GOVERNMENT OF THE DISTRICT OF COLUMBIA
OFFICE OF THE ATTORNEY GENERAL

ATTORNEY GENERAL
BRIAN L. SCHWALB

Public Advocacy Division
Social Justice Section

E-Docketed

January 6, 2023

PUBLIC VERSION

Ms. Brinda Westbrook, Secretary
Public Service Commission
of the District of Columbia
1325 G Street, N.W., Suite # 800
Washington, DC 20005

Re: Formal Case No. 1169 – In the Matter of the Application of Washington Gas Light Company for Authority to Increase Existing Rates and Charges for Gas Service.

Dear Ms. Westbrook:

On behalf of the District of Columbia Government, I enclose for filing the Rebuttal Testimony of Dr. Asa S. Hopkins, which has been designated Exhibit DCG (2A). Accompanying Dr. Hopkins' Rebuttal Testimony are three (3) exhibits designated Exhibits DCG (2A)-1 through DCG (2A)-3. Please note this is the public version of Dr. Hopkins' Rebuttal Testimony and certain information has been withheld or redacted due to confidentiality claims by the Company. A confidential version of Dr. Hopkins' Rebuttal Testimony has been filed with the Commission under separate cover. If you have any questions regarding this filing, please contact the undersigned.

Sincerely,

BRIAN L. SCHWALB
Attorney General

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Exh. DCG (2A)
PUBLIC VERSION

**BEFORE THE PUBLIC SERVICE COMMISSION
OF THE DISTRICT OF COLUMBIA**

In the Matter of:

WGL's Application for Authority to Increase Existing Rates and Charges for Gas Service in the District of Columbia

Formal Case No. 1169

Rebuttal Testimony of
Dr. Asa S. Hopkins

On Behalf of
The District of Columbia Government

Exhibit DCG (2A)

January 6, 2023

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EXHIBITS

I. INTRODUCTION AND QUALIFICATIONS

Q1 Please identify yourself.

A1 My name is Asa S. Hopkins. I am a Vice President at Synapse Energy Economics, Inc.

Q2 Are you the same Asa Hopkins that submitted direct testimony in this proceeding on November 4, 2022?

A2 Yes.

Q3 What is the purpose of your rebuttal testimony?

A3 The purpose of my rebuttal testimony is to address issues raised by the Office of the People's Counsel for the District of Columbia (OPC) and other intervenors in their direct testimonies, including the issues of the cost-effectiveness of leak-prone pipe replacement, the sustainability of Washington Gas Light Company's (WGL) business model, depreciation rates, rate of return on equity, and WGL's proposed Climate Action Recovery Tariff (CART) structure and specific proposed CART investments.

Q4 Are there any exhibits accompanying your rebuttal testimony?

A4 Yes. There are three (3) exhibits accompanying my rebuttal testimony, which are designated DCG (2A)-1 through DCG (2A)-3. These exhibits consist of excerpts from materials produced by WGL in response to data requests and by order of the Public Service Commission of the District of Columbia (Commission). These exhibits were prepared by me or under my direction.

II. SUMMARY OF CONCLUSIONS AND RECOMMENDATIONS

Q5 Please summarize your primary conclusions.

A5 My primary conclusions in this rebuttal testimony are summarized as follows:

- WGL's PROJECT*pipes* investments in replacing leak-prone pipe are a very expensive way of reducing greenhouse gas emissions, if they reduce emissions at all.
- WGL's rate base growth is unsustainable compared with its projected decrease in gas sales, and competition from electricity results in a need for the utility and its regulator to plan for a different business model to be implemented over the next few decades.
- The depreciation rates that WGL is using in this rate case violate the principle of intertemporal equity. That is, at WGL's proposed depreciation rates, today's customers are underpaying for assets and leaving unreasonable costs for future ratepayers.

I also continue to stand by my conclusions from my direct testimony.

Q6 Please summarize your primary recommendations.

A6 In addition to my recommendations in my direct testimony, I further recommend, based on the direct testimonies of other parties, that the Commission

- establish depreciation principles, including intertemporal equity, and require WGL to conduct a depreciation study that reflects those principles, such as by using a depreciation approach based on utilization of gas system assets or units-of-production;

- establish a return on equity at the lowest end of the range of reasonable rates (that is, 7.5 percent as shown by OPC Witness O'Donnell) for the portion of rate base associated with leak-prone pipe replacement capital invested after the date of the Commission's order in this proceeding; and

- disregard Witness Oliver's contention that it is inappropriate for WGL to propose an expanded Residential Essential Service (RES) credit and consider the RES credit proposal on its merits as part of a larger approach to reducing energy burden.

III. LEAK-PRONE PIPE REPLACEMENT

Q7 OPC Witness Walker testifies that PROJECT*pipes* has shown disappointing performance.[1] Do you agree?

A7 Witness Walker testifies that WGL has replaced only 4 to 5 miles of leak-prone pipe each year, and that at that rate it would take until 2116 to replace all leak-prone pipe on the system.[2] I agree that these are very low rates of pipe replacement, particularly when measured against the high cost of the replacement program in DC. [redacted][3]

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[1] Exhibit OPC (C), *Direct Testimony of Rod Walker*, p. 13.
[2] *Id*., p. 14.
[3] WGL Confidential Response to OPC Data Request 11-66, w/ relevant pages of attachment 3, pgs. 31 and 84-89 (filed August 16, 2022), attached hereto as DCG (2A)-1. The peers used in this analysis appear to be those listed on pages 3 and 4 of the exhibit (attachment 3, pgs. 84-85 of original response).

Q8 Does Witness Walker's testimony impact your assessment of the cost-effectiveness of the PROJECT*pipes* program?

A8 Yes. WGL claims that distribution pipe emissions have fallen by a cumulative 22,000 metric tons of CO_2-equivalent since PROJECT*pipes* began in 2014, as a result of replacing cast iron and bare steel services and mains with plastic.[4] Massachusetts's methane emission reduction regulation estimates the emissions factor for cast iron main at 28.7 metric tons of CO_2-equivalent per mile per year, and plastic pipe is 0.2 metric tons per mile per year.[5] Each mile of cast iron replaced by plastic would therefore reduce emissions by 28.5 metric tons per year. For PROJECT*pipes*, replacing 1 mile of cast iron main would cost an average of [redacted] while reducing annual emissions by 28.5 metric tons. This works out to a mitigation cost of more than [redacted], if we assume a pipe lifetime of 22 years (the time between now and 2045, when the District of Columbia is aiming for carbon neutrality, by which point all pipes should either be leak-free or retired). Even assuming a pipe lifetime of 80 years, the cost is about [redacted]. I recognize that leak-prone pipe replacement also reduces safety risks, but this mitigation cost is very high compared with the cost of electrification. Electrification also reduces safety risks, by retiring pipe. As an indicative comparison cost of which WGL management is well aware, work completed to support WGL's Climate Business Plan cites an estimate of a cost of the "policy driven electric" case as $301 per ton.[6]

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[4] Exhibit WG (L). *Direct Testimony of Melissa Adams*, p. 9.

[5] "310 Mass. Reg. 7.73 – Reducing Methane Emissions from Natural Gas Distribution Mains and Services." Accessed December 5, 2022 at https://casetext.com/regulation/code-of-massachusetts-regulations/department-310-cmr-department-of-environmental-protection/title-310-cmr-700-air-pollution-control/section-773-reducing-methane-emissions-from-natural-gas-distribution-mains-and-services.

[6] My citation of this number does not mean that I agree with the methods used to calculate it. DOEE's concerns about the methods in this study are documented in comments it filed in FC1142 and FC1167. Value is from: ICF. April 2020. *Opportunities for Evolving the Natural Gas Distribution Business to Support the District of Columbia's Climate Goals*. Prepared on behalf of AltaGas. p. TS-15. Accessed at

Mr. Walker, in contrast, looks at the actual performance of PROJECT*pipes* at reducing leaks, increasing safety, and reducing emissions, and finds that the program has no appreciable or identifiable effect on leaks or lost gas. If this is the case, the cost per ton of emission reductions that occur as a result of PROJECT*pipes* is effectively infinite, and any claim of climate benefits (even very expensive ones) from the program is cast in doubt.

Q9 On page 8 of his testimony, AOBA Witness Bruce Oliver testifies that WGL's rate base is rising much faster than its sales or customer base, which is unsustainable. Do you agree this trend is unsustainable?

A9 Yes. My analysis for DCG in Formal Case No. 1167 (F.C. 1167) reached the same conclusion. Regarding the separating trajectories for rate base, sales, and customers that Witness Oliver shows in Exhibit AOBA (A)-1, a high-level analysis that ICF conducted for WGL in support of its Climate Business Plan also showed that rate base will rise much faster than sales in all of WGL's Climate Business Plan scenarios. In fact, ICF's high-level analysis estimates that WGL's rate base would [redacted] between 2022 and 2050,[7] in real terms, while the company's Climate Business Plan projects a sales reduction of 36 percent between 2020 and 2050.[8]

To elaborate on the implications of these trends, my analysis in F.C. 1167 showed just how unsustainable WGL's rate base growth (driven by leak-prone pipe replacement) is, especially when considered in concert with rising supply costs and declining sales. The following figures, extracted from the DCG's October 3, 2022, reply comments in F.C. 1167, illustrate that unsustainability. First, Figure 1

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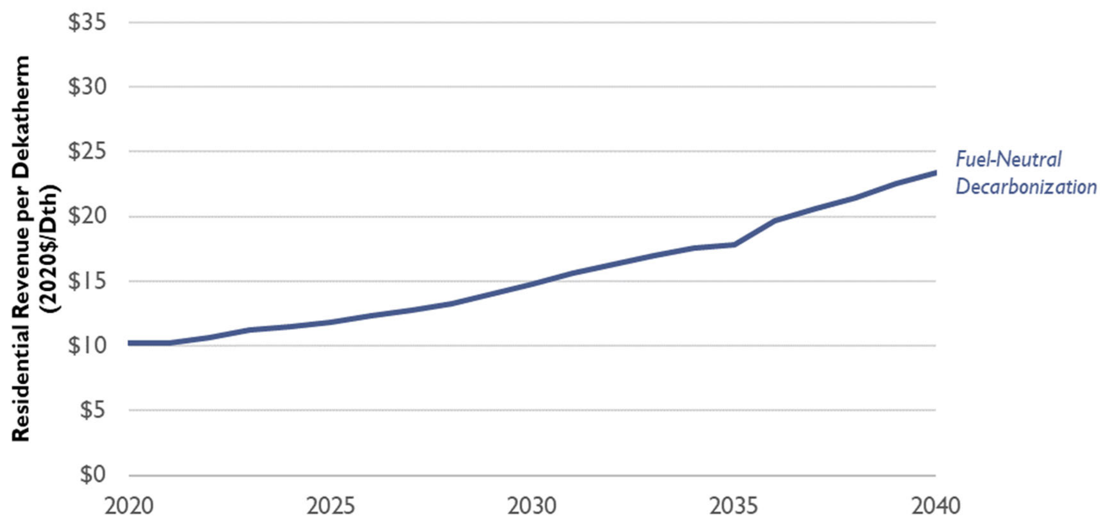
https://washingtongasdcclimatebusinessplan.com/wp-content/uploads/2020/04/Technical-Study-Report-Opportunities-for-Evolving-the-Natural-Gas-Distribution-Business-to-Support-DCs-Climate-Goals-April-2.pdf.

