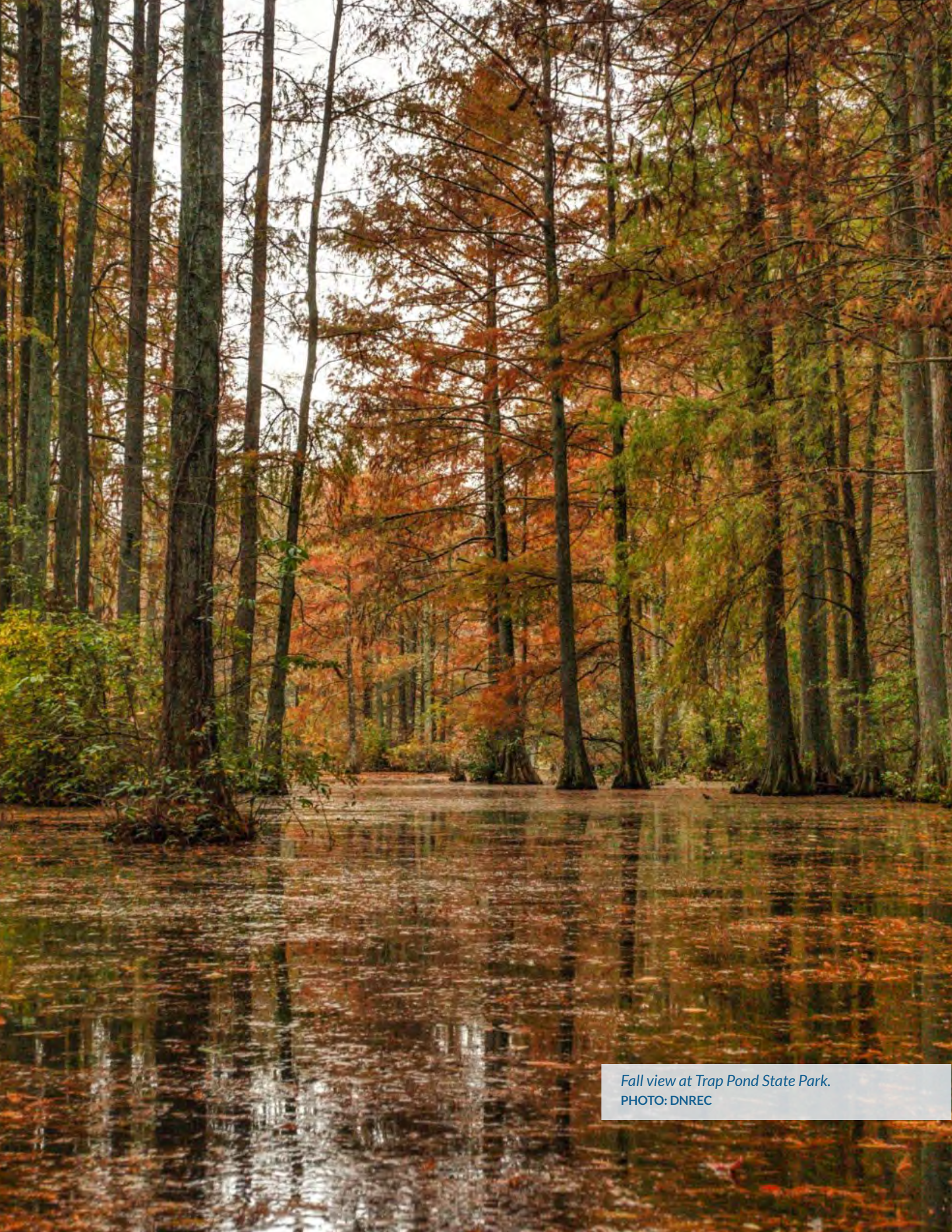
DECEMBER 2025

Delaware Climate Action Plan

A STATEWIDE PLAYBOOK FOR ADDRESSING CLIMATE CHANGE IN THE FIRST STATE



Fall view at Trap Pond State Park.
PHOTO: DNREC

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Colorful fall at Alapocas Run State Park in Wilmington, Delaware. **PHOTO: ADOBE STOCK**

Foreword: "A Message from Governor Meyer"

Delaware Governor Matthew Meyer
PHOTO: OGOV

To my fellow Delawareans,

In the lowest-lying state in the nation, climate change isn't abstract—it's a flooded basement, a closed road, or a small business counting the cost of "one more" storm. I've stood with families after a nor'easter pushed water into living rooms and storefronts; met farmers who watched fields stay soggy weeks longer than they used to; and talked with parents who worry each summer about heat waves and poor air quality keeping their kids indoors. While we've made great progress over the last several years in preparing for a future shaped by climate change, there is still much work left to do to ensure every family in every community feels safe and secure.

In 2021, Delaware published a Climate Action Plan that did something essential: it treated climate change as both an emissions challenge and a resilience challenge, laying out strategies to cut pollution while protecting people, homes, and critical infrastructure from sea level rise, flooding, hotter temperatures, and more frequent, more intense storms. It has since served as a practical playbook for state agencies, local governments, businesses, and neighbors to make smart, on-the-ground investments.

This updated 2025 Climate Action Plan builds on that approach. It aligns with the Climate Change Solutions Act of 2023, which set clear targets — cutting greenhouse gas emissions 50% by 2030 and reaching net-zero by 2050 — and required an all-of-government strategy so every regulation, purchase, and project considers both emissions and resilience. The Act also created independent technical advisors and a new team of agency climate officers to keep our planning grounded in the best science and implementation know-how.

Here's what that means in plain terms. We are going to keep our communities safe, our economy competitive, and our energy more reliable and affordable by doing the practical work right now: expanding multimodal transportation, protecting drinking water, building in smarter places, and accelerating cleaner power and efficiency that lower bills over time. The plan remains flexible — because technology, data, and partnerships evolve — and we'll keep adjusting as we learn.

Delawareans are with us. A statewide survey from February 2025 found residents overwhelmingly concerned about climate impacts and supportive of common-sense actions that build resilience and reduce harmful emissions. Most importantly, they want actions to go further, and that's exactly what this update does: more action that people can see and feel in their own neighborhoods.

And it's not just about protection, but about prosperity. By leading on environmental stewardship, sustainable transportation methods, energy efficiency, and clean, homegrown power, we're catalyzing new technologies, new companies, and good jobs for Delawareans. Entrepreneurship rooted in sustainability is not a "nice-to-have"; it's a growth strategy for a small, nimble state that knows how to collaborate and compete.

We are a state of neighbors. When waterways overflow, we stack sandbags together. When a storm knocks out power, lineworkers, first responders, and volunteers show up before the lights even flicker back on. That same spirit is contained within this plan. It's an invitation for every Delawarean — families, small businesses, nonprofits, local governments — to help carry a piece of the load.

As Governor, my commitment is simple: We don't make promises — we make plans, and then we turn those plans into progress. This updated 2025 Climate Action Plan reflects what we've learned since 2021, including what science and communities are telling us now and what our kids and grandkids will need from us tomorrow. As climate changes continue to have lasting effects, our window for change is narrowing. Yet Delaware has never been afraid of doing hard things on a tight timeline.

Now is the time to act. Now is our chance to maintain our quality of life and to give to future generations. Let's not waste it.

With gratitude and determination,

Matthew Meyer
76th Governor of the State of Delaware

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Acronyms and Abbreviations

ASHRAE	The American Society of Heating, Refrigerating and Air-Conditioning Engineers
AQ	Division of Air Quality
BTU	British Thermal Unit
CBR4	Christina-Brandywine River Remediation Restoration Resilience Project
CCE	Division of Climate, Coastal and Energy
CEMA	Center for Environmental Monitoring and Analysis
CERT	Community Emergency Response Team
CO_2	Carbon dioxide
DART	Delaware Administration for Regional Transit
degrees F	degrees Fahrenheit
DelDOT	Delaware Department of Transportation
DEMA	Delaware Emergency Management Agency
DEOS	Delaware Environmental Observing System
DHSS	Delaware Department of Health and Social Services
DNREC	Delaware Department of Natural Resources and Environmental Control
DNSC	Delaware Native Species Commission
DSWA	Delaware Solid Waste Authority
EPA	Environmental Protection Agency
EV	Electric vehicle
FEMA	Federal Emergency Management Agency
FW	Division of Fish and Wildlife
HFC	Hydrofluorocarbons
HVAC	Heating, ventilation, and air conditioning
I-ADAPT	Individual Adaptation Decision And Planning Tool
IECC	International Energy Conservation Code
IPCC	Intergovernmental Panel on Climate Change
LIHEAP	Low-Income Home Energy Assistance Program
LULUCF	Land-use, land-use change and forestry
MARC	Maryland Area Rail Commuter
$MMTCO_2e$	Million metric tons of carbon dioxide equivalent
NGO	Non-governmental organization
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System
OSHA	Occupational Safety and Health Administration
RASCL	Resilient And Sustainable Communities League
SEPTA	Southeastern Pennsylvania Transportation Authority
TEK	Traditional ecological knowledge
TMDL	Total maximum daily load
U.S.	United States (of America)
WHS	Division of Waste and Hazardous Substances
WiST	Wilmington and surrounding townships

A shared moment by the Delaware shore.
PHOTO: JACK SHIH

Executive Summary

Climate change is no longer a distant challenge in Delaware — it is a daily reality. Record-breaking heat waves, rising seas, stronger storms and persistent flooding show that climate change impacts in the First State are clear, immediate, and growing. These impacts threaten homes, infrastructure, public health, the economy and the natural environments that make Delaware unique.

The science is clear: Human activity is changing the climate.[1] As humans burn fossil fuels to power homes, businesses, cars, and industry, greenhouse gas emissions are trapped in the atmosphere. An increasing concentration of greenhouse gases in the atmosphere is driving climate change and its worsening impacts.

Bold action is needed at every level — from international cooperation on emissions to neighborhood resilience planning. With federal support for climate change action waning, strong state leadership is more important than ever. States have a unique and important role to play in meeting this moment and taking action to reduce the consequences of climate change. Delaware is well-positioned to lead and is committed to making progress for our quality of life and for the security of future generations.

Delaware's Risks and Vulnerabilities

Delaware faces a distinct set of climate change risks. The state's most pressing climate change hazards include rising temperatures, shifting precipitation patterns, and accelerating sea level rise.

Sea levels have already increased by about 15 inches since the early 1900s and are projected to rise an additional 1.2 feet to 1.5 feet by 2050. This increase in average tide levels is evident through the number of flooding days along the Delaware coast. In the 1950s, there were less than 10 days per year when flood levels exceeded the minor flood threshold. Today, that number exceeds 50 days annually — a trend that is projected to accelerate in the coming decades.[2]

The amount and intensity of precipitation is also changing. Delaware's total annual precipitation has increased by about 3 inches since 1895. Annual precipitation is projected to increase by 2 inches to 4 inches by 2050. Climate change is also driving an increase in extreme precipitation. This is especially apparent in the U.S. Northeast region, where heavy precipitation has increased by approximately 60% in recent decades.

Rising temperatures are further evidence of climate change in Delaware. The state's average annual temperature is now 3 degrees Fahrenheit (F) higher than in 1895. Mean annual temperature is projected to increase by an additional 2 degrees F to 4 degrees F by 2050. The annual average temperature increase means more than just hot summer days; nighttime temperatures will increase and there will be fewer days below freezing.

Climate change introduces emerging threats that are expected to grow in significance. These emerging threats include increased wildfire risk, prolonged drought, ocean and coastal acidification, more frequent extreme weather, invasive species, and expanding vector-borne diseases. The cost to Delaware, if these risks are not abated by rapid emissions reductions globally, was calculated to exceed $1 billion annually by late century. These costs include rising expenses associated with heat-related mortality, disease, decreased water quality and high-tide flooding among others.[3]

Delaware's Climate Action Plan

Delaware must simultaneously adapt to climate impacts that are already occurring while also reducing emissions to prevent those impacts from becoming unmanageable. Delaware's Climate Action Plan is the State's playbook for climate action, highlighting the critical link between climate change resilience and greenhouse gas emissions. The 2025 Climate Action Plan is a comprehensive update to the 2021 plan and is guided by the requirements of the Delaware Climate Change Solutions Act of 2023.

The centerpiece of the plan is a series of goals, strategies and actions for reducing greenhouse gas emissions and increasing resilience to climate impacts. The strategies and actions chosen for inclusion in this plan focus on activities that can reasonably be initiated or accomplished by 2030, when the next Climate Action Plan will be published.

The strategies and actions outlined in this plan are also designed to be flexible over time. Not all actions can be implemented at once; rather, they can be put in place as resources, data,

Attendees discuss planning and sustainability topics at the 2025 RASCL Summit. **PHOTO: DNREC**

technology and partnerships evolve. Actions may change over time based on increased understanding of climate impacts, technology advancements and stakeholder input.

Developing the Plan

This Climate Action Plan represents the culmination of a multiyear, collaborative effort. Initiated in 2024, it builds upon the foundation established by the previous Climate Action Plan issued in 2021 and integrates new data, research and community input to reflect Delaware's evolving climate priorities.

DNREC engaged with more than 2,300 community members, technical experts, and stakeholders to share information and gather feedback for inclusion in the plan. This included six community engagement sessions, four technical expert workshops, and 40 community events and small group meetings.

Equitable Climate Action

Delaware is especially vulnerable to climate change, but not all communities experience these effects equally. In Delaware, as in many parts of the United States, a legacy of historically discriminatory policies and inequitable decision-making shaped the built environment. Black, Indigenous and other people of color, as well as low-income households, are more likely to live near sources of air pollution or in flood-prone areas and to have less access to amenities such as urban green space. These environmental justice communities are often exposed to more environmental hazards while having fewer resources to prepare for, respond to, and recover from disasters such as flooding and tornadoes.

Equity and environmental justice were central to development of this Climate Action Plan. In implementing the actions in this document, a

thoughtful, future-oriented, and community-based approach must be taken. The following principles define how Delaware can achieve its climate goals while protecting people, strengthening communities, and ensuring durable results:

- Prioritize community perspectives in decision-making
- Ensure fair transition for workers and communities
- Protect health and safety
- Ensure transparency, accountability, and use of knowledge

Toward Net-Zero Emissions by 2050

Reducing Delaware's greenhouse gas emissions to nearly zero by 2050 helps avoid the worst impacts of climate change. Delaware's Climate Change Solutions Act sets statewide targets for greenhouse gas emission reductions. The targets are 50% reduction in greenhouse gas emissions by 2030 and net-zero emissions by 2050. Both targets are measured from a 2005 baseline. Delaware has already made significant progress in reducing its greenhouse gas emissions and has a path toward net-zero emissions by 2050.

Most greenhouse gas emissions in Delaware originate from three sources: transportation, industrial facilities and electricity generation. The transportation sector has been the largest emitting sector in Delaware since 2016 and represented 29.9% of emissions in 2021. Agriculture, solid waste and wastewater combined represent a small fraction of Delaware's emissions, typically 6% to 8% of gross emissions.

Delaware's emissions declined by 23.8% between 2005 and 2021. This decline in emissions occurred primarily in the electricity sector and was driven in part by fuel-switching of coal-fired power plants to natural gas, coupled with foundational state policies and programs.

DNREC worked with a technical consultant to calculate potential future emissions across sectors. This effort projected emissions to 2050 with existing policies and programs in place. With existing policies and programs, Delaware's emissions reductions could reach 54% by 2050. These reductions derive primarily from policies and programs for clean energy, energy efficiency improvements, reduced use of fossil fuels in buildings, and electrification of vehicles.

While Delaware makes considerable progress toward its emissions goals with existing policies and programs, there is a gap to close. To meet Delaware's mid-century emissions goals requires new programs and policies to rapidly reduce emissions and increase investments to improve the ability of our wetlands, forests, and agricultural lands to capture and store carbon. If a suite of additional policies and programs are implemented, Delaware can nearly reach its net-zero emissions goal by 2050, reducing emissions by 96.4% from 2005 levels.

The Climate Action Plan compiles a series of goals, strategies, and actions that would put Delaware on a path to meet its mid-century emissions targets. The goals and strategies are highlighted below.

Protecting Our Communities

Preparing for both established and emerging hazards and building resilience through climate adaptation is critical to safeguarding Delaware's residents, economy and environment. Climate adaptation is a

continuous process that can protect people, places and infrastructure; accommodate changing conditions; avoid future risk; and help communities strategically retreat from areas that cannot be safely protected.

