



The Urgent Need for Climate Action:

**Health Benefits for the State of Tennessee if the
United States Meets the Goals of the Paris Agreement**

**Staff Report
Committee on Oversight and Reform and Subcommittee on Environment
U.S. House of Representatives
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I. SUMMARY

In 2015, nearly every nation of the world agreed in Paris to act together to keep global warming below 2 degrees Celsius (C). This report provides the first estimate of what achieving this goal would mean for the health of residents in the State of Tennessee. These estimates are based on new research findings from Dr. Drew Shindell, Nicholas Distinguished Professor of Earth Sciences at Duke University, who is one of the world's leading experts on the health effects of climate change and air pollution.

Dr. Shindell testified before the Committee on Oversight and Reform on August 5, 2020, where he presented his national-level findings and described his methodology in detail.¹ This report applies his research to the State of Tennessee.

According to these estimates, approximately 79,000 premature deaths would be avoided in the state over the next 50 years if warming is kept below 2 degrees C. Limiting warming also would avoid approximately 69,000 emergency room visits and hospitalizations for cardiovascular and respiratory disease, and more than 7,623,000 lost workdays. In just ten years, nearly 48% of the premature deaths due to air pollution in the state could be eliminated.²

The economic value of these health benefits would be extremely large. Using Environmental Protection Agency (EPA) methods, the economic value of these health benefits would be more than \$630 billion in the state.

Despite these enormous public health and economic benefits, the Trump Administration has systematically rolled back numerous key regulations that protected the public from the adverse health impacts of burning fossil fuels. In addition, the United States formally withdrew from the Paris Agreement on November 4, 2020.³ One of the key findings of this report is that reversing course, listening to climate scientists, and acting in concert with other nations to prevent dangerous climate change would significantly improve public health.

This appears to be what President-elect Biden intends to do by pledging to rejoin the Paris Agreement on the first day of his presidency.⁴ President-elect Biden has also announced that his administration will take additional steps on climate beyond re-joining the Paris Agreement and will “lead an effort to get every major country to ramp up the ambition of their domestic climate targets.”⁵

The United States can save lives, reduce illnesses, and save trillions of dollars by acting now on its own—at a local, state, regional, and national level—to eliminate the primary impacts of fossil-fuel pollution. Over the next decade and beyond, eliminating fossil fuel combustion in this state and others and in coordination with the rest of the world will benefit Americans enormously while bringing the United States closer to the climate targets in the Paris Agreement.

II. THE SERIOUS PUBLIC HEALTH IMPACTS OF CLIMATE CHANGE

The American Lung Association, the American Academy of Pediatrics, the American Heart Association, and other leading health experts have declared: “Climate change is one of the

greatest threats to health America has ever faced—it is a true public health emergency.” According to these experts, “Climate change is the greatest public health challenge of the 21st century.”⁶

Climate change endangers health in many ways. The Centers for Disease Control and Prevention lists nine adverse impacts that climate change has on public health:

- (1) it worsens air pollution;
- (2) it causes longer and more intense allergy seasons;
- (3) it promotes the spread of dangerous diseases such as dengue fever and West Nile virus;
- (4) it increases the risks of contracting food and waterborne diarrheal disease;
- (5) it threatens food security by impairing crop quality and output;
- (6) it triggers stress-related disorders and increases the incidence of mental health problems;
- (7) it causes precipitation extremes, such as lethal floods and dangerous droughts;
- (8) it produces extreme heat events that cause deaths from heat stroke and cardiovascular and respiratory disease; and
- (9) it increases the frequency and intensity of wildfires, resulting in fatalities and increased hospitalizations from smoke exposure.⁷

This report focuses on two of the health benefits that would occur if there were a serious effort to curb climate change by reducing fossil fuel combustion: (1) the health benefits from reducing air pollutants and (2) the health benefits of reducing temperature increases, which will limit extreme heat days.

