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BEFORE THE
PUBLIC SERVICE COMMISSION
OF THE DISTRICT OF COLUMBIA

In the Matter of the Merger of AltaGas Ltd. and WGL Holdings, Inc.	Formal Case No. 1142

Direct Testimony of Asa. S. Hopkins

On Behalf of
the District of Columbia Government

September 29, 2017

PUBLIC VERSION
Exhibit DCG (C)

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I. INTRODUCTION AND QUALIFICATIONS

Q. PLEASE STATE YOUR FULL NAME AND BUSINESS ADDRESS.

A. My name is Asa S. Hopkins. My business address is 485 Massachusetts Ave., Cambridge, MA 02139.

Q. BY WHOM ARE YOU EMPLOYED AND IN WHAT CAPACITY?

A. I am a Principal Associate at Synapse Energy Economics.

Q. PLEASE DESCRIBE SYNAPSE ENERGY ECONOMICS.

A. Synapse Energy Economics is a research and consulting firm specializing in energy industry regulation, planning, and analysis. Synapse works for a variety of clients, with an emphasis on consumer advocates, regulatory commissions, and environmental advocates.

Q. PLEASE DESCRIBE YOUR PROFESSIONAL EXPERIENCE BEFORE BEGINNING YOUR CURRENT POSITION AT SYNAPSE ENERGY ECONOMICS.

A. Before joining Synapse Energy Economics in early 2017, I was the Director of Energy Policy and Planning at the Vermont Department of Public Service for more than five years. In that role, I served as the director of regulated utility planning for Vermont's public advocate in utility regulatory proceedings and also directed the state energy office.

Among my responsibilities was the preparation of Vermont's Comprehensive Energy Plan.

Prior to my time in Vermont, I worked as an American Association for the Advancement of Science (AAAS) Science and Technology Policy Fellow in the Office of the Undersecretary for Science at the U.S. Department of Energy, and as a postdoctoral scholar at the Lawrence Berkeley National Laboratory.

I hold a Bachelor of Science degree, summa cum laude, in physics from Haverford College and degrees of Masters of Science and Doctor of Philosophy, both in physics, from the California Institute of Technology.

I have attached my full CV as Exhibit DCG (C)-1.

Q. HAVE YOU PREVIOUSLY TESTIFIED BEFORE THIS COMMISSION?

A. No.

Q. HAVE YOU TESTIFIED BEFORE OTHER UTILITY REGULATORY BODIES?

A. Yes. I have testified before the utility regulators in Vermont and in the Province of Québec.

Q. ON WHOSE BEHALF ARE YOU TESTIFYING IN THIS CASE?

A. I am testifying on behalf of the District of Columbia Government (DCG or the District).

Q. WHAT IS THE PURPOSE OF YOUR TESTIMONY?

A. The purpose of my testimony is to examine the proposed merger of AltaGas and WGL Holdings (WGLH) (the Joint Applicants) in the context of the District's energy and climate change policy and that policy's implications for the future of natural gas distribution service in the District of Columbia. The District's policy informs my approach primarily to Public Interest Factors One (regarding the impact on ratepayers and District of Columbia's economy) and Seven (regarding natural resources and environmental quality), as identified in the District of Columbia Public Service Commission's (PSC or the Commission) Order No. 18843, although the merging companies' affiliates and public safety also feature in my analysis.

Q. DID YOU PREPARE OR DIRECT THE PREPARATION OF THIS TESTIMONY AND THE ACCOMPANYING EXHIBITS?

A. Yes.

II. OVERVIEW AND SUMMARY OF CONCLUSIONS AND RECOMMENDATIONS

Q. WHICH PUBLIC INTEREST FACTORS DO YOU ADDRESS IN YOUR TESTIMONY?

A. I primarily address Public Interest Factor Seven. I address Public Interest Factor One to the extent that the examination of Factor Seven illuminates economic risks and impacts on Washington Gas ratepayers.

Q. PLEASE DESCRIBE PUBLIC INTEREST FACTORS SEVEN AND ONE.

A. When considering whether to approve the merger, the Commission will consider whether each of seven factors is advanced by the proposed transaction. Public Interest Factor Seven relates to the effects of the transaction on "conservation of natural resources and preservation of environmental quality."[1] As described in the Commission's Order No. 17947 in the context of the Exelon-PHI merger, the District has several statutory and policy documents (such as the Clean and Affordable Energy Act of 2008, Distributed Generation Amendment Act of 2011, Community Renewable Energy Act of 2013, and the Sustainable DC Plan (Exhibit

[1] Formal Case No. 1142, *In the Matter of the Merger of AltaGas Ltd., and WGL Holdings, Inc.*, Order No. 18843, ¶ 7 (July 24, 2017). This factor was added in Order No. 17597 to the previously-existing set of six merger factors.

DCG (H)-2)) that describe the District's "efforts to address climate change, environmental sustainability goals, energy reduction goals, rising energy costs and the preservation of the natural environment."[2] In Order 17947, the Commission agreed that these statutory and policy documents "provide an appropriate framework against which to measure the effects of the Proposed Merger on conservation of natural resources and preservation of environmental quality in the District of Columbia, given specific goals and objectives that the District has adopted."[3] Among the specific goals the District has adopted is the goal of reducing greenhouse gas (GHG) emissions 50 percent below 2006 levels by 2032 and 80 percent by 2050.[4]

Public Interest Factor One relates to the effects of the transaction on "ratepayers, shareholders, the financial health of the utilities standing alone and as merged, and the economy of [DC]."[5] Different approaches to advancing environmental quality will have different impacts on

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2 Formal Case No. 1119, *In the Matter of the Joint Application of Exelon Corporation, Pepco Holdings, Inc., Potomac Electric Power Company, Exelon Energy Delivery Company, LLC and New Special Purpose Entity, LLC for Authorization and Approval of Proposed Merger Transaction*, Order No. 17947, ¶ 335 (Aug. 27, 2015).

3 *Id.*

4 *See, e.g.*, Exhibit DCG (H)-4.

5 Order No. 18843, ¶ 7.

ratepayers, the financial health of the utilities, and the economy of the District of Columbia, so Factor One is linked to Factor Seven.

Q. HOW IS THIS MERGER PROCEEDING RELEVANT TO THE DISTRICT'S ENERGY AND CLIMATE CHANGE POLICIES?

A. Achieving the District's climate change goals will require a transformation in how the District of Columbia gets its energy; heats and cools homes, businesses, and offices; and moves people and goods around, in, and out of DC. The District will require active, engaged, and supportive partners from across the energy industry if it is to be successful in meeting these goals while also maintaining a vibrant economy. And, Clean Energy DC (the District's energy plan) identifies, "the electric utility Pepco and the natural gas provider Washington Gas are important stakeholders in a strategy that successfully achieves the District's long-term climate and energy targets."[6] This proceeding is relevant because it determines who will set the direction and corporate values of Washington Gas, and thus the qualities and approach that this important partner will bring to meeting the District's goals. When reviewing the merger, the Commission should consider whether AltaGas, as the new corporate parent to Washington

[6] Exhibit DCG (H)-3 at 33.

Gas, is likely to advance the District's efforts, and thus benefit environmental quality.

Q. WHAT ARE THE POSSIBLE POSITIVE AND NEGATIVE CONSEQUENCES OF THIS MERGER ON THE DISTRICT'S ABILITY TO ACHIEVE ITS ENERGY AND CLIMATE CHANGE-RELATED GOALS?

A. A distribution utility committed to achieving the District's policies can engage its customers and suppliers, demonstrate leadership through its actions to inspire others to take action, and create innovative new approaches to meeting the District of Columbia's energy needs. On the other hand, if the District of Columbia's natural gas distribution utility resists the energy system transformations necessary to meet the District's climate change goals, it could seriously impede achievement of these important policy objectives by slowing action and coordination across sectors and energy service providers. The District of Columbia cannot afford to host a utility engaged in predatory delay[7] on climate action. This merger will determine who will be in charge of defining the utility's approach.

[7] *See* Exhibit DCG (C)-5 for an introduction to the concept of "predatory delay."

Q. PLEASE SUMMARIZE YOUR PRIMARY CONCLUSIONS.

A. My primary conclusions relate to the concerns that the Commission should keep in mind when evaluating the merger on Factor Seven. Here is a summary:

- Meeting the District's climate and energy goals will require an "all hands on deck" approach. It will require transformation of energy supply and demand in the electricity, building heat, and transportation sectors, and demand action and collaboration from diverse stakeholders, particularly the regulated utilities.
- Meeting the District's GHG emission goals will also require a reduction in the use of fossil fuel natural gas as a fuel in the District of Columbia. All the scenarios I modeled in which the District achieves its 2050 GHG goals have fossil gas sales falling more than 48 percent from 2015 levels or couple smaller reductions from 2015 levels with use of renewable natural gas.
- There is a wide range of possible futures for the District of Columbia's gas utility, all of which reflect significant changes from the status quo, and some of which include falling sales and associated risks to the traditional gas utility business model.

- AltaGas has not demonstrated that it is committed to and understands the energy system transition envisioned by the District's energy and sustainability policies.
- AltaGas has not demonstrated the values and business approach likely to result in a successful and lasting partnership with a District committed to substantial and rapid GHG emission reductions.
- AltaGas has not demonstrated that its corporate values are consistent with those of either the District or WGLH on the topic of climate change. For example, WGLH demonstrates consistent values with the District when it explicitly acknowledges and embraces the scientific findings of the Intergovernmental Panel on Climate Change, considers emission reductions to be a matter of corporate policy, and has exceeded its targets for GHG emission reductions, which in turn exceed those required by regulation or mandate. In contrast, AltaGas has no independent opinion on the science of climate change, considers emission reductions simply a "good idea regardless of whether global warming models are entirely correct,"[8] considers climate change regulations to be a risk to be mitigated, and prior to

[8] Exhibit DCG (C)-6 at DC-ALA-WGL_029252.

COP21 in Paris[9] had no opinion on whether to support an international agreement that seeks to limit global temperature rise to under two degrees Celsius (as was reached at that conference). Neither AltaGas nor its subsidiaries have established GHG emission reduction targets that exceed those required by regulation or mandate in any jurisdiction where it operates, and none have adopted any sustainability plan or GHG emission mitigation plan.

- If the Commission approves the merger, AltaGas will determine Washington Gas's approach on climate change issues. Thus, it will be more difficult for the District to meet its policy objectives.
- Renewable natural gas may be able to contribute to the District's policy objectives in a limited fashion, and further study of the future of decarbonized thermal energy in the District of Columbia is warranted. However, the Joint Applicants' proposed Merger Commitment to study development of renewable natural gas facilities falls short of the District's needs and has not been shown to provide any identified environmental benefits to the District of Columbia.
- Avoidable methane leaks could be a significant contributor to the District of Columbia's GHG emissions. The Joint Applicants'

[9] The 21st session of the Conference of the Parties to the United Nations Framework Convention on Climate Change.

proposed commitments do not include any aimed at reducing those emissions, and AltaGas has not shown itself to be a leader on this issue.

- The proposed Merger Commitment to support natural gas piping in affordable housing is essentially market development for the utility. It is not consistent with the District's environmental policy objectives and its economic benefits for participants have been oversold by the Joint Applicants.
- AltaGas has not shown that the proposed Merger Commitments to build or cause the building of a 5 MW Tier 1 or energy storage resource in the Washington area would result in a net reduction in the District of Columbia's GHG emissions, advance the District's energy policy, or provide any other identified environmental benefits to DC residents or ratepayers.

Q. PLEASE SUMMARIZE YOUR PRIMARY RECOMMENDATIONS.

A. I have restricted my analysis to Factors Seven and One, focusing on environmental issues. As such, I do not have a recommendation regarding whether, from the perspective of the other factors, the merger should be approved. If the only factor to be considered were Factor Seven, however,

I believe the merger as proposed by the Applicants is not in the public interest.

That said, if the Commission is nonetheless inclined to approve the proposed merger, then it should require several additional or changed commitments to provide meaningful and identifiable environmental benefits to the District of Columbia. In that case, the Commission should:

- require that WGL prioritize pipeline replacement and leak repairs for non-hazardous leaks based on methane measurements;
- require that AltaGas's low-income weatherization support be implemented through existing programs such as the Weatherization Assistance Program or the DC Sustainable Energy Utility;
- not approve the funding of any interior piping initiative as part of this merger, and require that the Funds identified for that purpose be devoted instead to energy efficiency;
- require that the study on biogas and renewable natural gas be conducted in an arm's length manner (so that AltaGas's business interests do not shape the results of the study), that a specific deadline be set for completion of the study, and that the study be made public to inform the District's thermal decarbonization strategy; and

- only count the 5 MW Tier 1 renewable or energy storage resource as a benefit if it is located in the District of Columbia.

