consumers' minds. To many, expanded pipeline infrastructure seems to offer the quickest fix.

However, this approach could lead states like Connecticut to violate on-the-books laws requiring reductions in greenhouse emissions (including carbon dioxide and methane) from fossil fuel sources like natural gas. In addition to the federal Clean Power Plan requirements, electric generators in Connecticut must meet emission caps specified by the Regional Greenhouse Gas Initiative (RGGI) and Connecticut's Global Warming Solutions Act (GWSA). Intended to help avert catastrophic climate change, Connecticut's GWSA requires an 80 percent reduction in carbon dioxide emissions by 2050 and likely leaves little room for natural gas use at all. Concurrently, state policies such as energy efficiency resource standards and renewable portfolio standards increasingly require a switch away from polluting fuels to cleaner ones.

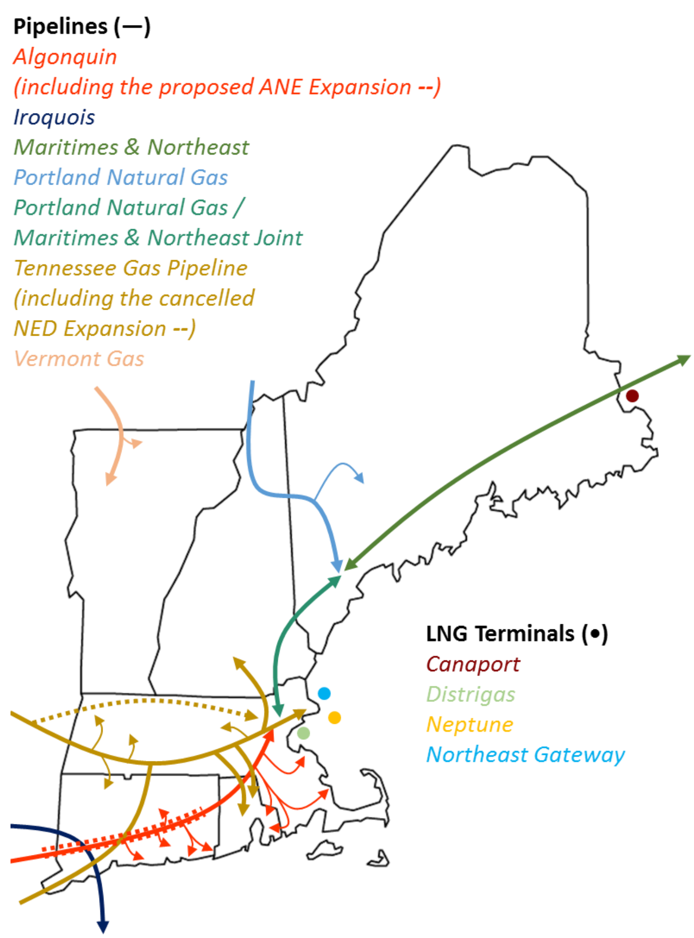
Investment in new gas pipeline may seem attractive in the very near term, but will likely become a stranded asset in the medium- to long-run. This would leave Connecticut's consumers on the hook for paying for a resource that is unneeded and unused.

Challenges in Planning

Connecticut is just one part of a six-state electricity system. Electric utilities in Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, and Maine work together in a single power pool controlled by the New England Independent System Operator (ISO-NE). ISO-NE coordinates the dispatch of power plants to ensure reliable electricity is provided to all New England ratepayers. ISO-NE also oversees long-term planning to ensure adequate generating capacity and transmission is in place for the future. Most of the electricity consumed in New England is generated in-region, with just 5-15 percent imported from New York and Canada.

The six states also share an interconnected natural gas pipeline and distribution system, which overlaps and connects with the electric system. Unlike electricity, all of the natural gas used in New England is imported from other states, Canada, or via liquefied natural gas (LNG) deliveries to a handful of sites. Upon delivery, large transmission pipelines pump natural gas into the region where it is then (a) delivered to end-use customers through smaller pipeline distribution systems, (b) sent to power plants via pipeline laterals, or (c) stored (in the form of LNG) until needed in storage facilities located throughout the region.

