DAVID S. LAPP
PEOPLE'S COUNSEL

WILLIAM F. FIELDS
DEPUTY PEOPLE'S COUNSEL

JULIANA BELL
DEPUTY PEOPLE'S COUNSEL

OPC
OFFICE OF PEOPLE'S COUNSEL
State of Maryland

6 ST. PAUL STREET, SUITE 2102
BALTIMORE, MARYLAND 21202
WWW.OPC.MARYLAND.GOV

NICOLE L. ZEICHNER
ASSISTANT PEOPLE'S COUNSEL
NICOLE.ZEICHNER@MARYLAND.GOV

February 22, 2023

Andrew Johnston, Executive Secretary
Maryland Public Service Commission
6 St. Paul Street, 16th Floor
Baltimore, Maryland 21202

Re: Case No. 9648—OPC Comments on WGL's *Preliminary Market Assessment: Maryland Gas Heat Pump Technology*

Dear Mr. Johnston:

The Office of People's Counsel files these comments, prepared with the assistance of Synapse Energy Economics, Inc. ("Synapse"), regarding Washington Gas Light Company's ("WGL") *Preliminary Market Assessment: Maryland Gas Heat Pump Technology* ("Market Assessment"), which was prepared for WGL by GTI Energy.[1] As explained below, because WGL's assessment—once corrected for its flawed assumptions—shows gas heat pumps are inferior for reducing greenhouse gas emissions, and because increasing customer reliance on fossil fuels is inconsistent with the State's climate policy and customer interests, the Commission should direct WGL to end its gas heat pump pilot program.

The crux of WGL's Market Assessment is an analysis purporting to compare the respective carbon dioxide (CO2) emissions intensities of a "market-prevalent" gas heat pump ("GHP"), an electric heat pump ("EHP"), and a gas furnace. Based on its analysis, WGL concludes that GHPs have significant CO2 abatement and market potential. However, WGL's analysis contains erroneous assumptions regarding both the efficiency of market-prevalent EHPs and the emissions intensity of the electricity that powers them. Taken together, WGL's errors significantly overstate the CO2 emissions intensity of EHPs and thereby paint GHPs' GHG abatement potential in a much rosier light than the facts warrant. In fact, based both on EHPs' greater efficiency and the fact that Maryland's electricity supply will grow increasingly clean under the State's Renewable Portfolio Standard[2], EHPs have far more potential to reduce CO2 emissions in Maryland than GHPs. The analysis in WGL's Market Assessment fails to show otherwise. Further, WGL's filing provides no basis to believe that GHPs will ever be

[1] ML No. 300743.
[2] PUA § 7-703.

cost-competitive with EHPs. Consequently, WGL's Market Assessment does not support WGL's conclusion that GHPs have "promising potential" or that a pilot could help "prove the concept of GHPs being a viable solution to drive deeper GHG abatement within an end-use reduction program portfolio."[3]

Background

On August 23, 2021, WGL filed updated proposals with the Commission for its Gas Heat Pump Pilot program and a separate demand response pilot program.[4] The Commission approved the pilots on October 27, 2021[5], with the modifications recommended by Staff and OPC.[6] In its August 23, 2021 filing, WGL stated that it would commission a market assessment concerning gas heat pumps in Maryland, and that it anticipated completing the market assessment during Q4 of 2021 and Q1 of 2022.[7] WGL did not file a preliminary market assessment until January 5, 2023.[8]

Comments

I. WGL's preliminary assessment fails to identify any commercialized or near-commercialized gas heat pumps.

Despite apparently being a year behind schedule, WGL's Market Assessment fails to deliver the assessment that the Commission required when it approved the pilot. WGL's revised pilot proposal, approved in October 2021, stated that the "first phase" of its pilot "will entail market research and analysis to identify commercialized or near-commercialized GHP units."[9] WGL told the Commission it would work with the Gas Technology Institute (GTI) "to conduct a comprehensive market assessment by leveraging previous GHP market analyses and engaging directly with product developers and manufacturers."[10] The proposal cited "various market and end use applications" and "different technology types," concluding that "a pilot-specific market assessment will help prioritize which GHPs best fit Maryland's climate, building stock and customer base."[11]

For reasons that WGL does not explain, the Market Assessment that WGL submitted on January 5 fails to identify a single commercialized or near-commercialized

