Future of Gas Utilities
Project Updates

It's been a busy year for Brattle's energy practice! Following up on the success of our Future of Gas series and symposium, where we outlined the key challenges and opportunities facing gas utilities, we wanted to share some project updates related to our work helping key stakeholders navigate the uncertainty that comes with decarbonizing the gas industry.

The highlights feature projects where Brattle experts:

- Helped develop strategies – including an exploration of alternative fuels – for Massachusetts to achieve a net-zero economy by 2050
- Assessed forecasted supply and demand for renewable gas in North America
- Analyzed alternative rate designs to bridge the operating cost gap between heat pumps and natural gas heating
- Performed a benefit-cost analysis framework for Non-Pipeline Alternatives

To learn more about Brattle's work assisting utilities, market operators and participants, regulators, and others transition to a clean energy future, please visit our practice page.

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EXPLORING ALTERNATIVE FUELS FOR MASSACHUSETTS

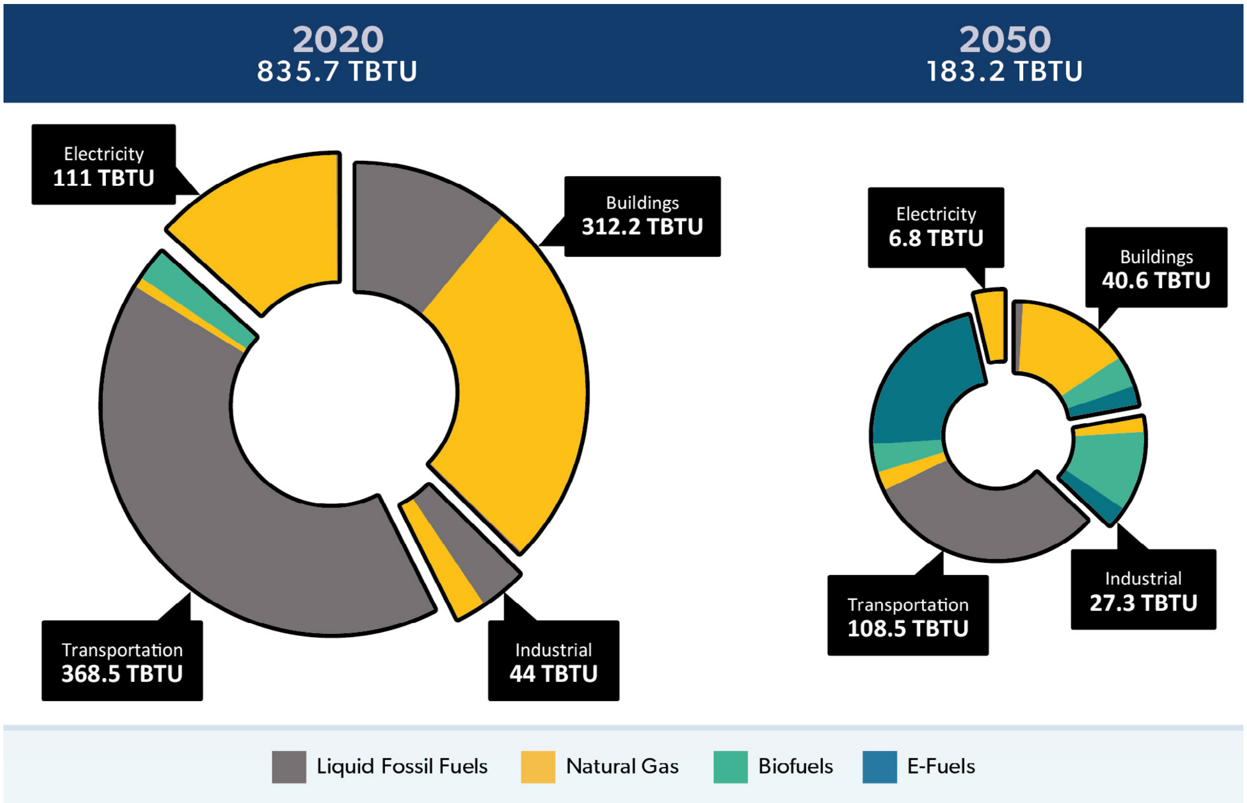
Brattle experts collaborated with the Massachusetts Executive Office of Energy and Environmental Affairs (EEA) and other state agencies to develop the strategies and policies necessary for Massachusetts to achieve a statewide greenhouse gas emissions limit of net zero in 2050. The ***Clean Energy and Climate Plan for 2050*** provides a policy blueprint for the Commonwealth to achieve a decarbonized future where vehicles, home heating, and the electric grid can operate with minimal reliance on fossil fuels.

