BEFORE THE
PUBLIC SERVICE COMMISSION
OF THE DISTRICT OF COLUMBIA

IN THE MATTER OF THE MERGER	**)**	
OF ALTAGAS LTD. AND	**)**	**Formal Case No.: 1142**
WGL HOLDINGS, INC.	**)**	

SETTLEMENT TESTIMONY
OF
PAUL J. HIBBARD

Exhibit JA (2Q)

On Behalf of
The Applicants

May 25, 2018

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I. INTRODUCTION AND SUMMARY OF POSITIONS

A. Introduction and Overview

Q. PLEASE STATE YOUR FULL NAME, BUSINESS ADDRESS AND OCCUPATION.

A. My name is Paul J. Hibbard. I am a Principal at Analysis Group, Inc. ("AGI"), an economic, finance and strategy consulting firm headquartered in Boston, Massachusetts, where I work on energy and environmental economic and policy consulting. My business address is 111 Huntington Avenue, 14th Floor, Boston, Massachusetts, 02199.

Q. HAVE YOU PREVIOUSLY SUBMITTED TESTIMONY BEFORE THE PUBLIC SERVICE COMMISSION OF THE DISTRICT OF COLUMBIA ("COMMISSION") IN THIS PROCEEDING?

A. Yes. I submitted rebuttal testimony on October 27, 2017, which included my background and experience. I also submitted post-settlement testimony in the related merger proceeding before the Maryland Public Service Commission on January 5, 2018.[1]

Q. WHAT IS THE PURPOSE OF YOUR POST-SETTLEMENT TESTIMONY?

A. I am testifying on behalf of AltaGas, Ltd. and WGL Holdings, Inc. ("Applicants") in Formal Case No. 1142, In the Matter of the Merger of

[1] Post-Settlement Testimony of Paul J. Hibbard, Maryland Public Service Commission Case No. 9449, January 5, 2018.

AltaGas, Ltd. and WGL Holdings, Inc., to provide the Commission with a description of and support for the environmental benefits of the additional commitments described in the Settlement Agreement that has been agreed to by the parties in Formal Case No. 1142.[2]

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

A. Yes.

B. Summary of My Post-Settlement Testimony and Conclusions

Q. PLEASE SUMMARIZE YOUR CONCLUSIONS.

A. I have three primary conclusions regarding the parties' settlement agreement:

- The settlement commitment to provide $4.2 million for energy efficiency and energy conservation initiatives, with a focus on low and limited-income residents, will reduce CO_2 emissions.[3] Specifically, over the lifetime of the installed measures, I estimate that CO_2 emissions will be reduced by 408.5 million pounds ("lbs").
- The settlement commitment to increase the size of the Tier 1

[2] Unanimous Agreement of Stipulation and Full Settlement, Public Service Commission of the District of Columbia Formal Case No. 1142, May 8, 2018 (hereafter "Settlement Agreement").

[3] Settlement Agreement, ¶ 3.

renewable or electric grid storage resource developed in the District to 10 MW will also reduce CO_2 emissions.[4] Specifically, I estimate that CO_2 emissions will be reduced by between 12.6 and 23.4 million lbs *each year* for the lifetime of the renewable or storage project.

- The settlement commitment to reduce the number of PHMSA-reported Grade 2 leaks each year between 2019 and 2023 will reduce methane emissions in the District.[5]

C. Organization of My Post-Settlement Testimony

Q. HOW IS YOUR POST-SETTLEMENT TESTIMONY ORGANIZED?

A. In Section II I summarize the settlement agreement terms that I believe are most relevant to the environmental and climate policy goals of the Commission and the District. In Section III I quantify, to the extent I am able, the environmental benefits of several of these settlement commitments. My conclusions are summarized in Section IV.

