clasp Efficient Appliances for People & the Planet

FACTSHEET

Improving Public Health & Advancing Justice40 with Appliance Energy Efficiency Standards

Federal energy efficiency standards for appliances and equipment reduce energy consumption and benefit human health. By conserving energy, these standards reduce both indirect emissions (from power plants) and direct emissions (from fossil fuel appliances), decreasing exposure to fine particulate matter ($PM_{2.5}$) pollution. $PM_{2.5}$ is a category of particulate pollution that is 2.5 microns or smaller in size that is able to enter the lungs and bloodstream, contributing to increased incidences of respiratory diseases and negative effects on the cardiovascular system that increase the risk of heart attacks and premature death.[1]

A recent report from CLASP reveals that the health benefits resulting from these standards align with the equity goals of the Justice40 Initiative, notably diminishing $PM_{2.5}$-related mortality in disadvantaged communities (DACs). This factsheet provides a high-level overview of key findings.

INEFFICIENT APPLIANCES CONTRIBUTE TO POOR OUTDOOR AND INDOOR AIR QUALITY

Appliances contribute to poor outdoor (ambient) air quality by emitting pollutants directly (through fuel combustion) or indirectly (through the generation of electricity). Common pollutants from direct and indirect appliances emissions include ammonia (NH_3), nitrogen oxides (NO_x), $PM_{2.5}$, sulfur dioxide (SO_2), and volatile organic compounds (VOCs), many of which are regulated by the US Environmental Protection Agency (EPA) under the Clean Air Act.[2]

Data from the National Emissions Inventory (NEI)[i] show that appliances were responsible for large quantities of emissions in 2017 (Table 1). Inhaling these pollutants can lead to respiratory, cardiovascular, and neurological health issues,[3] with children, the elderly, and those with conditions like asthma being especially vulnerable.[4] In the US, low-income communities and communities of color often bear a disproportionate share of this burden, resulting in more adverse health outcomes.[5]

TABLE 1. EMISSIONS FROM FOSSIL FUEL APPLIANCES AND POWER PLANTS IN 2017 (SHORT TONS)

YEAR	SECTOR	NH_3	NO_x	$PM_{2.5}$	SO_2	VOC
2017	Residential fossil fuel appliances[ii]	33,640	204,790	4,040	1,370	12,080
	Power plants[iii]	18,870	1,090,000	102,370	1,353,780	26,160
	Total	**52,510**	**1,294,790**	**106,410**	**1,355,150**	**38,240**

Source: National Emissions Inventory, 2017

i. The NEI is published every three years. At the time of analysis, data for the year 2020 were not publicly available.

ii. Emissions data were retrieved from the 2017 NEI for following source category: residential fuel combustion. Common uses of energy associated with this category include space heating, water heating, and cooking. Emissions in this category include the following fuel categories: gas, oil, and other. Residential heating involves the combustion of fuel, including coal, distillate oil, kerosene, natural gas, and liquefied propane gas (LPG). We did not apportion power plant emissions by source. Therefore, this estimate includes all power plant emissions in 2017.

iii. Emissions data were retrieved from the 2017 NEI for following source category: fuel combustion from electric generation for the following fuel classifications: coal, natural gas, oil, biomass, and other.

ENERGY EFFICIENCY STANDARDS HAVE HELPED IMPROVE AMBIENT AIR QUALITY AND LOWER $PM_{2.5}$-RELATED MORTALITY

CLASP estimates that standards adopted over the past 30 years resulted in the avoided release of over 200,000 tons of NO_x emissions and 250,000 SO_2 emissions in 2017 (Table 2).[iv] This is a nearly 15% decline from what we estimate emissions would have been in the absence of standards.

Using InMAP, a marginal change model that can be used to estimate the health impacts of pollution, we find that Federal appliance and equipment standards prevented between 1,900[v] and 4,400[vi] $PM_{2.5}$-related deaths in 2017. Using the value of a statistical life,[vii] we estimate the value of these benefits to be between $18 billion and $41 billion dollars.

