INTERFAITH Power & Light
MD . DC . NoVA

February 24, 2025

HB 973, Better Buildings Act of 2025
Position: **FAVORABLE**

"Do the best you can until you know better. **Then when you know better, *do better*.**"

— Maya Angelou

There is no good reason to build a gas-burning building in Maryland ever again.

Today, we can build better buildings than we did in the past: all-electric heat pumps, heat pump water heaters, and induction stoves are more efficient than their gas-burning predecessors, healthier to breathe around, don't require leaking pipes or risk explosions, and protect our damaged climate. So now that we know better, state law should require that we do better.

Maryland's faith communities are doing *our* best to care for our neighbors and our common home. And that's why we want to live, work, and pray in buildings that don't burn gas indoors.

Our communities understand the harms of gas-burning because we have measured the pollution ourselves.

We are one of several grassroots organizations in Maryland using hand-held detectors both to measure methane leaks outdoors and to measure nitrogen oxide (NO2) indoors. NO2 is a respiratory irritant generated by gas-burning stoves. The EPA's outdoor guideline for safe levels of NO2 is 100 parts per billion. Our colleagues at the Maryland Just Power Alliance (including Action in Montgomery, People Acting Together in Howard, and Anne Arundel Connecting Together), Adama Harouna and her team, have **measured NO2 in over three hundred kitchens** at Cider Mill Apartments in Gaithersburg, Enclave high rises in White Oak, and in Northwest Park's garden-style apartments. One such tenant was Ana Argueta in Silver Spring. After her gas-burning stove was on for twenty minutes, measured nitrogen oxide at 434 ppb, **four times the EPA outdoor limit.** Adama says that many of the kitchens she tests reach unhealthy NO2 levels when the families cook, contributing to asthma and other breathing problems, especially for young and old. We give a dish towel to every household with a gas-burning kitchen we test, sharing tips for reducing the impact of gas-burning on the air families are breathing.

Last November, IPL-DMV, the Maryland Just Power Alliance, and the Maryland Sierra Club published a joint report, *Cooking up Danger*, that detailed the findings of our extensive community science campaign. Of the nearly 700 gas-burning kitchens in the District of Columbia and Maryland tested for nitrogen dioxide, we found that nearly two-thirds exceeded the Environmental Protection Agency's health standard for safe outdoor exposure to nitrogen dioxide. Maryland has the opportunity to prevent further harms to our neighbors by passing legislation that would make our homes, houses of worship, and schools safer to breathe in.

Electrifying our homes and electrifying gas-burning buildings can be difficult and expensive. By contrast, **building Maryland buildings better to begin with is easy**. That's why grassroots coalitions helped pass all-electric building code bills already in Montgomery County, where we danced the "electric slide" in front of the council chambers, and in Howard County, where a series of passionate high school students led off supportive testimony from over a dozen community groups. Similar legislation will be introduced soon in Baltimore City.

Because of several years of grassroots education undertaken by a dozen organizations, a groundswell of Marylanders know better, and want to do better. We call on our leaders now to do your best for us, too.

BEYOND GAS

COOKING UP DANGER

Community Study Reveals Hazardous Nitrogen Dioxide Levels in DC and Maryland Kitchens

November 2024

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EXECUTIVE SUMMARY

When stoves, ovens, furnaces, and water heaters burn gas in our homes, they emit nitrogen dioxide, a chemical compound also known as NO_2. Though odorless and not visible at lower levels, NO_2 can have significant long-term impacts on human health, exacerbating respiratory issues and diseases.

Key Takeaways

Community scientists have tested nearly 700 DC and Maryland kitchens for NO_2. Nearly two-thirds of the kitchens tested in District of Columbia and Montgomery County, Maryland had unsafe levels of nitrogen dioxide (NO_2).

- Of the 663 kitchens tested, 416 (or 63%) recorded NO_2 readings at or above 100 parts per billion (ppb), the U.S. Environmental Protection Agency's health-protective standard for one hour of exposure.
- Of 269 kitchens tested in DC, 206 (or 77%) recorded readings over 100 ppb.
- Of 394 kitchens tested in Montgomery County, 210 (or 53%) recorded readings over 100 ppb.
- The average high NO_2 concentration was 168 ppb for all 663 tests, 181 ppb in DC, and 159 ppb in Maryland.
- The EPA's 100 ppb NO_2 health standard is for outdoor exposure. As we learned during the COVID-19 pandemic, breathing health-harming pollution concentrated indoors – where we spend most of our time – is far more dangerous. The EPA lacks the legal authority to regulate indoor NO_2.
- NO_2 is linked to a range of negative health consequences, including respiratory diseases like asthma and chronic obstructive pulmonary disease (COPD) as well as cardiovascular issues such as hypertension and heart attacks. Emerging evidence has shown NO_2 could be tied to increased risk of developing Type 2 diabetes as well as cognitive development and behavioral issues in children.
- With majorities of homes tested in DC and Montgomery County having unsafe levels of NO_2, policymakers and regulators in both jurisdictions must prioritize helping families upgrade to electric appliances.

The testing protocol involved turning on the stove for 30 minutes (either oven at 350° F and two burners on high, or turning on four burners and not the oven). Nitrogen dioxide levels were recorded after 15 minutes, at 30 minutes, and 15 minutes after the stove was turned off.

Stoves are centrally located in families' living spaces and are typically not vented outside, trapping emissions inside the home. People usually stand directly above the stove as it emits pollutants, often with young or elderly family members nearby, leading them to directly breathe in this pollution. Because of these concerns, the Beyond Gas citizen scientists decided to test NO_2 emissions in DC and Maryland kitchens.

We found indoor NO_2 pollution levels from moderate gas stove use far above the health standard set by the EPA for outdoor exposure, demonstrating that DC and Maryland residents would be well served by an accelerated transition away from burning gas in our homes and buildings.

Who We Are

This investigation is a project of Beyond Gas DC and Beyond Gas Maryland, a collaboration of:

- Action in Montgomery (AIM)
- Interfaith Power & Light (DC. MD.NoVA)
- Sierra Club
- Washington Interfaith Network (WIN)
- A growing number of DC and Maryland climate, faith, and community organizations and concerned citizens

Together we are working to speed our region's transition from burning fossil fuels in buildings to non-polluting, climate-friendly, and highly efficient energy.

Sampling chocolate fondue prepared on an all-electric induction cooktop at Saint Peter's Episcopal Church in Poolesville.