[3] ML No. 300743 at 7.
[4] ML No. 236756.
[5] ML No. 237601.
[6] ML No. 237563.
[7] ML No. 236756 at 21
[8] ML No. 300743.
[9] ML No. 236756 at 16-17.
[10] *Id.*
[11] *Id.*

GHP for acquisition and deployment in the pilot.[12] Instead, the Market Assessment mostly restates WGL's arguments from 2021 for why the pilot has value, while supplementing them with a comparative analysis of GHPs, EHPs, and gas furnaces that, as OPC explains below, is seriously flawed.[13]

WGL's silence concerning commercialized or near-commercialized GHPs raises questions about what GHP installations WGL has conducted to date, and what additional installations can be completed in time for evaluation during the pilot. In the Market Assessment, WGL says that "the pilot program will focus on installing and monitoring … residential GHP combi units and/or GHP space heat only units."[14] But the Assessment also states that "[m]anufacturers with market ready GHPs at the time of this Assessment are primarily serving the commercial buildings market," though a "limited offering of residential products" is expected in 2023.[15] More recently, in its February 15, 2023 semi-annual report to the Commission, WGL stated that it began installation of GHP units in Q4 of 2022.[16] Presumably these were all commercial-sector installations. But that begs the question of whether any residential GHPs can be both installed and evaluated within the pilot timeline.

More importantly, the apparent lack of appropriate and available GHPs for the pilot undermines the factual basis of WGL's comparative analysis. That analysis assumes the availability of a *residential* GHP operating at a "market-prevalent" efficiency. But if there is no market for residential GHPs, there can be no market-prevalent efficiency for such units. Consequently, the analysis is at best a projection of how a residential GHP *would* compare to an EHP and a gas furnace if, like the EHP and the furnace, the GHP were commercially available.

EHPs are a much more advanced technology than GHPs and—as WGL acknowledges[17]—they enjoy much greater federal and state policy support. For example, for the next ten years the 2022 Inflation Reduction Act provides a tax credit of 30 percent of the project cost, up to $2,000, for the installation of many EHPs. While both EHPs and GHPs are eligible for this credit, to date only EHPs have been certified as meeting the

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[12] WGL also does not explain its rationale for filing a *preliminary* assessment (or indicate when it might file a final assessment).
[13] WGL does not explain why it styled its submission as a "preliminary" assessment, rather than a final assessment, or whether it intends to submit a market assessment that accomplishes what was proposed.
[14] ML No. 300743 at 5.
[15] ML No. 300743 at 7.
[16] Washington Gas Light Company, *Washington Gas EmPOWER Maryland Semi-Annual Report: July 1, 2022 – December 31, 2022*, 19 (February 15, 2023) ML No. 301347.
[17] ML No. 300743 at 7.

efficiency ratings necessary to qualify for the credit.[18] The reason for policymakers' preference for EHPs is that EHPs are recognized both in the U.S. and internationally as a mature and ever-improving building decarbonization solution.[19] By contrast, because GHPs are technologically immature and less efficient than EHPs, they are not recognized as decarbonization solutions, and WGL's Market Assessment provides no reason to believe they will be.

II. WGL's analysis understates the energy efficiency of the electric heat pump that it compares to a gas furnace and a gas heat pump.

A. For an electric heat pump with a Heating Seasonal Performance Factor of 9.0, the correct coefficient of performance is 2.6, not 2.4.

In its comparison of gas heat pumps to electric heat pumps to gas furnaces, WGL incorrectly assigns a coefficient of performance ("COP") of 2.4 to an EHP with a Heating Seasonal Performance Factor ("HSPF") of 9.0. As a result, WGL understates the EHP's efficiency and overstates its emissions intensity.

By way of background, COP and HSPF are different efficiency metrics for heat pumps. COP, which applies to both EHPs and GHPs, is the ratio of the amount of energy the pump is providing as heat to the amount of energy going into the pump in the form of electricity or gas. The higher the COP, the more efficient the heat pump. HSPF, on the other hand, applies only to EHPs. The U.S. Department of Energy defines HSPF as "a measure over an average heating season of the total heat provided to the conditioned space, expressed in Btu, divided by the total electrical energy consumed by the heat pump system, expressed in watt-hours."[20]

WGL modeled how many units of energy are required for a gas furnace, a GHP, and an EHP each to produce 86 units of energy for space heating based on an assumed efficiency factor for each technology. Then WGL calculated how much primary energy each technology needs to produce 86 units of energy, based on assumptions about the efficiency of gas production, electricity generation, and electricity transmission.