TABLE 2. AVOIDED EMISSIONS FROM FEDERAL APPLIANCE AND EQUIPMENT STANDARDS (2017)

POLLUTANT	AVOIDED EMISSIONS (SHORT TONS)
NH_3	4,800
NO_x	209,260
$PM_{2.5}$	19,050
SO_2	250,100
VOC	5,290

Source: CLASP analysis

STANDARDS DELIVER EQUITABLE HEALTH BENEFITS & CAN HELP ADVANCE JUSTICE40 GOALS

The avoided premature deaths from reduced appliance and equipment pollution are distributed equitably across communities. According to CLASP modeling, the share of public health benefits from standards (*i.e.*, reductions in $PM_{2.5}$-related mortality) in DACs is roughly equal to their share of the population. According to the Climate and Economic Justice Screening Tool (CEJST), DACs represent 33% of the US population.[6] CLASP analysis shows that DACs populations receive 36% of the public health benefits (reduced $PM_{2.5}$-related mortality) from Federal appliance and equipment standards. In 45 states and the District of Columbia, the difference between the share of health benefits occurring in DACs and their share of the population did not exceed six percentage points (Figure 1). In just four states, this difference exceeded six percentage points.

Disadvantaged communities receive 36% of the public health benefit[viii] from appliance standards

The share of reduced $PM_{2.5}$-related mortality from appliance pollution occurring in DACs falls short of the Justice40 40% threshold. Executive Order 14008 specifies that "40 percent of the overall benefits" from Federal investments in covered programs should reach disadvantaged communities, but it does not require every project or investment to meet the 40% target.[7] The Buildings Technologies Office, a covered program under Justice40, must meet the Justice40 target, but individual projects or investments like appliance standards may either surpass or fall below this threshold.[8] Additionally, the proportion of benefits allocated to disadvantaged communities can vary depending on the chosen indicator. If we had selected a different indicator, like exposure to $PM_{2.5}$, the distribution of benefits may have been different.

While our findings are promising, more can be done to ensure DACs reap additional benefits of efficient appliances and equipment. For example, according to CEJST indicators,[9] DACs are likely to include a high number of low-income residents. Low-income residents are more likely to live in homes with older, inefficient appliances.[10, 11] Efforts to make energy-efficient and less polluting appliances more affordable and accessible to low-income households are needed to address the layered public health, social, economic, and environmental inequities facing DACs.

iv. The avoided emissions from Federal appliance and equipment standards were calculated by taking the difference between two scenarios: 1. actual emissions from residential fossil fuel appliances and power plants in 2017 as reported in the NEI and 2. a counterfactual scenario estimating emissions from the same sources in 2017 in the absence of standards. This counterfactual scenario was developed using 2017 NEI data (fuel combustion for electric generation and residential fuel combustion) and 2017 energy savings estimates from Federal appliance and equipment standards (electric appliances and residential fossil fuel appliances) provided by the Appliance Standards Awareness Project (ASAP) for standards adopted over a 30-year period (1987–2017).