INTRODUCTION

Nitrogen dioxide is a significant air pollutant, primarily produced through human activities, especially the burning of fossil fuels like coal, oil, methane gas, and gasoline. Burning methane gas in stoves, ovens, furnaces, and water heaters is the primary source of nitrogen dioxide (NO_2) in homes and other buildings. The fumes emitted by furnaces, dryers, and water heaters are legally required to be vented outdoors, but stove emissions are not legally required to be vented outside and most are not. Thus, stoves are a major source of NO_2 that people breathe inside their homes.

Exposure to NO_2 is linked to an array of negative health outcomes. NO_2 can irritate the respiratory system, reduce lung function, and increase the risk of respiratory infections. Long-term exposure can contribute to the development of asthma, COPD, and other respiratory diseases. NO_2 exposure is also linked to an increased risk of cardiovascular diseases, such as hypertension, heart attacks, and other heart-related problems. Emerging research has shown that among young children, NO_2 exposure may be linked to cognitive and behavioral issues. Evidence also suggests that chronic exposure to air pollution, including NO_2, may be associated with an increased risk of developing type 2 diabetes. While respiratory effects like asthma and lung irritation are the most direct consequences of NO_2 exposure, its impact on overall health is broad, influencing various bodily systems and potentially contributing to long-term health issues.

Amid rising awareness that burning of fossil fuels in buildings causes air pollution, many communities in DC and Maryland are concerned about the public health threat of burning gas in their homes. The product that gas utilities call "natural" gas, which is mostly methane, is also a concern for climate reasons, as buildings represent more than 16% of Maryland's climate pollution. Despite this growing awareness, DC and Montgomery County's gas utility Washington Gas, owned by the Canadian multinational AltaGas, continues to resist the transition to clean energy.

Methane is a highly potent greenhouse gas whose climate warming impact is 84 times as great as carbon dioxide. Recent studies show that fugitive emissions — gas leaking from drill sites, transmission pipelines, and the distribution pipes under our streets and in our homes — are happening at far higher rates than previous estimates.[1]

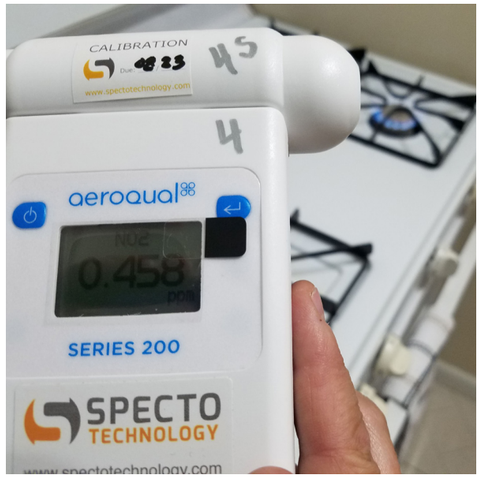
In 2020, after being denied access to the leaks data Washington Gas collects and shares with the District's Public Service Commission, a group of climate, community, and faith advocates decided to measure the gas leaks in the DC area.[2] With a small grant from the Sierra Club, the Beyond Gas DC coalition purchased a hand-held industry grade methane detector and began searching for leaks in neighborhoods around schools, houses of faith, and residential neighborhoods across DC's eight wards. In about 25 hours of testing time, the citizen science teams identified 387 leaks, 14 at or above the concentration at which gas can explode (50,000 parts per million).[3] After the leaks investigation demonstrated the significant threat posed by gas leaking outdoors, Beyond Gas wanted to explore the dangers of gas inside our homes.

When burned, methane gas emits pollutants like nitrogen dioxide, carbon monoxide, fine particulate matter (soot), formaldehyde, and benzene. As more than 62% of homes in the District of Columbia and 40% of homes in Maryland[4] use gas for cooking, the coalition decided to measure exposure to these pollutants inside DC and Maryland homes.

WHY NITROGEN DIOXIDE (NO_2)

Among the pollutants created when gas is burned, Beyond Gas decided to focus on NO_2 because of its immediate health impacts and because the detection equipment to measure it is relatively affordable and simple to operate.

We used Aeroqual Series 200 and 300 gas detection devices fitted with NO_2 sensor heads. Placed six feet from an emissions source (e.g., a gas stove or other gas appliance), the device provides NO_2 readings in about five minutes.



NO_2 HEALTH IMPACT

Nitrogen dioxide is an irritant and inflammatory agent that has been linked to or worsens asthma, bronchitis, COPD and other respiratory conditions in children and adults.[5] According to a 2013 meta-analysis[6] of the effects of indoor NO_2 and gas cooking, "children living in homes with gas cooking have a 42% increased risk of having current asthma, a 24% increased risk of lifetime asthma... per 15 ppb increase in indoor NO_2 level, children have a 15% increased risk of having current wheeze." In other words, very small increases (15 ppb) in children's exposure to NO_2 was correlated with significant increases in difficulty breathing due to narrowed airways. A 2023 study[7] published in the *International Journal of Environmental Research and Public Health* found that "12.7% of current childhood asthma in the US overall is attributable to gas stove use," and that depending upon the state, childhood asthma rates could potentially be reduced by up to 20% by eliminating exposure to emissions from gas stoves.[8]

Nitrogen dioxide exposure may also impact child cognitive development. A 2020 study[9] of a diverse group of 975 children found a correlation between prenatal and infant NO_2 exposure and behavior issues in children between four and five years old. Each 2 ppb increase in ambient NO_2 during the pregnancy was associated with an 6% increase in "externalizing behavior problems" such as rule breaking and aggressive behavior toward others between the ages of four and five. The association between post-natal exposure to NO_2 and behavior problems later was even stronger: each 2 ppb increase in ambient NO_2 was associated with an 8% increase in reported behavior issues. There is strong reason to believe that our gas-burning stoves are harming our families.

A Crestwood DC resident holds detector registering NO_2 at 240 ppb during her kitchen test in January 2024.

HOW MUCH NO_2 IS TOO MUCH?

The Environmental Protection Agency (EPA) National Ambient Air Quality Standards specify NO_2 levels of 100 ppb as the health standard for one hour of exposure for outdoor air.[10] The U.S. government does not regulate indoor air in residential homes and has no standard for unhealthy levels of NO_2 indoors.

EPA Standard for Outdoor NO_2 Exposure

The chart below benchmarks outdoor EPA standards for NO_2 exposure levels.

