THE FUTURE OF GAS UTILITIES SERIES

BRATTLE

The Future of Gas Utilities Series

TRANSITIONING GAS UTILITIES TO A DECARBONIZED FUTURE

Part 1 of 3

AUGUST 2021

Brattle

Agenda

SERIES INTRODUCTION

Energy Sector's Changing Landscape Threatens Natural Gas Utilities

Natural gas utilities face **increased risk** related to decarbonizing the energy sector.

- Pressure is increasing to ban new gas uses and gradually "electrify everything."
- However, as a countervailing force, a growing number of states have prohibited the enactment of bans on new gas connections.
- Regardless of bans, cost declines related to innovation, as well as federal, state, and municipal support policy, will increase electrification (as is happening with renewable adoption in the electricity sector).

At the same time, there are **approximately $150–180 billion of unrecovered gas distribution infrastructure.**

Utilities will need to consider how to **recover their costs from a shrinking customer base**, which could lead to higher rates and create a vicious cycle.

Sources: S&P Market Intelligence; American Gas Association; EIA 2015 Residential Energy Consumption Survey.

Impact Will Differ for Pure-Play, Combination, and Electric Utilities

The natural gas transition will impact all three types of utilities:

- **Combination utilities** may be better positioned to transition business from gas to electricity investment and sales. Gas sale declines presents downside risk, but electrification can present upside potential.
- Electrification serves as a boon to **electric utilities**, which can increase electricity investments and sales.
- **Pure-play gas utilities** face the most downside risk, and will need to be innovative and proactive to grow business.

Regulation will fundamentally answer the question of "who pays" for the transition, highlighting the need for well-designed regulatory strategy.

Who pays?

- Gas, electric, or combination utilities
- Shareholders or utility customers
- Gas or electric customers
- Current or future customers
- Advantaged vs. vulnerable populations

This series provides commentary on these issues and aims to help gas and combination utilities navigate the transition in a fiscally and socially responsible way.

Waiting Passively Is Not a Sustainable Option for Utilities or Customers

If gas utilities defer building a long-term strategy, they risk not having a voice in the policy, planning, and regulation process.

Gas demand reduction and bill increases for remaining customers will come with or without utility involvement. However, the needed change is likely to be delayed or inefficient without utility involvement.

The scale of the transition is massive: displacing natural gas in the US would involve replacing nearly 150 million heating and cooking appliances, in addition to the gas distribution system infrastructure.

Proactive implementation of suitable solutions affords utilities the following benefits:

- Allows utilities to build a diversified and tailored strategy ahead of regulatory mandates
- Finding substitute capital deployments makes gas utilities part of the solution, not an obstacle
- Satisfy customers, reduce costs, and head off or offset probable customer defection
- Address investor concerns

The transition process will play out over many years, **but the planning must start now**.

The Transition Presents Significant Growth Opportunities

Natural gas utilities can create new business opportunities as an enabler of the energy transition, through proactive and innovative approaches.

- Utilities' access to capital, capabilities in large-scale planning and execution, and experience in working with regulatory authorities make them uniquely positioned to help plan and implement large infrastructure transitions.
- Clean fuels, such as renewable natural gas (RNG) and hydrogen, can provide growth opportunities while re-utilizing gas utilities' existing infrastructure or right-of-ways.

Gas utilities have options to create and capture value and reduce customer costs.

- Utilities' pathways will depend on their characteristics (pure-play versus combination), location, customer base, and regulatory environment.

Natural gas utilities will need to work closely with legislators, regulators, and stakeholders to **design and pursue enabling regulatory mechanisms and policies** to navigate this transition.

Building Blocks for a Successful Energy Transition

1

Is it a real risk? How big is it, and how immediate?

- Policy risk
- Business strategy risks
- Cost of capital implications

2

What strategies will enable solutions?

- Regulatory framework for transition
- New technologies and infrastructure
- Securing life of existing assets

3

What steps can be taken to get there?

- Performance-based regulation
- Multi-year rate plan
- New programs

The Brattle Group's Future of Gas Utilities Presentation Series

The Brattle Group's Future of Gas Utilities building blocks will be presented in a series of three presentations to be released in the summer and fall of 2021.

The Brattle Group's Future of Gas Utilities Series will culminate in a **Symposium**, where industry and Brattle experts will convene to debate key challenges and opportunities facing the gas industry.

The remainder of this slide deck will cover the first building block: **Assessing Risk**.

Part 1: Assessing Risk

The Future of Gas Utilities Series

Risks and Opportunities of the Transition

Traditional gas utility business models face increasing risks as more states and locales challenge the long-run role natural gas could play in meeting climate and energy policy goals.

- Even though certain states are moving against this trend and enacting prohibitions on bans on new gas connections, cost declines related to technology innovation and federal, state, and municipal policy support will increase the deployment of lower-carbon alternatives to natural gas, as happened with renewables in the electricity sector.
- The transition is already underway: at the current rate, the number of homes with electric space heating could exceed the number of homes with gas space heating by 2032.

The transition will affect **gas companies' growth opportunities, cost recovery, and capital attraction.**

- In the past decade, gas utility capital expenditures have grown by around double the rate of water and electric utilities' spending, largely driven by safety and reliability.
- Utilities will need to recover their costs from a changing – and possibly shrinking – customer base.
- With energy and environmental policy targets rapidly approaching, gas utilities need to decide today how best to invest capital in long-lived assets and avoid stranded asset risks.
- Heightened perceptions of business risk are increasing financing costs for gas utilities. In early 2021, gas utilities traded at a ~20% discount relative to electric utilities.

Any strategic plan (including electrification and alternative gas technologies) must address equity and energy justice by considering financial, health, and economic impacts to vulnerable communities.

The Debate on the Future of Natural Gas Is Widespread

The **landscape for natural gas has shifted dramatically**, as states and cities across the country have passed natural gas bans and electrification mandates.

States are also launching proceedings on the role gas utilities will play in meeting the state's greenhouse gas (GHG) emissions and clean energy goals.

Proposed approaches include "electrify everything" or leveraging alternative gas technologies such as RNG, hydrogen, etc.