Compounding climate risks occur when multiple climate hazards and stressors interact and amplify each other, leading to cascading effects.[4] As climate change impacts continue to intensify, Delaware can expect to experience more compounding risks. For example, an extreme heat wave that occurs during a drought could exacerbate heat stress on crops, strain water supplies, and create ideal conditions for wildfires. Compounding climate risks can be particularly dangerous when extreme events coincide with or follow one another, straining emergency response, and impacting vulnerable populations most acutely.

While there is no one-size-fits-all solution, strategic action on climate adaptation delivers measurable returns. Research from the U.S. Chamber of Commerce shows that every dollar invested in climate resilience and disaster preparedness saves communities $13 in avoided economic losses.[5] Beyond financial benefits, holistic adaptation solutions can address multiple hazards simultaneously while generating co-benefits such as improved public health, enhanced ecosystem services and stronger social cohesion.

Long-term resilience will depend on sustained coordination, adequate resources and a shared commitment to building a more resilient Delaware. The Climate Action Plan compiles a series of goals, strategies and actions that will help Delaware prepare and protect its communities. The goals and strategies are highlighted below.

Legislative Hall in Dover, Delaware. PHOTO: ADOBE STOCK

Land Use Intersections

Land use patterns and practices have a powerful intersection with climate change in Delaware.

Historic suburban development patterns in Delaware increased car dependency and the resulting emissions from cars and trucks. Loss of farmland and forests reduces opportunities to store and sequester carbon in soil and roots. Continued development in or near floodplains exacerbates flood vulnerability while loss of forests, trees and wetlands reduces opportunities to improve resilience.

These challenges can be addressed in part through emerging opportunities to bring together partners to address climate change, housing, transportation, and land use through a single lens. Shared goals for affordable housing and transportation can be accomplished through promoting dense and connected communities and removing barriers to infill development. Shared goals for storing carbon, improving resilience and conserving natural spaces can be accomplished through increased land preservation and avoiding development in flood-prone areas.

Goals and Strategies for a Path Toward Net-Zero Emissions

TRANSPORTATION

Expand transportation choice through improved public transit and multimodal options

- Increase bus transit ridership by improving travel times, service frequency, efficiency and coverage.
- Increase train ridership by improving travel times, service frequency, efficiency and coverage.
- Expand multimodal transportation options in communities.

Prioritize safety and access for walking and biking

- Adopt a plan to complete a statewide multimodal network.
- Improve access to bikes.
- Design communities for pedestrian and cyclist safety.
- Expand multimodal transportation infrastructure funding.

Reduce light-duty vehicle tailpipe emissions and accelerate zero-emission vehicle deployment

- Improve accessibility and feasibility of zero-emission vehicles for all Delawareans.
- Expand education and outreach to highlight the benefits of electric vehicles.
- Ensure convenient, reliable and abundant access to electric vehicle charging stations.

Reduce tailpipe emissions from medium- and heavy-duty vehicles

- Incentivize the adoption of electric medium- and heavy-duty vehicles.
- Advance implementation of school bus electrification and charging infrastructure.
- Reduce emissions associated with freight and shipping operations.
- Assess the feasibility of adopting emerging low-carbon fuels.

Reduce emissions from off-road engines and equipment

- Reduce greenhouse gas emissions from lawn-care equipment.
- Explore opportunities for sustainable aviation fuel.
- Support electrification of vessels and equipment at Delaware ports and ferry terminals.

INDUSTRY

Support data collection, technical assistance, and regional cooperation

- Help industrial facilities decarbonize.
- Develop comprehensive industrial emissions policies through regional collaboration and improved reporting.

Advance energy efficiency in industrial buildings and processes

- Advance on-site energy storage at industrial facilities.
- Advance deployment of combined heat and power technology and energy-efficient equipment at industrial and manufacturing facilities.

Advance electrification in industrial buildings processes

- Electrify low-temperature industrial heat processes.
- Prepare for technology advancements for medium- and high-temperature industrial heat processes.

Advance low-carbon fuels, feedstocks and energy sources

- Advance the production and use of low-carbon fuels and energy sources.
- Advance the use of low-carbon feedstocks.
- Encourage technological advancement of clean hydrogen production and applications in industry sector processes.
- Prepare Delaware for the clean hydrogen industry.

Advance development of carbon capture, utilization and storage

- Support the development and scaling of carbon capture, utilization and storage.

ELECTRICITY GENERATION AND GRID INFRASTRUCTURE

Accelerate deployment of solar and wind energy

- Increase grid-scale solar capacity statewide.
- Increase distributed solar capacity statewide.
- Advance the development and scaling of offshore wind.
- Adopt new renewable and clean energy adoption targets.

Support emerging clean energy technologies

- Evaluate the potential of small modular nuclear reactor technology in Delaware's energy future.
- Explore the feasibility and potential benefits of thermal energy networks and district heating.

Modernize Delaware's electric grid

- Support utility efforts to modernize transmission infrastructure.
- Work with utilities to support emission reductions and cost-saving programs.
- Accelerate battery storage.
- Ensure electric vehicle technology contributes to enhanced grid stability and resilience.
- Prepare for data center impacts on grid stability, costs and emissions.

RESIDENTIAL AND COMMERCIAL BUILDINGS

Strengthen building energy codes and establish building performance standards

- Strengthen building energy codes for new construction.
- Establish building performance standards to improve energy use in existing buildings.
- Facilitate sustainable building standards for affordable housing developments.

Increase energy efficiency in new and existing buildings

- Advance adoption of high-efficiency, low-carbon building heating and cooling systems.
- Scale up residential and commercial energy efficiency programs to accelerate building decarbonization.
- Enhance access to energy efficiency programs for low-and moderate-income residents and small businesses to reduce energy burdens and support economic opportunity.

Support the long-term transition to electrification in new and existing buildings

- Electrify appliances and systems in residential and commercial buildings.

FORESTS AND URBAN TREES

Maximize carbon sequestration and environmental co-benefits potential of Delaware's forests and urban tree canopies

- Protect, conserve and expand forested lands.
- Expand tree planting and land management in urban and suburban areas.
- Improve forest management to protect habitats and reduce emissions.
- Improve forest and tree inventories and metrics tracking.

Advance the forestry industry in Delaware

- Promote traditional and non-traditional forest industries.
- Ensure future native tree supply.

OCEANS AND WETLANDS

Maximize carbon sequestration in wetlands and marine waters

- Protect and preserve existing wetlands.
- Facilitate marsh migration.
- Enhance Delaware's ability to manage wetlands for carbon sequestration.
- Protect and enhance carbon-storage capacity of coastal ecosystems.
- Assess marine carbon dioxide removal technologies.

AGRICULTURE

Reduce emissions and support carbon sequestration on crop lands

- Encourage cropland management practices that increase and maintain soil carbon sequestration.
- Encourage adoption of agroforestry practices.
- Reduce emissions from nutrient and manure management.
- Reduce emissions and energy demand through precision agriculture practices.
- Preserve agricultural lands.

Reduce emissions from the livestock industry

- Reduce operational emissions in the poultry industry.
- Improve management of and reduce emissions from pasturelands.

WASTE

Reduce operational emissions at landfills and wastewater treatment plants

- Reduce methane emissions from solid waste and wastewater treatment operations.
- Reduce energy consumption and fossil fuel use at solid waste and wastewater treatment operations.

Reduce and divert solid waste

- Divert non-organic waste to recycling and other measures.
- Divert organic material to composting and other management methods.

Goals and Strategies for Protecting Our Communities

EXTREME HEAT

Improve data collection, research and decision support tools for extreme heat

- Strengthen understanding of how extreme heat affects human health and well-being.
- Improve data tools for tracking excessive heat impacts on natural resources and agriculture.

Foster collaboration to support extreme heat preparedness

- Strengthen collaboration with healthcare providers and other trusted partners to advance heat monitoring and risk prevention.

Support heat-resilient design and communities

- Support a coordinated network of community cooling centers to ensure all Delawareans have access to safe cooling spaces.
- Support infrastructure and building designs that reduce heat impacts.

Enhance technical support for community cooling

- Advance heat-informed planning through research and data sharing.
- Educate the public and businesses about heat risks and potential solutions.

Enhance outreach and engagement about extreme heat, especially to vulnerable populations

- Target education and risk reduction in vulnerable communities, such as those located in urban heat islands.
- Conduct targeted efforts to protect Delaware's workforce, especially outdoor workers, from adverse extreme heat impacts.

SEA LEVEL RISE, PRECIPITATION AND INLAND FLOODING

Bolster research and monitoring efforts on sea level rise and flooding

- Increase awareness and understanding of impacts from sea level rise, precipitation and flooding through technical research and monitoring.

Incorporate climate change considerations to enhance the resilience of natural resources and habitats

- Protect and preserve tidal and non-tidal wetlands.
- Protect and preserve wildlife and fisheries.
- Create or enhance green spaces.
- Protect and maintain Delaware's shorelines.

Update designs and plans to protect infrastructure and prepare for additional flood risk

- Maintain and protect stormwater, wastewater and drinking water infrastructure.
- Protect homes and buildings from flooding.
- Prevent contaminant releases from occurring during flooding or inundation.
- Prepare a multi-decadal strategy for potential strategic retreat from areas highly vulnerable to persistent and repetitive flooding.

EMERGENT HAZARDS

Enhance drought preparedness and water management

- Incorporate drought considerations into state operations, plans and policies.
- Enhance understanding of drought risks and vulnerabilities.

Reduce wildfire risk and enhance fire management

- Increase understanding of urban fires and wildfire risk.
- Reduce wildfire risk through landscape and invasive species management.
- Increase readiness and preparedness for wildfires.

Enhance severe weather awareness and preparedness in Delaware

- Improve communications and response to severe weather.
- Monitor severe weather conditions to inform emergency alerts and policies.
- Understand how tornadoes affect forest ecosystems.

Advance vector-borne illness prevention and invasive species management

- Increase public understanding of vector-borne diseases.
- Increase technical understanding of vector-borne diseases.
- Support further data collection and research to inform invasive species management.

Increase coastal acidification monitoring and planning

- Research and monitor the impacts of coastal acidification.
- Use ocean acidification research to inform planning and preparedness efforts.

COMPREHENSIVE RESILIENCE

Protect natural and agricultural resources

- Enhance the resilience of natural landscapes and agricultural lands.
- Invest in nature-based solutions and infrastructure improvements that support resilience to multiple hazards.

Enhance technical support and design to advance resiliency

- Provide technical assistance to local governments to incorporate climate change into planning efforts.

Promote collaborative governance and policy alignment

- Align state investments with long-term resilience goals.

Strengthen climate resilience across systems and infrastructure

- Incorporate climate considerations into wastewater and hazardous waste remediation processes.
- Support resilient transportation structures and systems.
- Support resilient buildings and design.

Improve data collection, research and decision support tools

- Support accessible and transparent data collection and research to implement resilience strategies.

Enhance outreach, engagement and collaboration

- Coordinate with health care institutions to track and provide a holistic response to the health impacts of climate change.
- Continue to build relationships with Delaware's Tribal and Indigenous communities, partnering in climate planning, land stewardship and conservation.
- Increase access and resources to climate change educational materials and involvement opportunities for students.

Implementing Delaware's Climate Action Plan

This plan is intended to be a living document. It lays out a path for Delaware to continue preparing for the impacts of climate change on our economy, communities and natural resources, while meeting ambitious but achievable greenhouse gas emission targets. The plan does not create new mandates or requirements but lays out the actions that can be taken over time as resources, data and partnerships develop and evolve. The plan does not specify precisely how or when each action should be undertaken, or by whom. The success of this plan depends on continued collaboration and conversation with residents, communities and stakeholders across the state.

DNREC serves as the lead agency for coordinating implementation of this plan and for tracking progress. DNREC will work through the State Agency Climate Change Officers, the Governor's Energy Advisory Council and others to gauge and track progress related to the strategies and actions outlined in this plan.

Progress reports for this Climate Action Plan will be issued every 2 years — in 2027 and 2029 — leading up to the publication of the next Climate Action Plan due in 2030. Progress reports will highlight new activities that have been undertaken, progress on existing initiatives, and emerging issues or threats.

Conclusion

Delaware is prepared for this moment and is ready to take continuing and evolving actions to address the causes and consequences of climate change in the state. Actions will require partnership and keen attention to opportunities to improve equity through community-based climate actions. Progress for climate change will be tracked in a transparent and continuing way, showcasing Delaware's leadership in resiliency and sustainability.

Chapter 1: Introduction

Climate change is no longer a distant challenge in Delaware — it is a daily reality. Record-breaking heat waves, rising seas, stronger storms and persistent flooding show that climate change impacts in the First State are clear, immediate and growing. These impacts threaten homes, infrastructure, public health, the economy and the natural environments that make Delaware unique.

The science is clear: Human activity is changing the climate.[6] As humans burn fossil fuels to power homes, businesses, cars and industry, greenhouse gas emissions are trapped in the atmosphere. An increasing concentration of greenhouse gases in the atmosphere is driving climate change and its worsening impacts.

States have a unique and important role to play in meeting this moment and taking action to reduce the consequences of climate change. This Climate Action Plan outlines Delaware's twofold approach:

- Reduce emissions to near zero by 2050 to prevent future catastrophic changes from occurring.
- Protect communities through adapting and increasing resilience to the impacts of climate change.

Aerial view of Wilmington along the Christina River.
PHOTO: ADOBE STOCK

For decades, strategic climate action throughout Delaware has been essential to protecting the state's people, places, and resources. With this update to the state's Climate Action Plan, Delaware aims to strengthen its response to climate change and demonstrate a continued commitment to safeguarding the well-being of both its current residents and its future generations.

Why Delaware Must Lead

U.S. per capita emissions rank among the highest globally — far exceeding those of many developing nations.[7] This means emission reductions in Delaware can have a meaningful global and local impact. As a coastal state, a center for finance and industry, and a home to major transportation corridors including a vital port, Delaware faces significant challenges from climate change and is uniquely positioned to lead on climate action.

Bold action is needed at every level — from international cooperation on emissions to neighborhood resilience planning. With federal support for climate change action waning, strong state leadership is more important than ever. Delaware has the opportunity and responsibility to model climate informed decisions that others can follow. Cooperation and partnership with other states is also critical to making meaningful progress. Delaware is an inaugural member of the U.S. Climate Alliance, a bipartisan coalition of 24 governors advancing state-led, high impact climate action. Through the U.S. Climate Alliance and other similar partnerships, states collaborate, advance ambitious policies, and demonstrate the impact of collective action across states.

The overwhelming majority of Delawareans agree that taking action to reduce emissions and increase the state's resilience to climate change is important and necessary. Delawareans are also increasingly experiencing the impacts of climate change firsthand. In 2025, a statewide survey showed that 79% of Delawareans believe that climate change is a serious threat; the same percentage also believes that it will harm future generations. The survey also found that 55% of Delawareans report that they have personally experienced local impacts of climate change, demonstrating that these changes are not distant future concerns, but present realities affecting residents throughout the state. The number of Delawareans reporting that they have personally experienced climate change is also rising. When DNREC first began statewide climate change public perceptions surveys in 2009, just 22% reported personally experiencing sea level rise, increasing to 47% by 2019.