III. INTRODUCING CLEAN ENERGY DC AND SUSTAINABLE DC

Q. WHAT ARE CLEAN ENERGY DC AND SUSTAINABLE DC?

A. As Mr. Edward Yim describes in his testimony, Clean Energy DC (Exhibit DCG (H)-3) is the District's energy plan and statement of energy policy. It is closely associated with Sustainable DC (Exhibit DCG (H)-2), which is the District's sustainability plan.

Q. IS CLEAN ENERGY DC A FULLY ADOPTED PLAN?

A. Clean Energy DC is currently in final draft form. It is being revised based on public input and will be finalized in 2018. I understand that it is envisioned to be a living document, undergoing continual revision in response to changing circumstances and progress achieved. I understand that the GHG emission targets established in District policy are not subject to revision. As part of the District's commitment to upholding proportionally the commitments of the Paris Agreement, Mayor Bowser's Order 2017-142 of June 5, 2017 (Exhibit DCG (H)-4), directs DCG to implement the Clean Energy DC Plan and the Sustainable DC Plan. While

recognizing that Clean Energy DC is still evolving, I will for purposes of my testimony treat it as though it were a final document. I also note that Clean Energy DC has been developed through a public process with WGLH's involvement, and the Joint Applicants are aware of the District's climate change policies and the clean energy policies detailed in Clean Energy DC. AltaGas should expect the plan's final adoption in 2018 and subsequent implementation.

Q. HOW IS SUSTAINABLE DC RELATED TO THE SEVEN FACTORS AT ISSUE IN THIS MERGER PROCEEDING?

A. Sustainable DC addresses challenges in "Jobs and the Economy," "Health and Wellness," "Equity and Diversity," and "Climate and Environment." The economic interests of the District of Columbia and its ratepayers, reflected in Factor One, are related to Jobs and the Economy, while conservation of natural resources and preservation of environmental quality (Factor Seven) are most closely related to the Climate and Environment challenge. Sustainable DC reiterates and builds upon the District's goal of a 50 percent reduction from 2006 levels of GHG emissions by 2032 and 80 percent by 2050.

Sustainable DC classifies solutions into Built Environment, Energy, Food, Nature, Transportation, Waste, and Water. This proceeding relates primarily to the Energy and Built Environment solutions.

Q. HOW IS CLEAN ENERGY DC RELATED TO THE SEVEN FACTORS AT ISSUE IN THIS PROCEEDING?

A. Clean Energy DC builds on the goals and structure of Sustainable DC and dives deeply into the District of Columbia's energy future. Energy use is a substantial contributor to challenges to environmental quality, both local (e.g., local air pollutants) and global (climate change) (Factor Seven). Energy expenditures also represent a portion of household and business expenditures, so planning for energy is directly tied to planning for the economic well-being of the District of Columbia and its residents (Factor One).

Q. WHAT DOES CLEAN ENERGY DC SAY ABOUT THE ROLE OF WASHINGTON GAS AND THE DISTRICT'S ABILITY TO ACHIEVE ITS GOALS?

A. Clean Energy DC points out the important role of the District of Columbia's regulated utilities in achieving long-term targets: "the electric utility Pepco and the natural gas provider Washington Gas are important stakeholders in a strategy that successfully achieves the District's long-

term climate and energy targets."[10] Clean Energy DC also applauds Washington Gas for its leadership as a founding partner in the U.S. Environmental Protection Agency's (EPA) Natural Gas STAR Methane Challenge and its actions to reduce methane emissions intensity.[11]

Q. WHAT DOES CLEAN ENERGY DC SAY ABOUT THE FUTURE OF NATURAL GAS IN DC?

A. Natural gas composed 28 percent of the site energy use in the District of Columbia in 2012 and 17 percent of the GHG emissions.[12] It is therefore a significant fuel to plan for, from both an economic and environmental perspective. Clean Energy DC addresses the future of natural gas in a variety of ways. These can primarily be categorized as related to: (1) decarbonization, (2) new buildings and deep retrofits, and (3) fuel switching. Across all three of these areas, Clean Energy DC consistently states that the District should plan for a future with significantly reduced use of fossil natural gas.

[10] Exhibit DCG (H)-3 at 33.

[11] *Id*. at 109.

[12] *Id*. at 34, 36.

Q. WHAT IS DECARBONIZATION?

A. Decarbonization is the process of reducing GHG emissions to the extent necessary to meet the goals of the Paris Agreement and the District's climate change goals—a 50 percent reduction from 2006 levels of GHG emissions by 2032 and 80 percent by 2050—as steps toward eventual zero or negative net emissions.

Q. HOW DOES NATURAL GAS FEATURE IN CLEAN ENERGY DC'S DISCUSSION OF DECARBONIZATION?

A. It plays a significant role in the District's decarbonization efforts. Clean Energy DC states (Exhibit DCG (H)-3 at 22) that energy is the critical factor for whether the District can achieve its GHG emissions reduction goals:

> The success of the District's efforts to reduce GHG emissions depends on energy. Energy, through extraction and consumption of fossil fuel, is the most dominant source of GHG emissions. In the District, fossil fuels remain the dominant source of energy for electricity, for heating buildings through natural gas or fuel oils, and for motor vehicles. Because GHG emissions associated with fossil fuel combustion can continue to warm the climate for several hundred years after their release, phasing out fossil fuels from the District's energy supply (often called decarbonization) will be essential to achieving its climate change goals. Therefore, to successfully mitigate the impacts of climate change, the District must assist in broadly changing the way

> energy is produced, delivered, and used across the District.

In terms of natural gas specifically, the District of Columbia relies upon natural gas directly for both space and water heating, but also indirectly through the generation of electricity. Clean Energy DC addresses (*id.* at 119) the risk of lock-in to fossil fuel facilities when a significant transition is planned:

> [T]he District should carefully consider the role of natural gas in the District's electricity supply and its potential impact on the achievement of its GHG emission reduction targets. While natural gas can be less GHG intensive than coal if methane leakage is properly managed, the GHG intensity of natural gas is still much higher than renewable sources. Shifting from coal-fired generation to efficient natural gas facilities may decrease GHG emissions in the short-term; however, the useful life of natural gas facilities (30 to 40-plus years) may lock the District into a fossil fuel-based infrastructure, which would be incongruent with the 2050 GHG target.

Clean Energy DC points out the centrality of building heating[13] and cooling to economy-wide decarbonization, while recognizing that the exact path forward is uncertain. Clean Energy DC therefore proposes (*id.* at 127) a built environment thermal decarbonization study that would "determine the best way to eliminate GHG emissions from thermal energy used in the District." This study would consider various future options:

[13] I use heating throughout my testimony to mean both space and water heating.

> [l]ow carbon energy sources and systems that can be used to elicit this shift include electricity, biofuels, and low carbon neighborhood-scale energy systems, and necessary types of building equipment include baseboard heaters, heat pumps, and hydronic systems. Given the long-term importance of thermal energy demand to meeting the District's targets, careful research into which systems and technologies work best for the District should be prioritized. For each option, GHG implications should be assessed alongside other important variables, such as energy supply availability and stability, upfront capital requirements and costs to ratepayers, and resilience (e.g., the flexibility of the system to rely on backup energy sources, and the energy efficiency of equipment to minimize overall energy demand).

Electric heating can be accomplished via heat pumps or electric resistance heat (with efficiency strongly favoring heat pumps). Biofuels for heat include biodiesel used in place of heating oil, wood, or renewable natural gas (RNG; such as cleaned gas produced at landfills or by anaerobic digestion). Low-carbon neighborhood-scale energy systems could utilize any of these fuels and distribute heat among buildings using hot water, steam, or electricity. These neighborhood-scale systems could include RNG-fueled combined heat and power (CHP) or fuel cells coupled with microgrids to increase resilience and overall efficiency. Of these future options, only electric heat is in widespread use in the District of Columbia.

Q. CAN YOU EXPLAIN WHAT A HEAT PUMP IS AND HOW THIS DIFFERS FROM CONVENTIONAL HEATING SYSTEMS?

A. A heat pump uses electricity and the capacity of a fluid refrigerant to hold heat in order to move heat from place to place. Heat pumps can be used for space heat or to heat hot water. (An air source heat pump is essentially an air conditioner or refrigerator run "backwards" moving heat in rather than out.) Because the heat pump is moving heat, rather than generating it, it can have an effective efficiency far in excess of 100 percent.

Q. HOW IS NATURAL GAS IMPLICATED BY CLEAN ENERGY DC'S DISCUSSION OF NEW BUILDINGS AND DEEP RETROFITS?

A. Clean Energy DC includes an extensive discussion and reliance on building energy codes—which apply to new construction—as well as deep building retrofits as a regulatory and market tool to reduce energy use and emissions in buildings. As Clean Energy DC says (Exhibit DCG (H)-3 at 6): "To achieve the 50 percent GHG emissions reduction target, the District must move quickly toward the implementation of a net-zero energy building code that focuses on shifting buildings away from the use of fossil fuels (e.g., natural gas, coal, oil)." Clean Energy DC sets (*id.* at 55) the District on a path to adopting net-zero energy codes within the

next decade: "Use the 2016-17 and 2020 code updates to establish a pathway toward net-zero energy performance in all residential and commercial buildings over the next ten years, starting with the new construction of single-family and small multifamily buildings in 2020, and for all new construction by 2026."

Q. WHAT IS A NET-ZERO BUILDING?

A. A net-zero energy building generates enough energy on-site to account for all of the energy consumed in the building over the course of a year. Netting need not be done on a moment-by-moment basis—excess generation at some points compensates for consumption at other times. In order to keep consumption low enough that sufficient energy can be generated on-site, net-zero buildings must be very efficient. Clean Energy DC (*id.* at 56) lays out one prescriptive path (for a 2020 building code) to meet a high level of efficiency on the way to net zero:

- Minimum Insulation: R-40 walls, R-60 roof
- Minimum Windows: U=0.22
- Minimum air leakage rate: 1.0 ACH @ 50 Pascals
- Ventilation: rate and locations per ASHRAE using heat recovery and dedicated outdoor air systems, solar electric preheat
- Heating and cooling: reverse cycle chillers, high-performance air source heat pumps, with VRF or hydronic distribution, with carbon dioxide (CO_2) mandated as compression gas
- Lighting density: 0.3 W/ft^2

- A minimum daylighting of all occupied spaces
- Occupant and operator energy monitoring system and reduction strategy
- Minimum appliance standard: best in class ENERGY STAR®
- Hot water: heat pump-based system and solar hot water

Note that heating, cooling, and hot water for a building using this prescriptive path would be provided by electric systems. Other approaches could include the use of fuel cells or CHP with renewable natural gas (RNG). A building heated with fossil fuels, including fossil natural gas, cannot be net zero.

Q. HOW DOES CLEAN ENERGY DC ADDRESS FUEL SWITCHING TO OR FROM NATURAL GAS?

A. If electricity-related GHG emissions are falling due to supply-side policies like the renewable portfolio standard (RPS)—which requires 50 percent renewable electricity by 2032—further reductions in emissions from fossil natural gas can be obtained from switching existing uses to electricity, with the reductions increasing as the RPS progresses. Clean Energy DC lays out steps DC can take to plan for this. For example, Clean Energy DC says (Exhibit DCG (H)-3 at 93) DC should "Actively partner with HVAC and envelope/siding subcontracting unions and trade associations to

prepare for a transition to heat pump based systems and high-performance envelopes."

When considering revisions to the performance metrics for the District of Columbia Sustainable Energy Utility (DC SEU), Clean Energy DC (*id.* at 69) identifies that switching to natural gas in the short-term for building heat would be contrary to long-term goals:

> Without explicit recognition of the ultimate importance of long-term and permanent GHG reductions, using GHG savings as a benchmark could unintentionally incentivize fuel switching away from electricity and towards natural gas, which would be contrary to the long-term carbon reduction goals of the District.

Geospatial analysis can also help with planning for this transition (*id.* at 146):

> Developing a geospatial understanding of natural gas demand (and building thermal demand in general) will assist in the identification of neighborhoods where thermal energy demand is high and where a neighborhood energy system may consequently be supported …. It will additionally help to identify areas of high natural gas use and by extension, where electricity growth can be anticipated as buildings shift from natural gas to electricity-based equipment for their thermal needs.

Q. DOES CLEAN ENERGY DC COMPREHENSIVELY ADDRESS RENEWABLE NATURAL GAS OR BIOGAS OPTIONS?

A. No. Ideally the thermal decarbonization study called for in Clean Energy DC[14] would include an aspect that examines the possible balance between the increased use of electricity and renewable natural gas in meeting the District of Columbia's thermal energy needs in the face of deep decarbonization. The modeling I will discuss later in my testimony can provide some initial insights on the extent of electrification or RNG use necessary to meet DC's GHG emission goals.

Q. BASED ON YOUR EXPERIENCE CRAFTING AND REVIEWING STATE ENERGY PLANS, HOW WOULD YOU DESCRIBE THE CLEAN ENERGY DC TREATMENT OF NATURAL GAS?