The outcomes being debated vary widely: while some states have banned the use of gas in new buildings, **others have prohibited the enactment of such bans**.

STATES ENACTING GAS BANS | AS OF JULY 21, 2021

	STATE-WIDE	CITY			
	Proceeding on Future Role of Natural Gas	Proposed Gas Bans	Enacted Gas Bans	Implemented Moratoriums	Electrification "Reach" Codes
California	✓		✓		✓
Oregon	✓	✓			
Washington	✓	✓	✓		
New York	✓	✓		✓ PARTIALLY LIFTED	✓
Massachusetts	✓	✓	✓		
Colorado	✓	✓			✓
Washington, DC	✓				
Vermont					✓

Proposed Prohibition on Gas Bans	CO, MI, MN, NC, PA
Enacted Prohibition on Gas Bans	AL, AR, AZ, FL, GA, IA, IN, KS, KY, LA, MO, MS, OH, OK, TN, TX, UT, WV, WY

Gas Utilities Can Participate in a Decarbonized Future to Mitigate a Potential Death Spiral and Control Customer Costs

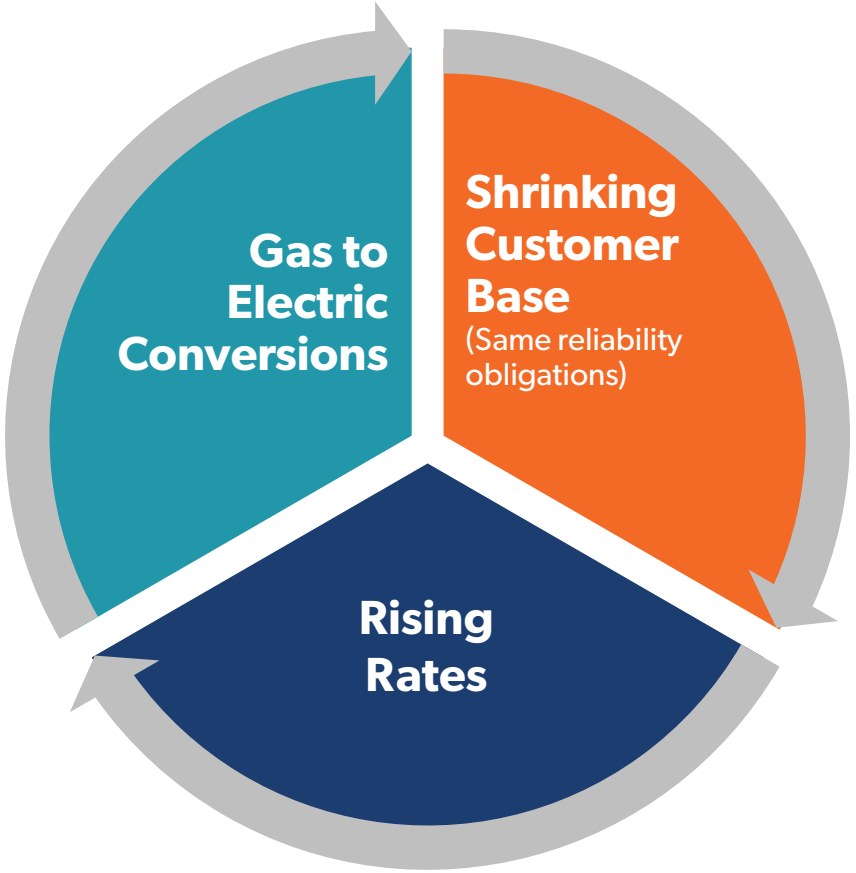
As states pursue degasification policies and homes convert to electric heating, **utilities risk losing customers and load.**

- Nationally, electric heating is outpacing gas heating adoption.
- Technology mandates and policy further accelerate the problem.

Utilities will likely **continue investing in their existing system for safety and reliability but need to recover those costs from a shrinking customer base.**

- This puts remaining customers at risk, a "death spiral" trend pushing more customers to electrification.
- Up to $150–180 billion of gas distribution assets could be under-recovered as a result of the transition.

This spiral will increase customer costs and increase energy burdens, especially for low-income and vulnerable populations.



Gas utilities may reverse this problem if they quickly become part of the solution to a decarbonized future.

Gas Utilities' Risks and Opportunities with Decarbonization

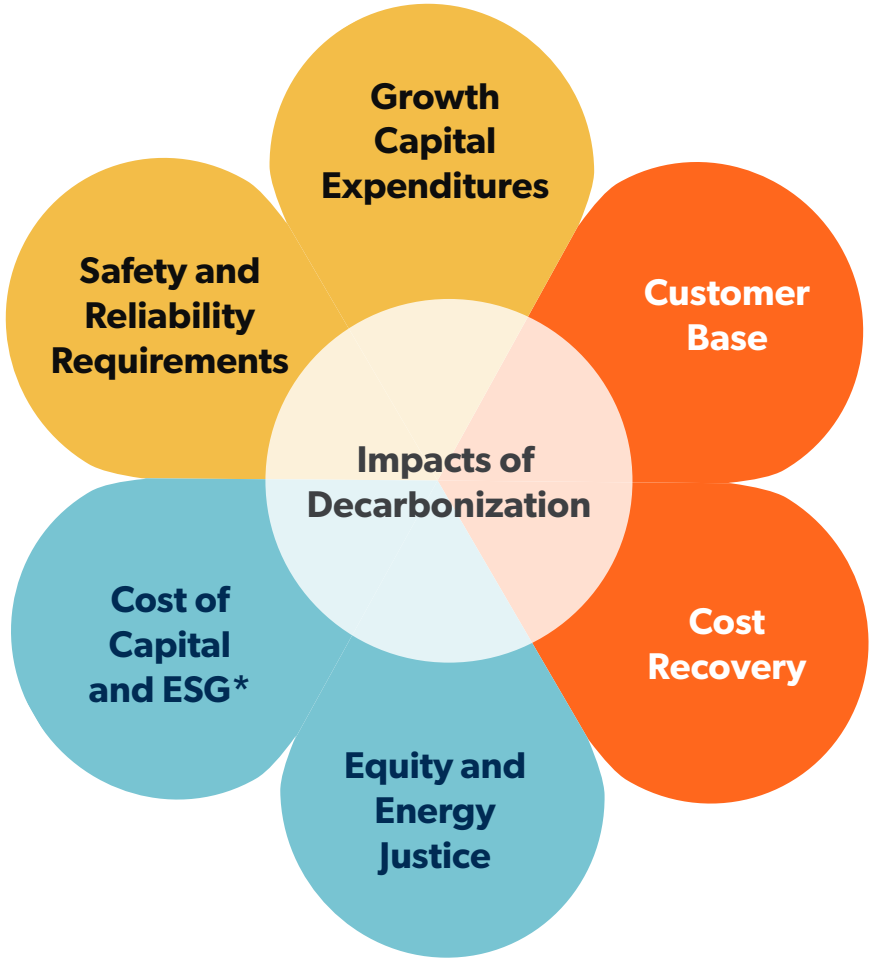
Proposed decarbonization pathways generally emphasize electrification, challenging the traditional business model of natural gas utilities.