A. Health Effects of Exposure to Air Pollution from Combustion of Fossil Fuels

The burning of fossil fuels for power generation, transportation, and heating, which is the primary cause of climate change, is the largest source of air pollution in the United States. According to a recent report from the National Academy of Sciences:

The scientific evidence is unequivocal: air pollution can harm health across the entire lifespan. It causes disease, disability and death, and impairs everyone’s quality of life. It damages lungs, hearts, brains, skin and other organs ... affecting virtually all systems in the human body.⁸

In addition to emitting large quantities of the principal greenhouse gas—carbon dioxide—burning fossil fuels emits sulfur dioxide and nitrogen oxides, which react in the atmosphere to form nitrate and sulfate particles and particles of soot. These small particles can penetrate deep into the lungs and cause serious adverse health effects, including premature death, heart attacks, aggravated asthma, and decreased lung function.⁹

Burning fossil fuels also contributes to ozone pollution, which is caused when emissions of nitrogen oxides react chemically with volatile organic compounds, carbon monoxide, or methane in the presence of sunlight.¹⁰ Ozone pollution can aggravate lung diseases such as

asthma and increase the frequency of attacks, and can cause chronic obstructive pulmonary disease.¹¹ According to the American Lung Association, breathing ozone “can shorten your life” by increasing the risk of premature deaths from cardiovascular disease, strokes, and respiratory causes.¹²

Vulnerable populations such as children, the elderly, low-income communities, and communities of color are at a disproportionately higher risk for experiencing the negative health impacts of these emissions.¹³ Children are more vulnerable because of their developing bodies and because they breathe more air relative to their body weight than adults, which causes them to be “more exposed to pollutants.”¹⁴ Children exposed to particulate and ozone pollution can face health consequences for the rest of their lives, such as increased risk of lung damage, impaired lung growth and pneumonia, and subsequent risks of asthma and obstructive pulmonary disease.¹⁵ Older adults also face many challenges to their health because they are more sensitive to air pollutants due to their low physiological reserve capacity, slower metabolism, and weaker immune system.¹⁶ For the elderly, exposure to air pollution can cause premature death.¹⁷

Low-income communities and communities of color can be at an especially heightened risk. Studies have shown that certain racial and ethnic groups have disproportionate exposure to air pollutants and toxic emissions from refineries and industrial plants, with Black and Latinx communities bearing the brunt of the exposure.¹⁸

There is also emerging evidence that exposure to air pollution, particularly particulate pollution, can adversely affect individuals with coronavirus. A Harvard University study published in April 2020 found that an increase of just 1 microgram per cubic meter of pollution is associated with an 8% increase in the death rate for patients with coronavirus.¹⁹ The study also found that coronavirus mortality rates were higher in areas that suffered from long-term pollution.²⁰

B. Health Effects of Exposure to Heat

Another significant benefit of reducing fossil fuel emissions is reducing exposure to excessive heat, which can be an immediate and life-threatening impact of climate change. The health consequences of extreme heat include heat stress and heat stroke, acute kidney injury, and exacerbation of congestive heart failure.²¹

Extreme heat exposure for young children can cause electrolyte imbalance, fever, respiratory disease, and kidney disease. Older populations are also at risk from heat exposure, especially those with pre-existing or underlying medical conditions, including diabetes and cardiovascular, respiratory, and renal disease.²²

For the elderly, extreme heat can cause a greater risk for heart attacks.²³ Although outdoor workers tend to be younger and healthier overall, they are also vulnerable due to their increased exposure to heat and sunlight.²⁴

As is the case for air pollution, heat can pose a special risk in low-income communities and communities of color. These communities are often hotter than other communities because

they lack tree cover.²⁵ Members of these communities also may have difficulty affording air conditioning and other measures that protect against excessive heat.

