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GOVERNMENT OF THE DISTRICT OF COLUMBIA
OFFICE OF THE ATTORNEY GENERAL

ATTORNEY GENERAL
BRIAN L. SCHWALB

Public Advocacy Division
Housing and Environmental Justice Section

E-Docketed

June 10, 2025

Brinda Westbrook-Sedgewick
Secretary, Public Service Commission
for the District of Columbia
1325 G Street N.W., Suite 800
Washington, D.C. 20001

Re: Formal Case No. 1167 -- In the Matter of the Implementation of Electric and Natural Gas Climate Change Proposals

Dear Ms. Westbrook-Sedgewick:

On behalf of the District of Columbia Government, I enclose for filing a whitepaper it commissioned authored by Synapse Energy Economics, Inc., setting forth alternative scenarios for addressing leak prone pipes in the District. The whitepaper is entitled "Alternative Approaches to Increasing Gas System Safety in the District of Columbia." If you have any questions regarding this filing, please contact the undersigned.

Sincerely,

BRIAN L. SCHWALB
Attorney General

By: */s/ Brian R. Caldwell*
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Alternative Approaches to Increasing Gas System Safety in the District of Columbia

Prepared for the Department of Energy and Environment and Office of the Attorney General for the District of Columbia for Submission in:

Formal Case No. 1167

In the Matter of Electric and Natural Gas Climate Change Proposals

June 10, 2025

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EXECUTIVE SUMMARY

The gas distribution pipeline system in the District of Columbia (sometimes referred to as the District), like those of many older urban areas in the United States, contains many miles of aging pipe made from materials such as cast iron and bare steel that are considered to be "leak prone," and thus a risk to public safety. Washington Gas Light Company (WGL) has been slowly replacing these assets with modern plastic equivalents at steadily increasing costs, under the name of PROJECT*pipes*, which WGL recently renamed the District Strategic Accelerated Facility Enhancement (District SAFE) Plan.[1] WGL's replacement-focused approach has left the District faced with high projected costs and slow progress toward increasing gas system safety. As a result, the Department of Energy and Environment and Office of the Attorney General for the District of Columbia asked Synapse Energy Economics, Inc. (Synapse) to examine alternatives to WGL's replacement-focused approach to aging pipe, informed by District policy and consistent with expected declines in gas use.

WGL proposes an expensive and risky approach

Since 2014, the Public Service Commission (PSC or the Commission) has approved a large-scale program to replace aging and leak-prone mains and services, run by WGL, which offers WGL the chance to begin to recover its investment before its next rate case. As part of its current District SAFE proposal, WGL plans to replace 12.4 miles of leak-prone main and 3,608 services[2] over three years, at a total cost of $215 million.[3] In comparison, the previous spending cap for the second PROJECTpipes plan was $150 million over three years. This pace is still far below the level needed to address all leak-prone pipes on WGL's system in a timely manner. At the planned pace for District SAFE, it would take over 150 years to retire all mains installed before 1970, and it would cost $6.2 billion to retire the mains and services installed before 1970, which is nearly five times the total amount invested by WGL in today's gas system.

WGL does not present a viable plan to reduce safety risks. As WGL points out in response to a District of Columbia Government (DCG) data request, "the system continues to age and the overall risk will continue to increase at a rate that outpaces the impact of the proposed planned replacement activities."[4] By the time WGL could replace all assets identified today as leak-prone, its younger plastic pipes would be nearing or past the end of their expected useful lives, so costs and risk would continue to rise.

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[1] FC 1179. WGL Revised Application.

[2] Services are the smaller pipes which connect the main under the street to a building.

[3] FC 1179. WGL Revised Application, Direct Testimony of Wayne A. Jacas, Table 4.

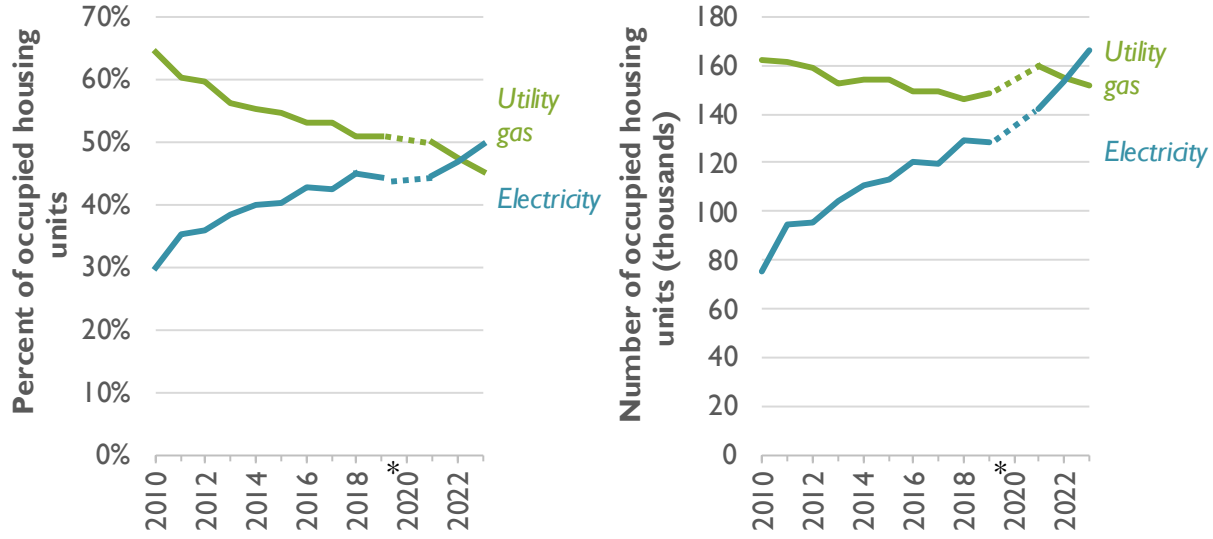
[4] FC 1179. WGL Response to District of Columbia Government (DCG) Data Request (DR) No. 1-11.

The costs of rebuilding the gas system are high and growing. WGL's average costs to replace mains in its new program proposal have increased at least 30 percent from 2014 to 2023. Increases are even more dramatic for service lines: On average, it costs WGL $35,300 to replace a leak-prone service line;[5] this is up almost a factor of two from an average of $19,920 between 2014 and 2023.[6] In many cases, the cost of fully electrifying a home will be comparable to or less than the cost of replacing its service line, yet WGL does not consider any options other than replacement.

Markets and policy challenge the status quo

Gas heating market share has been in a steady decline in the District of Columbia since at least 2010. WGL has managed to hold a relatively steady customer count while virtually all growth has come in electrically heated buildings. This dynamic reflects the rough parity in energy bills between gas and electricity (depending on equipment choices), combined with the cost of gas connection and the prospect of continually rising gas rates. Continuing a replacement-focused approach to addressing gas safety risks will drive gas rates higher and thereby challenge WGL's ability to hold onto its customer base.

Figure 1. Households heating with utility gas and electricity in D.C., percent of total occupied housing units (left), number of housing units (right)



*Source: U.S. Census Bureau, American Community Survey 1-year Estimates. *The U.S. Census Bureau did not publish 1-year estimates for the American Community Survey in 2020.*[7]

[5] FC 1179. WGL Response to DCG DR No. 3-11 (filed Nov. 26, 2024).

[6] FC 1179. WGL Revised Application, Exhibit WG (A)-1 (District SAFE Plan 2024), Figures 12 and 13.

[7] See: U.S. Census Bureau. "2020 ACS 1-year Estimates" at https://www.census.gov/programs-surveys/acs/technical-documentation/table-and-geography-changes/2020/1-year.html#:~:text=The%20Census%20Bureau%20did%20not,on%20data.census.gov.

Meanwhile, WGL also faces headwinds from public policy. The District of Columbia has adopted an ambitious policy to reduce greenhouse gas (GHG) emissions: it aims to reach carbon neutrality by 2045. Meeting this objective will require dramatic reductions in the amount of fossil gas distributed in the WGL system. The District has identified electrification as the primary technological pathway to achieve carbon neutrality in buildings, in part because, as studies by the American Council for an Energy-Efficient Economy have found, it is the "lowest-cost route to decarbonization for most U.S. homes."[8]

WGL has invested billions of dollars in the gas system in the District and argues for the need to invest billions more. As rates rise and customers with the means and opportunity choose electricity, rates will rise even faster and drive even more customers away from gas. Gas system costs will fall on a smaller and smaller portion of the population—a portion that is more likely to be low-income, disadvantaged, and renters. If assets are stranded, meaning their costs cannot be recovered from customers, either District taxpayers or WGL's investors will eventually pay, for a system of little value to either.

Alternative approaches are safer and less expensive

For comparison with WGL's business-as-usual proposed approach (WGL BAU), Synapse developed an alternative approach that incorporates all three risk-mitigating actions: repair, replacement, and retirement. We assume that instead of replacing all leak-prone pipe as planned, WGL takes a strategic 'repair and decommission' strategy, which accelerates leak repair, reduces pipeline replacement, and retires pipe by electrifying the buildings of customers served by leak-prone pipe instead of replacing the pipes. We distinguish between two variations on pipe retirement: a "Neighborhood Electrification Alternative" that includes higher levels of clustered, neighborhood electrification,[9] and a "Scattered Electrification Alternative" that does not coordinate electrification in clusters (although eventually reaches the same end point as the Neighborhood case).

These alternative approaches include additional proactive leak surveys beyond what is required by regulation. They also include additional funds for rapid leak repair to address increased leak detection, clear WGL's leak backlog, and address leaks quickly after they are identified. As risk reduction through repair and retirement ramps up in the alternative approach, spending on traditional pipeline replacement declines.

We find that:

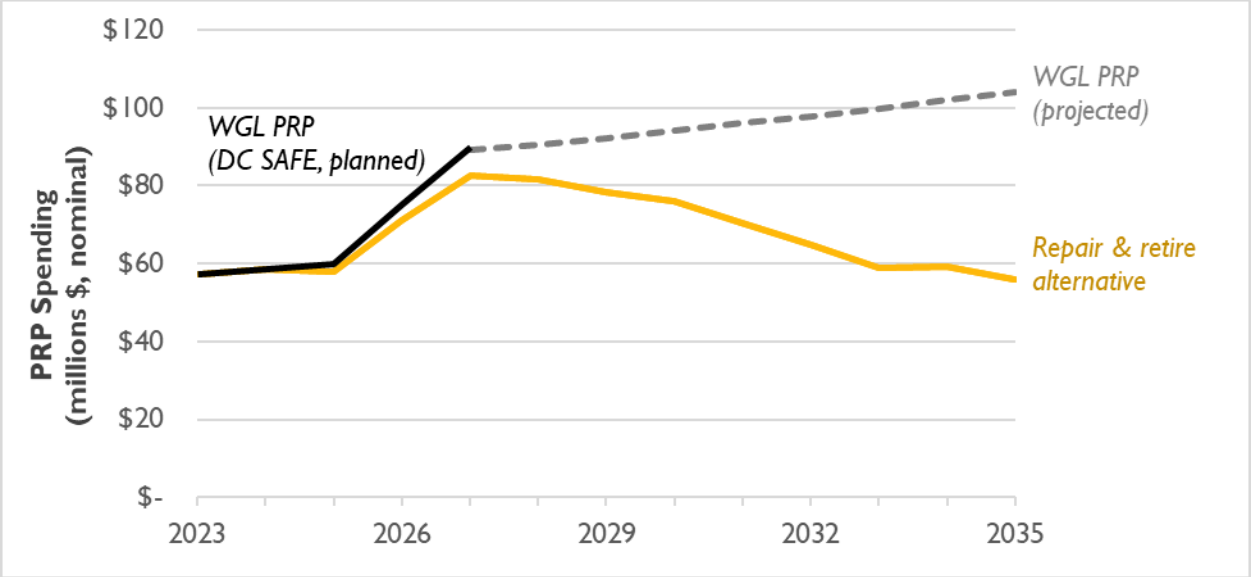
- **The Neighborhood Electrification approach is a less costly approach than the WGL BAU or Scattered approaches**: In the Neighborhood Electrification case, reducing spending

[8] Nadel, Steven. June 2023. *Impact of Electrification and Decarbonization on Gas Distribution Costs*, page 31. American Council for an Energy-Efficient Economy (ACEEE). Available at https://www.aceee.org/sites/default/files/pdfs/U2302.pdf.

[9] This approach could use clustered building-level electrification and thermal energy networks, such as the networks that WGL is required to pilot in Maryland under the 2024 Working for Accessible Renewable Maryland Thermal Heat (WARMTH) Act.

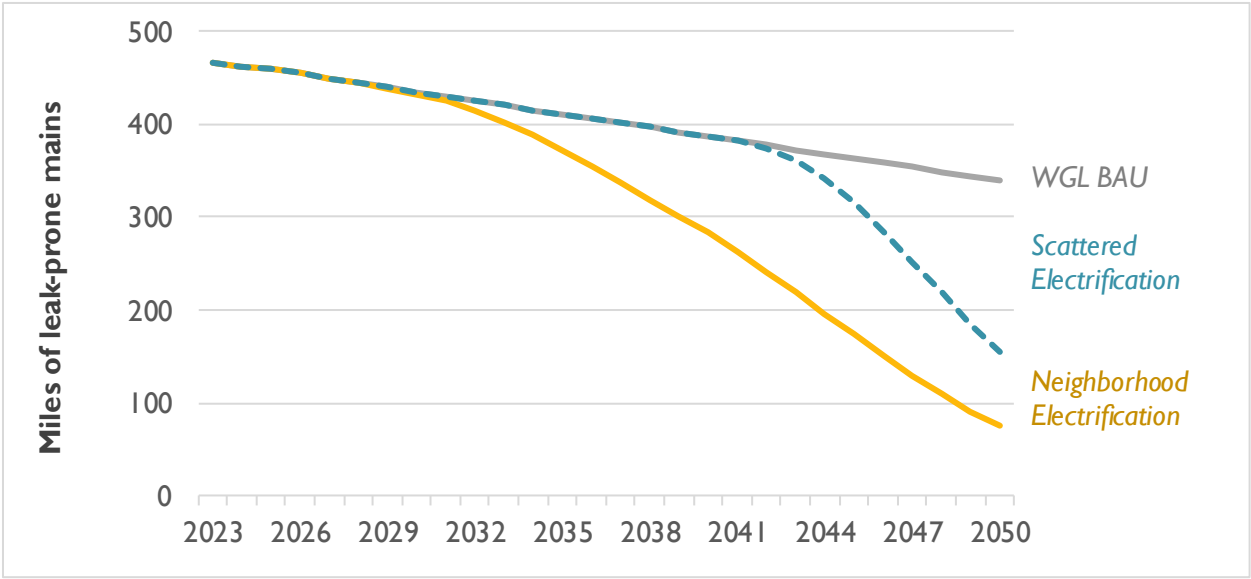
on traditional pipeline replacement saves $244 million over the next decade compared to the WGL BAU case. Even with incremental leak repair and advanced leak detection costs of $113 million in operation and maintenance costs over the same time period, there are still net cost savings of $130 million over the next 10 years.

