The Lancet Countdown on Health and Climate Change

Policy brief for the United States of America

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LANCET COUNTDOWN: TRACKING PROGRESS ON HEALTH AND CLIMATE CHANGE

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Introduction

This third annual Policy Brief focuses on the connections between climate change and health in the United States (U.S.) in 2018. It draws out some of the most nationally relevant findings of the 2019 global Lancet Countdown report with U.S.-specific data and supplemental sources to highlight the key threats and opportunities climate change poses for the health of everyone in the U.S.

Executive Summary

Worker productivity is decreasing due to extreme heat.

Heat limits worker productivity, and reduced labor capacity is often the first sign of health harms from heat. U.S. workers, especially in agriculture and industry, lost nearly 1.1 billion potential labor hours between 2000-2018 and 64.7 million potential hours in 2018 alone from extreme heat.

Exposure of older adults to heatwaves is increasing.

Heatwaves are increasingly frequent and severe, and adults aged 65 years or older are especially susceptible to sickness and death during these events. Since older adults are also a growing population in the U.S., the number of heatwave exposure events for older adults has been increasing in recent years relative to a 1986-2005 baseline.

People are dying from air pollution.

In 2016, fine particulate air pollution ($PM_{2.5}$) caused over 64,000 premature deaths in the U.S. Compared to the general population, Indigenous peoples, Blacks, Latinx, people living in poverty, or less educated individuals are more likely to experience and sometimes die earlier from unhealthy air. Burning fossil fuels like coal or oil is the largest driver of harmful air and carbon pollution.

FURTHER INFORMATION

This Brief draws on indicators 1.1.3, 1.1.4, 2.1.3, 3.1.1, 3.3.2 from the 2019 global Lancet Countdown report. Further information on the methodology and data used can be found in the full report and its appendix, available at www.lancetcountdown.org/2019-report. Please see appendix for case studies and supplemental materials as referenced in this Brief, available at www.lancetcountdownus.org.

SPECIAL U.S. FOCUS: CLIMATE CHANGE AND HEALTH EQUITY

Unequal Vulnerabilities and Health Burdens - Now and in the Future

Human-caused climate change continues to cause widespread harm to the health of people living in the U.S. While no one is immune from the threat climate change poses, these health harms are disproportionately borne by vulnerable and marginalized populations, a theme explored in this Brief. In addition, as today's children become adults, they are likely to face far greater health impacts from climate change than those occurring in recent years.

Decreasing carbon intensity but rising carbon emissions in the energy system.

While data from the 2019 global Lancet Countdown report indicates that the U.S. energy system had a record low carbon intensity in 2016, the most recent year available, U.S. energy-related carbon emissions rose by 2.8% in 2018, the largest increase since 2010. While renewable energy technology is increasingly cost-effective, the technology needs to be dramatically scaled up to lower the country's carbon emissions.

City-level climate assessments and local solutions to protect health.

Much of the U.S. recognizes the challenges that climate change brings. Nearly two-thirds of 136 cities surveyed in 2018 have completed climate risk assessments or are in the process of doing so. Health impacts vary by region and locality, underscoring the importance of identifying the communities most impacted, and the need for individual and local community action plans to protect health, especially for the most vulnerable.

Key Messages and Policy Recommendations

U.S. political leaders are faced with a critical choice: to either sow change now and reap the health benefits, or continue to delay and suffer health harms as a result. According to the Intergovernmental Panel on Climate Change (IPCC), global greenhouse gas (GHG) emissions must be reduced by at least 45% from 2010 levels by 2030 and reach net zero by 2050 to meet the goal of the Paris Agreement to limit warming to 1.5°C.[1]

The policy recommendations put forth in this Brief offer **tremendous health benefits attainable with rapid and substantial actions to combat climate change**. U.S. policymakers should **integrate health considerations into proposed climate policies**, recognizing that **the goal of responding to climate goes beyond reducing carbon emissions, and seize opportunities to improve health, save lives, and protect the most vulnerable**.[2,3]

For additional policy recommendations, please refer to the *U.S. Call to Action on Climate, Health and Equity: A Policy Action Agenda*, that was released in 2019.[4]

Mitigation of climate change: Improving health now and in the future through rapid reduction of GHGs and a just transition to clean, renewable energy

1. **Rapidly reduce GHG emissions:** Policymakers at all levels of government and across all sectors must ensure reductions in GHG emissions that far surpass the existing Paris Agreement commitments and align with IPCC recommendations.