A. Clean Energy DC has taken a thorough and deep look at the energy future for the District of Columbia. I am impressed that the plan carries the implications of its broad trends and transformations down to the level of specific and diverse programs (workforce training, DC SEU incentive structure, energy mapping) while simultaneously understanding what isn't known and setting out a path to rectify that lack of knowledge.

[14] *Id*. at 127.

IV. MEETING GHG EMISSION GOALS IN 2032 AND 2050

Q. WHAT ARE THE DISTRICT'S GHG EMISSION GOALS, QUANTIFIED IN TERMS OF CARBON DIOXIDE EQUIVALENT?

A. The District's goals are for a reduction from 2006 levels of 50 percent by 2032 and 80 percent by 2050. In 2006, the District of Columbia emitted slightly above 10.5 million metric tons of carbon dioxide equivalent (CO_2e),[15] so its 2032 goal is to reduce emissions to just above 5 million metric tons, and its 2050 goal is to reduce emissions to just above 2 million metric tons. The District has defined its emissions inventory such that direct fuel use in the District of Columbia is included, as well as emissions from electricity sources that serve DC, wherever they are located.

Q. WHAT ARE THE DISTRICT OF COLUMBIA'S EMISSIONS AS OF THE LAST COMPLETED INVENTORY?

A. As of 2015, the District of Columbia's emissions had fallen almost 24 percent from 2006 levels, to just over 8 million metric tons.[16] The fall in emissions since 2006 has primarily been the result of lower emissions in the electric generating sector as natural gas has displaced coal, although

[15] Exhibit DCG (H)-5.

[16] *Id.*

natural gas emissions have also fallen 11 percent. Exhibit DCG (H)-5 breaks down the District of Columbia's 2015 emissions by source. Modeling for Clean Energy DC estimates that 74 percent of 2015 emissions are from buildings, with an additional 23 percent from transportation, and 3 percent from waste.[17]

Q. WHAT IS THE DIFFERENCE BETWEEN LIFECYCLE GREENHOUSE GAS EMISSIONS AND DIRECT GHG EMISSIONS FOR AN ENERGY SOURCE?

A. Direct emissions come from combustion at the point of use or transformation, sometimes called "burner tip" emissions. Lifecycle emissions account for the emissions associated with the production and transport of the fuel (from mining, drilling, refining, transmission, distribution, etc.). For natural gas, lifecycle emissions also include emissions from losses of the fuel itself, since methane is a potent greenhouse gas.

[17] Exhibit DCG (H)-3 at 37.

Q. DOES THE DISTRICT OF COLUMBIA'S GHG INVENTORY ACCOUNT FOR LIFECYCLE EMISSIONS FROM EACH FUEL, OR ONLY FOR DIRECT EMISSIONS FROM COMBUSTION?

A. It accounts for direct emissions as well as for the methane emissions in in the District of Columbia, but it does not address upstream emissions. The District follows the Global Protocol for Community-Scale Greenhouse Gas Emission Inventories.

Q. WHAT'S THE IMPACT OF THIS CHOICE?

A. The emissions in the District of Columbia's inventory are lower than they would be if lifecycle GHG emissions were also included. They have also likely fallen faster than they would have if lifecycle emissions were included. This is because the emissions upstream from the burner tip are a larger factor for natural gas than they are for coal, the primary fuel that natural gas has displaced in the electric generating fleet. Later in my testimony I will further discuss the impact of lifecycle emissions accounting on the relative GHG impacts of natural gas.

Q. MEETING THE DISTRICT'S 2032 GHG EMISSIONS TARGET WOULD REQUIRE A NEARLY 40 PERCENT REDUCTION FROM THE 2012 LEVELS. WHERE CAN THOSE REDUCTIONS COME FROM?

A. The modeling conducted for Clean Energy DC estimates emissions reductions for each proposed action, and I will not detail them here. However, in broad terms the approach is to:

- Increase the renewable portion of electricity (to 50 percent by 2032 as required by the District's RPS);
- Reduce transportation demand through increased walking, bicycling, and use of public transit;
- Increase use of more efficient vehicles and electric vehicles; and
- Dramatically increase energy efficiency in buildings.

Q. HAVE YOU CONDUCTED INDEPENDENT MODELING TO ASSESS THE OPTIONS FOR THE DISTRICT OF COLUMBIA MEETING 2032 AND 2050 EMISSION TARGETS?

A. Yes, I used the Multi-Sector Emissions Model (M-SEM) developed at Synapse Energy Economics[18] to assess several scenarios investigating the role of natural gas in scenarios that meet those goals.

Q. PLEASE DESCRIBE M-SEM.

A. Based on publicly available data (primarily from the U.S. Energy Information Administration), M-SEM is a spreadsheet tool that allows a user to construct a reference case based on historical data and future projections at the state level. We use that reference case to test different shifts, policies, and cross-sector interactions. The tool lets us compare apples to apples: First, it gives us calibrated common units for all sectors so that we can transparently synthesize data by end-use, by sector, by state, and by fuel type. With these results, we can tie historical data to future trends for energy use and resulting emissions. M-SEM addresses only energy-related emissions; I will not address the small fraction of the District of Columbia's emissions that come from waste.

[18] Synapse Energy Economics, Inc., *Multi-Sector Emissions Model (M-SEM)*, http://www.synapse-energy.com/MSEM (last visited Sept. 21, 2017).

Q. IN YOUR MODELING, WHAT HAPPENS TO THE DISTRICT OF COLUMBIA'S EMISSIONS IN THE BUSINESS AS USUAL, OR "REFERENCE" CASE?

A. The Reference Case reflects the energy performance and emissions as estimated by the most recent Annual Energy Outlook from the U.S. Energy Information Administration,[19] modified to reflect the District's RPS. In the Reference Case, the energy sector does not change in any fundamental way other than the increased renewable fraction of electricity. I have assumed that the average emissions rate of PJM electricity remains constant at 0.45 pounds per MWh for electricity[20] without a corresponding retired renewable energy credit (REC), and that electricity with a retired REC has no emissions. In the Reference Case, the District of Columbia's emissions fall until 2032 due to the increasing renewable fraction of electricity, and then rise slowly with population and economic growth. 2032 emissions are 45 percent below 2006 levels, while 2050 emissions are 39 percent below 2006. (Emissions rise due to growth accompanied by no changes in policy after 2032.) Figure 1 shows the historical and future energy-related emissions trajectory under the Reference Case.

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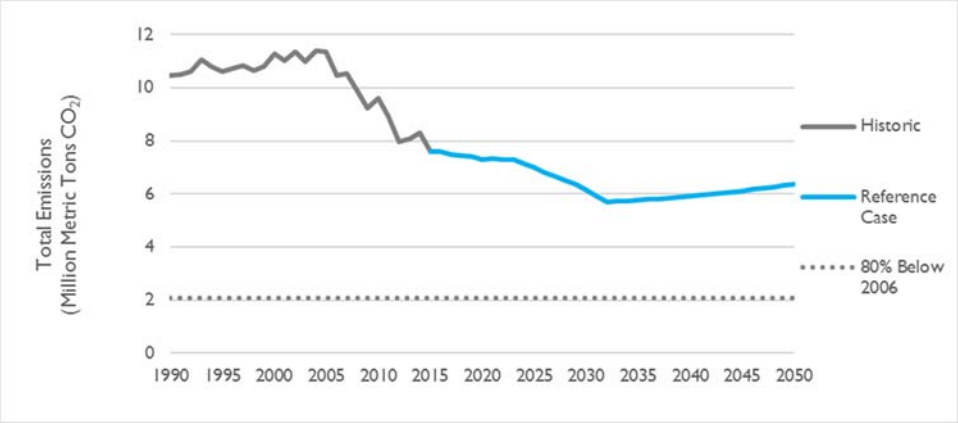
[19] Energy Information Administration, *Annual Energy Outlook 2017*, https://www.eia.gov/outlooks/aeo/ (last visited Sept. 21, 2017).

[20] Exhibit DCG (C)-7.

Figure 1: Historical and future emissions in the Reference Case



Q. FROM WHAT SECTORS WOULD THE REMAINING EMISSIONS REDUCTIONS BY 2032 NEED TO COME?

A. Remaining emissions reductions would need to come from the transportation sector, from direct fossil fuel use in the building sector, or from both.

Q. HOW DID YOU APPROACH MODELING CHANGES IN THESE SECTORS?

A. The pace of change in both transportation and direct fossil fuel use (primarily heating) is limited by the pace of turnover in the vehicle fleet, the pace of turnover in building heating systems, the pace of decarbonization of the pipeline gas system, the rate of change in resident and non-resident travel behavior, and the pace of building shell and

heating system improvements (either through retrofit or replacement with new buildings).

The Reference Case already includes Federal vehicle fuel economy standards, so further transportation emission reductions would require either reductions in vehicle demand (through mode change) or a vehicle fleet in the District of Columbia that exceeds the Federal standards. Maryland has adopted the California vehicle emissions standards, which should result in a somewhat faster pace of adoption there of zero-emission vehicles (such as electric vehicles (EVs)); given District of Columbia commuting patterns this should have some effect on DC's emissions profile.

To explore the range of possible options, I created a few scenarios that push the limits of what might be possible in terms of changes in transportation and building heat. These scenarios are:

- **A (Transport only):** Accelerated transportation electrification and mode shifting;
- **B (Buildings only):** Accelerated building shell and heating system improvement with heat pumps;
- **C (Efficiency only):** Travel mode shift and accelerated building shell and heating system improvement;

- **D (Electrification only):** Accelerated transportation electrification and heat pumps;
- **E (Everything but heat pumps):** Accelerated electrification of transportation, along with mode shift and building shell and heating system improvements;
- **F (Everything but EVs):** Accelerated heat pumps, along with mode shift and building shell and heating system improvements; and
- **G (All of the above):** Accelerated electrification of transportation and heating, along with mode shift and building shell improvements.

I did not build a scenario for decarbonization of pipeline gas[21] because I will use the bounds established by these scenarios to derive estimates of the extent of decarbonization of pipeline gas required to meet the 2032 and 2050 targets when deployed in addition to each scenario.

Q. WHAT PACE OF CHANGE DID YOU CONSIDER TO BE "AGGRESSIVE" IN EACH MODELED AREA?

A. For transportation electrification, I consider a pace of adoption of electric vehicles in line with the U.S. average as projected by Bloomberg New

[21] By "pipeline gas" I mean gas that is chemically appropriate for use as natural gas, whether it came from fossil fuel or renewable sources.

Energy Finance (BNEF).[22] BNEF's EV forecast is among the most aggressive published EV adoption forecasts. In this forecast, about 11 percent of sales are EVs by 2025, about 33 percent by 2030, and sales level out as they approach 60 percent of vehicle sales towards 2040. I assumed that vehicles remain in use about 12 years, so while by 2032 zero-emission vehicles constitute 33 percent of sales, they are only 13 percent of the vehicle fleet. Given the relatively immature state of the EV market for heavy-duty vehicle applications, I modeled them as lagging the light-duty fleet by ten years. As of today, there is no District-level or Federal policy that would lead to this trajectory, beyond the simple economics of batteries and the total cost of vehicle ownership.

For the aggressive case of travel mode shift, I assumed that District of Columbia is able to meet the Sustainable DC goal of 50 percent transit, 25 percent walking and biking, and 25 percent driving by 2032 and then hold that mode share constant to 2050.[23] Such a change would result in a roughly 50 percent reduction in light duty vehicle miles traveled in the District of Columbia by 2032, with corresponding reduction in emissions.

[22] Exhibit DCG (C)-8.

[23] The current proportions for the District of Columbia, after averaging the proportions for those who live in the "Inner Core" area with those who work there, are 50 percent driving, 41 percent transit, and 9 percent walking or biking. Exhibit DCG (C)-9.

For the aggressive case of building shell and heating system improvements, I assumed that efficiency programs would achieve accumulating savings of 1 percent of sales per year more than the business-as-usual for the next 20 years. This is a level that would put the District of Columbia near the top of all states in natural gas efficiency program performance, based on the data collected for the American Council on an Energy Efficiency Economy's state scorecard.[24]

For the aggressive case of heat pump deployment, I assumed that an increasing fraction of fossil-fuel-heated buildings would switch to heat pumps for space and water heating: about 20 percent of residential and 26 percent of commercial buildings by 2032 and 91 percent of residential and 87 percent of commercial buildings by 2050. This is consistent with all new buildings being built to use heat pumps (consistent with net zero design) by the early 2020s and retrofits of heat pumps into existing buildings at a pace somewhat faster than the natural replacement time for fossil fuel heating systems. I did not model any changes for buildings or water heaters that use electric resistance heat, although heat pumps may be very cost effective for such buildings and appliances as well.

[24] *See* Exhibit DCG (C)-10.