Figure 2. Capital spending on pipeline replacement program (PRP), in WGL BAU case vs. alternative approach



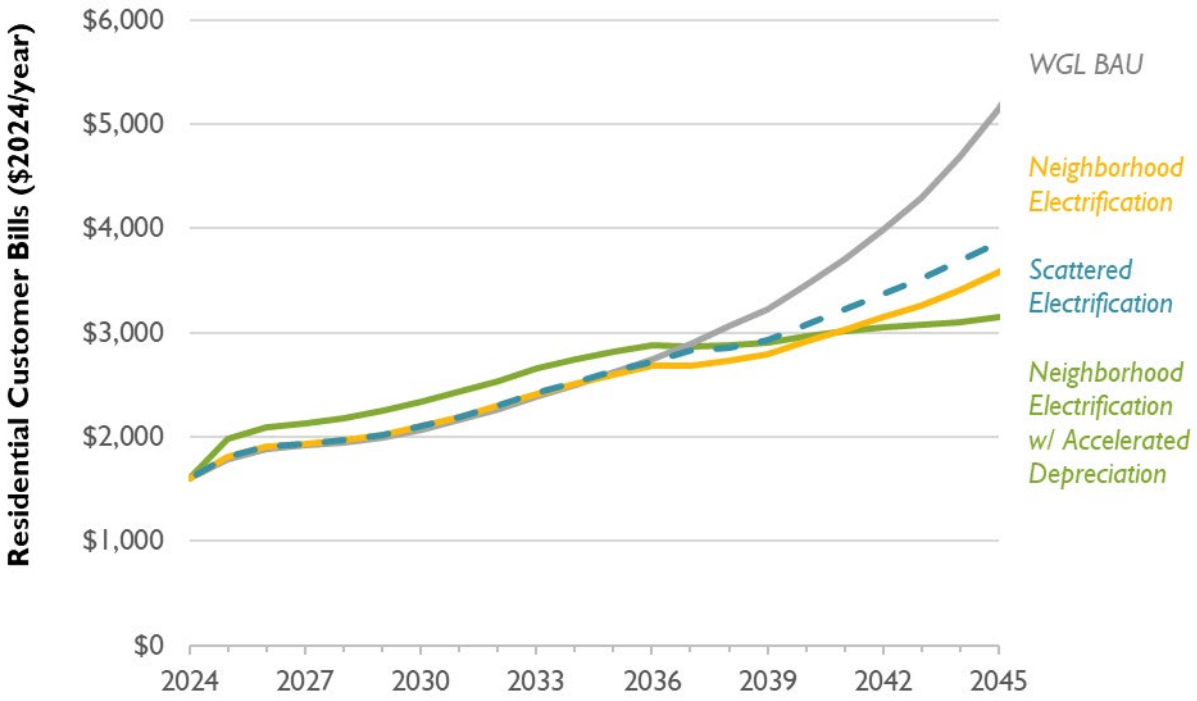
- **The Neighborhood Electrification approach reduces more leak risk and stranded asset risk than the WGL BAU or Scattered cases**: The same or more mains and services are retired than replaced under a BAU. Retiring pipe earlier and in clusters reduces the amount of leak-prone pipe on WGL's system faster than under BAU leak-prone pipe replacement activities.

Figure 3. Miles of leak-prone mains on WGL's system by scenario



- **The Neighborhood Electrification approach results in a 30 percent lower revenue requirement and lower bills for customers compared with the WGL BAU case**. Under the same assumptions around customer defection from the gas system, the Neighborhood Electrification approach has an overall lower revenue requirement and lower customer bills.

Figure 4. Residential annual average bills under all scenarios



- **The Scattered Electrification Alternative is more expensive and less safe than the Neighborhood Electrification case**. The Scattered case keeps more miles of pipe in the ground longer, where they require upkeep and present safety risks.

Synapse also modeled other alternative scenarios and sensitivities:

- Implementing accelerated depreciation in the Neighborhood Electrification case can further mitigate rate and bill increases in the later years, while eliminating stranded cost risk, at the cost of somewhat higher gas rates in the near term.
- In a "slow-change" scenario, inspired by WGL's preferred climate business plan scenario,[10] which attempts to use lower-carbon fuels and partial electrification to meet District policy goals, we find that gas bills would rise rapidly. This drives customers to

[10] WGL's "Fuel Neutral Decarbonization" scenario. *See:* FC 1142. WGL Climate Business Plan for Washington, D.C. Available at: https://edocket.dcpsc.org/apis/api/filing/download?attachId=101994&guidFileName=e69b6cb2-963c-4122-aca3-3b45e838b2b7.pdf.

fully electrify and converges on a scenario similar to the Scattered Electrification case. The Neighborhood Electrification Alternative approach would cost less and have lower safety and financial risk under this slow-change scenario than the BAU.

WGL's approach to addressing gas pipeline safety risk through a replacement-focused approach (as modeled in the WGL BAU scenario) is not the most financially sustainable option. It offers the highest long-term rates, least safety, and greatest investor risk. Alternative approaches that incorporate repair and retirement through electrification alongside targeted replacement increase safety while reducing overall rates and lowering stranded cost risk. The costs of the alternatives are comparable to the BAU approach in the near term, and fall over time to be lower, all while these approaches reduce safety risks faster and more completely than a business-as-usual approach.

1. INTRODUCTION AND BACKGROUND

The gas distribution pipeline system in the District of Columbia, like those of many older urban areas in the United States, contains many miles of aging pipe made from materials such as cast iron and bare steel that are considered to be "leak prone." Reducing gas leaks has both environmental value (methane is a potent greenhouse gas) and safety value (leaks present a risk of explosions or other hazards). WGL is required to maintain a safe and reliable gas distribution system and has been steadily replacing older assets for many years as part of normal operations. Following a series of gas-related emergencies in other states in the early 2010s, WGL proposed, and the Commission approved, a program to replace aging and leak-prone mains and services with favorable financial treatment. This program was originally called PROJECTpipes;[11] WGL recently renamed it the District Strategic Accelerated Facility Enhancement (District SAFE) Plan.[12] WGL receives accelerated cost recovery for activities in this program, so it begins recovering associated costs immediately through surcharge on customer bills, rather than through base rates after a rate case. Accelerated recovery removes a disincentive for capital investment inherent in traditional utility ratemaking.

Through its pipeline replacement program activities, WGL retired and replaced about 37 miles of aged main and 7,457 old services in the nine years from 2014 to 2023, as shown in Figure 5 and Figure 6.[13,14] The annual pace of replacement has fluctuated year-to-year, with an average of 3.8 miles of mains replaced per year over the first decade of PROJECTpipes. Total replacement activity remains far below the level needed to address all leak-prone pipes (LPP) on WGL's system in a timely manner. WGL plans to replace 12.4 miles of leak-prone main (averaging 4.1 miles per year) and 3,608 services over three years as part of its proposed District SAFE plan, at a total cost of $215 million. In comparison, the Commission approved roughly $350 million for PROJECTpipes programs from 2014 to the present.[15] WGL's proposed District SAFE budget represents a 50 percent increase in average spending per year relative to the previous PROJECTpipes cycle.

[11] District of Columbia Public Service Commission. "PROJECT*pipes*." Available at: https://dcpsc.org/Utility-Information/Natural-Gas/PROJECTpipes.aspx.

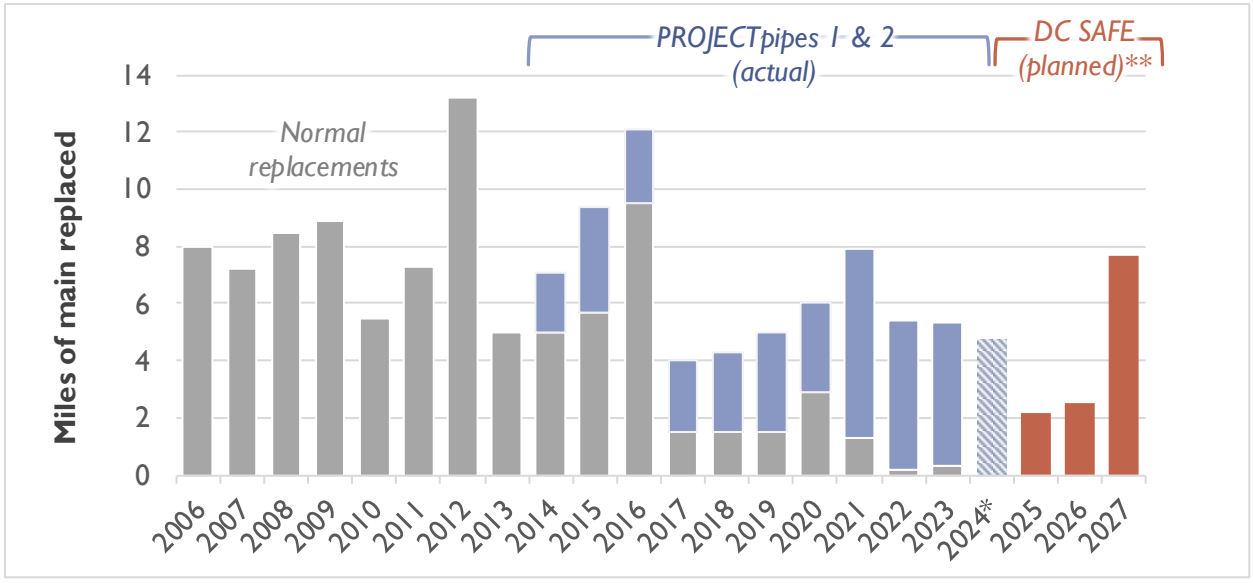
[12] As of WGL's 2024 Revised Application. From 2014 through 2023, WGL's leak-prone program was called "PROJECT*pipes.*"

[13] FC 1179. WGL Revised Application, Exhibit WG (A)-1 (District SAFE Plan 2024), Figure 9 and Figure 10.

[14] At the time of this report, actuals for 2024 had not been reported by WGL. Data for 2024 is the expected miles and services remediated as part of the PROJECTpipes 2 one-year extension through December 31, 2024, approved by the Commission in Order No. 21960 ¶ 14.

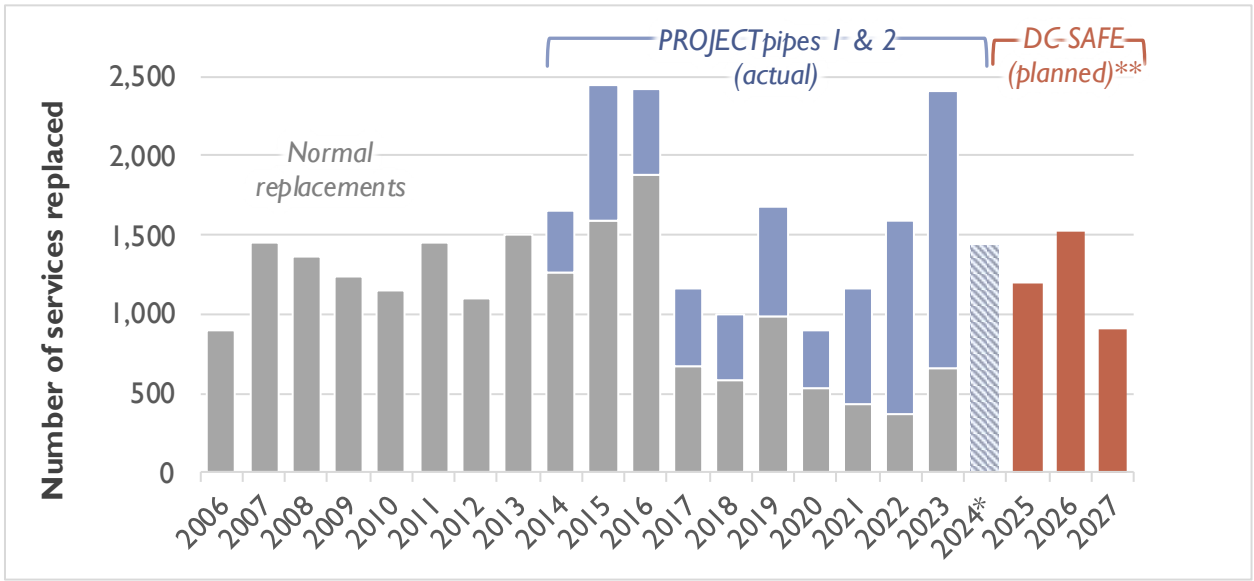
[15] Includes spending on PROJECTpipes 1 and PROJECTpipes 2, including extensions. The Commission authorized $177 million for PROJECTpipes 2 as well as an additional $50 million extending the program through 2024. Similarly, PROJECTpipes 1 was approved at $110 million, with an additional $12.5 million extension in 2020.

Figure 5. Annual miles of mains replaced as part of WGL's leak-prone pipe replacement program and normal operations



**As approved by the Commission in Order 21960 extending PROJECTpipes 2 for an additional year through December 31, 2024.*
***Does not include planned replacements as part of normal operations.*

Figure 6. Annual number of services replaced as part of WGL's leak-prone pipe replacement program and normal operations



**As approved by the Commission in Order 21960 extending PROJECTpipes 2 for an additional year through December 31, 2024.*
***Does not include planned replacements as part of normal operations.*

At the planned pace for District SAFE, it would take over 150 years to replace all mains installed before 1970 on WGL's system. It would take WGL about 20 years to replace all services installed before 1970. At WGL's estimate of per unit costs for District SAFE, it would cost about $6.2 billion to replace all

remaining mains and services installed before 1970.[16] For comparison, the entirety of WGL's current plant in service has a value of about $1.3 billion.

By the time all services installed before 1970 would be replaced at WGL's current pace of replacement, thousands more services installed after 1970 would be old enough to warrant replacement. This is even more true for mains, since it would be past 2150 before WGL would be done with retiring all mains installed before 1970. This increasing backlog is one of the main reasons that many experts have expressed concerns with the efficacy of accelerated pipe replacement programs. This includes the National Regulatory Research Institute (NRRI), which noted regarding such programs that their "high cost may exceed the economic, safety, and environmental benefits from fewer leaks."[17]

Investing hundreds of millions of dollars in replacing assets has driven increases in WGL's delivery rates at well over the rate of inflation, and continuing to invest at WGL's proposed rate would drive further rapid and sustained growth. While WGL's number of residential heating customers has remained relatively stable, the District has been growing rapidly; so WGL's market share is falling, with electric heating now the equipment of choice in a majority of District residences.[18] While the future of electric and gas prices is unknown, delivery costs that rise faster than inflation for years on end will likely further erode WGL's market position. The District of Columbia has adopted ambitious policies to reduce GHG emissions to reach carbon neutrality by 2045. Meeting this objective will require dramatic reductions in the amount of fossil gas distributed in the WGL system. While some amount of non-fossil gas may be available to replace fossil gas, these gases are expensive and their supplies are limited. Instead, the District has identified electrification as the primary technological pathway to achieve carbon neutrality in buildings, in part because as studies by the American Council for an Energy-Efficient Economy have found, it is the "lowest-cost route to decarbonization for most U.S. homes."[19] Volumes of gas distributed by WGL's system will fall substantially, potentially toward zero, to meet the District's climate policy.

Falling sales combined with increased capital investment risk creating unsustainably high gas rates—rates at which customers will either face severe energy burdens or choose to electrify in order to cut costs. Such a future poses risks to District of Columbia ratepayers as well as to WGL's investors. Financial outcomes can also create safety risks: a financially unhealthy utility may not be able to take actions necessary to maintain safety. The District of Columbia Department of Energy and Environment (DOEE)

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[16] $10.7 million per mile of main with associated services, and $35,300 per standalone service. *See:* FC 1179, WGL Response to DCG Data Request (D.R.) No. 3-11 (filed Nov. 26, 2024).

[17] The NRRI report was filed by WGL as part of it "Report on LAUF Best Practices"" see page 19 here: https://edocket.dcpsc.org/apis/api/Filing/download?attachId=208493&guidFileName=8818bb34-62a5-4fb2-82c1-ab9f5de49ac3.pdf

[18] In 2023, 49.6 percent of households used electricity for home heating, and 45.2% used natural gas. *See: https://www.eia.gov/state/data.php?sid=DC#ConsumptionExpenditures*

[19] Nadel, S. 2023. Impact of Electrification and Decarbonization on Gas Distribution Costs, page 37. American Council for an Energy-Efficient Economy (ACEEE). https://www.aceee.org/sites/default/files/pdfs/U2302.pdf#.

and Office of the Attorney General (OAG) asked Synapse Energy Economic (Synapse) to examine alternatives to WGL's replacement-focused approach to aging pipe, informed by District policy and consistent with expected declines in gas use. Our analysis found that WGL's approach to addressing gas pipeline safety risk through a replacement-focused approach is not the most financially sustainable option. It offers the highest long-term rates, the least safety, and the greatest investor risk. Alternative approaches that incorporate repair and retirement through electrification alongside targeted replacement increase safety while reducing overall rate increases and lowering stranded cost risk.