As Massachusetts embraces electrification as the primary decarbonization strategy, the state's total fuel use will fall significantly. However, some hard-to-electrify sectors – such as aviation, heavy transportation, and high-temperature industrial uses – will have to rely on alternative fuels. Key types of alternative fuels include:

- **Biofuels:** Biogases created by the natural decomposition of biological matter, or liquid biofuels such as bio-diesel and ethanol that can be extracted or produced from plant materials
- **Hydrogen:** Produced using zero emissions sources of electricity such as renewables, nuclear, and natural gas + carbon capture
- **Synthetic fuels:** Gaseous or liquid fuels that are often chemically similar to fossil fuels and can be synthesized from raw materials such as green hydrogen and CO_2

Many of these alternative fuels are currently quite costly and not widely available. Given feedstock limitations, significant potential demands from other sectors, and alternative decarbonization options, alternative fuels will likely be best suited for difficult-to-electrify applications where they are most valuable.

FUEL USE IN MASSACHUSETTS, BY SECTOR AND FUEL, 2020 AND 2050



Note: Estimates do not include renewable-based electricity, which is expected to increase significantly over the same time period.

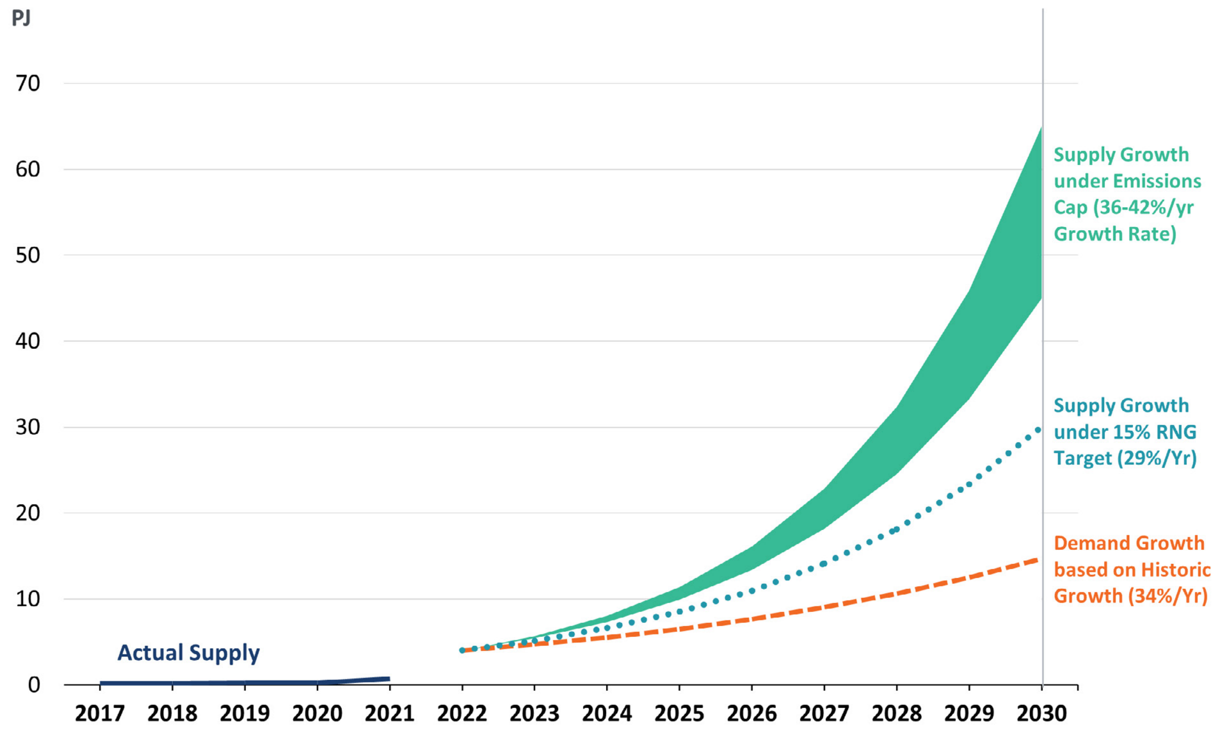
EVALUATING RENEWABLE NATURAL GAS SUPPLY AND DEMAND IN NORTH AMERICA

As part of the British Columbia Utilities Commission's (BCUC's) review of a gas and electric distribution utility's blending programs, Brattle experts conducted a study to evaluate the short-term forecast demand and supply of renewable natural gas (RNG).