2. **Commit to decarbonization:** Policymakers should adopt legislation and regulatory action that supports rapid transition of electricity generation away from fossil fuels and reduces emissions from the transportation sector. This would follow the precedent set by the ten states and the District of Columbia that have announced a 100% clean or renewable electricity goal, and the fourteen states and the District of Columbia that have enacted low-emission vehicle standards (as of October 2019).

3. **Enable healthier lifestyles to reduce carbon emissions:** Policymakers should invest in infrastructure that supports active travel like biking and walking. Interventions to facilitate active travel simultaneously decrease emissions of GHGs and air pollution, while also promoting physical activity and offering multiple benefits for health.

Adaptation to climate change: Protecting health and making healthcare systems resilient

4. **Invest in evidence-based adaptation and improved surveillance:** Federal, state, and local governments should invest further in evidence and monitoring to guide health protection strategies, including surveillance of the health impacts of climate change and efforts to improve understanding of how future climate trends are likely to impact health.

5. **Increase resilience by strengthening health systems:** Federal and state agencies should minimize climate-related disruptions to public health and healthcare systems through improvements such as resilient infrastructure, emergency preparedness, and supply chain resilience.

Climate Change is Harming the Health of Everyone

People in the United States are living in a changed world that is about 1.98ºF (1.1ºC) warmer than pre-industrial times;[1,5] 18 of the 19 hottest years ever recorded have been since 2000.[6] In addition to the direct health impacts of increasing heat,[7–9] these warmer temperatures expand the areas where mosquitoes that transmit diseases like Zika can live, and contribute to longer active mosquito seasons.[9,10] In addition, there were 14 climate- and weather-related disasters in the U.S. in 2018, each of which had associated health harms and exceeded a billion dollars in economic loss, with a record fourth-highest total of 91 billion U.S. dollars (USD).[11] Wildfires in California were the largest, deadliest, and costliest to date with significant health tolls (see appendix for case study - 2018 Camp Fire: California's Deadliest Wildfire).[12] At least five 'one-in-1,000 year' rainfall events took place in the U.S. in 2018, causing devastating flooding across the country,[13] with associated health risks including water contamination and diarrheal illness.[9,14] These are just a few examples of the widespread health consequences of climate change beyond the areas of focus in this Brief.

Rising Carbon Emissions in the U.S.

To minimize health harms, there is a need to address the main driver of climate change and reduce emissions of greenhouse gases (GHGs) such as carbon dioxide (CO_2). The *Intergovernmental Panel on Climate Change (IPCC) Special Report: Global Warming of 1.5ºC*, published in 2018, stated that global CO_2 emissions must be almost halved by 2030 and reach net zero around 2050 to limit the planet's warming to below 2.7ºF (1.5ºC) by 2100.[1] It has also been estimated that global emission reductions of at least 3% per year are needed in order to keep warming below 3.6ºF (2ºC),[15] a temperature that would result in far more health dangers than 2.7ºF (1.5ºC).[16] Instead, U.S. CO_2 emissions rose by an estimated 3.1% in 2018.[17]

Climate Change and Health Equity

Oil, gas, and coal operations produce air pollution and drive climate change, which is causing extensive harm to the health of people in the U.S.[14] Some people are more vulnerable, either because of increased susceptibility to harm (e.g., a person's age, pregnancy status, or existing health problems), increased exposure (e.g., a person's job, race, socioeconomic status, or location), limited ability to adapt to impacts (e.g., a person's disabilities or access to healthcare) - or a combination of these factors, which compound over time (Figure 1).[18] Just as climate change exacerbates existing health inequities by worsening harms and increasing costs for the most vulnerable, interventions to reduce GHG emissions can lessen health inequities and increase opportunities for everyone to enjoy a healthy life.[9,18]

Unequal Health Vulnerability in a Heatwave

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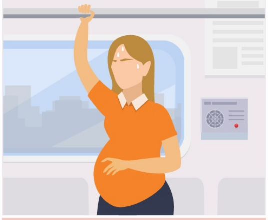
Certain populations are more vulnerable to the impacts of climate change, and disproportionately experience health harms from it, widening existing health disparities. This graphic shows how four people in an urban area are impacted by a heatwave, which are becoming more frequent and severe due to climate change, to highlight examples of vulnerability and adaptation.

