Recommendations for Analysis in Natural Gas Expansion Study

September 27th, 2013

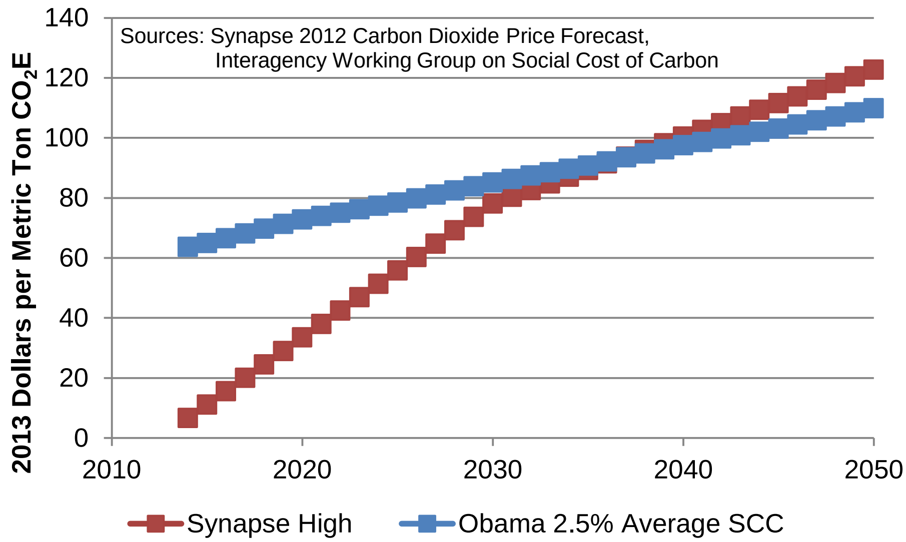
We would like to thank the Department of Energy Resources and Sussex Economic Advisors for conducting stakeholder outreach as a part of the Natural Gas Expansion Study. While we understand the Department's interest in moving forward expeditiously, the currently contemplated pace risks sacrificing the accuracy and validity of the study results. We urge the Department to provide Sussex with additional time to gather the necessary data and resources to complete the study. In addition, we offer the following recommendations:

- Thorough analysis would consider all relevant heating options simultaneously, including technologies like electric heat pumps, to develop a truly optimal strategy for Massachusetts. In the absence of a single report, the Natural Gas Expansion Study must fully take into account and complement, rather than undercut, the Commonwealth Accelerated Renewable Thermal Heating Strategy (CARTS) analysis and impending report.
- The Massachusetts Global Warming Solutions Act (GWSA) must be a part of the base case analysis. The GWSA established legally binding greenhouse gas (GHG) reduction targets for 2020, 2030, 2040, and 2050. There are two ways that these mandates should be examined in this study. First, the analysis should include a price on greenhouse gas emissions applied to the lifecycle emissions of relevant options. Second, the analysis should consider the lifecycle GHG emissions from any expansion in natural gas use through 2050 to allow for comparison with the GWSA limits. The analysis should also compare projected greenhouse gas emissions from total natural gas consumption with statewide greenhouse gas emissions targets.
- While it is not yet possible to comment on all policy options under consideration, there are a few general principles that apply. Energy efficiency, including thermal efficiency, must continue to be the resource of first resort, consistent with state law. Because of this, any conversions to natural gas must seize the opportunity for high efficiency furnaces and the incorporation of additional energy efficiency investment. Reforms to the payback period for hurdle rate calculations should be undertaken in order to prevent stranding costs in home heating systems that emit substantial amounts of GHGs and are incompatible with emission reduction targets. Another potential avenue for ensuring that any expansion does not jeopardize the achievement of the GWSA mandates would be the creation of a system transformation charge on any expansion projects that would fund additional energy efficiency and renewable thermal options by adding a charge to each therm of natural gas delivered.