Q. WHAT OTHER CHANGES DID YOU MODEL FOR THE PERIOD AFTER 2032?

A. In addition to continuing the aggressive scenario components I just detailed, beyond 2032 the District of Columbia's electricity portfolio can be further decarbonized. Clean Energy DC proposes a 100 percent renewable goal for 2050, and I assumed a linear transition from 50 percent renewable in 2032 to 100 percent zero carbon in 2050. (It does not matter for emissions modeling purposes whether the 2050 goal is met with renewable, nuclear, or some other zero-carbon portfolio.) The current PJM average emissions rate is comparable to the rate from natural gas generation, due to a mix of coal, gas, and zero-carbon resources. The carbon emitting resources need to be eliminated or virtually eliminated to fully decarbonize electricity. Reducing emissions from electricity has the additional effect of reducing emissions resulting from electrified transportation or heating.

Q. WHAT DOES YOUR MODELING SHOW ARE THE IMPACTS OF RETAINING FOSSIL FUEL ELECTRIC GENERATION IN 2050?

My modeling shows that retaining even 20 percent of the current electric generation mix (which has an average emission rate very close to that of natural gas) results in significant remaining emissions even when all other

aggressive scenario components are deployed (2050 emissions are only 75.6 percent below 2006 levels). This modeling supports Clean Energy DC's skepticism (Exhibit DCG (H)-3 at 119, referenced above) regarding a continuing role for natural gas in the electric portfolio if the District's GHG goals are to be met.

Q. WHICH OF THESE AGGRESSIVE CASES IS THE DISTRICT IN THE BEST POSITION TO EFFECTUATE?

A. The District has greater regulatory and policy authority over stationary energy uses than over transportation or vehicles. That means that District policymakers can have a greater impact on the electric portfolio (e.g. through RPS), electric and natural gas efficiency (e.g., through the DC SEU), and building shells, equipment or fuel choice for building applications (e.g., through building codes) than on vehicle choice. The District has not adopted the California zero emission vehicle (ZEV) regulations, and those standards, which currently run only through 2025, are outside of its control in any case. District action on electrification is therefore limited to incentives for vehicles or supporting infrastructure. Transportation mode share is in a middle ground, where the District can have more impact by providing attractive options for transit, biking, and

walking, especially when acting in partnership with other regional governments, but regulatory levers are limited.

Q. HOW WOULD YOU CHARACTERIZE THE ROLE OF FOSSIL NATURAL GAS IN THE SCENARIOS YOU EXAMINED THAT MEET THE DISTRICT'S 2050 GOAL?

A. Each of the scenarios that is successful in meeting the District's climate change mitigation goals requires some reduction in the use of fossil natural gas from the current level, and a larger reduction from the reference case consumption. As modeled, these reductions come from either increased energy efficiency (such as improved building envelopes and more efficient appliances) or from switching end uses from natural gas to electricity.

Q. PLEASE SUMMARIZE THE EMISSIONS REDUCTIONS ACHIEVED IN 2032 AND 2050 FROM THE SEVEN SCENARIOS YOU MODELED.

A. The District of Columbia's GHG emissions are dominated to an unusual degree by electric consumption. Our reference case plus an extension of the District's RPS to 100 percent zero-carbon by 2050 would result in a 69 percent GHG emission reduction from 2006 levels by 2050, but would not

have any effect on the failure to meet the 50 percent reduction target for 2032 (remaining at the 45 percent level seen in the reference case).

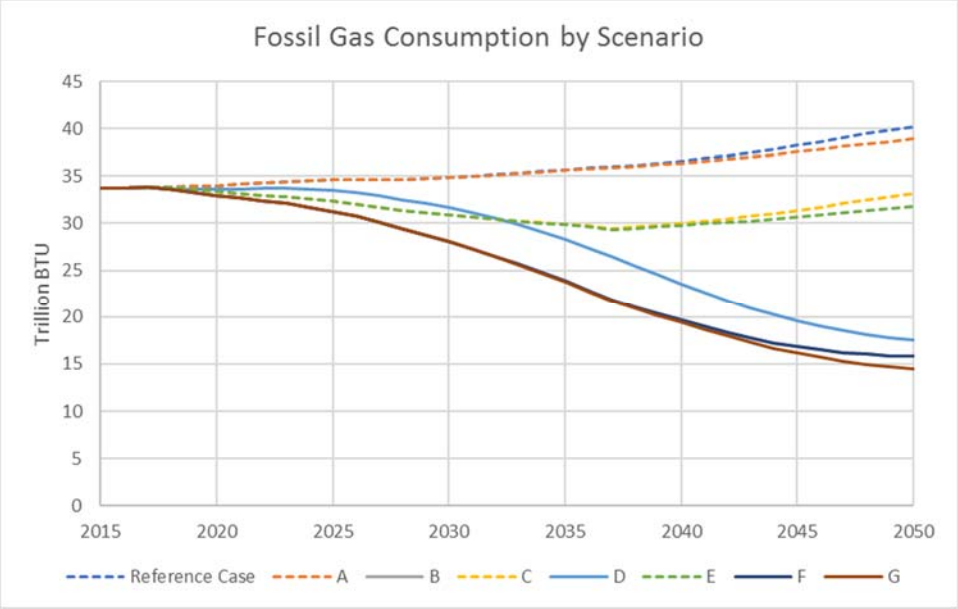
Adding each of the seven additional scenarios to the decarbonized electric case results in the emissions reductions and 2050 fossil natural gas consumption shown in Table 1.

Table 1: Emissions reductions and 2050 fossil natural gas consumption under modeled scenarios

Scenario	Emission Reduction from 2006 Level		2050 Fossil Gas Consumption (TBtu)
	2032	2050	
Reference Case	45.5%	39.1%	40.2
Reference Case plus extended RPS	45.5%	68.8%	40.2
A (Transport only)	49.1%	75.9%	38.9
B (Buildings only)	49.4%	82.1%	15.8
C (Efficiency only)	51.0%	75.5%	33.1
D (Electrification only)	48.2%	86.6%	17.5
E (Everything but heat pumps)	51.5%	79.6%	31.8
F (Everything but EVs)	52.5%	85.1%	15.8
G (All of the above)	53.0%	89.2%	14.5

For comparison, 2015 natural gas consumption in the District of Columbia was 33.7 TBtu. Figure 2 shows the trajectory of fossil natural gas use from 2015 to 2050 under each scenario and the Reference Case. The scenarios with solid lines meet the District's 2050 GHG emissions target, while those with dashed lines do not.

Figure 2: Fossil natural gas consumption from 2015-2050 in each modeled scenario



Q. WHAT CAN YOU CONCLUDE ABOUT HOW THE DISTRICT CAN MEET ITS GHG GOALS, BASED ON ANALYSIS OF THESE SCENARIOS?

A. I draw both quantitative and qualitative conclusions from this analysis. On the quantitative side: to meet its 2032 targets the District needs to take a comprehensive approach across all sectors. This is even more important for meeting 2050 goals. Heat pumps play a role in all of the scenarios that meet the 2050 goal. While Scenario E does not include increased deployment of heat pumps and does not meet the 2050 goal, it can be used to put an upper limit on the 2050 fossil natural gas sales that are consistent

with meeting the 2050 goal: 31.8 TBtu, a 6 percent reduction from 2015 levels and a 21 percent reduction from the Reference Case consumption of natural gas in 2050. When heat pumps are utilized as a tool to help meet the GHG goals, as Clean Energy DC envisions, natural gas sales should be expected to be significantly lower than 31.8 TBtu.

On the qualitative side: To meet these goals, the District must transform the markets for electricity, efficient products, new technologies like EVs and heat pump water heaters, building design, performance, and retrofits, while also changing travel behavior. It must move these markets faster than they have moved in the past, and it must move all of these markets at essentially the same time. Meeting the 2032 and 2050 GHG emission reduction goals will be a generational challenge for all parties involved in the District of Columbia's energy future. Meeting this challenge will require human capital, technical and policy innovation, ingenuity, persistence, long-term commitment, and clear-headed thinking and decision-making about the future.

Q. WHAT IS THE ROLE OF THE GAS DISTRIBUTION UTILITY IN MEETING THIS CHALLENGE?

A. Buy-in to the District's well-established GHG goals by District of Columbia's gas utility is essential to the successful pursuit of those goals.

Modeling results indicate that Washington Gas should be planning for reductions in sales of fossil gas, and for the implications of that change on infrastructure and the utility's business model. Established local utilities are trusted voices and experts in their communities, and Washington Gas is no exception. Washington Gas can set an example for other firms and households by increasing its own energy efficiency and reducing methane emissions from its pipes; it can encourage participation in the programs of and the funding of the DC SEU; it can provide clear and current information for customers about their energy options and the economic and environmental costs of those options; it can invest in and encourage the use of renewable natural gas; and it can provide input and expertise to District energy planning and program development.

In the event that the District's path to meeting its goals involves substantial declines in pipeline gas sales, Washington Gas and its parent company could also harness their expertise in shared capital infrastructure to invest in the new kinds of heating and cooling technologies that might serve the District of Columbia, including district heating, renewable combined heat and power, and shared ground-source heat pump infrastructure, and further invest in the activities of its non-gas affiliates to develop, procure, and sell more renewable electricity.

By the same token, gas utility management that resists addressing the District's GHG goals could impede progress by failing to take these kinds of progressive steps. The scale and pace of change required is large and fast enough that a critical institution failing to lead could create a major impediment.

V. IMPLICATIONS OF GHG GOALS FOR NATURAL GAS DISTRIBUTION IN THE DISTRICT OF COLUMBIA

Q. WHAT ARE SOME BUSINESS OPTIONS FOR THE DISTRICT OF COLUMBIA'S PIPELINE GAS UTILITY IN LIGHT OF THE DISTRICT'S GHG GOALS?

A. The distribution utility has a range of options. These include: identifying and developing renewable natural gas resources so that there will be a zero-carbon fuel to use in its pipeline network; developing new lines of business to meet customers' heating needs in zero-carbon ways (e.g., renewable CHP and district heat, or share ground-source heat pump infrastructure); and conducting careful infrastructure planning to avoid over-investing in distribution pipes that may be used less than historical patterns would suggest.

Q. WHAT IS RENEWABLE NATURAL GAS (RNG), AND WHERE DOES IT COME FROM?

A. RNG is a hydrocarbon fuel chemically similar enough to fossil natural gas that it can be used in pipelines, power plants, and appliances in place of fossil natural gas. However, it is derived from biological sources, such as the decay of organic material in landfills, the anaerobic digestion of organic and farm waste, or the thermochemical conversion of woody biomass. The gas produced through these processes often needs some amount of cleaning or scrubbing to be made chemically similar to fossil natural gas.

Q. HOW DO YOU THINK ABOUT RNG IN THE CONTEXT OF THE SCENARIOS YOU MODELED?

A. Where a scenario shows that the District's goals are not met using the tools deployed in that scenario, it implies to me that there is a potential for RNG to replace fossil natural gas and get the District closer to its goals. For each scenario that doesn't meet the District's goals, I have calculated the reduction in carbon intensity of natural gas combustion required to get from the scenario's results to the District's goals. This percent reduction can also be thought of as the required amount of RNG, as a percentage of all natural gas, to hit the District's targets when deployed in addition to the

changes that make up each scenario. These percentages are shown in Table 2, along with the absolute amount of RNG that would be required in 2050 (in TBtu per year).

Table 2: Necessary RNG quantities and sales shares to meet 2050 GHG goals in scenarios that otherwise do not achieve them

	RNG %	**TBtu/year of RNG**
A (Transport only)	20%	7.9
C (Efficiency only)	26%	8.6
E (Everything but heat pumps)	3%	0.8

RNG could also be used to supply the District of Columbia with zero-carbon electricity, if used in efficient electric generators such as fuel cells. (Fuel cells are promising because of the possibility to locate them in the District of Columbia to use them for on-site generation in net-zero buildings). 100 MW of around-the-clock electric generation from fuel cells with a heat rate of 6,000 BTU/kWh (somewhat more efficient than the best current technologies summarized in an EPA report on fuel cell CHP[25]) would require 5.26 TBtu/year of RNG fuel.

Q. IS RNG AVAILABLE TODAY IN THESE QUANTITIES?

A. No. There are no farms or landfills in Maryland or Virginia that produce renewable natural gas for use as compressed natural gas (CNG) or

[25]Exhibit DCG (C)-11.

injection into pipelines. Across the country, there are 36 landfills and 7 farms that upgrade biogas for use as CNG or injection into pipelines. Those 36 landfills can produce 165 Mcf per day,[26] or 0.06 TBtu per year, while the 3 of the 7 farms that report their product report a total of less than 2 Mcf per day, and they use some of that for on-site purposes.[27]

Q. MIGHT RNG BE AVAILABLE IN THESE QUANTITIES IN THE FUTURE SO THAT RNG COULD PLAY A SIGNIFICANT (EVEN DECISIVE) ROLE IN DISTRICT'S ACHIEVEMENT OF ITS GHG GOALS?