[7] *See* F.C. 1167, WGL's Confidential Response to DCG Data Request No. 1-2 w/ relevant pages of attachment 2 (filed September 9, 2022), which is attached hereto as Confidential Exhibit DCG (2A)-2.

[8] F.C. 1142, WGL and AltaGas, *Natural Gas and its Contribution to a Low Carbon Future: Climate Business Plan for Washington, D.C.* p. 4 (filed March 16, 2020)

shows the increase in residential revenue per dekatherm required by increasing rate base and supply costs in the "Fuel Neutral Decarbonization" case, with the average rate (in inflation-adjusted terms) rising past $2 per therm in the mid-2030s.

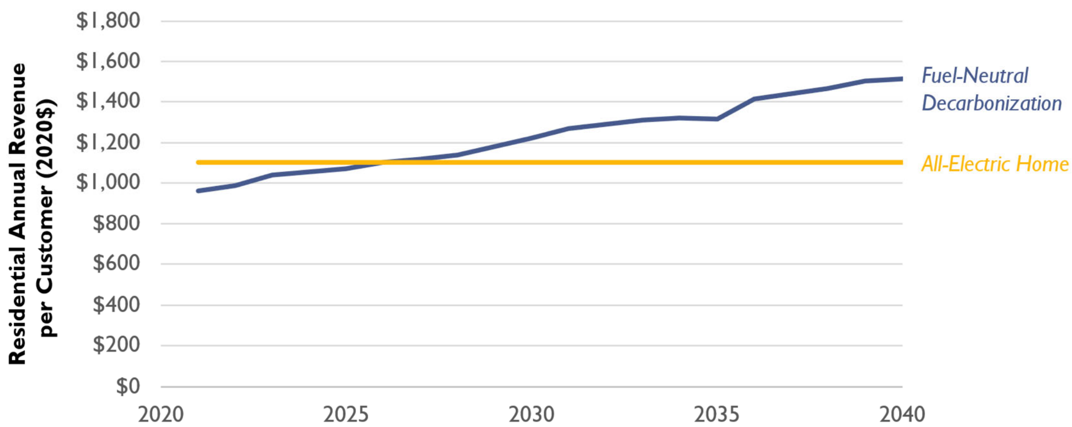
Figure 1. Residential revenue per dekatherm, Fuel Neutral Decarbonization scenario[9]



This increasing average rate (as shown in revenues per dekatherm) more than counteracts the decline in average sales per customer assumed in the Fuel Neutral Decarbonization case, so that revenue per customer (that is, the average bill) rises. In this model, average residential gas bills increase past the cost of the equivalent energy services from electricity within the next few years, as shown in Figure 2.

[9] F.C. 1167, *District of Columbia Government's Consolidated Reply Comments on Washington Gas Light Company's Climate Business Plan*, at p. 23 (October 3, 2022).

Figure 2. Residential annual revenue per customer, Fuel-Neutral Decarbonization scenario, compared with incremental electric bills for an all-electric home[10]



Due to the competitive position for gas versus electricity in this case, more customers would choose to switch to electricity, so WGL's preferred case is not a sustainable equilibrium. As more customers reduce their gas use or leave the gas system altogether, rates would rise faster, encouraging greater customer departures. If WGL were instead to focus on reducing rate base more in line with sales, through pipeline retirement and accelerated depreciation, rates could remain close to the level of WGL's favored "Fuel Neutral Decarbonization" case. This competitive dynamic, and the need to plan for a different business model to be implemented over the next few decades, is why I recommended in my direct testimony that the Commission or DOEE should develop a gas utility business model roadmap.

Q10 Did the Synapse analysis in FC1167 match WGL's current costs for PROJECT*pipes*?

A10 No, the Synapse analysis assumed that WGL was able to replace leak-prone pipe at a cost of about $840 per foot, about a [redacted]. If the analysis assumed WGL's actual

[10] *Id.*, p. 24.

recent costs for this work, it would simply exacerbate the issues I discussed above.

Q11 How much of the competitive challenge for pipeline gas service is due to the cost of alternative gaseous fuels (AGFs)?

A11 Approximately half of the increase in gas rates shown in Figure 1 is a result of the cost of AGFs. For this analysis, Synapse used a relatively optimistic cost of AGFs of about $15 per dekatherm. This falls at the lower end of the range of AGF costs that WGL assumed in its Climate Business Plan, of $10 to $25 per dekatherm.[11] As DCG pointed out in its F.C. 1167 comments, "in a Maryland based study, Energy and Environmental Economics (E3) estimated that AGFs would optimistically cost around $30 per dekatherm (in 2020 dollars).[12] On the conservative side, E3 projected that these fuel types could cost up to $70 per dekatherm (in 2020 dollars). Considering the similarities between Maryland and DC, both in terms of location and utility operations, WGL's cost estimate for AGFs is notably low. If the costs of AGFs are higher than WGL projects, the cost to operate a gas building will similarly increase."[13]

Q12 Do you agree with OPC Witness Walker's concern that considering infrastructure investments and gas commodity planning as separate items relies on assumptions about new technologies and leads to risks of stranded costs?[14]

A12 I do. As I described above, the changing competitive position of gas versus electricity is a result of both infrastructure and fuel supply costs. By planning a

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[11] *See* F.C. 1167, WGL's Spreadsheet 10 – "DC Energy Prices", which is attached hereto as Exhibit DCG (2A)-3. This document was originally filed confidentially on Sept. 1, 2021. However, as explained in the accompanying cover letter in the Exhibit, after DCG, OPC and Sierra Club filed a challenge to its confidential designation, WGL re-classified Spreadsheet 10 as a public document on April 7, 2022.

[12] Clark, T., D. Aas, C. Li, J. de Villier, M. Levine, and J. Landsman. October 20, 2021. *Maryland Building Decarbonization Study: Final Report*. Presentation by Energy and Environmental Economics. Available at: https://mde.maryland.gov/programs/Air/ClimateChange/MCCC/Documents/MWG_Buildings%20Ad%20Hoc%20Group/E3%20Maryland%20Building%20Decarbonization%20Study%20-%20Final%20Report.pdf.

[13] F.C. 1167, *District of Columbia Government's Consolidated Reply Comments on Washington Gas Light Company's Climate Business Plan*, p. 25-26 (filed October 3, 2022).

[14] Exhibit OPC (C), *Direct Testimony of Rod Walker*, p. 35-36.

replacement infrastructure to last for generations, WGL is assuming that AGFs will be available in the necessary quantity, with low-enough emissions, and at low-enough prices to justify its preferred course. However, even with favorable assumptions, electrification still quickly becomes a lower cost option for customers, thus raising the risk of stranding for long-lived gas distribution assets, if the utility does not change its approach to infrastructure decision-making and develop a revised business plan.

IV. FINANCIAL TREATMENT OF CAPITAL ADDITIONS

Depreciation

Q13 OPC Witness Walker discusses the Prince George Reinforcement Project on pages 37-38 of his testimony. What aspect of his discussion do you think is most relevant to the issue of stranded assets discussed above?

A13 The most relevant aspect of Witness Walker's testimony on this project is his point that it is important to consider the context for the choice to invest in a long-lived asset. Specifically, a new context, different from the constantly growing system of the past, could result in an asset losing its utility before it is fully depreciated, and thus becoming a stranded asset.

Q14 Beyond the Prince George Reinforcement Project, does Witness Walker's point about stranded assets have other implications for WGL's rate case?

A14 Yes. The Prince George Reinforcement Project provides an example of the importance of getting the right decision-making framework in place. In other words, when WGL management is considering whether to invest in a project like the Prince George's Reinforcement Project, it should evaluate whether the project would still make sense, and still be a prudent and cost-effective use of ratepayer funds, with a shorter useful life or a units-of-production based depreciation approach as a hedge against stranded assets.

Q15 What is a "units-of-production based depreciation approach"?

A15 Using a units-of-production based depreciation approach, also referred to as utilization-based depreciation, the total lifetime energy service provided by a given asset would be estimated (for example, the total number of therms that a typical segment of main would carry over its life). Then the plant invested in this asset would be divided by this estimate to estimate a depreciation cost per therm. This rate can be used each year, as the number of therms changes. 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 ten years, the utility would depreciate the asset by $200,000 per year ($0.10/therm times 2 million therms), and in the second ten years it would depreciate the asset by $100,000 per year ($0.10/therm times 1 million therms).

Q16 How does a units-of-production based depreciation schedule address the concern that Witness Walker expressed with the Prince George Reinforcement Project and stranded assets more generally?

A16 Mathematically, the return to shareholders (expressed as a percent of the invested equity) is the same whether an asset depreciates over a longer or a shorter time. However, utility managers seem to favor long depreciation lives. This may be because it helps to assure investors that the returns will continue to be achieved for a long time. They can also show earnings growth if capital is invested faster than it depreciates, so low depreciation rates make it easier to show growth.

In a rate case, the Commission can establish different depreciation rates that reflect the market and policy context. In the event that utility managers choose to use different rates, then it is clear they are making that choice, which can be evaluated for prudence in the event that costs are stranded.

Q17 Can you recommend a specific depreciation rate that would address Witness Walker's concern about stranded assets?

A17 I do not have specific numbers to propose. Instead, I recommend that the Commission establish depreciation principles and require WGL to conduct a depreciation study that reflects those principles. That way, the depreciation experts can review the implications of those principles for each of the utility's different types of assets and recommend specific approaches.

Q18 In your opinion, what principle is most important when setting a depreciation rate to avoid stranded assets?

A18 The key principle is intertemporal equity. That is, customers who use an asset at different times should pay a comparable amount for the existence and usefulness of that asset, if they receive a comparable service from that asset (such as the transportation of a therm of natural gas). In order to use this principle, the Commission and utility would need to adopt a best estimate of the future utilization of the gas system. The Commission could develop such a best estimate in F.C. 1167 by establishing a shared framework for decarbonization that DCG has requested, within the framework of Clean Energy DC and the District of Columbia's policy of carbon neutrality.

Q19 Do you think that the depreciation rates that WGL is using in this rate case reflects the principle of intertemporal equity?

A19 No, I do not. For example, WGL is using a 2015 Depreciation Study (which predates the publication of Clean Energy DC) and recommends a depreciation rate of 2.09 percent for distribution assets,[15] of which 0.6 percent reflects net salvage cost.[16] This implies an average asset useful life of about 67 years.[17] Using straight line depreciation of this sort, when even WGL's preferred case for the

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[15] F.C. 1137, Exhibit WG (H), *Direct Testimony of Ronald E. White*, p. 12, Table 2 (filed, February 26, 2016).
[16] F.C. 1137, Exhibit WG (H)-2, *2015 Depreciation Rate Study*, p. 28 (filed, February 26, 2016).
[17] Calculation: 2.09%-0.6% = 1.49%. A straight-line depreciation calculation assuming a 67-year lifetime would produce a depreciation rate of 1.49%.

utilization of its system shows sales falling substantially by 2050, violates the principle of intertemporal equity because future customers will pay unreasonably more, in the form of depreciation, to transport a therm of energy through any given distribution system asset than today's customers.