The remainder of this memo elaborates on these points. The key factors here will be the inclusion of a reasonable price on greenhouse gas emissions and a full lifecycle analysis of the greenhouse gas impacts of any proposed natural gas expansion. We recommend the use of two different GHG price trajectories in all scenarios, one based on the environmental damages of GHG emissions and one based on the cost of reducing GHG emissions. We further recommend that the damage-based price should be the recently updated values from the Obama Administration's Interagency Working Group on the Social Cost of

Carbon using a discount rate of 2.5% and that the reduction-based estimate should be based upon the high estimate from the Synapse 2012 Carbon Dioxide Price Forecast.[1]

Figure 1. Recommended GHG Price Trajectories[2]



Analysis Must Reflect Compliance with Massachusetts Global Warming Solution Act

The Massachusetts Global Warming Solutions Act, enacted in 2008, must be a part of the policy baseline as current law. Any projected expansion of natural gas distribution must be analyzed in the context of whether such an expansion of long-lived fossil fuel infrastructure can conform to the mandates of the GWSA, including the 2020 and 2050 mandates. It is not the role of either the Department of Energy Resources or its consultants to assume non-compliance with applicable statutes or repeal or amendment of the existing law.

The GWSA allowed the Secretary of Energy and Environmental Affairs to set an emissions limit for 2020 that is between a 10% and 25% reduction from 1990 levels within the state. M.G.L. § 21N-4. In 2010, the Secretary set the limit for 2020 at a 25% reduction from 1990 levels.[3] The GWSA mandates a 2050 emissions limit of at least 80% below 1990 levels and provides for interim targets in 2030 and 2040. M.G.L. § 21N-3. The Massachusetts Annual Greenhouse Gas Inventory has estimated 1990 emissions at 94.4 million metric tons carbon-dioxide-equivalent ($MMTCO_2E$).[4] This puts the 2020 limit at 70.8 $MMTCO_2E$ and the 2050 limit at 18.9 $MMTCO_2E$.

Natural gas price projections contained in the base case of the Energy Information Administration's 2013 Annual Energy Outlook or the section on natural gas prices in Synapse's Avoided Energy Supply

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[1] We believe that the Synapse high CO_2 price projection from 2012 is most appropriate as it reflects the more aggressive emission reduction commitments nationally and internationally consistent with the progression of climate policy over the last several decades, and prudently high costs for carbon capture and sequestration, new nuclear, and biomass. (See *2012 Carbon Dioxide Price Forecast* from Synapse Energy Economics.)

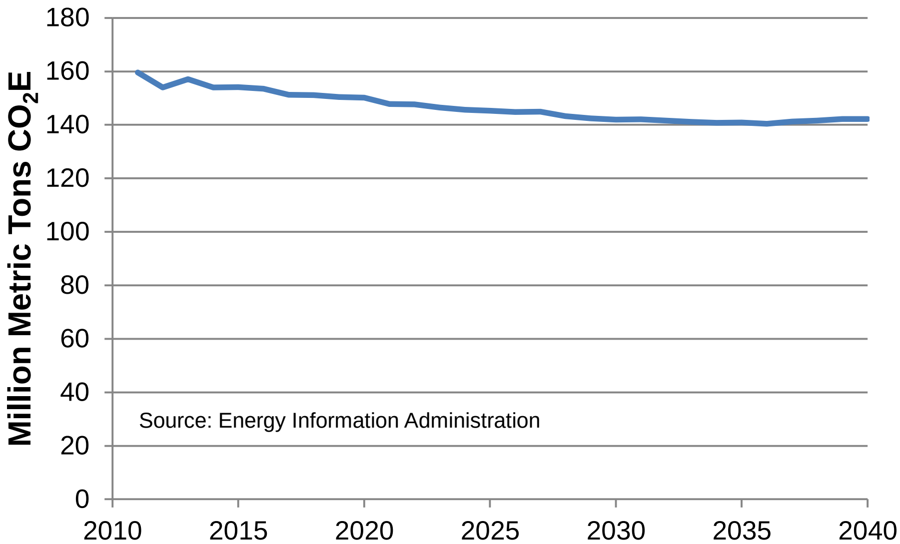
[2] "Synapse High" prices for 2040-2050 are linear projections of Synapse values from 2030-2040. 2014-2020 values are liner interpolations between current prices and 2020 Synapse price.

[3] http://www.mass.gov/eea/docs/eea/energy/2020-ghg-limit-dec29-2010.pdf

[4] http://www.mass.gov/eea/agencies/massdep/air/climate/global-warming-solutions-act-gwsa-implementation.html

Cost study are not consistent with compliance with the GWSA.[5] Figure 2 shows projected greenhouse gas emissions for New England in the 2013 AEO.