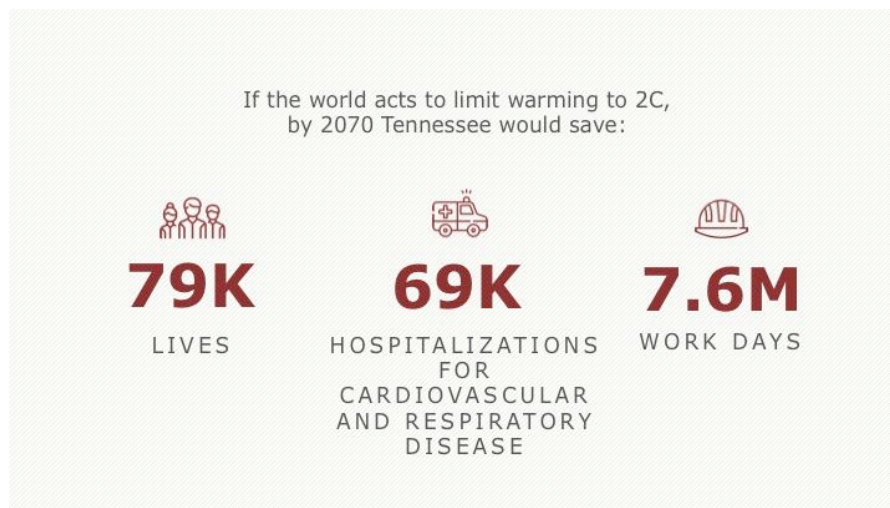
III. THE HEALTH BENEFITS OF PREVENTING CLIMATE CHANGE

This report presents the health benefits of reductions in air pollution and heat in the state from efforts to prevent climate change. It compares a scenario in which countries reduce combustion of fossil fuels and take other actions consistent with keeping global warming below 2 degrees C—which is a goal of the Paris Climate Agreement—with a reference scenario with only a modest increase in climate mitigation consistent with warming of about 4 degrees C by the end of the century.

This comparison shows that the health benefits of keeping global warming below 2 degrees C are substantial. Over the next 50 years, these estimated health benefits would include 79,000 avoided premature deaths, 69,000 avoided emergency room visits and hospitalizations, and 7,623,000 avoided lost work days in the state.

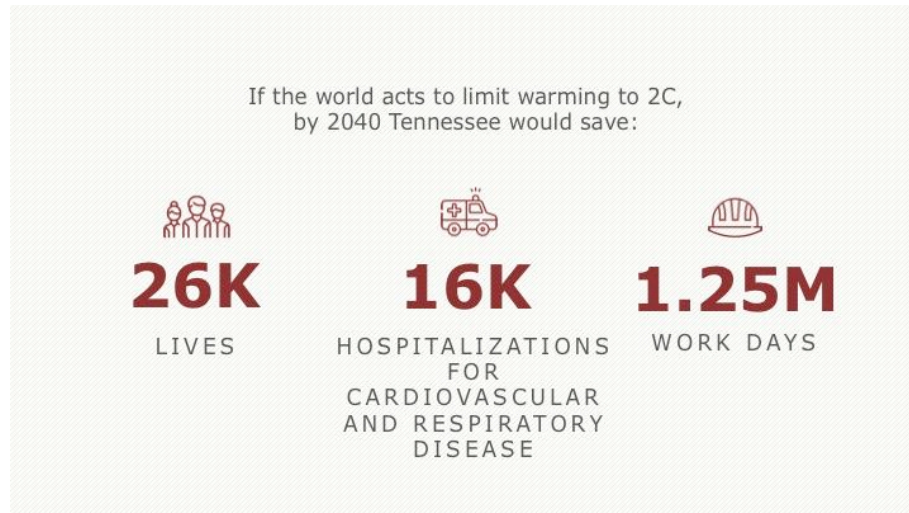
Many of these health benefits would result from reducing the emissions associated with burning fossil fuels. The health benefits from reduced air pollution would include an estimated:

- 75,000 avoided premature air pollution-related deaths;
- 69,000 avoided emergency room visits and hospitalizations for cardiovascular and respiratory disease;
- 23,000 avoided childhood bronchitis cases; and
- 3,969,000 avoided lost work days.