Q20 Was the use of straight-line depreciation for gas distribution assets with a long useful life just and reasonable in the past?

A20 Yes. In the past, it was reasonable to think that a typical gas system asset would see roughly stable utilization over its physical or engineering lifetime. In this case, spreading the cost equally over that time (as occurs in straight-line depreciation) is consistent with the principle of intertemporal equity because future customers would pay roughly the same amount per therm transported as the customers at the time the pipe is installed. If an asset is expected to be used steadily for a number of years (its useful life, which could be shorter than its engineering life) and then retired, a utilization-based approach produces the same result as a straight-line depreciation using the projected useful life.

Q21 What approach is better aligned with the principle of intertemporal equity in today's context?

A21 I believe the best approach would be a units-of-production or utilization-based depreciation approach. In this approach, customers who use the asset when utilization is high pay for a larger portion of the capital investment, and they leave a smaller remaining balance for future ratepayers when the utilization is lower.

Rate of Return

Q22 Are there any other tools at the Commission's disposal that could address the concerns expressed by Witness Walker regarding stranded assets?

A22 Yes. The Commission can set different rates of return on equity for capital investments to reflect its priorities. Long-term utility profits are directly related to the extent of capital the company invests. All regulation is incentive regulation: A higher rate of return on capital increases the utility's incentive to invest more capital. Cost of service regulation creates this incentive even in a situation where the societally preferred approach from the utility would be to optimize for other kinds of performance. For example, it may be societally preferable (and more consistent with policy) for a gas utility to reduce its capital expenditure on growth and new pipelines, such as to the level minimally required to maintain a safe and reliable system for the period while customers shift to other heating sources.

Q23 What do OPC Witnesses O'Donnell and Walker say about WGL's proposed rate of return?

A23 OPC Witness O'Donnell testifies that a return on equity of 9.0 percent, minus 25 basis points to account for what OPC Witness Walker calls the mismanagement of the PROJECT*pipes* program, would be a fair return, although his analysis shows a reasonable range between 7.5 and 8.7 percent that is supported by both the discounted cash flow and capital asset pricing model approaches.[18]

Q24 Do you agree with Witness Walker that WGL's rate of return should be lowered by 25 basis points to reflect poor management performance on *PROJECTpipes*?

A24 I agree with the rationale, and I believe that Witness Walker's proposal could be applied reasonably. His proposal is focused on lowering WGL's rate of return on equity as a penalty for poorly managing its pipe replacement program, whereas I am focused on the utility's incentive to invest. As a result, I would prioritize a different change in the ROE structure for WGL.

Q25 What change to the structure of Witness Walker's recommendation for WGL's return on equity would you recommend?

A25 The Commission should separate the rate of return for pipeline replacement from the rate on other portions of rate base in order to send a clear signal to utility management that these investments are not preferred. It is important to start to

[18] Exhibit OPC (D), *Direct Testimony of Kevin O'Donnell*, p. 57-58.

break the cycle that the more the utility spends in this unhelpful direction, the more it earns. With a lower return on these investments, shareholders would direct utility management to invest capital in other, more prudent ways.

Q26 Would a differential rate of return for different classes of investments address Witness Walker's concern?

A26 Yes. In this manner, the Commission would be sending a very clear signal to WGL that it will not allow the Company to earn a full rate of return on very high pipe replacement costs of dubious emissions and safety impact, as discussed in Witness Walker's testimony. Moreover, it is a relatively common practice for a regulator to allow a utility to earn a higher rate of return on capital as a reward for undertaking particular actions or for making certain kinds of investments. This provides an incentive for the utility to take those actions. On the other hand, a regulator could establish a lower rate of return for certain kinds of disfavored investments as long as the rate of return on those investments remains reasonable. Rate of return analyses, such as those presented by Witness O'Donnell in this proceeding, commonly establish a range of reasonable returns. A regulator could establish that some kinds of investments earn a value at the bottom of that range, while other portions of rate base earn a different return.

Q27 Based on Witness O'Donnell's testimony, do you have a specific recommendation for the return on equity?

A27 Yes. I recommend that the Commission establish a return on equity for pipeline replacement capital expenditures equal to the lowest reasonable value for ROE. The low end of Witness O'Donnell's range of reasonableness, supported by both the discounted cash flow and capital asset pricing models, is 7.5 percent, and I would recommend the Commission use this value as the ROE for investment in leak-prone pipe replacement.

Q28 Would you apply Witness O'Donnell's lowest reasonable ROE to all leak-prone pipe program investments that have occurred since the start of PROJECT*pipes*?

A28 No, I would apply the lower rate to capital invested after the effective date of the Commission's order in this docket. The point of this treatment is to impact WGL's future behavior with respect to infrastructure investment choices, so it makes sense to attach this lower ROE on a forward-going basis. I would also support Witness Walker's proposal to lower WGL's overall ROE by 0.25 percent to reflect the poor past performance of the PROJECT*pipes* program.

WGL management has known since at least early 2019 that it should reevaluate its leak-prone pipe approach to align with DC's climate change plans. The Clean Energy Omnibus Amendment Act was enacted in January 2019, following on the heels of the Clean Energy DC Plan. The Clean Energy Omnibus Act explicitly added climate change mitigation and the District's climate commitments to the Commission's and OPC's respective lists of formal considerations. The Clean Energy DC Plan formalized the path to 50 percent building energy and District-wide greenhouse gas emission reductions by 2032, goals that can only be achieved with a fundamental rethink regarding the role of natural gas and the increased use of heat pumps. These policy documents together set the District of Columbia on a course that does not align with a very expensive pipe replacement program. WGL management could have seen that this investment was inconsistent and changed its approach but has failed to do so. It is time to send a direct financial signal to change course. By changing the ROE for leak-prone pipe investments to a low but reasonable level, the Commission would ensure that utility management understands the District's seriousness with respect to cost-effectiveness and its emission reduction objectives.

V. CART INVESTMENTS

Q29 Have you reviewed the testimony of OPC and other intervenor witnesses regarding WGL's proposed CART mechanism and its initial proposed actions to be funded by the CART?

A29 Yes, I have read the testimonies of Witnesses Oliver, Dismukes, Walker, Stanton, and Grubert.

Q30 Do you generally agree with the conclusions reached by these Witnesses regarding the CART?

A30 I do. In particular, I agree with the conclusions reached by these witnesses that the CART would not provide appropriate incentives to WGL to contain costs,[19] that WGL has not shown that the proposed projects are consistent with the District's climate goals,[20, 21] and that WGL has not shown that the benefits of the proposed expenditures outweigh the costs.[22, 23]

Q31 Are the conclusions regarding the CART reached by these Witnesses consistent with WGL and AltaGas's commitments in the merger proceeding, Formal Case 1142?

A31 No, they are not. Specifically, these Witnesses' conclusions show that WGL is not honoring its "commitment to continued change and improvement in its operations, and provide an evolving portfolio of clean and renewable products and services to communities AltaGas serves"[24] as AltaGas agreed to in the merger proceeding. Term 76 of the merger agreement commits AltaGas to take actions to reduce emissions in line with the goal of limiting warming to no more than two degrees Celsius by the end of the century.[25] AltaGas CEO David Harris testified

[19] Exhibit OPC (A), *Direct Testimony of David E. Dismukes*, p. 5 and p. 54.
[20] Exhibit OPC (E), *Direct Testimony of Elizabeth A. Stanton*, p. 61-62.
[21] Exhibit Sierra Club (A), *Direct Testimony of Emily Grubert, PhD*, p. 27-31.
[22] Exhibit AOBA (B). *Direct Testimony of Timothy B. Oliver*, p. 41.
[23] Exhibit OPC (C), *Direct Testimony of Rod Walker*, p. 35.
[24] F.C. 1142, Order No. 19396, Appendix A, ¶ 76 (*rel.* June 29, 2018).
[25] *Id.*

in F.C. 1142 that "our plan is to work collaboratively with the Commission and the District to make sure that the transformation takes place in a healthy and effective way, minimizing the impact to the customers."[26] Instead, the CART presents a portfolio of actions that are not consistent with the District's climate goals, for which no emissions reductions have been estimated, and which may cost more than they provide in benefits.

Q32 Do you agree with Sierra Club Witness Grubert regarding WGL's failure to justify the proposed fleet CNG and hydrogen fuel cell mobility investments compared with electrification?

A32 Yes. As I described in my direct testimony, the District's transportation roadmap explicitly favors electrification for a wide range of vehicle types, including those types that would be addressed by these proposed WGL expenditures.

Q33 Sierra Club Witness Grubert testifies that a 50 percent hydrogen blend for WGL's proposed stationary fuel cell could only reduce greenhouse gas emissions by 17 percent.[27] Do you agree?

A33 I agree with Witness Grubert's underlying argument regarding the lack of climate benefits provided by this proposed project; however, the only thing I will note is that I believe the correct potential reduction is 21 percent, not 17 percent. As shown in Figure 3, increasing hydrogen blends with methane increases the percentage of energy supplied by hydrogen (and thus the potential greenhouse gas emission reductions if the hydrogen is climate neutral) in a nonlinear manner.[28]

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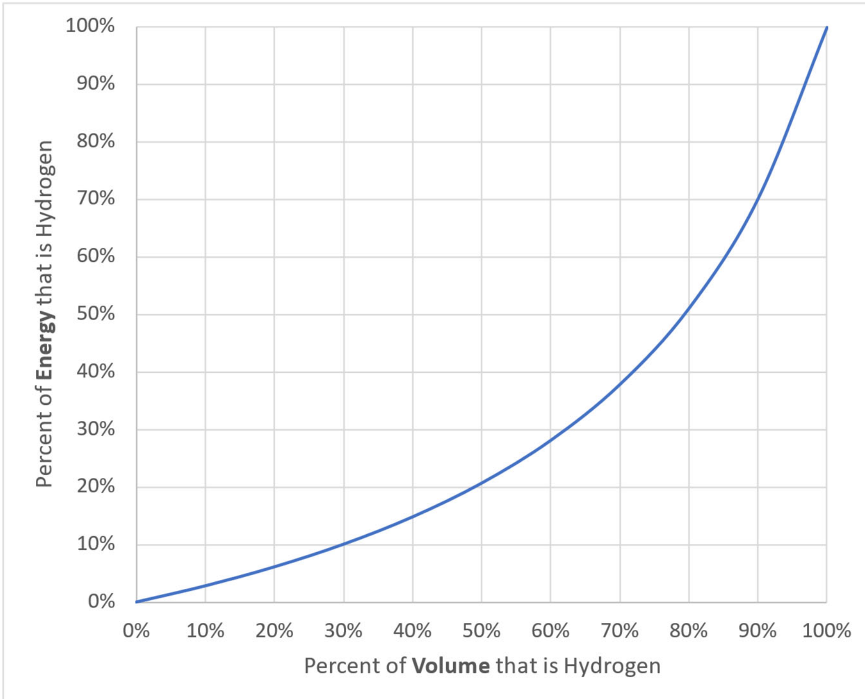
[26] F.C. 1142, Cross-examination of WGL Witness David Harris by Chairman Kane, Transcript, Volume 2, p. 447: 17-21 (December 6, 2017).