II. SUMMARY OF SETTLEMENT AGREEMENT TERMS PROVIDING QUANTIFIABLE BENEFITS RELATED TO THE ENVIRONMENT

Q. WHAT IS YOUR GENERAL POSITION ON WHETHER THE SETTLEMENT AGREEMENT REACHED BY THE PARTIES

[4] Settlement Agreement, ¶ 5.

[5] Settlement Agreement, ¶ 73.

WILL FURTHER THE ENVIRONMENTAL AND CLIMATE GOALS OF THE COMMISSION AND DISTRICT AND PROVIDE ENVIRONMENTAL BENEFITS?

A. The settlement agreement includes clear and meaningful commitments to address environmental and climate change risks associated with energy production and use, and charts a path by which AltaGas will work productively and cooperatively with the District, the Commission, and stakeholders to help meet the difficult challenges the District and the U.S. will face in the coming decades in the transition to a lower-carbon economy.

Q. COULD YOU PLEASE SUMMARIZE THE SPECIFIC SETTLEMENT AGREEMENT TERMS THAT YOU FIND ARE RELATED TO THESE ENVIRONMENTAL COMMITMENTS?

A. Yes. There are three specific commitments in the settlement agreement that lay out incremental environmental benefits:

- Commitment 3 provides for $4.2 million in energy efficiency and energy conservation funding, with a focus on low and limited-income residents;
- Commitment 5 increases the commitment to develop a Tier 1 renewable or energy storage project in the District to 10 MW; and
- Commitment 73 provides a commitment to reduce PHMSA-reported Grade 2 leaks to levels below the 2017 annual level, and imposes non-compliance payment penalties in the event the Company fails to achieve these reductions.

III. DESCRIPTION AND CALCULATION OF ENVIRONMENTAL BENEFITS

Q. WOULD YOU PLEASE DESCRIBE THE LIKELY ENVIRONMENTAL IMPACT DUE TO THE COMMITMENT TO FUND ENERGY EFFICIENCY AND ENERGY CONSERVATION PROGRAMS IN COMMITMENT 3?

A. Yes. A wealth of information collected by energy utilities demonstrates the extent of energy and demand reductions associated with investments in energy efficiency programs and measures. Energy savings, in turn, allow for reduced energy generation from fossil fuel units and, therefore, reduced emissions of CO_2 (as well as reduced impacts from emissions of other air pollutants and from the generation of liquid and solid waste) to meet end-user demand. Thus, the $4.2 million in funds provided will reduce CO_2 emissions. I estimate that lifetime CO_2 emissions will fall by 408.5 million lbs as a result of the commitment in Commitment 3.

Q. WOULD YOU PLEASE DESCRIBE IN MORE DETAIL THE METHODS, DATA, AND ANY UNDERLYING ASSUMPTIONS YOU RELIED UPON TO QUANTIFY THE ENVIRONMENTAL IMPACTS OF THE ENERGY EFFICIENCY AND ENERGY CONSERVATION FUNDING?

A. Yes. To estimate the CO_2 reductions due to the funds provided for energy efficiency and energy conservation programs, I proceed in two steps:

First, I estimate the amount of energy saved due to the $4.2 million going towards funding these programs. In order to develop this estimate, I rely on the compilation of data collected by the Northeast Energy Efficiency Partnership ("NEEP"). Specifically, I rely on the energy efficiency program measurement and verification data and analysis that is completed by the District's utilities, reviewed by the Department of Energy, and aggregated by NEEP. NEEP's data summarizes and organizes specific measured results of energy efficiency investments made within the state. Understanding that the commitment funding is focused on low-income households in particular, I identify NEEP data that allows me to calculate the District's lifetime cost of energy saved for these low-income programs in 2016 as $0.009 per kWh-saved.[6] Dividing the total monies spent on energy efficiency programs by this lifetime cost of energy yields lifetime energy savings.

