

CLIMATE CRISIS

The Rising Cost of Inaction



A special report by Pennsylvania Auditor General
EUGENE A. DEPASQUALE



Dear fellow Pennsylvanians,

You have a right to clean air, clean water and preservation of the environment around you.

The state Constitution guarantees these rights, and it establishes the commonwealth as the trustee of those public natural resources.

But protecting natural resources comes at a cost – and, as our climate changes and extreme weather happens more frequently, that cost will continue to climb. In 2018 alone, climate-related costs to Pennsylvania totaled at least \$261 million; that number includes the record-breaking floods and landslides that caused over \$125.7 million in infrastructure damage. Severe weather has also caused deaths, property damage and loss of livelihood.¹

Your tax dollars will increasingly be spent to clean up after such disasters if state government does not step up now and limit our contribution to the climate crisis. Instead of reacting only after a weather crisis, Pennsylvania’s leaders should be proactively seeking to mitigate the effects of coming storms, prioritizing actions that create family-sustaining jobs in fields such as construction and civil engineering. It is a simple fact that every \$1 spent on preventing natural disaster damage saves \$6 in recovery costs.²

Scientists agree that fossil fuels, which have helped fuel Pennsylvania’s economy for more than 200 years, emit harmful greenhouse gases that are changing the climate. Pennsylvania is, in fact, one of the top greenhouse gas emitters, ranking fourth in the nation in 2016.³

Other states have taken significant steps to lower their greenhouse gas emissions. Most of our neighbors have taken steps to limit power plant emissions, and others have set ambitious goals for renewable energy production and energy-efficiency measures. Pennsylvania lags behind these efforts.

It is clear that the federal government will not direct action on the climate crisis. It has, in fact, taken steps backward, by gutting the federal Environmental Protection Agency and ignoring air pollution violations.

This special report discusses Pennsylvania’s current plans to address climate change and how effectively they are being implemented. My team and I spoke with more than 70 environmental experts, including Department of Environmental Protection (DEP) staff, members of DEP’s Climate Change Advisory Committee, county professionals, consultants, respected climate researchers and advocates. We read DEP’s publicly released plans. We reviewed Gov. Tom Wolf’s January 2019 executive order on the environment, and we looked at the past to understand the laws and actions shaping current policy.

In addition to three observations, this special report offers nine recommendations for how state and local officials can take action to minimize the fiscal impact of extreme weather resulting from climate change.

Without leadership at the state and local levels, the costs from climate change grow catastrophically. We must act now to save lives and money in the future – and to preserve our natural resources for ourselves and for future generations.

Thank you for the opportunity to serve you.

Sincerely,



Eugene A. DePasquale



¹ <https://www.depgis.state.pa.us/ClimateChange/index.html>

² National Institute of Building Sciences. “National Institute of Building Sciences Issues New Report on the Value of Mitigation.” Published Jan. 11, 2018. <https://www.nibs.org/news/381874/National-Institute-of-Building-Sciences-Issues-New-Report-on-the-Value-of-Mitigation.htm>. Accessed July 29, 2019.

³ U.S. Energy Information Administration, Pennsylvania State Profile. <https://www.eia.gov/state/rankings/#/series/226>. Accessed July 24, 2019.

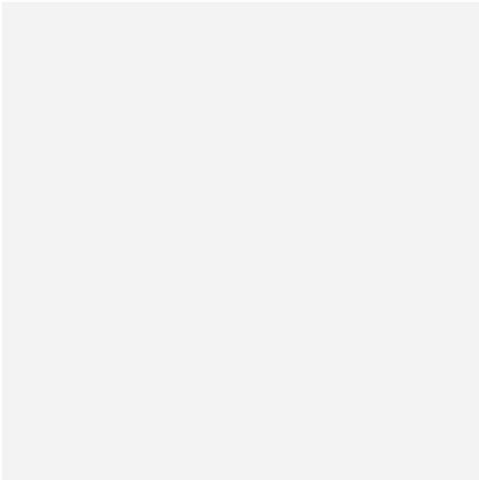
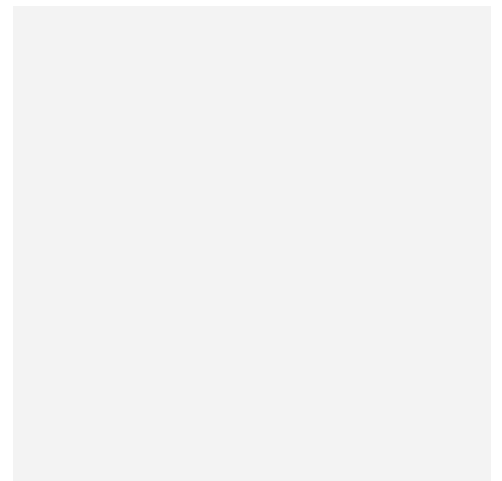


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GLOSSARY

PEMA | Pennsylvania Emergency Management Agency

DCNR | Pennsylvania Department of Conservation & Natural Resources

DEP | Pennsylvania Department of Environmental Protection

PennDOT | Pennsylvania Department of Transportation

Ozone Action Day | A public warning issued when hot/stagnant weather can cause air pollution to pose elevated health risks.

USDA | U.S. Department of Agriculture

PDA | Pennsylvania Department of Agriculture

FEMA | Federal Emergency Management Agency

DCED | Pennsylvania Department of Community & Economic Development

AEPS | Alternative Energy Portfolio Standards Act (Act 213 of 2004)

EPA | U.S. Environmental Protection Agency

HUD | U.S. Department of Housing and Urban Development

PENNVEST | Pennsylvania Infrastructure Investment Authority

ASCE | American Society of Civil Engineers

SFHA | Special Flood Hazard Area

FIRM | Flood Insurance Rate Maps

EMS | Emergency Medical Services

BACKGROUND WHAT IS
GLOBAL
CLIMATE
CHANGE?

Heavy, sudden downpours. Extended heat waves. Stretches of warm weather in deep winter.

For Pennsylvania, this is what climate change looks like. These effects are happening now: For example, the 48 months between June 2015 and June 2019 were officially the wettest period in Pennsylvania's history⁴, and Pennsylvania's five warmest summers on record have occurred in the last five years.⁵

What's happening in Pennsylvania is only one small piece of the U.S. and worldwide impact:

"OBSERVATIONS UNEQUIVOCALLY SHOW THAT CLIMATE IS CHANGING. ... THESE EMISSIONS COME MAINLY FROM BURNING COAL, OIL, AND GAS, WITH ADDITIONAL CONTRIBUTIONS FROM FOREST CLEARING AND SOME AGRICULTURAL PRACTICES."⁶

The Intergovernmental Panel on Climate Change (IPCC), the United Nations body that assesses the science related to climate change, said in a policy brief issued in 2018 that "human activities are estimated to have caused approximately 1.0° Celsius of global warming above pre-industrial levels ...

(which) is likely to reach 1.5° Celsius between 2030 and 2052 if it continues to increase at the current rate."⁷

It is the world's challenge: Work together to slow climate change, and limit the temperature increase to 1.5°C instead of 2°C.

A 1°C change is equivalent to 1.8° Fahrenheit, so limiting the overall temperature increase to roughly 2.7° F instead of 3.6° F might seem like an incremental difference – but that difference would be catastrophic.

The 1.5°C change over pre-industrial levels will bring about challenging changes to global weather, with increases in temperature extremes, heavy precipitation in some regions (such as Pennsylvania) and increased drought in others. Sea levels will increase, natural habitats will shrink, and polar ice caps will melt. But a 1.5°C change is more adaptable than a 2°C change.⁸

⁴ NOAA National Centers for Environmental information. "Climate at a Glance: Statewide Time Series." Published July 2019. <https://www.ncdc.noaa.gov/cag/>. Accessed July 10, 2019.

⁵ NOAA National Centers for Environmental Information. "Global Climate Report – August 2019." <https://www.ncdc.noaa.gov/sotc/global/201908#introduction>. Accessed Sept. 18, 2019.

⁶ National Climate Assessment report overview. <https://nca2014.globalchange.gov/highlights/overview/overview>. Accessed July 24, 2009. The National Climate Assessment is a team of more than 300 experts guided by a 60-member Federal Advisory Committee. It produced a report that was extensively reviewed by the public and experts, including federal agencies and a panel of the National Academy of Sciences.

⁷ Masson-Delmotte, V., et al (eds). IPCC 2018: Summary for Policymakers. "Global Warming of 1.5 degrees Celsius ..." https://www.ipcc.ch/site/assets/uploads/sites/2/2019/05/SR15_SPM_version_report_LR.pdf. Accessed July 24, 2019.

⁸ Levin, Kelly. World Resources Institute. "Half a Degree and a World Apart: The Difference in Climate Impacts Between 1.5C and 2C of Warming." <https://www.wri.org/blog/2018/10/half-degree-and-world-apart-difference-climate-impacts-between-15-c-and-2-c-warming>. Accessed July 24, 2019.

Severe thunderstorms. Record-breaking periods of high rainfalls and unseasonable weather.

At a 2°C change, sea levels will rise and swamp coastal cities; biodiversity and ecosystems will face extreme degradation; and decreased food production will create dire conditions for many regions.⁹

Managing climate change means that humans must reduce their greenhouse gas emissions. Greenhouse gases are those gases that absorb infrared radiation, trapping heat in the Earth's atmosphere. According to the federal Environmental Protection Agency (EPA), the top four most abundant greenhouse gases in the atmosphere are:

- ◇ carbon dioxide,
- ◇ methane,
- ◇ nitrous oxide, and
- ◇ fluorinated gases such as hydrofluorocarbons (HFCs or HCFCs).¹⁰

In addition to carbon dioxide, methane is of particular concern in Pennsylvania. It is the product of hydraulic fracturing, also known as fracking, which has led to the natural gas boom in the commonwealth. While methane is the product, it also leaks into the atmosphere throughout the life cycle of fracking extraction and distribution. Methane also is produced by many traditional farming practices.

⁹ Masson-Delmotte, V., *et al*, (eds). IPCC, 2018: Summary for Policymakers. In *Global Warming of 1.5°C ...* https://www.ipcc.ch/site/assets/uploads/sites/2/2019/05/SR15_SPM_version_report_LR.pdf. Accessed July 24, 2019.

¹⁰ United States Environmental Protection Agency. *Overview of Greenhouse Gases.* <https://www.epa.gov/ghgemissions/overview-greenhouse-gases>. Accessed July 24, 2019.

Broadly speaking, the effects of climate change in Pennsylvania will touch every aspect of the economy and every community in a multitude of ways. For this report, we will look at two categories: public health and safety factors, and economic factors. Some issues, such as flooding, touch both categories but will be discussed here in only one area. Regardless of how the effects are broken down, adapting to climate change will be expensive: from increased health care costs to increased electricity usage for cooling and recovery from severe weather. On the other hand, according to the National Institute of Building Sciences, every \$1 in natural disaster mitigation spending saves \$6 in recovery costs.

PUBLIC HEALTH AND SAFETY FLOODING

Flooding can be extremely destructive to property, and it can cause death and disease – and Pennsylvania is one of the most flood-prone states in the contiguous United States.

Pennsylvania’s many thousands of miles of rivers and streams are part of what makes it so flood-prone. Heavier rains, combined with increased development and overdue upgrades of stormwater systems, have created an extremely high-risk environment for many communities.

Flooding is disastrous for a community’s social and economic well-being. Repeated flooding can ruin a community’s tax base as property values decrease and businesses close, creating a negative cycle where local governments are less capable of recovering from a flood due to decreasing resources.