Figure 2. New England GHG Emissions in AEO 2013 Base Case



The emissions levels in this projection are far too high for Massachusetts to meet the long-term GWSA limits. For example, in this scenario, New England's GHG emissions are only reduced by 5% from 2020 to 2040. However, Massachusetts must reduce its emissions by approximately 50% over this period to be on track to meet the 2050 limit.

It is essential to account for the GWSA-mandated reductions by incorporating a price on GHG emissions into the analysis for the Natural Gas Expansion Study. One rationale for this is the likelihood that an explicit price will be incorporated on the relevant fuels in order to incentivize less carbon-intensive energy sources. However, even if such a price is not placed on relevant fuels, such a price can be conceptualized as the "shadow price" on the combustion of natural gas - the cost of achieving reductions from other sources and policies to meet the statutory mandates. Both of these conceptions of a price on GHG emissions are based on the cost of achieving reductions. An alternative conception, frequently referred to as the social cost of carbon, is based upon the benefits of eliminating an additional ton of emissions.

Figure 3 displays a wide range of prices on GHG emissions derived from several different sources and methods, including the AESC 2013 price projection.

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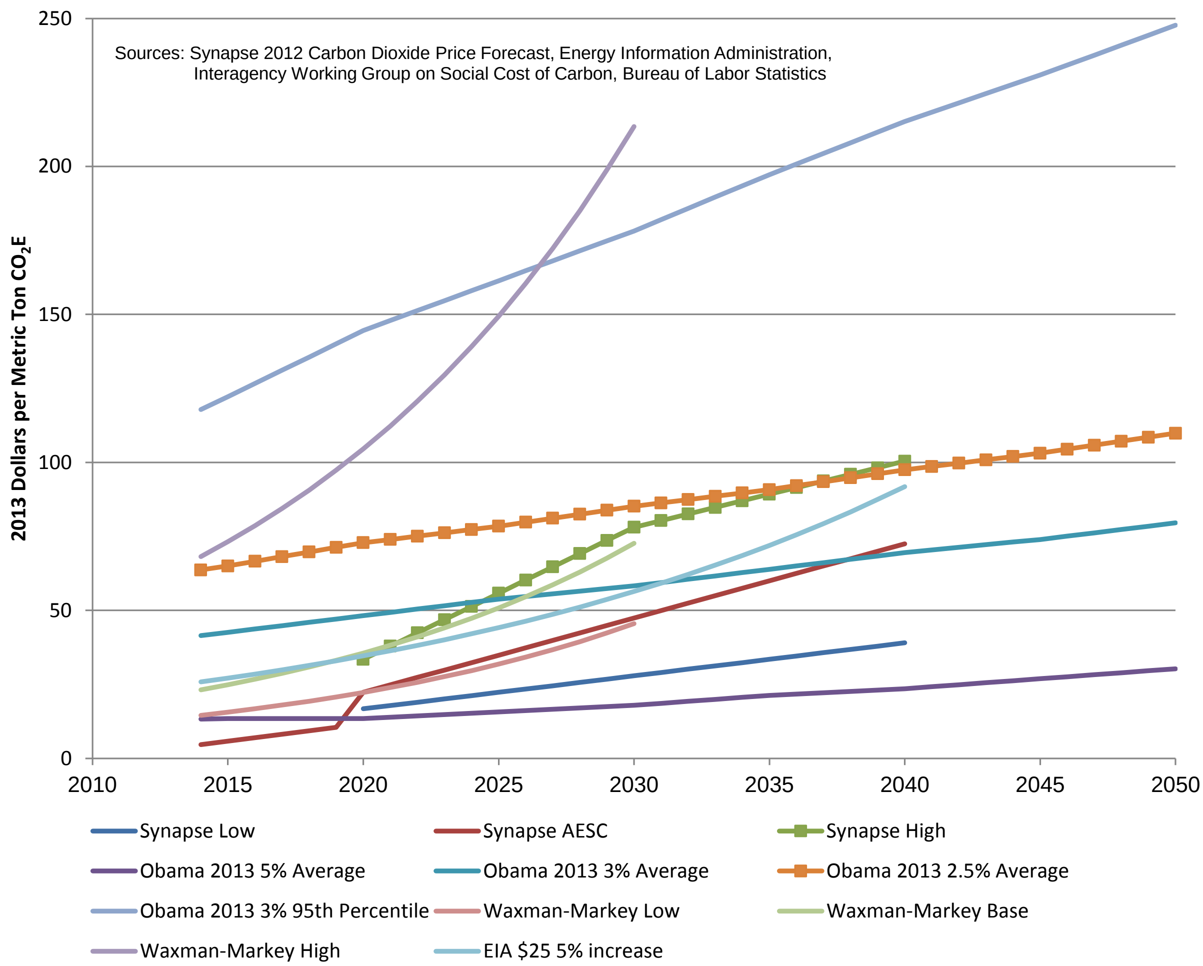
[5] We believe that the price trajectory for natural gas developed by Synapse for the Avoided Energy Supply Costs of New England: 2013 Report, represents one of the most comprehensive forecasts for natural gas prices because it includes potential costs for best practices associated with hydraulic fracturing, an estimate of the potential costs for compliance with the NSPS for volatile organic compounds, and the adjustment to the Henry Hub forecast included in the EIA 2012. However, it should be noted that the Synapse analysis does not include the impact of potential LNG exports (via export terminal projects in the permitting queue and/or approved by FERC), does not include an analysis of the impact of significant increases in demand for natural gas on price, does not include compliance costs for the National Emissions Standards for Hazardous Air Pollutants ("NESHAPS"), nor does it include any of the additional costs that would accompany the kind of transmission expansion that is contemplated by the Synapse report.