[27] Exhibit Sierra Club (A), *Direct Testimony of Emily Grubert, PhD*, p. 29.

[28] To make this figure, I used the energy density of methane (2.8 kWh/m^3) and hydrogen (10.7 kWh/m^3) to calculate the energy content of a blended gas composed of different portions of each gas (by volume), and the portion of that energy that comes from each gas.

Figure 3. Relationship between hydrogen as a fraction to volume to hydrogen as a fraction of energy, in a blend with methane.



Again, however, I agree with Dr. Grubert that these potential reductions are both minor (that is, far from the level of reduction required to meet the District's emission targets) and doubtful to be achieved. Hydrogen is an indirect greenhouse gas, and as a small molecule it has a greater ability to leak, so some greenhouse gas benefits from a blend would be lost. In addition, as I pointed out in my direct testimony WGL has not: (i) demonstrated that a supply source for the potential hydrogen actually exists; (ii) demonstrated how hydrogen would be transported to the site even if it did exist; (iii) provided assurance that hydrogen would actually be used; and (iv) shown how it would supply a 50 percent blend to this single asset while not exposing the rest of its system (which is not capable of handling such a blend) to hydrogen. In sum, I agree with Dr. Grubert that WGL has not demonstrated that this investment would advance the District's climate policies.

VI. RESIDENTIAL ESSENTIAL SERVICE CREDIT

Q34 Have you reviewed AOBA Witness Timothy Oliver's testimony regarding the Residential Essential Service (RES) credit?

A34 Yes, I have. Witness Oliver states that the development of a low-income social credit of this sort should be at the sole discretion of the Commission, and that the utility's role should be limited to providing the Commission and stakeholders with "empirical information regarding historical performance and effectiveness of the RES."[29]

Q35 Do you agree with Witness Oliver that WGL's proposed changes to the RES credit are "wholly inappropriate"?[30]

A35 No, I do not. It is common practice in rate design for a utility to make a proposal for a change in rates, rather than present the underlying cost causation and customer use data and ask the Commission to design the rates. As it has done in prior rate cases, WGL presented its rate design proposal as part of its Application. As a result of this common practice, WGL has proposed to reallocate some costs from one group of ratepayers to another, and the rates are recalculated. Many states have subsidized low-income rates where other ratepayers pay a bit more so that low-income families can have a lower energy burden. As I stated in my direct testimony, this energy burden-reducing credit should be part of a larger effort toward reducing energy burden and energy cost risk through weatherization and electrification. The Commission should disregard Witness Oliver's contention that it is improper for the utility to propose changes to low-income discount programs and consider WGL's RES credit proposal on its merits. As I stated in my Direct Testimony, the Commission should accept and implement WGL's RES proposal as part of a larger approach to reducing energy burden.

---

[29] Exhibit AOBA (B). *Direct Testimony of Timothy B. Oliver*, p. 40.
[30] *Id*.

Q36 Does this conclude your rebuttal testimony?

A36 Yes, it does.

BEFORE THE
PUBLIC SERVICE COMMISSION
OF THE DISTRICT OF COLUMBIA

IN THE MATTER OF:	)	
	)	
The Application of Washington Gas Light	)	**Formal Case No. 1169**
Company for Authority to Increase Existing	)	
Rates and Charges for Gas Service in the	)	
District of Columbia	)	

AFFIDAVIT

I declare under penalty of perjury that the foregoing rebuttal testimony was prepared by me or under my direction and is true and correct to the best of my knowledge, information, and belief.

Dr. Asa S. Hopkins

Executed this 6th day of January, 2023.

EXHIBIT

DCG (2A)-1

Please note that the following exhibit contains information claimed by WGL to be confidential or proprietary and, therefore, on that basis, is being withheld from the public version of this testimony. Any person wishing to obtain information subject to WGL's claim of confidentiality may contact the Company for an appropriate protective agreement or may challenge WGL's claim by seeking a "Confidential/Proprietary Information Determination Request" from the Commission pursuant to 15 D.C.M.R. § 150.7 of the Commission's Rules of Practice and Procedure.

EXHIBIT

DCG (2A)-2

Please note that the following exhibit contains information claimed by WGL to be confidential or proprietary and, therefore, on that basis, is being withheld from the public version of this testimony. Any person wishing to obtain information subject to WGL's claim of confidentiality may contact the Company for an appropriate protective agreement or may challenge WGL's claim by seeking a "Confidential/Proprietary Information Determination Request" from the Commission pursuant to 15 D.C.M.R. § 150.7 of the Commission's Rules of Practice and Procedure.

EXHIBIT

DCG (2A)-3

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April 7, 2022

VIA ELECTRONIC MAIL AND E-FILING

Ms. Brinda Westbrook-Sedgwick
Commission Secretary
Public Service Commission of the District of Columbia
1325 G Street, NW, Suite 800
Washington, DC 20005

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

Dear Ms. Westbrook-Sedgwick:

On October 26, 2021, Sierra Club, the Office of People's Counsel, and the District of Columbia Government (collectively, the "Joint Parties") filed a Confidential/Proprietary Information Determination Request ("the Request") in the above-captioned matter with respect to twelve spreadsheets filed confidentially by AltaGas Ltd. and Washington Gas Light Company (collectively, "the Companies") in support of their Climate Business Plan on September 1, 2021.[1] On November 5, 2021, the Companies voluntarily disclosed one of the disputed spreadsheets.[2] On March 10, 2022, in Order No. 21127, the Commission found that the Joint Parties had explained how release of the remaining 11 spreadsheets, with the exception of one worksheet in one of the spreadsheets, would cause substantial competitive injury.[3] Notwithstanding this finding, in paragraph 56 in Order No. 21127, the

[1] FC1167, Notice of Confidential/Proprietary Information Determination Request Regarding AltaGas Ltd.'s and Washington Gas Light Company's September 1, 2021 Filing, filed October 26, 2021.

[2] The Companies disclosed this spreadsheet as an attachment to their Initial Brief in Response to the Joint Parties' Request, filed November 5, 2021.

[3] FC1167, Order No. 21127 ¶¶ 51, 56. The Companies filed a public version of this worksheet on March 21, 2022.

Commission directed its Office of General Counsel ("OGC") to schedule a conference between the Companies and the Joint Parties "to attempt to reach a consensus on what additional information" could be released.[4]

Accordingly, OGC facilitated a conference between Companies and the Joint Parties on March 22, 2022 to assist in resolving the Joint Parties' dispute. The Joint Parties inquired whether the Companies would agree to disclose various portions of Spreadsheets 1, 4, 5, 6, 9, and 10. The Companies agreed to review these spreadsheets to determine whether the requested information reflected public data and could be disclosed.

Following the parties' conference, the Companies reviewed each spreadsheet identified by the Joint Parties and determined that certain information could be disclosed.

The parties met and conferred again on March 30, 2022, at which time the Companies identified the information that would be reclassified as public information.

Accordingly, enclosed for public filing are the following worksheets, originally filed confidentially by the Companies on September 1, 2021

- The worksheet titled "Summary CBP Tables" from Spreadsheet 1, with Rows 9-100 redacted;
- The worksheet titled "Coefficients and Conversions" from Spreadsheet 1;
- The worksheet titled "DC Emissions Inventory" from Spreadsheet 1, with Rows 116-123, Columns O to AU redacted;
- The worksheet titled "Residential Market Breakout" from Spreadsheet 4;
- The worksheet titled "DC Energy Prices" from Spreadsheet 10;
- The worksheet titled "Coefficients & Conversions" from Spreadsheet 11;
- The worksheet titled "DC Emissions Inventory" from Spreadsheet 11, with Rows 116-123, Columns O to AU redacted; and

[4] *Id*. ¶ 56.

- The worksheet titled "DC Emissions Inventory" from Spreadsheet 12, with Rows 116-123, Columns O to AU redacted.

Thank you for your time and attention. If you have any questions regarding this matter, please feel free to contact me.

Respectfully submitted,

Moxila A. Upadhyaya
Counsel for AltaGas Ltd.

Copy to: Certificate of Service
Christopher S. Gunderson, Esq.
J. Joseph Curran, III, Esq.

DC Prices

	Natural Gas Rate ($2017/MMBtu)			Fuel Oil Rate ($2017/MMBtu)			Propane Rate ($2017/MMBtu)			Electric Rate ($2017/MMBtu)			Electric Rate (cts2017/kWh)		
	Natural Gas	Natural Gas	Natural Gas	Fuel Oil	Fuel Oil	Fuel Oil	Propane	Propane	Propane	Electricity (LHS)	Electricity (LHS)	Electricity (LHS)	Electricity (RHS)	Electricity (RHS)	Electricity (RHS)
	Residential	Commercial	Industrial	Residential	Commercial	Industrial	Residential	Commercial	Industrial	Residential	Commercial	Industrial	Residential	Commercial	Industrial
2016	0	0	0	0	0	0	0	0	0	0	0	0			
2017	13	11	5	18	18	18	20	17	13	49	39	32	16	12	10
2018	12	10	5	22	21	22	23	19	14	47	38	30	15	12	10
2019	12	10	5	23	22	23	26	20	14	47	38	31	15	12	10
2020	12	11	5	23	22	23	28	20	14	47	37	30	15	12	9
2021	12	11	5	24	21	22	29	20	15	47	37	29	15	12	9
2022	13	11	5	24	21	22	30	21	15	48	36	29	15	12	9
2023	13	12	5	24	20	22	31	21	15	48	36	29	15	12	9
2024	13	12	6	25	21	22	32	22	16	48	37	29	15	12	9
2025	14	12	6	26	21	22	34	22	17	49	37	29	16	12	9
2026	14	12	6	26	21	23	35	23	17	49	37	29	16	12	9
2027	14	12	6	27	22	24	35	23	17	49	36	29	16	12	9
2028	14	12	6	27	22	24	36	23	17	49	36	29	16	12	9
2029	14	12	6	27	23	24	36	24	17	49	36	29	16	12	9
2030	14	12	6	28	23	24	37	24	18	49	36	29	16	11	9
2031	14	12	6	28	23	25	37	24	18	49	36	29	16	11	9
2032	14	13	6	28	24	25	37	24	18	49	36	29	16	11	9
2033	14	13	6	28	24	25	37	24	18	49	36	29	16	11	9
2034	14	13	6	29	24	25	38	24	18	49	36	29	16	11	9
2035	14	13	6	29	24	26	38	24	18	49	36	29	16	11	9
2036	14	13	6	29	25	26	38	25	18	49	36	29	16	11	9
2037	14	13	6	29	24	26	39	25	19	49	36	29	16	11	9
2038	14	13	6	29	25	26	39	25	19	49	36	29	16	11	9
2039	14	13	6	29	25	26	39	25	19	49	36	29	16	11	9
2040	14	13	7	30	25	26	39	25	19	49	35	28	16	11	9
2041	14	13	7	30	25	26	39	25	19	49	35	28	16	11	9
2042	14	13	7	30	25	27	39	25	19	49	35	28	16	11	9
2043	15	13	7	30	25	27	40	25	19	49	35	28	15	11	9
2044	15	13	7	30	25	26	40	25	19	49	35	28	15	11	9
2045	15	13	7	30	25	27	40	25	19	48	35	28	15	11	9
2046	15	13	7	30	25	26	40	25	19	49	35	28	15	11	9
2047	15	13	7	30	25	26	40	25	19	49	35	28	15	11	9
2048	15	13	7	30	25	26	40	25	19	49	35	28	15	11	9
2049	15	14	7	30	25	26	40	25	19	49	35	28	15	11	9
2050	15	14	7	30	25	26	40	25	19	48	35	28	15	11	9

