STATE OF VERMONT
PUBLIC SERVICE BOARD

Docket No. 7970

Petition of Vermont Gas Systems, Inc. for	**)**
a certificate of public good, pursuant to	**)**
30 V.S.A. § 248, authorizing the construction	**)**
of approximately 43 miles of new natural gas	**)**
transmission pipeline in Chittenden and Addison	**)**
Counties, approximately 5 miles of new	**)**
distribution mainlines in Addison County,	**)**
together with three new gate stations in Williston,	**)**
New Haven and Middlebury, Vermont	**)**

REBUTTAL TESTIMONY OF

ELIZABETH A. STANTON, PH.D.

ON BEHALF OF

CONSERVATION LAW FOUNDATION

AUGUST 14, 2013

Dr. Stanton's testimony responds to the rebuttal testimony of Mr. Bluestein and Ms. Simollardes. It identifies serious shortcomings in Mr. Bluestein's analysis regarding the life-cycle emissions of greenhouse gasses resulting from this project and the impact this has on evaluating the project's impacts. Dr. Stanton identifies shortcomings in the evaluation of the role of and opportunities for energy efficiency and identifies opportunities to significantly expand thermal efficiency to mitigate or offset increased emissions.

Rebuttal Testimony
of
Elizabeth A. Stanton, PhD

Q1. Please state your name and occupation.

A1. My name is Elizabeth A. Stanton, and I am a consultant with Synapse Energy Economics (Synapse).

Q2. Are you the same Elizabeth A. Stanton who prefiled direct testimony in this proceeding on behalf of Conservation Law Foundation (CLF)?

A2. Yes, I am.

Q3. On whose behalf did you prepare this prefiled rebuttal testimony?

A3. I prepared this testimony on behalf of the Conservation Law Foundation.

Q4. Please summarize your testimony.

A4. My testimony responds to the rebuttal testimony of Mr. Bluestein and Ms. Simollardes. It identifies serious shortcomings in Mr. Bluestein's analysis regarding the life-cycle emissions of greenhouse gases resulting from this project and the impact this has on evaluating the project's impacts. It identifies shortcomings in the evaluation of the role of and opportunities for energy efficiency and identifies opportunities to significantly expand thermal efficiency to mitigate or offset increased emissions.

Q5. Mr. Bluestein's testimony presents a life-cycle analysis of the emission consequences of Vermont Gas' Addison Expansion, and concludes that conversion to natural gas reduces greenhouse gas emissions in comparison to other fossil fuel heating options. Do you agree with this conclusion?

A5. No. There is too much underlying uncertainty to be confident in the result.

Q6. Please describe the sources of uncertainty in Mr. Bluestein's results.

A6. Mr. Bluestein's analysis is more detailed than that presented previously by Ms. Simollardes, but there are substantive uncertainties in his results that reduce confidence in his conclusions. The uncertainties include:

a) Mr. Bluestein assumes that 85 percent of the gas delivered to Vermont Gas comes from Western Canada (p.6, line 20-21). The actual percentage sourced from Western Canada is uncertain, and may vary both in the current period and in the more distant future.

b) Upstream emissions from Western Canadian gas are inferred by making adjustments to better-known emission factors from U.S. gas systems. Thus, emissions from 85 percent of gas delivered to Vermont Gas are based on sources that are largely conjectural.

c) Even if more, or even all, of the gas delivered to Vermont Gas were sourced from the better-studied U.S. gas systems, there remains significant uncertainty regarding the accuracy of the emission factors and leak rates used by Bluestein and others.

Finally, it is important to recall that only a portion of the uncertainty in natural gas leak rates will be resolved by additional research. An important part of the difference from one methane leak rate to another is variation in the actual conditions of different cradle-to-grave natural gas systems. This inherent variation motivates the importance of emission life-cycle analyses based on real, system-specific data.

Q7. Is variation the same as uncertainty?

A7. No. There are two important sources of the differences in methane leak rates among studies: uncertainty and variation.