[6] See https://reed.neep.org. NEEP provides lifetime energy savings as well as spending data for energy efficiency programs in the District. I calculate a lifetime cost of saved energy for low-income projects in the District by dividing the total lifetime energy savings for low income programs by the total cost of these programs in 2016. (see http://reed.neep.org/Glossary.aspx for further definitions). As described in NEEP documents, District utilities report energy efficiency data to the District of Columbia Sustainable Energy Utility ("DC SEU"), the agency in charge of all energy efficiency and renewable energy services. The DC SEU releases quarterly reports on energy efficiency. The Department of Energy retains a third party contractor to review the SEU's performance (see https://reed.neep.org/StateDocs-DC.aspx for more information). NEEP uses the data from the DC SEU in its reports.

Second, I estimate emissions reductions associated with the energy savings as the product of the energy savings and an emission rate for the portfolio of electric generation plants in the PJM region. I estimate the emission rate using the Gas Technology Institute's Source Energy and Emissions Analysis Tool ("SEEAT")[7] and the corresponding marginal emissions profile of the PJM region.[8] More specifically, the emission impact depends on the *effective* emission rate per unit of electricity used. This in turn depends on (1) the fuels and conversion efficiencies – and thus the associated emission rates per MWh generated – of generating units operating on the margin at the time of use, and (2) the bulk power system and distribution system losses in transmitting generated electricity to the point of end use. The SEEAT model approximates transmission/distribution losses based on location (in this case, a residential household in the District), and allows the user to select the appropriate mix

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[7] SEEAT is a publicly available model developed by the Gas Technology Institute ("GTI") available at http://www.cmictools.com/Default.aspx. The model relies on government data and other publicly available data sources to calculate point-of-use energy consumption and associated greenhouse gas emissions for various heating systems, cooling systems, and household appliances. Most inputs to the SEEAT model, including geographic area, electricity generation mix, composite emissions factors, and source energy factors, can be user-specified.

[8] I base this analysis on the marginal mix of plants over the full year under the understanding that energy efficiency and energy conservation programs would be in effect throughout the year. *See* Exhibit JA (2Q)-1.

of generating resources to approximate emission rates at the point of generation.

For this purpose, I use data from PJM to derive the average marginal fuel of the generation portfolio within the PJM region, in which the District resides. I summarize this electric generation portfolio in Exhibit JA (2Q)-1. I assume the average mix of resources operating on the margin since this represents the average emission rate that would be avoided at the time of use by avoiding or reducing electricity use.[9] The product of the emission rates and energy savings yields CO_2 reductions. Exhibit JA (2Q)-2 provides these results.

Q. WOULD YOU PLEASE DESCRIBE THE LIKELY ENVIRONMENTAL IMPACT OF INSTALLING 10 MW OF TIER 1 RENEWABLE GENERATION OR ENERGY STORAGE?

A. The settlement agreement requires the Applicants to invest in 10 MW of electricity storage or "Tier One" renewable resources. While any or all of such energy technologies can generate emission reductions and other environmental benefits, the ability to estimate such benefits is

[9] Over time the actual emission rate of generation at the time of use may be higher or lower depending on changes in the mix of resources operating in the region, and reduced demand associated with the installment of energy efficiency and conservation measures. However, for the purpose of estimating emission reduction benefits, I consider the recent average of marginal PJM emission rates to be a reasonable proxy given the scope and scale of use anticipated due to the settlement agreement.

complicated by not knowing how the investments will be made, and by the fact it is difficult to forecast with specificity the benefits that may accrue due to storage technologies. Thus, my quantification of benefits necessarily relies upon a simplified approximation using renewable resource investment as a proxy, discussed below.