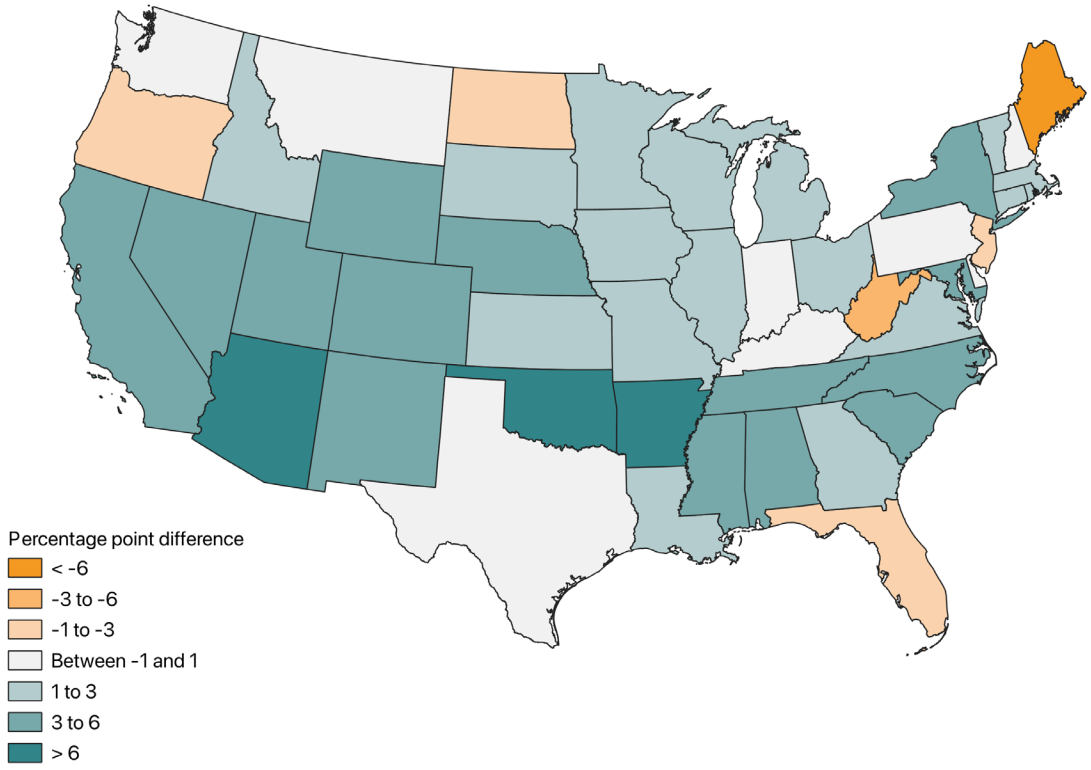
v. Our mortality "low" estimate was calculated using the concentration response function defined in Krewski, Daniel, Michael Jerrett, Richard T. Burnett, Renjun Ma, Edward Hughes, Yuanli Shi, Michelle C. Turner, et al. "Extended Follow-up and Spatial Analysis of the American Cancer Society Study Linking Particulate Air Pollution and Mortality." Research Report (Health Effects Institute), no. 140 (May 2009): 5–114; discussion 115–136.

vi. Our mortality "high" estimate was calculated using the concentration response function defined in Lepeule, Johanna, Francine Laden, Douglas Dockery, and Joel Schwartz. "Chronic Exposure to Fine Particles and Mortality: An Extended Follow-up of the Harvard Six Cities Study from 1974 to 2009." Environmental Health Perspectives 120, no. 7 (July 2012): 965–70. https://doi.org/10.1289/ehp.1104660.

vii. We calculated the monetary value of the mortality impacts by multiplying the mortalities estimates calculated using InMAP by the value of a statistical life for a 2017 income level. We estimated the 2017 income level dollar amount by linearly interpolating the three percent discount rate values for the years 2016, 2023, and 2028 used in the U.S. Environmental Protection Agency's Co-Benefits Risk Assessment Health Impacts Screening and Mapping Tool. We used a value of approximately $9.5 million in 2017 dollars. DOE monetizes health benefits using dollar-per-ton estimates for NO_x and SO_2 emissions for relevant sectors (see US EPA. "Technical Support Document: Estimating the Benefit per Ton of Reducing Directly-Emitted PM2.5, PM2.5 Precursors and Ozone Precursors from 21 Sectors." U.S. Environmental Protection Agency, Office of Air and Radiation, September 2023. https://www.epa.gov/system/files/documents/2021-10/source-apportionment-tsd-oct-2021_0.pdf.) Health benefits are presented at real discount rates of 3 and 7 percent.

viii. We define public health benefits as the estimated difference in modeled $PM_{2.5}$-related mortality from InMAP measured as the difference in mortality between two emissions scenarios: actual emissions from residential fossil fuel appliances and power plants in 2017 (NEI) and a counterfactual scenario estimating emissions from the same sources in 2017 in the absence of standards.