Without proactive adjustments, utilities face increasing **cost recovery risks from capital investments** to grow the gas system or to maintain safety and reliability requirements.

There are **offsetting opportunities**, such as:

- Alternative fuels (RNG, hydrogen) are a viable alternative for end-uses that lack cost-effective electrification options.
- Long-run deep degasification may be expensive to achieve, requiring utilities to invest in clean performance of existing assets.
- Utilities could own and rate base gas replacement infrastructure, earning a return on these decarbonization assets.

The transition will take time and depends on factors such as costs, regulatory and legislative mandates, and customer adoption.



*ESG stands for Environmental, Social, Governance investing

Traditional Planning Faces Conflicting Regulatory and Financial Expectations

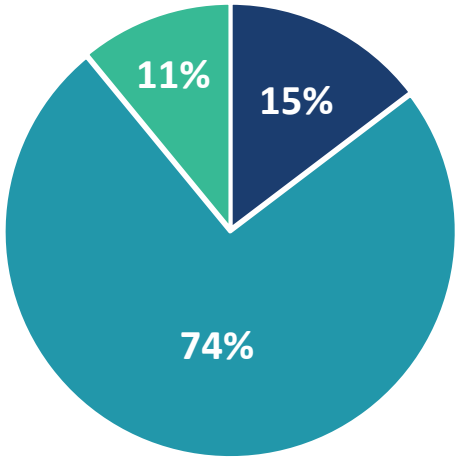
New gas assets placed into service today have a useful life of ~40 years – well beyond target dates for many decarbonization goals, creating cost-recovery risk.

- Gas utility capital expenditures have grown by around double the rate of water and electric utilities' capital expenditures.

Regulators are requiring gas utilities to develop gas long-range capital investment plans that conform to state climate and energy policy goals. Gas utilities and regulators need to decide today how best to deploy capital and avoid cost recovery risks due to the transition.

- **Alternative depreciation schedules** may be required to fully recover traditional gas investments before policy target dates.
- **Diversifying into gas decarbonization technologies** can limit exposure to lost growth opportunities and reduce stranded asset risk.

FORECASTED CAPITAL EXPENDITURES



Source: Investor Presentations, 2020. Utilities in the sample include Atmos Energy (ATO), New Jersey Resources (NJR), NiSource Inc. (NI), Northwest Natural Gas (NWN) and Southwest Gas (SWX).

NYS DPS Staff Proposal, 20-G-0131, February 12, 2021.

NY GAS PLANNING PROCEEDING | STAFF PROPOSAL

Utilities must incorporate demand-side solutions into their long-term planning to **reduce gas demand and the need for gas infrastructure investments.**

LDCs must **identify opportunities to avoid replacing leak prone pipe** and instead deploy "Non-Pipeline Alternative" investments.

Safety and Reliability Investments Will Remain a Priority

Utilities are under increasing pressure and are making **significant investments to meet new and existing safety and reliability requirements**.

- PHMSA's Mega Rule went into effect in 2020, mandating confirmation of Maximum Allowed Operating Pressures (MAOP), more frequent and regular pipeline integrity assessments, and new repair and leak detection requirements, amongst other requirements.
- This will require material investments, but increases the risk of obsolescence before the end of normal asset life (~40 years).

Utilities are also focused on replacing **leak-prone pipe,** which reduces methane emissions and helps meet state and corporate GHG emission targets.

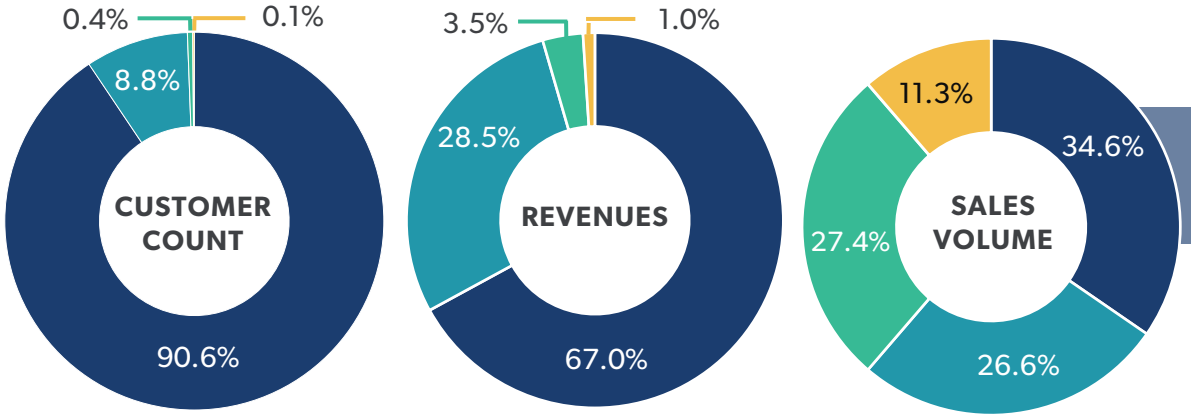
- 32 natural gas utilities have pledged to reduce methane intensity to 1% by 2025.
- New York is asking utilities to identify opportunities to retire leak prone pipe and instead deploy non-pipeline alternatives, such as electrification of heating.
- Methane is a more potent GHG than CO_2 even though it is short-lived. Its 20-year warming potential is 80x – and its 100-year warming power is 25x – that of CO_2, per ton emitted.