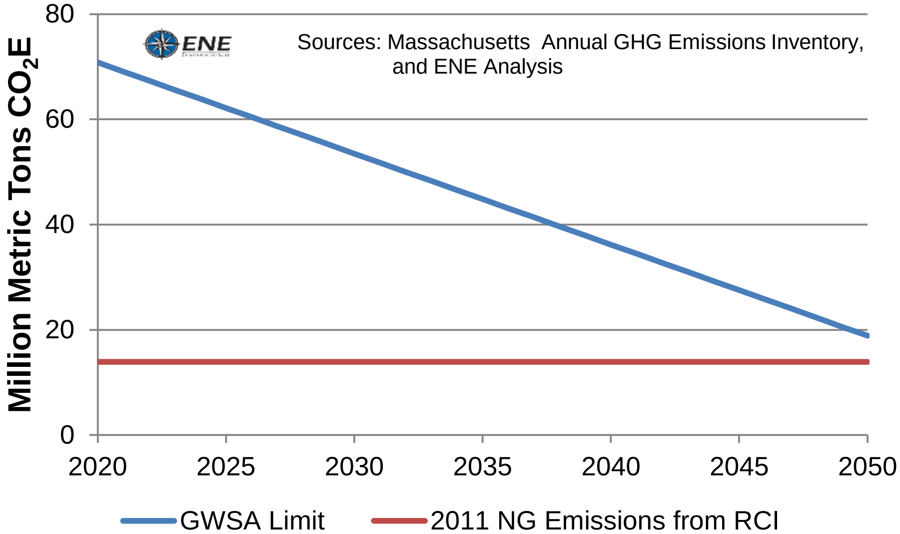
Figure 3. GHG Prices from Numerous Sources



In a dynamic market, a price on greenhouse gas emissions will change underlying fuel prices. To adjust for such changes, it may be desirable to adjust those prices using estimates based on the greenhouse gas pricing sensitivity scenarios performed by EIA as a part of the 2013 Annual Energy Outlook.

An additional check to make sure that a proposed expansion of natural gas usage will be consistent with the GWSA is to directly compare the expected emissions from natural gas with the overall GWSA limits. For example, figure 4 compares the 2011 GHG emissions from natural gas combustion in Massachusetts from the residential, commercial and industrial sectors with the overall GWSA limits.