A. Acquiring the RNG resources required to meet the District's goals in scenarios A or C would require (1) a dramatic increase in the national or regional availability of RNG with pipeline access and (2) the District of Columbia or region consuming more RNG than its likely share of the national production. I reviewed "The Potential for Renewable Gas: Biogas Derived from Biomass Feedstocks and Upgraded to Pipeline Quality" produced for the American Gas Foundation by the Gas Technology Institute in 2011.[28] This study analyzes three scenarios: a "non-aggressive" scenario in which 5-25 percent (depending on resource) of biomass is

[26] Exhibit DCG (C)-12.

[27] Exhibit DCG (C)-13.

[28] Exhibit DCG (C)-14.

processed into biogas; an "aggressive" scenario is which 15-75 percent is processed (representing concerted national effort to employ this resource) and a "maximum" scenario (a theoretical upper limit). The study refers to the "non-aggressive" and "aggressive" scenarios as the practical scenarios, so I have restricted my analysis to them. Note that even the non-aggressive scenario represents a dramatic increase in the generation and use of biogas from the current status.

In the non-aggressive scenario, total U.S. RNG production would reach 966.6 TBtu per year, of which 21.6 TBtu would come from Virginia or Maryland. For comparison, total U.S. residential and commercial fossil natural gas use in 2016 was 7,792 TBtu. Fuel cost is estimated to be in the range of $1 per therm (in 2011 dollars), not counting the cost of the capital infrastructure to produce and transport the fuel. The aggressive case would increase the supply to 2,485 TBtu or about 32 percent of 2016 consumption. Residential and commercial consumers in Maryland, Virginia and the District of Columbia use more natural gas as a fraction of the national consumption (~4.5 percent) than these states represent of the RNG potential (~2.2 percent), so meeting 20 percent or more of gas demand in the District of Columbia with RNG would require DC claiming more than its proportional share of production.

Q. COULD YOU SUMMARIZE THE RANGE OF POSSIBLE FUTURES THAT YOUR ANALYSIS IMPLIES FOR THE DISTRICT OF COLUMBIA'S NATURAL GAS DISTRIBUTION UTILITY?

A. There is a wide range of possible futures.

In one future, WGL becomes a national leader in the development of biogas resources, harnesses the RNG potential of the Washington region, and serves the District of Columbia with a high proportion of RNG. RNG could be used for electric production or combined heat and power (including with district heat) in addition to traditional building uses. To follow this path, RNG must be the most cost effective new option (beyond those assumed in each scenario to which it is being added) to reduce GHG emissions to a level required to meet moral and economic imperatives to address climate change. In particular, to get to this path RNG must compete favorably with the use of heat pumps. However, the required amount of RNG may or may not be available, depending on whether other jurisdictions are also following a similar path. (Action elsewhere will lower the cost of RNG due to technological learning and economies of scale, but it would also increase competition for the resource.)

In another future, the District rapidly transforms every market other than building fuel choice. This would include implementing a nation-leading natural gas energy efficiency program, and RNG would also play a minor supporting role. This future leaves heat pumps and RNG as the primary options for further emission reductions after 2050, as will be required to maintain the District's commitments to limiting global climate change.

In another future, District of Columbia gas customers convert to electric heat pumps for space and water heating, and natural gas use falls by more than half by 2050. In this case, relatively little RNG is required, so pipeline gas supply can remain inexpensive and primarily fossil in origin. However, falling consumption can drive the per-unit cost of the pipeline network up substantially, so that even low-cost supply has difficulty competing with heat pumps for most applications. There will likely remain specific applications – industrial uses, fuel cells, and combined heat and power, for example – where pipeline gas is essential. These customers, however, will likely be unwilling or unable to pay the costs of an extensive distribution network serving nearly every building. (A limited gas distribution network, or even delivery of CNG or LNG by truck, may suit their needs.) Note that this future can be self-accelerating: if some customers abandon natural gas, it will improve the economics of switching

for other customers, who may then follow suit. This may not be a promising outcome for the natural gas distribution utility without significant business model innovation.

These are just three examples of the many future scenarios possible for the District of Columbia's gas distribution utility. Other options could include various combinations of these three scenarios. Alternatively, the options available in the future may vary in ways that are not reflected here (especially if new technologies or other innovations bring options to bear that I have not considered here).

Q. WHAT ARE THE IMPLICATIONS OF THE FUTURES YOU HAVE DESCRIBED ABOVE FOR REGULATORS?

A. Historically electric and gas distribution utilities have operated with very little competition—generally speaking pipeline natural gas has been the fuel of choice for heating, while electricity serves other end uses. In the analysis presented above, the combination of technological change (primarily more efficient heat pumps and heat pump water heaters) and action on GHG emissions spurs competition, presenting new challenges for regulators and policymakers in a community with two incumbent and monopoly infrastructure providers. The outcome of this competition will thus be intimately shaped by regulatory and policy decisions, and

customers will be profoundly impacted regardless of the outcome. However, the most acute impact will be felt in the case of a self-accelerating shift away from pipeline gas.

Q. WHAT SHOULD REGULATORS AND POLICYMAKERS KEEP IN MIND IN THIS PROCEEDING AS THEY CONSIDER THE RISKS OF A SELF-ACCELERATING SHIFT AWAY FROM PIPELINE GAS?

A. High-stakes competition shaped by regulation and policy will be an unfamiliar business position for Washington Gas, and for its regulators. Flexibility and innovation in business models may be required from all parties. In this proceeding, the Commission should consider whether AltaGas is likely to improve the District's and WGL's abilities to address the challenges this transformation could bring.

In the context of self-accelerating decline in pipeline gas consumption, the proposed affordable housing piping initiative (Merger Commitment 2) may leave the District of Columbia residents least able to switch to electric options as the customers bearing the costs of the distribution system. This could lead to an unfair burden on these residents.

Continued investment in pipeline safety and leak mitigation further complicates the District's energy and climate planning in the context of

future changes in consumption. Washington Gas is in the early stages of a planned 40-year program to replace pipes with safer and less emitting new pipe. GHG goals (not to mention safety) could be set back substantially if the utility were to lose the ability to fund the necessary investments and leak rates increase. However, continued investment in new pipes while expecting a decline in sales could mean even higher rates, leading to greater use of electricity, and self-accelerating challenges.

Q. WHAT KIND OF PARTNER WILL THE DISTRICT NEED TO NAVIGATE THESE CHALLENGING CHANGES IN THE ENERGY SECTOR?

A. The District will require active, engaged, and supportive partners from across the energy industry if it is to be successful in meeting its GHG goals while being mindful of infrastructure costs. Key partners will be the District of Columbia's regulated utilities, serving electricity and pipeline gas. The corporate values and behavior of the gas utility will shape how successful the Distirct is, and at what cost. In this proceeding, the Commission should consider whether AltaGas has demonstrated an understanding of these risks and has the values and business approach likely to result in a successful and lasting partnership with the Distirct going forward.

VI. WILL THIS MERGER HELP THE DISTRICT MEET ITS ENERGY AND CLIMATE CHANGE GOALS?

A. Is AltaGas a promising partner for the District in meeting its energy and climate change goals?

Q. HAVE WGLH AND WASHINGTON GAS DEMONSTRATED A COMMITMENT TO GENERALLY ADVANCING THE ENERGY SYSTEM TRANSITION ENVISIONED BY SUSTAINABLE DC AND CLEAN ENERGY DC?

A. Yes. WGLH has embraced the science behind the need to act decisively on climate change,[29] recognizes that the reduction in emissions by 80 percent by 2050 is a policy imperative,[30] and has developed an unregulated business (WGL Energy) that provides low-carbon energy supply and efficiency options to customers around the country. These services include renewable electricity, carbon offsets, distributed generation (including CHP and fuel cells), and commercial and governmental energy efficiency. Washington Gas has also been a leader on methane emission reductions through its participation in the U.S.

[29] Exhibit DCG (C)-15 at DC-ALA-WGL_029126; Exhibit DCG (C)-16 at DC-ALA-WGL_029238.

[30] Exhibit DCG (C)-3 at 160:20-161:2.

EPA's Natural Gas STAR Methane Challenge program, and has committed to further methane emission reductions. As I discuss below, there is more that Washington Gas could do to reduce methane emissions, and I do not believe that the utility has begun to engage with the long-term business planning implications of decarbonization. That said, with respect to climate change issues, Washington Gas has demonstrated that it (for lack of better words) "gets it."

Q. HAS ALTAGAS DEMONSTRATED THAT IT IS COMMITTED TO ADVANCING THE ENERGY SYSTEM TRANSITION ENVISIONED BY SUSTAINABLE DC AND CLEAN ENERGY DC?

A. No. AltaGas has made broad statements about the importance of sustainability, environmental compliance, and innovation, but, in terms of concrete actions, it has not shown an appreciation for the scale of energy sector transformation necessary to achieve the District's GHG goals (and, looking globally, the goals of the Paris climate accords). AltaGas overstates the benefits and role of natural gas in making that transformation, and has failed to show that it is as progressive as Washington Gas on addressing climate change. Focusing more narrowly, AltaGas has not shown that its values and approach are consistent with the District's needs over the coming decades. The Merger Commitments,

which provide an opportunity to examine the embodiment of AltaGas's values in the form of concrete programs or investments, do not directly address the need to reduce emissions and combat climate change, and are not well aligned with the District's needs.

1. The Role of Natural Gas

Q. HOW DOES ALTAGAS VIEW THE ROLE OF NATURAL GAS, AND ALTAGAS'S ROLE IN THE NATURAL GAS INDUSTRY IN THE CONTEXT OF EFFORTS TO ACHIEVE DECARBONIZATION?

A. At its core, AltaGas is a natural gas company. In its 2016 Annual Report, it says that "AltaGas' strategy is to execute opportunities created by the renaissance of natural gas in North America and the increasing global demand for clean energy, by owning and operating a diversified mix of assets in gas, power, and utilities."[31] One of AltaGas's three lines of business (and its original focus) is Gas, while the "Utilities" line contains only natural gas utilities and the "Power" line owns primarily natural gas-fired generators.

[31] Exhibit JA-2 at 9.

In his supplemental testimony, Mr. O'Brien addresses the question of the overlap between a focus on natural gas and decarbonization.[32] He identifies five points:

1) Direct use of natural gas has lower emissions than use of "conventional" grid electricity; natural gas electric production has lower CO_2 emissions than some other common sources of electricity and can support the integration of renewable electricity on the grid;
2) Reducing pipeline leaks will lower the District of Columbia's GHG emissions, and AltaGas will work to reduce these leaks;
3) Innovation will be necessary to meet the challenge of climate change, and AltaGas supports innovation;
4) AltaGas also has business investments outside of natural gas (in renewable electricity and energy storage); and
5) AltaGas's midstream gas business can contribute to national and global emissions reductions by providing gas that can displace coal.

[32] Exhibit JA (2C) at 5-7.

Q. DOES MR. O'BRIEN'S TESTIMONY DETAIL ANY COMMITMENTS CONTAINED IN THE MERGER APPLICATION THAT PROMISE ADDITIONAL GHG REDUCTIONS OR THE INCREASED USE OF RENEWABLE ENERGY IN THE DISTRICT OF COLUMBIA?

A. No. The Joint Applicants have made no such commitments.

Q. HOW DOES MR. O'BRIEN'S FIRST POINT RELATE TO THE PUBLIC INTEREST FACTORS THAT THE COMMISSION MUST ASSESS IN THIS PROCEEDING?

A. The first point is not relevant to the Factors, except as it relates to Mr. Obrien's fifth point, which I will discuss in a moment. This first point addresses only the end use of natural gas and CO2 emissions, and it does not address methane emissions. Note that Mr. O'Brien compares the direct use of natural gas with grid electricity from carbon-emitting sources. He does not account for the falling emissions on the grid due to zero-carbon resources or for efficiency of the end use, rendering his statement a comparison between apples and oranges.

Q. HOW DOES MR. O'BRIEN'S SECOND POINT (ABOUT REDUCING PIPELINE LEAKS AND INCREASING ENERGY EFFICIENCY) RELATE TO THE COMMISSION'S PUBLIC INTEREST FACTORS IN THIS PROCEEDING?

A. The second point is not relevant to the Factors because AltaGas has not proposed to change anything about how quickly leaks are repaired or pipelines are replaced in the District of Columbia. A commitment to "work to reduce leaks" is not a promise to do anything in particular to achieve this result, and reflects the normal course of business for a gas utility. The Merger Commitment to fund low-income weatherization would make a minor contribution to reducing GHG emissions, although the Joint Applicants have made no energy or emission reduction target commitments. In addition, as I will discuss later, this funding will likely serve substantially fewer households than the Joint Applicants have claimed. There is a Merger Commitment for education about damage prevention, but it focuses on safety rather than emissions reduction. I will discuss implications of the literature on distribution system leaks and GHG emissions below and provide an example of the kind of merger commitment that would have reflected leadership on this issue.

