September 26, 2023

The Honorable Jennifer Granholm
Secretary
U.S. Department of Energy
1000 Independence Avenue, SW
Washington, D.C.

RE: EERE-2017-BT-STD-0019-0063 Energy Conservation Program: Energy Conservation Standards for Consumer Water Heaters

Dear Secretary Granholm:

Thank you for the opportunity to comment on the energy conservation standards for consumer water heaters. The undersigned health and medical organizations represent people concerned with the how energy use impacts energy production, low-income communities, health, and our environment. The Energy Policy and Conservation Act requires newly promulgated energy standards to save the maximum amount of energy it can while considering cost and technology. The proposed update will reduce household energy consumption which will in turn, lower consumer operating costs and reduce toxic and greenhouse gas emissions. These changes will also protect the health of communities. We therefore support the new standard and encourage you to adopt it.

Increased Energy Efficiency and Reduced Household Energy Use Confers a Variety of Benefits

As the Department of Energy enacts policies aimed at improving energy efficiency for consumer appliances, we would like to highlight the direct and indirect benefits of reducing the amount of energy people use in their homes. Residential energy use accounts for 22% of all energy use in the United States[1], and water heating accounts for about 13% of each home's energy usage[2] - the second biggest use of household energy behind space heating. Increasing efficiency of this one appliance will therefore make a notable difference in the homes' overall use of energy, which will save consumers money while improving their health and reducing climate and health altering changes to the outdoor environment.

Reducing Energy Use Will Save Consumers Money

Nationally, 67% (25.8 million) of low-income households face a high energy burden; low-income households spend three times more of their income on energy costs compared to the median spending of non-low-income households (8.1% versus 2.3%).[3] The proposed standards would help reduce these energy burdens.

Low-income households with gas water heaters would benefit from the proposed standards. For gas storage water heaters, the proposed standards would save low-income households an average of $137 over the lifetime of the product.[4] Only 2% of all low-income households have a gas instantaneous water

[1] U.S. Energy Information Administration Monthly Energy Review June 2022.
[2] U.S. Energy Information Administration Annual Energy Outlook 2022
[3] https://www.aceee.org/sites/default/files/pdfs/u2006.pdf.
[4] 88 Fed. Reg. 49140.

heater as these are typically premium products with a higher baseline price point.[5,6] Thus, low-income households would disproportionately benefit from the large utility bill savings associated with the proposed standards for electric storage water heaters. DOE estimates that low-income households with medium electric storage water heaters would see average life-cycle cost savings of $2,475, and 69% of low-income households with a medium electric storage water heater would experience a net benefit from the proposed rule (with 21% of low-income consumers not impacted).[7] In addition, renters, who are disproportionately low-income households, would especially benefit from the standards since landlords typically have no incentive to install efficient water heaters (since the tenants usually pay the energy bills). DOE's analysis shows that 65% of low-income households with medium electric storage water heaters are renters; of these, the vast majority pay their electricity bill. These households would incur no incremental cost while realizing $230 in average annual electricity bill savings.[8]Low-income households with gas instantaneous water heaters would see savings of $158 on average over the lifetime of the product because of the proposed standards.[9]

Reducing Energy Use in Gas Powered Appliances Will Improve Health

Methane gas powered water heaters are vented outside, however the reintroduction of combustion emissions into the home can impact the health of the home's occupant. Additionally, venting these pollutants outdoors can cause community-wide harm, particularly among low-income communities and communities of color who already experience increased levels of ambient air pollution.[10] For these reasons, increased efficiency standards for gas-powered appliances such as water heaters will improve health in several ways.