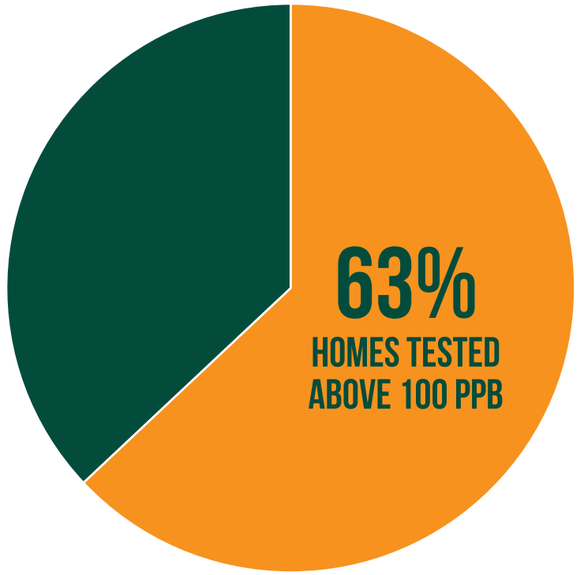
Air Quality Index	Protect Your Health Near Roadways
Good (0-50)	No health impacts are expected when air quality is in this range
Moderate (51-100)	Individuals who are unusually sensitive to nitrogen dioxide should **consider limiting prolonged** outdoor exertion
Unhealthy for Sensitive Groups (101-150)	The following groups should **limit prolonged** outdoor exertion: ■ People with lung disease, such as asthma ■ Children and older adults
Unhealthy (151-200)	The following groups should **avoid prolonged** outdoor exertion: ■ People with lung disease, such as asthma ■ Children and older adults Everyone else should **limit prolonged** outdoor exertion
Very Unhealthy (201-300)	The following groups should **avoid all** outdoor exertion: ■ People with lung disease, such as asthma ■ Children and older adults Everyone else should **limit** outdoor exertion

NO_2 TESTING RESULTS

Of 663 DC and Maryland homes tested, 416 (63%) recorded a top NO_2 reading over 100 ppb, the EPA's standard for maximum safe level for one hour of outdoor exposure. In DC, of 269 kitchens tested, 206 (77%) recorded at least one reading over 100 ppb. In Maryland, of 394 kitchens tested, 210 (53%) recorded at least one reading over 100 ppb. Region-wide the average high NO_2 concentration was 186 ppb, including an average of 181 ppb in DC and 159 ppb in Maryland.

NO_2 was generally zero in the house before testing began. All kitchens tested recorded NO_2 levels at least in the double digits.

Some of the patterns we expected were not confirmed by our findings. For example we expected to find that larger kitchens would consistently measure lower concentrations of NO_2. But we found that some larger kitchens had high NO_2 numbers, and some smaller kitchens (especially kitchens with two doors) had low numbers. There are likely other factors that we did not adequately measure.[11] Some of the larger kitchens we tested had been recently renovated, with large new gas stoves with double coil burners that likely burned a lot of gas. Some kitchens, even larger ones,



appeared to lack ventilation. Stagnant air, even in a larger space, could allow pollutants to accumulate.

When we restricted our sample to enclosed kitchens with just one door, the average high NO_2 measurement was much higher, between two and three times the EPA's outdoor limit: 199 ppb for enclosed kitchens of all sizes and 281 ppb for small kitchens (defined as 576 cubic feet or less, e.g., 8-feet by 8-feet by 9 feet).

An American University student apartment tested in December 2023 strongly illustrated the importance of ventilation. The kitchen had one door and no windows. It had a fan that was vented outside, which the residents tended not to use because it was noisy. So during the testing, the fan was left off, and NO_2 levels inside the kitchen spiked to 862 ppb, with high readings recorded in the dining area outside the kitchen as well. After completing the 30-minute test, the vent fan was turned on and NO_2 levels quickly plunged to 56 ppb. It is clear that good ventilation matters. But many stoves do not vent to the outside, many kitchens lack fans, and many people do not use their fans.

Oven Use and Higher Emissions

Oven use appears to result in higher NO_2 emissions. Initially we planned to use a single testing protocol, setting the oven at 350°F with two burners on high. When some of our testers found that the immigrant families they were working with did not use their ovens, we added a second protocol, turning on all four burners and not the oven.

Across all kitchen sizes we found:

- Average high NO_2 reading with oven and two burners in use: 181 ppb
- Average high NO_2 reading with four burners (no oven): 168 ppb

Fans Rarely Vent Outdoors and Often Go Unused

Unlike gas furnaces, water heaters, and dryers — whose emissions and health-harming pollutants are required to be vented outside — there is no such requirement for gas stoves and the vast majority are not vented to the outside. (Over-stove hood vents that come with microwave ovens catch grease but typically circulate the emissions back into the kitchen.) Our testers observed that whether hood fans vent outdoors or not, residents usually do not use them.

The Testing Process

We tested homes in the District of Columbia and Montgomery County, Maryland. Recruitment was done through Beyond Gas partners' email lists, neighborhood listservs, social media, word of mouth, and from news coverage.

Residents who wished to have their homes tested were scheduled with our testing teams and instructed to turn on their gas stoves 10 minutes before arrival time, using either the default protocol (oven at 350°F and two burners on high) or the alternate protocol (all four burners on high). The NO_2 detector was placed four to six feet from the running gas stove a few minutes before the first measurement.

NO_2 levels were recorded when the stove had been on for 15 minutes and 30 minutes.

A third reading was taken 15 minutes after the stove was turned off, and testers also recorded the highest NO_2 reading they saw during the test. Testers also measured the kitchen area (width x length x height in feet), noted the kitchen layout (one door, two doors, or open floor plan) as well as the building type (single-family home, rowhouse, or multifamily building). We recorded the number of adults and children in the home, whether any family member had respiratory issues, and, if so, their age.

Test results were shared with residents, comparing NO_2 levels in the home with the EPA's outdoor maximum of 100 ppb for one hour of exposure. Testers also offered information on ways to reduce families' emissions exposure, and information on local DC and Maryland programs supporting transitioning homes to electric appliances.

This was not a random sample. We cast the broadest net possible and tested 663 apartments, single-family houses, townhouses, and condos. The test group was influenced by the reach of our organizations, and includes a number of clusters where neighbors reached out to neighbors. That said, the sample of 663 homes was large and varied enough to be able to draw meaningful conclusions about the prevalence of NO_2 exposure for families with gas stoves in DC and Montgomery County homes.