🟥 RISK FACTOR

🟦 PROTECTIVE FACTOR

A/C = air conditioning

		Sasha | AGE: 6 | BLACK	**Mary** | AGE: 23 | WHITE	**Cesar** | AGE: 42 | LATINX	**Young** | AGE: 81 | ASIAN
					
KEY HEALTH RISK		Asthma attack from air pollution	Birth complications	Death from heatstroke	Heat-related heart failure
VULNERABILITY CATEGORY	**SUSCEPTIBILITY**	🟥 Child 🟥 Asthma 🟦 Otherwise healthy	🟦 Young adult 🟥 Pregnant 🟦 Healthy	🟦 Middle age 🟥 High blood pressure 🟥 Medication increases heat sensitivity	🟥 Older age 🟥 Heart condition 🟥 Medication increases heat sensitivity
	EXPOSURE	🟥 Person of color* 🟥 Lives by sources of air pollution 🟥 Air pollution worsened by heat	🟥 Apartment with poor insulation 🟥 Subway to work doesn't have A/C 🟦 A/C at work	🟥 Person of color* 🟥 Works outside in the sun 🟥 No A/C at home	🟥 Person of color* 🟥 Room on top floor 🟥 Poor A/C in nursing home
	ABILITY TO ADAPT	🟥 Inadequate health insurance 🟦 Middle class 🟦 Good family support	🟦 Health insurance 🟥 Poor 🟥 Lack of social support	🟥 No health insurance 🟥 Undocumented immigrant 🟦 Good social support	🟦 Health insurance 🟦 Middle class 🟥 Limited mobility
HEALTH OUTCOME		 Visits emergency department for an asthma attack	 Struggles to protect herself from heat but delivers a healthy baby	 Develops heatstroke and nearly dies	 Long hospitalization for heart failure
ADAPTATION ACTION		Real-time air-quality surveillance program sends warnings to vulnerable residents when pollution levels are high	Doctor is further educated on how heat impacts clinical practice and proactively counsels on heat risk throughout pregnancy	State health officials institute new heat-safety regulations to protect outdoor workers	Nursing home implements a heat emergency protocol to protect patients and invests in A/C improvements

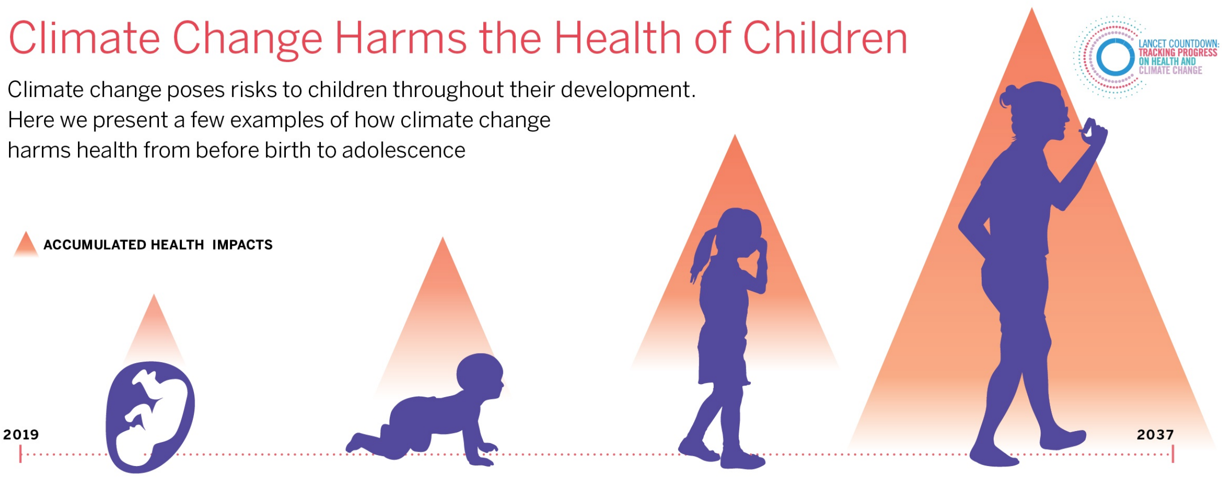
***Statistically, people of color are exposed to environmental harms at disproportionately higher rates. Therefore, we are including it here as a risk factor for exposure.**
Disclaimer: These fictional characters were created for illustrative purposes to highlight vulnerability, and certain vulnerabilities can exist in more than one category.