Gas powered water heaters are a source of pollution that has been shown to harm human health. For example, byproducts of burned methane gas contribute to premature mortality and increased risk for illness including ischemic heart disease, stroke, COPD, lung cancer, type 2 diabetes, and lower-respiratory infections.[11,12] There is a growing body of evidence showing an association between long-term exposure to air pollution and adverse birth outcomes. Short term exposure to high levels of air pollution can exacerbate asthma and cardiopulmonary symptoms.[13]

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[5] 2020 RECS Survey Data. https://www.eia.gov/consumption/residential/data/2020/index.php?view=microdata.
[6] DOE's analysis shows that the installed cost of a baseline gas instantaneous water heater is 50% more than that of a gas storage water heater.
[7] 88 Fed. Reg. 49141.
[8] https://www.regulations.gov/document/EERE-2017-BT-STD-0019-0058. pp. 11-3 and 11-6.
[9] 88 Fed. Reg. 49141.
[10]Wilhelm M, Qian L, Ritz B. Outdoor air pollution, family and neighborhood environment, and asthma in LA FANS children. *Health & Place*. 2009;15(1):25-36. doi:10.1016/j.healthplace.2008.02.002
[11]Singer BC, Pass RZ, Delp WW, Lorenzetti DM, Maddalena RL. Pollutant concentrations and emission rates from natural gas cooking burners without and with range hood exhaust in nine California homes. *Building and Environment*. 2017;122:215-229. doi:10.1016/j.buildenv.2017.06.021
[12]Roda C, Kousignian I, Guihenneuc-Jouyaux C, et al. Formaldehyde Exposure and Lower Respiratory Infections in Infants: Findings from the PARIS Cohort Study. *Environmental Health Perspectives*. 2011;119(11):1653-1658. doi:10.1289/ehp.1003222
[13] Tiotiu AI, Novakova P, Nedeva D, Chong-Neto HJ, Novakova S, Steiropoulos P, Kowal K. *Impact of Air Pollution on Asthma Outcomes*. Int J Environ Res Public Health. 2020 Aug 27;17(17):6212.

Indoor exposure to nitrogen dioxide from gas appliances, including water heaters can exacerbate asthma symptoms and wheeze in children and may increase lower respiratory tract illnesses and reduce lung function in children.[14]

Methane Gas Increases Risk of Heart Disease and Stroke

When methane gas is burned, several dangerous chemicals are created and emitted in or near living spaces. Carbon monoxide is a damaging air pollutant that can cause headache, fatigue, unconsciousness and death.[15] There is a large body of evidence that other pollutants such as nitrogen dioxide and particulate matter damages the respiratory and the cardiovascular system. When inhaled, $PM_{2.5}$ settles in the lungs which sets off a cascade of inflammatory reactions in the body. These reactions affect proper heart function and can cause arrhythmia and increase the risk of heart attacks. The combustion of methane can also produce ultrafine particulate matter. Ultrafine particulate matter is so small can cross the blood-brain barrier. This dramatically increases the risk of stroke and heart attack when the matter accumulates in brain tissue and heart tissue, respectively.[16]

Burned Methane Gas Increases Risk of Ozone-Related Illness

Nitrogen dioxide is a precursor to ozone, which is created by chemical reactions between volatile organic compounds and oxides of nitrogen in the presence of sunlight. Ozone reacts with and damages organic matter such as plant foliage, the human airway and other lung tissues. Exposure to ozone causes irritation and inflammation of the lungs, and leads to coughing, wheezing, worsening of asthma and lowered resistance to lung infections. Physical activity during peak ozone periods increases exposure and the likelihood of symptoms. Long-term exposure to higher ozone levels can permanently reduce lung function.[17] These health effects of ozone contribute to increased emergency department visits, hospital admissions and deaths on days with higher ozone concentrations, and to increased mortality associated with chronic ozone exposure.[18]

Burned Methane Gas Increases Risk of Asthma

Nitrogen dioxide is a primary air pollutant produced by the combustion of methane gas. The relationship between both short-term and long-term nitrogen dioxide exposure and the development of childhood asthma is well-documented.[19] For example, a 2013 study found that for every 5-ppb increase in nitrogen dioxide, the risk of wheeze and need for medication increased.[20] A meta-analysis found that children's

