THE GEORGE WASHINGTON UNIVERSITY
WASHINGTON, DC

Department of Environmental and Occupational Health

February 25, 2025
The Maryland State Senate
Attn: SB0804
Maryland State Government General Assembly
100 State Cir, Annapolis, MD 21401

**Re: SB0804, Better Buildings Act of 2025**

On behalf of the undersigned faculty and staff members at the George Washington University Milken Institute School of Public Health (GWSPH), **we are writing in strong support of SB0804: Maryland Building Performance Standards - Fossil Fuel Use, Energy Conservation, and Electric- and Solar-Ready Standards (Better Buildings Act of 2025).** This step towards net zero buildings by 2040 – as required by the Building Energy Performance Standards (BEPS) under the Climate Solutions Now Act of 2022 – is not only a critical component of Maryland's transition away from fossil fuel usage, but would **afford direct and local public health benefits to Maryland residents**. Research in the Environmental and Occupational Health Department at GWSPH addresses critical environmental and occupational health challenges to promote healthy environments where we live and work; as such, faculty and staff members offer expertise at the nexus of human health, policy, and equity.

Energy usage in both commercial and residential buildings is primarily allocated towards lighting, heating, and cooling.[1,2] In Maryland, natural gas accounts for the largest share of in-state electricity generation and is the second largest source of energy for heating.[3,4] Natural gas is used in appliances that are often in close proximity to humans and involve the process of combustion, or burning.[5] When natural gas or other fossil fuels are combusted, gasses and particles are released into the air. These gasses and particles, oftentimes deemed hazardous air pollutants, can impact indoor air quality and contribute to adverse health outcomes.[4,6,7]

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[1] German, R. (2011). (rep.). (S. Gossett, Ed.) *2011 Renewable Energy Data Book*. U.S. Department of Energy, Energy Efficiency and Renewable Energy. Retrieved January 24, 2023, from https://www.nrel.gov/docs/fy13osti/54909.pdf.
[2] U.S. Energy Information Administration. (2020). *Residential Energy Consumption Survey (RECS)*. EIA. Retrieved January 30, 2023, from https://www.eia.gov/consumption/residential/
[3] U.S. Energy Information Administration. (2025). *Maryland: State profile and energy estimates.* Retrieved February 10, 2025, from https://www.eia.gov/state/analysis.php?sid=MD
[4] U.S. Census Bureau. (2022). *Heating and air conditioning (HVAC): 2022 American Community Survey 1-year estimates.* Retrieved February 10, 2025, from https://data.census.gov/table?t=Heating+and+Air+Conditioning+(HVAC)
[5] Michanowicz, D. R., Dayalu, A., Nordgaard, C. L., Buonocore, J. J., Fairchild, M. W., Ackley, R., ... & Spengler, J. D. (2022). Home is where the pipeline ends: characterization of volatile organic compounds present in natural gas at the point of the residential end user. *Environmental Science & Technology*, *56*(14), 10258-10268.
[6] Environmental Protection Agency. (n.d.). *Sources of Combustion Products*. EPA. Retrieved January 30, 2023, from https://www.epa.gov/indoor-air-quality-iaq/sources-combustion-products
[7] Environmental Protection Agency. (n.d.). *What are combustion products?* EPA. Retrieved January 30, 2023, from https://www.epa.gov/indoor-air-quality-iaq/what-are-combustion-products

With this legislation, Maryland has the unique opportunity to achieve public health benefits and greenhouse gas reduction simultaneously. While increasing energy efficiency and displacing fossil fuels with electrification have been recognized as elements in the pathway to meet Maryland's sustainability goals,[8] the significant direct and local public health benefits of electrification are often undercounted. This joint faculty and staff comment will focus on the significant public health benefits that will be gained by adopting energy conservation requirements, electric-and solar-ready standards, and building requirements that meet laundry, water, and space heating demands without the use of fossil fuels.