This report is structured as follows. The remainder of this section provides background on relevant District policies and summarizes the policy-consistent building decarbonization pathway that Synapse developed. Section 2 describes different scenarios for addressing aging pipe, including WGL's proposal and alternatives that focus on repair and retirement, while targeting replacement to only necessary pipe segments. Section 3 presents the results of Synapse's modeling of the utility economics of each of these approaches, including rates, bills, and stranded cost risks. Section 4 concludes the report with insights gathered from the analysis.

1.1. Market and Technology Drivers of Electrification

Heat pumps make up an increasingly greater share of the national space heating and cooling equipment markets. In 2023, heat pumps made up 55 percent of commercial and residential heating appliance shipments (including oil furnace, gas furnace, and heat pumps) compared to 43 percent in 2013.[20] Similarly, heat pumps have also made up an increasingly greater share of air conditioning shipments, from 32 percent heat pumps in 2013 to 42 percent heat pumps in 2023. As the heat pump market matures and customers, distributors, and HVAC contractors become more familiar with the technology, adoption rates are likely to continue to increase. Further, due to their high efficiency compared to other technologies, heat pumps offer customers a way to reduce their energy bills, which could further drive adoption. A recent study found that 95 percent of households nationwide that install a high-efficiency heat pump would experience energy bill savings, although the upfront cost of more efficient equipment could be a barrier to adoption.[21]

At today's electric and gas rates in the District of Columbia, a heat pump needs to be at least 3.8 times more efficient than its gas competitor in order to offer operating cost savings (not including potential savings from avoiding the monthly gas customer charge). This means a heat pump needs to have a coefficient of performance (COP) of at least 3.04[22] to be less costly to operate than an 80-percent efficient gas furnace, and a heat pump water heater (HPWH) needs to have a uniform energy factor

[20] Shok, Katherine. March 27, 2024. "A look at AHRI data from the past decade." *Buildings Hub*. Available at: https://atlasbuildingshub.com/2024/03/27/a-look-at-ahri-data-from-the-past-decade/.

[21] Wilson, Eric J.H. et al. April 2024. "Heat pumps for all? Distributions of the costs and benefits of residential air-source heat pumps in the United States." *Joule*, 8 no. 4 1000 – 1035. https://doi.org/10.1016/j.joule.2024.01.022.

[22] Corresponding to a heating seasonal performance factor, or HSPF, of 10.4.

(UEF) of at least 2.47 to be cheaper to operate than a 0.65 UEF gas storage water heater. Both of these efficiency benchmarks are easily met by available products in the Mid-Atlantic climate. In fact, all electric HPWHs on the market in the United States have UEFs over 2.5 and just 14 of the 490 Energy Star certified HPWHs have UEFs below 3.0.[23]

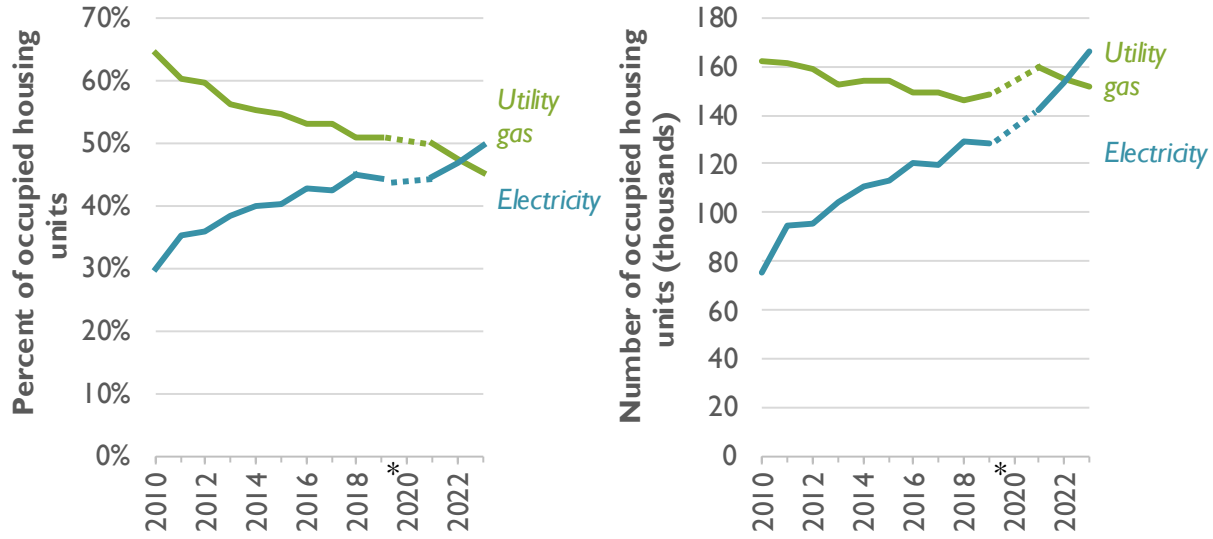
Average electricity and gas prices will likely continue to rise due to inflation and capital investments. However, one substantial driver for electric capital investments is the need to support more electric sales for electric vehicles, data centers, and electrifying buildings. These new uses that are driving investment in the electric system tend to be high load factor uses: they increase the volume of sales more than they increase the peaks that drive capital investment. Increasing sales with high load factors will tend to keep rates lower, because the fixed costs of the electric system can be spread over more sales. Time-of-use electric rates could also have a positive impact on the customer economics of electrification. Meanwhile gas rates are increasing due to capital investment in the context of stagnating sales. Over time, these forces should make electricity more and more competitive with gas and increase the available savings from electrification.

According to the U.S. Census, over the 2010–2023 period, the number of households heating with gas in the District fell by 7 percent, from about 162,000 to about 151,000.[24] Meanwhile the number of households heating with electricity more than doubled, from about 75,000 to about 166,000. Gas heating market share fell from 64 to 45 percent, while electric heating market share rose from 30 percent to almost 50 percent.

[23] Energy Star. "Energy Star Certified Heat Pump Water Heaters." Accessed January 2, 2025 at https://www.energystar.gov/productfinder/product/certified-heat-pump-water-heaters/results.

[24] U.S. Census Bureau. "Selected Housing Characteristics - House Heating Fuel." *American Community Survey 1-Year Estimates, Table DP04*. Available at: https://data.census.gov/table/ACSDP5Y2023.DP04?q=DP04: Selected Housing Characteristics&g=040XX00US11.

Figure 7. Households heating with utility gas and electricity in D.C., percent of total occupied housing units (left), number of housing units (right)



*Source: U.S. Census Bureau, American Community Survey 1-year Estimates. *The U.S. Census Bureau did not publish 1-year estimates for the American Community Survey in 2020 (see https://www.census.gov/programs-surveys/acs/technical-documentation/table-and-geography-changes/2020/1-year.html#).*

1.2. Summary of Relevant District Policy

The District of Columbia has a goal of reaching net-zero emissions by 2045, as established by the Climate Commitment Amendment Act of 2022.[25] After the passage of the Climate Commitment Act, Mayor Bowser released the Carbon Free DC strategy, the District's long-term strategy to reach carbon neutrality by 2045 and guide policymaking across all sectors: buildings, energy supply, transportation, and waste.[26] The District is currently developing the Clean Energy DC 2.0 plan, a more detailed plan for achieving the District's clean energy goals, including reaching carbon neutrality by 2045. Clean Energy DC 2.0 will build off the Carbon Free DC strategy and the 2018 Clean Energy DC (CEDC) plan, which presented actions to meet the District's 2032 GHG emissions goals (which have subsequently become more ambitious). Meeting the District's objectives will depend on comprehensive policy and programmatic action at the District level, Federal support, and market and technological evolution.

[25] *Climate Commitment Amendment Act of 2022.* D.C. Law 24-176. Available at: https://code.dccouncil.gov/us/dc/council/laws/24-176.

[26] Executive Office of the Mayor, District of Columbia Government. December 1, 2023. "Mayor Bowser Releases Carbon Free DC Strategy While Attending COP28." Press Release. Available at: https://mayor.dc.gov/release/mayor-bowser-releases-carbon-free-dc-strategy-while-attending-cop28v1.

The District has multiple policies promoting the creation of net-zero energy buildings.[27] The District's current energy conservation code includes a voluntary net-zero energy code.[28] The Greener Government Buildings Amendment Act of 2022 requires new District-owned buildings and substantial improvement projects that receive 15 percent or more of their funding from the District to comply with this net-zero energy code.[29] By 2026, all new and substantial improvements to commercial buildings and residential buildings taller than three stories must meet net-zero energy standards.[30]

Another policy helping the District make progress towards its 2045 goal is the District's Building Energy Performance Standard (BEPS), which sets energy performance targets for specific existing building types. Reducing the amount of energy that buildings use directly reduces emissions associated with this energy usage. The standard currently applies to privately-owned buildings 50,000 square feet or larger and District-owned buildings 10,000 square feet or larger. In 2028, privately-owned buildings 25,000 square feet or larger must also comply with the BEPS, and starting in 2034, all buildings 10,000 square feet must comply.[31]

In addition to increasing building energy efficiency, electrification of existing buildings will be important to achieving the District's net-zero goals. Accordingly, the Healthy Homes and Residential Electrification Act of 2024 created the Breathe Easy Program to provide 30,000 low-income and moderate-income households with electrification retrofits.[32]

Multiple federal actions and policies promote decarbonization and electrification of buildings. For example, several federal tax credits and rebates incentivize electrification. The 25C tax credit provides tax credits for air source heat pumps and HPWHs, and electrical panel upgrades installed in conjunction with either technology.[33] The Inflation Reduction Act authorized $8.8 billion for home energy efficiency and electrification rebates, including the Home Efficiency Rebates (HER) program, which will provide grants to state energy offices to provide rebates for energy efficiency upgrades such as heat pumps, and

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[27] District of Columbia Department of Energy & Environment. "Green Building in the District." Accessed 9/24/2024. Available at: https://doee.dc.gov/service/greenbuilding.

[28] 2017 District of Columbia Energy Conservation Code Appendix Z. 2020. Available at: https://doee.dc.gov/sites/default/files/dc/sites/ddoe/service_content/attachments/2017%20DC%20Energy%20Conservation%20Code_Appendix%20Z.pdf.

[29] *Greener Government Buildings Amendment Act of 2022.* D.C. Law 24-306. Effective March 10, 2023. Available at: https://code.dccouncil.gov/us/dc/council/laws/24-306.

[30] *Clean Energy DC Building Code Amendment Act of 2022.* D.C. Law 24-177. Effective September 21, 2022. Available at: https://code.dccouncil.gov/us/dc/council/laws/24-177.

[31] Building Innovation Hub. "BEPS Standards and Compliance Rules Finalized." Accessed 9/24/2024. Available at: https://buildinginnovationhub.org/special-update-beps-rules-released/.

[32] *Healthy Homes and Residential Electrification Amendment Act of 2024.* D.C. Act 25-488. May 31, 2024. Available at: https://lims.dccouncil.gov/downloads/LIMS/52291/Signed_Act/B25-0119-Signed_Act.pdf?Id=191649.

[33] Rewiring America. 2023. "25C Residential Energy Efficiency Tac Credit and 25D Residential Clean Energy Tax Credit." https://assets.ctfassets.net/v4qx5q5o44nj/3FYfJiYMILiXGFghFEUx0D/279f180456183d560d9c68d4de8baa67/factsheet_25C_25D.pdf.

the Home Electrification and Appliance Rebates (HEAR) program, which will provide grants for rebate programs for high-efficiency home appliances and equipment.[34] Finally, the Training for Residential Energy Contractors Program provides $200 million to state energy offices to train residential energy efficiency and electrification contractors.[35]

1.3. Decarbonization Pathway for the District's Buildings

Synapse modeled a decarbonization pathway for District residential and commercial buildings based on existing policies to estimate the pace at which customers reduce gas use and disconnect from the gas system. We modeled one scenario which assumes replace-on-failure electrification and a second scenario which assumes both replace-on-failure electrification and early retirement of remaining gas heating systems beginning in 2043.

Model Assumptions and Parameters

Synapse modeled the gas consumption and number of customers with gas equipment by modeling the turnover of residential and commercial space heating, water heating, cooking, and clothes drying equipment in its Building Decarbonization Calculator (BDC). We characterize baseline building stock and equipment using data from the U.S. Census Bureau's American Community Survey, along with the U.S. Energy Information Administration's (EIA) Residential Energy Consumption Survey (RECS) and Commercial Buildings Energy Consumption Surveys (CBECS). We assume new construction occurs at a rate equal to projected population growth.[36] We calculate equipment turn-over estimates using equipment survival curves from the U.S. Department of Energy.[37]

We developed market share trajectories for heat pump space and water heating equipment in existing and new buildings. A space heat pump existing building market share of 10 percent in 2024 would mean that 10 percent of homes that replace their gas heating equipment in 2024 install a heat pump, and 90 percent install a new gas system (i.e., a like-for-like replacement). Similarly, a 10 percent space heat pump new construction market share would mean that 10 percent of new buildings built in 2024 are built with a space heat pump.

Figure 8 displays the forecasted heat pump market share trajectories used in our stock-turnover modeling. These trajectories are based on compliance with D.C. climate policies and future mandates

[34] Office of State and Community Energy Programs. "Home Energy Rebates Frequently Asked Questions." Accessed 9/25/2024. https://www.energy.gov/scep/home-energy-rebates-frequently-asked-questions.

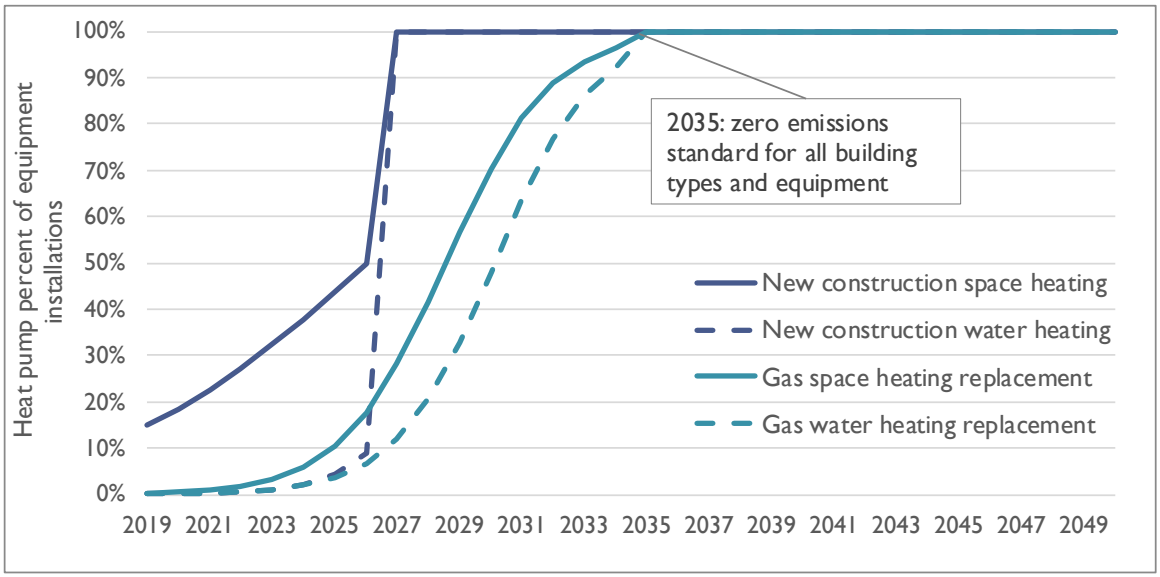
[35] Office of State and Community Energy Program. "Training for Residential Energy Contractors Grants (Formulas). Accessed 9/25/2024. Available at: https://www.energy.gov/scep/training-residential-energy-contractors-grants-formula.