Figure 1: Unequal health vulnerability in a heatwave.[9,14,18,20,21]

If our current trajectory continues, children, in particular children of color, in the U.S. today will face compounded health harms and billions of dollars in health-related costs over the course of their lives (Figure 2).[9,18,19] In fact, "without significant intervention, this new era will come to define the health of an entire generation."[22]

Climate Change Harms the Health of Children

Climate change poses risks to children throughout their development. Here we present a few examples of how climate change harms health from before birth to adolescence



Prenatal

- **Poor pregnancy outcomes** like low birth weight and pre-term delivery
- Increased risk of **low birth weight** and **neonatal death**

Infancy

- **Higher risk for heat-related illness** because developing bodies are less able to control temperature
- Heightened risk of **water- and food-borne infections** while immune system is developing

Childhood

- Long-term **lung problems** and more frequent **asthma attacks**
- Outdoor exposure increases risk of diseases from insects, like **Lyme disease**

Adolescence

- **Post-traumatic stress** and **anxiety** in survivors
- Negative impacts on **ability to think, outdoor recreation** and the **ability to play sports**

Sample Ways that Climate Change Harms Health

Extreme Heat (e.g., heatwaves): Becoming more frequent and severe. *Health Risks: deadly heatstroke, trouble thinking, increased injury risk, worsening of heart and lung disease, dehydration*

Poor Air Quality (e.g., particulate matter from coal burning or wildfires, ground-level ozone, increased pollen): Declining air quality resulting from carbon pollution and rising temperatures. *Health Risks: preterm birth, low birth weight, asthma, poor school performance and school absence, seasonal allergy flares, damage to developing brains, displacement from wildfire damage*

Extreme Weather Events (e.g., hurricanes, floods): Becoming more intense and some types more frequent. *Health Risks: injuries, drowning, water and food-borne illnesses, anxiety, depression, displacement, loss of economic opportunity, toxic stress*

Tick and Mosquito-borne Disease (e.g., Lyme Disease and Dengue) Growing risk of diseases transmitted by insects, like ticks and mosquitoes, spreading to new places and remaining active longer. *Health Risks: Lyme – heart, brain, and joint problems; Dengue – trouble breathing, bleeding, organs shutting down with severe dengue*

Figure 2: Climate change harms the health of children.[9,18,21–27]

Impacts of Heat on Health and Productivity

U.S. Data: Heat and Health - Change in Labor Capacity

Between 2000-2018, it is estimated that U.S. labor productivity declined by nearly 1.1 billion potential labor hours due to extreme heat, with particular losses in the industrial and agricultural sectors. In 2018 alone, 64.7 million potential work hours were lost (industry – 36.1 million; agriculture – 27.7 million; service - 910,000).* Southern U.S. states (defined as those below 34°N latitude) lost 15-20% of possible daylight work hours for heavy labor (e.g., agriculture and construction) in direct sun due to heat exposure during the hottest month in 2018 (July). Texas, Louisiana, Mississippi, Alabama, Georgia, and Florida were particularly impacted (Figure 3).[22]

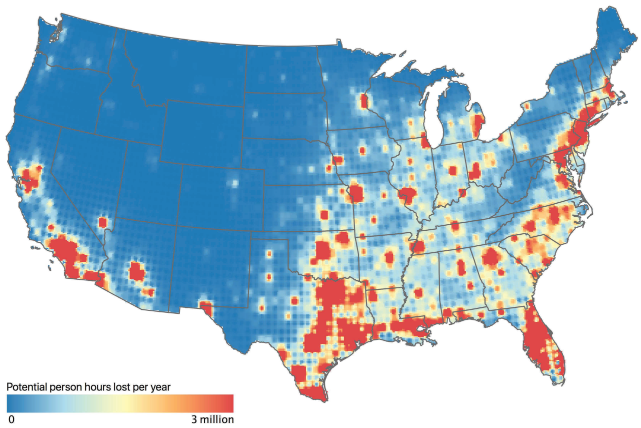


Figure 3: Potential full-time equivalent work (12 hours per day, 365 days per year) lost.[22]

Map of annual million potential person hours lost per cell based on % service sector working at 200W, % of industry sector working at 300W and % agricultural sector working at 400W with 3 million hours per cell-year, assuming all work in direct sun.