NO_2 RISES

In the course of testing, we learned that NO_2 from gas stoves does not stay in the kitchen and it often rises in a home. In a handful of cases, we tested and found significant NO_2 levels in families' upstairs bedrooms.

Tony, District of Columbia

We went to test Tony's house in DC's Ward 1. During the testing, Tony was nervous about the emissions because — despite having a spacious kitchen with a 9-foot ceiling and a vent fan in use — the NO_2 level had gone up to 112 ppb. As soon as the test was over, he breathed a sigh of relief and switched on the ceiling fan saying "Whew, let's clear this out!" but to our surprise, the NO_2 level then spiked to 159 ppb.

George, District of Columbia

George, a science educator, was already aware of the health issues around burning gas. So he was eager to test emissions levels in his single-family home in the Columbia Heights neighborhood of DC, especially since he and his wife have a baby, who was nine months old at the time. Emissions levels in his kitchen were high, up to 294 ppb. Then George asked us to also test his child's room upstairs. We put the detector in his baby's crib, and were shocked to see a reading of 190 ppb, nearly twice the EPA's maximum for one hour exposure.

Shruti, Montgomery County, Maryland

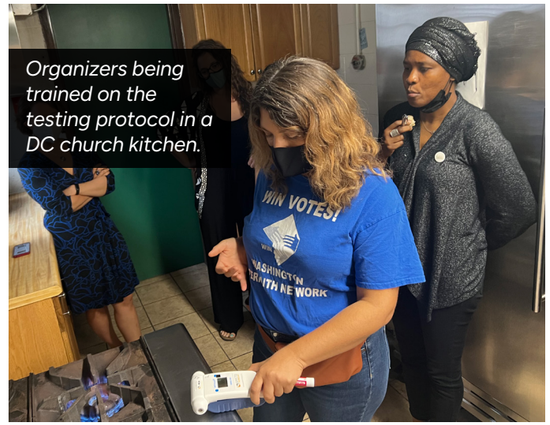
In August 2024, Beyond Gas held a training for volunteer testers at Shruti's home, a two-story colonial house in Kensington, Maryland. The kitchen and family room combined to make a large open area. Yet, in the course of the half-hour test, the level of NO_2 rose to 121 ppb. After the half-hour kitchen test, Shruti brought the NO_2 detector to the bedrooms upstairs, where NO_2 measured 133 parts per billion, even higher than in the kitchen.

How Long Does NO_2 Persist in the Air After Cooking?

We measured NO_2 15 minutes after the stove was turned off to help determine whether NO_2 persists in air or if it dissipates quickly. We found that across all kitchens tested, the average reading 15 minutes after shutoff was 34.7% lower than the highest reading recorded.

However, in 30% of cases, the reading 15 minutes after shut-off was higher than the readings taken while the stove was running, suggesting that 15 minutes may be too short a timeframe for measuring the reduction in NO_2 levels after a gas appliance is turned off.

To measure how long NO_2 persists after a stove is turned off, we tested five homes for four hours after the stove was turned off. We found that while NO_2 levels decline, the reduction is not immediate or steep. Nitrogen dioxide levels remained elevated for hours.



Organizers being trained on the testing protocol in a DC church kitchen.

Location	Highest NO_2 reading at any time in first 30 mins	NO_2 at 15 mins of stove use	NO_2 at 30 mins of stove use	NO_2 one hour after shut off	NO_2 two hours after shut off	NO_2 four hours after shut off
Woodley Park apartment	101 ppb	42 ppb	101 ppb	74 ppb	34 ppb	38 ppb
Dupont Circle apartment (window open)	567 ppb	448 ppb	567 ppb	168 ppb	75 ppb	56 ppb
Dupont Circle apartment (window closed)	886 ppb	693 ppb	886 ppb	425 ppb	168 ppb	53 ppb
H Street rowhouse	119 ppb	39 ppb	119 ppb	82 ppb	29 ppb	15 ppb
Cleveland Park apartment*	153 ppb	118 ppb	137 ppb	84 ppb	86 ppb	82 ppb

*This resident's practice was to open the two windows in his enclosed kitchen while cooking and to close them immediately afterward. The results suggest that it is important to continue ventilation after cooking is completed.

CITIZEN SCIENCE AND COMMUNITY ORGANIZING

By organizing communities block by block, Washington Interfaith Network (WIN) works to build a shared understanding of the harms of methane gas while strengthening community bonds and mobilizing residents to advocate for social and environmental justice. Through citizen science,

neighborhoods were able to identify the burning of fossil fuels as an issue and then push for the solution of electrification. One DC neighborhood taught us that citizen science is not just a way to collect data and spread information, but also an organizing tool that can change the trajectory of a neighborhood.

River Terrace was developed in the 1930s and 1940s as a planned community primarily for middle-class Black Washingtonians. It was part of a broader effort to address the housing needs of Black residents who faced segregation in other parts of the city. The neighborhood's housing stock mainly consists of rowhouses and garden-style apartments, and like many neighborhoods designed for Black residents, it is no stranger to environmental injustice. River Terrace residents face environmental harms from all sides: bounded by a freeway to the east, a former power plant to the north, a polluted river to the west, and another major roadway to the south.

Thanks to community advocacy, the old oil-fired power plant was shut down in 2015 after 100 years of leaking chemicals and other contaminants into the soil and adjacent Anacostia River. Michelle Hall, a native Washingtonian and longtime River Terrace resident, went door to door in 2002, surveying her neighbors alongside other advocates. She found that families had higher rates of cancer, asthma, and other respiratory conditions compared to the rest of the District. After years of advocating to close the power plant, Ms. Hall

now works to help her neighbors transition off burning fossil fuels inside their homes. She said: "We worked hard to close that power plant and make the air outside our homes safe to breathe. Now we are learning that breathing air inside our homes can also be dangerous. Gas is in our pipes leaking into our streets and when we come home to cook dinner, it greets us in our kitchens."

Rev. Andre Greene of Varick Memorial A.M.E. Zion Church is passionate about his work in the River Terrace community, and counts speaking out for the voiceless as a critical aspect of his ministry. Growing up in North Carolina, he was uneasy about his grandmother's stove, with its biting smell and blue flames. "I thought there's something wrong with how this appliance works. My suspicions were much later confirmed when I learned from parishioners Rosa and Michelle at Varick about the dangers of methane, the primary component of gas."