The cost to Delaware of unabated climate change was calculated to exceed $1 billion annually by late century. These costs include rising expenses associated with heat-related mortality, disease, decreased water quality and high-tide flooding among others.[8] While delaying action has significant economic costs, taking swift and immediate action to reduce emissions and increase resiliency has many benefits. Reducing emissions from vehicles and buildings leads to cleaner air, both indoors and outdoors, helping to prevent asthma, heart disease and other pollution-related health issues. At the same time, investing in new energy-efficient technologies strengthens energy security, improves grid reliability, and lowers energy

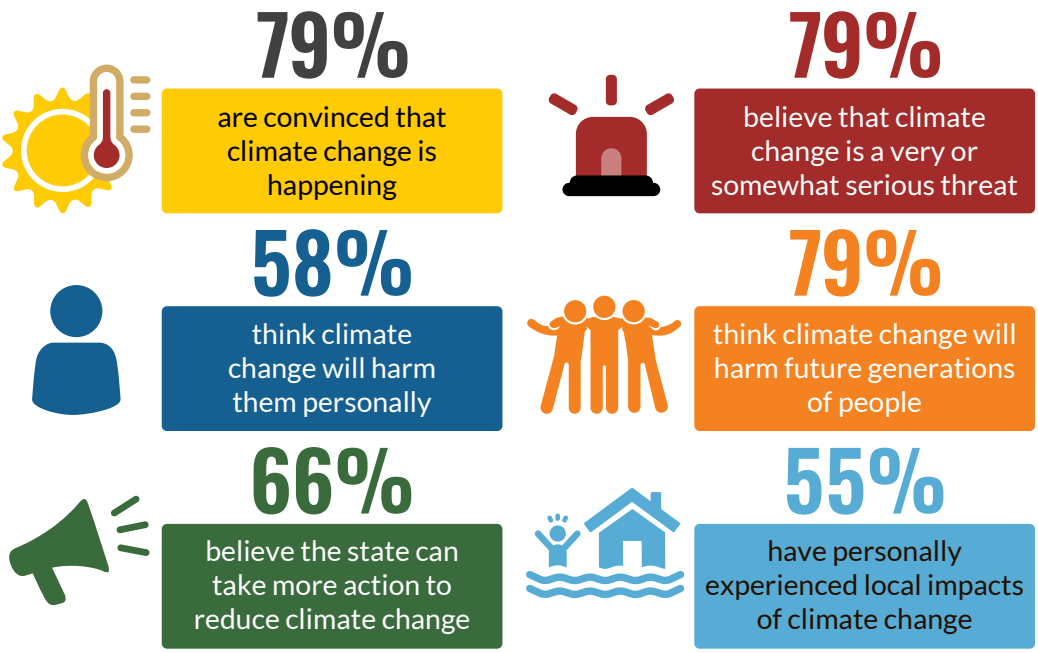


FIGURE 1.1. *Summary of statewide Climate Change Perceptions Survey results.*

bills. Climate solutions also support stronger, more connected communities. Expanding walkable, bikeable neighborhoods reduces emissions from vehicles, supports affordable housing, improves public health and preserves Delaware's natural landscapes. And these efforts grow Delaware's economy as well: Clean energy jobs in Delaware are projected to increase by 14% annually, with an estimated 1,800 new jobs created by 2030.[9]

Delaware's Climate Action Plan

In 2021, recognizing the critical need for action, the Delaware Department of Natural Resources and Environmental Control (DNREC) released the state's first comprehensive *Climate Action Plan*.[10] This landmark effort laid out a vision and tangible steps to reduce greenhouse gas emissions and strengthen community resilience, providing a strong foundation to guide Delaware's fight against climate change. Since 2021, the Climate Action Plan has been a resource for state agencies, local governments, businesses, and individuals, helping to guide investments, grant proposals and on-the-ground projects.

The Climate Action Plan highlights the critical link between climate change resilience and greenhouse gas emissions. Delaware must pursue both strategies simultaneously by adapting to climate impacts that are already occurring while also reducing emissions to prevent those impacts from becoming unmanageable. The 2025 Climate Action Plan is a comprehensive update to the 2021 plan, guided by the requirements of the Delaware Climate Change Solutions Act of 2023.

Climate Action Must Be Equitable

Delaware is especially vulnerable to climate change, but not all communities experience these effects equally. In Delaware, as in many parts of the United States, a legacy of historically discriminatory policies and

inequitable decision-making shaped today's built environment. Black, Indigenous and other people of color, as well as low-income households, are more likely to live near sources of air pollution or in flood-prone areas and to have less access to amenities such as urban green space. These environmental justice communities are often exposed to more environmental hazards while having fewer resources to prepare for, respond to and recover from disasters such as flooding and tornadoes.

These disproportionate impacts were a key focus in conversations with technical experts, industry leaders, community members, community organizations and nonprofits working directly with affected communities. Taking decisive climate action will benefit all Delawareans but reducing emissions and avoiding the worst consequences of climate change are especially necessary to protect those most affected.

All Delawareans deserve a brighter climate future. Throughout the strategies and actions in this document, the authors have committed to centering equity and environmental justice as part of climate action, including fair energy burden for low-income households, greater language accessibility for native speakers of Spanish and Haitian Creole, or expanding access to public goods like clean air, green space and public transit. More detail on how equity is incorporated into the plan's guiding principles can be found in *Chapter 8: Implementing the Plan*.

Climate Change Solutions Act of 2023 bill signing with former Governor John Carney. **PHOTO: DNREC**

Delaware Climate Change Solutions Act of 2023

To address climate change and safeguard local communities, Delaware enacted the *Climate Change Solutions Act of 2023*. This legislation is the foundation for climate action in the state. The Act establishes:

- An economy-wide greenhouse gas emission reductions target of 50% by 2030 and a target of net-zero emissions by 2050.
- An all-of-government implementation strategy, requiring state agencies to consider greenhouse gas emissions and climate resilience in decision-making for regulations, agency purchasing, construction projects and infrastructure planning.
- A framework for the state's Climate Action Plan, including a timeline for implementation reports and updated plans.
- Technical Climate Advisors, a committee of experts convened to issue climate planning scenarios for precipitation, temperatures and sea level rise every 5 years.
- State Agency Climate Change Officers, convened to coordinate development and implementation of strategies within state agencies.

The process to develop this Climate Action Plan and the contents of the plan were guided by and are consistent with the requirements of the Climate Change Solutions Act. The goals, strategies and actions included in this plan demonstrate a pathway toward net-zero emissions and improved community resilience.

How to Use this Plan

This Climate Action Plan is a playbook for climate action in Delaware that can be used by all Delawareans to better understand, then take action on climate change. It includes a basic summary about the causes of climate change and the consequences of climate change in Delaware. It includes information about the significant opportunities to create and sustain good quality, well-paying jobs focused on climate change solutions. It also highlights the important link between today's choices about land use and the future consequences of climate change in the First State. Throughout the document, technical terms are used. For ease of reading, a glossary is provided at the end of this plan.

The centerpiece of the plan is a series of **goals, strategies** and **actions** for reducing greenhouse gas emissions and increasing resilience to climate impacts:

- Goals are broad, overarching outcomes that can be achieved over a long time period.
- Strategies outline one of many possible approaches toward achieving a goal.
- Actions are specific steps that can be initiated within the next 5 years to implement a strategy.

The goals, strategies and actions included in this plan were developed to be consistent with overarching guiding principles outlined in the Climate Change Solutions Act. The proposed strategies and actions:

- Are equitable and seek to minimize the cost and maximize total benefit to the state.
- Encourage early action to reduce greenhouse gas emissions and increase resilience.
- Do not disproportionately impact overburdened and underserved communities.
- Complement efforts to maintain air quality standards and reduce emissions of air toxins.
- Consider overall societal benefits, including air pollution and diversification of energy sources.
- Seek to minimize administrative burden of implementation.
- Maintain an adequate and reliable energy supply for Delaware.

In addition, the strategies and actions chosen for inclusion in this plan focus on activities that can reasonably be initiated or accomplished by 2030, when the next Climate Action Plan will be published. In some cases, the actions that can be initiated within the next five years are deployment focused, calling for new programs, policies or technology implementation. In other cases, the actions focus on gathering information that can be used for future decisions about deployment. In these cases, the actions call for studies, feasibility assessments or pilot projects. In future climate action plans, strategies that previously contained actions focused on research and assessment may contain actions that use the results of those assessments to propose on-the-ground actions.

The strategies and actions outlined in this plan are also designed to be flexible over time. Not all actions can be implemented at once; rather, they can be put in place as resources, data, technology and partnerships evolve. Actions may change over time based on increased understanding of climate impacts, technology advancements and stakeholder input.

Who Should Use This Document

The primary purpose of this plan is to serve as a playbook for Delaware to achieve emissions reduction and resilience goals. State agencies are a key audience for this document, as many of the strategies and actions described in this plan require, or would benefit from, state agency action. These actions range from multiyear complex items, such as understanding the potential for nuclear energy in Delaware, to less complicated actions, such as forming partnerships or increasing outreach. State Agency Climate Change Officers will play a key role in sharing the plan with colleagues, providing educational opportunities and tracking implementation progress at their agencies.

Local community leaders can also use this document. While state-level implementation of many of the strategies in this plan will support local communities, implementation must be complemented by community-level planning efforts. Local communities and governments are critical partners because key decisions, such as land use, building code enforcement and local adaptation strategies, are made at the county and municipal level. In addition, recent legislation requires municipal and county comprehensive development plans to incorporate strategies to increase resilience to climate change; these strategies should be informed by the Climate Action Plan.[11]

Finally, the Climate Action Plan can serve as a tool for all Delaware residents. It extends beyond state agencies and local

governments; it is a comprehensive guide that every Delawarean can use to participate in the state's climate response. Whether you are a homeowner, business owner, local government official, community leader or engaged citizen, this plan provides actionable strategies that can be tailored to your role in building Delaware's climate resilience and reducing emissions.

Integration with Other State Planning Documents

The impacts of climate change span every sector, as do the emissions that cause climate change. In many cases, climate solutions overlap with other key state goals and initiatives, especially transportation, energy, housing and land use. In recognition of these critical intersections, the 2025 Climate Action Plan builds upon and references existing state planning initiatives and legal frameworks, including:

- *Delaware State Energy Plan*
- *Delaware Strategies for State Policies and Spending*
- *Delaware Hazard Mitigation Plan*
- *Delaware Department of Transportation (DelDOT) Carbon Reduction Strategy*
- *DART Reimagined: Reshaping Transit Services to Meet the Needs of Today and Beyond*
- *Charging Forward: Delaware's Strategy for Electric Vehicle Charging Infrastructure*
- *Delaware's Roadmap to Electric Vehicles*
- *Delaware Affordable Housing Production Task Force Report*

The Delaware Energy Plan and the Delaware Climate Action Plan are especially interconnected. The Energy Plan provides the technical backbone for energy systems planning in the state of Delaware. Many of the strategies to quickly and effectively reduce greenhouse gas emissions are energy systems related. The goals, strategies and actions in the Climate Action Plan are consistent with the strategies in the Delaware Energy Plan. The Climate Action Plan focuses on energy actions with the strongest link to emission reductions or resilience, but additional and more technical actions can be found in the Energy Plan. These two plans should be considered intrinsically linked and working together to reduce emissions toward net-zero while also providing benefits for energy reliability and consumer costs.

This integrated approach ensures that climate considerations are woven throughout Delaware's policy landscape, creating coherent and mutually reinforcing strategies across all sectors. Sector-specific intersections are identified in some sections of this document, and a list of policies and programs that can support implementation of this plan is available in Appendix A.

Building on Delaware's Climate Leadership

This document lays out actionable steps to build a better climate future. The plan demonstrates that economic growth and climate action are not only compatible but mutually reinforcing. As climate change intensifies, Delaware's response must evolve. Four years after the publication of the state's first Climate Action Plan, we face a narrowing window to achieve a sustainable, net-zero future that protects both current and future generations of Delawareans. This updated

Climate Action Plan builds on the progress made in Delaware and reflects what we have learned from scientists, technology experts, businesses and communities across the state. It reaffirms Delaware's commitment to ambitious emission reductions and resilience while embracing new strategies.

Cyclist at White Clay Creek State Park. **PHOTO: DNREC**

Earth's atmosphere.
PHOTO: UNSPLASH, ACTION VANCE

Chapter 2: Delaware's Changing Climate

Climate change represents one of today's most pressing challenges, driven by human activities that have fundamentally altered Earth's atmosphere. The scientific consensus is unequivocal: climate change is happening now, it is caused by humans, and its impacts are evident worldwide across communities, ecosystems and economies.

Climate change impacts are intensifying across Delaware. From coastal flooding that threatens property values and transportation networks to extreme weather events that disrupt agricultural systems and public health, climate change poses multifaceted risks to the First State. The increasing frequency and severity of these impacts underscore the urgent need for action that can protect Delaware's communities, preserve economic vitality and maintain the natural resources that define the state's character and support its residents' well-being.

Science of Climate Change

Since the late 19th century, humans have altered Earth's natural climate cycle by burning fossil fuels. As these fuels burn, they release greenhouse gases such as carbon dioxide and methane into the atmosphere, where they act like a heat-trapping blanket around the Earth. Some greenhouse gases,

such as carbon dioxide, are a naturally occurring part of Earth's atmosphere. However, the concentration of carbon dioxide in the atmosphere has increased by over 50% in less than 200 years. As of July 2025, the carbon dioxide concentration was 428 parts per million in the atmosphere, up from a preindustrial average of 280 parts per million.[12] The last time that carbon dioxide levels in the atmosphere were this high was approximately 3 million years ago, making current climate conditions unprecedented in human history.[13]

With this increased concentration of greenhouse gases in the atmosphere, average global temperatures are now 2 degrees F higher than in the late nineteenth century. While this 2-degree F temperature change may seem small, it is a global average that represents large and oftentimes damaging impacts. The National Oceanic and Atmospheric Administration (NOAA) reports that 2024 was the hottest year recorded since global records began in 1850. And the rate of warming is accelerating: The 10 warmest years ever recorded have all occurred in the past decade.[14]

Without decisive action to minimize greenhouse gas emissions and maximize resilience to climate change, communities across Delaware will face more frequent and severe climate impacts in the years ahead, adding to those already being experienced.

Delaware Climate Projections

Climate change in Delaware is here and now, with intense storms, heat waves and flooding emergencies happening more

The first meeting of the Technical Climate Advisors. **PHOTO: DNREC**

Trap Pond State Park. **PHOTO: DNREC**

frequently and projected to become increasingly common in the future. These impacts are damaging infrastructure, threatening public health, disrupting ecosystems and posing significant risks to the state's economy. In Delaware, the most prominent impacts of climate change are:

- Sea level rise
- More frequent and intense storms, precipitation and flooding
- Increased temperatures and extreme heat

While the impacts of climate change are already being felt, their future severity is not predetermined — it depends on the choices made today. Acting quickly to reduce greenhouse gas emissions can significantly reduce both global and local climate impacts. The more reliance on fossil fuels decreases and emissions are cut now, the less severe the consequences will be for Delaware. Conversely, inaction on climate change and continuing to invest in fossil fuels will have long-term consequences. To account for unknowns in future policy and actions, the Climate Action Plan incorporates projections covering a range of plausible futures.

In the sections that follow, projections of future climate change are described. For temperature and precipitation, there are two scenarios, a "low emissions" and a "high emissions" scenario. The "low emissions" scenario assumes that greenhouse gas emissions reduce quickly in the next several decades. The "high emissions" scenario assumes that current emissions trends continue. Sea level rise also includes three additional scenarios: intermediate-low, intermediate and intermediate-high.

About Climate Projections

In 2025, DNREC issued updated climate change projections in partnership with the Center for Environmental Monitoring and Analysis and the State Climatologist's Office. These updated projections are based on the most recent CMIP6 climate modeling used by the Intergovernmental Panel on Climate Change (IPCC) Sixth Assessment Report. The global model was downscaled using local climate data to account for Delaware's unique coastal climate and geography. The projections were reviewed and approved by Delaware's Technical Climate Advisors, a panel of experts from state agencies, higher education and other scientific institutions. Projections will be reviewed and updated every 5 years by DNREC and the Technical Climate Advisors.

Sea Level Rise

SEA LEVEL RISE AT A GLANCE

- Sea levels have increased about 15 inches since 1919 as measured at the Lewes tide gauge.
- Sea level rise has accelerated in recent decades.
- By 2050, sea levels are projected to rise 1.2 feet to 1.5 feet.
- By 2100, sea levels are projected to rise 2 feet to 3 feet under a "low emissions" scenario. Under a "high emissions" scenario, they are projected to rise 4 feet to 6 feet.

Sea level rise is an increase in sea-surface height relative to the land at a specific location. While sea levels are expected to rise worldwide as a result of climate change, Delaware is already experiencing sea level rise at a rate of twice the global average. This is due to a combination of factors, including the sinking of the land surface, melting of polar ice, changes in Atlantic Ocean currents and thermal expansion of warm ocean water. (See *Sea Level Rise, Precipitation and Inland Flooding* in Chapter 6.)

At the Lewes tide gauge, mean sea levels have risen by about 15 inches since 1919 (Figure 2.1). The rate of sea level rise in Delaware is accelerating, with over 6 inches of sea level rise occurring between 1990 and 2020. While the linear trend over the full 104-year period of record is 3.71 mm/year, when calculated over just the past 20 years, the linear trend is 7.09 mm/year, nearly doubled.