Figure 4. Comparison of 2011 GHG Emissions from Natural Gas Combustion from Residential, Commercial and Industrial Sectors with GWSA Limits



In 2011, natural gas combustion emissions from these sectors were 13.9 $MMTCO_2E$. This level of emissions would represent 20% of the overall limit in 2020, 26% in 2030, 38% in 2040, and nearly 75% in 2050. This demonstrates that, even without taking into account lifecycle emissions as discussed below, holding emissions flat from natural gas in these sectors will likely be insufficient after 2030 and will clearly be insufficient after 2040. This indicates that any policy recommendations should consider the likelihood that any additional capital investments by natural gas utilities would need to be paid off by 2030. Providing a chart that shows the expected emissions from any proposed expansion as compared to the GWSA mandates through 2050 would present a clearer sense of just how early expansion would cease to be compatible with meeting the mandates. Such a need also has implications for rate structures and consumer bill impacts from any proposed expansion which should be considered in this study.

Proper Accounting Method for Greenhouse Gases is Lifecycle Emissions

Notably, the current methods for accounting from GHG emissions from natural gas do not take into account the full life cycle emissions, including fugitive emissions from well production through distribution and end use. These sources of emissions can substantially reduce any climate benefit from switching from heating oil or propane to natural gas.[6] The impacts of such fugitive emissions have recently been gaining national attention; however, there is still much uncertainty about the size and scope of fugitive emissions.[7] Until better methods for assessing the scope of these emissions are developed, the study ought to account for lifecycle GHG impacts of expanded natural gas usage by assuming a range of

[6] Alvarez, et al., Greater Focus Needed on Methane Leakage from Natural Gas Infrastructure, (April 2012) PNAS: doi: 10.1073, available at http://www.pnas.org/content/109/17/6435.full; World Resources Institute, Clearing the Air: Reducing Upstream Greenhouse Gas Emissions from U.S. Natural Gas Systems (April 2013) available at http://www.wri.org/publication/clearing-the-air; ICF, Assessment of New York City Natural Gas Market Fundamentals and Life Cycle Fuel Emissions (August 2012) availableat http://www.nyc.gov/html/om/pdf/2012/icf_natural_gas_study.pdf; Fulton, et al., WorldWatch Institute, Comparing Life-Cycle Greenhouse Gas Emissions from Natural Gas and Coal, (August 25, 2011).

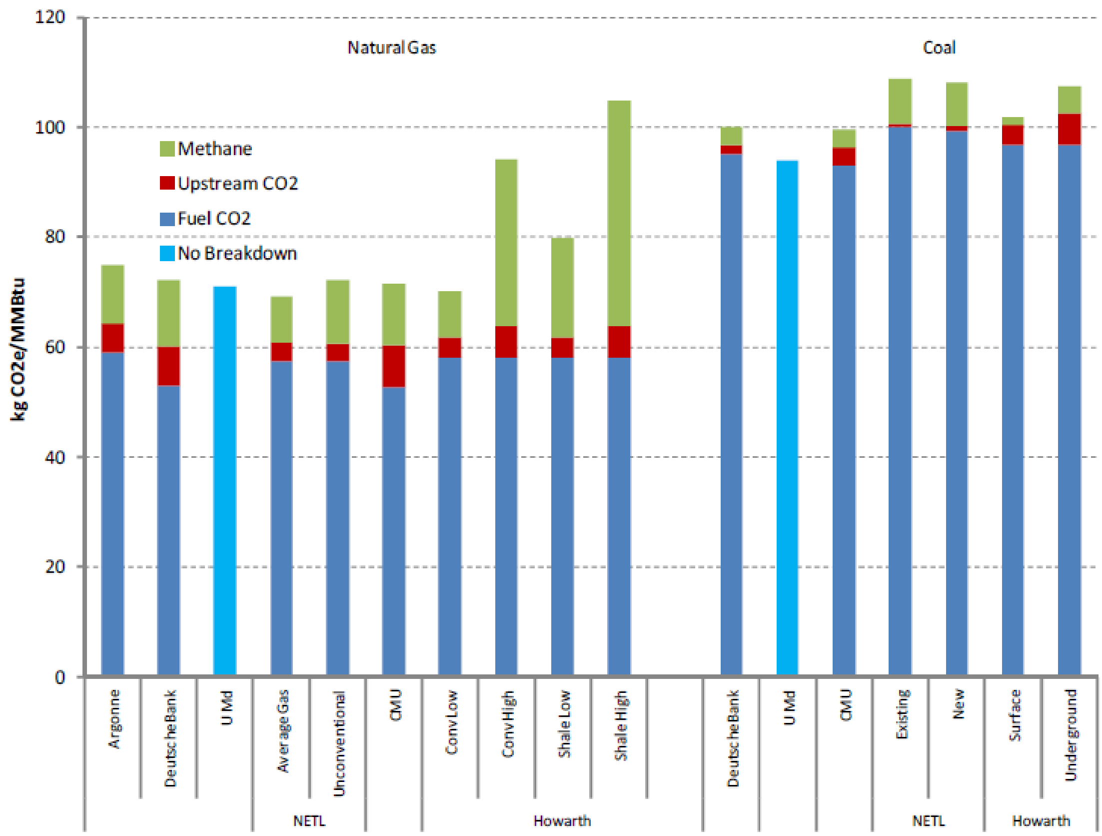
[7] See World Resources Institute, Clearing the Air at 9; United States Protection Agency, Office of Inspector General, EPA Needs to Improve Air Emissions Data for the Oil and Natural Gas Production Sector (February 20, 2013), available at http://www.epa.gov/oig/reports/2013/20130220-13-P-0161.pdf.