Some of the hardest-hit areas already are home to the most vulnerable residents, who are less able to effectively recover. For example, people living in poverty are at increased risk, as they disproportionately reside in flood-prone areas due to lower property values in those areas. Individuals living in poverty are less able to recover from a flood and have higher post-flood impacts.¹¹ Additionally, renters are particularly vulnerable, as they are less likely to carry flood insurance and can be trapped in a flood-damaged and potentially mold-filled home if their landlords refuse to release them from their leases.¹²

The impact of flooding can disparately affect people with decreased mobility, such as those without personal vehicles and people with disabilities. Older adults are more likely to sustain physical or mental harm due to flooding, including an increased risk of death.¹³

¹¹ https://download.nap.edu/cart/download.cgi?record_id=25381

¹² https://download.nap.edu/cart/download.cgi?record_id=25381

¹³ https://19january2017snapshot.epa.gov/sites/production/files/2016-10/documents/older-adults-health-climate-change-large-fonts_0.pdf

The increasing risk of flooding, landslides and land subsidence that heavy rainfall poses to pipelines and natural gas infrastructure led the federal Pipeline and Hazardous Materials Safety Administration to issue a warning to pipeline operators to follow best monitoring practices to reduce the risks of explosions and leaks. For example, in 2016 a pipeline leak caused by flooding in Lycoming County released over 50,000 gallons of gasoline into Loyalsock Creek. While the pipeline operator Sunoco was responsible for repairs and clean up, state agencies and local officials had to provide staff for local support efforts. In 2018, a landslide triggered a natural gas pipeline explosion in Beaver County. The blast destroyed a home and led to the temporary closure of a local school and nearby highway.

Certain kinds of sewer overflow systems in cities such as Pittsburgh, Harrisburg, Johnstown and Philadelphia flush untreated human waste into the rivers along with stormwater during heavy rainfalls, creating dangerous disease risks to residents. These old systems are currently in violation of the federal Clean Water Act, and while they are under consent decrees managing their upgrade plans with the U.S. Environmental Protection Agency, major changes to these systems are expensive and slow. The repairs will be paid for by customers – the homeowners, renters and businesses – of the utilities that operate the sewer systems. But until these systems undergo major upgrades, storms with heavy rainfall will continue to push untreated sewage into local waterways.

A sinking airport

Most flooding in Pennsylvania is occurs along rivers, creeks or streams. However, the Delaware River is affected by both sea level rise and storm surges, which will have costly and potentially dangerous impacts in southeast Pennsylvania, especially in Philadelphia.

Data presented to the Philadelphia Mayor's Office in 2014 suggested that the estimated sea level rise in the Philadelphia area could be as much as 20 inches higher by the 2040s.

Sea level rise, combined with storm surges, could cause between \$90 million and \$900 million in damages citywide, depending on severity and flood level, according to the City of Philadelphia.

In addition, parts of the Philadelphia International Airport, a major international transportation hub, are situated mere feet above sea level. Much of its infrastructure, including terminals and electric substations, are at risk from flooding.

The City of Philadelphia outlined these risks in its "Growing Stronger Toward a Climate-Ready Philadelphia" report, but the report notes many of the risk-mitigation steps have not yet been taken.

¹⁴ Phillips, Susan. StateImpact PA. "Federal pipeline safety regulators issue warning on floods and subsidence." Published May 21, 2019. <https://stateimpact.npr.org/pennsylvania/2019/05/21/federal-pipeline-safety-regulators-issue-warning-on-floods-and-subsidence/>. Accessed July 25, 2019.

Air Quality

Pollutants from burning fossil fuels and rising temperatures will compound already-worsening air pollution.¹⁵ Infants, children, adults with chronic upper respiratory disease or heart disease, and people who are economically disadvantaged are most at risk of harm from air pollution.¹⁶

Philadelphia experienced an increasing number of Ozone Action Days between 2014 and 2016, and several Pennsylvania cities suffer from a high level of year-round particulate pollution, which is caused by coal-fired power plants and diesel emissions.¹⁷

Increased numbers of Ozone Action Days and higher particulate levels are associated with an increase in asthma and other upper respiratory diseases. A recent study found the annual per-person cost of asthma was over \$3,000, including prescriptions, emergency room visits and outpatient visits.¹⁸ The American Lung Association reports that there are over 1.2 million individuals with asthma in PA,¹⁹ and the rate

of respiratory illnesses may increase by 10-14 percent by 2050 due to climate change.²⁰ Air quality has improved since the 1970 passage of and 1990 revisions to the Clean Air Act, when the most effective improvements were implemented, dramatically reducing the rates of illness and death caused by particulate pollution and ozone. However, in Pennsylvania, air pollution still leads to preventable illnesses and death, with rates potentially increasing with climate change.

Pennsylvania could have avoided 400 deaths and more than 750 illnesses in 2017 alone if levels of particulate and ozone pollution had been lower, according to New York University's Marron Institute of Urban Management.²¹

Pollen is another cause of air-related illnesses, including asthma, and with higher temperatures and longer growing seasons, the incidences of pollen-related allergic reactions and emergency room visits is expected to rise.²²

¹⁵ Shortle, James *et al.* Environment and Natural Resources Institute. "Pennsylvania Climate Impacts Assessment." Published May 2015. <http://www.depgreenport.state.pa.us/elibrary/GetDocument?docId=5002&DocName=2015%20PENNSYLVANIA%20CLIMATE%20IMPACTS%20ASSESSMENT%20UPDATE.PDF%20>. Accessed July 26, 2019.

¹⁶ Pennsylvania Department of Health. "The State of Health Equity in Pennsylvania." Published January 2019. <https://www.health.pa.gov/topics/Documents/Health%20Equity/The%20State%20of%20Health%20Equity%20in%20PA%20Report%20FINAL.pdf>. Accessed July 25, 2019.

¹⁷ American Lung Association. "State of the Air 2018." <https://www.lung.org/assets/documents/healthy-air/state-of-the-air/sota-2018-full.pdf>. Accessed July 25, 2019.

¹⁸ <https://www.atsjournals.org/doi/10.1513/AnnalsATS.201703-259OC>

¹⁹ <https://www.lung.org/our-initiatives/healthy-air/sota/city-rankings/states/pennsylvania/>

²⁰ Shortle, James *et al.* Environment and Natural Resources Institute. "Pennsylvania Climate Impacts Assessment." Page 133. Published May 2015. <http://www.depgreenport.state.pa.us/elibrary/GetDocument?docId=5002&DocName=2015%20PENNSYLVANIA%20CLIMATE%20IMPACTS%20ASSESSMENT%20UPDATE.PDF%20>. Accessed July 26, 2019.

²¹ <https://healthoftheair.org/uploads/323/ccd4f3f36eb99e650d7d184411ec4188.pdf>. Accessed July 25, 2019.

²² <https://agupubs.onlinelibrary.wiley.com/doi/full/10.1029/2018GH000153>

Heat

Prolonged heat can be especially dangerous to people who are old, very young and/or sick, especially for those without access to air conditioning or cooling centers.

In Pennsylvania, heat is the most common cause of death among weather-related fatalities over the last 30 years.²³ Over the past 10 years, Pennsylvania has recorded at least two deaths due to heat per year, except in 2014 and 2017. In four of those years, more than 15 people died because of heat.²⁴

Periods of extreme heat can lead to higher utility costs and stress the electrical grid, which can lead to regional or localized brownouts.²⁵ This can create dangerously hot conditions for those at home, as well as hurting the bottom line for affected businesses which close for the duration of the outage. Residents who can afford to run their air conditioners pay more in their electric bills, while Pennsylvanians who do not have access to a home air conditioner, or who own one but cannot afford the additional expense, face greater risks of harm from high heat. The Philadelphia Department of Health reported that the temperature in its urban areas can be as much as 20 degrees higher than temperatures in rural and suburban areas. Known as the heat island effect, the higher urban temperatures occur because buildings and pavement absorb heat, plus cars and air conditioning units release heat back into the atmosphere, among other factors.

SOURCE: WORLD HEALTH ORGANIZATION

“Climate change undermines the social and environmental determinants of health, including people’s access to clean air, safe drinking water, sufficient food and secure shelter.”

²³ Benscoter, Jana. PennLive.com. “Heat stroke tops list of weather-related deaths.” Published July 19, 2019. <https://www.pennlive.com/news/2019/07/heat-stroke-tops-list-of-weather-related-deaths.html>. Accessed July 26, 2019.

²⁴ *Ibid.*

²⁵ Pennsylvania Emergency Management Agency. “Commonwealth of Pennsylvania Hazard Mitigation Plan Update Chapter 4.” Page 185. <https://pahmp.com/wp-content/uploads/2018/10/Chapter-4-Risk-Assessment-Natural-Hazards.pdf>. Accessed Aug 6, 2019.

For the city of Philadelphia, the costs of keeping cool will be high:

- ◇ up to \$1 million in increased annual electricity costs from higher demand for air conditioning in municipal buildings, and
- ◇ a potential tripling of the current \$20,000 cost of Heatline, a city-run phone service that advises residents how to stay cool and refers those in need to emergency services.²⁶

High heat affects children in schools without air conditioning. A 2018 study found that cumulative heat exposure reduces academic achievement, and that air conditioning in schools mitigates that

reduction.²⁷ In Pennsylvania, school officials in buildings lacking air conditioning will dismiss children early on the hottest days, causing education disruptions and challenges for working parents.²⁸

Some districts have analyzed the costs to upgrade building infrastructure for air conditioning installation. The costs are higher in lower-income districts and where older buildings have outdated electrical infrastructure:

- ◇ Pittsburgh Public Schools: up to \$100 million²⁹
- ◇ Philadelphia Schools: \$145 million³⁰
- ◇ Reading: \$11 million to \$24 million for one middle school building³¹

²⁶ City of Philadelphia. "Growing Stronger: Towards A Climate-Ready Philadelphia." Page 19. <https://www.phila.gov/media/20160504162056/Growing-Stronger-Toward-a-Climature-Ready-Philadelphia.pdf>. Accessed Aug. 6, 2019.

²⁷ Goodman, Joshua *et al.* National Bureau of Economic Research. "Heat and Learning." Published May 2018. <http://scholar.harvard.edu/files/joshuagoodman/files/w24639.pdf>. Accessed Aug 6, 2019.

²⁸ Marroni, Steve. PennLive.com. "Mold, excessive heat plague Pa. schools, delay start of new year." Published Aug. 28, 2018. https://www.pennlive.com/news/2018/08/mold_excessive_heat_plague_pa.html. Accessed Oct. 17, 2019.

²⁹ Behrman, Elizabeth. The Post Gazette. "Pittsburgh Public: Installing air conditioning in schools would cost millions." Published Sept. 5, 2018. <https://www.post-gazette.com/news/education/2018/09/05/Pittsburgh-Public-Schools-air-conditioning-students-buildings-summer-heat-Pam-Capretta/stories/201809050159>. Accessed Oct. 17, 2019.

³⁰ Graham, Kristen A. and Maddie Hanna. The Philadelphia Inquirer. "Old schools, hot buildings: A 'public health concern'?" Published Sept. 8, 2018. <https://www.inquirer.com/philly/education/old-schools-hot-buildings-public-health-concern-philadelphia-yeardon-20180908.html>. Accessed Oct. 18, 2019.

³¹ Long, Jeremy. Reading Eagle. "Parents heated over lack of air conditioning in Reading School District." Published Sept. 15, 2018. <https://www.readingeagle.com/news/article/parents-heated-over-lack-of-air-conditioning-in-reading-school-district>. Accessed Oct. 18, 2019.

Disease

Diseases carried by ticks and mosquitoes are on the rise, and several of these diseases have no known treatments or cures and can lead to lifelong illness or death.

For example, Pennsylvania leads the nation in cases of Lyme disease³², which is carried by certain ticks. There were 11,900 cases of Lyme reported in Pennsylvania in 2017, which was more than double the number of cases in 2013.³³

The costs of treating Lyme disease are high, and 10 to 20 percent of people with the disease experience persistent symptoms after initial treatment.³⁴ In Pennsylvania's 2018-19 budget, \$2.5 million was allocated to a program to increase and improve Lyme disease surveillance, outreach

and research; in the 2019-20 budget, it was increased to \$3 million.³⁵

Other tick-borne diseases are also being found in Pennsylvania because of warmer winters.³⁶ Among the newcomers is the Lone Star tick, which can carry a disease that causes flu-like symptoms and an allergic reaction to red meat.

