Applied Economics Clinic
Economic and Policy Analysis of Energy, Environment and Equity

POLICY BRIEF

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Planning for the Future: Massachusetts Cleans Up Its Heating

This Applied Economics Clinic policy brief—prepared on behalf of the Gas Leak Allies (a coalition of over 20 non-profits, researchers, and experts)—finds that Massachusetts' FUTURE Act (if passed) could save consumers $10.7 billion while transitioning the Commonwealth to a zero-carbon, renewable thermal future.

Clean Energy and the FUTURE Act

The "FUTURE Act" (An Act For a Utility Transition to Using Renewable Energy, H.2849, S.1940) was introduced in the Massachusetts Legislature in early 2019. The FUTURE Act would improve the safety of today's gas distribution system by accelerating repairs of gas leaks, strengthening requirements for monitoring leaks, and prioritizing large gas leaks for rapid replacement.

The Act would address existing safety challenges by repairing gas leaks, while also creating a path for gas distribution companies to move from the business of delivering a fossil fuel to that of delivering clean energy: Gas utilities would be permitted to pipe renewable thermal energy (that is, hot and cool water) to homes and businesses. Funding mechanisms, such as a per therm renewable energy charge on customer bills, would help gas utilities make the transition.

AEC compared the costs of the status quo (including financial returns to investors) gas system repair in Massachusetts to the costs of repair under the FUTURE Act. Gas pipeline repairs required by the Act are estimated to cost $6.3 billion in today's dollars, as compared to the $17.1 billion required under the status quo, a savings of nearly $10.7 billion over 30 years (see Figure 1).[1]

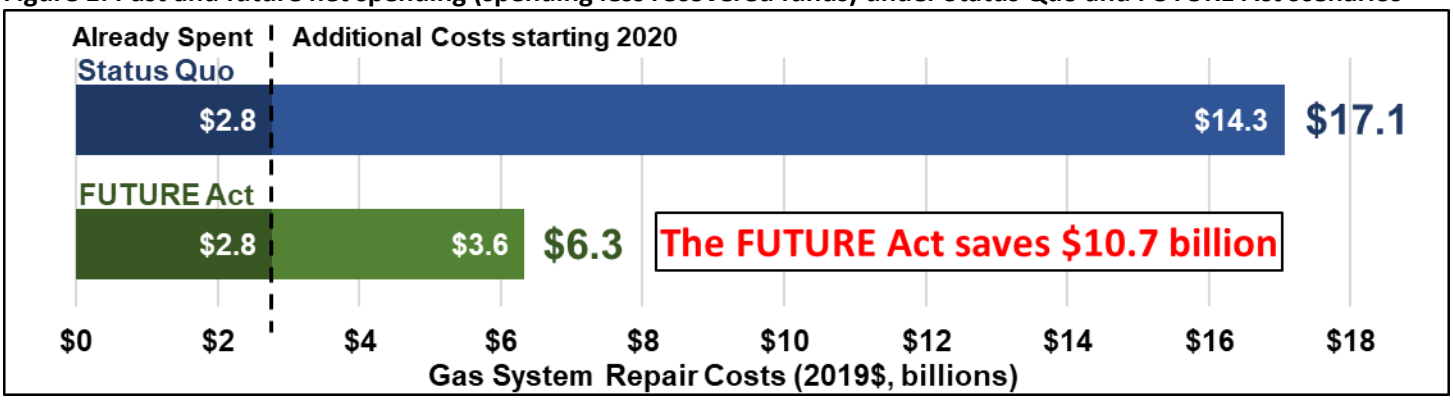
Fixing Massachusetts' Leaky Pipes

Gas leaks pose a significant threat to public safety, service reliability, and the environment. Although leaks are continually repaired or eliminated, new leaks continue to form faster than existing ones are fixed, causing a backlog of leaks to build up. An underlying cause of these leaks is the Commonwealth's aging, leak-prone gas pipeline infrastructure (e.g., uncoated steel, cast iron, wrought iron, among other materials).