## Eliminating Indoor Combustion will Improve Public Health

Air pollution is one of the leading risk factors for death and illness globally. While outdoor air pollution has garnered extensive attention both nationally and globally, the Environmental Protection Agency (EPA) cautions that indoor air pollutant concentrations can be two to five times higher than outdoor concentrations.[9] There are many sources of air pollution in indoor environments including building materials, cleaning products, and indoor combustion from heating and cooking.[10,11] Research shows that residential natural gas appliances produce pollutants harmful to human health, such as carbon monoxide (CO), nitrogen dioxide ($NO_2$), formaldehyde, and ultrafine particles (UFP).[12] Evidence of health effects resulting from burning gas indoors has been mounting since the 1990s, showing that the combustion processes associated with cooking, heating, and drying clothes indoors are linked to increased risk of heart attack, asthma, and other respiratory diseases.[13]

While the health effects of burning natural gas indoors have impacts on a broader population level, children are particularly susceptible to adverse health outcomes. One of the most frequently studied associations between indoor air pollution and childhood health is that of $NO_2$ and impacts on respiratory function. A meta-analysis of 41 studies conducted by Lin et al. (2013) quantitatively confirmed that exposure to indoor $NO_2$ increased the risk of current wheeze.[14] Given that most people spend nearly 90% of their time in enclosed buildings,[15] including schools, offices, recreational facilities, and residential property, among others, indoor air quality is a major factor contributing to health outcomes.

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[8] Maryland Department of the Environment. (n.d.). *Climate pollution reduction planning overview.* Retrieved February 10, 2025, from https://mde.maryland.gov/programs/air/ClimateChange/CPRP/Pages/Overview.aspx

[9] Environmental Protection Agency. (n.d.). *Why Indoor Air Quality is Important to Schools*. EPA. Retrieved January 30, 2023, from https://www.epa.gov/iaq-schools/why-indoor-air-quality-important-schools

[10] Logue, J. M., McKone, T. E., Sherman, M. H., & Singer, B. C. (2011). Hazard assessment of chemical air contaminants measured in residences. *Indoor air*, *21*(2), 92-109.

[11] Hodshire, A. L., Carter, E., Mattila, J. M., Ilacqua, V., Zambrana, J., Abbatt, J. P., ... & Farmer, D. K. (2022). Detailed Investigation of the Contribution of Gas-Phase Air Contaminants to Exposure Risk during Indoor Activities. *Environmental science & technology*, *56*(17), 12148-12157.

[12] Mullen, N.A., Li, J., Russell, M.L., Spears, M., Less, B.D. and Singer, B.C. (2016), Results of the California Healthy Homes Indoor Air Quality Study of 2011–2013: impact of natural gas appliances on air pollutant concentrations. *Indoor Air*, *26*, 231-245. https://doi.org/10.1111/ina.12190

[13] Environmental Protection Agency . (2008). (rep.). *Integrated Science Assessment (ISA) for Oxides of Nitrogen – Health Criteria*. Retrieved January 24, 2023, from https://cfpub.epa.gov/ncea/isa/recordisplay.cfm?deid=194645

[14] Lin, W., Brunekreef, B., & Gehring, U. (2013). Meta-analysis of the effects of indoor nitrogen dioxide and gas cooking on asthma and wheeze in children. *International journal of epidemiology*, *42*(6), 1724-1737.

[15] Klepeis, N. E., Nelson, W. C., Ott, W. R., Robinson, J. P., Tsang, A. M., Switzer, P., ... & Engelmann, W. H. (2001). The National Human Activity Pattern Survey (NHAPS): a resource for assessing exposure to environmental pollutants. *Journal of Exposure Science & Environmental Epidemiology*, *11*(3), 231-252.

**Expansion of Fossil Fuel Free Requirement to Stoves will Increase Health Benefits**

Electrification of laundry, water, and space heating demands will improve indoor air quality and occupant health; however, large population health gains are left on the table without also addressing gas stoves. A recent study conducted by researchers at Harvard University's Center for Climate, Health and the Global Environment (C-CHANGE) found that natural gas used in stove ranges contains 21 different air pollutants that are hazardous to human health.[3] Included in this hazardous category of air pollutants is CO, $NO_2$, toluene, and benzene, exposures to which may cause nausea, headaches, dizziness and, with long-term exposure (continued exposure over several years), cancer or death.[16, 17] In a recent study, Gruenwald et al. (2022) reported that 13% of current childhood asthma cases can be attributed to gas stove use in the U.S.[18] Maryland can increase the health benefits of this legislation by expanding the fossil free requirement to stoves, which will also increase its climate mitigation impact.