Working closely with the WIN, Rev. Greene is at the forefront of efforts to improve the quality of life of people in under-resourced communities. He says, "it's reminiscent of my advocacy work (against environmental injustice) in Flint, Michigan." He believes that all communities in the District have a right to thrive with a clean and healthy environment. That is why he enthusiastically agreed to have the level of NO_2 tested at his church. With no working fan and a tight space, the levels of NO_2 quickly rose to 297 ppb, nearly three times EPA's health-protective standard for one hour of exposure.

Rev. Greene observes, "Communities of color like River Terrace are disparately impacted by pollution. We know this is not by accident, but by design. And now it is time to redesign, to clean our river, to replace unhealthy fossil fuels with clean alternatives. We need to make sure that communities of color are the first to receive the benefits of a clean green economy."

River Terrace residents took what they learned about methane gas through our citizen science research to DC Council and were able to secure $2 million in funding for pilot projects in the River Terrace and Deanwood neighborhoods to help low-income households with energy efficiency upgrades, weatherization, and electrification.

We spoke with a longtime River Terrace resident who owns her home and was able to benefit from the pilot program to switch from gas appliances to an energy efficient electric heat pump, electric water heater, and electric stove. Knowing there was a hazardous gas leak extremely close to her home, she said she wanted to switch to safer and more energy efficient power sources. Nearby, her neighbor Rosa Lee is also making the switch and awaiting electric appliances. Ms. Lee said, "Gas was what I knew and that was it. I had no idea the effect it could have on children's health. I had a child with respiratory issues but never linked that with gas." Michelle Hall added: "When you know better you do better. After knowing the health impacts and seeing the numbers go up firsthand, it encouraged me to want to make the conversion from gas to electric."

In addition to the health and climate benefits of electrification, the pilot program was also designed to support housing preservation and affordability. Many Black-owned homes have been passed down generation to generation and are in desperate need of repairs. Yet as wages have stagnated and the cost of living has increased in the District, many homeowners do not have the ability to take on costly home repairs. As a result, too many Black homeowners are living in dilapidated housing, where they face higher utility bills because these homes are highly energy inefficient.

Community organizing in River Terrace has shown us that through citizen science and support for electrification, we can reverse the tide and begin to invest in Black wealth by ensuring that Black homeowners can afford to remain in place with improved quality of life.

New or Old, Gas Stoves Emit NO_2

One question often asked of our citizen scientists was, "Does this high reading mean something is wrong with my gas stove?" The answer is no. Burning gas produces NO_2. Gas stoves are doing exactly what they are designed to do.

Out of the 663 gas-burning homes tested, not a single one was free of nitrogen dioxide.

Testing Cara's recently renovated kitchen taught our team that even new appliances in large, open kitchens can have high readings. After watching NO_2 levels rise to 237 ppb within 30 minutes, Cara commented, "We had our kitchen renovated and had a gas stove put in just because we had always had a gas stove. We paid a lot for it. I've had on and off respiratory issues, and I definitely would have gotten an induction stove if I knew the risks of gas at the time."

In Neglected Rental Housing, Gas Pollution Exacerbates Poor Living Conditions

Beyond Gas partner Action in Montgomery (AIM) helps renters in low-income and public housing organize. AIM has integrated gas stove emissions testing (for NO_2) into this organizing and advocacy work. In June 2023, AIM organizers tested the home of Abaye, a resident of a complex of high-rise buildings in Silver Spring, Maryland. During a return visit in August, Abaye told AIM organizers:

"I have lived here for 16 years. My two sons live with me. When I moved in, I liked living here. But since then, there's been a lack of maintenance, mold, and rodents. Just this morning, the mouse traps caught three mice."

"I have sinus problems and difficulty breathing. I know my health issues come from poor indoor air quality. I can't stay in the kitchen while cooking. I get congested. My ears get blocked so I can't hear. So I was not surprised to learn about pollution from gas stoves."

"When I lived in Kenya, Rwanda, and Uganda, I always used electric stoves. The indoor air quality was better. I would love to electrify. I asked building management if I could switch from a gas stove to electric, but my request was denied. I was happy AIM helped me to get an induction burner."

"A few months ago, there was a fire on the 19th floor. Two people lost their lives. Residents smelled gas before we were evacuated. Management said the fire was caused by a cigarette, but we don't believe them. There is no safety here."

Glenn tests his father's home in May 2023

From Testing to Action

Glenn Hall is a DC native who was worried about his disabled father's health. When Jamoni Overby of Nature Forward suggested he test his father's kitchen for NO_2, Glenn jumped at the chance and some of his fears were confirmed. Glenn went on to help with testing in other DC homes.

"My dad is disabled so I usually am the person who prepares his meals, in his home in Ward 8, where I grew up. He has a decades-old gas stovetop, and over time I started noticing that every time I would cook for him, I would get light-headed or have a severe headache. I knew something was up and understood that burning gas could have health effects, but just didn't understand why. "

"When we tested my dad's kitchen, the NO_2 readings in the first few minutes passed the EPA's health standards for NO_2 exposure. I was blown away, but this gave me the confirmation I needed that something was wrong. My dad's health is my top priority and I want him to be able to safely age in place at our family home. After the test, we switched first to a hot plate and then to an induction burner. "

"After this experience, I helped to test other homes in my community. I was able to share my and my dad's story, and to give residents the information necessary to make the same switch we did."

Tenant Testing

Adama has spent the past decade leading campaigns to win high-quality after-school programming and new buildings in low-income schools. In 2022, she took of the helm on AIM's NO_2 testing, in part over concern for her son's asthma and the ill effects of their living conditions. Adama has since trained six other tenant leaders in NO_2 testing in five different housing complexes, together testing more than 325 homes so far. Adama has added methane testing in people's homes, finding several dangerous leaks. She now uses a plug-in induction stove to cook and distributes them to residents when they have gas leaks. Adama brought dozens of leaders to share their concerns at the Maryland Statehouse and with the Maryland Department of the Environment (MDE), helping to win hundreds of millions of dollars for electrification and weatherization. She has also testified in front of Congress to support indoor air quality standards.