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[14] Weiwei Lin, Bert Brunekreef, Ulrike Gehring, *Meta-analysis of the effects of indoor nitrogen dioxide and gas cooking on asthma and wheeze in children, Int J of Epidemiology*, 2013; 42 (6): 1724–1737

[15]US EPA,OAR. Carbon Monoxide's Impact on Indoor Air Quality | US EPA. US EPA. Published July 31, 2014. https://www.epa.gov/indoor-air-quality-iaq/carbon-monoxides-impact-indoor-air-quality

[16]US EPA. Health and Environmental Effects of Particulate Matter (PM). US EPA. Published May 9, 2019. https://www.epa.gov/pm-pollution/health-and-environmental-effects-particulate-matter-pm

[17]Calderón-Garcidueñas L, Mora-Tiscareño A, Fordham LA, et al. Respiratory damage in children exposed to urban pollution. *Pediatric Pulmonology*. 2003;36(2):148-161. doi:10.1002/ppul.10338

[18]Silverman RA, Ito K. Age-related association of fine particles and ozone with severe acute asthma in New York City. *Journal of Allergy and Clinical Immunology*. 2010;125(2):367-373.e5. doi:10.1016/j.jaci.2009.10.061

[19]*Integrated Science Assessment (ISA) For Oxides of Nitrogen – Health Criteria* (Final Report, 2016). US Environmental Protection Agency, Washington, DC, EPA/600/R-15/068, 2016, Table ES-1, p. Lxxxii, https://cfpub.epa.gov/ncea/isa/recordisplay.cfm?deid=310879.

[20]Belanger K, Holford TR, Gent JF, Hill ME, Kezik JM, Leaderer BP. Household Levels of Nitrogen Dioxide and Pediatric Asthma Severity. *Epidemiology*. 2013;24(2):320-330. doi:10.1097/ede.0b013e318280e2ac

risk of wheeze increased by 15 percent for every 15-ppb increase in nitrogen dioxide concentration.[21] Low-income, Black, and Hispanic children are at higher risk of asthma exacerbation and respiratory symptoms from methane gas pollution than their high-income and White counterparts due to often living in historically disinvested communities with higher levels of ambient outdoor air pollution and poorly maintained housing stock and building appliances.[22] Additionally, older adults are also at risk from prolonged nitrogen dioxide exposure. A recent epidemiological study of a large cohort of Medicare beneficiaries found long-term exposure to extremely low levels of NO_2 was associated with a higher risk of mortality among older adults.[23]

Leaking Methane Gas Risks

Appliances that use methane gas as a source of fuel can leak unburned gas and pose a risk to human health. A recent study found that consumer-grade natural gas contains varying levels of at least 21 different hazardous air pollutants, including benzene, toluene, ethylbenzene, xylene, and hexane. The researchers also found that these leaks can be undetectable by smell, with small leaks up to methane concentrations of 20 parts per million void of odorant concentrations necessary for sensory detection.[24]

Reducing Energy Usage from Electric Appliances Improves Health at the Community Level

Electric water heaters are safer for the occupant but inefficient appliances that gather energy from a the current grid also contributes to pollution and health impacts. Power plants that burn coal, oil and methane gas are also the largest source of carbon pollution, the second biggest driver of climate change.[25] The extraction and transport of oil and natural gas produce methane, a potent greenhouse gas that contributes to warmer temperatures that drive changes that threaten health. It will be beneficial to health to increase the efficiency of appliances, therefore, regardless of their fuel source.