fugitive emissions from well production through distribution. As there is no dispute that fugitive emissions do in fact occur, ignoring them is not a reasonable option.

To illustrate the significance of the assumptions regarding methane emissions, see figure 5 below, comprising a chart (prepared by ICF for the City of New York) depicting the results of replacing coal fired electricity generation with natural gas fired generation depending upon which methane leak study is used to calculate total greenhouse gas emissions:

Figure 5. ICF Chart on Lifecycle Emissions

Exhibit 5-3: Comparison of Recent Studies of Life-Cycle Emissions from Natural Gas and Coal Normalized to Methane GWP of 25 (kgCO_2e/MMBtu)



Source: Cited studies and ICF Analysis.

Under the scenario with the highest assumption for fugitive methane emissions, the use of natural gas for electricity generation actually produces GHG emissions equal to the emissions from the use of coal for electricity generation. The most recent study, published on September 17, 2013, concluded that leakage rates may be smaller than anticipated, but the results of the study are not conclusive.[8]

As a result, we recommend that the analysis of the GHG impacts of natural gas expansion include at least three scenario analyses to account for methane leaks. The analysis should consider the following three levels for methane leaks, 1.5%, 3% and 5.3%. If the LDCs have more specific numbers based on the sources of their natural gas supply and their own levels of lost and unaccounted for gas, it may be reasonable to use those numbers to evaluate the potential GHG emissions impacts of proposed levels of

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[8] Allen, et al., Measurements of Methane Emissions at Natural Gas Production Sites in the United States, (September 2013) available at http://www.pnas.org/content/early/2013/09/10/1304880110.full.pdf+html.

expansion *if* the numbers have been subjected to peer review. For reference, we are providing the testimony of Elizabeth A. Stanton presented in a recent docket regarding a gas expansion proposal in Vermont. Developing a range of estimates to account for fugitive GHG emissions is the only credible option until more certainty is reached regarding methane leaks from natural gas.

In conjunction with analysis of the GHG emissions that would result from expansion of natural gas infrastructure, the study should also provide recommendations to offset the potential increase in GHG emissions from natural gas expansion to ensure conformity with the mandates of the GWSA. Such recommendations should provide for the use of a substantial portion of expected customer savings to be invested in thermal efficiency programs through the addition of a system transformation charge per therm of natural gas delivered.

Proper Accounting for Non-Commodity Costs of Expanding Natural Gas Usage

No report on the potential economic and environmental impacts of natural gas expansion can be complete unless it also accounts for the impacts on ratepayers as a result of transportation costs, changes to the amount of gas that LDCs have available in storage to hedge prices, and the costs of any additional transmission capacity as a result of increased demand for natural gas. The increased use of natural gas for electricity generation has resulted in higher basis costs for the transportation of natural gas on the New England pipeline system. As a result, this year's Avoided Energy Supply Cost Study took into account the demand reduction induced price effect ("DRIPE") for natural gas and a cross-fuel DRIPE to attempt to estimate the benefits of reduced gas demand on electric prices. Figure 6 shows the relevant chart.