Rising temperatures have negative health impacts such as deadly heat stroke, adverse birth outcomes, and worsening heart, lung, and mental health conditions.[8] Heatwaves in the U.S. are becoming more frequent and intense, and the number of extreme heat days is increasing (Figure 4).[28,29]

Reduced labor productivity due to extreme heat illustrates the far-reaching impacts of climate change on human health (see appendix for extended case study - Heat-related Illness and Vulnerability in the Workplace).[12] Lost wages from potentially forfeited labor hours can further exacerbate financial burdens on already struggling families as well as impact the U.S. economy. Of these most impacted states, Mississippi, Alabama, and Louisiana have some of the highest poverty rates in the country.[32]

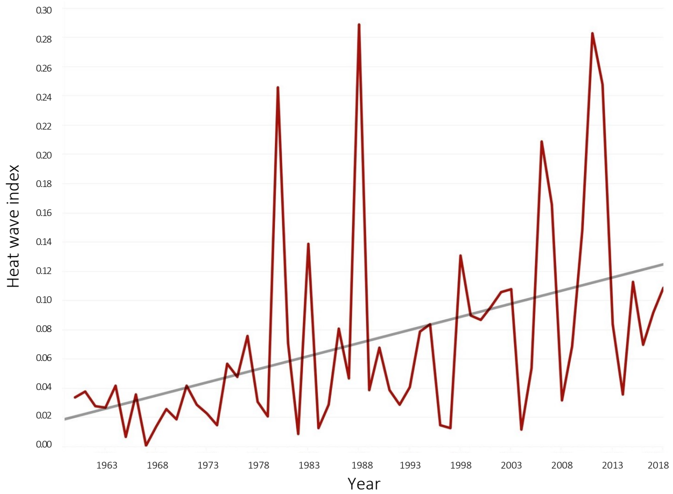


Figure 4: U.S. annual heat wave index from 1960 - 2018.[30,31]

This index highlights abnormally hot or cold days over the contiguous 48 states. As an example, a heat wave index of 0.2 could mean that 20% of the country had one heatwave, 10% experienced two heatwaves, etc.

U.S. Data: Heat and Health - Exposure of Vulnerable Populations to Heatwaves

Older adults age 65 and above are especially vulnerable to extreme heat. In 2011, 22.3 million additional heatwave exposure events for older adults occurred (with one exposure event being one heatwave experienced by one person 65 years and older) above the 1986-2005 average. In 2016, 11.6 million more exposure events occurred compared to baseline, followed by 3.7 million in 2017 and 3.1 million in 2018.[22]

By 2030, all "baby boomers" will be over the age of 65 and are projected to outnumber children under the age of 18 in the U.S. by 2034.[33] Thus, the observed trend of more heatwave exposure events in older adults above the 1986-2005 baseline is likely a reflection of both a larger number of older adults and the increased frequency and length of heatwaves.[28,34] As this population grows, the number of older adults at risk of illness, hospitalization, or death from extreme heat is also anticipated to increase.

Some of the reasons older adults are more vulnerable to the health impacts of extreme heat include the natural aging process, pre-existing illnesses (e.g., heart or lung problems), and medications that cause adverse reactions in extreme heat situations.[18] Older adults' ability to adapt to extreme heat can be limited by factors such as reliance on caregivers, decreased mobility, being homebound, social isolation, and lacking access to air conditioning - all of which increase their vulnerability as extreme heat exposure intensifies.[18,35,36]

*Updated methodology from the 2018 Lancet Countdown Global Report.

People in the U.S. are Dying from Air Pollution

U.S. Data: Air Pollution, Energy, and Transport - Premature Mortality from Ambient Air Pollution by Sector

In addition to causing climate change, fossil fuel combustion emits harmful air pollution, notably fine particulate matter known as $PM_{2.5}$ (particles 2.5 micrometers and smaller).[37] In 2016, there were 64,200 premature deaths in the U.S. due to ambient $PM_{2.5}$ air pollution, of which 8,600 were due to coal combustion in the power, industry, and household sectors.[22]