Installing low- or zero-carbon renewable generation – whether grid-connected or distributed – will reduce energy generated from higher-carbon resources on the system, and thereby reduce CO_2 emissions. But the ultimate impact of investments in storage technologies are more complex and uncertain. With storage, there are multiple modes of benefit – for example, immediate reductions in CO_2 emissions from storage could be realized if energy is stored at night when the marginal emission rate (of production) is low, and discharged during peak daytime hours when the marginal emission rate is higher. Longer-term emission reductions could flow if investments in storage capacity lead to the reliable integration of a greater quantity of variable renewable resources than otherwise would be installed. Conversely, while this may be a less likely outcome, storage could be used at times in ways that could lead to a net increase in emissions

(e.g., if energy is released when marginal emission rates are lower than at the time the energy is stored).[10]

Since the settlement agreement does not mandate the type or mix of storage/renewable technology investment, it is difficult to forecast the nature and quantity of potential emission reduction benefit of this commitment. However, I expect that it is more likely than not that this merger commitment will lead to investment in advanced energy technologies that will, over time, improve the emission profile of PJM operations, and produce emission reduction benefits. While the precise quantity of emission reductions is not possible to quantify at this time, I have made certain assumptions to conservatively approximate the potential magnitude of public health and environmental benefit associated with this commitment.

Specifically, I calculate the per MW impact of the commitment assuming that the generation portfolio to be constructed will be an investment in renewable resources, and that those resources will be some

[10] Storage is often viewed as an enabling resource - one that can directly support the reliability, capacity value, or cost reduction benefits of variable renewable resources. (U.S. Department of Energy, "Energy Storage," available at https://energy.gov/oe/activities/technology-development/energy-storage, accessed May 23, 2018.) However, to the extent storage is used exclusively to arbitrage energy prices in wholesale markets, the financial viability of this option rests with being able to use energy generated in low-price hours to support production in higher-priced hours, when the emission rates of marginal generation are often – if not mostly – higher than during lower-priced hours. (U.S. Environmental Protection Agency, "Electricity Storage," available at https://www.epa.gov/energy/electricity-storage, accessed May 23, 2018.)

mix of wind and solar. While wind and solar emit zero emissions, they also have lower capacity factors compared to conventional generation technologies. Consequently, I estimate the potential magnitude of emission reduction benefits of every MW of wind and solar assuming a mix operating at capacity factors typical of such resources in this region. Based on these assumptions, I approximate the annual CO_2 emission reduction benefit of this merger commitment to be between 1.3 and 2.3 million pounds per MW per year. As shown in Exhibit JA (2Q)-3, if all 10 MW of the commitment were to be constructed as some mix of wind and solar, I estimate that it would reduce annual CO_2 emissions by between 12.6 and 23.4 million pounds.

Q. WOULD YOU PLEASE DESCRIBE THE LIKELY ENVIRONMENTAL IMPACT OF REDUCING GRADE 2 METHANE LEAKS ON PIPELINES BY 2023 BY 10 PERCENT FROM THE 2017 ANNUAL LEVEL?

A. Yes. Quantifying such an impact is inherently difficult in that no information that I am aware of provides specific data on the emissions from Grade 1 leaks as compared to Grade 2 leaks. Such data are necessary to allow me to accurately estimate these impacts. However, despite the lack of specific data, any incremental reduction in the number of pipeline leaks due to the settlement commitments will reduce the release of methane, a powerful greenhouse gas. As such, this commitment would provide environmental benefits to the District.

IV. CONCLUSIONS

Q. PLEASE SUMMARIZE YOUR CONCLUSIONS.

A. In this testimony I evaluate three elements of the parties' settlement agreement that provide quantifiable environmental benefits. First, I find that the settlement commitment to provide $4.2 million for energy efficiency and energy conservation initiatives will lead to a reduction in CO_2 emissions equal to 408.5 million lbs. Second, I find that the settlement commitment to increase the size of the Tier 1 renewable or electric grid storage resource developed in the District to 10 MW will reduce CO_2 emissions by between 12.6 and 23.4 million lbs *each year* for the lifetime of the renewable or storage project. Finally, the settlement commitment to reduce the number of PHMSA-reported Grade 2 leaks each year between 2019 and 2023 will reduce methane emissions in the District.