[36] District of Columbia Office of Planning. 2024. *DC 2050: Outlook for the District's Next Comprehensive Plan.* Available at: https://planning.dc.gov/sites/default/files/dc/sites/op/page_content/attachments/DC%202050%20Short%20Paper_0.pdf.

[37] U.S. Department of Energy. 2009. "Notice of Proposed Rulemaking Technical Support Document Energy Conservation Program for Consumer Products." Appendix 8-C. Lifetime Distributions. Available at: https://www.regulations.gov/document/EERE-2006-STD-0129-0170.

and do not necessarily reflect current trends. We assume the market share trajectories for commercial buildings are the same as residential buildings and assume the market share for electric cooking and drying equipment are the same as HPWH trajectories.

Figure 8. Heat pump market share trajectories



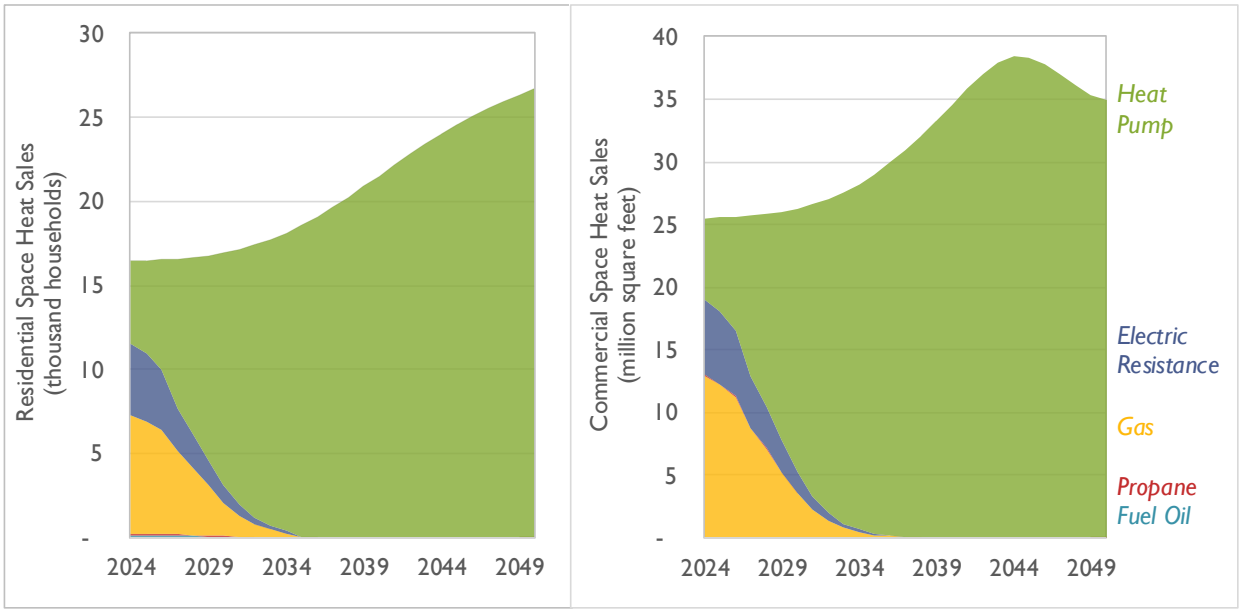
We assume that heat pump market shares in new construction will reach 100 percent by 2027, because the District's net-zero energy building code for new construction goes into effect in 2026. We assume heat pump market shares for existing buildings with baseline natural gas equipment will reach 100 percent by 2035, in alignment with the District's Carbon Free DC, 2045 Strategic Policy Roadmap.[38] Finally, we expect the market share trajectories for HPWHs to lag slightly behind space heat pumps, given the relatively nascent market for HPWHs compared to space heat pumps.

Model Results

Figure 9 shows annual space heat equipment sales by fuel type for commercial and residential buildings. These trajectories include equipment installed in new construction and existing buildings. In both commercial and residential buildings, sales of gas systems decrease rapidly until reaching nearly zero in 2035.

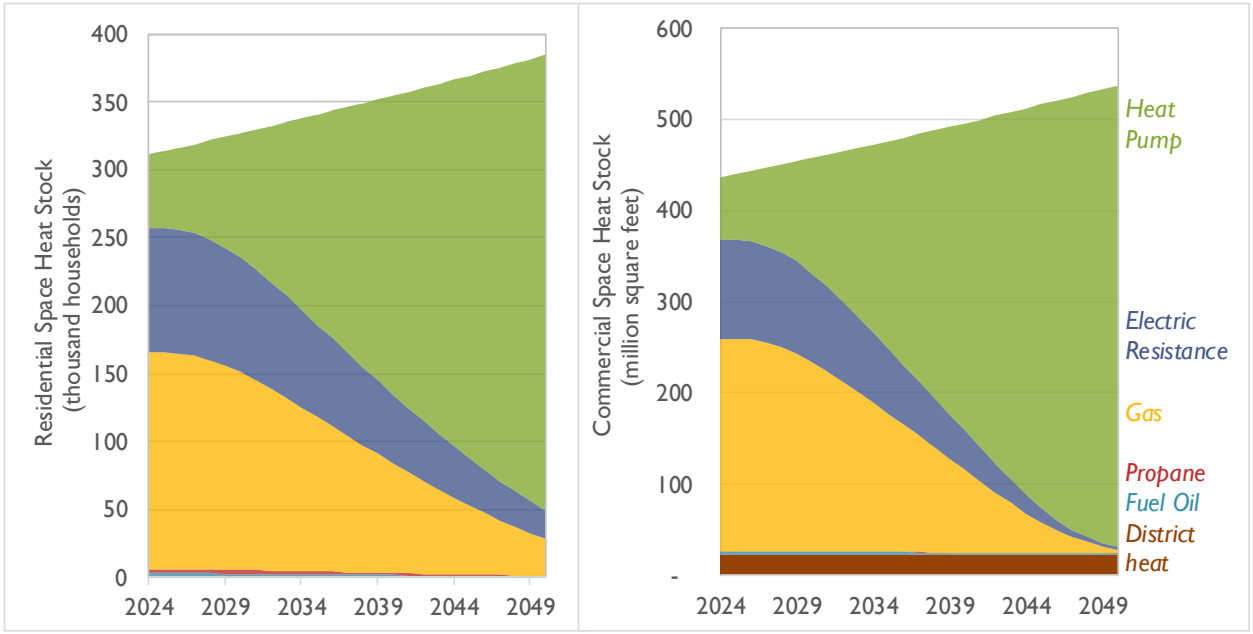
[38] District of Columbia Government, Carbon Free DC: 2045 Strategic Policy Roadmap (2023), at pg. 2, https://doee.dc.gov/sites/default/files/dc/sites/doee/service_content/attachments/CFDC%20Policy%20Roadmap_FINAL.pdf.

Figure 9. Space heat equipment sales



As shown in Figure 10, by 2045, approximately 14 percent of households still rely on natural gas for heating, and 7 percent of commercial square footage is heated by natural gas. By 2050, the portion of households that rely on natural gas for heating is 7 percent, and nearly no commercial buildings rely on natural gas for heating. Because many residential space heating systems can last over 20 years, and some can last over 30 years, some fossil systems installed in the late 2020s and early 2030s may persist beyond 2050, based solely on equipment engineering life.

Figure 10. Space heating stock results



Both residential and commercial buildings have nearly no natural gas water heating by 2050. The quicker decarbonization of water heating relative to space heating is due to shorter lifetimes of water heaters.

2. REPAIR AND REPLACEMENT SCENARIOS FOR LEAK-PRONE PIPE

The safety and environmental risks associated with aging pipe can be addressed using three general actions: replacement, repair, and retirement. All of these actions are consistent with the U.S. Department of Transportation's Pipeline and Hazardous Materials Safety Administration's (PHMSA) 2011 Call to Action on pipeline safety.[39]

Replacement: Replacing older pipe with new, plastic pipe reduces leaks due to the lower leak propensity of plastic material and better joints between plastic components. An advantage of replacement is that customers do not need to make changes to their building systems. Disadvantages include that the pipe remains at risk of excavation or other damage and that this is commonly the most expensive option for reducing safety risk. For example, under WGL's proposed District SAFE program, the average cost of replacing a service line is $35,300 per line.[40]

Repair: Repairing pipe when a leak is identified directly reduces leaked gas. Advantages of repair include its relatively low cost, the fact that it focuses directly on identified risks, and the fact that customers do not need to make changes to their building systems. Disadvantages include the shorter lifetime of repairs compared to new pipe, the need to identify leaks before repairing them, and that the pipe remains at risk of excavation or other damage. In addition, high-consequence leak events (including explosions) may be associated with brand new leaks, so these leak events may not be avoidable without very rapid detection and mitigation actions. Repairing pipe can mitigate near-term risk to support eventual decommissioning activities while avoiding the full cost of replacement.

Retirement: Retiring gas pipe means separating it from the gas system, sealing it in accordance with safety regulations, and ceasing to use it to provide gas service. An advantage of retiring gas pipe is that it completely removes all safety risk associated with the pipe, including excavation and damage risk. The primary disadvantage is that it requires customers to electrify or find other fuel sources for their equipment.

[39] U.S. Department of Transportation, Pipeline and Hazardous Materials Safety Administration (PHMSA). 2011. "U.S. Department of Transportation Call to Action To Improve the Safety of the Nation's Energy Pipeline System." https://www.phmsa.dot.gov/sites/phmsa.dot.gov/files/docs/Action%20Plan%20Executive%20Version%201%20NOV%2011.pdf.

[40] FC 1179. WGL Response to DCG D.R. No. 3-11 (filed Nov. 26, 2024).

When developing an approach to managing risk, a gas utility chooses some combination of these actions. This section examines two classes of approach. First, we describe WGL's preferred approach, which focuses on large-scale pipe replacements with reactive repairs and limited, opportunistic retirement through its Customer Choice proposal, described below. Second, we describe an alternative approach which uses a more balanced mix of the three actions, shifting the balance in favor of using replacement only when necessary and favoring retirement through electrification while taking a proactive approach to leak identification and repair.

2.1. Replacement-Focused Approach: WGL's Accelerated Pipe Replacement Efforts

WGL currently pursues a replacement-based approach. From 2014 through 2024, WGL's pipeline replacement program was called PROJECTpipes. During the two cycles of PROJECTpipes, WGL retired 37 miles of LPP and 7,457 leak-prone services.[41] In 2024, the PSC rejected WGL's proposal for a third PROJECTpipes funding cycle and directed WGL to file a new, more targeted plan. In Order No. 22003, the PSC required that WGL file a plan that considered stranded asset risk and advanced leak detection (ALD) and refocus the pipeline replacement program to address the District's climate policies that promote electrification. On September 27, 2024, WGL filed its application for the District SAFE program.[42]

As part of its District SAFE proposal, WGL plans to replace 12.4 miles of main, 996 leak-prone service lines associated with those mains, and 2,612 other services not associated with those mains.[43] WGL plans to spend a total of $215 million on this effort, accelerating in quantity over the three-year plan: $50 million for a portion of 2025, $75 million in 2026, and $90 million in 2027. In comparison, the previous spending cap for the second PROJECTpipes plan was $150 million over three years. While WGL does not state a planned approach or budget for the period after 2027, WGL argues that eliminating LPP by 2045 would require a rapid increase in the pace of main and service line replacements.[44]

On a proportional basis, WGL's approach targets services more than it targets mains. While WGL will replace all leak-prone services associated with mains it replaces, it has also set aside a substantial additional sum to replace services that are not associated with the mains it replaces. Overall, it appears that in the initial years about 60 percent of WGL's proposed budget would go to services, and 40 percent to mains. This prioritization may be justified in part based on cost-benefit risk assessment, with services favored by their lower cost per unit of risk reduced.

[41] FC 1179. WGL Revised Application, Exhibit WG (A)-1 (District SAFE Plan 2024), Figure 9 and Figure 10.

[42] FC 1179. WGL Revised Application, filed September 27, 2024.

[43] FC 1179. WGL Revised Application, Direct Testimony of Wayne A. Jacas, Table 4.

[44] FC 1179. WGL Revised Application, Exhibit WG (A)-1 (District SAFE Plan 2024), page 39.

WGL states that the combined effort to address mains and services associated with those mains costs $10.7 million per mile.[45,46] WGL states that replacing a service line as a standalone project costs an average of $35,300 per service. While WGL does not break out the cost of mains versus services for combined projects, if we assume that service line replacements in those contexts cost no more than service lines as standalone projects, the cost of main replacements alone is at least $7.9 million per mile.[47] This reflects an increasing upward trend in the cost of pipe replacement for mains and services: the historical average cost per mile from 2014 to 2023 was only $6 million per mile, and $19,290 per standalone service.[48]

Finally, WGL's approach also includes repairing leaks as part of its ongoing operations and maintenance activities.[49] On average over the past three years, WGL repaired about 1,400 leaks per year.[50] In keeping with PHMSA regulations and the Gas Piping Technology Committee (GPTC) "Guide for Gas Transmission and Distribution Piping Systems," WGL classifies leaks as grade 1 (hazardous), grade 2 (probable future hazard to public safety), or grade 3 (non-hazardous and expected to remain non-hazardous). Over the past six years, "other" (non-hazardous) leaks on WGL's system have decreased, but hazardous grade 1 leaks have not shown the same decreasing trend.[51] The GPTC Guide states that grade 1 leaks should be repaired immediately to protect life and property, grade 2 leaks should be repaired within a year (or no longer than 15 months), and grade 3 leaks should be monitored and revisited after no longer than 15 months. PHMSA has proposed a revised regulation[52] that would shift leaks that pose a significant hazard to the environment into the grade 2 classification and shorten the repair timeline for these leaks (generally to six months). PHMSA further proposes a 24-month repair timeline for grade 3 leaks. The proposed regulation would also shorten the recurrence time for utility leak surveys.

Notably, WGL's replacement-focused approach does not include any significant proposals for customer electrification. In its District SAFE application, WGL proposes a "notification and opt-out process to address the possibility that existing customers may intend to cease service" with WGL.[53] As proposed by

[45] WGL is unable to break out the cost of main replacement from the cost of service line replacement associated with mains.

[46] FC1179. WGL Response to DCG D.R. No. 3-11 (filed Nov. 26, 2024).

[47] There are an average of about 80 services per mile replaced (996 services over 12.4 miles); at $35,300 each they would cost about $2.8 million. $10.7 million minus $2.8 million is $7.9 million. If services with mains cost less to replace than stand-alone services, then the per-mile cost for mains is greater.

[48] FC 1179. WGL Revised Application, Exhibit WG (A)-1 (District SAFE Plan 2024), Figures 12 and 13.

[49] Note that spending on leak repair is not part of the proposed District SAFE plan.

[50] FC1179. WGL Response to Sierra Club D.R. No. 1-16 (filed Nov. 15, 2024).

[51] District of Columbia Public Service Commission. "Natural Gas Leaks in the District of Columbia." Updated November 2024. Available at: https://dcpsc.org/Utility-Information/Natural-Gas/Natural-Gas-Leaks.aspx.

[52] Department of Transportation Pipeline and Hazardous Materials Safety Administration. 2023. "Notice of Proposal Rulemaking: Pipeline Safety: Gas Pipeline Leak Detection and Repair." *Federal Register*. https://www.federalregister.gov/documents/2023/05/18/2023-09918/pipeline-safety-gas-pipeline-leak-detection-and-repair.

[53] FC 1179. WGL Revised Application, Exhibit WG (A), pgs. 8-9 (Rogers).