Mosquito-borne diseases are also creating increased risk. For example, instances of West Nile Virus increased 550 percent in Pennsylvania, from 20 cases in 2017 to 130 in 2018.³⁷ This virus has no medications to treat it or vaccines to prevent it. The 2018-19 budget included a small increase to the \$5.4 million allocated to manage a mosquito control and surveillance program.³⁸

³² Centers for Disease Control and Prevention, Lyme Disease Recent Surveillance Data. <https://www.cdc.gov/lyme/datasurveillance/tables-recent.html>. Accessed July 25, 2019.

³³ Centers for Disease Control and Prevention, Lyme Disease Historical Data. <https://www.cdc.gov/lyme/stats/tables.html>. Accessed July 25, 2019.

³⁴ U.S. Department of Health and Human Services. *"Tick-Borne Disease Working Group: 2018 Report to Congress."* Page 48. <https://www.hhs.gov/sites/default/files/tbdwg-report-to-congress-2018.pdf>. Accessed July 25, 2019.

³⁵ *"As Spring Begins, Wolf Administration Urges Residents to Protect Against Lyme Disease."* Published April 1, 2019. <https://www.media.pa.gov/Pages/Health-Details.aspx?newsid=582>. Accessed July 25, 2019.

³⁶ Sonenshine, Daniel E. *"Range Expansion of Tick Disease Vectors in North America: Implications for Spread of Tick-Borne Disease."* Published March 9, 2018. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5877023/>. Accessed July 25, 2019.

³⁷ Pennsylvania Department of Health testimony presented by Secretary Dr. Rachel Levine on May 13, 2019 at Widener University.

³⁸ Murphy, Jan. PennLive.com. *"What will Pa.'s \$32.7 billion budget buy?"* Published June 23, 2018. https://expo.pennlive.com/news/erry-2018/06/0823a0425c5604/inside_pas_327_billion_state_b.html. Accessed July 25, 2019.

Equity Issues

Climate change will exacerbate already existing health and safety disparities, experts said.

For example, almost 33 percent of the state's population is located in Environmental Justice Areas, which DEP's Office of Environmental Justice defines as communities with populations that are 30 percent people of color and/or 20 percent low-income.³⁹ Climate change will affect this population in disproportionate ways, as these communities are already struggling with decreased

access to health care, worse air quality and less-resilient housing options.

Climate action on the state level must take these disparities into account and ensure that any actions help overcome the inequality and resolve environmental injustices.

Individuals in these communities are also less likely to carry flood or renters insurance, meaning recovery from floods will be more difficult and costly, if not impossible.

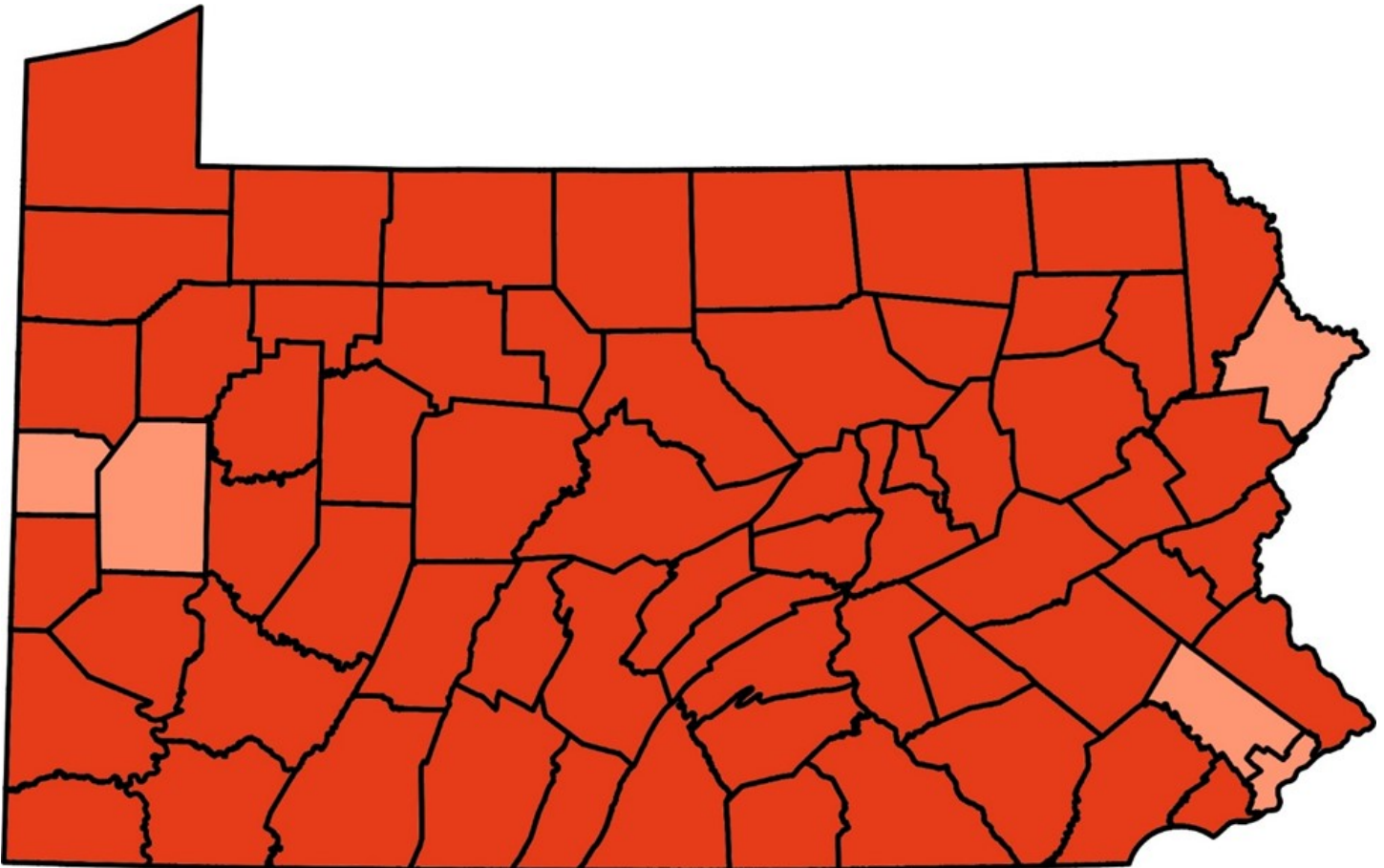
³⁹ Office of Environmental Justice, Pennsylvania Department of Environmental Protection testimony presented by Allison Acevedo on May 13, 2019, at Widener University.

Agriculture

Pennsylvania has more than 53,000 farms that created nearly \$8 billion in goods sold in 2017.⁴⁰

Farms are already enduring climate change effects, including temperature swings, heavy rains, more flooding, and changing and increasing pests.

2018's historic wet season led to the U.S. Department of Agriculture (USDA) designating 62 Pennsylvania counties as having suffered natural disasters, which allowed farmers in those counties to apply for emergency financial assistance to help with disaster recovery⁴¹:



This designation included major agricultural counties like Lancaster, Chester and York.

⁴⁰ U.S. Department of Agriculture. "2017 Census of Agriculture: Pennsylvania State Profile." https://www.nass.usda.gov/Publications/AgCensus/2017/Online_Resources/County_Profiles/Pennsylvania/cp99042.pdf. Accessed July 25, 2019.

⁴¹ U.S. Department of Agriculture. "USDA Designates 33 Pennsylvania Counties as Primary Natural Disaster Areas." Published March 26, 2019. https://www.fsa.usda.gov/state-offices/Pennsylvania/news-releases/2019/strn_pa_20190326_rel_007?utm_medium=email&utm_source=govdelivery. Accessed July 25, 2019.

DEP's Climate Impact Assessment Update of 2015 analyzed the potential and varying effects of climate change on agriculture in Pennsylvania, while that agency's Climate Action Plan includes ideas for farmers and landowners to reduce their emissions.

Although DEP officials pointed out that DEP is developing an enhanced impacts assessment that will reflect a more comprehensive and detailed evaluation of the impacts of climate change on agriculture as a follow-up to the 2015 Impact Assessment, it is important to note that Pennsylvania Department of Agriculture has no comprehensive plan to address how climate change will affect the state's farm and food industries, although the 2016 Invasive Species Management Plan acknowledges changing temperatures as a root cause of new and increased pest pressure.⁴²

During PDA's 2019 budget hearing before the House Appropriations Committee, Secretary Russell Redding said, "There's no separate initiative around" addressing climate change for the state's farmers.⁴³

Other jobs directly related to climate change

Tackling the climate crisis by increasing investments in energy-efficiency measures and renewable energy sources will help boost state and local economies by creating family-sustaining jobs for construction and skilled trade workers who are already preparing for the work.

Jobs in and around the natural gas sector have grown exponentially since the early 2000s. As the infrastructure grows to process and transport natural gas and its byproducts, the state has also seen an increase in those types of jobs, too, as seen in pipeline buildouts and the ethane cracker plant in Beaver County, which created over 5,000 jobs during the construction period and will have 600 permanent positions once it is operational.

Energy efficiency, clean vehicles and renewable energy sectors are driving immense growth in employment opportunities in Pennsylvania. Since 2014, the clean tech workforce has grown by nearly 60 percent, to nearly 90,000 total employees in 2018, according to E2, an environment-focused nonprofit.

Leaders of local unions are adapting to the new demands. Officials with the I.B.E.W. Local #5 in Pittsburgh said for this report that "building automation, renewable energies, storage and smart grid technologies all demand special attention, which requires added time and effort in our apprenticeship program."

Building & Construction Trades Council leaders said their workers look forward to helping address climate change by installing energy-efficient chillers, windows and low-flush toilets that in large buildings can add up to substantial water savings. Additionally, projects to separate sewer and storm water conveyance pipes in cities across the state have the potential to improve the environment and put people to work.

State policies to increase renewable energy goals and energy efficiency can further drive job creation. For example, DEP's report "Pennsylvania's Solar Future Plan" estimates that increasing solar energy to 10 percent of in-state energy consumption would result in at least 60,000 new jobs.

⁴² https://www.agriculture.pa.gov/Plants_Land_Water/PlantIndustry/GISC/Documents/Five-Year%20Plan%2009.19.17.pdf

⁴³ Budget Hearing Transcript, Department of Agriculture. House of Representatives, Appropriations Committee. March 5, 2019. https://www.legis.state.pa.us/WU01/LI/TR/Transcripts/2019_0025T.pdf

Timber

Pennsylvania has a major timber industry, with more than 80,000 workers and nearly \$12 billion in annual sales.⁴⁴ The Department of Conservation & Natural Resources' (DCNR) Bureau of Forestry offers for sale more than 70 million board feet of timber per year. Those revenues go into the bureau's operating budget, and from 2008-15, that income averaged more than \$22 million.⁴⁵

Climate change also creates new challenges and health risks for employees in state parks and forests because of increased exposure to pest-spread illnesses such as Lyme disease.

Climate change will significantly alter the forests of Pennsylvania.⁴⁶ The effects on the state's forests range from changing forest composition, loss of tree species, changes in insect and disease pressures, and invasive plants and animals. Without needed investments and resources, DCNR acknowledges the Bureau of Forestry lacks essential staff, support and capability to manage those changes.⁴⁷

ECONOMIC FACTORS

Tourism

Traveler spending supported 6.6 percent of Pennsylvania jobs in 2017, with travel and tourism generating \$4.5 billion in state and local taxes.⁴⁸

2017 was the eighth consecutive year of growth in the sector, much of it coming from outdoor recreation. Outdoor recreation generates \$29.1 billion in consumer spending annually in Pennsylvania, supporting 251,000 direct jobs and generating \$1.9 billion in state and local tax revenue.⁴⁹

Despite overall growth in this sector, climate change will have a severe, negative impact on winter recreation, as Pennsylvania is expected to experience less snowfall and warmer temperatures.⁵⁰ Already, low

snowfall caused a 12 percent decrease in skier visits from 1999 to 2010 in Pennsylvania, creating a potential economic loss of over \$50 million.⁵¹ And while ski operations can invest in snowmaking machines, temperatures must be low enough to maintain snow. Ski resorts could lose 15-20 percent of the season to warmer winters over the coming decades, and many ski resorts may not exist beyond 2070.⁵²

Climate change and severe weather are causing significant damage to manmade structures within Pennsylvania's park and forest systems, which draw 40 million visitors each year. DCNR has identified \$1 billion needed for restoration and repairs to infrastructure in state parks and forests — an amount that will only grow as climate change worsens.