Enabling regulatory mechanisms will need to be designed and implemented to recover safety and reliability costs from a changing and/or declining customer base.

Shifts in Customer Base Increase Cost Recovery Risks

The transition **will not occur at the same pace or magnitude across customer classes**, which compounds cost recovery risks (cost allocation, appropriate tariff designs, equity and energy justice).

- Residential customers, who are more likely to convert to electric alternatives, comprise 90% of total natural gas utility customers and 67% of revenues, but they account for only one-third of total system volumes.
- Harder to electrify industrial customers are a small portion of total customers but about 27% of total sales volumes.
- Differences in customer transition trends will impact the pace and feasibility of achieving state GHG emission targets.



Gas utilities can mitigate this risk by focusing on degasification solutions for commercial and industrial customers, which could most effectively help meet state and corporate decarbonization goals.

Declines in customer base, starting with easy-to-electrify customers, will raise costs for remaining customers, such as for low-income and other vulnerable customer populations.

Gas Utility Customer Base

Industrial | Commercial | Residential | Other

68M	$67B	29.7B
total customers	total revenues	MMBtu*

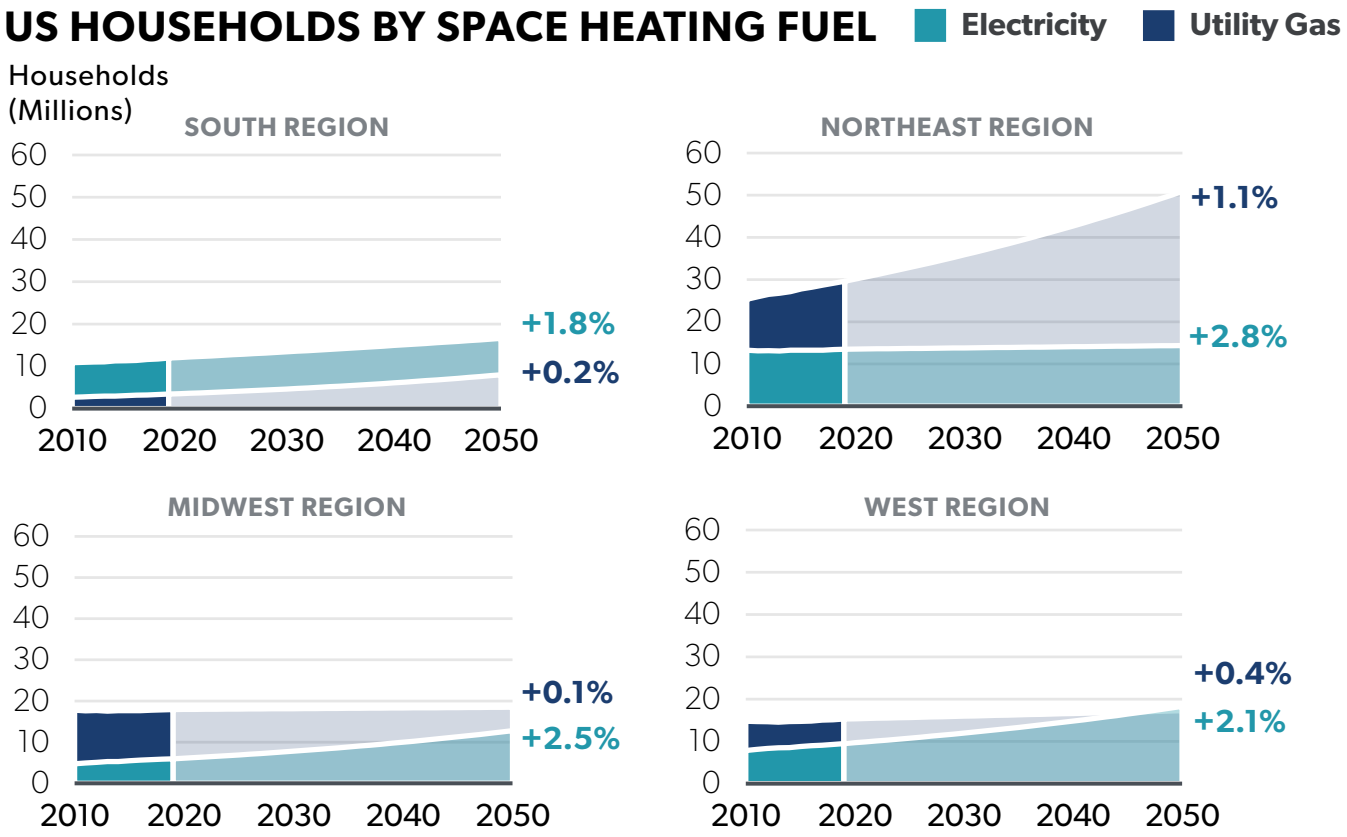
Source: S&P Market Intelligence, data as of year-end 2019.
Note: Other revenues and sales volumes reflect electric power revenues and sales.
*American Gas Association summary statistics

Heating Electrification Will Accelerate Declines in Gas Customer Base

Heating electrification is outpacing gas growth in some parts of the country. At the current pace, the number of homes with electric space heating could surpass homes with gas space heating by 2032.

- Heat pumps remain more expensive than gas furnaces, but could become more competitive with technological improvements and financial incentives.
- Economics of heat pump water heaters (HPWH) can be more appealing because of lower upfront costs relative to heat pumps. HPWH also has a higher efficiency than its gas counterpart.