Over the past two decades, the Massachusetts Department of Public Utilities (DPU) has implemented several programs to promote the replacement of leak-prone gas distribution infrastructure. In 2009, the Department approved the now-defunct "targeted infrastructure replacement factor" programs to allow several gas utilities to charge their customers for the costs of repairing or replacing leak-prone infrastructure.

In 2015, DPU approved the first annual gas system enhancement plans (GSEPs), required for each gas utility, with the aim of replacing more than 6,000 miles of aging, leak-prone infrastructure over a 20-year period.[2]

Figure 1. Past and future net spending (spending less recovered funds) under Status Quo and FUTURE Act scenarios



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Gas System Repairs are Expensive

Between 2015 and 2019, Massachusetts utilities spent an estimated $3.4 billion on replacing leak-prone pipes and repairing gas leaks. Roughly $0.7 billion has been recovered to date through the GSEP charge on customer bills, leaving $2.8 billion in outstanding costs.

STATUS QUO

Under current law (called "Status Quo" in Figure 1 and Table 1), Massachusetts utilities aim to replace more than 6,000 miles of leak-prone gas infrastructure within the next two decades. Over the 15-year period between 2020 and 2034, utilities will spend an additional $14.3 billion to finish replacing all leak-prone gas infrastructure and repairing any remaining gas leaks.

FUTURE ACT

Under the FUTURE Act, utilities would focus on repairing the worst gas leaks (that are potentially explosive and leak the most methane), while transitioning to renewable thermal energy. Over the 30-year period between 2020 and 2049, utilities would need to spend $3.6 billion on continued leak repair and replacement of pipes.

MONTHLY GAS SYSTEM REPAIR COSTS

In 2020, Massachusetts' utilities will charge customers 7 cents per therm (or $5 per month on average—70 therm per month customer) for gas system projects. At this rate, it would take over 100 years to fully recover the $17.1 billion in costs under the Status Quo scenario (see Figure 2). Since the estimated lifetime of a new gas pipeline is 50 years, these assets would not be paid off until long after they have fully depreciated. Utilities would need to increase customer charges to $15 per month to fully pay off status quo repairs by 2050.

A dramatic reduction in the number of traditional gas customers is also a real possibility as households and businesses transition to electrified and/or renewable thermal heating systems to meet the state's emission-reduction mandate. With fewer customers each year, utilities would need to pay more in early years to cover these costs: a constant rate of $31 per month would make up for customer losses. Alternatively, utilities could charge more each year to fewer customers: from $15 per month today to over $465 per month as fewer gas customers remain to pay these charges.

Under the FUTURE Act, gas utilities would only need to charge customers a fixed rate of $11 per month until 2050 to pay off the $6.3 billion in costs, assuming a constantly decreasing number of customers (see Figure 2). With a variable customer rate, the monthly charge would rise from $6 per month today to over $178 per month as the number of gas customers declines.

HEAT PUMP COSTS

The FUTURE Act's $10.7 billion in potential savings does not take into account added costs of switching heating and cooling equipment to efficient electric heat pumps. Heat pumps, as individual units or in local networks, could foster a transition to renewable thermal energy.

Table 1. Summary of Status Quo and FUTURE Act costs

	2019$ (billions)	
	Status Quo	FUTURE Act
Already Spent Through 2019		
Leak-Prone Pipe Replacement		
Capital	$1.6	$1.6
Return to Investors	$1.2	$1.2
Gas Leak Repair		
Capital	$0.3	$0.3
Return to Investors	$0.3	$0.3
Recovered Costs-to-Date	-$0.7	-$0.7
Already Spent Sub-total	$2.8	$2.8
Additional Costs Starting 2020		
Leak-Prone Pipe Replacement		
Capital	$7.7	$0.6
Return to Investors	$5.9	$0.4
Gas Leak Repair		
Capital	$0.4	$1.6
Return to Investors	$0.3	$1.0
Additional Costs Sub-total	$14.3	$3.6
Total Costs	**$17.1**	**$6.3**