For example, when coal is burned, the health-endangering pollutants it releases, including nitrogen oxides and sulfur oxides affect all the major body organ systems.[26] Coal combustion contributes to four of the leading causes of mortality in the US: heart disease, cancer, stroke, and chronic lower respiratory diseases.[27] Air pollutants caused by coal combustion, in particular the very small particulates known as $PM_{2.5}$, adversely affect the respiratory system. $PM_{2.5}$ is known to trigger asthma attacks; contributes to chronic obstructive pulmonary disease (COPD); and is correlated with mortality from lung cancer, the

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[21]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:10.1093/ije/dyt150

[22]Hansel NN, Breysse PN, McCormack MC, et al. A Longitudinal Study of Indoor Nitrogen Dioxide Levels and Respiratory Symptoms in Inner-City Children with Asthma. *Environmental Health Perspectives*. 2008;116(10):1428-1432. doi:10.1289/ehp.11349

[23]Qian Y, Li H, Rosenberg A, et al. Long-Term Exposure to Low-Level NO2 and Mortality among the Elderly Population in the Southeastern United States. *Environmental Health Perspectives*. 2021;129(12). doi:10.1289/ehp9044

[24]Michanowicz DR, Dayalu A, Nordgaard CL, et al. 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*. 2022;56(14):10258-10268.

[25] United States Environmental Protection Agency. *Sources of Greenhouse Gas Emissions.* April 13, 2023. Available at https://www.epa.gov/ghgemissions/sources-greenhouse-gas-emissions.

[26] United States Protection Agency. *The Sources and Solutions: Fossil Fuels* January 20, 2023 available at https://www.epa.gov/nutrientpollution/sources-and-solutions-fossil-fuels.

[27] World Health Organization. *Household Air Pollution*. November 28, 2022 available at: https://www.who.int/news-room/fact-sheets/detail/household-air-pollution-and-health

leading cancer killer in both men and women. Pollutants produced by coal combustion also damage the cardiovascular system and the neurological system. Coronary heart disease is a leading cause of death in U.S., and coal combustion air pollutants, especially nitrogen oxides and $PM_{2.5}$, are known to negatively impact cardiovascular health.[28] These impacts include cardiac arrhythmias, heart attacks, and congestive heart failure. Finally, a growing body of research is connecting poor air quality and exposure to $PM_{2.5}$ to neurological impacts caused by increased inflammation and oxidative stress.[29] The result of these changes can cause developmental delays, an increase of depressive and anxiety disorders, and permanent loss of intelligence[30] early in life and an increased risk of neurological diseases (including Parkinson's disease, Alzheimer's disease, and other dementias) later in life.[31]

In summary, by significantly increasing the efficiency of water heaters the proposed standard will promote more-efficient condensing technology. The transition will improve human health, combat climate change, and reduce utility bills. We strongly urge you to adopt the proposed increased standard.

Sincerely,
American Lung Association
American Public Health Association
Asthma and Allergy Foundation of America
Climate Psychiatry Alliance
National Association of Pediatric Nurse Practitioners
Physicians for Social Responsibility
Public Health Institute

[28] United States Protection Agency. *Air Pollution and Cardiovascular Disease Basics. September 12, 2022.* Available at: https://www.epa.gov/air-research/air-pollution-and-cardiovascular-disease-basics

[29] Zundel CG, Ryan P, Brokamp C, Heeter A, Huang Y, Strawn JR, Marusak HA. Air pollution, depressive and anxiety disorders, and brain effects: A systematic review. Neurotoxicology. 2022 Dec;93:272-300. doi: 10.1016/j.neuro.2022.10.011. Epub 2022 Oct 21. PMID: 36280190; PMCID: PMC10015654.

[30] United States Protection Agency. *Air Pollution and Cardiovascular Disease Basics. September 12, 2022.* Available at: https://www.epa.gov/air-research/air-pollution-and-cardiovascular-disease-basics

[31] Shi L, Wu X, Danesh Yazdi M, Braun D, Abu Awad Y, Wei Y, Liu P, Di Q, Wang Y, Schwartz J, Dominici F, Kioumourtzoglou MA, Zanobetti A. Long-term effects of PM2·5 on neurological disorders in the American Medicare population: a longitudinal cohort study. Lancet Planet Health. 2020 Dec;4(12):e557-e565. doi: 10.1016/S2542-5196(20)30227-8. Epub 2020 Oct 19. PMID: 33091388; PMCID: PMC7720425.