WGL, the Customer Choice Pilot Program will run for three years and is a process to provide notification to the affected customers of impending replacements allowing the customers to opt out of the planned service line replacement. WGL would thereby avoid installing a new service line that would never be used and useful. The service line replacement location will be identified 12 months in advance and customers will have approximately 11 months to complete the opt-out process.[54] However, WGL does not propose any incentives for electrification or other non-pipe alternatives, nor has it proposed any measures to coordinate with electrification program administrators such as DOEE and the DC Sustainable Energy Utility to meaningfully advance customer awareness of alternatives to pipe replacements. Overall, WGL's proposed District SAFE program is heavily weighted towards pipe replacement, with BAU efforts to repair pipe and virtually no coordinated plan to retire segments of pipe rather than replace them.

2.2. Three-R Approaches

For comparison with WGL's proposed approach, Synapse developed an alternative approach that incorporates all three risk-mitigating actions: repair, replacement, and retirement.

Leak repair

DOEE and OAG filed a study conducted in 2021 which reports the results of a vehicle-based methane survey of 713 miles of District streets.[55] This study identified 3,346 methane sources on this portion of District streets. Assuming these methane sources are gas leaks, and scaling this up to the 1,219 miles of gas distribution pipe in the District of Columbia, would imply about 5,720 leaks in the District of Columbia. Based on the map of the surveyed areas in the 2021 study, Synapse assumes that residential areas with older pipe were over-represented in this study, which brings the scaled-up leak estimate down to about 4,900. In any event, this methane source estimate is well in excess of the number of leaks identified and tracked by WGL.[56]

The alternative approach that Synapse developed for pipe risk mitigation includes an active and sustained effort to identify and repair this larger universe of leaks. Specifically, Synapse assumes that there is a leak backlog associated with these previously unidentified leaks and that the rate that new leaks come into existence is about one-third greater than the annual number of leaks that WGL has historically identified and addressed each year.[57] Addressing the leak backlog while aggressively

[54] FC 1179. WGL Revised Application, Exhibit WG (A), pgs. 8-9 (Rogers).

[55] Ackley, B. and N. Phillips. October 31, 2021. *2021 Fugitive Methane Emission Survey of the District of Columbia*. Filed in FC 1130 and FC 1154.

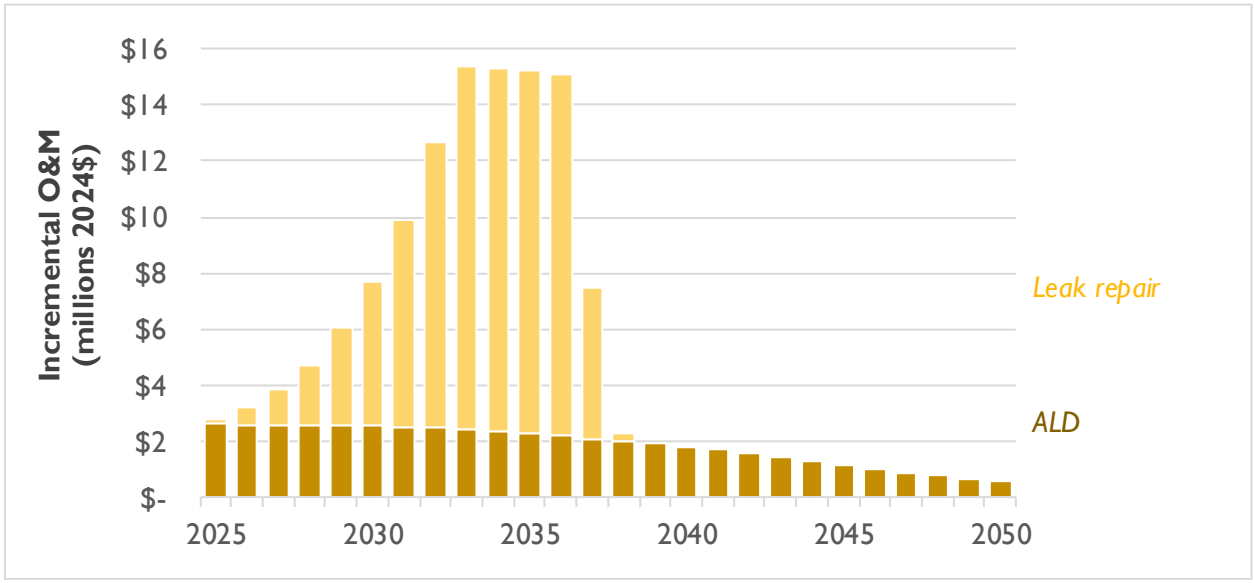
[56] In contrast, WGL's leak surveying and reporting approaches for 2021 identified just 1,530 leaks, so it is possible that there are more leaks than WGL has identified. *See:* FC1179. WGL response to Sierra Club Data Request 1-16 (filed Nov. 15, 2024).

[57] This approximation is based on the fact that there are many methane sources that WGL has not identified, but also that if the rate of leak genesis were very much greater than the rate that WGL identifies leaks, there would have developed a much

surveying the District of Columbia for new leaks would require additional operations and maintenance expenditure.

Additional leak detection and repair expenditure would come from two drivers: frequent ALD surveys, using ALD technology similar to that used in the DOEE study, and additional leak repairs. Based on data presented in PHMSA's leak detection and repair rulemaking, we estimate that leak detection surveys cost about $1,660 per mile.[58] To survey all 460 miles of LPP on WGL's distribution network in the District of Columbia three times a year, and survey the remaining pipe once a year, would mean surveying about 2,140 miles per year. At $1,660 per mile, this is an annual cost of $3.5 million. WGL would be required by the draft PHMSA regulation to survey all leak-prone pipes annually and all other pipes every three years. Assuming the same cost profile, the base case leak detection regime is expected to survey 710 miles per year, at a cost of roughly $1.2 million, so the incremental cost is lower: $2.4 million per year. As WGL retires LPP, this cost falls (in real terms), as shown in Figure 11.

Figure 11. Incremental operations and maintenance costs from additional leak repair and advanced leak detection (ALD) as part of the alternative approach



We assume additional leak repairs cost $9,165 per leak.[59] We have assumed a ramp-up in incremental leak repairs at a rate that is associated with the savings from reduced carrying cost associated with a reduction in replacements. (See the following subsection.) We have capped the leak repair rate at

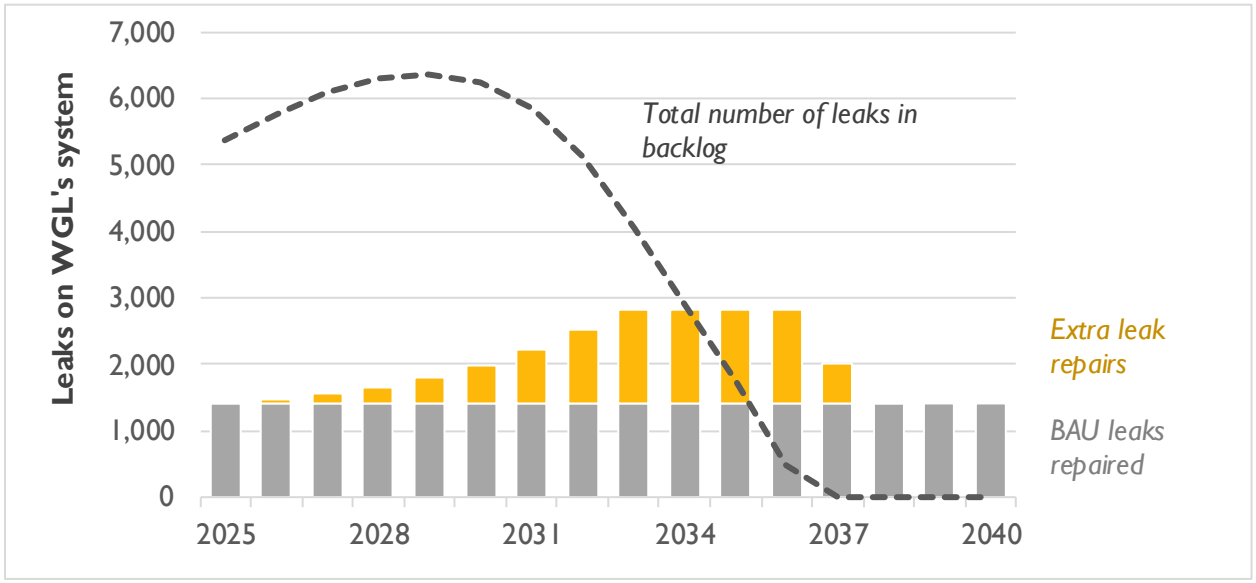
larger leak backlog. At a rate of one-third above WGL's leak identification rate, it would have taken about 10 years to develop the gap between the measured number of methane sources and WGL's leak count. We are not aware of any data that would allow us to better estimate the rate of leak genesis at this time.

[58] PHMSA. April 2023. *Preliminary Regulatory Impact Analysis*. Docket No. PHMSA-2021-0039; Pipeline Safety: Gas Leak Detection and Repair. Table 23 shows 2024 incremental cost of $275 million ($2020) estimated to survey 201,031 miles. $1,367 in $2020 is about $1,660 in $2024.

[59] Average cost per leak repair 2021-2023. *See*: FC 1180. WGL Response to DCG D.R. No 1-2, filed November 18, 2024.

double WGL's current rate. Figure 12 illustrates the projected ramp-up in leak repair and the impact on the annual number of leaks on WGL's system under the alternative approach, assuming that all the methane sources the DOEE study found were leaks from WGL's system. By 2039, the extra leak repair push has repaired the leak backlog such that all of the new leaks on the system are addressed promptly when found in that year. In part this is due to the accelerated electrification from neighborhood electrification efforts, which means there are fewer miles of pipe across the system and thus fewer annual leaks. In comparison, under a more scattered electrification approach, additional leak repair activities above the baseline level continue through 2045, since more pipes remain on the system for longer.

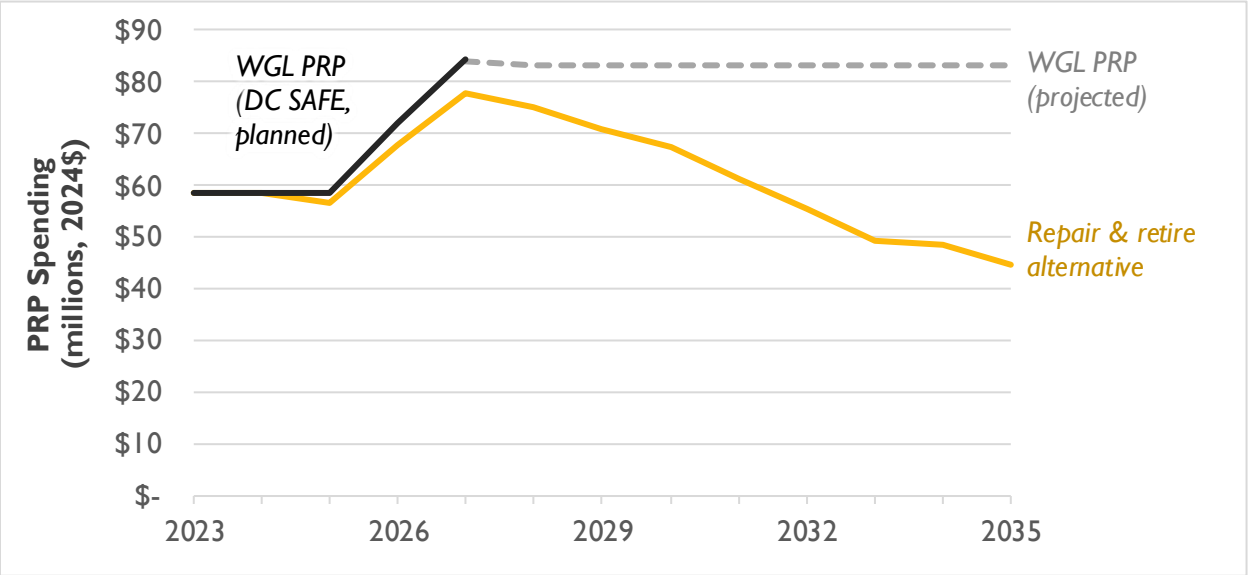
Figure 12. Projected annual leaks repaired and total remaining leaks on WGL's system in the alternative approach



Targeted replacement

There is going to be LPP that needs to be replaced rather than left in place or retired. Examples include pipes associated with others' road work or construction (where there would be substantial costs to revisiting the pipe later, and multi-year advance planning is not likely to be possible); replacement triggered by the unsuitability of repair for a given pipe segment (e.g., if there are multiple leaks or the leak is caused by unrepairable damage to the pipe); and replacement of larger-diameter mains that serve many smaller downstream pipes or may have a lifetime that extends beyond carbon neutrality in 2045. As risk reduction via retirement ramps up in the alternative approach, spending on traditional pipeline replacement declines, as shown in Figure 13.

Figure 13. Spending on pipeline replacement program (PRP), in WGL BAU case vs. alternative approach



Pipe retirement through electrification

The District has identified electrification as the primary technical pathway by which it will meet carbon neutrality in the building and transportation sectors. When all buildings on a given pipe segment fully electrify,[60] the pipe serving those buildings is no longer used and useful and can be safely retired, provided that it is not needed to serve downstream customers. One way to retire LPP and thereby reduce safety risks is to identify risky segments that are at or near the ends of the distribution system, and electrify the buildings served. As these electrified segments collect in a given area (or if a given segment is a dead end), the pipes can be retired from service. Additionally, services are even more straightforward to electrify, as one service typically serves a single customer and does not have any "downstream" effects. As WGL's DC SAFE program heavily focuses on replacing services, this presents an opportunity to retire those services through electrification instead.

Synapse divided all electrification (as modeled in its BDC tool) into three categories: (1) electrification of buildings served by pipe segments otherwise identified for retirement and replacement in a given year as part of efforts to address aging LPP;[61] (2) electrification of buildings in clusters based on the topology and fuel flow in the gas system, with the intention of enabling retirement of parts of the gas network; and (3) electrification that occurs in a scattered fashion across the District (and which could allow gas asset retirement as carbon neutrality approaches and segments happen to no longer be used). Of these

[60] Or otherwise disconnect from pipeline gas such as through the use of delivered fuels for some or all end uses currently met by gas.

[61] This category consists of actions that are often referred to as "non-pipeline alternatives" or "NPAs."

three categories, the first has direct implications for the scale of pipeline replacement programs, because it allows potentially risky assets to be retired without creating stranded cost risk for the utility.

Synapse developed two approaches that combine different blends of these three categories of electrification. All include the same amount of electrification and meet the same GHG objectives—they differ as to whether clustered electrification is used as part of the toolkit for addressing risks facing the gas system. We refer to these two approaches as "neighborhood electrification" (in which electrification is clustered to allow mains to be retired) and "scattered electrification." Both approaches are used alongside enhanced repair and targeted replacements to comprehensively address both the risk of aging and LPP and gas utility transition risk.

2.3. Accelerated Depreciation

Gas system assets have engineering lives that can extend multiple decades (typically in the range of 40 years for service lines and 60 years or more for mains). The District's carbon neutrality timeline is much faster than these times, so assets will not be used consistently across their engineering life. Standard approaches to recovering invested capital use straight-line depreciation over the engineering life. This means that for an asset with a 40-year expected life, 2.5 percent of the cost of the investment (including the cost of removing and disposing of the asset at the end of its life) is recovered every year. This approach is not consistent with declining asset use and carbon neutrality in 20 years because there will be little to no gas sales from which to recover the depreciation expense after neutrality, and the rate impact of recovery even before neutrality would be unsustainably high. If the investment is not recovered, the assets become "stranded" and some combination of future investors, ratepayers, and taxpayers would pay the difference (or take a loss on the investment).