I declare under penalty of perjury that the foregoing testimony is true and correct to the best of my knowledge, information, and belief.

Executed this _24_ day of May, 2018.

Paul J. Hibbard

Exhibit JA (2Q)-1
PJM Full Year Average Marginal Fuel Type

Emission Category	PJM Full Year Average Marginal Fuel Posting
Coal	37.8%
Natural Gas	47.9%
Oil	5.2%
Other Nonrenewable	0.3%
Solar	0.2%
Nuclear	1.6%
Wind	6.9%

Note:
In 2017, 0.01% of the time the marginal unit was classified as "Missing Data," and 0.07% of the time as "Min Gen/Dispatch Reset." These categories are excluded from the calculated 2016 annual average marginal fuel posting.

Source:
Monitoring Analytics, 2017 Marginal Fuel Postings, available at http://www.monitoringanalytics.com/data/marginal_fuel.shtml.

Exhibit JA (2Q)-2
Lifetime CO_2 Emissions Reduction from Energy Efficiency Funding

Energy Efficiency Funding ($) $[A]_1$	D.C. Lifetime Cost of Energy - Low Income Programs ($/kWh) $[B]_2$	Energy Efficiency Savings (MWh) $[A]_1 / [B]_2 / 1000 = [C]$	Emission Rate Electricity (lbs CO_2/MWh) $[D]_3$	Lifetime Emission Reduction (lbs CO_2) $[C] * [D]_3 = [E]$
4,200,000	0.009	466,667	875	408,520,000

Sources:

[1] Energy efficiency commitment corresponds to ⁋ 3 of the Unanimous Agreement of Stipulation and Full Settlement submitted in the context of the AltaGas-WGL merger to the Public Service Commission of the District of Columbia on May 8, 2018.

[2] District of Columbia Lifetime Cost of Energy - Low Income Programs is calculated using 2016 NEEP REED data.

[3] Emission rate data is from the Gas Technology Institute's SEEAT tool.

[4] Monitoring Analytics, 2017 Marginal Fuel Postings, available at http://www.monitoringanalytics.com/data/marginal_fuel.shtml.

Exhibit JA (2Q)-3
Annual Emissions Reduction from Tier 1 Renewable Resource

Percent of Commitment Allocation, by Fuel Type	Tier 1 Resource Commitment (MW) $[A]_1$	Capacity Factor $[B]_2$	Annual Tier 1 Replacement of Baseload (MWh) $[A]_1 * [B]_2 * 8{,}760hrs = [C]$	Emission Rate Electricity (lbs CO_2/MWh) $[D]_3$	Annual Emission Reduction (lbs CO_2) $[C] * [D]_3 = [E]$	Annual Emission Reduction per MW (lbs CO_2) $[E] / [A] = [F]$
100% Wind	10	30%	26,706	875	23,378,301	2,337,830
50% Wind, 50% Solar	10	23%	20,552	875	17,991,325	1,799,133
100 % Solar	10	16%	14,398	875	12,604,350	1,260,435

Sources:

[1] The renewable generation development in the District of Columbia commitment corresponds to ⁋ 5 of the Unanimous Agreement of Stipulation and Full Settlement submitted in the context of the AltaGas-WGL merger to the Public Service Commission of the District of Columbia on May 8, 2018.

[2] The capacity factors for PJM in 2016 from SNL Financial are: wind (30%) and solar (16%). For the mix of solar and wind, this table uses the average of the solar and wind capacity factors, 23%.

[3] Emission rate data is from the Gas Technology Institute's SEEAT tool.

CERTIFICATE OF SERVICE

I, the undersigned counsel, hereby certify that on this 25th day of May, 2018, I caused copies of the foregoing to be hand-delivered, mailed, postage-prepaid, or electronically delivered to the following:

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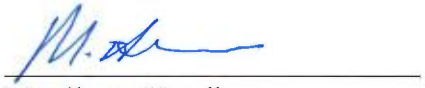

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