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[18] *See* https://www.energystar.gov/about/federal_tax_credits/air_source_heat_pumps
[19] *See*, e.g., International Energy Agency, *Heat Pumps: Technology Deep Dive* (September, 2022), available at https://www.iea.org/reports/heat-pumps
[20] *See* U.S. Department of Energy, "Air Source Heat Pumps," at https://www.energy.gov/energysaver/air-source-heat-pumps

WGL used a COP of 1.4 for the gas heat pump it models, which it says is a "market-prevalent efficiency."[21] For the EHP, WGL used a COP of 2.4 in its calculations,[22] claiming that this COP applies to a heat pump with a 9.0 HSPF rating. But in fact, a HSPF of 9.0 corresponds to a COP of about 2.6. [23] (A COP of 2.4 corresponds to a lower HSPF of 8.2). By using the lower COP in its calculations, WGL overstated the amount of energy input an EHP with an HSPF rating of 9.0 needs to produce 86 units of heat energy, and therefore also overstated the CO2 emissions intensity of the EHP. Had WGL used a COP of 2.6 for the modeled EHP, it would have calculated the primary energy requirement for the EHP as 77.7 units, rather than 85.4, and would have calculated an emissions intensity differential of 22 percent relative to a gas furnace, not 14.6 percent.

B. WGL's analysis improperly uses a winter seasonal-average COP for the GHP while using a winter peak COP for the EHP.

As noted above, WGL incorrectly modeled an EHP with a 9.0 HSPF as having a COP of 2.4, rather than 2.6. In fact, however, WGL should have modeled an EHP with an HSPF of 10 and a COP of 2.9.

The 1.4 COP that WGL used for its GHP is a winter seasonal average COP, rather than a winter peak COP. To make an apples-to-apples comparison, WGL should also have used a seasonal average COP for the EHP. That would have meant using a COP of about 2.9 (which corresponds to an HSPF of more than 10).[24] During winter peak conditions, the EHP's efficiency would be lower—but a GHP's COP would likewise be lower than 1.4. Indeed, WGL's filing states that in commercial applications GHPs would rely on traditional boilers during peak winter conditions. This means that these commercial buildings would be heated by systems with efficiencies under 100 percent at winter peak. Meanwhile, cold-climate EHPs can have COPs well over 1.5 even at 5 degrees Fahrenheit, and greater than 2.0 at Maryland's design temperatures (which range

[21] ML No. 300743 at 5. For purposes of these comments, OPC assumes that residential GHPs, if successfully commercialized in the future, would operate with a seasonal average COP of 1.4, as GHPs for the commercial market currently do. WGL's Market Assessment acknowledges that GHP manufacturers have not served the residential market to date: "Manufacturers with market ready GHPs at the time of this Assessment are primarily serving the commercial buildings market. Other GHP manufacturers are in the process of commercializing a limited offering of residential products in 2023, with additional models expected in the following years." ML No. 300743 at 7.
[22] WGL states this number as "~2.4." ML No. 300743 at 4.
[23] *See* Northeast Energy Efficiency Partnership, *Cold Climate Air Source Heat Pump List*, available at https://ashp.neep.org/#!/product_list/.
[24] *See id.*

from 10 to 22 °F).[25] A field study of EHP performance in Vermont, which has much colder winters, found that the average COPs of electric heat pumps range from 2 to 2.7 at temperatures equivalent to the coldest days in Maryland.[26]

That same study found much higher COPs at the higher temperatures typical of Maryland winters, such as the 40 degrees assumed by WGL's modeling. For example, the Vermont study found a COP of 3.2 at 30 °F and a COP of 3.6 at 40 °F.[27]

In sum, to make a fair and accurate comparison between a GHP (assuming it was commercially available) and an EHP, WGL should have used a COP of 2.9 for the EHP in its analysis (which corresponds to an HSPF of more than 10 and reflects a seasonal average), not a COP of 2.4. Had WGL properly modeled an EHP with a COP of 2.9, its calculations for the EHP's energy input and emissions intensity would have been significantly lower.