⁴⁴ <https://news.psu.edu/story/571406/2019/04/26/impact/timber-2019-expo-spotlights-pennsylvanias-forest-products-industry>

⁴⁵ <https://www.dcnr.pa.gov/Business/TimberSales/Pages/default.aspx>

⁴⁶ Shortle, James *et al.* Environment and Natural Resources Institute. "Pennsylvania Climate Impacts Assessment." Page 123. Published May 2015. <http://www.depgreenport.state.pa.us/elibrary/GetDocument?docId=5002&DocName=2015%20PENNSYLVANIA%20CLIMATE%20IMPACTS%20ASSESSMENT%20UPDATE.PDF%20>. Accessed Oct. 23, 2019.

⁴⁷ DCNR. "Climate Report: Adaptation and Mitigation." Page 29. http://www.docs.dcnr.pa.gov/cs/groups/public/documents/document/dcnr_20033655.pdf.

⁴⁸ Tourism Economics. "The Economic Impact of Travel in Pennsylvania: Tourism Satellite Account Calendar Year 2017." https://visitpa.com/sites/default/master/files/pdfs/2017_Economic_Impact_of_PA_Travel_and_Tourism_FINAL.pdf. Accessed July 25, 2019.

⁴⁹ https://outdoorindustry.org/wp-content/uploads/2017/07/OIA_RecEcoState_PA.pdf. Accessed July 25, 2019.

⁵⁰ Shortle, James *et al.* Environment and Natural Resources Institute. "Pennsylvania Climate Impacts Assessment." Published May 2015. <http://www.depgreenport.state.pa.us/elibrary/GetDocument?docId=5002&DocName=2015%20PENNSYLVANIA%20CLIMATE%20IMPACTS%20ASSESSMENT%20UPDATE.PDF%20>. Accessed July 26, 2019.

⁵¹ Protect Our Winters and Natural Resources Defense Council. "Climate Impacts on the Winter Tourism Industry in the United States." Published December 2012. <https://www.nrdc.org/sites/default/files/climate-impacts-winter-tourism-report.pdf>. Accessed July 25, 2019.

⁵² Grant, Julie. StateImpact PA. "Skiing's future in Pennsylvania depends on pace of climate change." Published March 24, 2014. <https://www.alleghenyfront.org/skiings-future-in-pennsylvania-depends-on-pace-of-climate-change/>. Accessed July 25, 2019.

Infrastructure

At the same time Pennsylvania’s Department of Transportation (PennDOT) is struggling to pay for the maintenance and upkeep of roads and bridges, the agency is spending more money on emergency repairs from flooding and landslides (see “About landslides,” page 18).⁵³ In 2018, for example, PennDOT estimated damage to state-maintained roads and bridges at more than \$105 million — the highest price tag in 10 years.

Other state agencies – including PEMA, DCED and DCNR – must be prepared to allocate increasing funding to emergency preparation planning and education and disaster relief and recovery. According to PEMA, increased funding and staffing is necessary to more effectively plan and coordinate disaster mitigation work.

Residences and businesses will become much more vulnerable to flooding and other disasters, and their ability to recover will be hindered if they are not covered by flood insurance.

Municipalities will face unexpected costs due the

effects of climate change—flooding especially can cause thousands or tens of thousands dollars in damage to local infrastructure, especially when much of the state’s stormwater systems are aging and in need of repairs (see What We Heard 1, page 23).

For example, an estimated \$200,000 to \$300,000 worth of damage was caused by one instance of flooding in Mount Joy, Lancaster County, in August 2018.⁵⁴ In that same storm, another Lancaster County municipality, Rapho Township, incurred about \$225,000 in damage to bridges and roads, while the township’s budget for emergency road work was only \$20,000.⁵⁵

In a more recent example, flooding in late July 2019 in the eastern Pittsburgh suburbs of O’Hara and Penn Hills caused hundreds of thousands of dollars of damage.⁵⁶

⁵³ Pennsylvania Department of the Auditor General. “Performance Audit Report: Pennsylvania Department of Transportation.” Published April 2019. <https://www.paauditor.gov/Media/Default/Reports/PA%20Department%20of%20Transportation%20Audit%20Report%2004-25-19.pdf>. Accessed July 25, 2019.

⁵⁴ Stauffer, Heather. Lancaster Online. “185 Lancaster County residents have submitted damage reports from August flooding.” Published Sept. 14, 2018. https://lancasteronline.com/news/local/lancaster-county-residents-have-submitted-damage-reports-from-aug-flooding/article_fc3ae3ae-b78b-11e8-bdad-4363d7a511a0.html. Accessed Oct. 18, 2019.

⁵⁵ *Ibid.*

⁵⁶ Carr, Dillon and Brian C. Rittmeyer. Trib Live. “Penn Hills, Plum, O’Hara face costly repairs after floods.” Published July 23, 2019. <https://triblive.com/local/valley-news-dispatch/penn-hills-plum-and-ohara-faces-costly-repairs-after-floods/>. Accessed Oct. 18, 2019.

About landslides

Landslides are triggered by both human-caused and natural changes in the environment, such as land development and erosion or heavy rainfall. Because increased precipitation is a predicted effect of climate change, certain areas of the state with an already elevated risk of landslides due to topography and development must be prepared for landslide occurrences.

There is very little in the way of reporting requirements or tracking of damages to assess risk.

PEMA tracks landslides based upon county reporting, but officials say they recognize that counties might not report every event.

Helen Delano, senior geological scientist at the Department of Conservation & Natural Resources (DCNR), said in spring 2019 that there is still not enough data to track or attempt to predict landslide risks. She identified several areas that must be addressed:

1. No regulatory structure or requirements exist for reporting landslide occurrences or damage totals (she tracks occurrences via Google alerts);
2. Land-use ordinances do not have requirements to address landslide risk;
3. No insurance is available for landslide risk, partly because little is known about the risk,
4. Landslides are not regulated unless they affect a road, pipeline or waterway (and then DEP and/or PennDOT may get involved).

In fact, PennDOT officials said, the agency has seen a surge in costs associated with cleaning up after landslides. In 2018, PennDOT's District 11 — which comprises Allegheny, Beaver and Lawrence counties in western Pennsylvania — estimated it would cost more than \$53 million to repair all of that year's landslides.

Delano said companies and consultants regularly call her hoping to find updated landslide maps, which she does not keep. Callers include representatives from high-risk operations such as pipelines and oil drillers, she said.

PennDOT officials said they do monitor potential slide areas. When slides are repaired, they added, underlying drainage issues are addressed as much as possible.

WHAT HAS PA DONE TO ADDRESS CLIMATE CHANGE?

Pennsylvania's initial intentional efforts to address climate change began in the early 2000s. During that time, the governor and the General Assembly created the three key acts that serve as the foundation for the state's climate action today:

- ◇ **ALTERNATIVE ENERGY PORTFOLIO STANDARDS ACT (ACT 213 OF 2004):** Much of the growth of renewable energy in Pennsylvania can be attributed to the AEPS.

For example, in 2006, zero percent of electricity sold to utility customers in Pennsylvania was from renewable sources; in 2017, about 6 percent came from renewable sources included in the AEPS program.

But Pennsylvania has fallen behind other states by not updating this law. For example, other states – including neighboring states with similar environmental conditions – require much higher quantities of renewable energy to be produced. In “Pennsylvania’s Solar Future Plan” report,⁵⁷ for example, DEP notes that the current target of 0.5 percent solar generation by 2021 is “significantly lower” than New Jersey, whose target is 5.1 percent by 2021; and Maryland, which in 2018 updated its requirements for utilities to source 14.5 percent solar by 2030.

The AEPS also requires that 18 percent of electricity supplied by state electric distribution companies be generated by alternative sources by 2021, a requirement that the state is on track to meet.⁵⁸

- ◇ **CLIMATE CHANGE ACT (ACT 70 OF 2008):** This law requires that DEP publish greenhouse gas

emissions inventories annually and release the Climate Impact Assessment and Climate Action Plan reports every three years. The act also requires DEP to administer a Climate Change Advisory Committee.

- ◇ **ENERGY EFFICIENCY AND CONSERVATION LAW (ACT 129 OF 2008):** Act 129 requires electricity distribution companies to spend a pre-determined amount of money per year on energy efficiency measures for their customers to reduce electricity demand and consumption. These investments include high-efficiency appliance and lighting rebates, building retrofits, and smart meter installation.⁵⁹

However, Act 129 has a financial cap⁶⁰ that limits the amount that can be invested in these programs, slowing the effectiveness of the program. Twenty-nine other states have similar mandatory energy efficiency programs, and none has the financial cap on investments. The programs in other states can more heavily invest in energy savings, meaning that they are reducing emissions and lowering electricity bills more effectively and faster than Pennsylvania.

Act 129 saves electricity customers money while reducing emissions. From June 2017 through May 2018, net statewide savings for customers was estimated at \$108 million.⁶¹

⁵⁷ <http://www.depgreenport.state.pa.us/elibrary/GetDocument?docId=1413595&DocName=PENNSYLVANIA%26%2339%3bS%20SOLAR%20FUTURE%20PLAN.PDF%20%20%3cspan%20style%3D%22color:blue%3b%22%3e%28NEW%29%3c%2Fspan%3e>. Accessed July 25, 2019.

⁵⁸ Note that “alternative” does not equal “renewable.” Sources of electricity accepted into the AEPS include solar, wind, low-impact hydro, geothermal, biomass, biologically derived methane gas, coal-mine methane and fuel cell resources, waste coal, and more. For more, see Pennsylvania’s Climate Action Plan, page 27. <http://www.depgreenport.state.pa.us/elibrary/GetDocument?docId=1454161&DocName=2018%20PA%20CLIMATE%20ACTION%20PLAN.PDF%20%20%20%3cspan%20style%3D%22color:blue%3b%22%3e%28NEW%29%3c%2Fspan%3e>.

⁵⁹ Keystone Energy Efficiency Alliance. “Act 129: Energy Savings for Consumers.” <https://keealliance.org/wp-content/uploads/2018/08/Act-129-Fact-Sheet-2018.pdf>. Accessed July 25, 2019.

⁶⁰ The cap is set at 2 percent of 2006 electricity distribution companies’ spending levels.

⁶¹ Pennsylvania Utility Commission. “State Evaluator Annual Report Act 129 Program Year 9.” Page 12. http://www.puc.state.pa.us/Electric/pdf/Act129/Act129-SWE_AR_Y9_022819.pdf. Accessed July 29, 2019.

More recently, legislators have introduced bills with goals related to climate action, but none has made it into law.

The Pennsylvania Attorney General’s Office has taken action on climate change. In April 2018, it joined 14 other states and the City of Chicago to sue the EPA for ignoring its responsibilities under the Clean Air Act in delaying methane control standards.⁶² In October 2018, the Attorney General’s Office again joined with several states and cities, including Philadelphia, to file comments with the EPA regarding its planned rollback of the Clean Power Plan.⁶³

After the White House decided to withdraw the U.S. from the Paris Agreement, the Pennsylvania Treasury Department signed the “We’re Still In” pledge to signify that the department would adhere by the agreement’s goals, saying in a news release: “Climate change represents a catastrophic threat to Pennsylvania if we do not take action.”⁶⁴

Additionally, the Treasury Department partnered

with the Foundation for Renewable Energy and Environment to create The Pennsylvania Sustainable Energy Finance Program, which provides for a “prudent, market-based investment vehicle that promotes energy and water efficiency, clean energy generation, economic development and environmental improvement” for qualifying organizations in the commonwealth.⁶⁵

In January 2019, Gov. Tom Wolf issued an executive order that established climate goals for the commonwealth, set performance goals for state agencies, and established a GreenGov Council.