Adama says, *"I'm a mother of a son with asthma, a tenant for 23 years, and an organizer who has tested more than 300 low-income apartments with high levels of NO_2, worse air quality than what the EPA recommends outdoors. We tenants can't choose whether or not to electrify our homes. We need our landlords to do it, and so we have to organize to make it happen. We want to be part of the solution for climate change and we tenants don't want to be left behind."*

Working with Landlords

Ana, a leader in AIM and the President of the JoAnn Leleck Elementary School PTA, first started organizing with other tenants in 2015 to improve chronic issues in the apartment complex she has lived in for 15 years. Many residents were experiencing chronic respiratory illness. When Adama and AIM started doing NO_2 testing, Ana signed on to test the homes in her community. Because of the relationship Ana and other tenants built with the apartment owner, Kay Management, they are now working together with state officials to make sure Kay Management can access funding to make energy upgrades in the apartment complex.

As Ana testified, *"It is our children who suffer the most from the use of gas. They get sick, they miss school, they don't learn properly. Are we condemned to live like this just because we live in apartments? No. We deserve the right to a clean and safe home. We want Northwest Park to be a model of a clean and healthy community."*

Speaking Out for Low-Income Residents

The Rev. Catherine Manhardt from St. James Episcopal Church in Potomac got involved in AIM's statewide climate campaign after the creation care team at her church wanted to get more involved in advocacy. Rev. Catherine says, *"God has promised us a future where we are all able to flourish and I believe we have the responsibility to bring our world a little bit closer to that future by caring for creation."*

Rev. Catherine did NO_2 testing at her congregation members' homes in Potomac and also at the Enclave Apartments. She realized that while the problem existed at all income levels, there was a disparity in levels because lower-income apartment complexes had poorer ventilation and less efficient appliances. Manhardt felt called to address this disparity. She testified at an hearing for stronger Building Energy Performance Standards and came to advocacy days in Annapolis for EmPOWER Maryland reform. Rev. Catherine observed, *"At these hearings and in the State House, you don't see many regular people, even though our lives will be impacted by legislation and regulations. The legislators told us it left an impression that we brought their constituents to share their personal stories."*

Making the Invisible Visible

Tifereth Israel Congregation works with Interfaith Power & Light (DC.MD.NoVA). Beyond Gas tested the Silver Spring condo of Rabbi Jason and Devora Kimelman-Block. Three members of Tifereth Israel Congregation had kitchens with gas stoves and NO_2 readings over the EPA's health standard limit for outdoor NO_2 exposure, but the Kimelman-Blocks' kitchen had the highest readings.

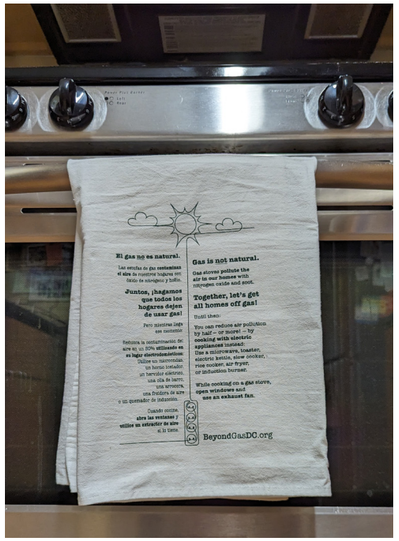
Rabbi Jason's strongest memory was his shock at seeing the NO_2 measurement of 450 ppb, 4.5 times the EPA's outdoor NO_2 standard. Rabbi Jason describes the experience as *"a wake up call."* After the test, he said:

"We decided we would try to cut down [on cooking with gas]. We knew what the costs of replacement would be, so we decided to start modifying. We bought ourselves two plug-in induction burners, removed all the burner equipment, and just put the induction burners on our stove. We had a dual convection oven and microwave and started leaning into that a little more for baking. When we do use the gas-burning oven, we make sure to blast the fan. It was a pretty easy adjustment.

"The test made the invisible noticeable to us. We raised our kids in the other version and it seemed fine, but now that we have this knowledge, we need to change."

RECOMMENDATIONS FOR FAMILIES

Immediate Actions to Reduce NO_2 Exposure from Gas Stoves



Increase ventilation

- Open windows and doors when using a gas stove or oven.
- Use the vent fan above the stove or exhaust fan on the wall, if you have one.
- Put a fan in your window to vent gas fumes outdoors during and after stove use.

Avoid using your gas stove when possible

- Use electric cooking appliances like a microwave, toaster oven, air fryer, crockpot, or electric kettle.
- Purchase a portable induction cooktop, which can plug into a standard electrical outlet.

Longer term: Upgrade your home to electric appliances and invest in energy efficiency

Now is a great time to move to healthier, highly efficient electric equipment for heating and cooking. Not only is the market responding to increased demand for induction cooktops through a greater range of products and lower prices, a number of state and federal incentives are available to upgrade to high efficient, clean technology.

- Beginning January 1, 2023, the Inflation Reduction Act offers tax credits of $150 for a home energy audit and up to 30% of the project cost of an electrical panel upgrade, capped at $600.
- Thanks to the passage of the Healthy Homes Act in 2024, low- and moderate-income DC residents will be able to transition their homes off fossil fuels at no cost once the program is set up.
- Under the Affordable Home Electrification program, income-eligible D.C. residents can apply to upgrade for an electric panel upgrade and an induction cooktop free of charge.
- Thanks to the passage of the EmPOWER Maryland Energy Efficiency Act, Maryland will soon increase the amount of rebates and incentives for home energy audits, panel upgrades, and new appliances.
- Income-eligible DC residents can access rebates today from the Inflation Reduction Act for an electric stove. These rebates are expected to become available in Maryland in 2025.
- You can learn more about what programs are available where you are at Rewiring America's IRA Calculator.

RECOMMENDATIONS FOR POLICYMAKERS

To protect DC and Maryland families from the health threat posed by NO_2 and other pollutants emitted by burning methane gas in homes and other buildings, policymakers must accelerate the transition from fossil fuels to clean and efficient electric systems. This will require legislation and programs to incentivize electrification, end wasteful spending on fossil fuel pipelines, and identify funding sources to help households to transition off the fossil fuels harming public health and driving the climate crisis.

DC Recommendations

Fully fund electrification and efficiency retrofits in the homes of low- and moderate-income DC residents.