Air pollution is known to have a wide range of negative health impacts, and the health damages of air pollution are experienced unequally.[38,39] For example, Blacks and Latinx are exposed to higher levels of $PM_{2.5}$ air pollution (21% and 12% higher, respectively) when compared to the overall population.[40] Indigenous people have also been found to be more exposed to air pollution.[41] Despite higher exposure, these populations contribute least to the problem. Blacks and Latinx bear an excess "pollution burden," meaning they experience 56% and 63% more air pollution exposure, respectively, than they cause from their own consumption of goods and services.[40] This inequality contributes to a shorter lifespan due to $PM_{2.5}$ exposure for people who live in counties that are poorer, less educated, or have a higher proportion of Black residents.[42]

Mitigation of Climate Change: Carbon Emissions in the U.S. Energy System

Understanding the sources of GHG emissions can inform where to focus efforts (Figure 5).[43] The transportation and electricity generation sectors were the largest sources of emissions. U.S. carbon emissions per capita in 2016 remained one of the highest in the world at approximately 14.6 tons of CO_2 per person compared to 6.7 in China, 5.4 in the United Kingdom, and 1.6 in India.[44]

U.S. Data: Energy System and Health - Carbon Intensity of the Energy System

Since 1971, the carbon intensity of the total primary energy supply (TPES) in the U.S. has declined. In 2016 (the most recent year for which data available), the carbon intensity of TPES reached a record low of 53.3 metric tons of CO_2 emitted for each terajoule (TJ) of primary energy (Figure 6).[22]

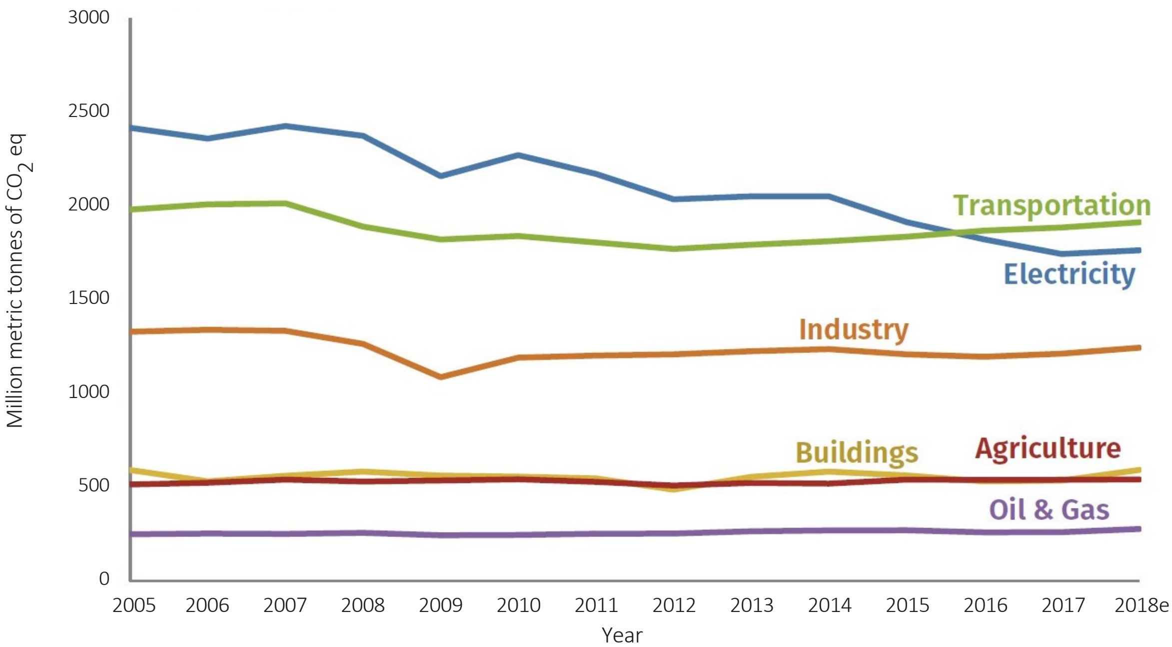


Figure 5: Greenhouse gas (GHG) emissions by sector in the U.S. from 2005 - 2018e.[45]
2018e is an estimated 2018 value. Energy CO_2 estimates included in these economy-wide GHG numbers are calculated using EIA, rather then EPA methodology, and thus include transportation fuels for interntational travel and a number of other minor differences.