Q. HOW DOES MR. O'BRIEN'S THIRD POINT (ABOUT INNOVATION) RELATE TO THE COMMISSION'S PUBLIC INTEREST FACTORS IN THIS PROCEEDING?

A. The third point does not have direct implications for the Factors because AltaGas and WGLH have not demonstrated that the combined entity will be any more innovative than WGLH is today or will be without the merger. Again, expressing support for innovation is not a commitment to do anything.

Q. HOW DOES MR. O'BRIEN'S FOURTH POINT (ABOUT NON-NATURAL GAS INVESTMENTS) RELATE TO THE COMMISSION'S PUBLIC INTEREST FACTORS IN THIS PROCEEDING?

A. The fourth point is relevant in that it highlights AltaGas's approach to the power sector, and thus its ability to contribute to greater positive change on environmental quality in that sector. It also illuminates the perspective that AltaGas brings to the utility sector. Of the 1,688 MW of capacity in AltaGas's power portfolio, nearly 1,200 MW are from seven natural gas generators. The remainder is composed of two wind farms, two biomass/wood generators, and a set of three linked hydroelectric facilities. This indicates to me that AltaGas is at its core a natural gas company and

it does not bring fundamental new skills in renewable energy to the service of the District's energy goals. While AltaGas has developed one large battery storage system, it is by no means unique in developing and deploying grid-scale storage.[33]

Moreover, AltaGas appears to view policies or actions that compete with or challenge the notion of growth in the natural gas sector, such as the promotion of greater renewable electric generation, as threats. AltaGas describes its position on climate change regulation as "consistent" with that of the Canadian Association of Petroleum Producers, which it characterizes as including that "compliance should be achievable within the context of growing production."[34] [redacted] [35] AltaGas also views renewable electricity as something [redacted]

[33] The utility storage sector exceeded 200 MW over the last year, of which AltaGas's Pomona project was 20 MW. Exhibit DCG (C)-17.

[34] Exhibit DCG (C)-18, at DC-ALA-WGL_041880.

[35] Exhibit DCG (C)-19 at DC-ALA-WGL_ 033450.

[redacted] [36] In its 2016 Annual Report, AltaGas identifies "the impact of the climate change regulations" as an environmental risk to be "mitigated."[37]

Q. HOW DOES MR. O'BRIEN'S FIFTH POINT (ABOUT ALTAGAS'S MIDSTREAM BUSINESS) RELATE TO THE COMMISSION'S PUBLIC INTEREST FACTORS IN THIS PROCEEDING?

A. The fifth point is relevant because it provides an opportunity to examine how AltaGas's historical core business—mid-stream gas—may or may not contribute to a decarbonizing world. In the merger context, this examination should inform the Commission as to whether AltaGas's core business is aligned with meeting global climate change objectives, such as those embraced by the District and nearly every country in the world through the Paris Agreement. If it were so aligned, it would contribute to the environmental objectives represented by Factor Seven.

[36] Exhibit DCG (C)-20 at DC-ALA-WGL_ 032671.

[37] Exhibit JA-2 at 46.

Q. WHAT HAS BEEN DETERMINED REGARDING THE EMISSIONS IMPACT OF INCREASED USE OF NATURAL GAS (IN THE POWER SECTOR AND ELSEWHERE) AROUND THE NATION AND WORLD, AS RAISED BY MR. O'BRIEN'S FIRST AND FIFTH POINTS?

A. Simply increasing access to natural gas does not assure a GHG emission reduction, and especially not to the levels required by DC's 2050 goals or the long-term objectives of the Paris Agreement. A 2014 paper by McJeon et al.[38] takes a global energy system view through the use of integrated global energy-economy-climate models. In this work, global availability of low-cost natural gas results in little to no global emissions reductions, and may result in increases. This is the result of two effects. First, low-cost natural gas competes with renewable energy and other low-carbon sources as well as competing with coal. Second, lower overall costs of energy result in increased energy consumption and less adoption of energy efficiency. While this model is global, I expect that the forces the authors identify would play out in U.S energy markets as well unless countered by policy intervention.

[38] Exhibit DCG (C)-21.

In an analysis relevant to AltaGas's plans to export Canadian LNG, Coleman et al.[39] raise a similar set of concerns regarding LNG export from British Columbia. Coleman et al. conclude that the GHG impacts of LNG export depend on what resources it displaces—there could be a net GHG reduction if LNG displaces coal and a net increase if it displaces other resources. Given the complexity of the global LNG market, combined with the complexity of the markets and dispatch policies of electric sectors in LNG importing countries, it may not be possible to conclude whether LNG exports result in a new increase or decrease in emissions. In a related issue brief for the C.D. Howe Institute, Coleman and Jordaan conclude that "It is impractical for regulators to assess how individual LNG export facilities will affect overseas greenhouse gas emissions because of uncertainty in markets, which presently makes it nearly impossible to predict exactly where the natural gas will be consumed."[40]

Mr. O'Brien has overstated the case for natural gas as a contributor to GHG emission reductions and, consequently, the consistency of AltaGas's natural gas focus with the District's GHG emission reduction goals.

[39] Exhibit DCG (C)-22.

[40] Exhibit DCG (C)-23 at 1.

Q. ARE METHANE EMISSIONS FROM THE WGL DISTRIBUTION SYSTEM A CONCERN FOR THE DISTRICT IN MEETING ITS GHG EMISSION REDUCTION GOALS?

A. Yes. In addition to safety concerns about methane leaks, methane emissions from even leaks that are not dangerous can add up to noticeable fractions of a region's GHG inventory. Washington Gas calculates that its 2014 losses from pipelines contributed about 72,000 tons of CO2-equivalent to the atmosphere.[41] This is slightly less than 1 percent of the District of Columbia's total GHG emissions and about 5 percent of the emissions from natural gas combustion. These calculations are based on emissions to the atmosphere of about 2.9 million kg of natural gas, or about 0.4 percent of the gas delivered in the District of Columbia.

Q. WHAT ROLE DOES METHANE LEAK REDUCTION PLAY IN MEETING THE DISTRICT'S GHG REDUCTION GOALS?

A. Emission inventories, like that conducted by Washington Gas, typically do not rely on measurements of actual emitted gas. Instead, loss fractions are attributed to each mile of various kinds of pipe (cast iron has the most

[41] Exhibit DCG (C)-24 at DC-ALA-WGL_029121. WGL used a global warming potential of 25 for methane, which is lower than the most recent accepted value of 28 from the 5th Assessment Report of the IPCC.

losses, etc.).[42] There have been attempts to make atmospheric measurements of methane to determine how much can be attributed to leaks from the distribution system of major U.S cities. McKain et al.[43] used sensors located around the Boston area to measure the methane concentrations and chemical composition analysis to attribute those emissions to natural gas systems. They conclude that the "inferred mean annual [natural gas] loss rate in the study area was 2.7 ± 0.6 percent of the total delivered gas in 2012–2013, with little seasonal dependence."[44] Lost and unaccounted for (LAUF) gas fractions for Massachusetts distribution utilities also average 2.7 percent, although attribution explicitly cannot be inferred from this paper. This result implies that Massachusetts's state GHG inventory, which assumes a methane emission rate corresponding to 1.1 percent of natural gas consumption, may be significantly underestimating the emissions.

A 2014 study by Jackson et al.[45] reports the results of a leak survey conducted in the District of Columbia. The researchers drove a set of chemical sensors comprehensively around the District of Columbia (1,500

[42] *See, e.g., id*.

[43] Exhibit DCG (C)-25.

[44] *Id*. at 1943.

[45] Exhibit DCG (C)-26.

road miles) and recorded 5,893 leaks. The researchers identified 12 Grade 1 leaks[46] in manholes (including one leak where the methane concentration was 50 percent, or 500,000 parts per million). Jackson et al. compare the result of the District of Columbia survey with another conducted in Boston, MA, and show that the leak density was similar in the two cities but that leak rates were higher in DC. While an atmospheric study in the vein of McKain et al. has not been conducted for the District of Columbia, the Jackson et al. results imply that DC may also be undercounting methane emissions from the distribution system and leaks may account for a large fraction of WGL's LAUF gas. This could mean that methane emissions compose a large fraction of the total emissions attributable to natural gas use in the District of Columbia. If methane leakage is 3 percent instead of 0.4 percent, then methane emissions could account for more than 5 percent of the District of Columbia's total GHG emissions, or one third of the emissions from natural gas combustion. Measurements to more concretely determine Washington Gas's methane leak rate would be very valuable in calculating the District of Columbia's true GHG footprint, and in determining how much reduction in methane leaks is necessary to meet emission reduction goals.

[46] A Grade 1 leak is a leak that represents an existing or probable hazard to persons or property, and requires immediate repair or continuous action until the conditions are no longer hazardous.

Q. WASHINGTON GAS IS REPLACING PIPES AT AN ACCELERATED RATE AND CLAIMS FALLING EMISSIONS. WHAT HAS ALTAGAS COMMITTED REGARDING REDUCING LEAKS?

A. AltaGas has made no commitment to reduce Washington Gas's methane leak rates, in the District of Columbia or elsewhere, beyond those already planned and approved by the Commission. AltaGas has proposed to fund a new public safety program focused on preventing damage to pipes, but has made no methane emission reduction calculation or reduction claim regarding this program. AltaGas has also committed that Washington Gas will have sufficient access to capital to complete its current capital plan, which includes the accelerated pipeline replacement program during that period, although Washington Gas would be able to fund its own capital plans without the merger as well.[47]

Q. HAS ALTAGAS DEMONSTRATED LEADERSHIP ON METHANE EMISSIONS IN ITS OTHER UTILITIES, OR ELSEWHERE IN ITS NATURAL GAS BUSINESSES?

A. No. AltaGas subsidiaries have addressed leak repair and methane emissions as required by their regulators, but they have not demonstrated

[47] Exhibit DCG (C)-3 at 18:6-8.

leadership. AltaGas utilities have not participated in the EPA "Natural Gas Star" program and have not made emission reduction commitments (either voluntary or mandatory).[48] AltaGas is a member of the Canadian Association of Petroleum Producers (CAPP), which recently advocated to the Canadian regulatory authorities for less stringent standards regarding methane emissions from the upstream oil and gas sector.[49]

Q. WHAT COULD ALTAGAS AND WGL HAVE PROPOSED IN THIS MERGER PROCEEDING THAT WOULD HAVE SHOWN LEADERSHIP IN ADDRESSING THE CHALLENGE OF METHANE LEAKS?

A. The Joint Applicants could have proposed to prioritize the repair of non-hazardous leaks and the replacement of pipe segments based on the measured methane flow from leaks. This approach has been taken in other states recently, but is not yet standard practice. In 2016, New Jersey's Public Service Electric and Gas (PSEG) worked with Google and EDF to prioritize its pipeline replacements based on measured methane leak rates.[50] Methane emissions from targeted areas were reduced 83 percent. Without prioritization, it would have taken 35 more miles of pipeline

[48] Exhibit DCG (C)-27 at DC-ALA-WGL_025905 to -07.

[49] Exhibit DCG (C)-28.

[50] Exhibit DCG (C)-29.

replacement to achieve the same reductions. New York regulators have also recently approved a similar approach by National Grid.[51] The Commission should condition approval of this merger on institution of a methane-emission-based prioritization program for both leak repair and pipe segment replacement in the District of Columbia. Execution and oversight of such a program would require public disclosure of measured methane emissions. A prioritization approach would reduce emissions faster, at less cost to ratepayers, than an approach that does not use methane emission data.

2. Corporate Values

Q. WHAT DO ALTAGAS AND WGLH SAY ABOUT THEIR ALIGNMENT ON ENVIRONMENTAL MATTERS?

A. As you would expect when filing to advocate approval of such a merger, they claim agreement in approach. For example, on page 12 of his testimony, Mr. McCallister says:

[51] Exhibit DCG (C)-30.

> Yes, our view is the same. Both companies see the promotion of clean energy and environmental sustainability as of fundamental importance to communities and to our businesses' ability to best serve those communities. Clean, efficient energy solutions are important to our customers and the future of our business. Integration of natural gas, renewable technologies, energy storage, and energy efficiency combine to form the basis for the advanced energy economy.[52]

(Mr. McCallister repeats item 70 (at 32) of the Joint Applicants' Application.)

On page 14 of Mr. Harris's testimony, he says:

> Foremost among the AltaGas core values is the safety of our employees and the public, and protection of the environment; values shared by WGL. AltaGas continuously strives to improve its safety and environmental management practices.[53]

Q. DO THE STATEMENTS IN THIS CASE AND THE ACTIONS OF WGLH AND ALTAGAS SUPPORT THEIR STATEMENTS REGARDING COMMON GROUND?

A. No. In several places in filings in this proceeding, WGL and AltaGas have expressed or documented significantly different approaches to the challenges of climate change and sustainability. The differences suggest that WGL is more aligned with the District's approach than is AltaGas.

[52] Exhibit JA (B) at 12:1-7.