- In 2024, the DC Council unanimously passed the Healthy Homes Act, which creates a program within the DC Department of Energy and Environment (DOEE) to provide electrification retrofits to 30,000 low- and moderate-income (LMI) residents by 2040 at no cost to the resident.
- The Healthy Homes program will initially be funded by a slight increase to the Sustainable Energy Trust Fund (SETF) fee on utility bills. Low-income families are exempt from the fee. The DC Council should ensure that SETF funding goes to its intended purpose: energy efficiency, renewable energy, and electrification for LMI residents. The SETF should not be raided for unrelated spending.
- The SETF is insufficient to fund all 30,000 retrofits over the next 15 years. The Council will need to identify other funding sources, such as expanding the Renewable Portfolio Standard on electricity to apply to gas and other heating fuels and using the revenue for weatherization, energy efficiency, and electrification for LMI households at no cost to the households.

Accelerated depreciation of gas pipelines, ensuring that DC residents are no longer paying for multi-billion dollar dirty energy infrastructure costs past 2045, the year DC has pledged to achieve carbon neutrality, making fossil fuel infrastructure obsolete.

- Washington Gas has sought pipeline replacement spending topping $10 billion.[12] Typically, investments in gas pipelines have been paid off over 60 years or more, meaning costly pipeline replacements this decade would burden DC residents into the 2080s, 40 years after DC is set to stop relying on the fossil fuels that use the pipelines. This is akin to taking out a 60 year mortgage on a home that will become uninhabitable in 20 years.
- DC should enact legislation requiring full cost recovery for all utility fossil fuel assets on a timeline consistent with DC's climate commitment of carbon neutrality by 2045. This will save DC residents billions of dollars in wasteful long-term fossil fuel pipeline spending and allow the money to instead be invested in reducing residents' utility bills through energy efficiency and electrification.

Begin an orderly transition to continually reduce DC's methane gas piping infrastructure and gas consumption through strategic geographic electrification.

- DC's utility regulator, the Public Service Commission, has struggled to uphold its statutory mandate to meet DC's climate commitments, which state that the District will transition from fossil fuels like methane gas to efficient electric alternatives. Commissioners have even stated that upholding the financial health of the utilities is more important than the climate.
- DC should enact legislation requiring the Public Service Commission to begin to plan and implement a transition away from methane gas pipelines with targeted electrification in discrete geographic areas that can be fully electrified, eliminating the need for gas piping and freeing residents and business of the multibillion dollar cost of maintaining aging gas pipelines. LMI households will need assistance electrifying through Healthy Homes and other electrification initiatives.

Maryland Recommendations

Ensure the Public Service Commission's Future of Gas docket produces a meaningful plan for the equitable transition off of methane gas in Maryland.

- Through the 2022 Climate Solutions Now Act, the Maryland General Assembly made a statutory commitment to reduce statewide greenhouse gas emissions 60% by 2031 and reach net-zero carbon emissions by 2045. Over 16% of Maryland's emissions come from fossil gas use in buildings across the state, not including the social and climate costs of the associated extraction and transportation, making building electrification and creating a future beyond gas essential to meeting the state's statutorily mandated goals.
- To transition away from gas while protecting Maryland ratepayers, Maryland needs a holistic plan; a Future of Gas proceeding allows for this type of long-term gas system planning. Through the proceeding, and with input from experts, citizen advocates, and utilities, the Public Service Commission can establish an overarching strategy that includes infrastructure planning, equity considerations including how the transition is funded, transition strategies for gas utilities, opportunities to minimize cost and rate impacts, and other foundational considerations.

Testing the kitchen of Maryland Delegate Lorig Charkoudian.

Adopt strong statewide regulations to transition homes and businesses off of gas-burning, through a Building Energy Performance Standard (BEPS) and a Zero-Emission Heating Equipment Standard (ZEHES).

Building Energy Performance Standard (BEPS)

- The Maryland Department of the Environment should adopt and implement a strong Building Energy Performance Standard (BEPS) and ensure effective and equitable implementation. BEPS was established in the Climate Solutions Now Act of 2022, and requires most large buildings, 35,000 square feet or larger and including residential, to reduce on-site pollution, but the final regulation will define how strong and equitable the policy is.

- The final BEPS regulation should include a meaningful pathway, through interim guidance, to include the adoption of an energy use intensity (EUI) standard, a metric that incentivizes efficient electrification, rather than outdated technologies that can end up costing consumers more. Additionally, implementation of BEPS regulations should include funds to help nonprofit buildings subject to BEPS hire a navigator to assist with energy benchmarking and pay for third-party verification. Funds should also be available for energy audits for buildings who do not meet the standards.

Zero-Emission Heating Equipment Standard (ZEHES)

- The Maryland Department of the Environment should release draft regulations for an impactful zero-emission heating equipment standard (ZEHES) by June 2025, with a timeline for full adoption by December 2025. ZEHES is a policy that phases in the adoption of heating systems that do not produce climate emissions or air pollution after a certain date; this will provide a market incentive to encourage the adoption of efficient electric appliances, like heat pumps and heat pump hot water heaters.
- The creation of a ZEHES regulation was called for in Maryland's December 2023 Climate Pollution Reduction Plan and in Governor Moore's June 2023 Executive Order to Advance Maryland's Pollution Reduction Plan. Gov. Moore is fulfilling that pledge by creating a pathway to phase in the adoption of highly efficient heating equipment, making a dent in more than 16% of emissions that comes from buildings.

Reform the Maryland Strategic Infrastructure Development and Enhancement (STRIDE) program to ensure public dollars are no longer wasted on dirty infrastructure.

- The Maryland Strategic Infrastructure Development and Enhancement (STRIDE) program is a mechanism where utilities can be reimbursed for repair, replacement, and development of gas infrastructure in the name of safety, but with minimal oversight and accountability. Maryland's gas utilities have spent more than $2 billion on new gas infrastructure under the STRIDE program since it was enacted in 2013. If allowed to continue unchecked, the utilities are projected to spend another $8 billion.
- Maryland should adopt legislation that would modernize the existing STRIDE program to prioritize using safe alternatives to replacement, including leak detection and repair in conjunction with electrification.

Adopt an all-electric building code for new construction.

- To meet its net zero carbon pollution by 2045 commitment, Maryland should not allow new buildings to burn fossil fuels that directly spew carbon pollution into the air.
- State legislators and municipalities should adopt legislation that would require new buildings in Maryland meet their space and water heating needs without the use of fossil fuels. This has already been done in Montgomery County, and is under consideration in other counties. This policy would cost nothing, save Marylanders money, and reduce pollution.