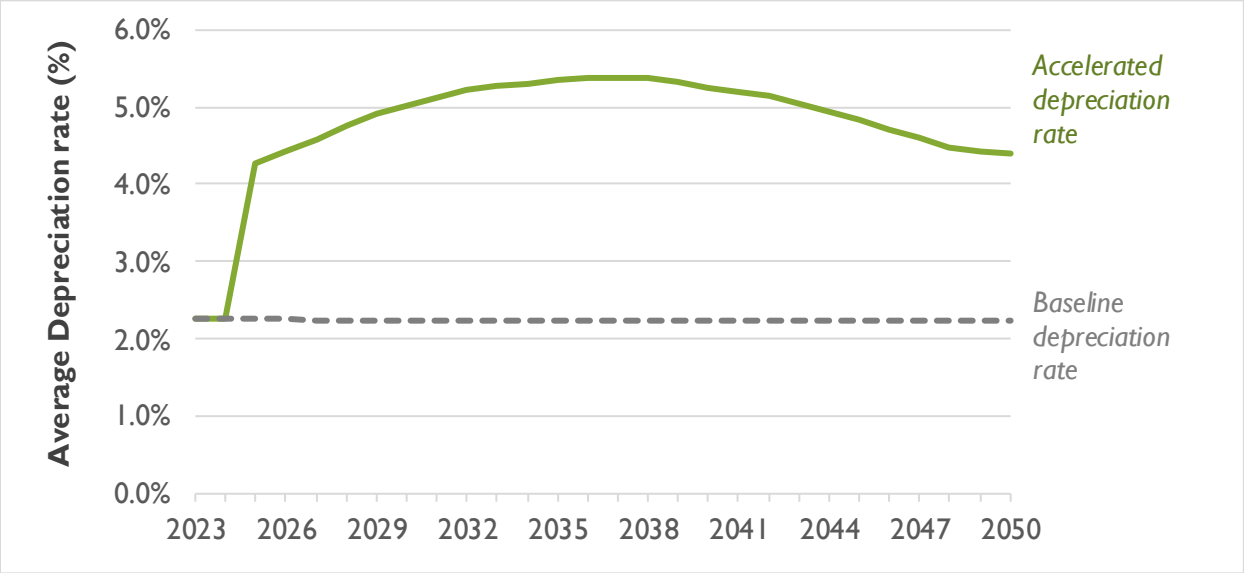
There are numerous accounting and recovery mechanisms that can be used to mitigate stranded asset risk. The most prominent are different forms of accelerated depreciation. One option is to simply shorten the expected lives of assets by some number of years. This would reduce the stranding risk but may not be aligned with the carbon neutrality timeframe. Another option is to change the lifetime of all assets that would otherwise go past 2045 to have shorter lifetimes and complete depreciation by that date. Both of these approaches continue the "straight-line" approach, which has the advantage of simplicity and the disadvantage of recovering roughly the same amount of the investment every year—resulting in per-unit rates that rise very quickly as sales fall.

Utilization-based depreciation (also referred to as "units of production") depreciates each asset based on the flow of gas through it. This approach addresses intergenerational equity by fixing the amount of recovery per therm and allowing the depreciation expense recovered to fall each year as the number of therms served falls. For example, if a utility invests $3 million in an asset with a 20-year useful life, and the asset is expected to carry two million therms in each of its first 10 years of life, and one million therms in each of its next 10 years of life, then over its life it carries 30 million therms (2 million times 10 plus 1 million times 10). The per-therm depreciation rate would therefore be $0.10 per therm ($3 million divided by 30 million therms). During the first 10 years, the utility would depreciate the asset by

$200,000 per year ($0.10/therm times 2 million therms), and in the second 10 years it would depreciate the asset by $100,000 per year ($0.10/therm times 1 million therms).

A utilization-based depreciation approach only makes the most sense to use where there is a known or projected trajectory for future gas use. This implies a managed transition, as in the neighborhood electrification case. For this case, Synapse developed depreciation rates on a utilization-based approach, assuming that all assets in the WGL system were treated as one large group of similar assets whose use falls as modeled in the BDC. In practical application, the utility would separate its assets into different groups and assess their utilization separately; this would change the results in detail but the general thrust would not change from the simplified approach that Synapse quantified. As a result of the utilization-based depreciation approach, the average depreciation rate would nearly double, as shown in Figure 14, in a case where utilization of WGL's system falls in line with the BDC scenario discussed above.

Figure 14. Average depreciation rate over study period, WGL BAU vs. accelerated depreciation



Depreciation costs also include the cost of removal and decommissioning, referred to as "net salvage." In a status-quo paradigm, salvage costs for mains and services are related to the cost of removing the pipe as part of the act of replacement at the end of the engineering life. Typical net salvage costs for mains and services are in the range of 50 to 75 percent of the original capital cost. This paradigm would shift in two ways for a future where most assets are retired within a shorter lifetime. First, it may be less expensive to safely decommission a pipe segment than it would be to remove it as part of replacement. Federal pipe safety regulations allow pipes to be abandoned in place provided they are empty and cannot be refilled with gas. Second, the recovered salvage rates include the effect of inflation over the lifetime of the assets; if the effective lifetimes are much shorter this inflation effect needs to be adjusted. Preliminary analysis indicates that these effects are likely sufficient to reduce net salvage costs by a factor or two or more; Synapse assumed a reduction by a factor of two in its analysis.

3. UTILITY BUSINESS AND RATE IMPACTS FROM MODELED SCENARIOS

3.1. Synapse's Gas Rate Model

For this analysis, Synapse used its in-house Gas Rate Model (GRM) to model the impact on customers and utility finances from changes in District SAFE spending. The GRM allows Synapse to project gas utility rates based on different scenarios for utility investment, sales, and financial models. We use input data from annual utility financial reports. Additionally, the GRM uses data from the PHMSA to determine the scale of each utility's pipe system, as well as the age of pipes and the number of LPPs.[62] The model tracks utility plant in service, depreciation, capital additions and retirements, operations and maintenance, and income taxes. It also accounts for capital structure and changes in tax rates. Looking to the future, the model allows us to test scenarios for different levels of investment and customer growth or decline, pipeline replacement programs, early retirements, stranded costs, and changes in depreciation rates.

3.2. Scenario Assumptions

As described in Section 1.3, Synapse ran four scenarios modeling different approaches to addressing LPPs on WGL's system:

- **WGL Business-As-Usual (BAU) case**: Pipeline replacement program investment and pipe replacement begin at the level of the proposed District SAFE plan (2025 through 2027), then continue at the 2027 level indefinitely.
- **Scattered Electrification Alternative case:** This scenario assumes that instead of replacing all LPP as planned, WGL takes a strategic 'repair and decommission' strategy, which reduces pipeline replacement and electrifies end-uses of gas from some LPPs, especially services, instead of replacing the LPPs. This case increases investment in leak detection and repair, as described above.
- **Neighborhood Electrification Alternative case**: The scenario is the same as the Scattered Electrification Alternative case but includes clustered electrification initiatives that retire mains, including LPPs, starting in the late 2020s.
- **Neighborhood Electrification Alternative with Accelerated Depreciation**: This scenario assumes the same spending on LPP repair and decommissioning as the Neighborhood Electrification Alternative case. In addition, this scenario uses utilization-based

[62] U.S. Department of Transportation: Pipeline and Hazardous Materials Safety Administration. "Gas Distribution, Gas Gathering, Gas Transmission, Hazardous Liquids, Liquefied Natural Gas (LNG), and Underground Natural Gas Storage (UNGS) Annual Report Data." Available at: https://www.phmsa.dot.gov/data-and-statistics/pipeline/gas-distribution-gas-gathering-gas-transmission-hazardous-liquids.

depreciation rates, which would limit stranded cost risks associated with meeting the District's GHG emissions goals.

As described above, the three alternative, balanced approaches begin similarly to WGL's proposal, including replacement of high-risk mains and services, then quickly shift toward retirement as a prominent contributor to risk reduction (while continuing some replacement activities). The alternatives begin with a focus on retiring services; retiring services can accelerate more quickly than retiring mains because there is no need for multi-customer coordination. These alternative approaches also include additional proactive advanced leak surveys beyond what is required by regulation, and additional funds for rapid leak repair to address increased leak detection, clear WGL's leak backlog, and address leaks quickly after they are identified.

There are a few important shared assumptions to note before proceeding to the detailed descriptions and preliminary results for each financial approach.

All scenarios project gas sales and customers to decline in alignment with the District's decarbonization pathways. Specifically, Synapse applied the electrification trajectory from the BDC outputs described in Section 1.2, scaling the decline in gas use in buildings into a decline in the number of residential and commercial gas customers served by WGL. This trajectory assumes that most customers electrify and depart the gas system by 2050. Accordingly, by 2040, half of residential and commercial customers have departed the gas system, and the number of customers falls by 85 percent by 2050 (as compared to 2024). At the same time, pipeline gas sales have decreased by 95 percent by 2050. In this scenario, the commercial sector disconnects from the gas system more quickly than the residential sector, on average, although a few large commercial gas customers stay on the system (e.g., large facilities perhaps with combined heat and power or district heating applications). The general shape and final outcome of our results would be reproduced if the transition happens slower; costs would be higher due to greater investment in replacement.

There are a few variables that are the same for all cases unless stated otherwise in the sub-scenarios, as outlined in Table 1.

Table 1. Shared scenario assumptions

Input	Assumption
Cost of debt, debt fraction of capital, after-tax ROE	Held constant at 2020 value
Inflation	2% per year (based on the long-term Federal Reserve target)
Capital additions and retirements	Distribution plant mains and services and associated asset types are calculated separately and are based on customer additions and departures, electrification assumptions, PHMSA data, and leak-prone pipe assumptions. Constant 2% growth rate for other capital (reflecting higher inflation in utility industry).
Operations and maintenance expenses	Constant 2% growth rate (grows with inflation). Additional leak repair and leak detection costs modeled in alternatives cases.
Alternative fuels	No alternative fuels (renewable natural gas, hydrogen) modeled
Gas fuel price	Henry Hub Natural Gas Spot Price projections from EIA's Annual Energy Outlook
Depreciation rates	Assumes constant depreciation rates equal to the values used in recent rate cases, except for the accelerated depreciation case

Sources: Washington Gas Light Co. Rate Case. 2020. Case No. 9651. Volume 1. Direct Testimony of Douglas I. Bonawitz. Schedule DIB-1, page 1. Available at: https://www.psc.state.md.us/search-results/?q=9651&x.x=0&x.y=12&search=all&search=case.

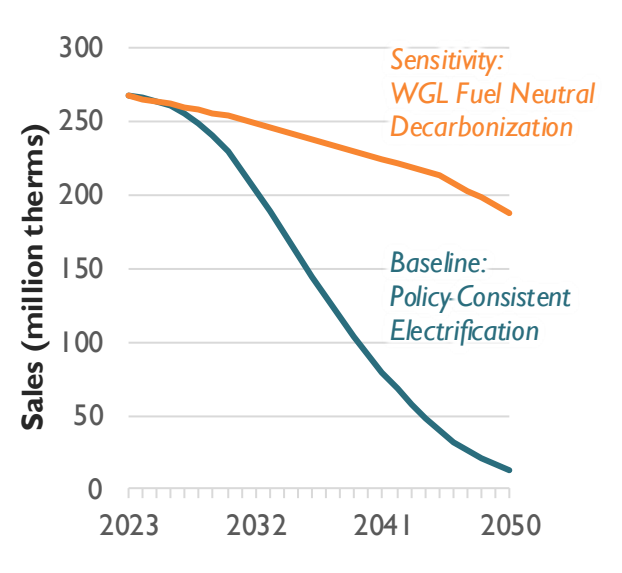
U.S. EIA. Annual Energy Outlook 2023. Table 13: Natural Gas Supply, Disposition and Prices, Henry Hub Spot Price. Available at: https://www.eia.gov/outlooks/aeo/data/browser/.

"Slow-Change" Sensitivity

To explore how the relative impacts between the modeled approaches would differ under a less aggressive electrification future, Synapse modeled a "slow-change" sensitivity that assumes more customers remain on the gas system and reduce GHG emissions by using non-fossil fuels. We modeled this sensitivity on the Fuel Neutral Decarbonization scenario from WGL's Climate Business Plan.[63] In this case, WGL's preferred scenario in that plan, WGL aims to use lower-carbon fuels and partial electrification to meet District policy goals.

For this sensitivity, we assume that sales decrease by 5 percent by 2032 and 30 percent by 2050, as stated by WGL for its Fuel Neutral Decarbonization scenario (see Figure 15).

Figure 15. Sales trajectories under baseline and sensitivity cases



WGL's Fuel Neutral Decarbonization scenario assumes 40 percent of residential and 20 percent of commercial customers adopt "hybrid heating," where heat pumps serve the majority of the heating load but supplemental gas heating is used for the coldest days. Consistent with this approach's use of partial electrification, we assume the average consumption per customer decreases by 15 percent by 2050, resulting in an 18 percent reduction in the total number of customers by 2050. In comparison, our baseline policy-consistent case assumes that the total number of customers decreases by nearly 85 percent by 2050.

Notably, under the Fuel Neutral Decarbonization scenario, WGL attempts to meet the District's climate policy goals through increasing use of alternative lower-carbon fuels, including renewable natural gas (RNG), hydrogen blending, and Power-to-Gas (P2G), and offsets. Consistent with WGL's assumptions, we assume that RNG will meet 25 percent of sales in 2040 and 40 percent of sales in 2050, and hydrogen and P2G will meet 18 percent of supply in 2050.[64] A study by ICF for WGL estimates the future cost for RNG ranging from approximately $8 to $53 per MMBtu (in 2024 dollars).[65] Using this data we developed cost trajectories for RNG reflecting the potential pace and share of RNG feedstock growth over the next two decades. For hydrogen and P2G, we used

[63] WGL's "Fuel Neutral Decarbonization" scenario. *See:* FC 1142. WGL Climate Business Plan for Washington, D.C. https://edocket.dcpsc.org/apis/api/filing/download?attachId=101994&guidFileName=e69b6cb2-963c-4122-aca3-3b45e838b2b7.pdf

[64] WGL Climate Business Plan Appendix E, Table 2. Prepared by ICF for AltaGas. https://edocket.dcpsc.org/apis/api/filing/download?attachId=101994&guidFileName=e69b6cb2-963c-4122-aca3-3b45e838b2b7.pdf

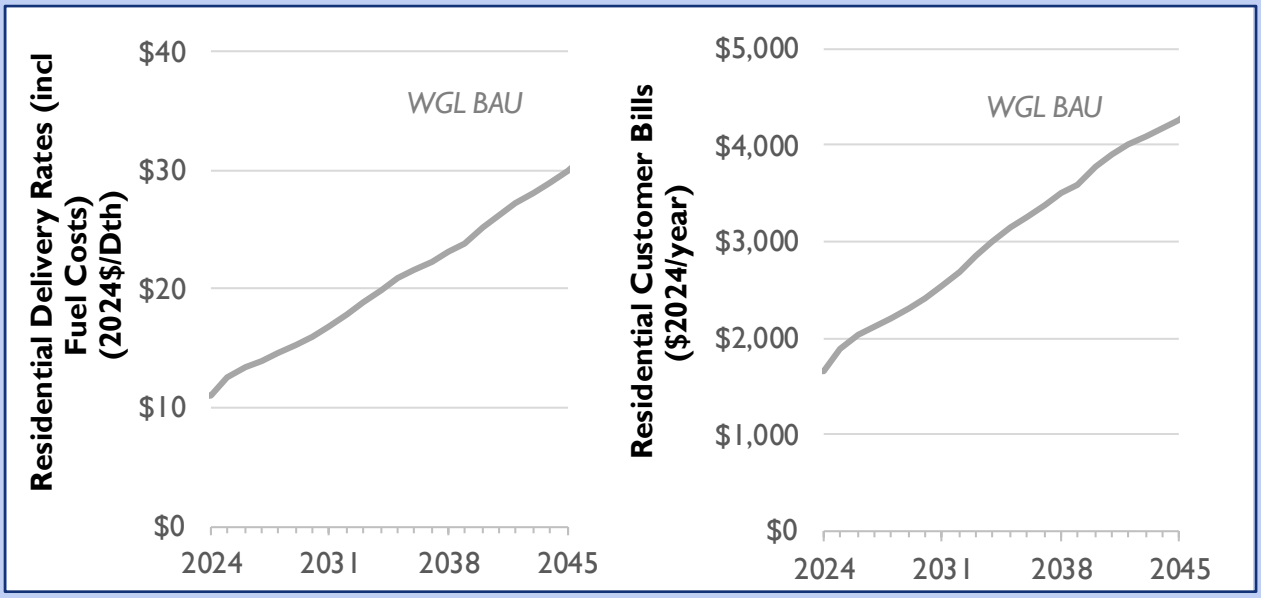
[65] ICF. 2020. *Study on the Use of Biofuels (Renewable Natural Gas) in the Greater Washington DC Metro Area*. Prepared for Washington Gas Light Company. Table 33. https://washingtongasdcclimatebusinessplan.com/wp-content/uploads/2020/04/200316-WGL-RNG-Report-FINAL.pdf.

costs developed by Energy and Environmental Economics, Inc. (E3) for the State of Maryland.[66]

In the BAU scenario under the "slow-change" sensitivity, revenue requirement, customer bills, and rate base increase steadily through 2050, as infrastructure investments continue and costly lower-carbon fuels are integrated into WGL's supply. Under this sensitivity, we find that under WGL's proposed approach, gas bills would rise rapidly: by 2035, gas bills will have nearly doubled, despite the fall in average gas consumption.