	Natural Gas Rate ($2017/MMBtu)			Fuel Oil Rate ($2017/MMBtu)			Propane Rate ($2017/MMBtu)			Electric Rate ($2017/MMBtu)			Electric Rate (cts2017/kWh)		
	Residential	Commercial	Industrial	Residential	Commercial	Industrial	Residential	Commercial	Industrial	Residential	Commercial	Industrial	Residential	Commercial	Industrial
2017	13.01	11.02	5.34	18.19	17.90	18.21	19.72	16.52	12.96	49.14	38.56	31.78	15.65	12.28	10.12
2020	12.04	10.69	5.40	23.18	21.72	22.53	27.70	20.05	14.22	47.20	36.85	29.63	15.03	11.74	9.44
2025	13.57	12.24	5.84	25.71	21.04	22.43	33.57	22.48	16.55	48.71	36.61	29.40	15.51	11.66	9.36
2030	13.86	12.45	6.06	27.62	23.01	24.41	36.59	23.58	17.51	48.93	36.03	28.80	15.58	11.47	9.17
2035	14.16	12.71	6.35	28.72	24.16	25.57	38.01	24.35	18.27	49.26	35.99	28.80	15.69	11.46	9.17
2040	14.37	12.89	6.54	29.58	24.94	26.34	39.17	24.90	18.78	48.98	35.50	28.50	15.60	11.31	9.07
2050	15.02	13.60	7.31	29.95	24.91	26.23	39.73	25.09	18.92	48.46	34.89	28.40	15.43	11.11	9.05

*Cost Curve for 7 BCF by 2050 Glide Path (Case 4)

**Cost Curve For 2 BCF by 2050 Glide Path (Case 2)

	Conventional Natural Gas		Fuel Oil		Propane Rate		Electric Rate ($2017/MMBtu)		Electric Rate ()		Renewable Natural Gas (RNG) ($2018/MMBtu)*	P2G ($2018/MMBtu)	Hydrogen ($2018/MMBtu)	Convention Nat Gas commodity Cost ($2018/MMBtu)	P2G ($2018/MMBtu)	Hydrogen ($2018/MMBtu)	Renewable Natural Gas (RNG) ($2017/MMBtu)**
	Residential Rates	*Commercial Rates*	*Residential Rates*	*Commercial Rates*	*Residential Rates*	*Commercial Rates*	*Residential Rates*	*Commercial Rates*	*Residential Rates*	*Commercial Rates*	*Premium to Natural Gas*	*Premium to Natural Gas*	*Premium to Natural Gas*	*Procurement Costs*	*Full Cost*	*Full Cost*	*Premium to Natural Gas*
	$2018/MMBtu								cts2017/kWh		$2018/MMBtu			$2018/MMBtu			$2018/MMBtu
2017	13.01	11.02	18.19	17.90	19.72	16.52	49.14	38.56	15.64	12.27	8.16	13.02	11.02	3.00	16.02	14.02	5.33
2018	11.78	10.42	21.75	21.39	23.24	18.88	47.04	37.99	14.97	12.09	8.16	13.02	11.02	3.00	16.02	14.02	5.33
2019	11.54	10.37	22.54	22.00	25.95	19.92	46.93	38.22	14.94	12.16	8.16	13.02	11.02	3.00	16.02	14.02	5.33
2020	12.04	10.69	23.18	21.72	27.70	20.05	47.20	36.85	15.02	11.73	8.16	13.70	11.70	2.31	16.02	14.02	5.33
2021	12.28	10.91	23.54	21.20	29.06	20.38	47.38	36.56	15.08	11.64	9.47	17.31	15.31	2.42	19.73	17.73	5.73
2022	12.58	11.20	23.74	20.58	30.36	20.95	47.55	36.34	15.13	11.56	11.33	20.55	18.55	2.44	22.98	20.98	6.33
2023	12.96	11.60	24.35	20.34	31.42	21.36	47.77	36.26	15.20	11.54	12.53	21.12	19.12	2.63	23.75	21.75	6.06
2024	13.35	12.01	25.33	20.52	32.49	21.90	48.25	36.52	15.36	11.62	13.47	21.38	19.38	2.54	23.92	21.92	6.94
2025	13.57	12.24	25.71	21.04	33.57	22.48	48.71	36.61	15.50	11.65	12.42	20.90	18.90	2.48	23.38	21.38	6.06
2026	13.66	12.32	26.15	21.46	34.52	22.92	48.91	36.60	15.57	11.65	12.16	20.58	18.58	2.61	23.19	21.19	5.86
2027	13.71	12.34	26.83	22.15	35.30	23.23	48.97	36.45	15.59	11.60	10.76	20.40	18.40	2.61	23.01	21.01	5.79
2028	13.78	12.41	26.98	22.35	35.91	23.44	48.99	36.31	15.59	11.56	10.59	20.16	18.16	2.67	22.82	20.82	5.66
2029	13.81	12.41	27.45	22.80	36.31	23.53	48.95	36.13	15.58	11.50	11.51	19.76	17.76	2.88	22.64	20.64	5.37
2030	13.86	12.45	27.62	23.01	36.59	23.58	48.93	36.03	15.57	11.47	11.12	19.66	17.66	3.13	22.79	20.79	5.86
2031	13.88	12.45	27.82	23.23	36.78	23.63	48.98	35.98	15.59	11.45	12.58	19.63	17.63	3.19	22.82	20.82	5.94
2032	13.98	12.55	28.10	23.53	37.05	23.79	49.14	36.04	15.64	11.47	12.44	19.70	17.70	3.18	22.88	20.88	6.24
2033	14.07	12.64	28.48	23.86	37.37	24.00	49.28	36.09	15.69	11.49	12.18	19.14	17.14	3.30	22.44	20.44	6.04
2034	14.11	12.68	28.51	23.93	37.70	24.19	49.29	36.07	15.69	11.48	11.95	18.86	16.86	3.39	22.25	20.25	5.49
2035	14.16	12.71	28.72	24.16	38.01	24.35	49.26	35.99	15.68	11.45	12.02	18.89	16.89	3.17	22.06	20.06	5.63
2036	14.22	12.77	29.13	24.52	38.33	24.53	49.29	35.96	15.69	11.45	12.00	18.82	16.82	3.05	21.87	19.87	5.67
2037	14.28	12.82	29.02	24.43	38.59	24.64	49.36	35.96	15.71	11.45	11.64	18.41	16.41	3.26	21.67	19.67	5.37
2038	14.29	12.82	29.20	24.60	38.80	24.73	49.23	35.82	15.67	11.40	11.35	18.08	16.08	3.41	21.48	19.48	5.49
2039	14.32	12.84	29.36	24.76	38.99	24.81	49.11	35.68	15.63	11.36	10.83	17.75	15.75	3.78	21.53	19.53	5.03
2040	14.37	12.89	29.58	24.94	39.17	24.90	48.98	35.50	15.59	11.30	11.31	17.57	15.57	3.76	21.33	19.33	5.15
2041	14.40	12.90	29.66	24.98	39.29	24.94	48.90	35.44	15.56	11.28	11.11	17.72	15.72	3.81	21.53	19.53	5.02
2042	14.44	12.94	29.88	25.15	39.42	25.01	48.72	35.26	15.51	11.22	11.03	17.79	15.79	3.74	21.53	19.53	5.32
2043	14.50	13.01	29.91	25.17	39.55	25.09	48.60	35.14	15.47	11.19	11.23	18.00	16.00	3.82	21.81	19.81	5.20
2044	14.56	13.06	29.91	25.09	39.68	25.16	48.54	35.07	15.45	11.16	11.25	18.01	16.01	3.80	21.81	19.81	5.17
2045	14.63	13.15	29.99	25.15	39.78	25.20	48.49	34.99	15.43	11.14	11.04	17.93	15.93	3.88	21.81	19.81	5.16
2046	14.69	13.21	29.98	25.05	39.84	25.21	48.56	34.99	15.46	11.13	10.81	17.86	15.86	3.96	21.81	19.81	5.09
2047	14.75	13.28	29.99	24.96	39.87	25.22	48.59	35.00	15.46	11.14	10.58	17.80	15.80	4.03	21.82	19.82	4.92
2048	14.84	13.38	30.05	25.00	39.88	25.22	48.60	34.99	15.47	11.14	10.36	17.98	15.98	4.09	22.07	20.07	4.76
2049	14.95	13.51	29.99	24.93	39.84	25.17	48.53	34.95	15.45	11.12	10.47	17.92	15.92	4.15	22.07	20.07	4.87
2050	15.02	13.60	29.95	24.91	39.73	25.09	48.46	34.89	15.42	11.10	10.34	17.86	15.86	4.21	22.07	20.07	4.78

Fuel Prices Pasted in from CBP files (Spreadsheet 1)

Residential Rates ($2017 per MMBtu)

Rates by Fuel	2017	2020	2025	2030	2035	2040	2050
Natural Gas	13.01	12.04	13.57	13.86	14.16	14.37	15.02
Fuel Oil	18.19	23.18	25.71	27.62	28.72	29.58	29.95
Propane	19.72	27.70	33.57	36.59	38.01	39.17	39.73
Electricity	49.14	47.20	48.71	48.93	49.26	48.98	48.46

Commercial Rates ($2017 per MMBtu)

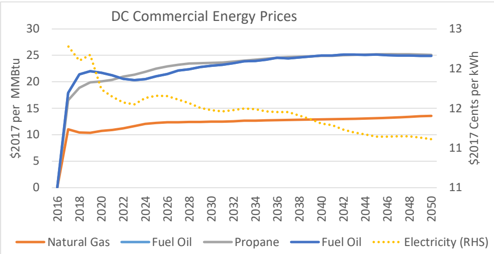
Rates by Fuel	2017	2020	2025	2030	2035	2040	2050
Natural Gas	11.02	10.69	12.24	12.45	12.71	12.89	13.60
Fuel Oil	17.90	21.72	21.04	23.01	24.16	24.94	24.91
Propane	16.52	20.05	22.48	23.58	24.35	24.90	25.09
Electricity	38.56	36.85	36.61	36.03	35.99	35.50	34.89

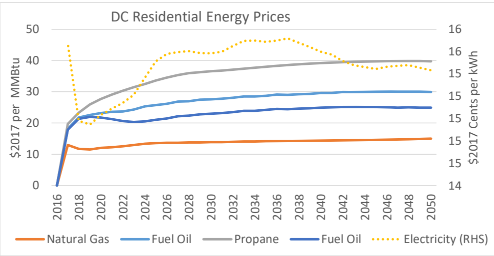
Industrial Rates ($2017 per MMBtu)