The executive order sets specific goals and directs state agencies to incorporate environmentally sustainable practices – actions which should produce appreciable energy-use changes. However, the targets do not match the Intergovernmental Panel on Climate Change’s most recent target of 100 percent reduction in greenhouse gases by 2050 from 2010 levels.⁶⁶

Pennsylvanians’ views on climate change

According to a 2019 statewide poll conducted by Franklin & Marshall College, the majority of Pennsylvanians support climate change action:

- ◇ “Most registered (Pennsylvania) voters believe that climate change is currently causing problems (67%) and most (68%) think the state should do more to address those problems.”
- ◇ “Two in three (68%) voters believe the state should pursue policies that prioritize renewable energy.”

While Pennsylvanians are divided about the cause of climate change, most acknowledge that weather patterns are changing. Pennsylvanians want their communities to be livable, to be resilient and to continue to provide a good quality of life. Addressing the effects of climate change will go a long way in reaching those goals.

⁶² https://ag.ny.gov/sites/default/files/methane_complaint.pdf

⁶³ https://ag.ny.gov/sites/default/files/cpp_replacement_comments.pdf

⁶⁴ <https://patreasury.gov/newsroom/archive/2017/07-10-Torsella-Remain-Paris-Accord.html>

⁶⁵ <https://freefutures.org/pennsef/about/>

⁶⁶ Gov. Wolf’s target by 2050 is 80 percent of 2005 levels. According to DEP’s 2018 Greenhouse Gas Inventory, emissions had already decreased by 5.44 percent from 2005 to 2010.

Gov. Wolf also had Pennsylvania join the U.S. Climate Alliance, in which states commit to meeting goals of the Paris Agreement, among other aims.

Finally, Gov. Wolf issued an executive order in October 2019 for Pennsylvania to become the final Mid-Atlantic state to join the Regional Greenhouse Gas Initiative (RGGI). RGGI is a cap-and-invest program that sets limits on carbon emissions from power plants, so that plant operators must then purchase emissions “allowances” from an auction. The number of allowances is limited by the cap on emissions.

The program has been operational for 10 years, and the results from multiple analyses have shown that RGGI has helped to lower carbon emissions from power plants in the member states, while bringing other benefits to those states, including job creation and positive economic outcomes.

States receive money through the auction proceeds. Each state can determine how it allocates the funding; these expenditures include energy-efficiency programs, renewable energy projects, utility bill assistance for low-income residents, education and job training, and transportation funding. Jobs are then created to complete these projects.

The Analysis Group found, in a 2018 study, that from 2015-2017, RGGI led to \$1.4 billion of positive economic activity in the then-nine-state region.⁶⁷

Other benefits of the program include a decrease in particulate pollution, leading to potential savings in healthcare expenditures and fewer missed school/work days due to illness.⁶⁸

Because RGGI states invest in energy-efficiency programs over time, electricity customers have started to save money on their utility bills. From 2015-17, electricity consumers saved \$99 million and consumers of natural gas and heating oil saved \$121 million.⁶⁹

Critics of joining RGGI argue that it could conversely cause electricity prices to increase, which could disproportionately affect low-income residents’ utility bills.

However, recent modeling has shown that joining RGGI would be a net benefit for Pennsylvanians. With the proper policies and investment priorities in place, RGGI would help lower Pennsylvanian’s electricity bills as compared to business-as-usual projected increases. Joining RGGI could also bring in additional revenue to help the state reinvest in renewable energy goals, improve energy efficiency measures, and assist with job-training efforts.

The state could see approximate annual revenues of \$250 million in the first year, decreasing slightly over time (in real dollars) with a lowered cap, but with about \$2 billion cumulatively over the first 10 years of the program.⁷⁰

⁶⁷ https://www.analysisgroup.com/globalassets/uploadedfiles/content/insights/publishing/analysis_group_rggi_report_april_2018.pdf

⁶⁸ Acadia Center. “*The Regional Greenhouse Gas Initiative: 10 Years in Review.*” Published September 2019. https://acadiacenter.org/wp-content/uploads/2019/09/Acadia-Center_RGGI_10-Years-in-Review_2019-09-17.pdf. Accessed Oct. 21, 2019.

⁶⁹ https://www.analysisgroup.com/globalassets/uploadedfiles/content/insights/publishing/analysis_group_rggi_report_april_2018.pdf

⁷⁰ Figures are in 2012 dollars. Natural Resources Defense Council. “*Modeling Pennsylvania’s Power Future: 2019 Carbon & Clean Energy Policy Scenarios.*” Presentation, June 2019.

Local and state leaders are struggling to plan for extreme weather and other climate change effects due to a lack of coordination and inadequate resources.

As its name suggests, the state Department of Environmental Protection (DEP) is the agency tasked with leading the commonwealth’s efforts to protect the environment. A months-long review showed a need for major improvements in coordination and resource-sharing among the governor’s office, DEP officials and other government offices.

For example, several people said for this report that a major lack of coordination exists between the main DEP office and its six regional offices. One regional office manager said that, as of several days after DEP’s Climate Action Plan was released in April 2019, they had not read it and were not sure what “responsibility the regional office would have in implementation efforts.”

DEP senior staff acknowledged during an interview in spring 2019 that they have no plans in place to coordinate with counties on the roll-out of the Climate Action Plan. And after a recent Climate Change Advisory Committee meeting, one member admitted that officials in his county were not even aware the plan was being released.

Some other county representatives, such as planners and commissioners, are pursuing their own paths to help reduce greenhouse gas emissions – but the state is not providing enough assistance or guidance for these piecemeal plans.

The legislatively mandated Climate Action Plans outline steps stakeholders could take to reduce their emissions, but it appears DEP is not disseminating that information to interested county officials. Many of those county officials said they do not have the capacity or knowledge in house to know how to effectively reduce their emissions and that more guidance from DEP would be helpful in developing their local plans. For instance, county and local planners said they are lacking data, benchmarking information and reference materials to help them make decisions about best practices to reduce their local emissions.

Often, the push to reduce emissions comes from a grassroots effort in a small area, and no regional or statewide governmental entities exist to share information across communities. Advocacy organizations like the Sierra Club have filled the void by connecting local policymakers and advocates with needed information or education. The Sierra Club has organized local activists to push for clean energy resolutions at the municipal level, and so far, 19 Pennsylvania communities have passed resolutions to work towards 100 percent clean energy by 2050. These communities include State College, Reading, and Conshohocken.⁷¹

Only a few counties — such as Chester, Montgomery and Philadelphia — have taken county-wide action; most municipal action is done independently. Without organization to facilitate and disseminate these models, time and opportunities are not optimized in duplicative efforts.

Planning for the effects of climate change — flooding especially — suffers from the absence of a coordinated effort. Pennsylvania’s aging infrastructure compounds the risks and damages of increased precipitation, as heavier rainfall events overwhelm the current systems and lead to flooding of private and public property. These events are already being seen across the state with regularity, with rainfall totals exceeding expectations and creating flash floods.

The American Society of Civil Engineers (ASCE) has repeatedly sounded the alarm, going so far in its 2018 state report card as to give the state’s roads, bridges, stormwater, wastewater and drinking water categories all D grades, meaning they are “in poor to fair condition and mostly below standard, with many elements approaching the end of their service life.”⁷² Stormwater controls not only help reduce pollution into the waterways, but can also mitigate the risks and severity of flash flooding, improving resiliency in communities.⁷³ Stormwater systems work by slowing, retaining and diverting stormwater; ideally these systems are sized appropriately and regularly maintained.

Currently, though, these systems in Pennsylvania, as in much of the nation, are old, ill-maintained and often overlooked. There is no statewide assessment of the existing conditions and capacity of Pennsylvania’s stormwater systems, ASCE has pointed out,⁷⁴ which means no one — in the public or private sector — has any idea how much these systems are at risk of failure during severe weather.

Limited state funding is available for stormwater upgrades and repairs, but none are ongoing or stable sources; they are often competitive, usually one-time grants, bonds or loans. Pennsylvania’s PENNVEST program can be used for stormwater system upgrades, but historically this program has had only a small percentage of funding go to stormwater projects.

⁷¹ Long, Jeremy. Reading Eagle. “Reading wants to lead the charge for green energy targeting 100% clean electricity by 2035.” Published June 24, 2019. <https://www.readingeagle.com/news/article/reading-waiting-for-a-green-light-on-renewable-energy>. Accessed Oct. 18, 2019.

⁷² American Society of Civil Engineers. “Report Card for Pennsylvania’s Infrastructure: 2018.” Page 6. https://www.infrastructurereportcard.org/wp-content/uploads/2016/10/ASCE-PA-report_2018.pdf. Accessed July 31, 2019.

⁷³ <https://wefstormwaterinstitute.org/wp-content/uploads/2015/09/Rainfall-to-Results.pdf>

⁷⁴ American Society of Civil Engineers. “Report Card for Pennsylvania’s Infrastructure: 2018.” Page 110. https://www.infrastructurereportcard.org/wp-content/uploads/2016/10/ASCE-PA-report_2018.pdf. Accessed July 31, 2019.

A lack of reliable funding streams for infrastructure is a perpetual problem in the state. For example, PennDOT Secretary Leslie Richards said in spring 2019 that the agency is “billions of dollars short” for maintenance of roads and bridges. In fact, a recent audit found that \$4.2 billion has been diverted from transportation maintenance funds through the state budget process since 2012-13.⁷⁵

The bottom line: The state lacks coordination and specific plans to reduce greenhouse gas emissions to minimize Pennsylvania’s impact on climate change and to properly create or implement adequate plans to lessen damage caused by extreme weather. Other states vary in their planning, but some are out in front of these issues.

For example, in 2012, Washington state released “Preparing for a Changing Climate: Washington State’s Integrated Climate Response Strategy,” a comprehensive framework of steps to protect its economy, natural resources and communities that might potentially serve as a model for Pennsylvania.⁷⁶

About stormwater systems

Stormwater systems are usually owned and operated by local authorities. These systems include both Municipal Separate Storm Sewer Systems (MS4s), which have separated conveyance pipes for stormwater and wastewater, and Combined Sewer Overflows (CSOs), which convey stormwater and wastewater together.

Pennsylvania has the highest number of CSOs of any state, and these systems can release untreated human and industrial waste and other pollutants into the environment when the systems are overwhelmed by rainwater, according to ASCE. Some cities with CSOs – such as Philadelphia, Pittsburgh, Erie, Scranton and Johnstown – remain under orders from the EPA and the state government to significantly reduce their CSO outflows.

Pennsylvania has two large MS4s and 1,059 small MS4s. The vast majority are community-based and managed by a publicly owned authority; the remainders belong to other entities such as universities and prisons.

Performing necessary upgrades to the state’s MS4s will be expensive. If state government does not allocate funding, then resources will have to be paid for through local channels such as stormwater fees. No resources could be found that estimate the total price tag for these upgrades.

⁷⁵ Department of the Auditor General. “Performance Audit Report: Pennsylvania Department of Transportation.” Published April 2019. <https://www.paauditor.gov/Media/Default/Reports/PA%20Department%20of%20Transportation%20Audit%20Report%2004-25-19.pdf>. Accessed July 26, 2019.

⁷⁶ Washington State, Department of Ecology. “Preparing for a Changing Climate: Washington State’s Integrated Climate Response Strategy.” Published April 2012. <https://fortress.wa.gov/ecy/publications/publications/1201004.pdf>. Accessed Sept. 17, 2019.

Pennsylvania is not prepared for the severe impacts of climate change, and a solely reactive approach will lead to millions of dollars spent on recovery and remediation.