Figure 4. New England's Natural Gas Infrastructure



Source: Synapse Energy Economics

Unlike for the electric system, there is no coordinating agency for New England's natural gas system. Nearly 100 electric generators, 50 end-use utilities, and numerous industrial facilities purchase fuel from New England's many natural gas suppliers without any coordinated planning. End-use utilities and industrial facilities tend to reserve natural gas from pipeline owners through long-term "firm" contracts, whereas most electricity generators purchase available natural gas on the spot market. This leaves electric generators particularly vulnerable to supply constraints and price fluctuations, especially during cold winter days when demand for natural gas for both heating and electricity is very high. During these spikes in natural gas prices, electricity generators must buy more expensive gas. These higher prices are then passed to consumers.

As the overall use of natural gas has increased over the past several years, stakeholders have become more concerned with finding ways to address these potentially costly price spikes. Multiple solutions to this issue have been proposed, with some already being implemented. Some of these solutions include:

- **Increased procurement of renewables and energy efficiency:** Although not implemented solely to decrease winter peak spikes in prices, changes to state energy efficiency plans and renewable procurement laws (such as Massachusetts' Summer 2016 large hydro requirement) are expected to offset a portion of future natural gas demand.
- **Increased use of existing infrastructure:** Another potential solution is to guarantee ship-borne deliveries of LNG to existing terminals in New England, through the use of long-term contracts or other incentives. Other infrastructure solutions involve more strategic use of existing storage facilities and repairing leaking pipeline infrastructure.
- **Construction of New Pipelines:** Some have proposed to construct new pipelines or expand existing pipeline infrastructure. These projects would be paid for in part by electric generators (and passed through to electric ratepayers). In theory, asking electric ratepayers to pay for part of the pipeline would decrease the risk of entering into long-term contracts for electric generators. Furthermore, more pipeline capacity would increase the overall potential of the system to supply natural gas, helping to avoid price spikes (at least until demand catches up with the newly constructed supply). Although government entities in several New England states initially approved this approach, the Massachusetts Supreme Judicial Court and the New Hampshire Public Utilities Commission both ruled in 2016 that state law prohibits such a pipeline contract.
- **Changes to ISO-NE rules:** Although it does not have jurisdiction over natural gas markets, ISO-NE has made changes to electricity markets with the aim of lowering prices and ensuring reliability. Following supply constraints and large price spikes during January 2014, ISO-NE put in place a temporary "winter reliability" program that encourages generators with dual-fuel capabilities to keep a supply of oil onsite in case of gas shortages. ISO-NE has also adopted changes to its market rules that will penalize resources that cannot perform during times of greatest system need, aiming to incentivize gas generators to contract for firm gas supply. Despite the 2014-2015 winter being colder than the 2013-2014 winter, overall electricity costs to consumers were reduced by over 40 percent, part of which can be attributed to changes in ISO-NE rules.