Rates by Fuel	2017	2020	2025	2030	2035	2040	2050
Natural Gas	5.34	5.40	5.84	6.06	6.35	6.54	7.31
Fuel Oil	18.21	22.53	22.43	24.41	25.57	26.34	26.23
Propane	12.96	14.22	16.55	17.51	18.27	18.78	18.92
Electricity	31.78	29.63	29.40	28.80	28.80	28.50	28.40

Wholesale Rates ($2017 per MMBtu)

Rates by Fuel	2017	2020	2025	2030	2035	2040	2050
Henry Hub	3.05	3.69	4.07	4.26	4.26	4.50	5.01
Renewable Natural Gas							
CNG							
LNG							
Motor Gasoline	20.72	24.47	26.31	27.67	28.76	29.58	30.35
Diesel Fuel	19.46	23.41	26.40	27.64	28.88	30.00	30.20





	Electricity per kWh		Utility (piped) gas per therm		Gasoline per gallon		Electricity per Mmbtu	
	United States	Washington area	United States	Washington area	United States	Washington area	United States	Washington area
2014	0.137083333	0.1255	1.078916667	1.197583333	3.424916667	3.420916667	0.43	0.39
2015	0.138083333	0.125416667	0.94475	1.074	2.51	2.482333333	0.43	0.39
2016	0.135166667	0.127916667	0.92125	1.045416667	2.203583333	2.223166667	0.42	0.40
2017	0.13775	0.128416667	1.0195	1.273583333	2.468666667	2.4815	0.43	0.40
2018	0.13625	0.128166667	1.047166667	1.088083333	2.793583333	2.789083333	0.43	0.40
2019	0.137111111	0.129111111	1.040777778	1.262	2.700111111	2.673555556	0.43	0.41

			full name	api key	units	Ratio to Middle Atla	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026
		Residential		3-AEO2018.2.													
Residential-Propane	Residential	Propane	Energy Prices: Resi	3-AEO2019.3.ref2	2018 $/MMBtu	100%		19.72	23.24	25.95	27.70	29.06	30.36	31.42	32.49	33.57	34.52
Residential-Distillate Fuel Oil	Residential	Distillate Fuel Oil	Energy Prices: Resi	3-AEO2019.4.ref2	2018 $/MMBtu	100%		18.19	21.75	22.54	23.18	23.54	23.74	24.35	25.33	25.71	26.15
Residential-Natural Gas	Residential	Natural Gas	Energy Prices: Resi	3-AEO2019.5.ref2	2018 $/MMBtu	94%		13.01	11.78	11.54	12.04	12.28	12.58	12.96	13.35	13.57	13.66
Residential-Electricity	Residential	Electricity	Energy Prices: Resi	3-AEO2019.6.ref2	2018 $/MMBtu	119%		42.35	40.54	40.45	40.68	40.83	40.98	41.17	41.59	41.98	42.16
-Commercial		Commercial		3-AEO2019.8.													
Commercial-Propane	Commercial	Propane	Energy Prices: Com	3-AEO2019.9.ref2	2018 $/MMBtu	101%		16.52	18.88	19.92	20.05	20.38	20.95	21.36	21.90	22.48	22.92
Commercial-Distillate Fuel Oil	Commercial	Distillate Fuel Oil	Energy Prices: Com	3-AEO2019.10.ref	2018 $/MMBtu	99%		17.90	21.39	22.00	21.72	21.20	20.58	20.34	20.52	21.04	21.46
Commercial-Residual Fuel Oil	Commercial	Residual Fuel Oil	Energy Prices: Com	3-AEO2019.11.ref	2018 $/MMBtu	97%		6.86	8.69	7.13	8.26	9.22	10.03	11.19	12.53	12.75	13.13
Commercial-Natural Gas	Commercial	Natural Gas	Energy Prices: Com	3-AEO2019.12.ref	2018 $/MMBtu	124%		11.02	10.42	10.37	10.69	10.91	11.20	11.60	12.01	12.24	12.32
Commercial-Electricity	Commercial	Electricity	Energy Prices: Com	3-AEO2019.13.ref	2018 $/MMBtu	146%		41.15	40.54	40.78	39.33	39.02	38.78	38.70	38.97	39.07	39.05
-Industrial		Industrial		3-AEO2019.15.													
Industrial-Propane	Industrial	Propane	Energy Prices: Indu	3-AEO2019.16.ref	2018 $/MMBtu	101%		12.96	13.75	14.31	14.22	14.54	15.11	15.46	16.00	16.55	16.96
Industrial-Distillate Fuel Oil	Industrial	Distillate Fuel Oil	Energy Prices: Indu	3-AEO2019.17.ref	2018 $/MMBtu	99%		18.21	21.75	22.69	22.53	22.14	21.67	21.55	21.88	22.43	22.84
Industrial-Residual Fuel Oil	Industrial	Residual Fuel Oil	Energy Prices: Indu	3-AEO2019.18.ref	2018 $/MMBtu	97%		6.79	8.58	7.05	8.20	9.18	10.00	11.18	12.53	12.75	13.13
Industrial-Natural Gas	Industrial	Natural Gas	Energy Prices: Indu	3-AEO2019.19.ref	2018 $/MMBtu	124%		5.34	5.34	5.36	5.40	5.27	5.26	5.40	5.58	5.84	5.92
Industrial-Metallurgical Coal	Industrial	Metallurgical Coal	Energy Prices: Indu	3-AEO2019.20.ref	2018 $/MMBtu			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Industrial-Other Industrial Coal	Industrial	Other Industrial C	Energy Prices: Indu	3-AEO2019.21.ref	2018 $/MMBtu	100%		3.54	4.26	4.27	4.42	4.38	4.41	4.43	4.48	4.52	4.56
Industrial-Coal to Liquids	Industrial	Coal to Liquids	Energy Prices: Indu	3-AEO2019.22.ref	2018 $/MMBtu	100%		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Industrial-Electricity	Industrial	Electricity	Energy Prices: Indu	3-AEO2019.23.ref	2018 $/MMBtu	100%		19.56	18.75	18.99	18.24	18.01	17.87	17.91	17.99	18.10	18.09
-Transportation		Transportation		3-AEO2019.25.													
Transportation-Propane	Transportation	Propane	Energy Prices: Tran	3-AEO2019.26.ref	2018 $/MMBtu	100%		19.37	18.27	18.46	18.37	18.63	19.12	19.45	19.92	20.40	20.77
Transportation-E85	Transportation	E85	Energy Prices: Tran	3-AEO2019.27.ref	2018 $/MMBtu	100%		22.19	29.81	35.83	33.95	33.48	32.29	31.88	29.66	27.21	27.00
Transportation-Motor Gasoline	Transportation	Motor Gasoline	Energy Prices: Tran	3-AEO2019.28.ref	2018 $/MMBtu	100%		20.72	23.17	23.62	24.46	24.76	25.01	25.51	26.00	26.31	26.53
Transportation-Jet Fuel	Transportation	Jet Fuel	Energy Prices: Tran	3-AEO2019.29.ref	2018 $/MMBtu	100%		12.41	16.23	16.32	17.60	17.42	17.24	17.54	17.87	18.16	18.54
Transportation-Diesel Fuel (distillate fuel oil)	Transportation	Diesel Fuel (distilla	Energy Prices: Tran	3-AEO2019.30.ref	2018 $/MMBtu	100%		19.35	22.90	22.50	23.93	23.97	23.75	23.98	24.45	24.84	25.01
Transportation-Residual Fuel Oil	Transportation	Residual Fuel Oil	Energy Prices: Tran	3-AEO2019.31.ref	2018 $/MMBtu	100%		6.89	8.72	7.65	6.60	6.98	6.58	6.94	7.41	7.71	8.04
Transportation-Natural Gas	Transportation	Natural Gas	Energy Prices: Tran	3-AEO2019.32.ref	2018 $/MMBtu	100%		12.12	12.14	12.10	12.02	11.61	11.50	11.46	11.45	11.50	11.39
Transportation-Electricity	Transportation	Electricity	Energy Prices: Tran	3-AEO2019.33.ref	2018 $/MMBtu	100%		23.70	29.27	33.00	33.77	34.68	35.27	35.64	35.96	36.20	36.33
-Electric Power		Electric Power		3-AEO2019.35.													
Electric Power-Distillate Fuel Oil	Electric Power	Distillate Fuel Oil	Energy Prices: Elect	3-AEO2019.36.ref	2018 $/MMBtu	100%		18.39	21.96	22.77	22.51	21.95	21.23	20.93	20.99	21.35	21.80
Electric Power-Residual Fuel Oil	Electric Power	Residual Fuel Oil	Energy Prices: Elect	3-AEO2019.37.ref	2018 $/MMBtu	100%		11.00	12.72	12.25	12.20	11.96	11.57	11.55	11.70	11.92	12.32
Electric Power-Natural Gas	Electric Power	Natural Gas	Energy Prices: Elect	3-AEO2019.38.ref	2018 $/MMBtu	100%		3.90	3.76	3.61	3.74	3.67	3.71	3.87	4.10	4.34	4.40
Electric Power-Steam Coal	Electric Power	Steam Coal	Energy Prices: Elect	3-AEO2019.39.ref	2018 $/MMBtu	100%		2.69	2.64	2.59	2.62	2.83	2.85	2.85	2.81	2.82	2.78
Electric Power-Uranium	Electric Power	Uranium	Energy Prices: Elect	3-AEO2019.40.ref	2018 $/MMBtu	100%		0.66	0.66	0.66	0.66	0.67	0.67	0.67	0.67	0.67	0.67
-Average Price to All Users		Average Price to All Users		3-AEO2019.44.													
Average Price to All Users-Propane	Average Price to A	Propane	Energy Prices: Aver	3-AEO2019.45.ref	2018 $/MMBtu	100%		18.44	21.28	23.38	24.82	25.74	26.73	27.50	28.33	29.19	29.90
Average Price to All Users-E85	Average Price to A	E85	Energy Prices: Aver	3-AEO2019.46.ref	2018 $/MMBtu	100%		22.19	29.81	35.83	33.95	33.48	32.29	31.88	29.66	27.21	27.00
Average Price to All Users-Motor Gasoline	Average Price to A	Motor Gasoline	Energy Prices: Aver	3-AEO2019.47.ref	2018 $/MMBtu	100%		20.72	23.18	23.62	24.47	24.76	25.02	25.51	26.00	26.31	26.53
Average Price to All Users-Jet Fuel	Average Price to A	Jet Fuel	Energy Prices: Aver	3-AEO2019.48.ref	2018 $/MMBtu	100%		12.41	16.23	16.32	17.60	17.42	17.24	17.54	17.87	18.16	18.54
Average Price to All Users-Distillate Fuel Oil	Average Price to A	Distillate Fuel Oil	Energy Prices: Aver	3-AEO2019.49.ref	2018 $/MMBtu	100%		19.15	22.69	22.54	23.67	23.55	23.36	23.52	23.97	24.37	24.61
Average Price to All Users-Residual Fuel Oil	Average Price to A	Residual Fuel Oil	Energy Prices: Aver	3-AEO2019.50.ref	2018 $/MMBtu	100%		7.45	8.83	7.71	7.09	7.47	7.11	7.54	8.09	8.33	8.66
Average Price to All Users-Natural Gas	Average Price to A	Natural Gas	Energy Prices: Aver	3-AEO2019.51.ref	2018 $/MMBtu	100%		5.58	5.42	5.27	5.34	5.37	5.49	5.73	5.99	6.18	6.24
Average Price to All Users-Metallurgical Coal	Average Price to A	Metallurgical Coal	Energy Prices: Aver	3-AEO2019.52.ref	2018 $/MMBtu	100%		4.01	4.39	4.08	3.91	3.76	3.70	3.68	3.69	3.72	3.75
Average Price to All Users-Other Coal	Average Price to A	Other Coal	Energy Prices: Aver	3-AEO2019.53.ref	2018 $/MMBtu	100%		2.72	2.71	2.67	2.72	2.91	2.93	2.93	2.90	2.90	2.87
Average Price to All Users-Coal to Liquids	Average Price to A	Coal to Liquids	Energy Prices: Aver	3-AEO2019.54.ref	2018 $/MMBtu	100%		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Average Price to All Users-Electricity	Average Price to A	Electricity	Energy Prices: Aver	3-AEO2019.55.ref	2018 $/MMBtu	100%	0.00	30.03	29.20	29.23	28.74	28.61	28.53	28.57	28.78	28.94	28.99