FLOODING'S IMPACT

Nearly all the experts consulted for this report agreed that Pennsylvania is not prepared for the damage that future flooding will cause. Almost all of them agreed on a few key points:

- ◇ Communities are flooding that hadn't flooded before;
- ◇ These communities aren't prepared for increased flooding;
- ◇ Information about how to incorporate the effects of climate change into flood planning efforts is not yet widely available; and
- ◇ The state's lawmakers and leaders are not prioritizing funding or programming to proactively mitigate the risks of flooding.

According to PEMA, flooding is by far the most extensive hazard in Pennsylvania,⁷⁷ and "more intense precipitation incidents that are localized and not widespread" are becoming more common. This type of flooding — flash flooding — is difficult to predict and is occurring in places that haven't previously flooded. This section examines what is being done to prevent damage from flooding as well as what cost effective measures could be adopted by state and local governments.

⁷⁷ <https://pahmp.com/wp-content/uploads/2018/10/Chapter-5-Capability-Assessment.pdf>

The costs of flood remediation, and the risk of floods, are both much higher than Pennsylvanians expect them to be. Consider, for example, that:

- ◇ Just 1 inch of water on the first floor of a home costs, on average, \$25,000 to repair and, generally, standard homeowners insurance does not cover the damage.
- ◇ Total damage to Pennsylvania insured property owners over the past 40 years is just under \$1.2 billion.
- ◇ The total flood damage to Pennsylvania's uninsured property owners is unknown.

Although progress is being made, flood management and recovery in the United States – including Pennsylvania – is still primarily reactive. Planning efforts to mitigate the most damaging and dangerous effects of flooding are disjointed across the state. Standardized regulations for counties and

municipalities to follow do not exist. The interrelated issues of the floodplain and stormwater are regulated separately. And top-down guidance from state agencies – for local land use and development, or for statewide water resources – has not been released in a timely fashion.

In many cases, the responsibility for repairing flood damage is on the property owner or resident – primarily through the purchase of flood insurance. There are federal programs, administered either by FEMA or HUD, to mitigate the effects of flooding through buyouts and demolition of structures that have flooded repeatedly and to assist in certain types of rebuilding and renovations that occur after a flood if emergency status has been declared; however, qualifying for these programs is time- and labor-intensive, with a median wait time in Pennsylvania of about five years from disaster declaration to case closure.⁷⁸

FLOOD INSURANCE'S ROLE

Flood insurance is expensive, and many premiums are increasing as the federal program undergoes an overhaul to better tie premiums to actual flood risk and remove subsidies for certain types of structures.

Many homeowners, particularly in flood-prone areas, may be shocked to find out their new rates.⁷⁹ For example, in Lycoming County, where premiums already cost \$1,000 to \$3,000 per year, local officials are concerned that premiums may rise to \$9,000 or more annually.⁸⁰

If a home with a federally backed mortgage is in a Special Flood Hazard Area (SFHA), then the owners are required to purchase flood insurance. Property owners who have paid off their mortgages in these areas, have alternative financing, or who are not located in these areas, often choose to forgo flood insurance due to the cost.

⁷⁸ <https://www.nrdc.org/sites/default/files/going-under-post-flood-buyouts-report.pdf>

⁷⁹ <https://www.fema.gov/nfiptransformation>

⁸⁰ Hibbard, Katelyn. Williamsport Sun-Gazette. "National flood insurance rates to see 'scary' increase." Published April 20, 2019. <http://www.sungazette.com/news/top-news/2019/04/national-flood-insurance-rate-to-see-scary-increase/>. Accessed Oct. 18, 2019.

OBSERVATIONS: WHAT WE HEARD 2

Flood Insurance Rate Maps (FIRMs) are one of the primary resources used to determine flood risk. The maps identify what are known as the 100-year and the 500-year flood risks, and they impact insurance rates. For example, flood insurance on a \$150,000 home in a moderate-risk flood zone in southcentral Pennsylvania cost about \$2,500 in 2019. Fifteen years ago, flood insurance for that same house was about \$1,200.

While FIRMs are useful, they are often misunderstood or relied upon in less-than-ideal ways. People may falsely believe a home or region is “in” or “out” of flood risk areas because the area is not included on a rate map.⁸¹ The reality is that floods do not adhere to lines on maps. As the Pennsylvania Insurance Department says, much of the flooding that happens in Pennsylvania is outside of these flood hazard areas; in fact, while a property within the SFHA has one in four chance of flooding over a 30-year period, a property outside of that area still has a one in seven chance.⁸²

Yet Pennsylvania’s homes and businesses are under-insured: Just 15 percent of property owners who should have flood insurance obtain it.⁸³ That number has decreased 24 percent since 2013.⁸⁴

SOURCE: TESTIMONY OF MARY ELLEN RAMAGE, MANAGER, BOROUGH OF ETNA IN ALLEGHENY COUNTY, BEFORE A JOINT SENATE HEARING APRIL 25, 2018

“[F]lood protection MUST be a proactive focus of our federal, state, county and local government. Currently, it is a REACTIVE approach when substantial damage has already occurred, including loss of life in many cases.”

⁸¹ https://www.naic.org/documents/cipr_study_1704_flood_risk.pdf

⁸² Pennsylvania Insurance Department testimony presented by David Buono on May 13, 2019, at Widener University.

⁸³ Pennsylvania Emergency Management Agency. “Commonwealth of Pennsylvania State Hazard Mitigation Plan Update Chapter 5.” Page 626. Published October 2018. <https://pahmp.com/wp-content/uploads/2018/10/Chapter-5-Capability-Assessment.pdf>. Accessed July 29, 2019.

⁸⁴ Pennsylvania Emergency Management Agency. “Commonwealth of Pennsylvania State Hazard Mitigation Plan Update Chapter 5.” Page 618. Published October 2018. <https://pahmp.com/wp-content/uploads/2018/10/Chapter-5-Capability-Assessment.pdf>. Accessed July 29, 2019.

Regular homeowner and commercial insurance policies do not cover damage from flooding. This gap in insurance coverage means that taxpayers may end up picking up the tab when an uninsured property floods.

The combination of heavy downpours and aging stormwater infrastructure means that many more property owners, renters and businesses are at risk of flooding. And the lack of flood insurance policies means that more money will be spent on recovery – if recovery is possible.

PREVENTING FLOOD DAMAGE

Communities can take action by taking steps to lower risks. FEMA’s Community Rating System is a program that helps communities lower flood insurance prices by putting in place flood mitigation practices. Yet only 28 Pennsylvania municipalities participate in this program (see “PA’s CRS communities”).

The 28 participating communities are saving policyholders over \$450,000 annually on their flood insurance policies.⁸⁵ The 2018 state Hazard Mitigation Plan identified 10 communities with the highest potential savings if they were to join the Community Rating System: Philadelphia, Pittsburgh and Johnstown cities; Bristol, Susquehanna, Upper Darby and Abington townships; and Yardley, New Hope and Forty Fort boroughs.

Resource constraints around staffing and funding, low level of institutional support and the burdensome reporting requirements create a high barrier for many Pennsylvania communities to enter the Community Rating System.⁸⁶ The other major issue for communities is that CRS must be administered at the municipal rather than county level – and while other states, such as Florida and Virginia, allocate funding for rating system specialists or other ways to assist communities, Pennsylvania does not provide support in that way.

PA’s CRS Communities

ALLEGHENY COUNTY: Etna Borough, Shaler Township, Upper St. Clair Township

BEDFORD COUNTY: Bedford Township

BLAIR COUNTY: Altoona

BUCKS COUNTY: Lower Makefield Township, Warwick Township

COLUMBIA COUNTY: Bloomsburg

DAUPHIN COUNTY: Harrisburg

DELAWARE COUNTY: Brookhaven Borough

LUZERNE COUNTY: Hanover Township, Kingston Borough, Wilkes-Barre

LYCOMING COUNTY: Jersey Shore Borough

MIFFLIN COUNTY: Granville Township, Lewistown Borough

MONTOUR COUNTY: Danville Borough

NORTHUMBERLAND COUNTY: Herndon Borough, Milton Borough, Northumberland Borough, Sunbury, Upper Augusta Township

PERRY COUNTY: Newport Borough

SNYDER COUNTY: Chapman Township, Monroe Township, Penn Township, Selinsgrove Borough

UNION COUNTY: Lewisburg Borough

⁸⁵ Pennsylvania Emergency Management Agency. “Commonwealth of Pennsylvania State Hazard Mitigation Plan Update Chapter 5.” Page 623. <https://pahmp.com/wp-content/uploads/2018/10/Chapter-5-Capability-Assessment.pdf>. Accessed July 31, 2019.

⁸⁶ Fowler, Lara B. et al. The Center for Rural Pennsylvania. “Flood Mitigation for Pennsylvania’s Rural Communities: Community-Scale Impact of Federal Policies.” Page 46. Published April 2018. <https://www.rural.palegislature.us/documents/reports/Flood-Mitigation-2017.pdf>. Accessed July 29, 2019.

Communities can invest in improving the built environment to lower their risk of devastating flooding. Green infrastructure is a type of stormwater management system that mimics natural processes to slow, absorb and store runoff. Green infrastructure is being used in some Pennsylvania communities to reduce the effects of heavy rainfall. This type of stormwater management has important other benefits: reduce the effects of extreme heat,⁸⁷ improve air quality,⁸⁸ help remove water pollution to meet EPA requirements, and reduce energy usage.

- ◇ In Lancaster, the city’s green infrastructure plan was evaluated to reduce capital costs by \$120 million while saving \$661,000 annually in reduced wastewater treatment costs.⁸⁹ The cost of the 25-year, \$140 million plan to install these systems are covered by state and federal funding initiatives as well as a fee on property owners.⁹⁰
- ◇ Philadelphia has also embarked on a major, 25-year green infrastructure plan. The project, called “Green City, Clean Water,” invests approximately \$1.2 billion into these projects. A 2016 report, conducted in Year 5 of the project, estimated that the green infrastructure investment will produce a \$3.1 billion impact on the Philadelphia economy, including \$2 million in local tax revenues annually.⁹¹
- ◇ In the Wyoming Valley, a five-year plan costing approximately \$17 million would install 65 projects to reduce erosion, capture runoff and store stormwater.⁹²

Because the General Assembly has so far not allocated funding to maintain the commonwealth’s infrastructure, utilities and localities are financing stormwater projects with a fee paid by property owners or utility users. While an average homeowner’s fees are usually under \$200 per year, some institutions such as businesses or school districts are facing fees into the tens of thousands. In Franklin County, Greencastle-Antrim School District is estimating an annual fee of \$47,000, and there is concern that the fee will lead to higher property taxes.⁹³

Yet when a flooding event occurs, it is taxpayers who are funding clean up and recovery for those who are not properly insured and prepared for floods.

BEYOND FEDERAL DISASTER RELIEF

Finally, widespread belief exists that federal disaster relief will be made available to help all communities that have significant damage from natural disasters. Unfortunately this belief is not correct, and it leads to decision-makers, including local elected officials and homeowners, not being proactive enough in their prevention planning.

⁸⁷ <https://www.epa.gov/green-infrastructure/reduce-urban-heat-island-effect>

⁸⁸ <https://www.epa.gov/green-infrastructure/green-infrastructure-and-air-quality-impacts>

⁸⁹ https://www.epa.gov/sites/production/files/2015-10/documents/cnt-lancaster-report-508_1.pdf

⁹⁰ Stuhldreher, Tim. “Green projects key in Lancaster meeting EPA stormwater mandates.” Published Feb. 11, 2018. https://lancasteronline.com/news/local/green-projects-key-in-lancaster-s-huge-task-of-meeting/article_39c485f0-2bfc-11e9-9ebf-4bed8f512861.html. Accessed Oct. 18, 2019.

⁹¹ https://gsipartners.sbnphiladelphia.org/wp-content/uploads/2016/02/SBN_FINAL-REPORT.pdf

⁹² Learn-Andes, Jennifer. Times Leader. “State clearance expected soon for stormwater fee-funded projects.” Published July 30, 2019. <https://www.timesleader.com/news/751273/state-clearance-expected-soon-for-stormwater-fee-funded-projects>. Accessed Oct. 18, 2019.