Uncertainty regarding leak rates stems from the many unknowns regarding both past and future conditions at every stage of the natural-gas life cycle. Variation is the actual difference in leak rates from one natural-gas extraction-transportation-distribution system to another. While the former can be reduced through improved (and more consistent) measurement techniques and better knowledge regarding future regulatory requirements expected to impact on leaks (and the degree to which these regulations will be enforced), the latter source of differences among leak rates cannot be resolved by improved research.

As the WRI paper explains: “With hundreds of thousands of wells and thousands of natural gas producers operating in the U.S., [the scale of methane leak rates] will likely remain an active debate, even as forthcoming data from EPA and other sources aims to clarify these questions in the coming months.”

Q8. Are there any other potential sources of error in Mr. Bluestein's emissions analysis?

A8. Yes. Mr. Bluestein's concludes that the Addison Expansion will result in a reduction in greenhouse gas emissions, but this conclusion is based on the assumption that use of the Addison Pipeline will be reserved to conversion from other fossil fuel heating. (Per Mr. Teixeira's testimony, p.10: the increase in peak demand due to the Addison Expansion would be 68,262-65,367=2,895 MCF and the increase in pipeline capacity would be 62,175-57,850=4,325 MCF. On a peak day, excess capacity due to the expansion would, therefore, be 1,430 MCF, or one-third of maximum capacity.)

There does not appear to be any policy measure in place that would preclude a new electricity generation or manufacturing facility powered by natural gas to be sited on the Addison line, or on the line proposed to serve the Ticonderga Mill. New, expanded uses of natural gas—beyond present day fossil fuel heating—would offset or eliminate the emissions reductions that are calculated using Mr. Bluestein's method and could very easily result in higher emissions using Mr. Bluestein's methodology and data sources.

Q9. Is the scale of emissions from natural gas uncertain as of the present day?

A9. Yes. There is no consensus on the appropriate life-cycle leak rate for natural gas systems: The scale of emissions from natural gas is uncertain.

An April 2013 report by the U.S. Environmental Protection Agency Office of Inspector General points to significant gaps in the very commonly used EPA emissions factors for natural gas systems. The report notes, “Incomplete emissions data, such as the gaps described above for nonpoint sources, will lead to modeling results that underestimate the air quality impacts from oil and gas production activities” (Office of Inspector General. (April 18, 2013). Final Report No. 13-P-0161 EPA Needs to Improve Air Emissions Data for the Oil and Natural Gas Production Sector. p. 20 available at: http://www.epa.gov/oig/reports/2013/20130220-13-P-0161.pdf). The OIG report lays out a long list of items that would be necessary In order to fill such gaps and thus increase the accuracy of the emissions factors. Then EPA Assistant Administrator Gina McCarthy and Principal Deputy Assistant Administrator Lek Kadeli, responded saying, “The EPA agrees with the OIG's recommendations” (McCarthy, G., & Kadeli, L. G. (April 18, 2013). Response to the Office of Inspector General (OIG) Final Report No. 13-P-0161 EPA Needs to Improve Air Emissions Data for the Oil and Natural Gas Production Sector, dated February 20, 2013 available at: http://www.epa.gov/oig/reports/2013/13-P-0161_Agency_Response.pdf). In McCarthy’s memo, the EPA outlines corrective actions, the earliest of which would not occur until 2014.

Q10. Do the methane emission factors provided by the U.S. EPA in its emissions inventory resolve the uncertainty regarding methane leak rates?

A10. No, they do not. The WRI paper explains that the reason for broad agreement among most life-cycle analyses of natural gas is that they "rely heavily" on the same data source: EPA average emission factors. This appears to be a serious vulnerability for any meta-analysis of these studies. It cannot be surprising that studies based on the same underlying data reach, broadly, the same conclusions. The WRI paper describes EPA's methane emission factors as "dated" but prefers EPA's data to alternate sources that may be less transparent.