FIGURE 1. COMPARISON OF THE SHARE OF PUBLIC HEALTH BENEFITS TO DACS FROM FEDERAL APPLIANCE AND EQUIPMENT STANDARDS TO THEIR DAC SHARE OF THE POPULATION (2017)



Source: CLASP analysis of InMAP model outputs.
Note: This map compares the share of benefits (avoided $PM_{2.5}$-related mortality) from Federal appliance and equipment standards delivered to DACs to their share of the population for the contiguous US. Areas shaded in teal show states where the share of benefits realized in DACs is greater than their share of the population. Areas shaded in orange show states where the share of benefits realized in DACs is less than their share of the population. Hawaii and Alaska were excluded from the analysis because InMAP is only able to analyze changes $PM_{2.5}$ concentrations for the contiguous US.

RECOMMENDATIONS

RAISE THE BAR FOR EFFICIENCY STANDARDS

DOE should continue to set new, ambitious standards for appliances and equipment and meet its legally binding deadlines provided under the National Appliance Energy Conservation Act (NAECA) of 1987 for updating standards in a timely manner.

INCLUDE DACS AND COMMUNITIES OF COLOR

Community members and advocates should be formally engaged in the design and implementation of appliance efficiency policies. Where formal community input pathways such as community advisory groups do not exist, they should be created. Existing non-profit and advocacy organizations already working in appliance efficiency should form new partnerships with community-based organizations and environmental justice groups to ensure that all voices are heard when standards are under development. Community-based and environmental justice organizations can operate as trusted partners between policymakers and communities, playing a critical role in outreach and education throughout the policymaking and implementation process.

Inclusion should not stop at policy design. Implementation is equally as important. Efficiency programs at all levels should seek to employ people from disadvantaged communities and communities of color, and engage community leaders in the execution of

policies, programs, and initiatives. These representatives can play a critical role in garnering community support, carrying out outreach and education programs, and ensuring the programs truly speak to the needs of the community.

CONSIDER HEALTH BENEFITS

DOE should consider health benefits when calculating the distributional benefits of climate and clean energy investments under Justice40. Decreasing exposure to pollutants and environmental burdens is one of the eight policy priorities guiding DOE's implementation of Justice40. Current examples of these benefits include avoided emissions and decreased exposure in DACs.[12] DOE may also wish to understand whether these benefits reduce gaps in life outcomes, like mortality. Outcomes are the ultimate test for whether a policy or program ultimately serves broader social and economic ends. Tools like EPA's BenMAP or InMAP can help implementing agencies assess both the environmental and public health impact of specific policies.

REMOVE BARRIERS TO EFFICIENT APPLIANCES FOR DACS

Governments should expand appliance efficiency outreach efforts and incentivize efficient appliance purchases, among both homeowners and landlords. Most DACs have large populations of minority and/or low-income residents. These demographic groups are more likely to be renters with little influence over appliance purchase decisions or home efficiency improvements. State and local governments, utilities, non-profits, and consumer advocacy groups should aggressively promote opportunities for savings to both homeowners and landlords through federal funding and programs, *e.g.,* the Inflation Reduction Act, ENERGY STAR, and efficient appliance rebate programs, etc. The Inflation Reduction Act includes several rebates and tax credits for energy-efficient or electric appliance and equipment upgrades, but many of these incentives are geared toward homeowners or single-family homes. Ensuring that incentives designed to target disadvantaged communities—like homeowner managing energy savings (HOMES) rebates or the Department of Housing and Urban Development's Green and Resilient Retrofit Program, and low-income rebates through the ENERGY STAR program—reach their intended beneficiaries will be crucial. The impact of these efforts could result in a greater share of health benefits going to disadvantaged communities.

ENDNOTES

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