This average bill increase threatens the realism of the "slow-change" scenario: Customers facing the rising costs of gas service are more likely to fully convert to electricity. As more customers fully electrify, the premise of the "slow-change" scenario breaks down, rates and bills rise more rapidly, and this future converges on a scenario similar to the Scattered Electrification case (although perhaps somewhat delayed depending on exactly when customer behavior changes). For this reason, we have not integrated a "slow-change" scenario into our assessment of alternatives to WGL's pipe replacement approach.

Figure 16. Residential gas rates (left) and gas bills (right) under "slow-change" sensitivity



[66] We used E3's "low-cost" scenario. Energy and Environmental Economics, Inc. 2021. *Maryland Building Decarbonization Study: Final Report*, page 98. https://mde.maryland.gov/programs/Air/ClimateChange/MCCC/Documents/MWG_Buildings%20Ad%20Hoc%20Group/E3%20Maryland%20Building%20Decarbonization%20Study%20-%20Final%20Report.pdf

3.3. Composition of WGL's System

Distribution plant makes up 75 percent of WGL's total gas plant in service, or roughly $1 billion. Gas utility distribution systems primarily consist of two key components: mains, which are the larger pipes that serve many customers on a street; and services, which deliver the gas from the mains to the house. Of WGL's total distribution plant, approximately 43 percent is for services and 48 percent is for mains.[67] Because services connect to individual buildings, if a customer electrifies their building, WGL should be able to decommission the service line serving that residence, thereby eliminating the risk associated with those service lines. If all the customers on a single street electrify, the utility could retire the main pipes that serves that street.

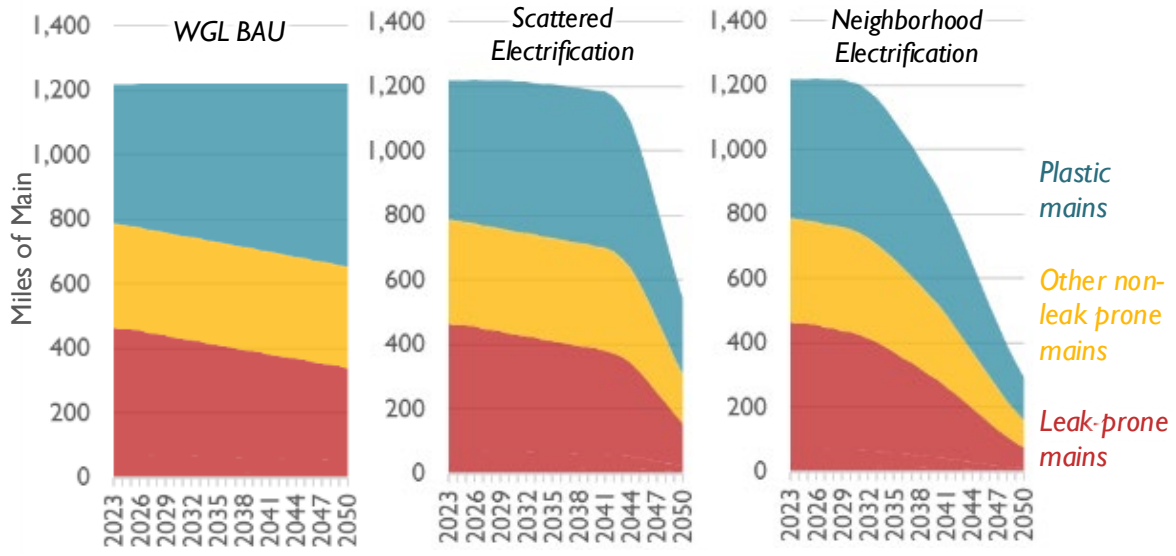
Figure 17 below shows the different composition and size of WGL's distribution pipe system under the BAU, Neighborhood Electrification, and Scattered Electrification scenarios. As of 2024, leak-prone mains make up 38 percent of WGL's system, measured in miles.[68,69] In the BAU case (left), the system stays about the same physical size, and LPP is slowly replaced by newer pipe. Even under WGL's proposed expanded budget for accelerated pipe replacements, WGL's system retains more than 75 percent of today's leak-prone mains in 2050. In the Electrification Alternative cases, in contrast, the overall system shrinks to a quarter of its current size by 2050, driven by increased rates of pipeline retirement. In the Scattered Electrification case, the scale of the gas system still has nearly the same amount of pipe as the BAU case until 2040, when scattered electrification begins to result in areas where small amounts of targeted action can enable mains to be retired. The Neighborhood Electrification case targets electrification to allow earlier main retirements, reducing the total miles of mains by 27 percent by 2040 and 76 percent by 2050.

[67] The less than 10 percent remainder consists of meters, house regulators, measurement and regulating station equipment, and other distribution equipment.

[68] PHMSA identifies leak-prone mains as unprotected bare and coated steel mains, cathodically protected bare steel mains, and cast-iron mains.

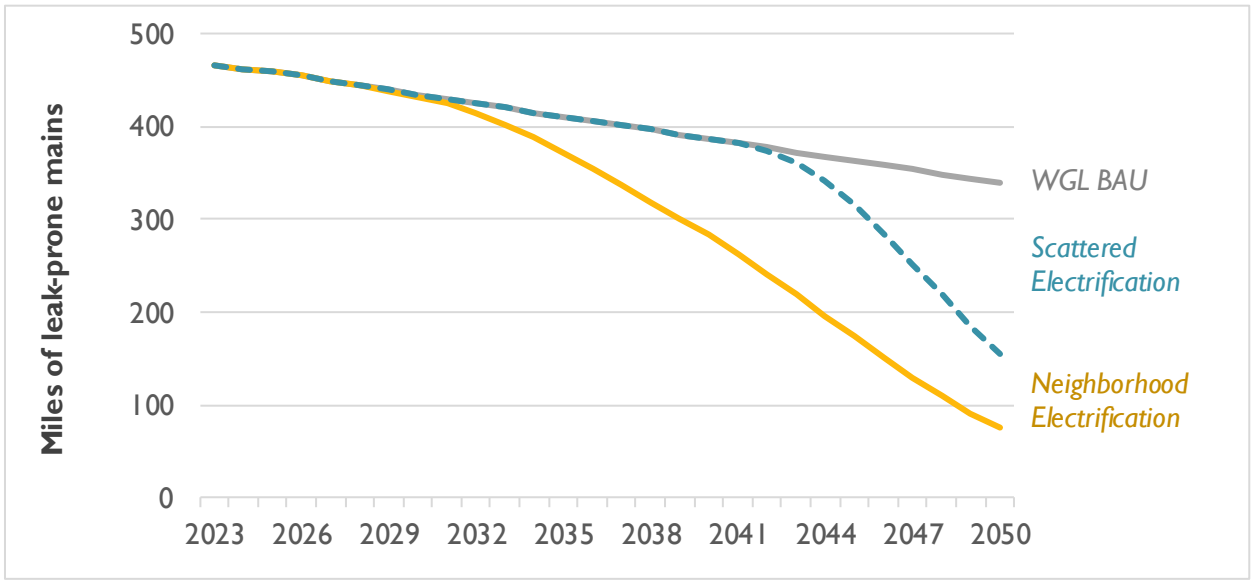
[69] U.S. Department of Transportation: Pipeline and Hazardous Materials Safety Administration. "Gas Distribution, Gas Gathering, Gas Transmission, Hazardous Liquids, Liquefied Natural Gas (LNG), and Underground Natural Gas Storage (UNGS) Annual Report Data." Available at: https://www.phmsa.dot.gov/data-and-statistics/pipeline/gas-distribution-gas-gathering-gas-transmission-hazardous-liquids. Accessed December 5, 2024.

Figure 17. Total miles of main by age group and scenario



Notably, LPP is retired at a faster rate than other mains so the Neighborhood Electrification case should be both safer and have lower GHG emissions, as shown in Figure 18. Through 2030, the increased electrification in the Neighborhood Electrification case mostly balances out the reduced investment in WGL's pipe replacement program. In the Neighborhood Electrification case, by 2030, more mains are retired through electrification than would otherwise be replaced as a part of District SAFE in the BAU case.

Figure 18. Miles of leak-prone mains by scenario



In comparison, the decline in the number of services remains similar between scenarios. This is because the aggregate pathway for building decarbonization is the same in all cases; they differ in how the electrifying buildings are distributed across the gas system. Across all scenarios, by 2040, the total number of services has decreased by half, and no leak-prone services remain on the system. By 2050, the total number of services has decreased by 86 percent from today, driven by customer departures from the gas system.

Notably, the scenarios take different approaches to electrification between the BAU, Scattered, and Neighborhood Electrification scenarios. As shown in Figure 19, while both cases eventually retire similar amounts of pipe, the Neighborhood Electrification case retires more mains earlier than the Scattered case, reducing total miles on the system earlier and more gradually. In the BAU case, we do not assume any mains are retired through clustered or neighborhood electrification. The differences between the scenarios are even more stark for electrified services (Figure 20). In the WGL BAU case, all services are retired through scattered electrification, without any strategic clustering. In the Scattered and Neighborhood Electrification cases, an increasing number of services are retired and electrified in clusters with the associated main.

Figure 19. Cumulative miles of main retired by the electrification strategy, Scattered vs. Neighborhood Electrification Alternative

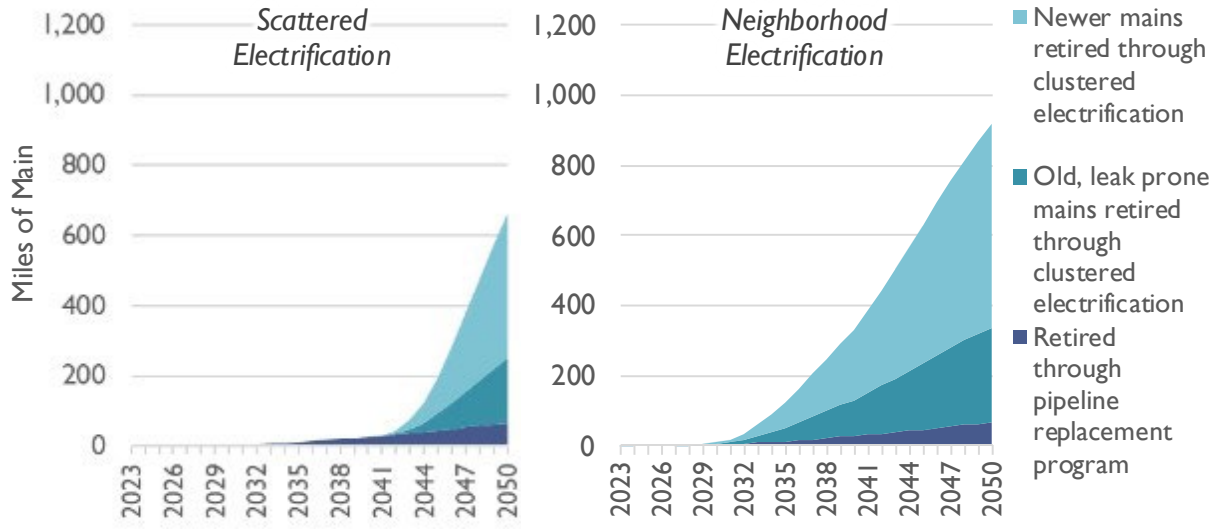
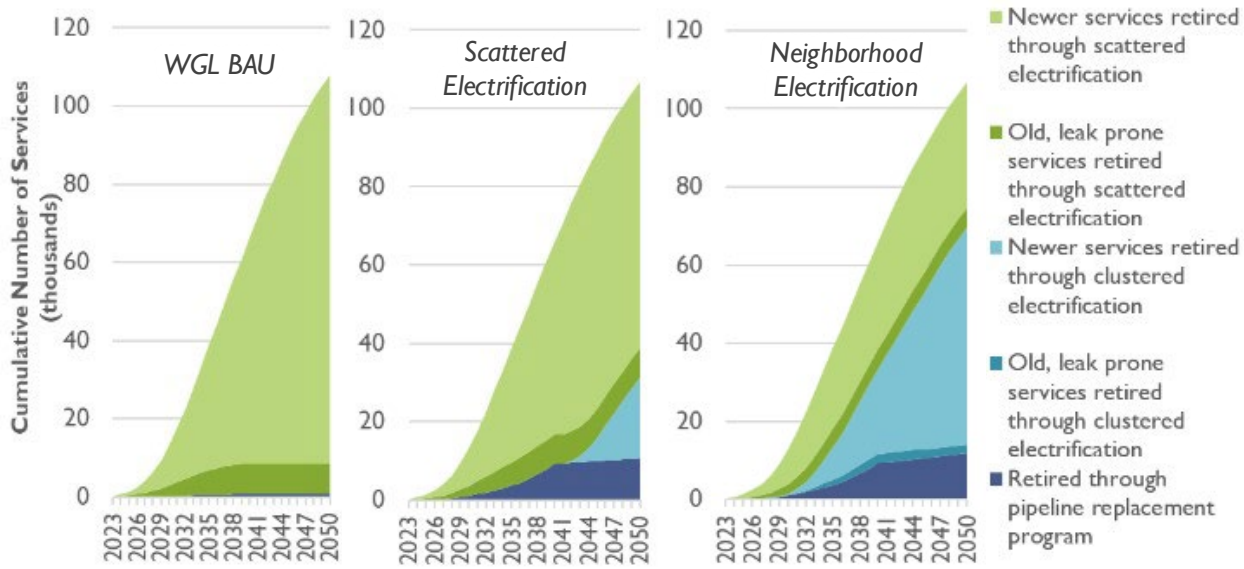


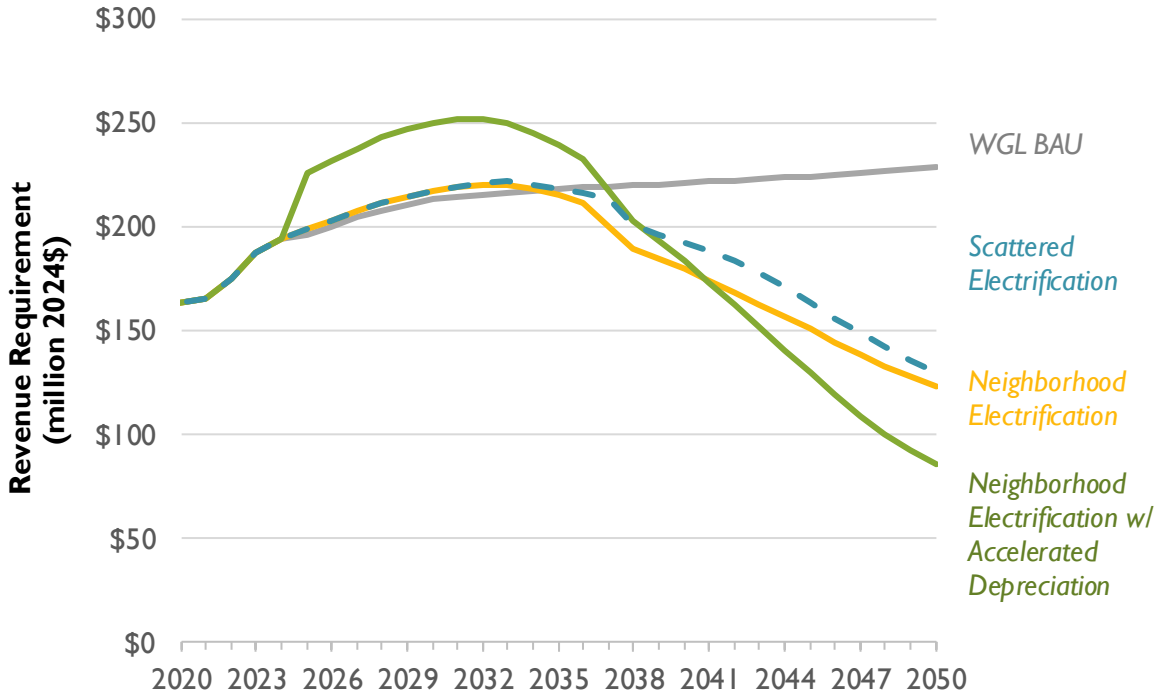
Figure 20. Cumulative number of services retired, by scenario and electrification strategy



3.4. Rate Base and Revenue Requirement

Figure 21 shows the trajectories of revenue requirement for WGL under the four scenarios for LPP and system transition (including the case with changes in depreciation rates). We find that WGL's revenue requirement would overall be lower under the Alternative scenarios than under the WGL BAU case, without any changes to depreciation rates. In contrast, the revenue requirement spikes in 2025 for the Accelerated Depreciation case to be 15 percent higher than the cases without modified depreciation. Revenue requirement under the Accelerated Depreciation case stays higher than the BAU case through 2036 and is higher than the Neighborhood Electrification case until 2040. By 2050, the revenue requirement with accelerated depreciation is 30 percent lower than in the Neighborhood Electrification case.