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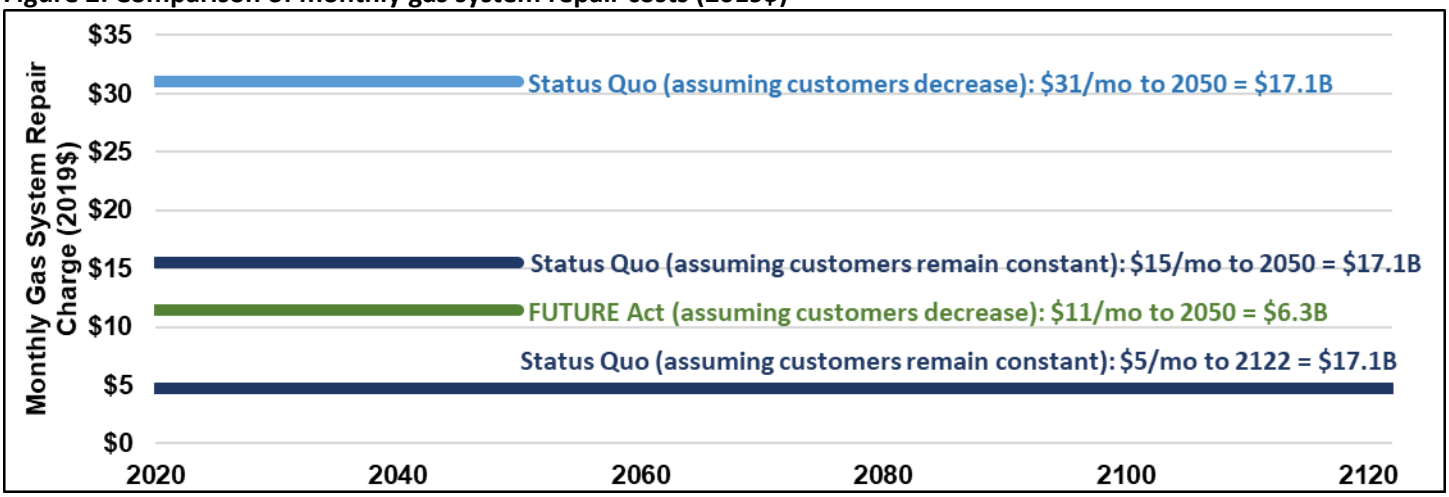
Figure 2. Comparison of monthly gas system repair costs (2019$)



District thermal networks may cost less than individual household systems, but the degree of savings is still uncertain. Instead, we estimated the cost of changing all 1.4 million homes that currently have gas heat and electric AC to air source heat pump systems. (Our estimate does not include the cost of necessary upgrades to aging electric systems or changes to home heating distribution systems.) For a median-sized home:

- With no financial incentives from the state, heating with gas plus cooling with electric AC is $700 cheaper than heat pumps over the 18-year lifetime of the system. (That's about a $40 per year savings.)
- Massachusetts offers a $431 rebate to switch from a gas furnace to a heat pump, which leaves households with $269 in costs over the systems lifetime.
- Redirecting the $1,100 in incentives that Massachusetts pays for the installation of new gas furnaces plus electric AC to instead go to new heat pump owners would more than cover these costs.

Massachusetts households are eligible for zero-interest "HEAT Loans" from the Mass Save program to buy a new heat pump. With no upfront costs to consumers, and a reallocation of current gas furnace and electric AC rebates, switching to heat pumps is costless for a median-sized or smaller home.

For larger homes, the current Massachusetts heat pump rebate is not sufficient, and even reallocating the current state rebates is not enough to make heat pumps the most economic choice. Taking into consideration the varying sizes of Massachusetts homes—including very large homes—we estimate that the additional incentives necessary to move all 1.4 million homes that currently heat with gas over to heat pumps would be $2.1 billion.

However, if Massachusetts were to redirect the $1.5 billion in expected gas furnace and electric AC rebates to go instead to new heat pump owners, the additional incentive needed would fall from $2.1 to $0.6 billion—or 6 percent of the potential savings from the FUTURE Act.