[53] Exhibit JA (A) at 14:17-20.

Q. CAN YOU PROVIDE EXAMPLES?

A. Yes. Examples include:

- Corporate positions with respect to the science of climate change;
- Willingness to take leadership positions and exceed regulatory requirements; and
- Existence of GHG emission reduction targets or plans.

Q. WHAT IS WGLH'S POSITION ON THE SCIENCE OF CLIMATE CHANGE AND THE NECESSITY OF REDUCTIONS IN GREENHOUSE GAS EMISSIONS?

A. When asked whether WGLH agrees that "continued emission of greenhouse gases will cause further warming and long-lasting changes in all components of the climate system increasing the likelihood of severe, pervasive, and irreversible impacts for people and ecosystems," and "that limiting climate change would require substantial and sustained reductions in greenhouse gas emissions which, together with adaptation, can limit climate change risks," WGLH responded that "WGL Holdings agrees with this statement, and publicly stated so in its 2015-16 Sustainability Report."[54] Importantly, the two quotes WGLH was asked about are drawn

[54] Exhibit DCG (C)-31 at DC-ALA-WGL_029125 (citing Exhibit DCG (C)-33 at 11); Exhibit DCG (C)-15 at DC-ALA-WGL_029126 (citing Exhibit DCG (C)-33 at 11).

from the Intergovernmental Panel on Climate Change's most recent Summary for Policymakers.[55] The IPCC is the international body, established by the World Meteorological Organization and the United Nations Environmental Programme, for assessing the science related to climate change. WGLH is therefore in alignment with the global scientific consensus on climate change.

The identified passage of the Sustainability Report reads:

> At WGL, we recognize the scientific consensus that human activity – primarily GHG emissions and the conversion of land for agriculture and development – is contributing to changes in the global climate including changing weather patterns, rising sea levels and more extreme weather events. We believe that actions must be taken now to stabilize and reduce emissions in line with the international goal of preventing temperatures from rising more than two degrees Celsius by the end of this century. Climate change presents risks to WGL and our operations, but also provides us with an opportunity to be part of the solution. These factors underlie our commitment to continued change and improvement in our operations, and provide an evolving portfolio of clean and renewable products and services to communities we serve.
>
> WGL has a three-pronged approach to addressing the risks of climate change. We are reducing our own emissions, assisting or enabling our customers to reduce theirs, as well as modernizing and strengthening our infrastructure so that customers can have resilient services in the face of climate

[55] Exhibit DCG (C)-32.

> impacts. We set emissions reductions goals for 2020 that we achieved ahead of schedule. At the same time, we are also increasing our sourcing and supplying of renewable energy to our customers and expanding energy efficiency offerings while enabling customers to purchase carbon offsets to help drive efficient and clean energy use.
>
> We make these efforts because we understand that it is our responsibility as a business to be a part of the solution. We also believe we have a unique role to play in providing energy answers to the challenges of transitioning to a 21st century, low-carbon economy.[56]

Q. WHAT IS ALTAGAS'S POSITION ON THE SCIENCE OF CLIMATE CHANGE AND THE NECESSITY OF REDUCTIONS IN GREENHOUSE GAS EMISSIONS?

A. When asked if AltaGas agreed with the same pair of quotes as WGLH, AltaGas was equivocal:

> AltaGas is aware that statement has been made by the Intergovernmental Panel on Climate Change, and does not have an independent view on the statement. AltaGas broadly agrees that greenhouse gas emissions from human activities are a source of climate change, and believes that reducing carbon emissions is a good idea regardless of whether global warming models are entirely correct.[57]

In 2015 (the year of the 21st Conference of the Parties, or COP21, in Paris that resulted in the Paris Agreement), AltaGas was asked by CDP

[56] Exhibit DCG (C)-33 at 11.

[57] Exhibit DCG (C)-6 at DC-ALA-WGL_029252.

(formerly Carbon Disclosure Project) "Would your organization's board of directors support an international agreement between governments on climate change, which seeks to limit global temperature rise to under two degree Celsius from pre-industrial levels in line with IPCC scenarios such as RCP2.6?" AltaGas responded "No opinion."[58] CDP also asked what activities AltaGas was taking to help deliver such an agreement in Paris; AltaGas did not respond.

Q. ARE THE POSITIONS OF WGLH AND ALTAGAS CONSISTENT WITH EACH OTHER?

A. No. WGLH explicitly adopts the international scientific consensus, embraces their "responsibility as a business to be a part of the solution," and exceeds its emission reduction goals while assisting customers to reduce their emissions. AltaGas, by contrast, does not have an independent view on the international scientific consensus and has no opinion on whether to support the United Nations climate change process which led to the Paris Agreement. On the necessity to reduce emissions, AltaGas believes reductions are a "good idea," while indicating a lack of agreement or certainty that scientific "global warming models are entirely correct." When asked in his deposition whether Washington Gas sees emission

[58] Exhibit DCG (C)-18 at DC-ALA-WGL_041882.

reductions as "a good idea or more of a policy imperative," Mr. McCallister states that Washington Gas has taken the necessity to reduce emissions "more as a policy" but also agrees that it is a "good idea."[59]

Q. WHICH COMPANY'S POSITION ON THE SCIENCE OF CLIMATE CHANGE AND THE NECESSITY OF REDUCTIONS IN GREENHOUSE GAS EMISSIONS IS MORE ALIGNED WITH THE DISTRICT'S POSITION?

A. WGLH's position is more aligned with the District's policies for emission reduction and its support for the goals and commitments of the Paris Agreement.

Q. IF THIS MERGER IS APPROVED, WHO WILL DETERMINE WGLH'S AND WASHINGTON GAS'S POLICIES REGARDING CLIMATE CHANGE AND THE NECESSITY OF REDUCTIONS IN GREENHOUSE GAS EMISSIONS?

A. AltaGas, as the owner of Washington Gas, would be able to set policy direction and guide Washington Gas's engagement with policymakers and regulators on these issues. Mr. McCallister confirmed that AltaGas would

[59] Exhibit DCG (C)-3 at 160:20-161:2.

be able to set these policy directions.[60] Mr. Harris confirmed that AltaGas would appoint the WGL board of directors.[61]

Q. HOW DO THE DIFFERENT POSITIONS ON THE SCIENCE OF CLIMATE CHANGE AND THE NECESSITY OF REDUCTIONS IN GREENHOUSE GAS EMISSIONS RELATE TO PUBLIC INTEREST FACTOR SEVEN?

A. Under Factor Seven, the Commission will consider whether the merger advances environmental quality. Washington Gas utility ownership and management will determine whether the District has a partner who is engaged, supportive of District policy, and understands the urgency to quickly reduce emissions; or one who questions the District's approach and sees value in delay. Delay in action to reduce emissions harms environmental quality.

Q. HOW DO WGLH AND ALTAGAS DIFFER ON GHG EMISSIONS TARGETS OR PLANS?

A. Washington Gas has been a leader on emissions reduction, through both methane leak reduction and operational actions. Washington Gas met its voluntary commitment to reduce the methane emissions intensity of its

[60] *Id*. at 161:18-21.

[61] Exhibit DCG (C)-4 at 128:17-19.

pipeline network by 18 percent several years early,[62] and developed a new target, this time to a 38 percent reduction by 2025.[63] Washington Gas has been a participant in the EPA's voluntary "Natural Gas Star" program and its associated "Methane Challenge" program.[64] It also met its voluntary target to reduce operational emissions 70 percent by 2020 – reducing them 74 percent by 2015.[65] WGLH publishes a sustainability report and website[66] that includes a corporate approach to climate change mitigation and adaptation. This report serves as WGLH's response to requests for the company's climate change mitigation plan.[67]

In contrast, no AltaGas utilities have made commitments to reduce fugitive emissions or decrease the carbon intensity of natural gas service.[68] When asked to provide climate change mitigation or adaptation plans, or the most similar such documents, for AltaGas or any of its subsidiaries, AltaGas produced no plans or documents.[69]

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[62] Exhibit DCG (C)-33 at 66-7.

[63] Exhibit DCG (C)-34 at DC-ALA-WGL_029239.

[64] Exhibit DCG (C)-35.

[65] Exhibit DCG (C)-33 at 66.

[66] WGL Energy Answers, *Sustainability*, http://sustainability.wglholdings.com/ (last visited Sept. 19, 2017).

[67] *See*, for example, Exhibit DCG (C)-36 at DC-ALA-WGL_029241.

[68] Exhibit DCG (C)-37 at DC-ALA-WGL_029123.

[69] Exhibit DCG (C)-38 at DC-ALA-WGL_029255.

Q. WHICH OF THESE APPROACHES TO GHG EMISSIONS TARGETS OR PLANS IS MORE CONSISTENT WITH THE DISTRICT'S GOALS AND POLICIES?

A. Washington Gas and WGLH's approach is more consistent with the District's goals and policies, and with this critical aspect of environmental quality.

Q. WHAT CONCLUSIONS DO YOU DRAW FROM ALTAGAS'S APPROACH TO CLIMATE CHANGE?

A. I am concerned that it will be a negative to pass control of WGLH and Washington Gas to AltaGas, a company that is:

- unwilling to state a supportive opinion on the established science of climate change or the process to reach an international agreement to limit temperature rise;
- has not established GHG emission targets that exceed those required by regulation or mandate in any jurisdiction where it operates; and
- has no sustainability plan or GHG emission mitigation plan.

Ultimately, I am concerned that the merger as proposed represents a step in the wrong direction for a District committed to substantial and rapid greenhouse gas emission reductions.

B. Do the Merger Commitments advance the District's energy and climate change policies, and thus Factors One and Seven?

Q. WHICH OF THE MERGER COMMITMENTS HAVE YOU EXAMINED FOR THEIR RELEVANCE TO ADVANCING THE DISTRICT'S ENERGY POLICY?

A. I examined the Merger Commitments that the Joint Applicants identified as relevant to Factor Seven: Nos. 2 (affordable housing piping support), 3 (low-income weatherization), 5 (storage or tier one renewable resource), and 6 (biogas study).

Q. DO ANY OF THE MERGER COMMITMENTS IDENTIFY GHG EMISSION REDUCTIONS POST-MERGER?

A. No. Both Mr. Harris and Mr. McCallister have acknowledged that the Merger Commitments contain no GHG emission reduction targets.[70]

[70] Exhibit DCG (C)-4 at 227:13-229:2; Exhibit DCG (C)-3 at 154:2-5.

Q. DO ANY OF THE MERGER COMMITMENTS REQUIRE, AFTER THE MERGER, THAT WASHINGTON GAS PERFORM ANY ASPECT OF ITS OPERATIONS IN A WAY THAT IS MORE PROTECTIVE OF THE ENVIRONMENT?

A. There are one-time commitments that could increase environmental quality outside of Washington Gas's operations (Nos. 3 and 5), but no such commitments that relate to sustained changes in Washington Gas's operations.

Q. IN TOTAL, DO THE MERGER COMMITMENTS ADDRESS YOUR CONCERN THAT ALTAGAS IS NOT A PROMISING PARTNER FOR THE DISTRICT?

A. No. The commitments reflect an unambitious approach that does not change my opinion that AltaGas is not a promising partner.

Q. ASIDE FROM FAILING TO ADDRESS YOUR OVERALL CONCERNS ABOUT THIS MERGER, DO ANY OF THE MERGER COMMITMENTS PROVIDE MEANINGFUL BENEFITS TO THE DISTRICT OF COLUMBIA?

A. Low-income weatherization is a consistent need, and the funds offered by commitment No. 3 would provide a benefit, especially if they are well-coordinated with existing programs. The biogas study (No. 6) may be

valuable, but it depends on how the study is scoped, conducted, and released. No other commitment I examined is assured of providing meaningful net benefits.

1. Low Income Weatherization

Q. DOES THE COMMITMENT TO SPEND $2.2 MILLION ON DEVELOPING AND FUNDING LOW-INCOME WEATHERIZATION PROGRAMS SUPPORT THE DISTRICT'S ENERGY POLICY, AS EMBODIED IN CLEAN ENERGY DC?

A. Yes, this is a supportive commitment, although I do have concerns regarding how the funding might be managed. Weatherizing low-income homes reduces energy demand, GHG emissions, and energy burden on those households least able to afford energy, while also increasing the residents' comfort and health, so more support for this is always welcome. That said, in the context of DCG support for low-income weatherization, this is not a great sum. The Department of Energy and Environment spent more than $3.6 million in FY 2017 on weatherization, including $2.3 million on private sector buildings and $1.3 million on public housing. The $2.2 million commitment is also equal to about 40 percent of the FY 2016 spending on natural gas efficiency from the DC Sustainable Energy

Utility.[71] As I will discuss below, redirecting the funding from the Affordable Housing Multifamily Piping commitment to this or other efficiency programs would rectify a significant failing in the Merger Commitments.