Electric utilities are promoting rebates for heat pumps and HPWHs to accelerate adoption. As heat pumps and other decarbonization technologies become more popular, **gas utilities need to think strategically about how to participate in this transition in order to remain viable.**

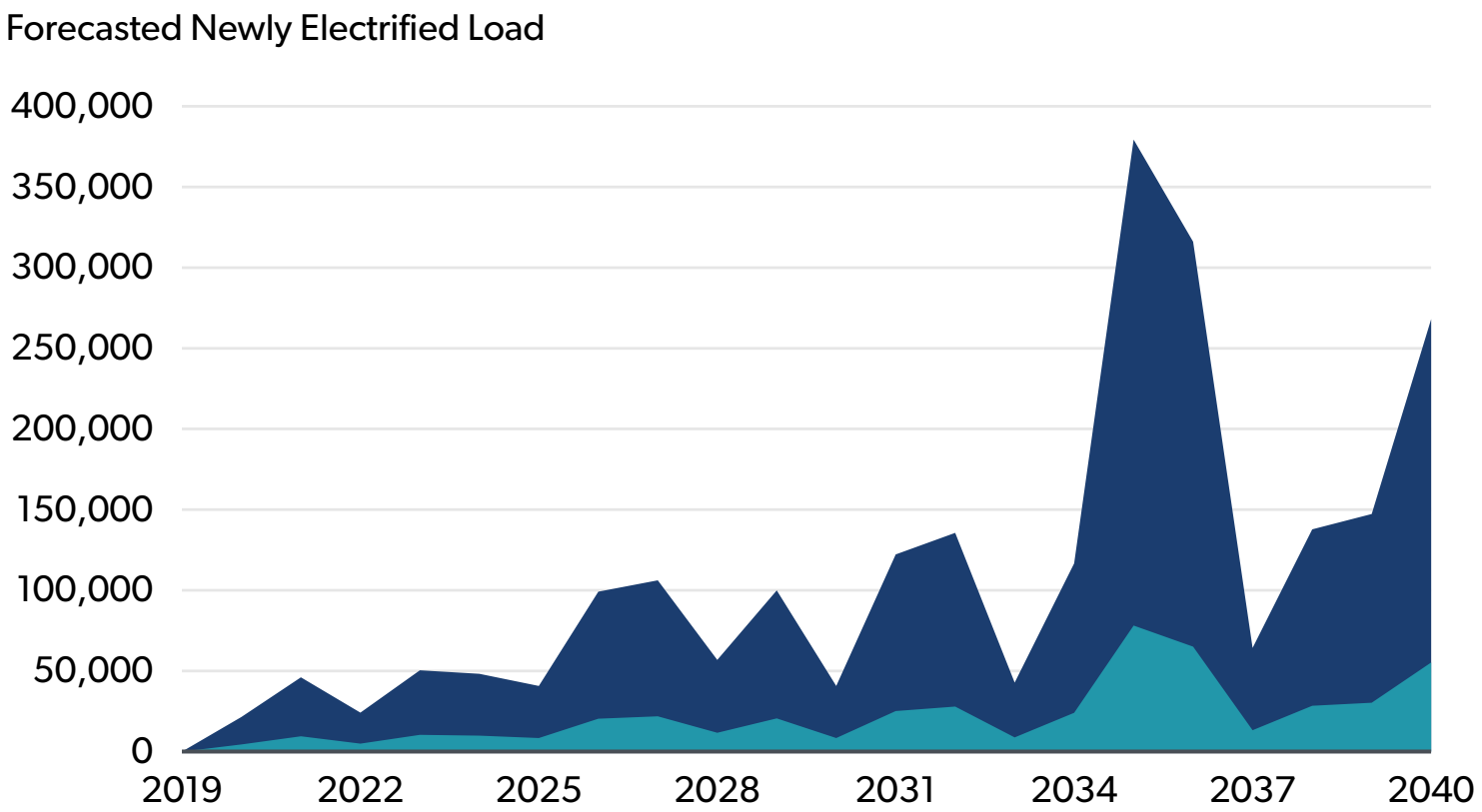


Source: US Census Data, 2019. | Note: Electricity includes both heat pumps and electric resistance heating.

At current rates, homes with electric heating could surpass homes with gas heating by 2032 nationally.

Death Spiral for Gas Utilities: An Illustrative Example

ELECTRIFICATION OF HEATING SECTOR CASE STUDY: NEW YORK GENERIC UTILITY



Source: CCIS NYISO forecast.
*Assumed forecast of new heat pumps from CCIS forecast, calculated new load and related costs. We assume AHSP at $12,800 and GHSP at $35,700 in real dollars. Capital cost assumptions come from New Efficiency NY Analysis of Residential Heat Pumps.

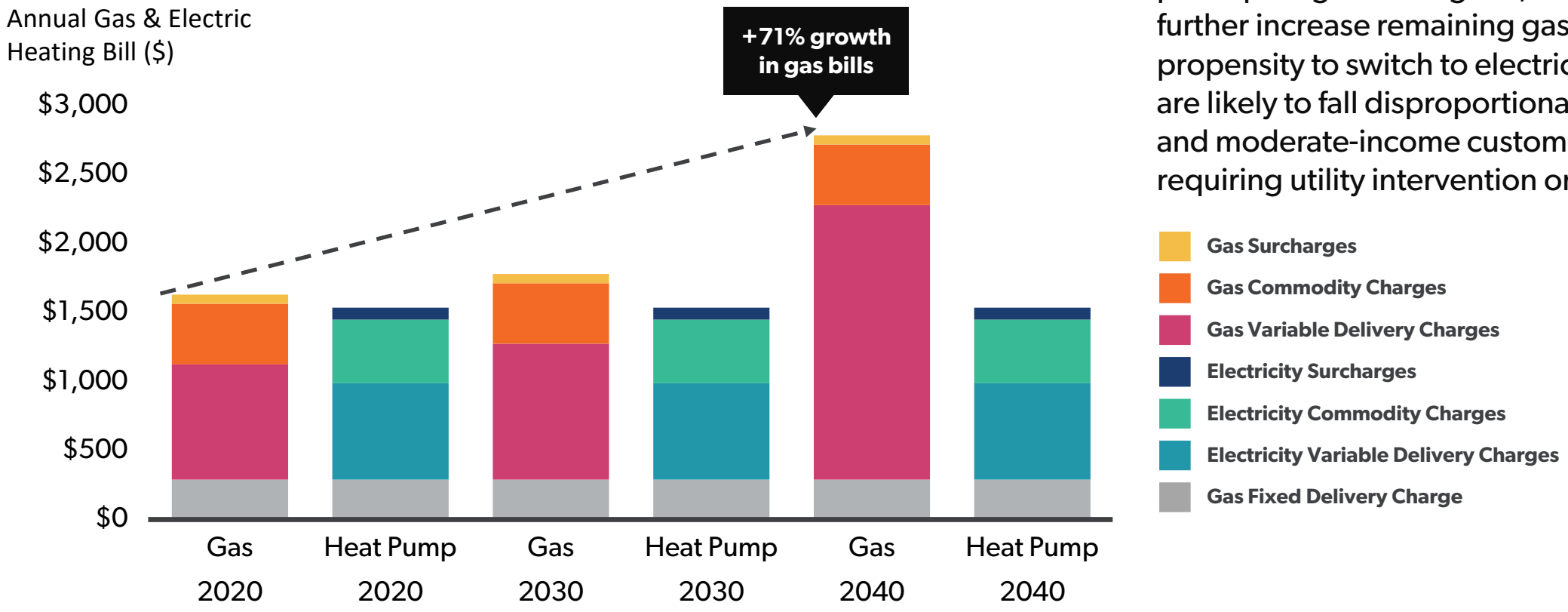
The impact of increasing electrification will vary based on state and local regulations and decarbonization goals.