⁹³ Hardy, Shawn. The Record Herald. “Stormwater fees announced in Greencastle.” Published June 5, 2019. <https://www.therecordherald.com/news/20190605/stormwater-fees-announced-in-greencastle>. Accessed Oct. 18, 2019.

As the state learned in 2018, significant damage can happen over the course of several storms in a short timeframe, but that does not qualify for federal relief – and such micro-burst-style storms are likely to occur more often because of climate change. PEMA officials said in May 2019, “these precipitation incidents resulted in highly localized areas of significant impact, which has made it very difficult to meet disaster thresholds to qualify for federal disaster assistance.”

Moreover, FEMA is underfunded for the current level of need. Large-scale disasters such as hurricanes tend to quickly exhaust federal resources, leaving less funding available to help in areas where severe but smaller-scale weather events have occurred.

Additionally, PEMA officials said, there’s increased competition for funding for preparedness and hazard mitigation activities.

And these issues don’t just apply to flooding. Allegheny County Emergency Management requested federal assistance after landslides caused \$22 million in damage in 2018, and FEMA declined, stating:

“BASED ON FEMA’S REVIEW ... IT WAS DETERMINED THAT THE DAMAGE IDENTIFIED IN THE REQUEST RESULTED FROM SEPARATE AND DISTINCT EVENTS, NONE OF WHICH WERE OF THE SEVERITY AND MAGNITUDE AS TO BE BEYOND THE CAPABILITIES OF THE COMMONWEALTH AND AFFECTED LOCAL GOVERNMENTS. THEREFORE, IT WAS DETERMINED THAT SUPPLEMENTAL FEDERAL ASSISTANCE WAS NOT NECESSARY.”⁹⁴

In 2018, approximately \$63 million in damage to public infrastructure in Pennsylvania was not covered by FEMA disaster assistance.⁹⁵

The bottom line: Every \$1 spent on preventing natural disaster damage saves \$6 in recovery costs.⁹⁶

Emergency responders

Adding to the lack of preparedness is the strained situation for emergency responders. Emergency medical services (EMS) funding is severely lacking, and other changes have put the ability of EMS to respond to disaster situations in serious question. In Easton, for example, the fire department was not equipped to handle the events of Hurricane Sandy in 2012, which included three simultaneous house fires, among other emergencies.

State agencies’ roles are changing based upon increased precipitation events. PEMA’s role has “become more flexible” in providing rescue support, including increased usage of helicopter hoist and rescue operations, at additional expense to the state. As these precipitation events become more common, these expenses will continue to increase, especially if the state and local governments do not take more proactive steps to reduce the impacts of flooding.

The State Hazard Mitigation Plan inventories risks to state and critical facilities to determine vulnerability, and the 2018 plan found that the increased precipitation will vastly increase risk to these facilities.

⁹⁴ Shumway, John. KDKA-TV. “FEMA Denies Pa.’s Request for Disaster Relief to Fix Landslides.” Published Oct. 16, 2018. <https://pittsburgh.cbslocal.com/2018/10/16/allegheny-county-landslide-disaster-relief-denied-fema/>. Accessed July 26, 2019.

⁹⁵ Pennsylvania Governor’s Office. “Restore Pennsylvania: Storm Preparedness and Disaster Recovery.” Published June 2019. <https://www.governor.pa.gov/wp-content/uploads/2019/06/20190506-Restore-Pennsylvania-Flood-Control-Disaster-Response.pdf>. Accessed July 30, 2019.

⁹⁶ National Institute of Building Sciences. “National Institute of Building Sciences Issues New Report on the Value of Mitigation.” Published Jan. 11, 2018. <https://www.nibs.org/news/381874/National-Institute-of-Building-Sciences-Issues-New-Report-on-the-Value-of-Mitigation.htm>. Accessed July 29, 2019.

Pennsylvania must join other states in doing more to reduce greenhouse gas emissions, especially carbon dioxide and methane, in the electric power, agricultural, transportation and industrial sectors.

Pennsylvania has historically been a leader in energy innovation and production. It was home to the nation's first commercial oil well in 1859 and, 99 years later, the first commercial nuclear power plant.

An abundant supply of coal, which has been mined in Pennsylvania since the 1700s, fueled the industrial revolution and fostered the growth of the steel and railroad industries in the state. Today, natural gas from the Marcellus and Utica Shale formations has helped Pennsylvania secure its position as the top exporter of electric power among U.S. states.⁹⁷

Not only did energy production play a vital role in the development of Pennsylvania's economy and sprawling transportation infrastructure, but taxes paid by energy producers and the industries they supported also were – and still are – an important source of revenue for state government.

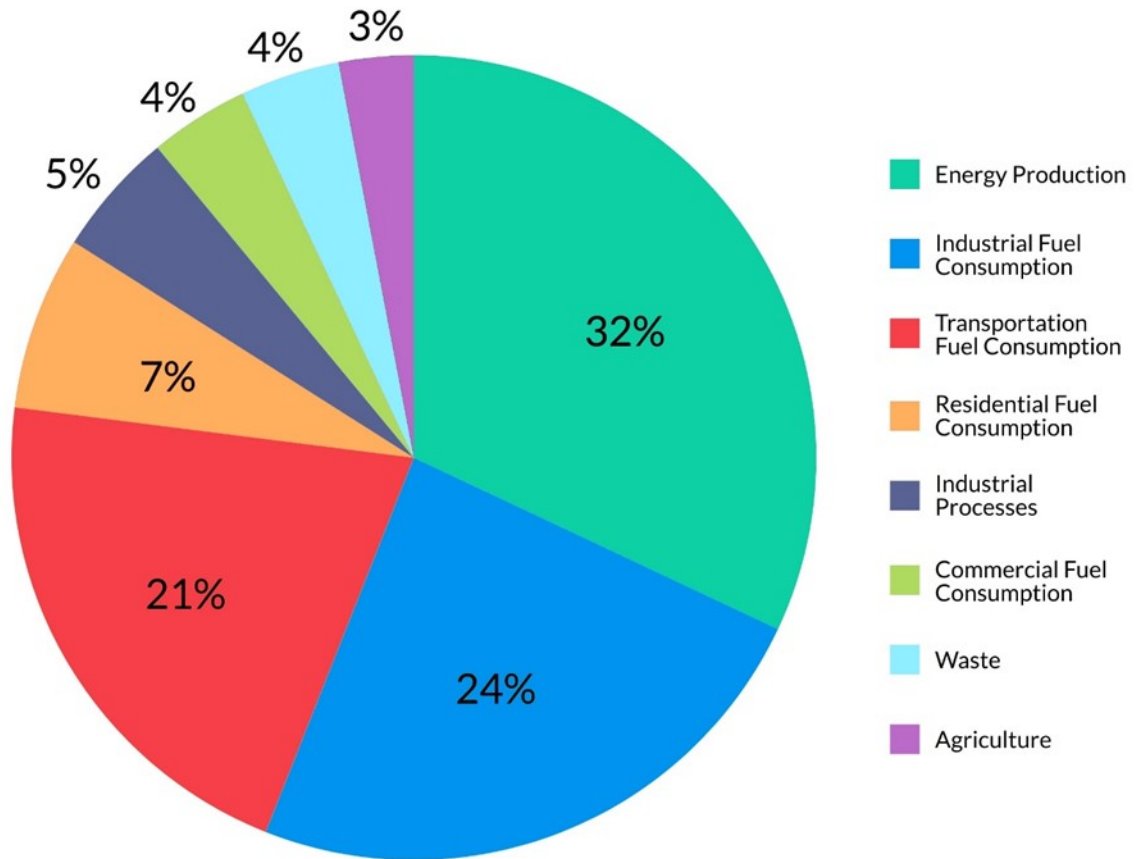
As of 2017, Pennsylvania ranked behind only Texas in production of natural gas and was the third-largest coal-producing state. It also ranked second in electricity generation from nuclear energy.⁹⁸

⁹⁷ U.S. Energy Information Administration. "California imports the most electricity from other states; Pennsylvania exports the most." Published April 4, 2019. <https://www.eia.gov/todayinenergy/detail.php?id=38912>. Accessed July 31, 2019.

⁹⁸ U.S. Energy Information Administration. "Pennsylvania: State Profile and Energy Estimates." <https://www.eia.gov/state/?sid=PA>. Accessed July 31, 2019.

In Pennsylvania, greenhouse gas emissions come from these sectors of the economy⁹⁹:

GREENHOUSE GAS EMISSIONS IN PA
BY SECTOR, 2015



To address its contribution to climate change, Pennsylvania must begin to reduce emissions in its electric power sector — and focus on addressing the high levels of methane pollution in the state from conventional and unconventional drilling and abandoned oil and gas wells.

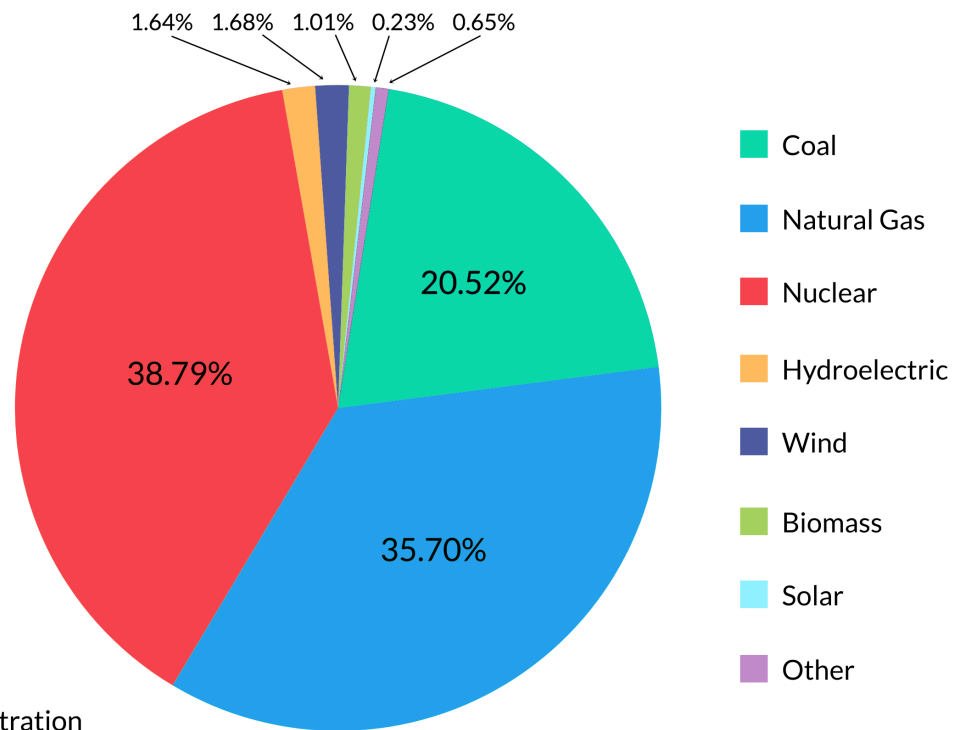
However, even if emissions from methane sources and electricity generation were reduced in the state, the industrial, transportation and agricultural sectors must still take action to broadly reduce emissions.

⁹⁹ Pennsylvania Department of Environmental Protection. "Pennsylvania Climate Action Plan." Page 33. Published Nov. 20, 2018. <http://www.dep.state.pa.us/elibrary/GetDocument?docId=1454161&DocName=2018%20PA%20CLIMATE%20ACTION%20PLAN.PDF%20%20%20%3cspan%20style%3D%22color:blue%3b%22%3e%28NEW%29%3c%2Fspan%3e>. Accessed Oct. 24, 2019.

ELECTRIC POWER SECTOR

About 55 percent of the electric power generated in Pennsylvania is produced by coal and natural gas. Nuclear makes up nearly 40 percent, and renewables make up about 5 percent.

