

Mark D. Kleinginna Testimony

Thermal Network Testimony

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Introduction – Good morning and thank you so very much for your time to discuss this extremely important topic. My background in the energy industry dates back to 1988 when I was exposed to natural gas take-or-pay contracts during my graduate studies. I have had 34 years of continuous and progressive experience in the energy industry ever since. I have worked for consultants, gas utilities, end-users, and brokers over that period. My work as a natural gas supply manager during the coldest winter day on record, as well as a natural gas industry executive significantly informs my testimony today. I am currently a professor at Penn State in the Renewable Energy and Sustainability Program there, as well as a full-time energy consultant.

The events of the past 6 weeks point to the very critical importance of energy network reliability and resilience. Massachusetts is in a very precarious position from a natural gas heating perspective. It relies on a delivery system which is at the very end of the national natural gas transmission system. Massachusetts does not have access to significant underground natural gas storage, and also relies on liquefied natural gas for reliability in the winter months. Boston city gate prices are the most volatile in the North American market. What is happening in Europe is not just illustrative of the value of resilience and reliability of energy supplies. It will also significantly affect the costs for natural gas in Massachusetts as North American Natural gas returns to being a global commodity as opposed to the local one it has been for the last decade plus... Decarbonization pathways that do not model this existential commodity risk could severely burden those customers least able to pay over the long run. As an anecdotal illustration I will point to two facts:

1. Long-term natural gas pricing (5-10 years in the future) are at least \$1.00 per MMBtu higher than what was used to model the economics of decarbonization pathways in the report which was submitted.
2. Boston City Gate for Winter 2022-2023 is now trading at close to \$20.00 per MMBtu. This is double the historical price for Boston futures.

To continue to rely on this commodity to heat homes in the winter, exposes those least able to react to these changes in the market to ever greater costs. Low-income customers will be the most exposed to this volatility and increased costs. This is a significant economic justice issue. To the extent possible, it becomes ever more incumbent on the Commonwealth's leadership to lead this transition away from a global commodity with all the associated risk to a more easily locally controlled and optimized asset.

Fossil fuel combustion at the point of demand has been the preferred solution for three reasons:

1. Economics – unburdened cost for fossil fuel consumption has been lower than alternatives
2. Fossil fuel is easy to store to meet the volatility of the weather
3. Momentum – switching to other alternatives is scary because lack of heat is a significant safety issue

Thermal Networks work to address each of these reasons for the preference of fossil fuels:

1. As we burden the cost for fossil fuels with carbon costs as well as realize that the costs for natural gas in Massachusetts have risen significantly as the consequences of the European situation, the economics of thermal networks incorporating renewable electricity in ground source heat pumps become compelling.
2. Thermal networks are a local and viable form of thermal storage because they allow an almost constant coefficient of performance for heat pumps regardless of the weather.
3. As we build out the technology of thermal network and do more and more pilot programs we become much more confident that they can perform during times of high demand. Certain Scandinavian countries rely on district energy for more than 50% of heat during the Winter.

Thermal networks offer 3 important characteristics to Massachusetts that the current thermal combustion system does not:

1. Localized resiliency, reliability and affordability which is not dependent on a global commodity or a North American distribution system
2. The removal of combustion at the load which mitigates or eliminates safety issues and the need to replace leak prone pipes
3. A business model which offers benefits all year round providing more even cash flows to the thermal provider, better access to cooling, and energy peak load reduction not just in the Winter but also during the Summer

The study prepared by E3 which does not include the volatility of the natural gas commodity in its analysis has Networked Geothermal costing a similar amount as the Hybrid Electrification approach over the next 30 years. This is likely to be reduced as more experience is gained with networking energy sources and sinks across the local topology.

Clearly the impact on emissions of thermal networks is positive as we already know that heat pumps provide a reduction in emissions of 50% vs. Natural gas combustion for heating. As the thermal network captures more heat and leads to less waste as well as lowers electric peaks, the impact on emissions will be even greater. As the grid becomes ever more reliant on zero carbon generation, the emissions impact is driven ever closer to zero because thermal networks provide carbon free thermal storage which is the most difficult part of the fossil fuel transition to solve.

To conclude, I strongly recommend that Massachusetts consider investing in the localized energy resilience which can only be offered by Thermal Networks. It will allow the state to declare energy independence from the volatility of the global energy markets as well as the vicissitudes of the cost of natural gas cost pipeline cost recovery.

Thank you for your time and attention.