For example, up to **60% of New York's gas heating sector may be electrified by 2040.**

- This requires around **4 million additional heat pumps**, costing about **$80 billion.***
- Adds about 20% to residential electric consumption.

Death Spiral for Gas Utilities: An Illustrative Example

RATES IMPACT FOR GAS AND ELECTRIC CUSTOMERS
– GAS UTILITY NO-ACTION "DEATH SPIRAL" SCENARIO



There is a large potential for non-participant gas bill to grow, which will further increase remaining gas customer's propensity to switch to electric. Impacts are likely to fall disproportionately on low- and moderate-income customers, requiring utility intervention or offsets.

Source: CCIS NYISO forecast and The Brattle Group analysis. | Note: Rate impacts for a gas furnace and air source heat pump customer.

Adverse Investor Reactions to Risks Are Emerging

Investors' **risk perceptions are shifting** as states and locales transition away from natural gas and reduce GHG emissions.

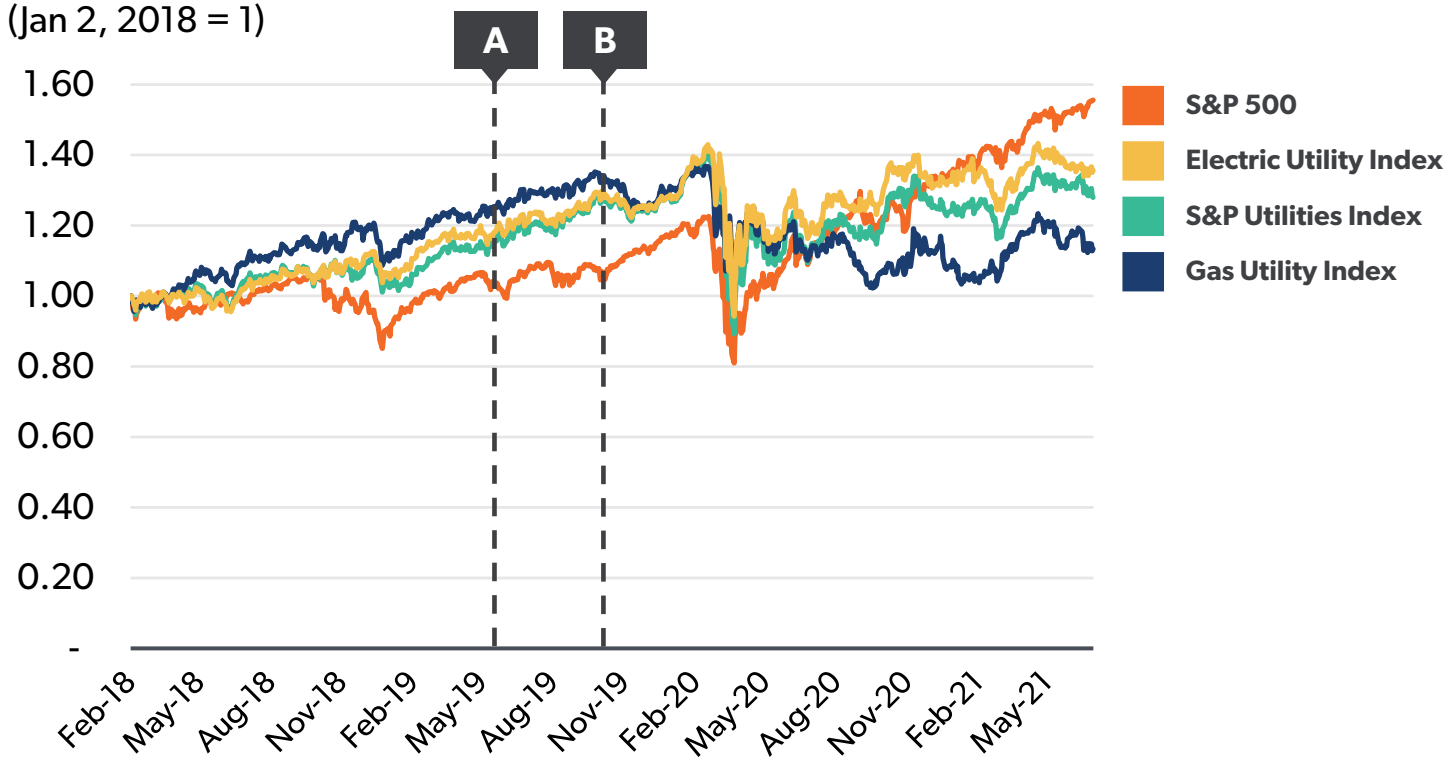
A Berkeley, CA passes the nation's first gas ban (July 2019)

B Brookline, MA passes first East Coast gas ban (Nov 2019)
Five additional CA municipalities have enacted gas bans

All else equal, gas utilities have to **issue more shares to raise the same amount of equity capital**, relative to other utilities.