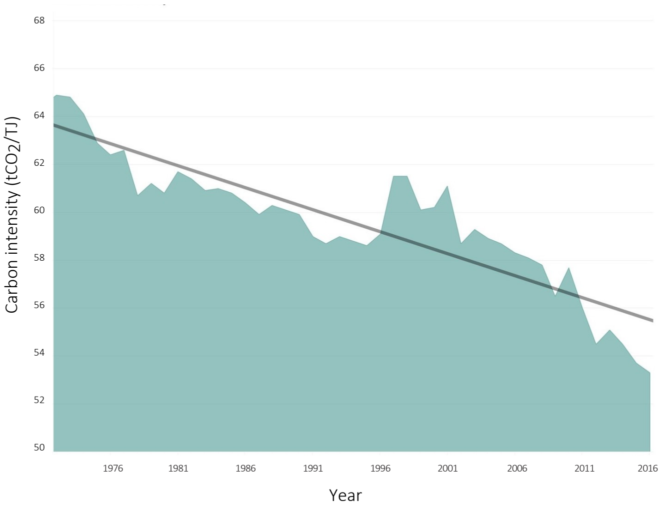


Figure 6: Carbon intensity of the U.S. energy system by tons of CO_2 (tCO_2) emitted for each per TJ of primary energy supplied.[22]

The U.S. Energy and Information Administration reports that U.S. energy-related CO_2 emissions rose by 2.8% in 2018, which was the largest increase since 2010.[46] There was also a 4% rise in U.S. energy consumption in 2018 (see appendix - Rising Energy Consumption in the U.S. and Need for Indoor Climate Control).[12,47] Meanwhile, prices for electricity from renewable sources have dropped substantially, making wind and solar increasingly competitive.[48]

Policies that reduce carbon emissions in the energy sector, such as increasing the use of renewable energy and optimizing energy efficiency, will improve health by reducing climate-related health harms and air pollution from the burning of fossil fuels. The U.S. EPA has developed estimates of the health benefits of improved air quality per kilowatt hour of increased renewable energy and energy efficiency investments.[49] Transitioning rapidly to renewable sources makes economic sense, with costs outweighed by the billions of USD saved from health benefits alone.[50,51] One study found that the health savings from state and local renewable energy policy in the "Rust Belt" region exceeded the policy cost by 34%.[50] These benefits will vary by location, and the transition should be managed in a fair and just way.

Adaptation to Climate Change: Local Solutions to Protect Health

U.S. Data: Adaptation Planning and Assessment - City-level Climate Change Risk Assessments

City level governments are especially well placed to implement adaptation measures. Of 136 U.S. city governments surveyed in 2018, two-thirds were in the process of or had completed a climate risk assessment, 11% intended to complete one in the future, and 23% responded "No."[22]

Unfortunately, even with a rapid and urgent reduction of GHG emissions, harms to health and disruptions to healthcare systems will persist since GHGs can remain in the atmosphere for hundreds of years.[52] Thus, it is critical for the U.S. to build on work like the Centers for Disease Control and Prevention's Building Resilience Against Climate Effects (BRACE) framework to determine the best ways to protect health through proactive adaptation in parallel with GHG mitigation.[53] There is also growing recognition in the medical community of the threat climate change poses to health and the delivery of care (see appendix - The Consequences of Climate Change on Clinical Practice and Healthcare Delivery: Opportunities for the Healthcare Sector).[12]

Since climate change impacts each region of the U.S. differently, a national understanding of how to best protect and improve health must be tailored at city and regional levels. A recent study showed that there are substantial regional differences in the heat conditions during which individuals are hospitalized, demonstrating how population responses to a given climate impact can vary by location.[54] For instance, the peak in hospitalizations for heat-related illnesses occurs at around 80ºF in the West and Northwest, while the peak in the South occurs at about 105ºF. In many regions, officials issue heat alerts at points hotter than at which individuals are being affected. In recognition of this disconnect, Northern New England and New York lowered their thresholds for heat alerts,[55] with reductions in heat-related illnesses in older adults already observed in New York City.[56]

Within cities, certain populations are at greater risk of harm from temperature rises because of existing inequities, "urban heat islands" (warmer area in cities due to human-made structures which can be up to 22ºF hotter than surrounding areas at night),[57] a lack of greenspace, inadequate housing, or not having air conditioning or the money to keep it running.[35,58–61] To aid effective allocation of limited resources, states like Florida and Minnesota are mapping populations that are especially at risk of exposure to heat, flooding, and air pollution to protect residents' health.[62,63]

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