BREAKDOWN OF PA'S ENERGY SOURCES, 2018



The most significant decreases in greenhouse gas emissions in Pennsylvania likely are a result of the natural gas boom, which led to the displacement of many coal-fired power plants. Burning natural gas emits about half as much carbon dioxide as burning coal,¹⁰⁰ and coal emissions from electricity generation have dropped nearly in half since 2005.

Outside of this decrease, the electric power sector in the state has made little progress in reducing emissions and, in fact, emissions from this sector are predicted to increase 27 percent by 2026 without a cap on carbon.¹⁰¹

While nuclear remains a controversial energy source due to public perceptions of safety issues, the closure of Three Mile Island means that the state's greenhouse gas emissions from electricity generation will increase, as natural gas – or, less likely, coal – fills that gap in production.

¹⁰⁰ This does not account for the fact that methane leakage is unmeasured. If the methane being released from natural gas extraction and transport is higher than what is currently being estimated, then there may not have been much of a decrease in greenhouse gas emissions.

¹⁰¹ Burtraw, Dallas, *et al.* Resources for the Future. "Options for Issuing Emissions Allowances in a Pennsylvania Carbon Pricing Policy." Published 2019. <https://www.rff.org/publications/issue-briefs/options-issuing-emissions-allowances-pennsylvania-carbon-pricing-policy/>. Accessed Nov. 5, 2019.

REGULATING METHANE

Methane is a powerful greenhouse gas with a lifespan of about 20 years. During its time in the atmosphere, its warming capacity is exponentially stronger — at least 28 times stronger — than carbon,¹⁰² which means that methane leakages and releases from the growing natural gas infrastructure in Pennsylvania are contributing to the accelerating pace of climate change.

Comprehensively measuring and regulating methane must be a major component of lowering emissions. Pennsylvania is making progress in this area but still lags behind where it could be if it used the most up-to-date technology available. Meanwhile, Colorado, which developed its regulations with the assistance of the natural gas industry, is measuring and regulating methane much more effectively than Pennsylvania.

In 2016, Gov. Wolf announced the Methane Reduction Strategy. The first part of this strategy introduced new permits to address methane emissions from new natural gas wells and infrastructure. Another component, still in awaiting review by the Environmental Quality Board, would reduce leaks of methane at existing wells,

which would address the bulk of these emissions.

In the announcement, the administration acknowledged that the natural gas industry reported “almost 115,000 tons of methane emissions from unconventional wells and mid-stream operations in Pennsylvania in 2014. This is considered a low estimate, since fugitive emissions are difficult to quantify.”¹⁰³ Several experts consulted for this report confirmed that the methane emissions numbers being reported to DEP by the industry may not be accurate and that actual rates may be much higher.

Moreover, the state does not require companies to report emissions from conventional wells, meaning there is another source of methane pollution going unmeasured and unregulated. A recent estimate totaled just under 270,000 tons of methane emitted annually from conventional oil and gas wells, a number that does not include abandoned wells.¹⁰⁴ Conventional wells may be a large source of emissions, even if the wells have lower production.

Technical and procedural fixes to record and reduce methane leakages are available to Pennsylvania but are not yet being implemented.

¹⁰² DeCarlo, Peter. Testimony to Pennsylvania House Committee hearing on methane, January 24, 2019. http://www.pahouse.com/files/Documents/Testimony/2019-01-24_054758__hdpc012419.pdf. Accessed August 15, 2019.

¹⁰³ Pennsylvania Governor’s Office. “Governor Wolf Announces New Methane Rules to Improve Air Quality, Reduce Industry Loss.” Published Jan. 19, 2016. <https://www.governor.pa.gov/governor-wolf-announces-new-methane-rules-to-improve-air-quality-reduce-industry-loss/>. Accessed July 31, 2019.

¹⁰⁴ <https://www.edf.org/pa-oil-gas/#/air-emissions>

TRANSPORTATION SECTOR

The transportation sector contributes 21 percent of the state’s greenhouse gas emissions. State action on lowering transportation-related emissions is minimal at best. Several minor DEP initiatives have increased access to alternative fuels — which includes electric charging stations, liquid natural gas and biofuels — as well as a rebate for those who buy electric vehicles.

One of these initiatives is Driving PA Forward, formed to disburse funding from the Volkswagen Diesel Settlement. Pennsylvania received the fifth-highest amount of funding in the nation, a total of about \$118 million. The state received an “F” grade from two environmental groups for its handling of funds from the Volkswagen Diesel Settlement. The groups found that Pennsylvania is not prioritizing electric vehicles and instead dedicating a major portion of the funding to other fuels, including new diesel vehicles.¹⁰⁵

In the latest round of funding, a total of \$8.5 million was awarded to 34 projects, which included 60 charging stations.¹⁰⁶ In comparison, New Jersey’s latest round of funding included \$3.2 million dedicated to installing 827 charging outlets.¹⁰⁷ Level 2 chargers typically take several hours to fully charge a car.

Transportation initiatives have the benefit of often being funded through external sources such as federal funds; also available in Pennsylvania are funds from oil and gas impact fees. While there is no evidence yet of any major statewide efforts to lower emissions from the transportation sector, Pennsylvania has committed to working with 12 other jurisdictions to design the Transportation Climate Initiative, a regional approach to decreasing emissions from the transportation sector.

About oil and gas wells

Abandoned oil and gas wells release methane at unknown and varying rates. There is no regulatory requirement to include this methane in measurements of greenhouse gases at a national or state level.

DEP does not have a complete count of how many unplugged, abandoned wells exist in the state. Studies have attempted to estimate the number, with results ranging from 250,000 to a worst-case scenario of 750,000.

In the department’s most recent Oil & Gas report, DEP said that it located 11,359 wells and that, “unfortunately, given its current resources, it will likely take DEP many years to locate all” of these wells.

Plugging these wells will be expensive and could cost the state more than \$8.6 billion to address them all, according to DEP projections. Currently, however, DEP has just \$600,000 allocated annually to plug these wells.

¹⁰⁵ <https://pennenvironmentcenter.org/sites/environment/files/reports/PAP%20VW%20Scorecard%20May19.pdf>

¹⁰⁶ Pontecorvo, Emily. WHYY. “In Pennsylvania, some of VW settlement funds replace old diesel vehicles with new diesel vehicles.” Published Aug. 5, 2019. <https://stateimpact.npr.org/pennsylvania/2019/08/05/in-pennsylvania-some-of-vw-settlement-funds-replace-old-diesel-vehicles-with-new-diesel-vehicles/>. Accessed Oct. 18, 2019.

¹⁰⁷ Fallon, Scott. North Jersey Record. “More than 800 new electric vehicle charging outlets coming to New Jersey.” Published Feb. 28, 2019. <https://www.northjersey.com/story/news/environment/2019/02/28/more-electric-car-charging-stations-nj-gov-phil-murphy/3015066002/>. Accessed Oct. 18, 2019.

Pennsylvania leaders could look to states like Maryland and New York for examples of how to lower emissions in the transportation sector. Both of those states are members of the Multi-State ZEV Task Force, which has the goal of lowering emissions through increased usage of electric vehicles through consumer outreach, stringent vehicle fuel standards, and market transformation.¹⁰⁸

INDUSTRIAL SECTOR

There is no significant action at the state level to decrease greenhouse gas emissions from the industrial sector. While a major emitter in the nation as well as in Pennsylvania, the industrial sector is not often at the forefront of the climate discussion, perhaps because these emissions are difficult to reduce without the still-costly technology of carbon capture and storage.¹⁰⁹

Heavy industry's emissions come from both direct fossil consumption and use of electricity. Reducing emissions from the industrial sector will go beyond the standard efficiency measures that are effective for homes and office space. And many Pennsylvania industries are in the highest emitting sectors such as cement, iron and steel, and chemicals/plastics.

Act 30 of 2018, one of the only recent state laws addressing climate action, allows counties to use a financing mechanism to assist commercial and industrial properties in making upgrades that lower energy use.¹¹⁰ However,

the law does not make this program automatically accessible to every facility in the state.

AGRICULTURAL SECTOR

While non-governmental agricultural organizations are working with the farming community to encourage best management practices such as soil carbon sequestration, green technologies – such as methane digesters or using some of their land for solar photovoltaic installations – the Pennsylvania Department of Agriculture has not released any climate action plan for the state's farmers for how best to adapt to changing conditions or best practices to reduce a farm's greenhouse gas emissions.

Other parts of the executive branch have taken some small steps. DEP's Climate Action Plan includes actions that farmers and others in agriculture can take to reduce emissions. The recently passed Pennsylvania Farm Bill incentivizes carbon-sequestering agriculture practices.¹¹¹ Overall, however, experts consulted for this report said there is a long way to go to support farmers' efforts to lower their emissions and be prepared for the changing climate. No state has emerged as a leader in this area.

The bottom line: Pennsylvania needs state-level leadership and guidance on reducing greenhouse gas emissions from the various sectors that produce the most of them.

¹⁰⁸ <https://www.nescaum.org/documents/2018-zev-action-plan.pdf>

¹⁰⁹ Beck, Lee. GreenBiz.com. "Carbon capture is the only way to address the world's climate blindspots." Published Jan. 25, 2019. <https://www.greenbiz.com/article/carbon-capture-only-way-address-worlds-climate-blindspots>. Accessed Oct. 18, 2019.

¹¹⁰ <https://www.legis.state.pa.us/cfdocs/legis/li/uconsCheck.cfm?yr=2018&sessInd=0&act=30>. Accessed July 31, 2019.

¹¹¹ Testimony of Hannah Smith-Brubaker, executive director of Pennsylvania Association for Sustainable Agriculture, delivered at hearing at Penn State University, March 14, 2019.

- 1 **The governor** should expand the GreenGov Council into a climate hub to improve coordination, especially among DEP, state leaders, county leaders and local leaders to encourage and facilitate climate action at all levels of government.
- 2 **DEP** should improve upon its public awareness campaign that educates citizens on what they can do to reduce greenhouse gas emissions and participate in climate action on the local, county and state levels.
- 3 **DEP** should develop and follow implementation measures for its Climate Action Plan to help Pennsylvania stakeholders learn how they can effect change.
- 4 **The governor** should include in his 2020-21 budget an increase for all state agencies – including DEP, PEMA, PennDOT, DCNR and DGS – that are involved in planning for and reacting to severe weather and other climate change effects.
- 5 **The governor and General Assembly** should prioritize pro-active planning at all levels by:
 - ◇ fully funding applicable state agencies to lead this effort,
 - ◇ harmonizing regulations currently in place,
 - ◇ improving outreach and education to counties; and
 - ◇ implementing statewide planning, including an updated state water plan, a statewide land use plan, and guidance to implement these plans.
- 6 **The General Assembly** should create a resiliency fund that PennDOT and other state agencies could draw from to pay for natural disaster clean-up that is not funded by federal or other state sources.
- 7 **The General Assembly and DEP** should take comprehensive and timely steps to measure and regulate methane emissions from the oil and gas sector.
- 8 **The General Assembly and DEP** should offer incentives to improve electric vehicle usage, sales and infrastructure in the state through targeted investments and consumer education.
- 9 **The Department of Agriculture** should better engage with the state’s agriculture sector to develop and release a plan of action for climate change, including best practices to reduce emissions and to improve resiliency.

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Clear Air Council	Pennsylvania Department of Environmental Protection Climate Change Advisory Committee
Conservation Voters of PA	Pennsylvania Department of Environmental Protection North Central Regional Office
Delaware Valley Regional Planning Commission	Pennsylvania Department of Environmental Protection Policy Office
Diamond City Partnership	Pennsylvania Department of Transportation Bureau of Planning and Research
Environmental Defense Fund	Pennsylvania Environmental Council
GT Energy	Philadelphia Department of Public Health
Keystone Energy Efficiency Alliance	Philadelphia Office of Sustainability
Kleinman Center for Energy Policy	Susquehanna Economic Development Association Council of Governments
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