Q. WHAT ARE YOUR CONCERNS REGARDING MANAGEMENT OF THE FUNDS?

A. AltaGas proposes to provide $2.2 million to "develop and fund" supplemental low-income weatherization programs, with $200,000 funding the development of the programs leaving $2 million for actual customer assistance.[72] The District has well-established low-income weatherization and efficiency programs, so AltaGas should not be proposing to develop another program. These programs could deploy AltaGas's without losing 10 percent to program development costs.

Based on their filing, I fear that AltaGas misunderstands the costs of successful low-income weatherization. AltaGas estimates that they will fund $1,500 worth of efficiency measures for each participating customer. However, the District's Weatherization Assistance Program has average

[71] The DC SEU spent $4,972,870 related to natural gas efficiency in FY 2016. Exhibit DCG (C)-39 at 37.

[72] Exhibit DCG (C)-40 at DC-ALA-WGL_043108.

costs of over $8,500 per unit.[73] A separate program with a much lower spending plan per unit risks only partly improving the efficiency of each home and losing the opportunity for a comprehensive treatment.

2. Renewable Natural Gas

Q. DOES THE PROPOSED $450,000 RENEWABLE NATURAL GAS STUDY SUPPORT THE DISTRICT'S ENERGY POLICY, AS EMBODIED IN CLEAN ENERGY DC?

A. To some extent, although the study could be better scoped to address more pressing needs. Clean Energy DC does mention the use of low carbon biomass and other waste-to-energy facilities, particularly in the context of neighborhood-scale energy facilities. These facilities could provide district heating and support local microgrids, for example. Biogas as part of a combined heat and power or fuel cell system that can power a microgrid would be highly consistent with Clean Energy DC. However, this is an incidental need for study when compared with the core thermal energy emissions and planning challenges facing the District.

Q. IS THERE ANY TIMELINE FOR WHEN ALTAGAS MUST COMPLY WITH THIS COMMITMENT?

A. No, but there should be.

[73] $3.67 million weatherized 423 units in FY2017.

Q. WILL THE STUDY BE SPECIFIC TO THE BIOGAS OPPORTUNITY AND NEEDS OF THE DISTRICT OF COLUMBIA?

A. No. This study is a single commitment in the District of Columbia, Maryland, and Virginia, so it will examine all of Washington Gas's service territory and be directed by some combination of the policy objectives of all three jurisdictions.

Q. DOES ALTAGAS HAVE EXPERIENCE IN CONSTRUCTING OR INVESTING IN RENEWABLE BIOGAS FACILITIES?

A. No. According to their response to OPC DR 4-8, "AltaGas does not currently have any investments in any renewable biogas facilities. AltaGas' wholly owned subsidiary, Pacific Northern Gas Ltd., has investigated several similar projects in British Columbia, including the use of sawmill waste wood to produce renewable natural gas and the use of landfill gas in its pipeline system."[74] AltaGas did not cite any biogas facilities with which it has specific familiarity.

[74] Exhibit DCG (C)-41 at DC-ALA-WGL_023373.

Q. HAVE THE APPLICANTS SUFFICIENTLY DESCRIBED THIS COMMITMENT TO EVALUATE WHETHER IT WOULD BE OF PUBLIC VALUE?

A. It is impossible to tell. The Applicants failed to provide any materials, budgets, or planning documents to support the $450,000 budget for this study. As a result, the Commission has no way of knowing how extensive of a study to expect or whether it will provide real value to Washington Gas, regulators, policy makers, or other stakeholders. The commitment is solely to conduct a study and to spend $450,000 on it.

Q. WOULD THIS STUDY DELIVER CONCRETE BENEFITS TO DISTRICT OF COLUMBIA RESIDENTS OR RATEPAYERS?

A. No. As proposed this study is simply an exercise in corporate research and development regarding potential future business opportunities for AltaGas, akin to the investigation their subsidiary has already conducted in British Columbia.

Q. IS ALTAGAS COMMITTING TO SHARE THE RESULTS OF THIS STUDY WITH THE DISTRICT OR THE PUBLIC?

A. No. For this study to even possibly be considered a benefit in this proceeding, it must be made public.

Q. HOW COULD THE RENEWABLE NATURAL GAS COMMITMENT BE IMPROVED?

A. This commitment could be improved in one (or both) of two ways to better advance Clean Energy DC. First, it could be structured as a commitment to actually develop or procure renewable natural gas (for example in an analog to an electric renewable portfolio standard). Developing a market for this resource could support a path forward for the natural gas distribution utility even in the face of deep decarbonization. By committing to begin a transformation into an infrastructure company that distributes renewable fuels, AltaGas and WGL would be embracing and supporting the decarbonization envisioned by the District while utilizing its existing infrastructure.

A second way this commitment could be improved would be to restructure it as support for some or all of the thermal decarbonization study called for by Clean Energy DC, and managed outside of AltaGas or WGLH control for the District's benefit. A portion of that broader study would relate to biogas.

3. Affordable Housing Multifamily Natural Gas Initiative

Q. DOES THE PROPOSED $2 MILLION COMMITMENT TO PAY FOR INTERIOR NATURAL GAS PIPING IN AFFORDABLE HOUSING SUPPORT THE DISTRICT'S POLICY, AS EMBODIED IN CLEAN ENERGY DC?

A. No. These funds would serve only to increase Washington Gas's customer base and effectively lock low-to-moderate income District of Columbia residents into using fossil natural gas for the next several decades. This fails to reduce fossil fuel use. In addition, it risks placing these low-to-moderate income families on the wrong side of escalating per-unit gas pipeline costs if city-wide pipeline gas use declines.

Q. WHAT ABOUT THE FUEL COST SAVINGS THESE FAMILIES MIGHT ENJOY IN THE MEANTIME?

A. Washington Gas has overstated the annual fuel cost savings that these households would enjoy from using natural gas instead of electricity. WGL witness Mr. Frye cites a savings of $400-500 per year.[75] However, this claim is based on a set of poor assumptions. These include: (1) not including the monthly customer charge for gas use (which an all-electric home would not pay), (2) not including any taxes, fees, or similar charges

[75] Exhibit JA (J) at 10.

on either electric or gas bills, (3) not using the actual electric rate that customers would pay, and (4) not including heat pump water heaters as an option.

Q. WHAT IS THE IMPACT OF CORRECTING THESE ERRORS?

A. I corrected these errors in the spreadsheet model that Mr. Frye presented as justification for his savings claim.[76] I also updated the energy factors (EF) of the water heater options to match those available as the least expensive major-brand appliances available at Home Depot.[77] The resulting annual energy costs can be found in Exhibit DCG (C)-2. For all-electric households, annual bills range between $479 and $753. For gas households, annual bills range between $645 and $803 – providing no savings compared with electricity.

[76] Exhibit DCG (C)-42.

[77] Except for the heat pump water heater, where I used an EF of 2.5 even though Home Depot sells a 3.5 EF product.

Q. WASHINGTON GAS AND PEPCO OFFER LOW-INCOME ASSISTANCE PROGRAMS, WHICH MAY BE AVAILABLE TO RESIDENTS OF AFFORDABLE HOUSING. IF YOU ASSUME THAT PARTICIPANTS IN THIS PROGRAM WOULD BE PARTICIPANTS IN THESE PROGRAMS, WOULD THIS CHANGE THE RELATIVE ECONOMICS?

A. No. For households that qualify for the Washington Gas Residential Essential Service (RES) program and Pepco Residential Aid Discount (RAD) program, the all-electric annual bills range from $403 to $634 while the gas annual bills range from $517 to $647. To give gas the benefit of the doubt I assumed that the high-price condition applied, giving a 70 percent winter reduction. If there were only a 55 percent reduction in delivery charges, the annual bills for gas use would range from $543 to $678. (I was uncertain whether the gas supply price Mr. Frye used would trigger the high price provision.)

In either RES case, electric options with heat pump water heaters (HPWHs) remain cheaper than gas, while those using resistance water heaters are in line with the higher-bill gas options. While HPWHs are more expensive, the DC SEU offers $500 rebates that bring their price down to within $200 of the upfront cost of a standard efficiency gas water

heater (based on prices at Home Depot) – resulting in a payback of less than two years for choosing the most efficient all-electric option. The HPWH I priced at Home Depot has an even higher EF (3.5) than the EF I assumed in expanding Mr. Frye's spreadsheet (2.5), so the payback could be even faster.

Q. WHAT ABOUT THE GREENHOUSE GAS EMISSION IMPACT OF USING GRID ELECTRICITY INSTEAD OF NATURAL GAS?

A. Right now, the electric grid has somewhat higher emissions than direct use of natural gas (setting aside the implications of methane leakage[78]). Across the range of household appliance efficiencies in Exhibit DCG (C)-2, annual CO2 emissions from the all-electric option range between 6,671 pounds and 10,478 pounds. Emissions from the gas options range between 5,103 pounds and 6,777 pounds. These calculations use the 2018 level of the District's RPS (16.5 percent), along with 2016 avoided emissions factors from EPA's AVERT tool.[79] By 2030, however, the District's RPS will bring emissions from the electric options down substantially. In 2032 the RPS will require 50 percent renewable electricity, while fossil natural gas emissions will be unchanged. By 2032, when the pipes installed under

[78] As discussed above, methane leakage could increase the effective GHG rate for District of Columbia's gas consumption substantially.

[79] Exhibit DCG (C)-43.

Washington Gas's program would be less than 15 years old, annual CO2 emissions from the all-electric option would range between 4,148 pounds and 6,516 pounds. (This calculation assumes the generation mix other than RPS renewables remains unchanged, which is a conservative assumption given the market forces challenging coal plants.) So, while near-term emissions reductions might be obtained from use of natural gas, in the longer term the electric option would have comparable or lower emissions.

Q. WOULD WASHINGTON GAS BENEFIT FROM THIS PROGRAM, EVEN IF PARTICIPANTS WOULD NOT?

A. Yes, Washington Gas would grow its customer base and its ratebase of distribution infrastructure. [redacted]

WGL would increase its ratebase by the capital investment in the service piping outside the building and the meters for each customer. If the new

[80] [redacted]

building required extension of distribution pipelines then that would add to ratebase, as well.

Q. IN YOUR OPINION, ARE FACTORS ONE AND SEVEN ADVANCED BY THE PROPOSED AFFORDABLE HOUSING PIPING PROGRAM?

A. No, they are not. The program has not been shown to save the residents of affordable housing any net savings on their energy bills, while effectively locking them into using a fuel with a pipeline infrastructure that might get significantly more expensive on a per-unit basis. Meanwhile, the environmental impacts are not conclusively in gas's favor when viewed over the lifetime of the building or even the lifetime of a typical heating system (20 or more years). If the funds directed to this initiative were instead provided to low-income weatherization or other efficiency programs, these problems would be cured.

4. Energy Storage or Tier One Renewable Resources

Q. DOES THE PROPOSED COMMITMENT TO BUILD OR CAUSE TO BE CONSTRUCTED A 5 MW ELECTRIC ENERGY STORAGE OR TIER 1 RENEWABLE RESOURCE IN THE WASHINGTON, DC AREA SUPPORT THE DISTRICT'S POLICY, AS EMBODIED IN CLEAN ENERGY DC?

A. Yes, if the resource provides benefits to the residents of the District of Columbia. The installation could provide such benefits by generating renewable energy credits (RECs) that are eligible for use in the District's RPS (or especially solar RECs if located within the boundaries of the District of Columbia), by contributing to the avoidance or deferral of other electric grid investments (such as new substations), or by increasing the reliability or resilience of the electric grid (such as through deployment as part of a microgrid).

Q. HAVE THE JOINT APPLICANTS COMMITTED TO BUILD THE RESOURCE REFERRED TO IN COMMITMENT 5 WITHIN THE DISTRICT OF COLUMBIA?

A. No.

Q. SHOULD THE ESTIMATED $7.8 MILLION INVESTMENT IN THIS RESOURCE BE CONSIDERED A MERGER BENEFIT?

A. No. While this would clearly be an expenditure on the part of the Applicants, they would also receive significant revenues (ultimately paid by ratepayers in the District of Columbia and elsewhere) for the operation of the facility. These revenues might come in the form of regulation service or capacity payments from the PJM markets (for storage) or energy, capacity, and REC payments (for generation). The net benefits to District of Columbia residents from this investment should be quantified based on the services the resource will provide and the costs DC residents will pay for those services, not based on the capital invested. These benefits cannot be quantified because the Applicants have not described the investment in sufficient detail.

It is also unclear whether this commitment should be considered to reflect a change from what would happen absent the merger. The policy and market supports for Tier 1 renewable energy generation and energy storage exist regardless of this case. WGLH, for example, has already invested in more than 5 MW of Tier 1 renewable resources in the District

of Columbia,[81] so it is unclear whether this commitment reflects anything more than what WGLH might construct absent the merger.

Q. DOES THIS CONCLUDE YOUR TESTIMONY?

A. Yes, it does.

[81] Exhibit DCG (C)-45 at DC-ALA-WGL_008763.