WRI explains that EPA's average emission factors are not the product of direct, upstream measurements and comments on uncertainties regarding EPA data that may have resulted in assumptions that either under- or over-estimate the final leak rate:

> *"Inherent shortcomings associated with this underlying methodology coupled with dated methane emissions factors may result in an overestimate of methane emissions to the extent that published GHG inventory estimates do not reflect technology improvements or additional voluntary measures not required by law (e.g., practices that are conducted for economic reasons). On the other hand, the GHG inventory may underestimate methane emissions, to the extent that EPA's dated average emissions factors do not accurately reflect new emissions-intensive processes, leakage from accidents, poorly maintained equipment, and/or operators not following best practices."*

The problem, in general, with the existing suite of leak rate assessments is, according to WRI a “paucity of direct observations”. The presentation of a range of emission rates is important in WRI meta-analysis precisely because of the difference between these leak rates. More direct measurement of actual conditions is needed both to improve the accuracy of the existing average emission factors provided by EPA and widely used in natural-gas life cycle studies, and to better demonstrate the variation in leak rates among upstream natural-gas systems.

There is considerable uncertainty and variation in currently available methane leak rates, which is why it is important to include the full range of methane leak rates. Excluding a study with higher than average results would not improve the accuracy of WRI’s meta-analysis.

Q11. Should a “best” or “most likely” methane leak rate be chosen for use in analysis until a more definitive and accurate range of leak rates is developed

A11. No. Given the underlying uncertainty regarding the correct range of actual methane leak rates, the most appropriate approach would be to present the PSB with a range of possible emission outcomes from the Addison Expansion. Ms. Simollardes testimony assumed that there were no methane emissions from the project. Dr. Stanton’s initial testimony provided an illustration of the effect of introducing a positive methane leak rate to the project’s emissions analysis. Mr. Bluestein provided a more detailed emissions analysis including positive methane leak rates, although his methodology included several flaws discussed above. An improved analysis of the life-cycle emissions of the Addison Expansion would be based on emission factors derived from measurements taken of the specific natural-gas system upstream of the Addison Expansion. This method would reduce uncertainty concerning the most appropriate leak rate. Of course, no study can definitively erase uncertainty regarding leak rates in future years.

As the WRI report notes: "Clearly, further data collection efforts are needed to resolve lingering questions about the scale of methane emissions from U.S. natural gas transmission systems."

Q12. How should the uncertainty regarding upstream emissions from natural gas be understood in the context of Vermont PSB's decision regarding whether or not to grant approval to Vermont Gas' request for a Certificate of Public Good for the Addison Expansion?

A12. An investment in natural gas infrastructure will "lock in" Vermont to either use this infrastructure or deal with large stranded costs over the next 50 to 100 years. As long as there is significant uncertainty in the emissions from natural gas, Vermont risks adopting long-lived natural gas infrastructure that is not compatible with meeting Vermont's 2050 greenhouse gas reduction goals. Approving Vermont Gas' request represents a gamble, on the part of the PSB, that Vermont's current and future sources of gas will be at the low end of the current range of possible emission rates in the literature and not at the higher end, and that the uses of the gas will only replace oil or propane. Both assumptions are unlikely and as a result the project proposed will most likely increase greenhouse gas emissions over the life of the project.

EPA itself suggests that the current emission rates are very likely an underestimate (OIG; McCarthy and Kadeli). Similarly, a new study published in Geophysical Research Letters found higher than previously expected methane leak rates from Utah gas field and concluded that: "Methane (CH4) emissions from natural gas production are not well quantified and have the potential to offset the climate benefits of natural gas over other fossil fuels." (DOI: 10.1002/grl.50811) available at: http://onlinelibrary.wiley.com/doi/10.1002/grl.50811/abstract

A 2012 paper in the Proceedings of the National Academy of Sciences of the United States of America (PNAS) found that the greenhouse gas implications of switching to natural gas depended on the end use, but did not examine home heating. The PNAS study concluded that improved science and data are needed to resolve uncertainty regarding upstream emissions of natural gas systems:

> *Despite recent changes to EPA's methodology for estimating CH4 leakage from natural gas systems, the actual magnitude remains uncertain and estimates could change as methods are refined. Ensuring a high degree of confidence in the climate benefits of natural gas fuel-switching pathways will require better data than are available today. EPA's rule requiring natural gas industry disclosure of GHG emissions should begin to produce*

data in 2012, though it is unlikely that most uncertainties will be resolved and possible systematic biases eliminated. Specific challenges include confirming the primary sources of emissions and determining drivers of variance in leak- age rates. Greater direct involvement of the scientific community could help improve estimates of CH4 leakage and identify approaches that enable independent validation of industry-reported emissions. Available at: http://www.pnas.org/content/109/17/6435

Q13. Do you agree with Ms. Simollardes testimony at pages 5-7 regarding the role of energy efficiency for Vermont Gas?