Sea levels are projected to rise 2 feet to 3 feet by 2100 under a low emissions scenario, and 4 feet to 6 feet under a high emissions scenario. As can be seen in Figure 2.1, projected sea level rise between now and 2050 is fairly consistent under all planning scenarios; a certain amount of sea level rise is already "locked in" based on current emissions and warming. However, when considering long-term impacts out to 2100, there is a markedly wider spread in possible outcomes between higher and lower emission scenarios.

FLOOD FREQUENCY

As sea levels rise, so does the frequency and severity of tidal flooding. There has been an increase in the number of flooding days along the Delaware coast as measured by the National Weather Service minor flood threshold. In the 1950s, there were less than 10 days per year when flood levels exceeded

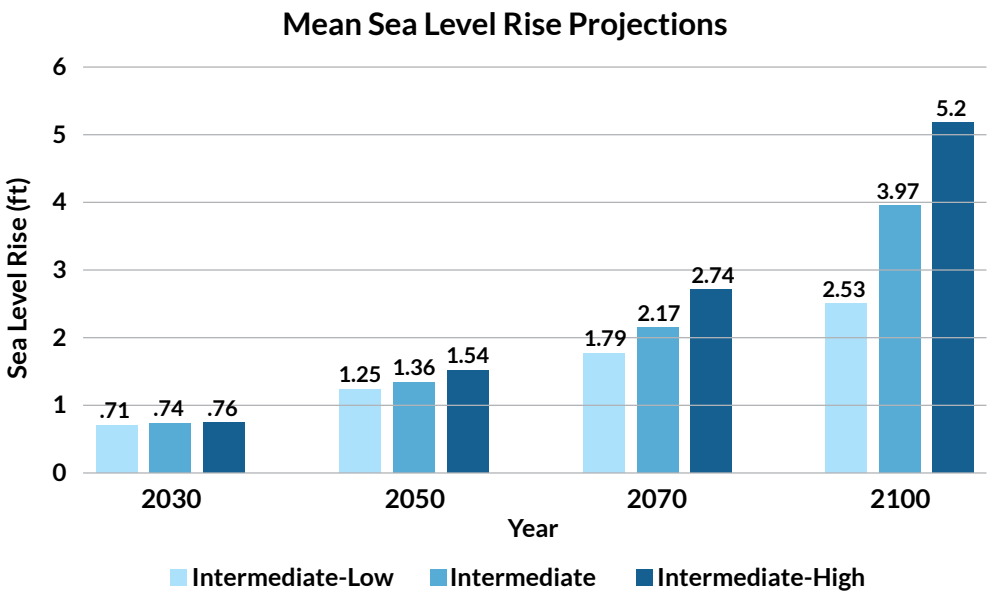


FIGURE 2.1. *Mean sea level rise projections for Delaware.* SOURCE: 2025 CLIMATE PROJECTIONS REPORT.

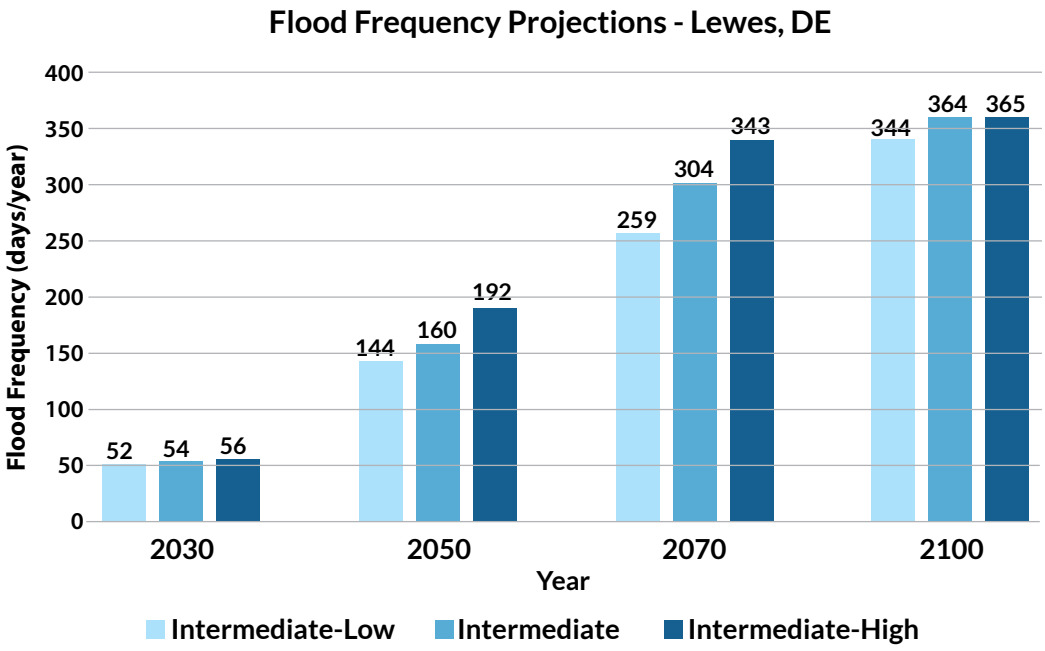


FIGURE 2.2. *Future projections of the number of high-tide flooding days per year under the sea level rise planning scenarios for Lewes, DE.* SOURCE: 2025 CLIMATE PROJECTIONS REPORT.

the minor flood threshold. Today, Delaware experiences more than 50 days per year where the tide levels exceed minor flood level.

The number of days with minor flooding, or more, will increase in coming decades. Figure 2.2 indicates the number of days this flood threshold will be exceeded under different future sea level rise scenarios. Under the intermediate and higher scenarios, the accelerating trend eventually plateaus at or near 365 flooding days per year — indicating that this flood threshold becomes the new daily normal.

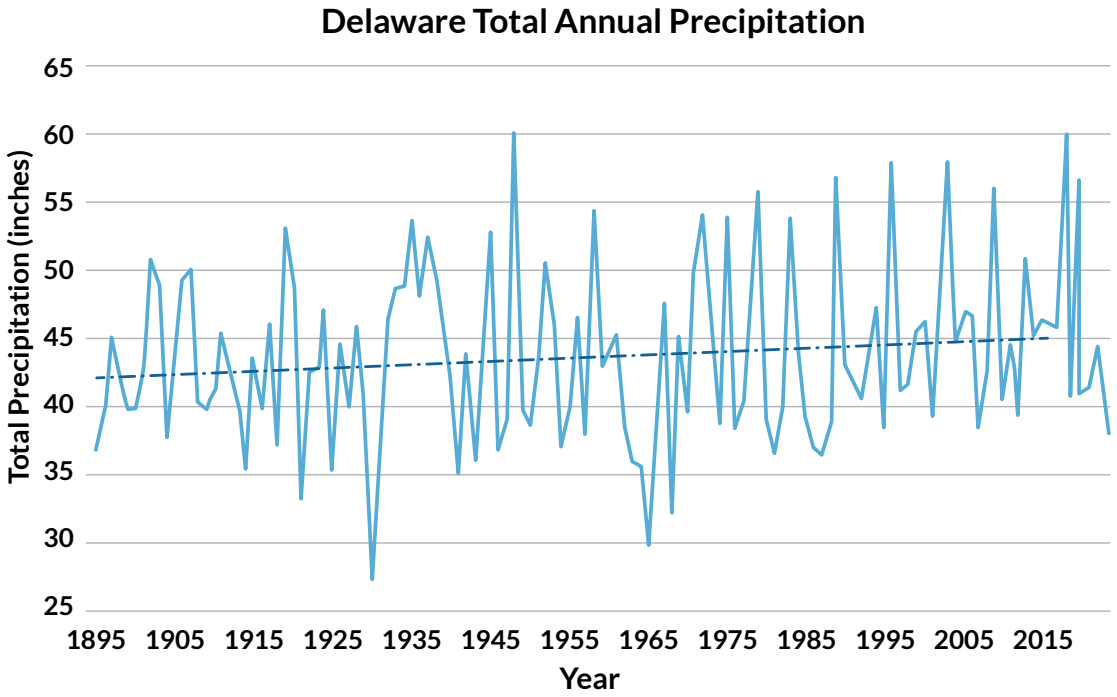


FIGURE 2.3. *Total annual precipitation in Delaware, 1895 to 2023.* **SOURCE: NOAA CLIMATE AT A GLANCE.**

Heavy Precipitation, Storms and Flooding

PRECIPITATION AT A GLANCE

- Delaware's total annual precipitation has increased by about 3 inches since 1895.
- Precipitation in Delaware is highly variable, ranging from as low as 27 inches to as high as 60 inches in a year.
- Delaware's annual precipitation is projected to increase by 2 inches to 4 inches by mid-century.

Delaware receives an average of 44 inches of precipitation per year (Figure 2.3), but it can vary significantly between years and months. In part because of this high year-to-year variability, the Climate Action Plan includes strategies to address both flooding and drought, to ensure that extreme events on both the high and low end of precipitation are accounted for. (See also *Sea Level Rise, Precipitation and Inland Flooding* in Chapter 6.)

Since 1895, Delaware's annual total precipitation has increased by about 3 inches per year and is projected to increase by another 2 inches to 4 inches per year by mid-century. While projections indicate only a small increase in total annual precipitation, increases in average rainfall are not evenly distributed across all seasons. Climate models suggest that winter shows the strongest seasonal increase in precipitation, with potential implications for agriculture and water demand.[15]

Across the United States, climate change is driving an increase in extreme precipitation. A warmer atmosphere can hold more water vapor, so as temperatures increase, it can

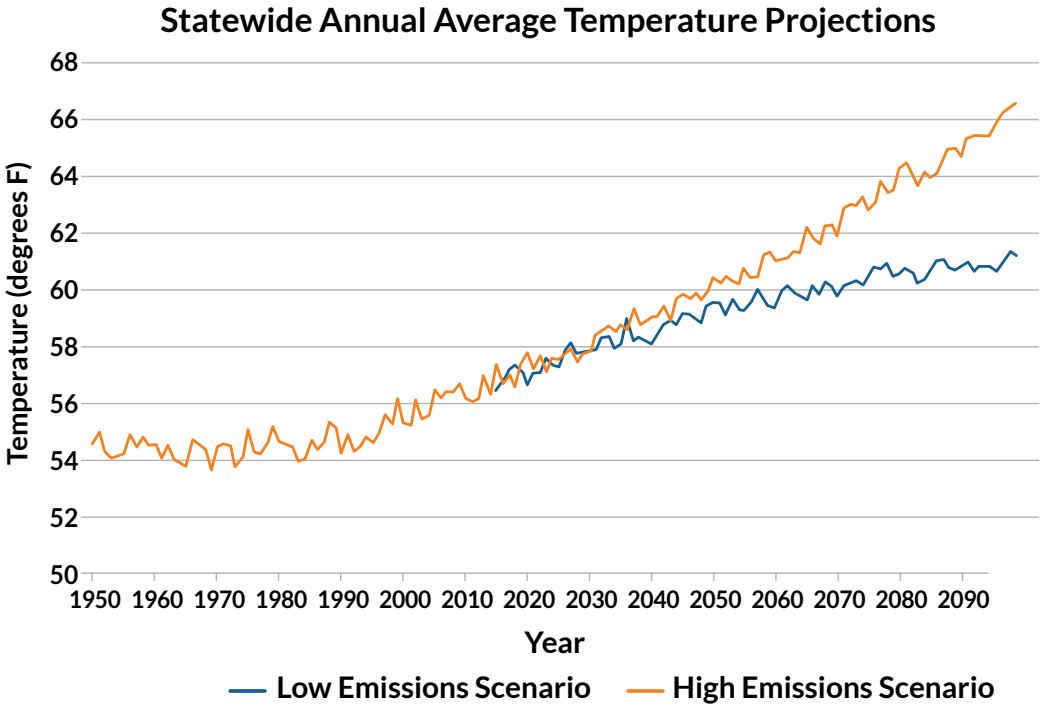


FIGURE 2.4. *Statewide annual average temperature projections.* SOURCE: 2025 CLIMATE PROJECTIONS REPORT.

produce more intense precipitation events. This is especially apparent in the U.S. Northeast region, which includes Delaware. According to the Fifth National Climate Assessment, heavy precipitation has increased by approximately 60% in recent decades across the Northeast. This indicates that not only is the total amount of precipitation changing, but the intensity of that precipitation is also changing.

Extreme Heat and Hotter Temperatures

HEAT AT A GLANCE

- Delaware's average annual temperature has increased by 3 degrees F since 1895.
- By 2050, mean annual temperatures are projected to increase by 3 degrees F to 4 degrees F.
- By 2100, mean annual temperatures are projected to increase by 5 degrees F to 9 degrees F.

Average temperatures across Delaware are rising due to climate change. The state's average annual temperature is now 3 degrees F higher than in 1895. The warming trend is consistent across all seasons, indicating that Delaware is experiencing both hotter summers and warmer winters. (See also *Extreme Heat* in Chapter 6.)

By the end of the century, mean annual temperatures are expected to increase by 5 degrees F to 6 degrees F under a low emissions scenario, and 8 degrees F to 9 degrees F under a high emissions scenario (Figure 2.4).

The annual average temperature increase will be experienced in a variety of different ways. For example, nighttime temperatures will increase, and there will be fewer days below freezing.

There will also be more very hot days. The projections show that the number of days that reach 90 degrees F will increase. Under a low emissions scenario, the number of days exceeding 90 degrees F are projected to increase by 35 days annually. Under a high emissions scenario, the number of hot days over 90 degrees F is projected to increase by 75 days.

Emergent Hazards

While sea level rise, precipitation and flooding, and extreme heat remain the most prominent impacts of climate change in Delaware, these are not the only climate impacts that the state faces. Emergent hazards are climate hazards that have been previously less significant or prevalent in Delaware, but climate change may be altering their frequency or severity.

The Climate Action Plan also incorporates the following hazards:

- Drought
- Wildfire
- Extreme Weather
- Vector-borne disease and invasive species
- Ocean and coastal acidification

Risks and Impacts

The three primary climate change impacts — sea level rise, more frequent precipitation and increased temperatures — coupled with the emergent hazards listed above, have tremendous implications for Delaware's economy, communities and way of life. Additional details on Delaware-specific risks and impacts can be found in Chapter 6.

Flooding at Mispillion Harbor. **PHOTO: DNREC**

Chapter 3: Developing the Plan

This Climate Action Plan represents the culmination of a multiyear, collaborative effort. Initiated in 2024, it builds upon the foundation established by the previous Climate Action Plan issued in 2021 and integrates new data, research and community input to reflect Delaware's evolving climate priorities.

The development of this plan was guided by scientific analysis and extensive engagement with technical experts, stakeholders and Delaware residents. DNREC prioritized evidence-based decision-making, commissioning several key studies that provided the backbone for the emission reductions and climate resilience strategies and actions in the plan.

Community Engagement Session participant contributes to the "Wall of Ideas" activity. **PHOTO: DNREC**

Stakeholder Engagement and Collaboration

DNREC engaged with thousands of Delawareans to ensure this Climate Action Plan reflects the state's priorities, concerns and vision. In total, DNREC interacted with over 2,300 Delaware residents about Delaware's changing climate and the Climate Action Plan.

Public and stakeholder engagement was carried out as part of an 18-month outreach

strategy structured around a three-pronged approach:

1. **Technical expert conversations** with key industry leaders to provide feedback on the feasibility of climate action strategies.
2. **Community engagement sessions** to hear directly from the public about their climate concerns, priorities and suggestions.
3. **Local community events and small group meetings** to reach communities that may be under-represented in traditional engagement formats.

TECHNICAL EXPERT CONVERSATIONS

DNREC hosted four workshops with technical experts in September 2024 to gather initial feedback.[16] The 80 workshop participants included technical experts and professionals working in the following sectors: buildings and energy, industry and waste, agriculture and natural working lands, and transportation and land use. Each workshop was designed to identify the impacts of climate change in different sectors, how each sector is addressing those impacts, and what additional support may be needed to overcome barriers to action. The meetings also focused on brainstorming specific climate change emission reductions and adaptation strategies that could be reflected in the Climate Action Plan.