Figure 6. Synapse AESC Chart on Gas-Electric DRIPE[9]

Exhibit 7-28. Gas-to-Electric Cross-Fuel Heating DRIPE, $/MMBtu, 2014 gas efficiency installations

	Winter or Space Heating							Annual Baseload						
	CT	MA	ME	NH	RI	VT	ISO	CT	MA	ME	NH	RI	VT	ISO
2014	$3.0	$5.3	$1.1	$1.1	$0.7	$0.2	$11.5	$1.6	$2.9	$0.6	$0.6	$0.4	$0.1	$6.2
2015	$8.9	$15.6	$3.3	$3.3	$2.1	$0.8	$34.0	$4.9	$8.5	$1.8	$1.7	$1.2	$0.4	$18.4
2016	$8.9	$15.6	$3.4	$3.3	$2.1	$0.8	$34.1	$4.9	$8.5	$1.8	$1.8	$1.2	$0.4	$18.5
2017	$3.5	$6.1	$1.3	$1.3	$0.8	$0.3	$13.4	$2.0	$3.6	$0.7	$0.7	$0.5	$0.2	$7.8
2018	$2.4	$4.2	$0.9	$0.9	$0.6	$0.2	$9.2	$1.5	$2.6	$0.5	$0.5	$0.4	$0.1	$5.6
2019	$1.2	$2.1	$0.4	$0.4	$0.3	$0.1	$4.6	$0.8	$1.4	$0.3	$0.3	$0.2	$0.1	$2.9
2020	$0.8	$1.3	$0.3	$0.3	$0.2	$0.1	$2.9	$0.5	$0.9	$0.2	$0.2	$0.1	$0.0	$1.9
2021	$0.6	$1.0	$0.2	$0.2	$0.1	$0.1	$2.2	$0.4	$0.7	$0.1	$0.1	$0.1	$0.0	$1.4
2022	$0.4	$0.7	$0.1	$0.1	$0.1	$0.0	$1.5	$0.2	$0.4	$0.1	$0.1	$0.1	$0.0	$0.9

The impacts of any proposed expansion should be considered in the context of the impacts it will have on the current pipeline capacity, electricity prices, and the LDCs' ability to hedge through selling stored gas. That is, any costs that the LDCs expect to have socialized by customers or all ratepayers should be included in the total cost of the proposed expansions to provide for an apples-to-apples comparison of any expansion of natural gas for thermal uses as opposed to electricity and renewable options.

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[9] From Synapse AESC, at 7-31

Incorporating Energy Efficiency Investment into Natural Gas Conversions

In order to avoid over-investment in natural gas infrastructure and equipment (and resulting emissions), any incentives for natural gas expansion should maximize energy efficiency.

The many policy options for incorporating energy efficiency investment into natural gas conversions fall into three general categories: monetary incentives or penalties for the utilities, conditions on incentives for new natural gas customers, and proper structure for regulatory analyses.[10]

There are two primary options in the first category. First, the utilities could be rewarded for high levels of new high efficiency boilers and furnaces in any conversions or, conversely, penalized for low levels of high efficiency equipment. Second, cost recovery for interconnection could be forbidden unless the new customers meet certain efficiency criteria.

In the second category, incentives related to natural gas conversions – either state or ratepayer funded – can be conditioned on high efficiency equipment and energy efficiency audits. For example, access to the Massachusetts solar rebate program is conditioned on an energy audit.[11]

Finally, hurdle rate analyses for cost recovery for main expansions must have reasonable energy efficiency assumptions in order to be valid. For example, these analyses should assume high efficiency combustion equipment and reasonable investment in additional energy efficiency measures in order to project what revenue will be coming to the utility from that customer.

We look forward to continuing engagement in developing a comprehensive and accurate analysis of the economic and environmental impacts of natural gas expansion.

Sincerely,

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Director of Market Initiatives, ENE

Mark LeBel
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[10] It is important to note that, although federal law preempts any general efficiency requirements for new boilers and furnaces in Massachusetts, these proposals would all contain a legally defensible distinction because they would not necessarily apply to the purchasing decisions of existing gas customers.

[11] See Program Manual for Commonwealth Solar II program, at: http://images.masscec.com.s3.amazonaws.com/uploads/programdocs/CSII_Program%20Manual_V15_Final.pdf