If dangerous emissions from fossil fuels usage are rapidly reduced, many significant health benefits would occur **in the near future**. By 2030, premature deaths from air pollution would be reduced by almost 48% from 2020 levels, preventing 2,000 premature deaths in the state. The cumulative estimated health benefits over the next two decades, from 2020 to 2040, would include an estimated:

- 26,000 avoided premature air pollution-related deaths;
- 16,000 avoided emergency room visits and hospitalizations for cardiovascular and respiratory disease;
- 12,000 avoided childhood bronchitis cases; and
- 1,264,000 avoided lost work days.



By 2050, premature deaths due to air pollution in the state would be reduced by 67% from 2020 levels if global warming is kept below 2 degrees C.

While the health benefits of reducing emissions from the combustion of fossil fuels occur immediately, it can take several decades for reductions in emissions to result in lower temperatures. The benefits attributable to reduced heat are likely to become noticeable around 2050. Between 2050 and 2070, 4,000 premature deaths due to heat exposure in the state could be prevented if the world keeps global warming below 2 degrees C. During this same time period, 3,654,000 lost work days due to heat exposure could be avoided. By 2070, approximately 43% of the premature deaths due to heat exposure would be prevented.

The economic value of these health benefits would be substantial. Under EPA’s method for valuing lives and avoided health impacts, the economic benefit to the state over the next 50 years would be approximately \$630 billion in current dollars.

While the health benefits are greatest if U.S. action is matched by equivalent efforts by other nations, there are significant health benefits even if the United States acts alone. Over the next 15 years, unilateral U.S. climate action would achieve 83% of the avoided premature deaths in the state that would result from global action. Over the next 50 years, unilateral U.S. climate action would prevent 73% of premature deaths.

IV. THE TRUMP ADMINISTRATION’S ATTACK ON CLIMATE ACTION

Despite the enormous health benefits of keeping global warming below 2 degrees C, President Trump and his administration have taken numerous anti-climate actions, including

announcing the withdrawal of the United States from the Paris Climate Agreement and rolling back key environmental protections, which have placed the health of both the planet and Americans at risk. According to the Sabin Center at Columbia Law School, the Trump Administration has repealed or weakened more than 150 climate mitigation and adaptation measures.²⁶

The Paris Agreement, adopted by 196 nations in 2015, aimed to reduce global greenhouse gas emissions, keep the global temperature rise below 2 degrees C (based on pre-industrial levels), and pursue additional action to further limit that temperature change to 1.5 degrees C.²⁷ The Paris Agreement also called for the U.N. Intergovernmental Panel on Climate Change's October 2018 Special Report on Global Warming, which highlighted that limiting warming to 1.5 degrees C would result in a much more livable future than the 2 degree goal.²⁸

The United States played a pivotal role in creating the agreement, pressing for increased transparency and accountability from governments. In accordance with the agreement, the United States had pledged to “reduce national greenhouse gas emissions by about a quarter by 2025, compared with 2005 levels.”²⁹

On November 4, 2019, however, the Trump Administration notified the United Nations that the United States would withdraw from the Paris Agreement the following year.³⁰ The withdrawal took effect on November 4, 2020.³¹ The United States is now the only nation to withdraw from the global agreement to fight climate change.

In addition to withdrawing from the Paris Agreement, the Trump Administration has rolled back key domestic regulations that reduce the emissions from fossil fuel combustion that cause climate change. These rollbacks include:

- The Clean Cars Rule: In March 2020, the Trump Administration finalized the rollback of the clean cars rule—one of the major efforts by the Obama Administration to combat climate change.³² The rule aimed to double the average fuel economy of new cars by 2025, eliminating an estimated 6 billion tons of greenhouse gas emissions.³³ The rule finalized by the National Highway Traffic Safety Administration, Department of Transportation, and EPA to replace the Obama-era rule, called the Safer Affordable Fuel-Efficient (SAFE) vehicles rule, instead will “lead to nearly a billion additional metric tons” of carbon dioxide emissions.³⁴
- The Clean Power Plan: The Clean Power Plan (CPP), finalized in 2015, was one of the Obama Administration's key efforts to address climate change and protect environmental and human health.³⁵ The CPP created the “first-ever national standards that address carbon pollution from power plants.”³⁶ However, the Trump Administration has replaced the CPP with its own significantly weaker Affordable Clean Energy (ACE) rule.³⁷ Research has found that the ACE rule could increase the amount of greenhouse gas emissions, such as carbon dioxide, sulfur dioxide, and nitrogen oxide, compared to no policy at all.³⁸ According to the EPA's own assessments, this new rule will lead to thousands of additional deaths from air pollution.³⁹