COMMUNITY ENGAGEMENT SESSIONS

DNREC hosted two rounds of community engagement sessions in each county, the first in October 2024 and the second in September 2025.[17,18] In total, more than 200 Delawareans participated in the six in-person workshops. Each session was designed to foster a participatory environment where attendees could express their concerns and ideas for the future of climate action in Delaware. Attendees were encouraged to engage with a variety of interactive activities and table displays to share their ideas and suggestions

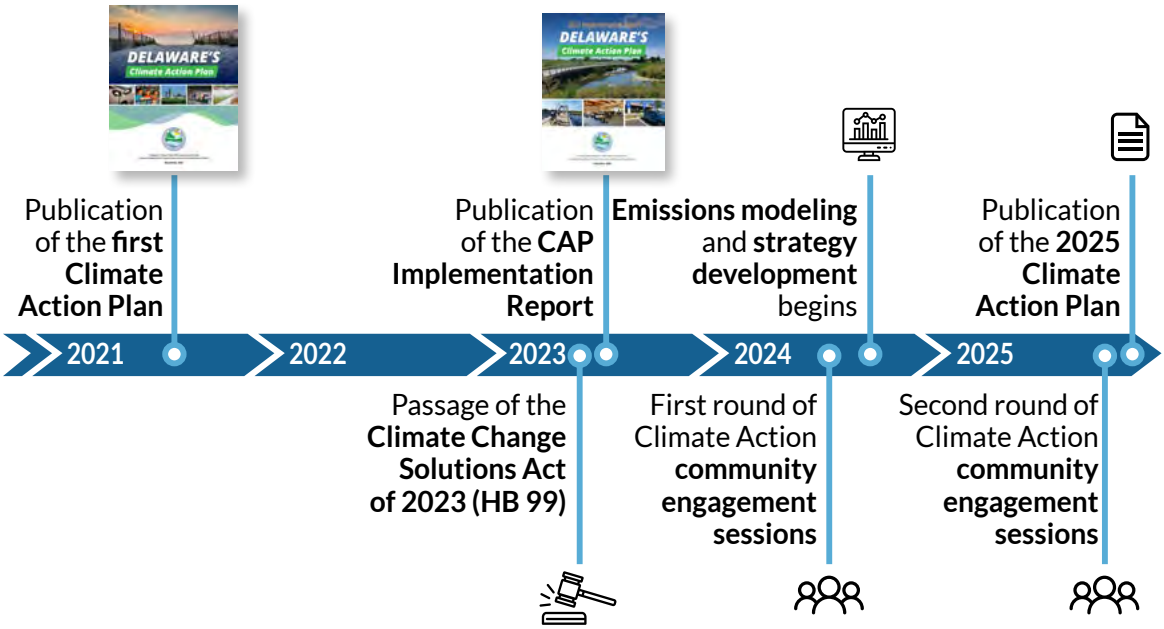


FIGURE 3.1. *Timeline of key milestones in Climate Action Plan development.*

with DNREC staff on how Delaware should prepare for and address statewide climate change impacts. In addition, at the 2025 sessions, participants were invited to review a comprehensive list of draft strategies and actions that were under consideration for inclusion in the Climate Action Plan. Attendees received questionnaire forms at each session to record their thoughts and feedback. Questionnaires and workshop materials were also offered online for those unable to attend in person.

LOCAL COMMUNITY EVENTS AND SMALL GROUP MEETINGS

Throughout plan development, DNREC engaged with communities across Delaware through a series of virtual and in-person meetings and community events. DNREC proactively met groups where they already gather by joining existing meetings or attending events hosted by those groups. Each meeting was guided by discussion questions similar to those used in the technical expert workshops but tailored for each group. Participants shared how they are currently responding to climate change, if at all, and offered insights on how DNREC can better support them.

At community events, DNREC used a new display called the "Climate Change Living Room," which was created as a portable, welcoming space intended to encourage open dialogue between DNREC staff and the public on climate change and other environmental topics. The casual atmosphere of the Climate Change Living Room facilitated conversations that centered primarily on participants' personal experiences with climate change impacts in their communities, as well as their questions about current and future state

Community Engagement Workshop in October 2024. **PHOTO: BETH KRUMRINE, DNREC**

Experts from the agriculture sector provide feedback on the 2025 Climate Action Plan. **PHOTO: DNREC**

Fall 2025 Community Engagement Session participants share feedback with DNREC staff. **PHOTO: DNREC**

climate action initiatives. More traditional informational table displays were used at events where the living room display was not feasible due to space limitations.

Summary documents for the technical expert workshops and public engagement sessions are available online at de.gov/climateplan.[19]

DNREC staff with the Climate Action Plan "Wall of Ideas."
PHOTO: DNREC

Attendees at Newark Community Day stop by the DNREC's "Climate Living Room" display to discuss climate change.
PHOTO: DNREC

A family learns about climate risks while playing "Climate Plinko" at Blackbird Creek Fall Fest . **PHOTO: DNREC**

Science and Data-Driven Foundation

This Climate Action Plan is grounded in the best available science and data. DNREC commissioned four studies to support development of the plan. Each brought unique insights that shaped the scope, timing and focus of the plan's strategies:

1. **Greenhouse Gas Emissions Modeling**
   This modeling effort assessed future emissions under two scenarios: existing policies and programs and additional actions that can be taken to achieve a path toward net-zero emissions by 2050. This work, detailed further in Chapter 4, provided a critical analytical backbone for identifying high-impact opportunities for emission reductions and evaluating trade-offs among competing priorities. This modeling effort also examined the timing, feasibility and cumulative benefits of proposed actions, helping to shape the strategies in this plan.[20]

2. **Climate Change Projections Report**
   The future climate change scenarios used to inform this plan were developed by the University of Delaware Center for Environmental Monitoring and Analysis with guidance and input from the Delaware Technical Climate Advisors. This *report* contains updated projections for sea level rise, precipitation and temperatures under lower and higher emissions scenarios. Findings from this report are summarized in Chapter 2.[21]

3. **Clean Energy and Climate-Related Jobs Workforce Development Assessment**
   DNREC commissioned a study to examine the current size and composition of Delaware's clean energy workforce, identify priority occupations, and evaluate the state's training and education infrastructure. The assessment found that while Delaware has a solid foundation of workforce development programs and strong partnerships among employers, schools and training institutions, there are

notable gaps, particularly in the availability of programs for emerging climate-related occupations. Additional details about this report can be found in Chapter 7.[22]

4. **Climate Change Perceptions Survey** DNREC conducted a statewide climate change survey in February 2025. This scientifically valid study polled more than 1,500 Delaware residents through phone, text and online platforms. The data gathered provided DNREC with valuable insights into how Delawareans perceive climate change as a threat and which climate action strategies receive the strongest public support. The full report is online at de.gov/climatesurvey.[23]

Development of Goals, Strategies and Actions

The workshops, engagement sessions and technical input, combined with the scientific studies described above, informed a comprehensive list of potential strategies and actions. This list was refined over time through iterative reviews and consultation with technical experts and the public and through a public comment period. In addition, existing state documents and other state climate action plans were reviewed for relevant strategies.

REVIEW OF EXISTING PLANS

Existing data, information and plans were compiled and reviewed to ground this plan in a broad understanding of current climate policy landscapes, both within Delaware and nationally. The initial list of strategies and actions was compiled after review of existing plans, including the 2021 Delaware Climate Action Plan, the Delaware Energy Plan and the 2023 Climate Action Plan Implementation Report.

FORMATION OF SECTOR- AND HAZARD-BASED TEAMS

Following this foundational review, DNREC established specialized teams organized around key sectors and climate hazards. These teams combined internal DNREC staff with external experts from state agencies, regional organizations and partner institutions. Their charge was to provide technical guidance and to refine and prioritize strategies relevant to their areas of focus. Each team was organized around the specific sectors and hazards now included throughout this plan (see Chapter 4 and Chapter 6).

In addition to hosting regular team meetings to develop proposed strategies for the plan, team leads consulted with other subject matter experts to gather feedback on specific strategies and actions. For example, the industry sector team reached out to 32 industrial organizations and businesses, resulting in eight one-on-one meetings to gather feedback and refine sector-specific actions.

U.S. EPA Climate Pollution Reduction Grant

The development of this plan was made possible, in part, by a Climate Pollution Reduction Grant from the U.S. Environmental Protection Agency. This 4-year, $3 million grant provided funding for contractual services and staffing, enabling DNREC to significantly expand its planning capacity. The grant also supported investments in robust community engagement efforts and allowed DNREC to conduct detailed technical analyses and modeling to identify the most impactful emission reductions and climate resilience strategies for Delaware.

Recent climate and energy planning documents. **PHOTO: DNREC**

TECHNICAL CLIMATE ADVISORS AND CLIMATE CHANGE OFFICERS

Two groups that played an important role in shaping the 2025 Climate Action Plan are the Technical Climate Advisors and the Climate Change Officers. Both were established under the Climate Change Solutions Act of 2023 and were convened in part to support the development of this updated plan.

1. **Technical Climate Advisors**
   The Technical Climate Advisors serve in an expert advisory capacity to DNREC and are tasked with evaluating and updating Delaware's climate projections, specifically scenarios for sea level rise, temperature and precipitation. The group is composed of a broad and multidisciplinary panel appointed by the DNREC secretary, drawing from state agencies, universities and research institutions. Members include climatologists, water resource experts, university faculty, and DNREC staff. Their role is crucial for grounding the Climate Action Plan in the most recent science and ensuring that resilience planning reflects evolving climate risks.

2. **Climate Change Officers**
   The Climate Change Officers are designated from each of nine key cabinet-level departments in Delaware, including DNREC, the Department of Agriculture, the Department of Health and Social Services, DelDOT, the Delaware State Housing Authority and others. Under the leadership of a Chief Climate Change Officer, they serve both operational and strategic roles. They assess progress toward the 2030 and 2050 emission reductions targets, guide implementation of plan strategies, and coordinate agency-level input for updates to the Climate Action Plan.

By leveraging a diverse range of data sources, technical analyses and the collective expertise of both technical experts and community stakeholders, this plan offers a well-informed, actionable playbook for meeting Delaware's emissions and resiliency goals.

State Agency Climate Officers gather to review 2025 Climate Action Plan draft strategies. **PHOTO: DNREC**

Chapter 4: Toward Net-Zero Emissions by 2050

Reducing Delaware's greenhouse gas emissions to nearly zero by 2050 helps avoid the worst impacts of climate change. As laid out in the introductory sections of this plan, the accumulation of greenhouse gases in Earth's atmosphere is warming our planet, causing the climate change impacts Delawareans are already experiencing.

Delaware's Climate Change Solutions Act sets statewide targets for greenhouse gas emission reductions. The targets are 50% reduction in greenhouse gas emissions by 2030 and net-zero emissions by 2050. Both targets are measured from a 2005 baseline. The Act also requires the Climate Action Plan to include recommendations for "legislative, regulatory and policy changes necessary for the State to meet its greenhouse gas emission reductions targets."

Delaware has already made significant progress in reducing its greenhouse gas emissions and has a path toward net-zero emissions by 2050. This path requires rapid emission reductions from existing sources and significant investments to improve the ability of our wetlands, forests and agricultural lands to capture and store carbon.

Delaware Memorial Bridge at dusk.
PHOTO: ADOBE STOCK

This chapter outlines progress to date in achieving Delaware's emission reductions goals and highlights results of technical emissions modeling showing a path toward net-zero emissions by 2050. It also contains sector-specific data and information and provides a series of goals, strategies and actions that can be taken to drive emissions down in Delaware.

Measuring Greenhouse Gases

Carbon dioxide is the most abundant greenhouse gas, making up nearly 80% of U.S. greenhouse gas emissions.[24] Other greenhouse gases, such as methane, nitrous oxide, and fluorinated gases, also contribute to climate change. Each type of greenhouse gas traps heat at a different rate. Scientists use a measurement called global warming potential to quantify the warming effect of different gases. As an example, one molecule of methane contributes 30 times more warming than one molecule of carbon dioxide over 100 years, so its global warming potential is 30.

To make it easier to measure and discuss emissions, greenhouse gases are measured by "carbon dioxide equivalent." Throughout this document, you will see emissions described as "million metric tons of carbon dioxide equivalent," or "$MMTCO_2e$." This allows direct comparison of emissions with a single consistent unit.

Delaware's Greenhouse Gas Emissions Profile

Progress toward Delaware's emissions goals is measured using the state's annual greenhouse gas inventory. This report identifies emission types and sources of emissions in Delaware and quantifies emissions from different sources. The 2021 Delaware Greenhouse Gas Inventory is the most recent report available due to the length of time required to collect and analyze emissions data. Throughout this plan, discussion of Delaware's current emissions profile references the 2021 emissions data.

Emissions are reported in two ways: on a gross and net basis. Gross emissions reflect the total emissions, including out-of-state emissions associated with electricity generated outside of Delaware but used within the state. Net emissions reflect gross emissions minus the carbon sequestered by Delaware's forests, wetlands and farmlands. Annual net emissions are smaller than annual gross emissions because they account for the value of our natural and working lands in storing carbon from the atmosphere.

Storing Carbon Dioxide through Sequestration

There are many ways that carbon dioxide can be removed from the atmosphere. Carbon dioxide can be absorbed by plants and stored in biomass and soils, dissolved into oceans, or even captured from the air using emerging technology. These removal pathways are called carbon sequestration, and the soils, forests, wetlands and marine ecosystems that store excess carbon are called carbon sinks. Removing excess carbon dioxide through sequestration is an important part of the strategies and actions presented in the Climate Action Plan and key to meeting the state's net-zero emission target.

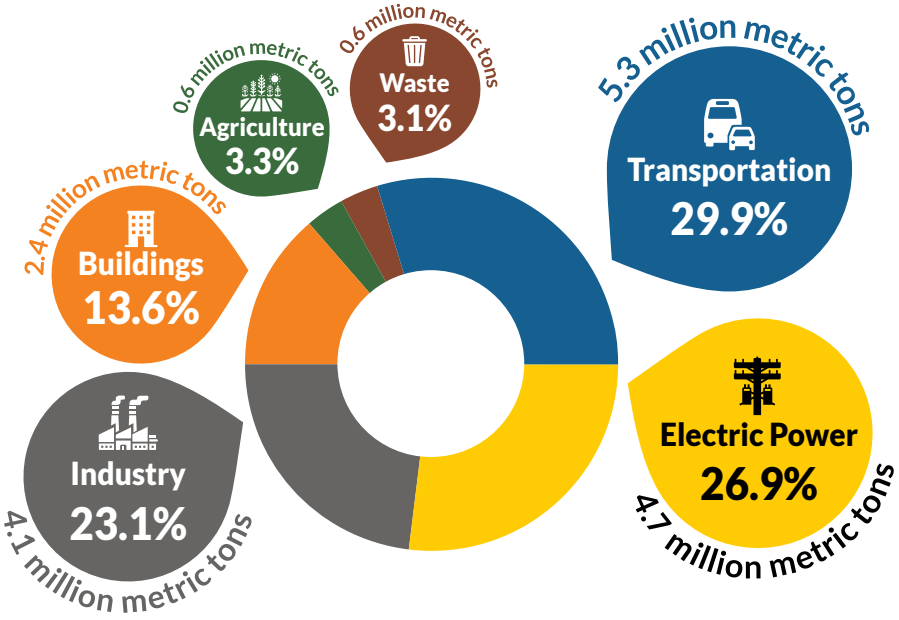


FIGURE 4.1. *Gross greenhouse gas emissions by sector in Delaware (2021).*

Most greenhouse gas emissions in Delaware originate from three sources: transportation, industrial facilities and electricity generation (See Figure 4.1). The transportation sector has been the largest emitting sector in Delaware since 2016 and represented 29.9% of gross emissions in 2021. Agriculture, solid waste and wastewater represent a small fraction of Delaware's emissions combined, typically 6% to 8% of gross emissions.[25]

Delaware's net emissions declined by 23.8% between 2005 and 2021. Total net emissions in 2005 were 22.1 $MMTCO_2e$. By 2021, Delaware's net emissions decreased to 16.9 $MMTCO_2e$. This decline in emissions occurred primarily in the electricity sector (see Figure 4.2) and was driven in part by fuel-switching of coal-fired power plants to natural gas, coupled with foundational state policies and programs including the Regional Greenhouse Gas Initiative and Renewable Energy Portfolio Standards. Emissions increased between 2020 and 2021, largely due to the impact of the economic rebound following the COVID-19 pandemic.[26]

Delaware's Path Toward Net-Zero Emissions by 2050

To illustrate Delaware's potential future emissions and path to net-zero emissions by 2050, DNREC worked with a technical consultant to model greenhouse gas emissions. Emissions modeling is a tool for calculating and anticipating future emissions across sectors.