A13. Not entirely. Ms. Simollardes recognizes on page 5 that "Vermont Gas agrees that energy efficiency needs to be a key component of Vermont's energy future and Vermont Gas' portfolio." Ms. Simollardes, however, assumes a very limited role for energy efficiency that does not recognize the opportunity to expand energy efficiency to offset the increased greenhouse gas emissions from the proposed project.

Q14. Can you explain?

A14. The Addison Expansion will likely increase Vermont's greenhouse gas emissions. Because of the project's potential to support new natural gas electricity generation or other new manufacturing facilities, its emissions must be evaluated based on the foreseeable uses of the gas over the next 20 to 50 years and the capacity of the pipeline proposed to deliver gas. Ms. Simollardes and Mr. Bluestein assume a far more limited use of gas solely to replace existing oil and propane; based on this assumption, they determine no increase in greenhouse gas emissions.

One means to effectively mitigate the higher greenhouse gas emissions resulting from the expansion, would be for Vermont Gas to commit to a significant expansion of thermal efficiency well beyond the limited improvements suggested by Mr. Poor in his testimony.

Q15. Why use efficiency to offset emissions?

A15. The need and opportunities for thermal efficiency in Vermont have already been well evaluated and quantified in the Vermont Thermal Efficiency Task Force Report (CLF-EAS-10). Significantly expanding thermal efficiency is specifically called for in the enactment of the Vermont Energy Efficiency and Affordability Act, 10 V.S.A. § 581, which established building efficiency goals and as stated in the TETF Report (CLF-EAS-10) at pg. ES-3 calls for:

- Improving the energy fitness of 25% of the state's housing stock by 2020 (approximately 80,000 housing units)
- Reducing annual fuel use and fuel bills by an average of 25% in the housing units served
- Reducing total fossil fuel consumption across all buildings by an additional 0.5% each year, leading to a total reduction of 6% annually by 2017 and 10% annually by 2025

- Saving Vermont families and businesses over $1.4 billion on their fuel bills over the lifetimes of the improvements and measures installed
- Increasing weatherization services to low-income Vermonters

The report goes on to recognize the significant environmental and economic benefits of significantly increasing thermal efficiency.

Since efficiency has long been recognized as the cleanest and lowest cost means to reduce greenhouse gas emissions, it makes sense to turn first to efficiency to offset the increase in emissions from the Addison Expansion.

Q16. Can you describe how an effective offset based on thermal efficiency would work?

A16. Such an offset would use a substantial portion (for example, 75 percent) of Vermont Gas' claimed "savings" from the expansion to pay for expanding thermal efficiency as contemplated in the TETF Report. Features of a reasonable offset wo uld include:

- Payment per unit of gas sold – this is comparable to how other efficiency programs are funded.
- Ability to ramp up over time and expand as more gas is used.
- Provide benefits more broadly than only to Vermont Gas customers.

Q17. Why should Vermont Gas or its customers pay for expanding efficiency for other fuel users?

A17. All Vermonters will bear the burden of greenhouse gas emissions from the expansion as they impact the state's ability to meet its emission reduction goals. Greater greenhouse gas reductions can be achieved by expanding thermal efficiency measures beyond Vermont Gas customers.

Q18. Can the details of this program be designed as part of ongoing Vermont Gas efficiency work?

A18. Yes. The details of this program could be designed in connection with the same study recommended by Mr. Poor in his testimony on page 6. The potential study recommended by Mr. Poor should be expanded to include the means to address the need to create real, additional, permanent, verifiable offsets for the potential greenhouse gas emission increases over the life of the project through thermal efficiency.

Q19. Does this conclude your testimony at this time?

A19. Yes.