DC and Maryland are on the Path to 100% Clean Electricity

One of the questions we hear most is, "Why should we transition homes and buildings to electricity when electricity is generated by coal and gas?" In fact, our electricity grid is already cleaner than methane gas in both DC and Maryland and we are on the path to 100% clean electricity.

Since the Clean Energy DC Omnibus Act passed in 2018, DC has been increasing its share of electricity from renewable sources every year. In 2018, 16.5% of DC's electricity was from clean sources, in 2024 it was 45% renewable, and in 2025 a majority of DC's electricity – 52% – will come from clean sources like wind and solar. By 2032, 100% of DC's electricity will be from renewable sources.

Maryland first passed its Renewable Energy Portfolio Standard in 2004 and has since updated the program to strengthen its targets. Maryland has committed to generating 14.5% of the state's electricity from solar by 2030. Through the passage of the POWER Act in 2022, Maryland set a statutory target of deploying 8.5 gigawatts of offshore wind energy by 2031. The state is exploring more ambitious targets through Governor Moore's commitment to achieving 100% clean energy by 2035. Electrifying is better than gas-burning for the climate today, and every year the math gets better.

CONCLUSION

Burning methane gas in homes is not making our lives better as our gas utility claims. It is damaging Earth's ecosystems, and the pollutants from gas burned in our homes are making our families sick.

We have better alternatives like heat pumps for heating and cooling and induction stoves for cooking, which are healthier, more efficient, and less expensive to operate. Advocates in climate, faith, and low-income communities can play a critical role in spreading the word, organizing our neighbors and, together, pressing for policies to speed the transition off gas. Citizen science investigations like this one allow us to see and measure the pollutants from burning gas in our homes, bringing communities together to advocate for electrification, cleaner air, and affordable housing. The Beyond Gas citizen science teams in the District of Columbia and Maryland will continue investigating the threats burning gas poses to our communities.

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APPENDIX

Glossary

Climate-friendly: not harmful to the environment, especially not contributing to climate change through production of heat-trapping greenhouse gasses.

Citizen science/scientist (also community science/scientist): a person without specialized training who contributes to scientific work, for example collecting information to help scientists.

COPD: Chronic Obstructive Pulmonary Disease, a long-term lung disease that makes breathing more difficult.

Correlation: a connection or relationship between two or more things which may or may not be causal.

EPA: Environmental Protection Agency: U.S. government agency mandated with protecting human health and the environment.

Fossil fuel: An energy source such as gas, coal, and oil formed from decayed organic material, or prehistoric plants and animals buried under layers of rock.

Induction cooktop: an all-electric stovetop burner that uses electromagnetic energy to heat compatible pots and pans.

Inflammatory agent: a substance that stimulates an inflammatory response in the body.

Methane: a combustible gas with no smell or color, that is the main component of "natural" gas.

Natural gas: A fossil fuel used for heating, cooking and in industrial processes, composed mostly of methane with smaller amounts of ethane, propane, and other gasses.

Nitrogen dioxide (NO_2): a chemical compound formed with one nitrogen atom and two oxygen atoms, primarily produced by burning fossil fuels. NO_2 is a pulmonary irritant and inflammatory agent in the body.

Parts per billion (ppb): a unit of measurement used to express the concentration of a substance in a solution or mixture. It indicates how many parts of a substance are present in one billion parts of the total mixture, making it a vital metric for assessing concentrations of gasses and pollutants in the atmosphere.

PCB: Polychlorinated biphenyl, a highly toxic and carcinogenic chemical compound used in industrial applications and consumer electronics before being internationally banned in 2001.

Pollutant: a substance that causes pollution, especially in the air or water.

Pulmonary irritant: a substance that causes irritation or inflammation in the lungs when inhaled.

Citations

1 Nature, March 14, 2024, Sherwin et al, "U.S. oil and gas system emissions from nearly one million aerial site measurements." The study, led by Stanford scientist Evan D. Sherwin, found that methane emissions from six major drilling areas were "roughly three times the national government inventory estimate."

2 In March 2020, Beyond Gas DC asked Washington Gas and DC's Public Service Commission for their data on gas leaks in DC. The request was denied because the data on gas leaks in our neighborhoods is "confidential" and not allowed to be known to DC residents.

3 February 2022 report, Neighborhood Researchers Find Hundreds of Methane Gas Leaks Across DC.

4 Highlights for Appliances in U.S. Homes by State, 2020, U.S. Energy Info. Admin., https://www.eia.gov/consumption/residential/data/2020/state/pdf/State%20Appliances.pdf

5 Kashtan Y, Nicholson M, Finnegan CJ, et al. Nitrogen dioxide exposure, health outcomes, and associated demographic disparities due to gas and propane combustion by U.S. stoves. Science Advances. 10(18):eadm8680. doi:https://doi.org/10.1126/sciadv.adm8680

6 Lin W, Brunekreef B, Gehring U. Meta-analysis of the effects of indoor nitrogen dioxide and gas cooking on asthma and wheeze in children. International Journal of Epidemiology. 2013;42(6):1724-1737. doi:https://doi.org/10.1093/ije/dyt150

7 Gruenwald, T.; Seals, B.A.; Knibbs, L.D.; Hosgood, H.D., III. Population Attributable Fraction of Gas Stoves and Childhood Asthma in the United States. Int. J. Environ. Res. Public Health 2023, 20, 75. https://doi.org/10.3390/ijerph20010075

8 Gruenwald et al. "the proportion of childhood asthma that could be theoretically prevented if gas stove use was not present...varied by state (Illinois = 21.1%; California = 20.1%; New York = 18.8%; Massachusetts = 15.4%; Pennsylvania = 13.5%)

9 Environmental Research, Vol 183, April 2020 "Exposure to ambient air pollution and early childhood behavior: A longitudinal cohort study" Loftus et al.

10 EPA Primary National Ambient Air Quality Standards (NAAQS) for Nitrogen Dioxide.

11 In part this was because our study design prioritized testing families under usual cooking conditions, with vent fans on or off, windows open or closed, etc.

12 The DC Department of Energy and Environment estimated the upfront cost of the Washington gas pipeline replacement proposal to be up to $4.5 billion (Direct Testimony of DC government witness Edward Yim, FC1154-115, June 15, 2020). The economic consulting firm Synapse Energy Economics found that using a conservative estimate of the upfront cost, the total cost once debt service and corporate profits are added would up to $14 billion (Comments of the District Department of Transportation with the assistance of Synapse Energy Economics, FC 1175, May 2, 2023).

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