- Methane Regulations: Methane is the second most potent greenhouse gas. During the Trump Administration, the Department of Interior has repealed the Bureau of Land Management rule to reduce methane emissions on federal lands, stayed standards limiting methane emissions from existing landfills, and rescinded standards limiting methane emissions from new oil and gas facilities.⁴⁰

V. CONCLUSION

In 2015, the nations of the world, including the United States, agreed in Paris to act together to keep global warming below 2 degrees C. This report shows that taking global action to meet this goal will bring profound and long-lasting health and economic benefits to the state. Under the Trump Administration, however, the United States has pulled out of the Paris Agreement, and EPA and other agencies have rolled back U.S. efforts to reduce greenhouse gas emissions. If the United States reverses course and collaborates with other nations to meet the Paris goals, public health will benefit immensely. President-elect Biden and his administration have the opportunity to lead the world in addressing the climate crisis.

APPENDIX: METHODOLOGY

Estimates of the health impacts of fossil fuel and climate policy in this report were compiled from climate modeling performed by the Multidisciplinary Studies of Climate Science and Human Society team led by Dr. Drew Shindell at Duke University and provided to the Committee by Co-Equal. His modeling used computer simulations of the impact of future emissions of carbon dioxide and other greenhouse gases along with associated pollutants such as ozone and particulate matter. The simulations compared the effects of a transition across all sectors and all countries to a 2 degree C pathway relative to a reference scenario that leads to approximately 4 degree C warming by the end of the century.

To estimate the benefits of U.S.-only action, a second set of simulations compared three scenarios: (1) decarbonizing the entire world's power sector; (2) decarbonizing only the U.S. power sector; and (3) maintaining current policies along with projected changes in energy demand, but not taking further action to reduce burning of fossil fuels for energy production. In the decarbonization scenarios, the rate of decarbonization of the power sector was assumed to be consistent with keeping warming below 2 degrees C.

These simulations were performed using NASA's global climate model developed at the Goddard Institute for Space Studies (version: GISS-E2.1R). That model includes representations of the physical and chemical processes that govern Earth's climate and the composition of the atmosphere, has been widely used in climate research over the past several decades, and has been shown to realistically capture many of the physical quantities and trends that have been observed by the fleet of NASA and NOAA Earth-observing satellites.

Dr. Shindell's model calculated the human health impacts of exposure to both pollution and heat for each set of scenarios, focusing on results in the United States. These impacts were evaluated on a grid of approximately 50 x 50 km (33 x 33 miles). This relatively high-resolution simulation allows the model to capture pollutant exposures in urban areas, as documented in prior publications using similar methodology.

The health impacts analysis used the most up-to-date epidemiological relationships based on decades of public health data on air-pollution related deaths, heat-related deaths, and nonfatal impacts of exposure. In the case of particulate matter, these epidemiological relationships come from a comprehensive report released in 2018 by 54 of the world's leading experts on small particle air pollution.⁴¹ In the case of ozone, these epidemiological relationships come from a 2016 study that updates the prior analyses by the same team that is the basis of standard U.S. and international health analyses.⁴²

Dr. Shindell's calculations for the economic values of the health benefits are estimated using EPA's value of a statistical life with respect to avoided deaths, average costs of emergency room visits and hospitalizations in the U.S. for these avoided health impacts, and county-level employment data for avoided lost work. The EPA value of a statistical life is an accepted measure of how much society is willing to pay to reduce the risk of death. EPA's base value of a statistical life is adjusted from 2010 to 2019 assuming a 2% annual increase in income (and hence willingness to pay) over inflation. All values are reported in 2019 U.S. dollars.

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