2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050
35.30	35.91	36.31	36.59	36.78	37.05	37.37	37.70	38.01	38.33	38.59	38.80	38.99	39.17	39.29	39.42	39.55	39.68	39.78	39.84	39.87	39.88	39.84	39.73
26.83	26.98	27.45	27.62	27.82	28.10	28.48	28.51	28.72	29.13	29.02	29.20	29.36	29.58	29.66	29.88	29.91	29.91	29.99	29.98	29.99	30.05	29.99	29.95
13.71	13.78	13.81	13.86	13.88	13.98	14.07	14.11	14.16	14.22	14.28	14.29	14.32	14.37	14.40	14.44	14.50	14.56	14.63	14.69	14.75	14.84	14.95	15.02
42.21	42.22	42.18	42.17	42.21	42.35	42.47	42.48	42.45	42.48	42.54	42.43	42.32	42.21	42.14	41.99	41.88	41.84	41.79	41.85	41.87	41.89	41.82	41.76
23.23	23.44	23.53	23.58	23.63	23.79	24.00	24.19	24.35	24.53	24.64	24.73	24.81	24.90	24.94	25.01	25.09	25.16	25.20	25.21	25.22	25.22	25.17	25.09
22.15	22.35	22.80	23.01	23.23	23.53	23.86	23.93	24.16	24.52	24.43	24.60	24.76	24.94	24.98	25.15	25.17	25.09	25.15	25.05	24.96	25.00	24.93	24.91
13.66	13.86	14.26	14.36	14.56	14.79	14.87	15.01	15.14	15.38	15.50	15.54	15.69	15.79	15.88	16.09	16.13	16.12	16.20	16.21	16.24	16.26	16.23	16.23
12.34	12.41	12.41	12.45	12.45	12.55	12.64	12.68	12.71	12.77	12.82	12.82	12.84	12.89	12.90	12.94	13.01	13.06	13.15	13.21	13.28	13.38	13.51	13.60
38.90	38.75	38.55	38.45	38.40	38.46	38.52	38.49	38.40	38.38	38.38	38.22	38.08	37.88	37.82	37.63	37.50	37.43	37.34	37.33	37.35	37.34	37.29	37.23
17.22	17.41	17.46	17.51	17.55	17.73	17.93	18.12	18.27	18.44	18.54	18.62	18.70	18.78	18.81	18.88	18.96	19.03	19.07	19.07	19.07	19.07	19.02	18.92
23.54	23.74	24.20	24.41	24.63	24.94	25.26	25.34	25.57	25.93	25.84	26.01	26.17	26.34	26.38	26.54	26.55	26.46	26.52	26.40	26.28	26.32	26.26	26.23
13.66	13.86	14.26	14.36	14.56	14.79	14.87	15.01	15.14	15.38	15.50	15.54	15.69	15.79	15.88	16.09	16.13	16.12	16.20	16.21	16.24	16.26	16.23	16.23
5.93	6.02	6.02	6.06	6.05	6.20	6.28	6.31	6.35	6.44	6.46	6.45	6.47	6.54	6.52	6.57	6.63	6.72	6.81	6.87	6.94	7.09	7.21	7.31
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.59	4.61	4.64	4.68	4.72	4.74	4.75	4.77	4.79	4.82	4.85	4.88	4.89	4.90	4.91	4.94	4.96	4.98	5.00	5.03	5.05	5.07	5.09	5.11
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
17.98	17.90	17.78	17.73	17.71	17.75	17.76	17.74	17.73	17.73	17.72	17.66	17.61	17.54	17.53	17.45	17.46	17.41	17.40	17.40	17.42	17.46	17.47	17.49
21.01	21.18	21.24	21.28	21.31	21.46	21.64	21.80	21.93	22.07	22.17	22.23	22.30	22.37	22.40	22.46	22.53	22.59	22.62	22.63	22.63	22.63	22.59	22.52
26.40	25.74	25.47	24.56	24.54	24.60	24.41	24.08	24.09	24.12	23.97	24.17	24.59	25.11	25.80	26.57	27.42	27.97	28.50	30.04	32.13	33.60	33.60	33.53
27.08	27.28	27.53	27.67	27.94	28.18	28.32	28.55	28.76	28.98	28.99	29.15	29.35	29.58	29.68	29.89	29.94	30.00	30.05	30.14	30.21	30.33	30.35	30.35
19.06	19.44	20.07	20.19	20.45	20.84	21.05	21.23	21.50	21.81	21.88	22.09	22.28	22.40	22.51	22.72	22.84	22.81	22.98	22.96	23.03	23.17	23.13	23.12
25.72	25.93	26.40	26.63	26.86	27.17	27.49	27.57	27.83	28.18	28.09	28.27	28.42	28.58	28.61	28.75	28.76	28.64	28.69	28.54	28.38	28.41	28.34	28.32
8.44	8.61	8.90	9.41	9.56	9.67	9.82	10.63	10.61	10.75	11.32	11.38	11.46	11.56	11.63	11.75	12.02	11.48	11.54	12.23	12.85	11.87	11.87	12.49
11.24	11.15	10.99	10.91	10.80	10.84	10.84	10.82	10.82	10.86	10.86	10.84	10.85	10.90	10.89	10.94	11.01	11.09	11.18	11.26	11.34	11.48	11.60	11.70
36.26	36.15	36.04	35.88	35.79	35.75	35.72	35.61	35.45	35.32	35.21	34.99	34.78	34.60	34.33	34.03	33.74	33.58	33.43	33.34	33.23	33.12	32.95	32.75
22.47	22.62	23.08	23.24	23.45	23.72	24.10	24.13	24.34	24.74	24.64	24.81	24.98	25.21	25.29	25.51	25.55	25.56	25.64	25.64	25.67	25.73	25.66	25.63
12.86	13.06	13.47	13.58	13.78	14.01	14.10	14.24	14.38	14.62	14.74	14.79	14.94	15.04	15.13	15.35	15.39	15.38	15.47	15.47	15.50	15.52	15.49	15.50
4.40	4.48	4.47	4.51	4.50	4.65	4.70	4.73	4.77	4.83	4.82	4.80	4.82	4.88	4.84	4.89	4.95	5.02	5.10	5.14	5.21	5.36	5.46	5.55
2.79	2.79	2.81	2.85	2.85	2.80	2.80	2.79	2.80	2.81	2.82	2.82	2.83	2.84	2.84	2.84	2.84	2.83	2.83	2.84	2.83	2.83	2.83	2.84
0.67	0.68	0.68	0.68	0.68	0.68	0.68	0.69	0.69	0.69	0.69	0.69	0.69	0.70	0.70	0.70	0.70	0.70	0.71	0.71	0.71	0.71	0.71	0.72
30.44	30.84	31.05	31.18	31.26	31.45	31.68	31.91	32.12	32.35	32.51	32.63	32.74	32.84	32.89	32.97	33.05	33.13	33.17	33.18	33.17	33.15	33.08	32.95
26.40	25.74	25.47	24.56	24.54	24.60	24.41	24.08	24.09	24.12	23.97	24.17	24.59	25.11	25.80	26.57	27.42	27.97	28.50	30.04	32.13	33.60	33.60	33.53
27.08	27.28	27.53	27.67	27.94	28.18	28.32	28.55	28.76	28.98	28.99	29.15	29.35	29.58	29.68	29.89	29.94	30.00	30.05	30.14	30.21	30.33	30.35	30.35
19.06	19.44	20.07	20.19	20.45	20.84	21.05	21.23	21.50	21.81	21.88	22.09	22.28	22.40	22.51	22.72	22.84	22.81	22.98	22.96	23.03	23.17	23.13	23.12
25.32	25.54	26.00	26.22	26.45	26.76	27.07	27.16	27.40	27.75	27.67	27.84	27.99	28.16	28.18	28.33	28.33	28.22	28.28	28.13	27.98	28.02	27.95	27.93
9.08	9.27	9.58	10.05	10.21	10.35	10.48	11.22	11.25	11.40	11.93	11.99	12.09	12.19	12.26	12.40	12.62	12.18	12.24	12.84	13.38	12.54	12.54	13.07
6.27	6.34	6.38	6.44	6.43	6.57	6.63	6.69	6.73	6.82	6.87	6.88	6.91	6.97	6.98	7.04	7.14	7.20	7.29	7.35	7.43	7.56	7.64	7.73
3.79	3.83	3.88	3.90	3.94	3.98	4.00	4.02	4.04	4.06	4.07	4.08	4.09	4.10	4.11	4.12	4.13	4.15	4.18	4.19	4.21	4.22	4.24	4.25
2.88	2.88	2.89	2.93	2.93	2.89	2.89	2.88	2.89	2.90	2.91	2.92	2.92	2.93	2.93	2.93	2.93	2.93	2.93	2.93	2.93	2.93	2.93	2.94
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
28.93	28.88	28.78	28.75	28.75	28.83	28.91	28.91	28.89	28.90	28.93	28.84	28.77	28.67	28.64	28.53	28.46	28.43	28.39	28.41	28.43	28.44	28.41	28.37

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Data 1: District of Columbia Natural Gas Prices