- Gas utilities currently trade at a ~20% discount relative to electric.
- However, P/E ratios for gas utilities remain elevated at approximately 18 (vs. 19 for electric utilities and 18.5 for S&P util.)

UTILITY STOCK PERFORMANCE



Notes: **Gas Utility Index includes:** Atmos Energy, Chesapeake Utilities, New Jersey Resources, NiSource, NW Natural, ONE Gas, South Jersey Industries, Southwest Gas, Spire. **Electric Utility Index includes:** AEP, Southern, FirstEnergy, Exelon, Duke, Progress Energy, Evergy, NextEra, Edison International, Dominion. Electric Utility Index is currently trading 3% above S&P Utility Index and 20% above the Gas Utility Index. Data through June 30, 2021.

1: United Nations Environment Programme, Net Zero Banking Alliance.

Investors Are Becoming Actively Involved in the Debate

Environment, Social, and Governance (ESG) investors are pressuring gas utilities to reduce GHG emissions and eliminate usage of fossil fuels.

43 banks across 23 countries announced a pledge to achieve "net-zero banking," meaning their lending and investment portfolios are on track to reach net zero emissions by 2050.[1]

Utilities are increasingly highlighting RNG, hydrogen, and emission reduction efforts in their investor materials.

70 gas utilities across 31 states have set corporate carbon emission reduction targets.

1: United Nations Environment Programme, Net Zero Banking Alliance.

Equity and Energy Justice Concerns Must Be Considered

Gas utilities and regulators will also need to **consider the risks and impact of the transition on low-income and less advantaged communities**, who may experience rising bills and longer exposure to emissions.

- Public policy is increasingly focused on fairness of service and equitable access to decarbonization technology.
- As more affluent customers adopt electric heating, low-income gas customers could disproportionately experience rate increases and/or be neglected by developers for obtaining new decarbonization technologies.
- For example, adverse effects from electrification on low-income communities can be observed in rooftop adoption, in which low-income communities subsidize delivery costs for homes with rooftop solar receiving net energy metering (NEM).

Turning Increasing Risk into Opportunity

Gas utilities need to **create an adaptive, long-term business plan that anticipates** the pathways, drivers, accelerators, and decelerators of the transition and identify the type and timing of impacts.

Long-term modeling tools can help

> **Economy Decarbonization Model:** How different might the pace and means of decarbonization be? There are many enabling technologies and policy "knobs" yet to be turned or applied. What are these pathways, and how can they be realized or adjusted? When and how will gas utilities be affected under these different pathways?

> **Distribution System Planning Model:** How can gas distribution investments, operations, pricing, and financing be altered so that utilities not only survive but grow in the face of the transition's long-term effects?

By understanding the possible pathways, utilities can identify their comparative advantages, target market niches, and needed operational and regulatory adjustments.

- A "base case" would look at sales and profits with a passive response to trends in electrification.
- Responsive strategies are then developed for how to influence the path(s) that are likely to occur and how to prepare for their contingencies by selectively avoiding some risks and embracing others.

In Part 2 of this series, we will examine the solution elements available to gas utilities.

How Brattle Can Help

Brattle's Unique Interdisciplinary Experience Provides a Holistic Skillset to Guide Transition

Brattle's Expertise Can Tackle Analysis That Spans All Building Blocks

Assess Transition Risks

Analyze how natural gas bans, electrification mandates, and ESG investment trends will impact business risk and cost of capital.

Estimate revenue loss to electrification under different future scenarios.

Use system dynamics to identify rate risks and customer feedback effects.

Evaluate Strategy and Solutions

Facilitate strategy workshops to establish transition principles, identify potential business strategies, and determine near- and long-term action items.

Identify revenue potential from owning and rate-basing electrification infrastructure and evaluate rate impacts using system dynamics.

Implement Regulatory Changes

Design and calculate tariffs to incentivize transition and protect customer costs.

DEEP Can Help Utilities Understand Risks and Evaluate Solutions

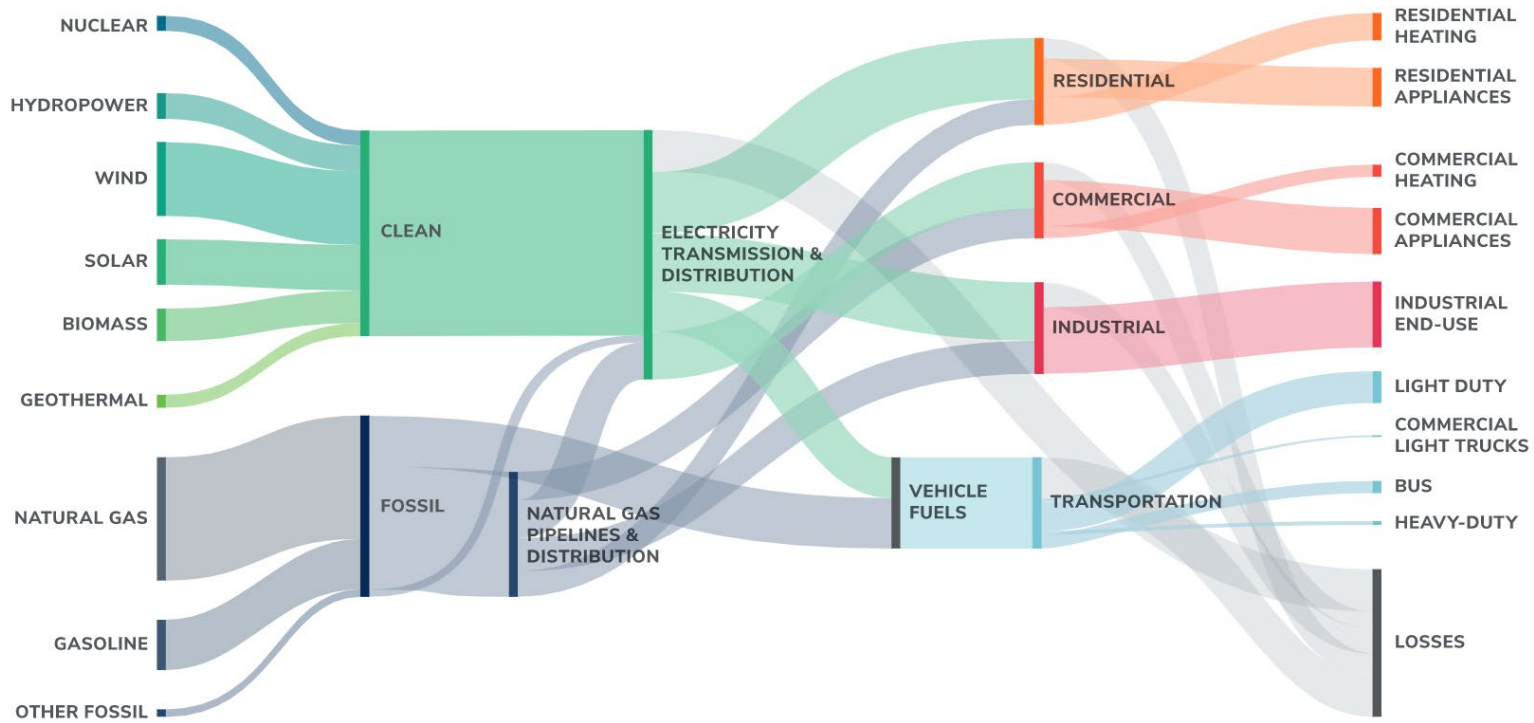
Brattle's **Decarbonization, Electrification & Economic Planning (DEEP) Model** is an energy economy modeling tool that can evaluate:

- The uptake of technologies and impact on gas consumption
- The roles of efficiency, electrification, and fuel-switching
- The utility and customer costs of specific technology pathways

DEEP can evaluate long-term planning impacts and the interactions of:

- Technology adoption
- Decarbonization policies
- Macroeconomic conditions
- Supply and demand

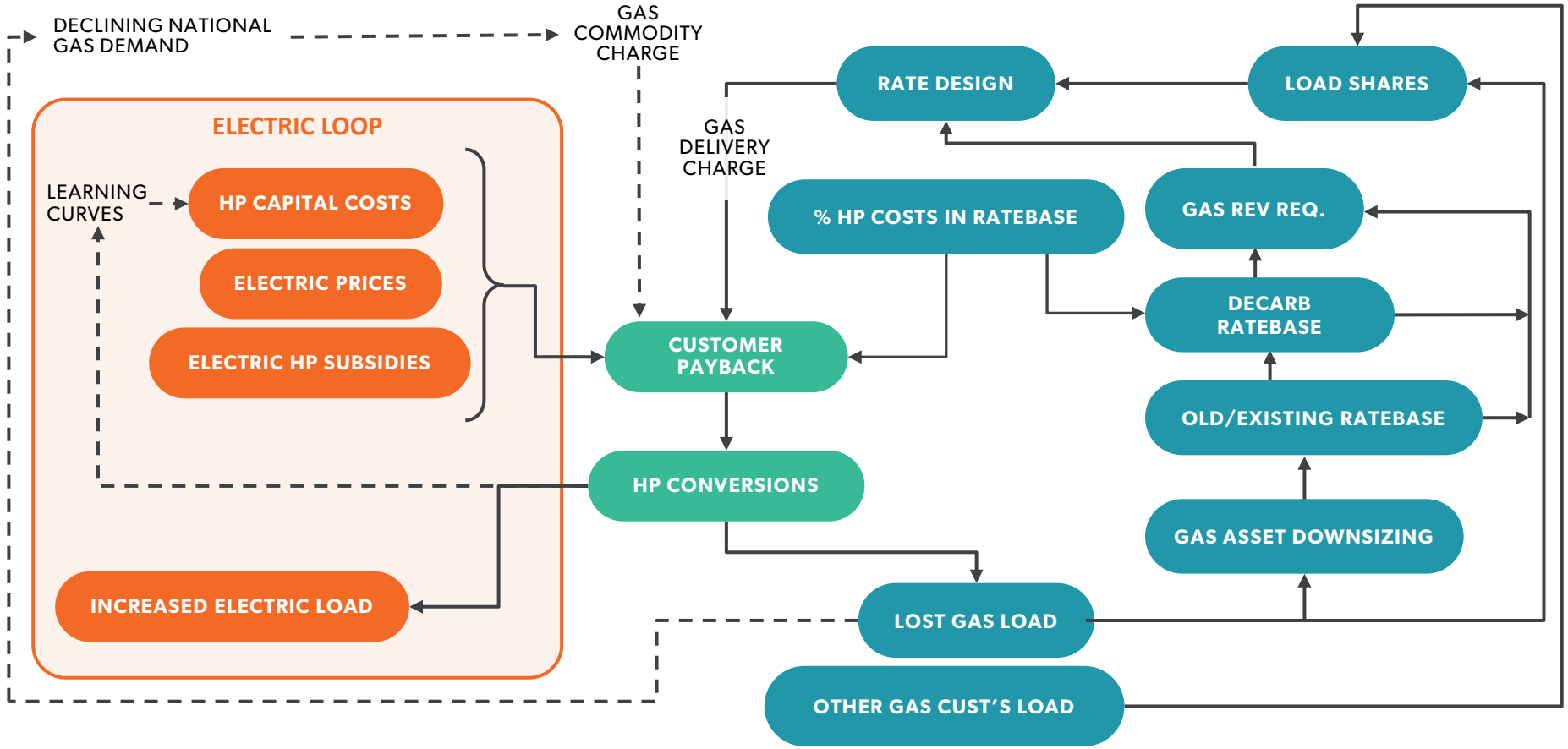
DECARBONIZATION, ELECTRIFICATION & ECONOMIC PLANNING (DEEP) MODEL



The model can be run in **(1) planning mode** and **(2) optimization mode** to meet client-specific needs.

Dynamic Modeling Can Help Utilities Understand Risk and Evaluate Potential Strategies

Brattle's technical and analytical abilities can model pathways for decarbonization and the complex interdependencies both within and between the gas and electric sectors, many of which have not yet been thoroughly studied.



Brattle's **System Dynamics Model** can help utilities analyze the complex feedbacks and interdependencies associated with the transition.

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Clarity in the face of complexity

Brattle