## Electrification Will Improve Hyperlocal Air Quality and Advance Health Equity

In addition to the benefits of improving indoor air quality, commercial building electrification will improve overall air quality, with significant benefits for health equity. Historical trends in the United States show that lower income, marginalized, and minority communities experience higher levels of exposure to air pollution due to their proximity to high-emitting sources of air pollution.[19] In the state of Maryland, 7.6% of children and 8.9% of adults suffer from asthma. Black children visit the emergency department for asthma-related issues at nearly five times the rate of white children.[20] Furthermore, research conducted by Akinyemi et al. (2024) found that Maryland residents in the lowest quartile of income were over three times as likely to experience an asthma-related emergency department visit when compared to residents in the highest quartile for income.[21]

The proposal before the Maryland State Senate has the potential to meaningfully address these health inequities. Maryland achieved an overall reduction in greenhouse gas emissions between 2005 and 2022; however, the commercial buildings sector saw a 23% increase in emissions, the only sector in the state to experience a rise in emissions.[22] Commercial buildings

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[16] Centers for Disease Control and Prevention. (2018, April 4). *CDC*. Facts About Benzene. Retrieved January 24, 2023, from https://emergency.cdc.gov/agent/benzene/basics/facts.asp#:~:text=The%20Department%20of%20Health%20and,of%20the%20blood%2Dforming%20organs

[17] Centers for Disease Control and Prevention. (2021, February 10). Toluene. Retrieved January 24, 2023, from https://wwwn.cdc.gov/TSP/substances/ToxSubstance.aspx?toxid=29

[18] Gruenwald, T., Seals, B. A., Knibbs, L. D., & Hosgood, H. D. (2023). Population Attributable Fraction of Gas Stoves and Childhood Asthma in the United States. *International Journal of Environmental Research and Public Health*, *20*(1), 75.

[19] Castillo, M. D., Kinney, P. L., Southerland, V., Arno, C. A., Crawford, K., van Donkelaar, A., ... & Anenberg, S. C. (2021). Estimating intra-urban inequities in PM2. 5-attributable health impacts: A case study for Washington, DC. *GeoHealth*, *5*(11), e2021GH000431.

[20] Maryland Department of Health. (n.d.). *Asthma and environmental health.* Retrieved February 10, 2025, from https://health.maryland.gov/phpa/OEHFP/EH/pages/asthma.aspx

[21] Akinyemi, O., Weldeslase, T., Odusanya, E., Fasokun, M., Agboola, B., Andine, T., Ayeni, E., Michael, M., & Hughes, K. (2024). The relationship between neighborhood economic deprivation and asthma-associated emergency department visits in Maryland. *Frontiers in Allergy*, 5. https://doi.org/10.3389/falgy.2024.1381184.

[22] Rosen, T., Scarr, A., Ridlington, E., & Wendlandt, W. (2024, November 12). *Less coal, more oil: Climate pollution trends by state*. Environment America Research & Policy Center. Retrieved from https://environmentamerica.org/center/resources/less-coal-more-oil-climate-pollution-trends-by-state/

release carbon dioxide ($CO_2$), nitrogen oxides ($NO_x$), and particulate matter into the atmosphere, contributing to poor ambient air quality and adverse health outcomes. $NO_x$ are precursors to the climate warming pollutant ozone, an air pollutant that is known to exacerbate asthma and contribute to reduced lung function.[23] Efforts aimed at reducing greenhouse gas emissions from the commercial sector, such as requiring new commercial buildings to have key electrification technologies, will improve surrounding air quality.[24] For example, expanding solar capacity could enhance local air quality and reduce broader climate risk by reducing the reliance on fossil fuel power plants, which currently supply more than half of Maryland's energy.[25] Emissions from fossil fuel power plants make up a major portion of harmful air pollutants in the U.S., including $NO_x$ and sulfur dioxide ($SO_2$), while contributing 40% of the country's $CO_2$ emissions, intensifying climate risks.[26]