The Other Cost of Gas

In September 2018, failures in utility supervision resulted in a series of gas explosions and fires in Massachusetts' Merrimack Valley. Twenty-two people were hospitalized and one person killed. Although residents were allowed to return home after three days, electric and gas systems could not be safely restored for three months. Columbia Gas pled guilty to violating the federal Pipeline Safety Act and paid $196 million in fines and settlements. Under the plea agreement, Columbia's parent company must sell off its operations in Massachusetts. In early June 2020, the Massachusetts Attorney General opened an investigation into phasing out all gas in favor of alternative heating methods by 2050.

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Methodology

MASSACHUSETTS LEAK-PRONE INFRASTRUCTURE: The extent of leak-prone gas infrastructure was estimated based on the composition of each utilities' system as reported in the 2015 GSEP filings. Using the utilities' definition of leak-prone infrastructure (including pipes composed of uncoated steel, cast iron, wrought iron), 30% (roughly 6,200 miles of gas mains and 240,000 associated services) of the distribution system was composed of leak-prone infrastructure in 2015 and 24% (5,000 miles and 188,000 services) in 2020 (1, 3).

PAST GAS SYSTEM ENHANCEMENT SPENDING: The total cost of replacing leak-prone gas infrastructure in the Commonwealth was estimated using a detailed capital revenue requirement calculation including: all realized and estimated replacement costs; depreciation and rate of return on the undepreciated balance using a depreciation period of 15 years; and an assumed escalation rate of 2%, and a rate of return of 9.06% (4). We used actual replacement costs incurred for 2015 through 2018 and the utilities' replacement cost estimates for 2019. For the total cost of repairing gas leaks in the Commonwealth between 2015 and 2018, we used estimates as reported by each utility (5).

RECOVERED GAS SYSTEM ENHANCEMENT COSTS: GSEP recovered an estimated $657 million from 2015 to 2019. Total estimated recovered costs are the 2019 GSEP adjustment factor ($0.049 per therm) multiplied by the gas delivery volumes (in therms) for each state utility with a GSEP (2, 7). U.S. EIA gas delivery volumes were used for 2015 through 2018, while 2019 gas delivery volumes were derived from projections in each utilities' 2019 GSEP filings.

STATUS QUO SCENARIO: The "Status Quo" estimates the costs to fully replace the Commonwealth's leak-prone gas infrastructure and the continued repair of gas leaks from 2015 to 2034, per current law. From 2020 to 2034, replacement costs were calculated as total remaining leak-prone infrastructure multiplied by average replacement costs from the historical period ($/mile or $/service) (3). Replacement costs were distributed evenly across the 15-year period and escalated at an assumed rate of 2%. Since Status Quo assumes full replacement of the Commonwealth's leak-prone gas infrastructure by the end of 2034, gas leaks, and thus the need to repair them, decrease over time. From 2019 to 2034, we assume that the costs associated with gas leak repair will linearly decrease (as leak-prone pipes are replaced) so that the repair cost associated with gas leaks amounts to $0 by 2035.

FUTURE ACT SCENARIO: The "FUTURE Act" estimates the cost of continued gas leak repair and safety replacements, while transitioning to renewable thermal energy, and assumes that the Commonwealth's heating sector will switch completely to renewable thermal energy by 2050. Starting in 2020, pipe replacement would only occur for unavoidable safety obligations such as cracked mains (we assume this to be 5% of current replacement levels, acknowledging that this rate is challenging to predict), while gas leak repairs would continue at the same pace until 2049. Costs were escalated at an assumed rate of 2%. To estimate the total cost of repairing MA gas infrastructure, we performed the same capital revenue requirement calculation, but truncated the 15-year depreciation period starting in 2037 to end in 2050.

Notes

[1]All dollar values presented in 2019 dollars, converted (when necessary) using the CPI-U.

[2]Colonial Gas plans to complete leak-prone infrastructure replacements over an 11-year period, and NSTAR Gas and Boston Gas a 25-year period. Blackstone Gas, does not have any leak-prone infrastructure in its distribution system. Source: 19-GLR-01 page 4

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