MODELING TWO SCENARIOS FOR FUTURE EMISSIONS

The modeling effort estimated and projected future emissions under two different scenarios. The first scenario is a 'reference case' where existing policies and programs continue, and where no additional actions are taken to reduce emissions. The second scenario is the 'path toward net-zero' scenario. In this scenario, the existing programs and policies would continue, and additional significant, economy-wide

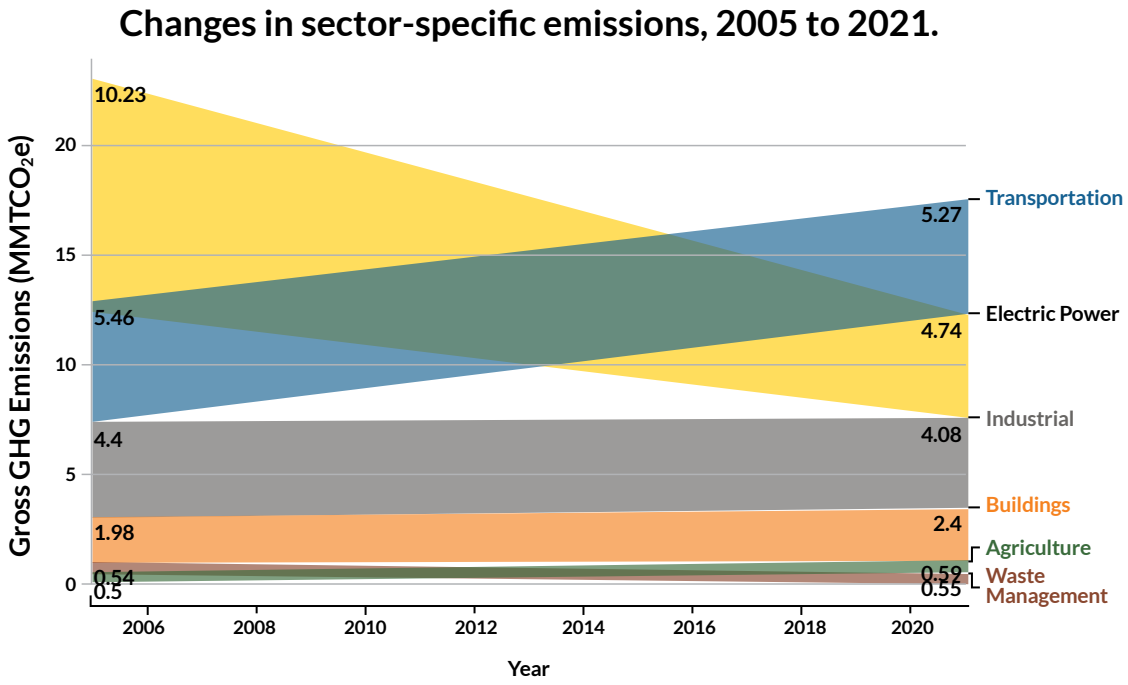


FIGURE 4.2. *Changes in sector-specific emissions, 2005 to 2021.*

actions would be taken to drive emissions toward net-zero by 2050. This scenario-based modeling effort provides an understanding of the gap that must be closed to meet the state's emission targets. It also provides information about the programs and policies that can be deployed to close the remaining gap.

The estimates of future emissions under the two scenarios were developed using a combination of publicly available and proprietary tools. Inputs to the models were wide-ranging and include data such as fuel prices, electricity consumption, electricity efficiency standards, vehicle miles traveled, vehicle types and feedstocks. Models account for economic growth, population growth and electricity imported from out of state, among other considerations.

The models also account for connections between sectors. For example, greenhouse gas emission projections from the transportation sector account for an increasing amount of clean electricity used to fuel electric vehicles.

The modeling did not incorporate the potential impact of emerging large energy users, such as hyperscale data centers, on emissions in Delaware or on the regional electricity grid. Data centers and their potential impact on energy use, water use and air pollutants are an emerging topic with significant uncertainty regarding scope, scale, timing and location.

REFLECTING FEDERAL POLICIES IN EMISSIONS MODELING

The scenario-based emissions modeling was conducted from October 2024 through April 2025. Since initiation of the modeling effort, many federal policy changes have occurred that could hinder progress and impact Delaware's future greenhouse gas emissions. These changes include the elimination of major federal tax credits and reduction or cancelation of federal programs and grants. Proposed changes also include federal regulatory actions that would roll-back or

relax federal standards for emissions and energy conservation. Many of these policy and funding changes are being challenged in court by Delaware and coalitions of states.

The federal uncertainty posed a challenge for modeling Delaware's future emissions. Despite the uncertainty, federal programs and policies in place as of January 2025 are included in the model results. This choice was made because these programs are foundational to progress and because several federal changes made in 2025 have been reversed or overturned in court challenges. Federal regulations, programs and policies are important for continued emission reductions and the emission model results presented here reflect their importance. Ultimately, the emissions projections outlined in this document represent an optimistic outlook. Additional modeling will be conducted in support of the 2030 Climate Action Plan and will be able to reflect the federal policy landscape with more certainty.

USING EMISSIONS MODELS TO GUIDE SELECTION OF STRATEGIES AND ACTIONS

The modeling of future greenhouse gas emissions under each scenario serves to highlight both near- and long-term actions that can be taken to reduce greenhouse gas emissions. However, this Climate Action Plan primarily has a near-term, five-year focus. While the goals and strategies highlighted in this plan generally have a longer time horizon, the actions listed within each strategy are those that can be initiated or completed within the next five years.

Results of the emissions modeling effort described in this chapter were used to guide selection of the goals, strategies and actions incorporated into this plan. The emissions model results should be considered

Wetlands overlooking Assawoman Bay and Fenwick Island. **PHOTO: ADOBE STOCK**

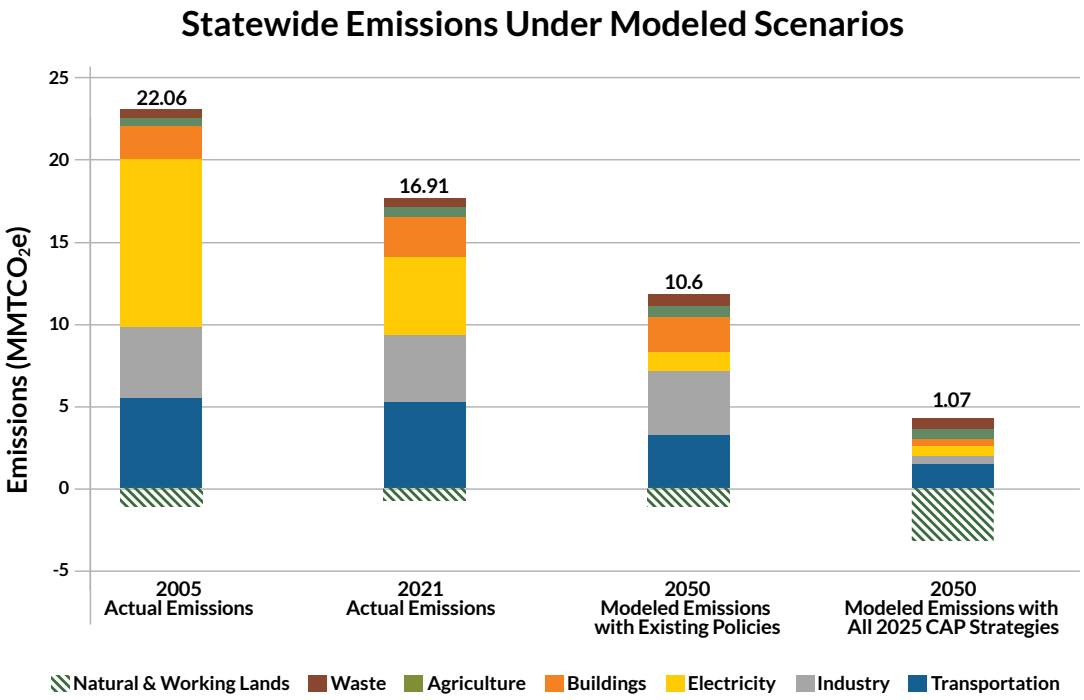


FIGURE 4.3. *Economy-wide net greenhouse gas emissions under modeled scenarios. Striped bars represent net negative emissions from carbon sequestration on natural and working lands. Labels above each bar show net emissions, not gross.*

directional, rather than resulting directly from implementation of specific actions in the plan.

EMISSIONS PROJECTIONS FOR 2050 WITH EXISTING POLICIES AND PROGRAMS

Emissions modeling indicates that Delaware will continue to make progress reducing emissions through 2050, but that additional policies and programs will be necessary to achieve the 2030 and 2050 targets. With existing policies (the "reference case"), Delaware's greenhouse gas emissions are projected to decline on a net basis by 36% between 2005 and 2030. Between 2005 and 2050, emissions are projected to decline by 54% (see Figure 4.3). The reductions in emissions from existing policies are primarily driven by continued deployment of clean energy, energy efficiency improvements, reduced use of fossil fuels in buildings and electrification of vehicles. Industrial emissions decline only slightly, reflecting a limited number of existing policies and programs that reduce industrial emissions.

EMISSIONS PROJECTIONS FOR 2050 WITH ADDITIONAL POLICIES AND PROGRAMS

Delaware can make considerable progress toward its emissions targets with existing policies and programs, but there is a gap to close between projected emissions and the targets. To provide information about strategies that could close this gap, a second scenario was modeled. This scenario assumes that Delaware would implement a suite of additional policies and programs within all sectors to further drive emissions downward toward net-zero by 2050. These additional policies included accelerated use of renewable fuels, carbon capture technologies and energy efficiency for industrial processes. It continued and accelerated efforts

for a cleaner electric grid, vehicle electrification, sustainable aviation fuels and electrification of heating and cooking in buildings. It also included significant wetland restoration efforts and additional strategies for sequestration in farmlands so that natural and working lands could help to offset difficult-to-abate emission sources that would remain by 2050.

With these additional actions, the model shows that Delaware can nearly reach its net-zero emissions goal by 2050, reducing net emissions by 96.4% from 2005 levels. Near-term, emissions could decline by 41.5% by 2030.

Using these model assumptions, in 2050, Delaware's gross emissions could decrease to 4 $MMTCO_2e$. These remaining emissions could be offset by actions that increase carbon sequestration by wetlands, forests and farms, with wetland restoration being the simple most impactful nature-based strategy. Maximizing the utilization of these lands for carbon sequestration would result in net greenhouse gas emissions of 1.07 $MMTCO_2e$ in 2050, nearly achieving the net-zero emissions target.

Figure 4.4 illustrates the potential reductions by sector for the additional actions. Industrial actions, including low-carbon fuels, represent the largest opportunity for potential future reductions. The second-largest opportunity is from practices that serve to sequester carbon in natural and agricultural lands. Energy efficiency actions are also particularly impactful for emission reductions, especially in the near term. Continued electrification of vehicles, deployment of renewable and clean energy and increased electrification of heating and cooking in buildings play a continued significant role in reaching emission targets. Potential emission reductions of these additional actions are described in the sector-specific sub-sections below.

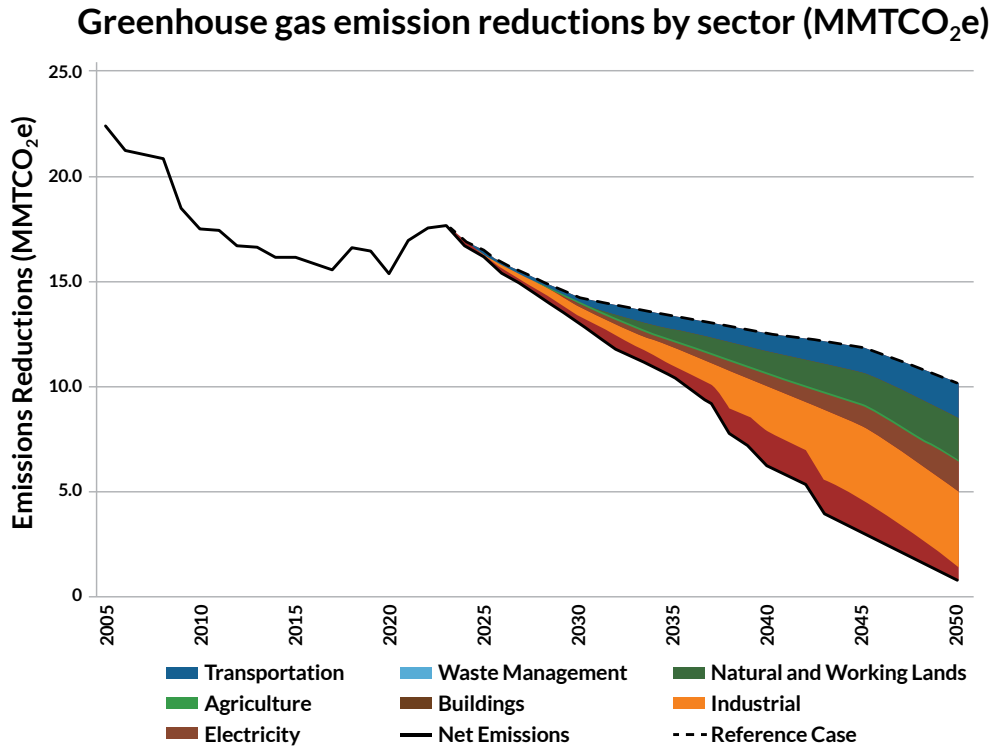


FIGURE 4.4. *Greenhouse gas emission reductions by sector ($MMTCO_2e$).*

Emissions Sector Analysis and Strategies

Bicycle riders cross a bridge on the Jack A. Markell Trail. **PHOTO: WRA JAM**

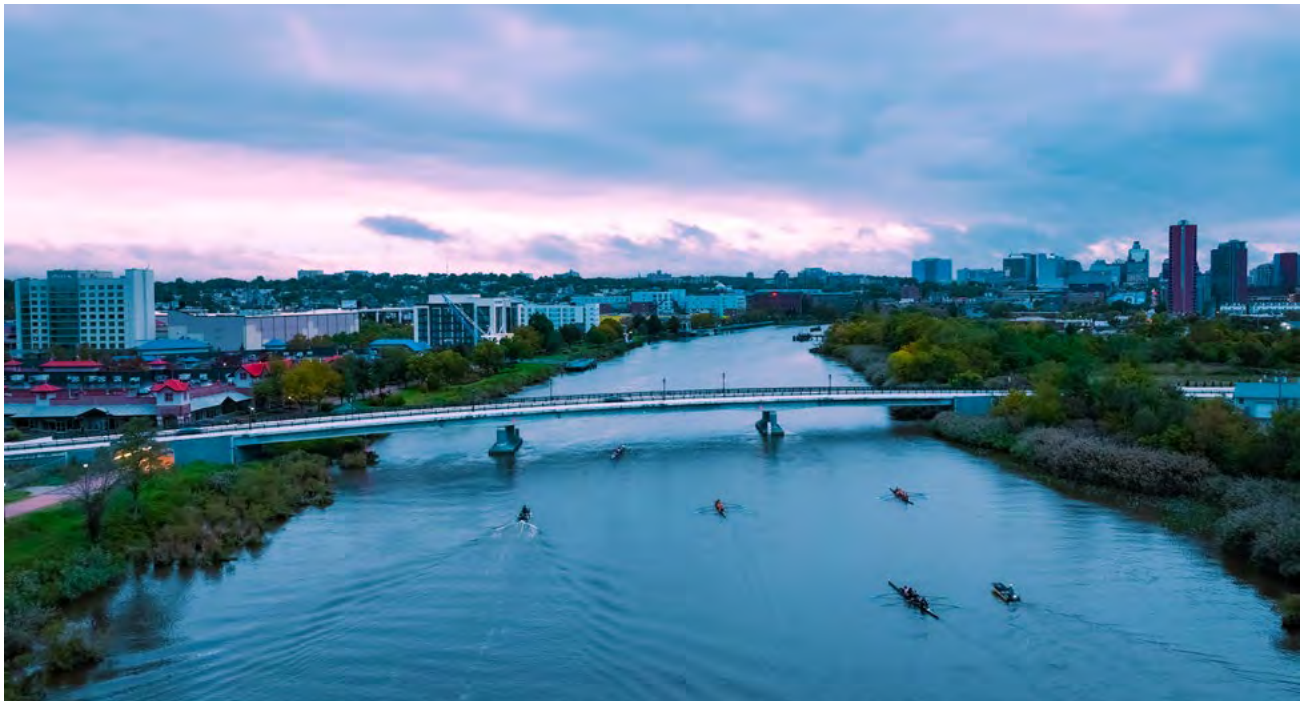
The following sections of this chapter contain detailed information about emissions and potential emission reductions opportunities and strategies by sector:

- Transportation
- Industry
- Electricity Generation and Grid Infrastructure
- Residential and Commercial Buildings
- Forests and Urban Trees
- Oceans and Wetlands
- Agriculture
- Waste

Foundational policies and programs as well as progress since the 2021 Climate Action Plan are highlighted for each sector. Each section also contains information about historic emissions, the sector-specific emissions modeling assumptions and modeling results. Each section concludes with the goals, strategies and actions that will drive emission reductions in the sector.