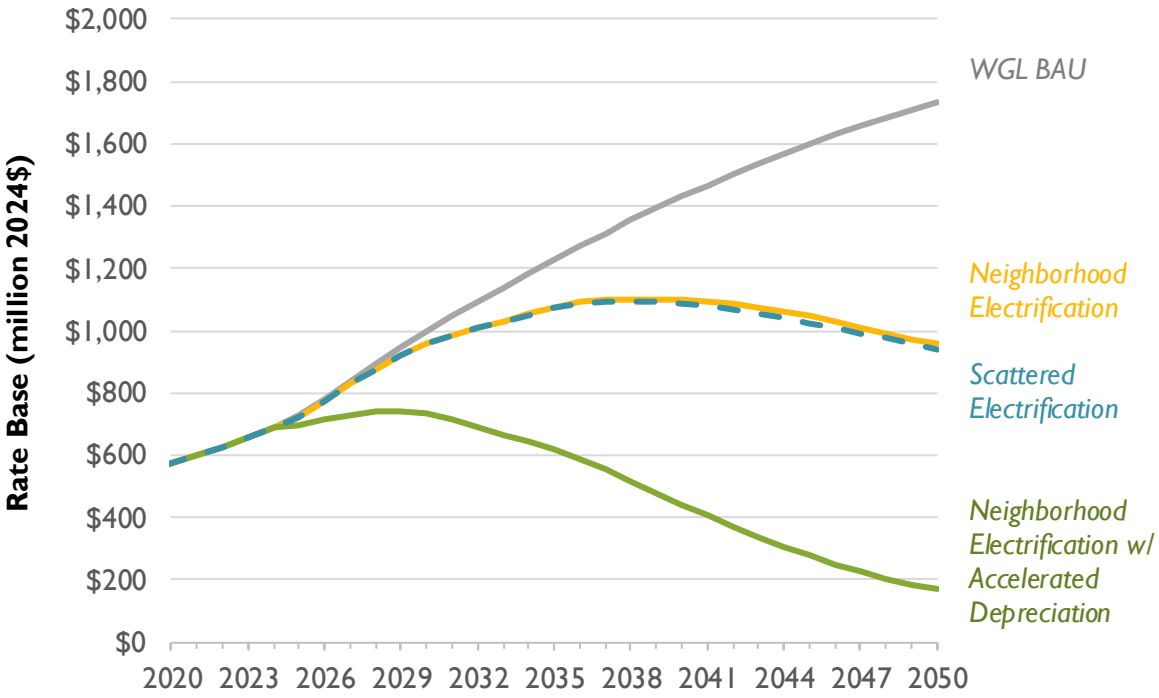
Figure 21. Residential and commercial gas revenue requirement for all four scenarios



WGL's rate base has risen substantially in the last few years, thanks in large part to LPP replacement activities. As shown in Figure 22, in the BAU/DC SAFE scenario, rate base continues to rise, nearly tripling by 2050 in real terms. In comparison, rate base increases at a more moderate pace under the Scattered and Neighborhood Electrification Alternative scenarios, resulting in rate base that is 45 percent less than rate base under the WGL BAU by 2050.[70] This is driven by the increased customer departures due to electrification, which allow the associated retirement of services and meters, or in the case of clustered electrification, entire portions of the gas system. In the Accelerated Depreciation case, rate base decreases steadily: by 2050, rate base has decreased by three-quarters. The Accelerated Depreciation case offers a reduction in stranded asset risk in return for somewhat higher delivery rates in the nearer term.

[70] Note that Synapse does not assume that unrecovered costs of retired services lines and meters are stranded, and instead assumes that the investment remains in rate base through at least 2050 even though the assets are retired.

Figure 22. Residential and commercial rate base for all four scenarios



Accelerated depreciation allows for the recovery of the cost of the assets faster, leaving an even smaller rate base by 2050. This case has higher revenue requirements and rates through the late 2030s, in exchange for essentially eliminating stranded cost risk for investors and resulting in lower rates for the last customers on the gas system. This case should be more financially sustainable, offering predictable cash flow for the utility that could also be coupled with an increase in the debt portion of the capital structure while still meeting rating agency targets for the relationship between cash flow and debt. A financially stable gas utility should also have sufficient funds and access to capital to maintain reliable and safe service. In the other cases, stranded cost risk and lower cash flows could result in reduced access to capital and inability to make necessary expenditures to maintain a safe system.

3.5. Rates and Bills

In all scenarios, customers who remain on the gas system are expected to face higher rates and pay high annual gas bills. To estimate bill impacts, Synapse divided the residential portion of WGL's revenue requirement and associated fuel costs by the number of residential customers per year (Figure 23). Similarly, we approximate gas rates under each scenario by taking WGL's annual revenue requirement (including return on rate base, fuel costs, and depreciation and operating expenses) and dividing by the projected amount of gas sold to customers (Figure 24).

Average residential gas bills rise with rates, because the decline in per-customer average consumption does not outpace the increase in delivery rates. In the WGL BAU case residential customer bills have risen by a third by 2030 and doubled by 2040. In the Neighborhood Electrification case, increased

electrification and lower revenue requirement mean that bills rise slower than in the WGL BAU case. In 2045, residential customer bills are 30 percent lower than in the WGL BAU case.

Rates increase significantly in all scenarios, doubling by the late 2030s. However, rates under the WGL BAU case rise at a faster pace, ending up 43 percent higher by 2045 than the Neighborhood Electrification case. As shown in Figure 21 above, the Alternative cases have a lower revenue requirement than the WGL BAU case. They also have the same sales, so rates are lower for these cases. Adding accelerated depreciation costs makes rates and bills in the Accelerated Depreciation case higher in the earlier years, although they fall below the BAU case rates by 2037, and below the Neighborhood Electrification case without depreciation changes around 2040, for residential customers.

As gas rates rise, electricity will become less expensive for space and water heating in comparison to natural gas, which would contribute to more customers leaving the gas system in favor of electrification. Under all scenarios, policies and programs will be necessary to assist low- and moderate-income households who may face barriers and difficulties to electrifying their homes and leaving the gas system, thus facing increasingly higher gas bills.

Figure 23. Residential annual average bills under the four scenarios

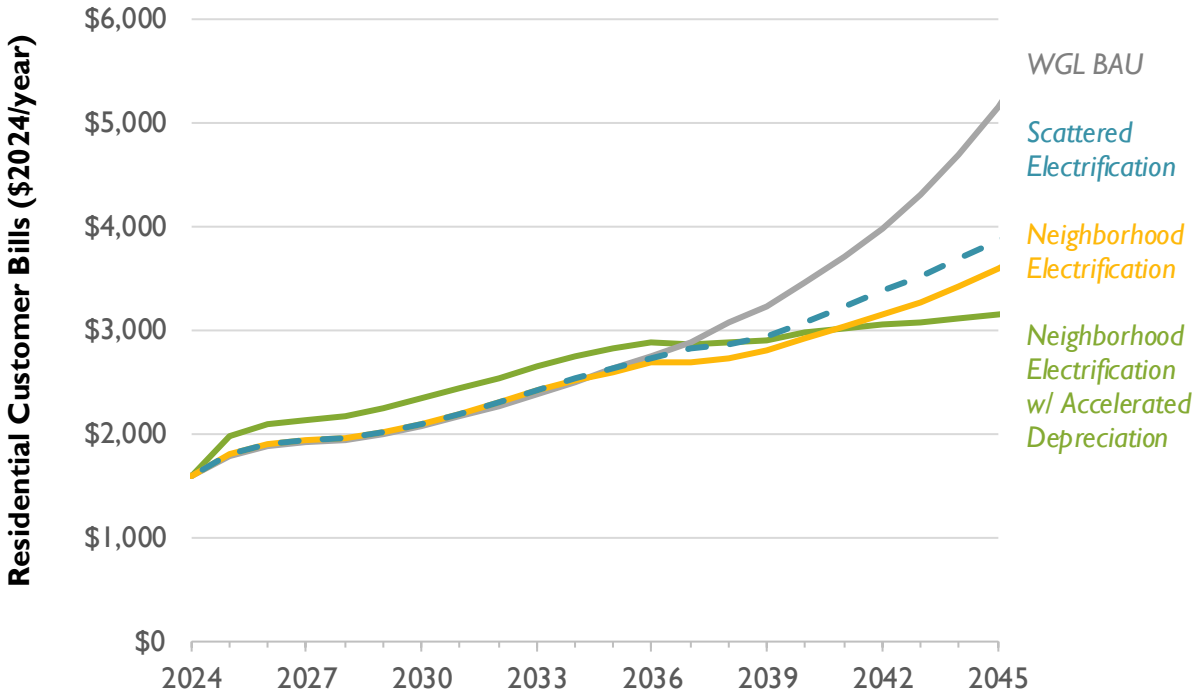
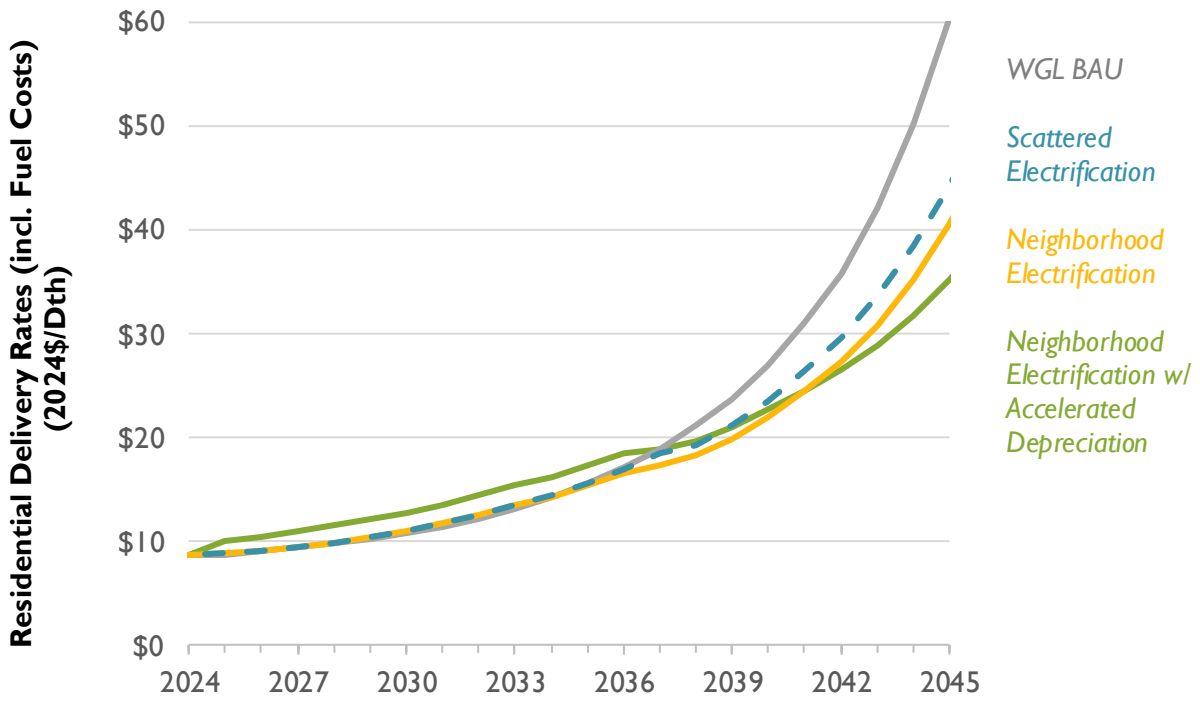


Figure 24. Residential gas rates in 2024$/dekatherm, including fuel costs, for all scenarios



4. CONCLUSIONS

WGL's District SAFE plan does not reflect the fact that the future of the gas system in the District of Columbia will differ from the past. WGL's approach to addressing gas pipeline safety risk through a replacement-focused approach (as modeled in the WGL BAU scenario) is not the most financially sustainable option, and offers the highest long-term rates, the least safety, and the greatest investor risk. Furthermore, the potential for financial unsustainability and risk from this approach in the long term could negatively impact the utility's ability to provide safe and reliable service. A business-as-usual approach to addressing LPP would make this risky and potentially unsafe future more, rather than less, likely.

Alternative approaches to traditional LPP replacement that incorporate repair and retirement through electrification alongside targeted replacement increase safety while reducing overall rates and lowering stranded cost risk, relative to the BAU approach. The costs of the alternatives are comparable to the BAU approach in the near term, and fall over time to be lower, while these approaches also reduce safety risks faster and more completely than the BAU. Overall, the savings from taking an alternate approach lower the risk of financial instability associated with customer departure, as well as stranded cost risk that might threaten WGL's access to capital markets, enabling WGL to maintain a steady hand on the safety and reliability of the system and better manage its workforce issues through the transition.

The Alternative cases also provide more time and flexibility to target electrification assistance to low-income household and rental properties and improve the equity outcomes of the energy transition.

Pursuing managed (clustered) electrification makes for a smaller, safer system while also reducing costs compared with an unmanaged (scattered) approach to electrification. The managed case has noticeably better risk characteristics than the unmanaged case because it retires more leak-prone mains sooner. The managed case is also less expensive than the unmanaged case, due to lower operations and maintenance costs associated with the smaller system.

Importantly, gas system planning should account for asset lifetimes and depreciation costs when considering these alternatives. We find that accelerated depreciation causes near-term rates to increase substantially (although on the same scale as WGL is requesting in its current rate case), but in return nearly eliminates stranded cost risk, while lowering long-term rates and enhancing WGL's capability to run a safe and reliable system.

CERTIFICATE OF SERVICE

I certify that on June 10, 2025, a copy of the whitepaper prepared for the District of Columbia Government on Alternative Approaches to Increasing Gas System Safety was electronically delivered to the following parties:

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