In order to achieve British Columbia's emissions cap by 2030, the utility will need to reach an average annual RNG supply growth rate of 35–42%. At the same time, the company will have to compete for limited RNG supply with other gas distribution companies as well as demand for RNG from North America's transportation and industrial sectors. Increasing demand for RNG will spur new supply in the short term, but technological and feedstock constraints will limit supply growth.

For example, Canada's RNG production potential represents about 3.6% of the country's current natural gas consumption. Similarly, the US's short-term RNG potential can only serve a small fraction of the country's total residential natural gas demand, a dynamic that places upward pressure on RNG prices. In addition, prices will likely remain elevated because of the relatively high price caps approved by regulators for RNG programs. Finally, gas distribution companies can meet their decarbonization targets through notional RNG supplies or carbon offsets. However, care must be taken to ensure these tools produce real carbon reduction benefits as intended.

RNG SUPPLY AND CUSTOMER DEMAND GROWTH TRAJECTORIES FOR A COMBINATION UTILITY



DESIGN COMPARING THE ECONOMICS OF HEAT PUMPS TO NATURAL GAS UNDER ALTERNATIVE ELECTRIC RATE STRUCTURES

Brattle experts assisted an investor-owned gas and electric distribution utility by evaluating the impact of different electric rate designs on bridging the operating cost gap between heat pumps and natural gas heating. Their results were presented in a whitepaper prepared for the Energy Systems Integration Group (ESIG).

Using consumption data of over 100 residential customers that currently use gas for heating, the Brattle team modeled the hourly electricity load impacts of the customer's potential conversion to heat pumps. Customer-specific factors – such as their heating behavior and building characteristics – and regional factors, such as climate, affect energy usage patterns.

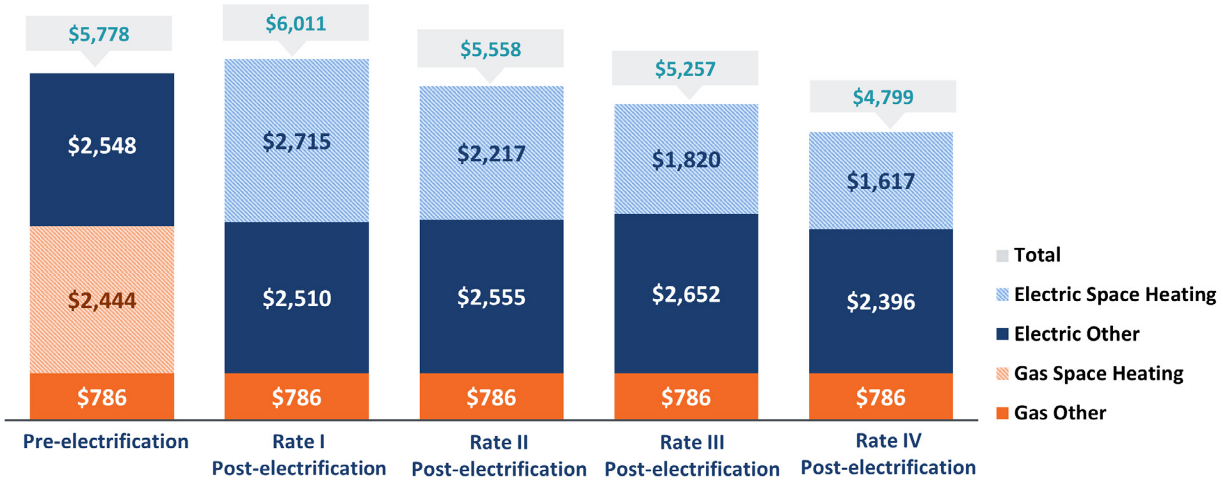
To estimate customer bills post-electrification, four different electric rate structures were considered:

1. The default flat volumetric rate
2. A higher fixed charge and lower flat volumetric rate
3. Time-varying volumetric rate
4. Time-varying demand-based rate

All of the modeled rate structures were cost-based, meaning they are not subsidized rates.

Results show that from a total energy cost (electric + gas) perspective, operating gas heating is cheaper than heat pumps for most customers on the default electric rate. However, switching to any of the three alternative rate structures makes heat pump operation cheaper than gas heating. In addition, the alternative rates are more cost-reflective than the default rate, sending more efficient price signals to customers.

ANNUAL ENERGY COSTS FOR RESIDENTIAL CUSTOMERS OF A NORTHEASTERN UTILITY, UNDER 4 ELECTRIC RATE STRUCTURES



Note: Total energy bills are higher after electrification if a customer remains on electricity **Rate I**, the default rate. However, switching to one of the modeled alternative rates makes the post-electrification bill cheaper than the pre-electrification bill. The alternative rates are **Rate II** with a higher fixed charge and lower volumetric charges; **Rate III** with time-varying volumetric charges; and **Rate IV** with time-varying demand charges.

Source: The Brattle Group

BENEFIT-COST ANALYSIS FRAMEWORK FOR NON-PIPELINE ALTERNATIVES

Brattle experts assisted an investor-owned electric and natural gas utility in developing and implementing a Benefit-Cost Analysis (BCA) framework for its Non-Pipeline Alternatives (NPA) program. NPAs are demand- or supply-side technologies and programs that allow a utility to defer or avoid investment in the natural gas distribution system. Examples of NPAs include energy efficiency, gas demand response, electrification, or alternative supplies (e.g., RNG).

NPA programs have gained attention following recent orders in New York and California requiring utilities to incorporate NPAs into their long-term gas planning processes:

- In a May 2022 order, the New York Public Service Commission required gas utilities to develop NPA BCA frameworks and incorporate them into their long-term gas planning process. The utilities are required to include a "no infrastructure" planning scenario whereby NPAs are used to close the gap between demand and supply. The Commission also required gas utilities to identify opportunities where leak-prone pipes could be replaced with an NPA rather than a traditional natural gas infrastructure project. Lastly, gas utilities must conduct a qualitative and quantitative analysis for "large" projects to justify the use of traditional gas projects over an NPA.
- In December 2022, the California Public Utilities Commission issued an order in its long-term gas planning docket providing a new framework to evaluate gas utility infrastructure investments to meet the state's goal of reaching net zero by 2045. For gas projects over $50 million and starting in the first five years of the forecast, gas utilities must provide detailed information on NPAs considered.

The Brattle-designed BCA framework is technology-agnostic and can be applied to individual NPAs or a portfolio of NPA projects. The framework considers various benefit categories, such as avoided commodity costs; interstate pipeline and storage costs; on-system infrastructure; reliability and resiliency benefits; and environmental and non-energy benefits. Examples of cost categories include incremental on-system investments, alternative fuel costs and emissions, and incremental participant costs. The framework then applies a societal cost test to identify potential NPA investments.