III. WGL's analysis overstates the emissions rate of electricity that will power EHPs in Maryland.

WGL's analysis assumes that 100 percent of the electricity used by the EHP is generated by a combined-cycle gas power plant. This assumption is inappropriate—and also results in an overstated CO2 intensity rate for the EHP—because marginal emissions rates in Maryland will decrease in coming years to comply with the state's Renewable Portfolio Standard (RPS) target of 50 percent by 2030.[28]

While gas generation is typically on the margin in short-term market dispatch in the PJM Interconnection, the RPS requires that any incremental electricity demand (such as from a new heat pump) in 2030 be met with at least 50 percent incremental renewable generation over the course of the year. Moreover, that fraction will increase further over time. Although there may be times when marginal emission rates are higher—*e.g.*, during

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[25] Winter heating design temperature is the outdoor temperature that a location stays above for 99% of all the hours in the year, based on a 30-year average. The design temperatures cited above are from a 2015 EPA guide and would likely be higher based on more current data. *See* U.S. EPA. 2015. ENERGY STAR Certified Homes County-Level Design Temperature Reference Guide, available at https://www.energystar.gov/ia/partners/bldrs_lenders_raters/downloads/County%20Level%20Design%20Temperature%20Reference%20Guide%20-%202015-06-24.pdf.

[26] Cadmus Group. 2017. *Evaluation of Cold Climate Heat Pumps in Vermont*. Figure 14. Available at: https://publicservice.vermont.gov/sites/dps/files/documents/Energy_Efficiency/Reports/Evaluation%20of%20Cold%20Climate%20Heat%20Pumps%20in%20Vermont.pdf; National Weather Service. Monthly Climate Plots: Baltimore/Washington, available at: https://www.weather.gov/lwx/cliplot_monthly?site=KBWI.

[27] *Id.*

[28] PUA § 7-703.

severe cold snaps when inefficient gas turbines are typically on the margin in PJM—Maryland's policy objectives are grounded in aggregate, not momentary, emissions. When Maryland's renewable electricity policies are properly accounted for, the long-term marginal generation resource powering a new electric heat pump in the State would meet the heat pump's load with much lower-carbon electricity than WGL assumes.

Had WGL used an appropriate long-term marginal emissions rate it would have calculated a much larger emissions intensity differential for the EHP, relative to the GHP and the gas furnace. Instead, WGL used a short-term marginal emissions rate that in any case does not reflect marginal emissions in the PJM Interconnection at all times.[29] Specifically, if in addition to using a COP of 2.9, WGL had assumed that 50 percent of electricity supplied to EHPs came from zero-carbon resources, it would have calculated an emissions intensity of about 356, which is *48 percent lower* than the emissions intensity of the GHP and represents a 65 percent reduction relative to gas furnace.[30] In fact, it would be appropriate to use an even lower electric emission rate because WGL's analysis should start from a hypothetical future year in which GHPs are readily available on the market, by which time the electric grid will be even cleaner.

Conclusion

WGL's Market Analysis dramatically overstates the benefits of GHPs relative to EHPs and provides no reason to believe that GHPs will ever be cost-competitive with EHPs. Since the Commission's initial approval[31] of WGL's GHP pilot program – with OPC's initial support – the Climate Solutions Now Act of 2022 was enacted. Maryland now has aggressive policy goals that strive for a 60 percent reduction in 2006 GHG emissions levels by 2031.[32] GHPs are not yet available to residential customers in the United States, and by the time that they are, it is expected that technological innovations will lead to even more efficient commercially available and cost-effective EHPs.[33] Meanwhile, the cost of efficient EHPs is decreasing, in part due to tax credits under the Inflation Reduction Act.

Investing time and resources on a new type of fossil fuel appliance is the wrong path for Maryland. Additionally, WGL is over a year behind in its originally anticipated

[29] At times, wind is on the margin in PJM during the winter.
[30] The CO2 intensity of an EHP with HSPF 9, as assumed by WGL, would be about 30 percent lower than that of the GHP.
[31] ML No. 236756.
[32] Envir. Art. § 2-1204.1.
[33] *See* https://www.energy.gov/eere/buildings/residential-cold-climate-heat-pump-challenge.

pilot schedule, which means that—absent a highly expedited schedule—any findings will not be available in time for 2024-2026 program planning. The Commission should end this pilot program before any additional ratepayer funds are expended on a technology that is inconsistent with Maryland's policy goals.

Sincerely,

/electronic signature/
Nicole L. Zeichner
Assistant People's Counsel

/electronic signature/
Mark C. Szybist
Assistant People's Counsel

NLZ/bl
cc: All Parties of Record