Under this proposal, areas overburdened by asthma and air pollution could see improvements in hyperlocal air quality and subsequent health outcomes. An analysis conducted by Johnson et al. (2020) estimated the air quality and public health benefits that could result from the implementation of New York City's Roadmap to "80 × 50", a plan with similar features to the Better Buildings Act of 2025.[27] When evaluating the overall benefits resulting from building emissions scenarios, which included the transition to high-efficiency electric technologies and increased solar adoption, overall emissions were estimated to decrease by 59% in buildings over 25,000 square feet. Furthermore, the greatest improvements in air quality were seen in neighborhoods with higher levels of poverty.[28]

It is important to note that this legislation is not without precedent. Similar policies have passed in New York State; Denver, Colorado; Boston, Massachusetts; and the District of Columbia.[29,30,31,32] Montgomery County, the most populous county in Maryland, passed legislation in 2022 requiring an "all electric building standard," comprehensively banning all

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[23] Lippmann, M. (1991). Health effects of tropospheric ozone. *Environmental science & technology*, *25*(12), 1954-1962.
[24] Karlsson, M., Alfredsson, E., & Westling, N. (2020). Climate policy co-benefits: a review. *Climate Policy*, *20*(3), 292-316.
[25] Nuclear Energy Institute. (2024). *Maryland State Energy Profile.* Retrieved February 10, 2025, from https://www.nei.org/CorporateSite/media/filefolder/resources/fact-sheets/state-fact-sheets/Maryland-State-Fact-Sheet.pdf
[26] National Renewable Energy Laboratory. (2007). Emissions of greenhouse gases from the use of transportation fuels and electricity. U.S. Department of Energy. Retrieved February 10, 2025, from https://www.nrel.gov/docs/fy07osti/41998.pdf
[27] New York City Mayor's Office of Sustainability. (2014). (rep.). *New York City's Roadmap to 80 X 50*. Retrieved January 24, 2023, from https://www1.nyc.gov/assets/sustainability/downloads/pdf/publications/New%20York%20City%27s%20Roadmap%20to%2080%20x%2050_Final.pdf.
[28] Johnson, S., Haney, J., Cairone, L., Huskey, C., & Kheirbek, I. (2020). Assessing air quality and public health benefits of New York City's climate action plans. *Environmental science & technology*, *54*(16), 9804-9813.
[29] New York State Senate. (2023). *Senate Bill S562A: All-Electric Building Act*. New York State Senate. Retrieved from https://www.nysenate.gov/legislation/bills/2023/S562/amendment/A
[30] City and County of Denver. (2022). Ordinance 22-1653: 2022 Denver Building and Fire Code. Denver City Council. Retrieved from https://denver.legistar.com/LegislationDetail.aspx?ID=5966691&GUID=9523D7F2-C8E9-40A8-A665-5FEA12715444
[31] City of Boston. (2023). *Executive Order 2023-01: Fossil Fuel-Free Municipal Buildings*. City of Boston. Retrieved from www.boston.gov
[32] Council of the District of Columbia. (2022). *Law 24-177: Clean Energy DC Building Code Amendment Act of 2022*. Council of the District of Columbia. Retrieved from https://code.dccouncil.gov/us/dc/council/laws/24-177#%C2%A72

buildings' use of fossil fuels, including for cooking.[33]

In conclusion, building electrification will reduce indoor and outdoor air pollution, help address inequities in air quality, and improve the health of Maryland's residents. For these reasons, we strongly support the proposed building performance standards requiring the electrification of laundry, water, and space heating demand as well as solar- and electric-readiness standards for new and significantly improved buildings as an important step towards a healthier and more equitable Maryland.

Sincerely,

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[33] Buildings – Comprehensive Building Decarbonization, Bill 13-22, Montgomery County Council. (MD. 2022). www.montgomerycountymd.gov