Because the Climate Action Plan is updated every five years, the strategies and actions presented focus on actions that can feasibly be initiated or accomplished within the next five years (see Chapter 1 for additional context about strategies and actions).

TRANSPORTATION



The Senator Margaret Rose Henry Bridge, a multimodal bridge over the Christina River which includes travel lanes and a 14-foot-wide, separated bike/pedestrian path. **PHOTO: DELDOT**

Transportation is Delaware's largest source of emissions and a cornerstone of the state's economy. The movement of people, goods and services by road, air, water and rail supports commerce and daily life, connecting Delawareans to jobs, education, recreation and each other. This sector also includes off-road engines and equipment such as lawnmowers, marine vessels and aircraft. By reducing transportation-sector emissions, Delaware can simultaneously improve public health, advance equity, build community resilience and take a significant step toward achieving Delaware's net-zero emissions future.

In 2021, the transportation sector accounted for 29.9% of Delaware's total greenhouse gas emissions. Since 2005, emissions from transportation have declined by 3.5%, largely due to improving passenger vehicle efficiency. Though progress has been made, the sector has remained the largest source of emissions since 2016. The limited reduction in transportation emissions is largely due to continued reliance on gasoline and diesel vehicles, compounded by population growth, land use patterns and investment decisions that increase travel demand.

Nearly half of transportation emissions are from passenger cars and light-duty trucks. Heavy-duty vehicles such as tractor trailers and garbage trucks account for 25.6% of transportation emissions. Off-road sources of emissions, such as trains, planes, boats, farm equipment and lawn-care equipment, account for 20.7% of the sector's emissions, with an additional 3.2% coming from construction vehicles. Hydrofluorocarbon emissions, a high global warming potential

gas, account for 2.0% of vehicle emissions from air conditioning systems in all vehicle types. Delaware's net-zero emissions future cannot be achieved without reducing vehicle emissions by electrifying transportation, reducing vehicle miles traveled, and preparing Delaware for new technology types.

FOUNDATIONAL POLICIES AND PROGRAMS

Delaware has a strong foundation of policies, programs and partnerships to support the reduction of greenhouse gas emissions and other pollutants from transportation. Examples are highlighted below. For a more comprehensive list of transportation policies and programs, see Appendix A.

Vehicle Emission Standards

Delaware has adopted stricter tailpipe emission standards than those set by federal air quality regulations. These standards play a critical role in reducing greenhouse gas emissions and air pollution from vehicles.

Electric Vehicles and Charging Station Incentives

Delaware incentivizes switching to electric vehicles. DNREC's *Clean Transportation Incentive Program* offers rebates for electric and plug-in hybrid vehicles and for publicly available electric vehicle charging stations.[27] Energize Delaware also offers rebates for home charging stations. In addition, the National Electric Vehicle Infrastructure fund awarded Delaware with $17 million to install DC-fast charging stations along highways throughout the state.[28]

EV charging station. **PHOTO: DNREC**

Long-Range Transportation Planning

The Delaware Department of Transportation's *Long Range Transportation Plan: Connecting Everyone Everywhere* lays out a vision for a safe, reliable and efficient transportation system that supports a more sustainable future. The plan acknowledges statewide challenges such as aging infrastructure, increasing vehicle miles traveled and pedestrian and cyclist safety, and proposes strategies that integrate transportation planning with land use, prioritize infrastructure investments in growth areas, and enhance mobility options for all Delawareans.[29]

RECENT PROGRESS

Since the 2021 Climate Action Plan, the state has accelerated progress toward lowering vehicle emissions especially through deployment of electric vehicles and expanding multimodal transportation options. Key program highlights are below:

Growth of Electric Vehicle Adoption

Since 2020, the number of electric vehicles registered in Delaware has grown from approximately 2,000 to over 14,000. This rapid increase reflects growing consumer confidence supported by a broader range of available models, declining vehicle costs and improved access to charging infrastructure.

Improving Delaware's Bus Network

In 2024, the Delaware Administration for Regional Transit (DART) published *DART Reimagined*, the result of a comprehensive, yearlong study conducted to reshape the statewide bus network into a more efficient, reliable, and sustainable transit system. The plan outlines a phased implementation strategy, focused on enhancing service reliability, frequency and quality. When fully implemented, the plan will expand walkable transit access from one-third to one-half of Delawareans, improving the convenience and opportunity to reach destinations through public transit.[30]

DART buses. PHOTO: DELDOT

Clean Ports and Ferries

In 2023, Port Delaware, through its partnership with the Diamond State Port Corporation, secured $127 million in grant funding through the U.S. Environmental Protection Agency's *Clean Ports Program*. The funding will electrify container handling operations at Port Wilmington and support the procurement of electric equipment for use at the Delaware Container Terminal, part of Port Wilmington's expansion. The Delaware River and Bay Authority also received funding through this program to conduct several studies including an emissions inventory for ferry operations, emission reductions strategy analysis, and resilience planning and evaluation for the Cape May-Lewes Ferry terminals.[31]

Feasibility Study for Statewide Passenger Rail Service

Funded by a Federal Railroad Administration grant, the Diamond State Rail Line Corridor Study examines options for passenger rail service running from Wilmington or Newark through Kent and Sussex counties to destinations in Maryland. It assesses potential station locations, ridership demand and multimodal connections, with the goal of increasing mobility options and access to opportunity while easing traffic congestion.

PATHWAY TO NET-ZERO EMISSIONS

Accelerating the transition from internal combustion engine cars and trucks to zero-emission vehicles presents a significant opportunity to reduce greenhouse gas emissions, as on-road vehicles account for 74% of the sector's emissions.[32] In addition, supporting the ability to walk, bike and ride transit in Delaware improves access to essential destinations while lowering emissions, and leads to co-benefits such as better air quality, increased physical activity and lower risk of respiratory and cardiovascular illness. By pursuing low-carbon fuels and electrification for off-road equipment, the sector can further reduce emissions from aircraft, marine vessels and other utility equipment, which together account for more than a quarter of transportation emissions.

Between 2005 and 2021, transportation-related emissions in Delaware declined from

Interstate 95 near Wilmington, a key transportation corridor and major source of transportation-related emissions in Delaware. **PHOTO: ADOBE STOCK**

5.46 to 5.27 $MMTCO_2e$, a reduction of 3.5%. While this decline reflects some progress in fuel efficiency, it underscores the challenges posed by continued reliance on internal combustion engine vehicles and the ongoing growth in travel demand.

By 2050, modeling suggests that the continuation of Delaware's current policies and programs could reduce emissions from the transportation sector by an additional 38% to 3.27 $MMTCO_2e$. The existing policies modeled included rebates for electric vehicles, the continuation of federal and state regulations for tailpipe emissions and state fleet electrification. Potential emission reductions from existing policies and programs represent an optimistic outlook due to recent federal actions that have rolled back several key regulations and incentive programs.

To define a pathway toward net-zero emissions by 2050, modeling assessed the impact of a suite of potential future actions, including additional deployment of electric vehicles and increased access to multimodal transportation. With full implementation, these measures could reduce transportation sector emissions to 1.57 $MMTCO_2e$ by 2050, representing a 71.2% reduction from 2005 levels. However, the transportation sector is not expected to achieve zero emissions by 2050, primarily due to the slow turnover of the internal combustion engine vehicle fleet and the enduring influence of suburban development patterns that sustain reliance on private vehicle use. Figure 4.5 shows historic and modeled future emissions in the transportation sector.

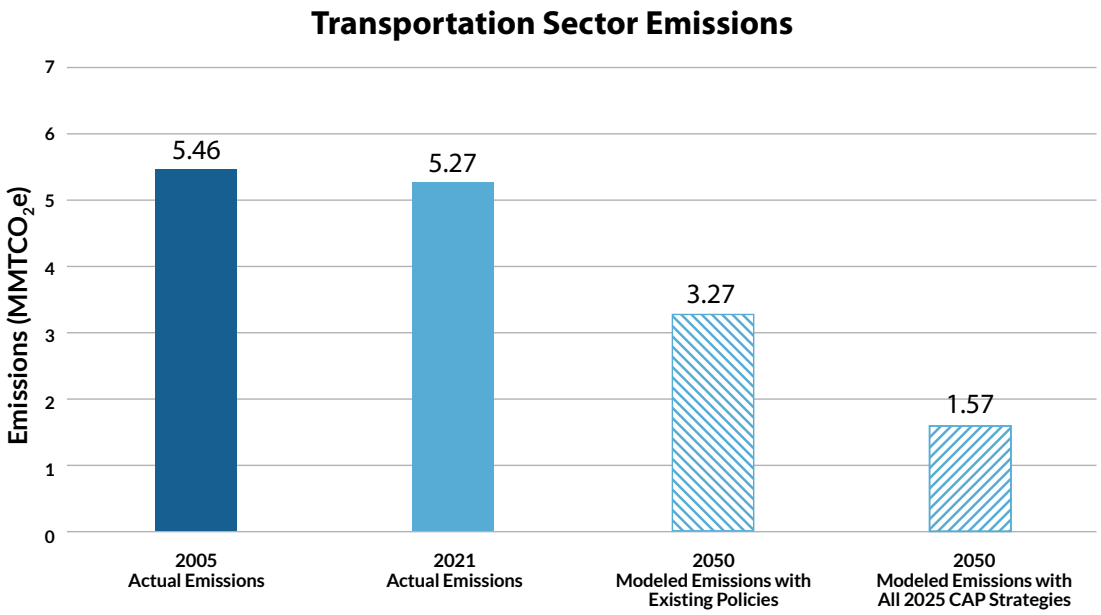


FIGURE 4.5. *Transportation sector emissions under modeled scenarios.*

Modeling Assumptions

The following are the key assumptions made in modeling emissions reductions from the transportation sector:

- Greater access to walking, biking and transit reduces vehicle miles traveled by 14% by 2050.
- Zero-emission medium- and heavy-duty vehicle sales reach 100% by 2050.
- Zero-emission light-duty vehicle sales reach 100% by 2050.
- Public and private investments will expand electric vehicle charging access.
- Delaware's electric grid is increasingly powered by clean and renewable energy.
- The use of sustainable aviation fuel will increase.
- Ferries and port vessels and equipment will progressively electrify after 2027.

STRATEGIES AND ACTIONS

The following strategies and actions provide a playbook for reducing emissions in the transportation sector. While transitioning to electric and other zero-emissions vehicles is key to emissions reductions, significant efforts are needed to improve transportation choices and pedestrian safety. Reducing emissions from vehicles, while also providing opportunities to reduce vehicle miles traveled, improves air quality and public health, supports more cost-effective travel and creates more accessible and connected communities across Delaware. Strategies addressing vehicles and transportation choice are also complemented by strategies for off road vehicles.

Person boarding DART bus. PHOTO: DELDOT

Amtrak Acela train pulls into Wilmington station.
PHOTO: CREATIVE COMMONS

GOAL: EXPAND TRANSPORTATION CHOICE THROUGH IMPROVED PUBLIC TRANSIT AND MULTIMODAL OPTIONS

Expanding transportation options gives Delawareans more freedom in where and how they travel while decreasing costs and reducing emissions. By improving access to transit and making it easier to walk, bike or use shared mobility, Delaware can reduce its reliance on passenger vehicles, which are the largest contributor to transportation emissions. These strategies focus on sustainable modes of travel, lowering vehicle miles traveled and decreasing greenhouse gas emissions.

Strategy T1: Increase bus transit ridership by improving travel times, service frequency, efficiency and coverage.

Bus transit is one of the most flexible and cost-effective forms of transportation, capable of efficiently moving large numbers of people while serving a variety of populations. Improving service quality makes public transit a more attractive option, encouraging a shift away from private vehicle use and supporting emission reductions.

T1.1. Support the implementation of the DART Reimagined plan to deliver measurable operational improvements.
T1.2. Extend core local bus routes to state, county and municipal parks during peak visit hours and on weekends.
T1.3. Actively support and fund transit initiatives focused on bus rapid transit service.
T1.4. Prioritize capital funding for the upgrade of passenger amenities at bus stops, including seating, lighting, weather protection and clear digital signage.

Strategy T2: Increase train ridership by improving travel times, service frequency, efficiency and coverage.

Expanded train service across Delaware can make rail a more convenient and attractive alternative to driving for both in-state and interstate travel, helping to reduce traffic congestion, cut emissions and expand regional mobility.

T2.1. Ensure continued regional rail service by maintaining SEPTA, MARC and AMTRAK service in Delaware.
T2.2. Support the ongoing feasibility study for Diamond State Rail, which would provide rail service statewide.

Strategy T3: Expand multimodal transportation options in communities.

Offering a range of transportation options and the opportunity to transfer between them gives people the flexibility to choose the mode that best fits their needs. Multimodal transportation integrates various travel options, such as transit, biking, walking and shared mobility which increase equity and offer an integrated network of car-free transportation options.

T3.1. Expand micromobility, shuttles and other shared mobility services in areas where traditional transit is not cost-effective.
T3.2. Invest in mobility hubs that allow safe and convenient transfers among buses, trains, car share vehicles, bikes and other forms of transportation.

GOAL: PRIORITIZE SAFETY AND ACCESS FOR WALKING AND BIKING

Active transportation such as walking and biking reduces the need for trips made by car and provides health benefits. However, Delaware ranks among the least safe states for pedestrians and cyclists; pedestrians account for 25% of all roadway fatalities in Delaware. By designing communities that are walkable and bike friendly, with dedicated lanes, safe crossings and accessible infrastructure, Delawareans can choose healthier and more sustainable options while significantly improving safety outcomes.

Strategy T4: Adopt a plan to complete a statewide multimodal network.

A coordinated plan ensures that infrastructure investments support seamless, accessible travel across all modes of transportation.

T4.1. Update DelDOT capital projects design guidance to prioritize safe biking design.
T4.2. Develop criteria that address the acute and cumulative effects of transportation pollution in roadway planning.
T4.3. Strengthen the standards and enforcement of Delaware's "Complete Streets" policy to accelerate and enhance existing efforts to create complete communities.

Strategy T5: Improve access to bikes.

Improving access to bikes supports short-trip travel without a car, reducing emissions and increasing mobility options.

T5.1. Implement incentive programs for bike and e-bike adoption in low-income communities.
T5.2. Pilot citywide bike and community bike share programs.
T5.3. Provide model codes to municipalities for bike parking minimums and design.

Strategy T6: Design communities for pedestrian and cyclist safety.

Promoting mixed-use development, where residential, commercial and recreational areas intersect, makes walking and cycling safer, more convenient and practical for daily commuting.

- **T6.1.** Collaborate with local governments, Metropolitan Planning Organizations and state agencies to encourage compact, mixed-use development, especially near transit and central business districts.
- **T6.2.** Provide assistance to local governments to support reducing or eliminating minimum parking requirements.
- **T6.3.** Develop pedestrian- and cyclist-only interconnections between businesses and residential areas.
- **T6.4.** Invest in infrastructure upgrades to increase safety, such as signaling at crosswalks and intersections, raised crosswalks and traffic calming measures.
- **T6.5.** Improve community engagement in transportation planning by establishing more inclusive, transparent and consistent processes.