Analyzing the Potential Solutions

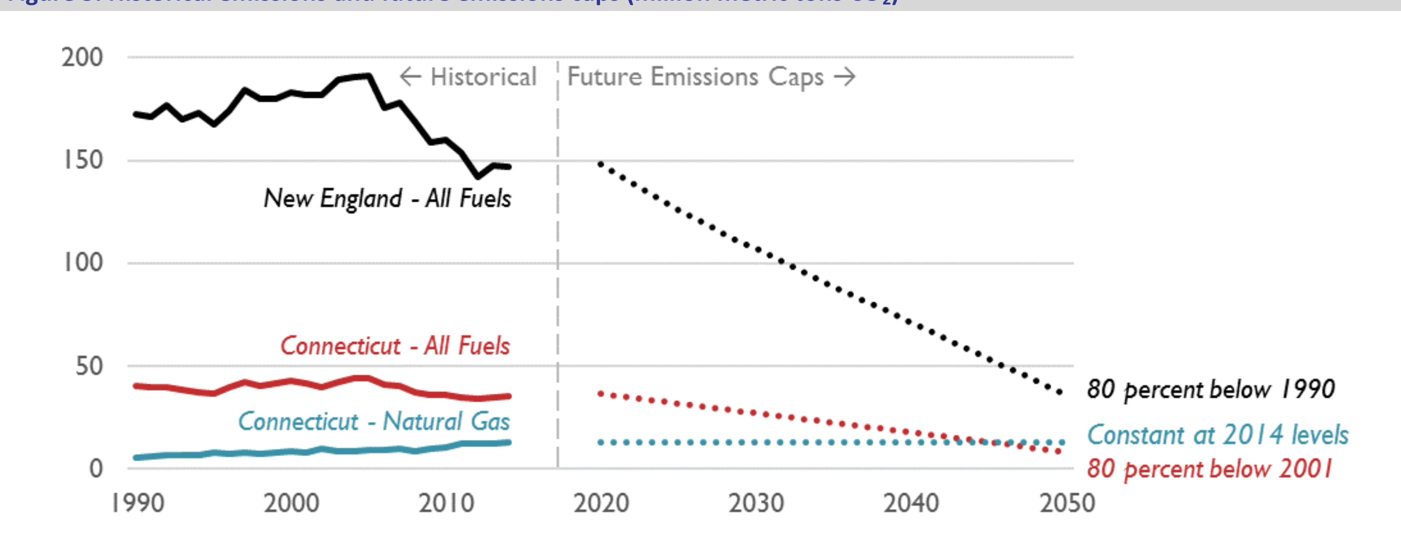
Numerous reports analyzing one or more of the above solutions have been released over the past few years by entities ranging from state offices—including the Massachusetts Attorney General, the Maine Public Utilities Commission, and the Massachusetts Department of Environmental Resources—to utilities and pipeline developers such as Eversource, National Grid, Spectra, and Kinder Morgan. Each of these reports has examined different questions, including whether new pipeline infrastructure will be needed for reliability or for economic reasons and whether a new pipeline is the most cost-effective solution compared to alternatives.

Perhaps unsurprisingly, each of these reports has come to different conclusions about the need for a pipeline, the potential net benefits of a pipeline, or the set of alternatives that would yield still better benefits than a pipeline-based solution. Unfortunately, many of these studies have notable drawbacks, including using outdated information on future electric sales estimates or natural gas price projections, or failing completely to account for legally mandated emissions reductions.

This last omission is perhaps the most glaring: While by 2014 New England emissions had reduced by 15 percent compared to 1990 levels, emissions will need to be reduced by an additional 23 percentage points by 2030 in order to stay on track with state emission requirements. By 2050, emissions will need to be reduced to levels of 80 percent below 1990. For Connecticut, this means that with no changes, emissions from its natural gas consumption alone will exceed its emissions cap for all fuels statewide by the year 2046.

Given these legal constraints on carbon dioxide emissions, it is unlikely that natural gas use in New England will be able to continue to increase, or even remain at current levels, eliminating the need for major new pipeline infrastructure.

Figure 5. Historical emissions and future emissions caps (million metric tons CO_2)



Note: Connecticut's GWSA requires emissions to be 80 percent below 1990 emissions levels by the year 2050, or about 9 million metric tons of CO_2-equivalent. Natural gas use in Connecticut was by itself responsible for 13 million metric tons of CO_2 in 2014. This figure does not include greenhouse gas impacts associated with methane leaks or upstream production. Source: Synapse Energy Economics

About Synapse

Synapse Energy Economics, Inc. is a research and consulting firm specializing in energy, economic, and environmental topics. Since its inception in 1996, Synapse has grown to become a leader in providing rigorous analysis of the electric power sector for public interest and governmental clients.

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