Sourcekey	NA1480_SDC_3	N3050DC3	N3010DC3	NA1504_SDC_4	N3020DC3	N3020DC4	N3035DC3	N3035DC4	NA1570_SDC_3	N3045DC3
Date	**District of Columbia Natural Gas Pipeline and Distribution Use Price (Dollars per Thousand Cubic Feet)**	**Natural Gas Citygate Price in the District of Columbia (Dollars per Thousand Cubic Feet)**	**District of Columbia Price of Natural Gas Delivered to Residential Consumers (Dollars per Thousand Cubic Feet)**	**District of Columbia Natural Gas % of Total Residential - Sales (%)**	**District of Columbia Price of Natural Gas Sold to Commercial Consumers (Dollars per Thousand Cubic Feet)**	**Percent of Commercial Natural Gas Deliveries in District of Columbia Represented by the Price (%)**	**District of Columbia Natural Gas Industrial Price (Dollars per Thousand Cubic Feet)**	**Percent of Industrial Natural Gas Deliveries in District of Columbia Represented by the Price (%)**	**District of Columbia Natural Gas Vehicle Fuel Price (Dollars per Thousand Cubic Feet)**	**District of Columbia Natural Gas Price Sold to Electric Power Consumers (Dollars per Thousand Cubic Feet)**
1980			4.57		4.22					
1981			5.5		5.12					
1982	3.94		6.64		6.28					
1983	4.73		8.1		7.44					
1984	4.37		8.05		7.04					
1985	4.16		7.91		6.72					
1986	3.61		7.52		5.91					
1987	3.02		7.09		5.01					
1988	2.94		6.96		5.03					
1989	3.03		7.44	100	5.3					
1990	2.99		7.18	100	5.63	100				
1991	2.78		7.07	100	5.17	97.3				
1992	2.95		7.61	100	5.36	99				
1993	2.58		8.34	100	5.75	98				
1994	2.13		8.29	100	6.16	90.9				
1995	1.97		8.03	100	6.04	76.8			2.06	
1996	3.02		9.19	100	7.37	70.5			4.94	
1997	2.97		9.39	100	7.37	54.9		0	3.01	
1998	2.52		8.91	1	7.36	52.3		0	2.6	
1999	2.39		8.7	93.2	7.38	45.9		0	2.8	
2000	4.63		10.81	82.8	9.63	35.6		0	3.99	
2001	5.36		12.65	75.4	12.02	22.4		0	5.14	
2002			11.01	74.5	10.3	23.5		0	4.37	
2003			13.29	70.7	12.73	30.5			5.95	
2004			14.31	75.4	13.6	23.3			6.76	
2005			16.87	79.8	13.17	100		0	8.93	
2006			16.96	76.7	14.67	100		0	9.5	
2007			15.67	76.2	13.69	100		0	9.49	
2008			16.49	76.3	13.9	100		0	15.57	
2009			13.92	76.1	12.99	100		0	6.83	
2010			13.53	75.5	12.26	100		0	4.87	
2011			13.06	75	12.24	16.9		0	4.17	4.96
2012			12.1	73.9	11.19	17.9		0	9.38	
2013			12.45	75	11.64	19.1		0		
2014			13.05	73.8	12.18	19.9		0		
2015			11.98	73.3	11.07	21.4				
2016			10.9	73.2	9.88	19.5				
2017			12.53	73.9	10.87	20.1				
2018			11.78	75.6	10.42	21.7				

Average Energy Prices - Washington DC

https://www.bls.gov/regions/mid-atlantic/data/averageenergyprices_washingtondc_table.htm

Average prices for electricity, utility (piped) gas, and gasoline, United States and Washington area, 2010-2019, not seasonally adjusted

Year and Month	Electricity per kWh		Utility (piped) gas per therm		Gasoline per gallon	
	United States	Washington area	United States	Washington area	United States	Washington area
2010						
January	0.124	0.127	1.155	1.318	2.779	2.766
February	0.123	0.124	1.161	1.358	2.709	2.752
March	0.125	0.128	1.137	1.303	2.829	2.806
April	0.126	0.124	1.091	1.244	2.906	2.915
May	0.127	0.125	1.08	1.211	2.915	2.962
June	0.132	0.137	1.084	1.307	2.783	2.784
July	0.133	0.135	1.111	1.489	2.783	2.744
August	0.133	0.135	1.102	1.492	2.795	2.752
September	0.132	0.135	1.062	1.253	2.754	2.703
October	0.127	0.125	1.069	1.254	2.843	2.819
November	0.125	0.12	1.059	1.23	2.899	2.9
December	0.125	0.119	1.078	1.192	3.031	3.064
2011						
January	0.125	0.123	1.085	1.218	3.139	3.169
February	0.125	0.123	1.095	1.215	3.215	3.193
March	0.127	0.122	1.077	1.23	3.594	3.597
April	0.127	0.124	1.078	1.193	3.863	3.871
May	0.129	0.125	1.068	1.192	3.982	4.049
June	0.134	0.129	1.077	1.213	3.753	3.846
July	0.135	0.132	1.078	1.238	3.703	3.713
August	0.135	0.13	1.079	1.292	3.68	3.739
September	0.135	0.131	1.063	1.182	3.664	3.622
October	0.13	0.123	1.047	1.182	3.521	3.49
November	0.128	0.118	1.044	1.196	3.475	3.478
December	0.127	0.119	1.034	1.264	3.329	3.355
2012						
January	0.128	0.119	1.021	1.243	3.447	3.464
February	0.128	0.12	0.986	1.191	3.622	3.676
March	0.127	0.12	0.978	1.094	3.918	3.929
April	0.127	0.12	0.951	1.166	3.976	4.086
May	0.129	0.12	0.907	1.104	3.839	3.845
June	0.135	0.131	0.927	1.188	3.602	3.48
July	0.133	0.129	0.943	1.124	3.502	3.481
August	0.133	0.127	0.96	1.228	3.759	3.756
September	0.133	0.126	0.953	1.073	3.908	3.848
October	0.128	0.119	0.962	1.038	3.839	3.722
November	0.127	0.115	0.994	1.118	3.542	3.493
December	0.127	0.116	1.004	1.108	3.386	3.385
2013						
January	0.129	0.116	0.996	1.116	3.407	3.477
February	0.129	0.117	0.997	1.141	3.748	3.808
March	0.128	0.118	0.994	1.11	3.792	3.804
April	0.128	0.118	1.02	1.219	3.647	3.682
May	0.131	0.116	1.036	1.223	3.682	3.628
June	0.137	0.125	1.038	1.213	3.693	3.633
July	0.137	0.13	1.025	1.153	3.687	3.687
August	0.137	0.134	1.003	1.026	3.658	3.656
September	0.137	0.135	1	1.062	3.616	3.552
October	0.132	0.129	0.999	1.097	3.434	3.426
November	0.13	0.124	0.999	1.119	3.31	3.371
December	0.131	0.123	0.998	1.105	3.333	3.449
2014						
January	0.134	0.124	1.04	1.148	3.378	3.442
February	0.134	0.123	1.078	1.19	3.422	3.406
March	0.135	0.123	1.154	1.453	3.59	3.556
April	0.131	0.123	1.137	1.331	3.717	3.71
May	0.136	0.122	1.111	1.238	3.745	3.721

June	0.143	0.126	1.088	1.242	3.75	3.726
July	0.143	0.128	1.093	1.21	3.69	3.71
August	0.143	0.131	1.06	1.093	3.54	3.51
September	0.141	0.133	1.058	1.111	3.463	3.416
October	0.136	0.129	1.033	1.107	3.241	3.209
November	0.134	0.122	1.035	1.108	2.945	2.953
December	0.135	0.122	1.06	1.14	2.618	2.692
2015						
January	0.138	0.123	1.036	1.136	2.17	2.342
February	0.138	0.124	1.007	1.073	2.308	2.321
March	0.136	0.121	0.985	1.211	2.544	2.499
April	0.137	0.118	0.947	1.168	2.545	2.499
May	0.137	0.116	0.93	1.175	2.832	2.698
June	0.143	0.129	0.942	1.05	2.889	2.84
July	0.142	0.13	0.933	0.995	2.893	2.833
August	0.142	0.131	0.932	1.035	2.745	2.667
September	0.141	0.134	0.921	1.049	2.463	2.427
October	0.136	0.13	0.909	1.046	2.357	2.297
November	0.134	0.124	0.903	1	2.249	2.229
December	0.133	0.125	0.892	0.95	2.125	2.136
2016						
January	0.134	0.125	0.898	0.92	2.034	2.027
February	0.134	0.126	0.895	0.951	1.833	1.891
March	0.134	0.127	0.884	1.027	2.021	2.01
April	0.134	0.127	0.879	0.978	2.196	2.22
May	0.133	0.126	0.877	1.009	2.324	2.372
June	0.138	0.135	0.891	1.086	2.422	2.421
July	0.139	0.133	0.931	1.149	2.287	2.323
August	0.139	0.132	0.943	1.067	2.218	2.214
September	0.139	0.134	0.954	1.032	2.269	2.278
October	0.134	0.128	0.961	1.038	2.304	2.313
November	0.131	0.121	0.97	1.179	2.246	2.288
December	0.133	0.121	0.972	1.109	2.289	2.321
2017						
January	0.134	0.123	1	1.147	2.409	2.439
February	0.135	0.125	1.003	1.216	2.36	2.393
March	0.134	0.124	0.989	1.248	2.386	2.39
April	0.135	0.125	1	1.281	2.479	2.461
May	0.137	0.125	1.036	1.382	2.448	2.446
June	0.142	0.132	1.04	1.424	2.4	2.408
July	0.143	0.135	1.031	1.416	2.344	2.345
August	0.142	0.135	1.027	1.362	2.436	2.423
September	0.142	0.133	1.018	1.218	2.688	2.728
October	0.137	0.131	1.02	1.206	2.545	2.598
November	0.136	0.126	1.028	1.199	2.608	2.591
December	0.136	0.127	1.042	1.184	2.521	2.556
2018						
January	0.135	0.127	1.048	1.186	2.596	2.619
February	0.135	0.127	1.077	1.241	2.632	2.636
March	0.135	0.125	1.054	1.139	2.631	2.635
April	0.134	0.126	1.044	1.159	2.795	2.777
May	0.136	0.126	1.05	1.2	2.963	2.917
June	0.139	0.13	1.042	1.165	2.97	2.988
July	0.139	0.131	1.038	1.088	2.93	2.932
August	0.139	0.132	1.055	1.173	2.919	2.921
September	0.138	0.132	1.03	0.592	2.93	2.907
October	0.136	0.132	1.023	0.918	2.945	2.915
November	0.134	0.125	1.02	1.04	2.733	2.715
December	0.135	0.125	1.085	1.156	2.479	2.507
2019						
January	0.135	0.126	1.082	1.26	2.352	2.399
February	0.136	0.126	1.051	1.281	2.412	2.406
March	0.135	0.128	1.048	1.26	2.62	2.596
April	0.135	0.127	1.034	1.29	2.894	2.829
May	0.136	0.127	1.035	1.276	2.963	2.91
June	0.139	0.132	1.035	1.272	2.814	2.79
July	0.14	0.131	1.029	1.256	2.836	2.805
August	0.139	0.131	1.034	1.337	2.716	2.722
September	0.139	0.134	1.019	1.126	2.694	2.605
October						
November						
December						

CERTIFICATE OF SERVICE

I hereby certify that on this 6th day of January 2023, I caused true and correct copies of the foregoing Public Version of the Rebuttal Testimony of Dr. Asa S. Hopkins on behalf of the District of Columbia Government – Exhibit DCG (2A) and accompanying Exhibits DCG (2A)-1 through DCG (2A)-3 -- to be emailed to the following:

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