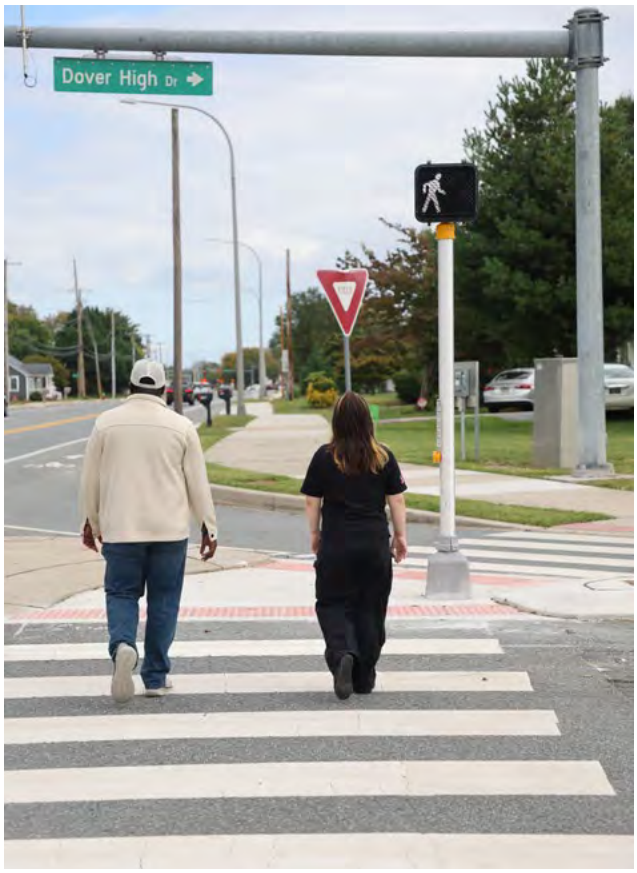
A "complete street" in Newark. Complete streets are streets designed to be safe and accessible for all users, including pedestrians, cyclists, motorists and transit riders. **PHOTO: DELDOT**

Bicycle riders in Dover. **PHOTO: DELDOT**

Strategy T7: Expand multimodal transportation infrastructure funding.

Increased investment can accelerate the build-out of projects that reduce vehicle dependence and support more sustainable travel modes.

- **T7.1.** Increase DelDOT Cycling Infrastructure Innovation Fund.
- **T7.2.** Continue to explore and maximize opportunities for active transportation infrastructure and innovation using state transportation funds.
- **T7.3.** Support funding for education/access programs — e.g., DelDOT's Safe Routes to School program.



Two pedestrians using a crosswalk in Dover.
PHOTO: DELDOT

GOAL: REDUCE LIGHT-DUTY VEHICLE TAILPIPE EMISSIONS AND ACCELERATE ZERO-EMISSION VEHICLE DEPLOYMENT

Reducing tailpipe emissions from light-duty vehicles is a cornerstone of Delaware's strategy to achieve net-zero emissions by 2050. Light-duty vehicles account for the majority of vehicles on the road and are the largest component of transportation emissions. Increasing the adoption of zero-emission vehicles can significantly reduce greenhouse gas emissions while improving air quality and public health outcomes.

Strategy T8: Improve accessibility and feasibility of zero-emission vehicles for all Delawareans.

Widespread electric vehicle adoption is critical for reducing transportation emissions and ensuring all Delawareans can access and use zero-emission vehicles. Additionally, electric vehicle drivers experience lower vehicle operating costs, reduced maintenance needs, and the convenience of charging at home or on the go.

- **T8.1.** Expand state incentive programs for electric and plug-in hybrid electric vehicle purchases and leases.
- **T8.2.** Establish local electric vehicle car sharing programs to support access to zero-emission vehicle mobility for populations with limited access to personal vehicles.
- **T8.3.** Launch an electric vehicle facilitator program offering technical assistance and guidance to support residents and businesses adopting electric vehicles.

An electric vehicle using a solar-powered charging station. **PHOTO: DNREC**

EV Parking Space Symbol. **PHOTO: DNREC**

Strategy T9: Expand education and outreach to highlight the benefits of electric vehicles.

Expanding outreach helps Delawareans make informed decisions about electric vehicles by addressing common questions and concerns. Increasing awareness of the benefits of electric vehicles, such as cost savings, reduced maintenance and cleaner air, can accelerate adoption.

T9.1. Collaborate with schools to incorporate clean transportation topics into driver education, environmental science and vocational programming.

T9.2. Co-host electric vehicle ride-and-drives and dealer open houses, translate materials and use trusted messengers to share information about electric vehicles, rebates and charging with overburdened and under-resourced communities.

Strategy T10: Ensure convenient, reliable and abundant access to electric vehicle charging stations.

Though most electric vehicle drivers will be able to complete up to 80% of all charging at home, ample public charging infrastructure is critical to supporting electric vehicle adoption. Increasing availability and ease of charging will help more Delawareans confidently transition to electric vehicles.

T10.1. Create model ordinances for local governments to streamline permitting and installation of vehicle charging stations.

T10.2. Launch a pilot program for on-street charging.

T10.3. Expand state incentive programs for electric vehicle infrastructure.

T10.4. Consider implementing consumer protections related to electric vehicle charging.

Royal Farms EV Charging Station. **PHOTO: DNREC**

GOAL: REDUCE TAILPIPE EMISSIONS FROM MEDIUM- AND HEAVY-DUTY VEHICLES

Medium- and heavy-duty vehicles make up a small portion of total vehicles on the road but account for more than a quarter of transportation emissions due to their size and high fuel use. As technology improves, Delaware can lead in preparing infrastructure for electric- and hydrogen-fueled medium- and heavy-duty vehicles, supporting key freight corridors that align with a net-zero future.

Strategy T11: Incentivize the adoption of electric medium- and heavy-duty vehicles.

Medium- and heavy-duty vehicles are responsible for a disproportionate share of transportation emissions, particularly in freight corridors and near industrial zones. Supporting the electrification of these vehicles through incentives and strategic infrastructure investments can yield substantial greenhouse gas reductions while also improving air quality for Delaware's communities.

T11.1. Identify locations and deploy charging infrastructure for medium- and heavy-duty electric vehicles through the multi-state Clean Corridor Coalition.

Strategy T12: Advance implementation of school bus electrification and charging infrastructure.

Delaware law requires the Department of Education to procure an increasing percentage of zero-emission school buses each year, with at least 30% of new bus purchases required to be electric by 2030. Advancing this transition will require strategic investments in charging infrastructure and targeted incentives.

T12.1. Continue efforts to address challenges and opportunities for installation and operation of school bus charging stations.
T12.2. Encourage electrification of privately contracted school buses.

Strategy T13: Reduce emissions associated with freight and shipping operations.

Freight and shipping operations represent a significant source of transportation emissions that can be reduced through improved operational practices and fleet modernization. Supporting idle reduction technologies, route optimization, last-mile delivery innovations, and accelerated adoption of zero-emission vehicles will help freight businesses lower their carbon footprint while improving efficiency and reducing operating costs.

T13.1. Support the adoption of idle mitigation strategies and logistics management strategies.
T13.2. Encourage freight businesses to adopt best practices for route optimization, last mile solutions and mode switching.
T13.3. Improve marketing of existing incentive programs for fuel switching to accelerate the transition to zero-emission vehicles.

Strategy T14: Assess the feasibility of adopting emerging low-carbon fuels.

Emerging low-carbon fuels, such as renewable diesel, clean hydrogen and renewable natural gas, offer promising pathways to reduce emissions from hard-to-electrify vehicle segments, including heavy-duty trucks and off-road equipment. Assessing the feasibility of these fuels — alongside infrastructure and pilot opportunities — will help identify where they can play a meaningful role in Delaware's decarbonization strategy.

T14.1. Assess potential applications for hydrogen fuel cells, renewable natural gas, and renewable diesel where feasible.
T14.2. Work with industry partners to understand fueling infrastructure needs for alternative fuels.
T14.3. Explore pilot projects to test emerging low-carbon fuels in sectors where emissions are difficult to reduce.

View of Wilmington Airport. PHOTO: ADOBE STOCK

GOAL: REDUCE EMISSIONS FROM OFF-ROAD ENGINES AND EQUIPMENT

Reducing emissions from off-road engines and equipment is an important opportunity for Delaware, as these sources, including lawn-care equipment, marine vessels and aircraft, collectively account for over 20% of transportation emissions. While some off-road engines, such as residential and commercial lawn tools, are small, they can emit more pollution by volume than vehicles.

Strategy T15: Reduce greenhouse gas emissions from lawn-care equipment.

Small off-road engines used in lawn-care equipment — such as mowers, leaf blowers and trimmers — are disproportionately high emitters of greenhouse gases and air pollutants. Reducing these emissions through electrification, incentive programs and education can improve air quality, lower noise pollution and support a healthier environment in residential and commercial areas across the state.

T15.1. Expand existing and create new programs to incentivize the electrification of commercial lawn equipment.

T15.2. Work with affordable housing partner organizations to provide zero-emission lawn-care equipment to new homeowners, especially in overburdened or under-resourced communities.

T15.3. Launch an outreach campaign to educate residents, landscaping professionals and property managers on the benefits of zero-emission lawn-care equipment.

Strategy T16: Explore opportunities for sustainable aviation fuel.

Sustainable aviation fuel is a low-carbon alternative to conventional jet fuel derived from renewable feedstocks such as waste oils and agricultural byproducts. This fuel is chemically similar to conventional jet fuel but emits significantly fewer lifecycle greenhouse gas emissions and can be used in existing aircraft with no infrastructure changes.[33]

T16.1. Track innovations in sustainable aviation fuel production and potential opportunities for Delaware agricultural producers.

T16.2. Explore pathways and incentives for increasing the use of sustainable aviation fuel.

Strategy T17: Support electrification of vessels and equipment at Delaware ports and ferry terminals.

Electrifying ferries, cargo-handling equipment and other operations at Delaware's ports and terminals can reduce greenhouse gas emissions and improve local air quality. Pilot programs, infrastructure investments and utility coordination are key to transitioning away from diesel-powered equipment and supporting the use of clean energy in the maritime industry.

T17.1. Consider pilot programs for port equipment electrification and renewable shore power.

T17.2. Reduce barriers to electrification by working with utilities to reduce electricity demand charges.

Cape May-Lewes Ferry. PHOTO: CREATIVE COMMONS

INDUSTRY

Historic Wilmington in 1931, showing industrial activity on the riverfront. **PHOTO: DELAWARE PUBLIC ARCHIVES**

Industrial activity in Delaware dates to the 1700s when the Brandywine River powered mills that produced goods including flour, cloth and gunpowder.[34] Today, the manufacturing of pharmaceuticals, medicines, pesticides, fertilizers and chemicals along with oil refining drives Delaware's industries. Food processing and fabricated metals manufacturing are also significant components of the state's economy. Delaware's manufacturing economy includes nearly 600 companies that employ more than 35,000 people and contribute billions of dollars annually to the state's economy.[35]

The industry sector is Delaware's third largest source of greenhouse gas emissions, producing 23.1% of statewide emissions. This share is 7.3% lower than in 2005, primarily due to a decrease in statewide industrial activity.[36] With no additional actions to reduce emissions, industrial emissions are projected to grow, overtaking transportation as Delaware's leading source of emissions by 2050.[37]

Petroleum refining currently represents the largest portion of industrial emissions, followed by chemicals manufacturing, and other non-energy-producing industries.[38] Reducing emissions in the industry sector is challenging because effective reduction technologies depend on factors such as facility size, manufacturing processes and location.

Nonetheless, achieving the state's emissions reduction target depends on reducing emissions across all industries.

FOUNDATIONAL POLICIES AND PROGRAMS

Several policies and programs have been instrumental for developing and advancing momentum for industrial decarbonization in Delaware. Key initiatives include:

Delaware State Energy Plan

In 2024, DNREC published the 2024-2028 Delaware State Energy Plan, which outlines strategies to achieve the state's energy goals. The plan discusses the role of industry in fulfilling the State's energy goals by pursuing lower-emissions sources of energy such as renewable energy, nuclear power and hydrogen, as well as through carbon capture and storage.[39]

Mid-Atlantic Industrial Assessment Center

Housed at the University of Delaware and funded by the U.S. Department of Energy, the Mid-Atlantic Industrial Assessment Center is one of several nationwide Industrial Training and Assessment Centers. It provides technical assistance to small- and medium-sized industrial facilities, identifying cost savings in energy use and waste reduction, often leading to improved efficiency and lower waste generation. The center has completed 235 audits, resulting in savings of $43.55 million for the facilities through reducing energy usage by 4.44 trillion Btu.[40]

U.S. Department of Energy Better Buildings Initiative

The U.S. Department of Energy's Better Buildings Initiative helps partners achieve portfolio-wide emissions and efficiency goals through two key initiatives: the Better Climate Challenge and the Better Plants Program. The Better Climate Challenge commits participants to cut direct and indirect greenhouse gas emissions by at least 50% within 10 years, and the Better Plants Program supports reductions in energy, waste and water use. In return for technical assistance, participants share data, solutions and best practices to advance decarbonization across the sector. The State of Delaware participates in the Better Buildings Initiative, while Chemours and W. L. Gore & Associates, Inc., are participants of both the Better Climate Challenge and the Better Plants Program. There are several other companies headquartered in other states with operating facilities in Delaware that also participate in these programs.[41]

The Mid-Atlantic Industrial Assessment Center at the University of Delaware. **PHOTO: MID-ATLANTIC INDUSTRIAL ASSESSMENT CENTER**

Greenhouse Gas Mandatory Reporting Program

Delaware participates in the U.S. Environmental Protection Agency's Greenhouse Gas Mandatory Reporting Program. This program requires industries emitting more than 25,000 $MTCO_2e$ annually to report their emissions.[42]

RECENT PROGRESS

Since the publication of the 2021 Climate Action Plan, the state has built stronger relationships with industry stakeholders and advanced the science and infrastructure for low-carbon fuels and feedstocks, particularly hydrogen.

Relationship Building with Industrial Facilities and Organizations

Since 2021, DNREC has cultivated relationships with over 30 industrial facilities and organizations across chemicals, food and beverage, fabricated metals, and science and technology sectors, conducting ten in-depth stakeholder conversations that informed this plan. These new relationships have strengthened Delaware's capacity to develop and implement targeted decarbonization solutions that align with both state climate goals and industrial facility needs.

Designation of Mid-Atlantic Clean Hydrogen Hub

In October 2023, the U.S. Department of Energy selected the Mid-Atlantic Clean Hydrogen Hub (MACH2) for up to $750 million in federal funding. The Hydrogen Hub proposes to support and commercialize the production, consumption and connective infrastructure of clean hydrogen in Delaware, southeastern Pennsylvania and southern New Jersey to reduce emissions from heavy industry and transportation, reducing an estimated 25 $MMTCO_2e$.[43]

Continued Phaseout of High Global Warming Potential Gases: Hydrofluorocarbons

Building on the 2021 Climate Action Plan's hydrofluorocarbon (HFC) phase-out strategy, Delaware's hydrofluorocarbon regulation advanced emission reductions by restricting hydrofluorocarbons in air conditioning, refrigeration, aerosol propellants and foam end-uses for new equipment. Most hydrofluorocarbons were phased out by September 2021, with full phase-out completed by January 1, 2024.[44]

PATHWAY TOWARD NET-ZERO EMISSIONS

The industry sector is the third largest source of greenhouse gas emissions in Delaware, accounting for 23.1% of statewide emissions in 2021, and is projected to become the leading source by 2050. This sector presents one of the state's most significant opportunities for emission reductions through increased energy efficiency, a transition to low-carbon energy sources and the deployment of emerging technologies. Market-ready solutions such as efficiency upgrades and fuel switching can be widely implemented today, while innovations including low-carbon hydrogen production, and carbon capture, utilization and storage are rapidly advancing through pilot and demonstration projects. Full deployment of these measures can reduce emissions, improve community air quality, lower industrial operating costs, stimulate innovation and deliver positive economic benefits.

Between 2005 and 2021, emissions from the industry sector decreased by 7.3%, primarily due to a decline in statewide industrial activity.[45] Emissions in this sector can be broadly categorized as originating from either refining or manufacturing operations, with refining being the largest source. Emissions reduction in the industry sector is challenging because effective reduction technologies depend on factors such as facility size, manufacturing processes and

location. Nonetheless, reducing greenhouse gas emissions from the industry sector is crucial for Delaware to meet its climate goals.

To define a pathway toward net-zero emissions by 2050, modeling incorporated the impact of a suite of potential future actions, including energy efficiency improvements, low-carbon fuel adoption, low-carbon hydrogen production, and carbon capture, utilization and storage deployment. With full implementation, these measures can reduce industry sector emissions by 91% by 2050, positioning Delaware to meet its long-term climate goals. Implementing emission reductions strategies modeled for refining operations alone could avoid 23.6 $MMTCO_2e$ cumulatively between 2025 and 2050.[46] Figure 4.6 shows historic and modeled future emissions in the industry sector.

Modeling Assumptions

The following are the key assumptions made in modeling emissions reductions from the industry sector:[47]

- Energy efficiency in refining operations will improve by 33% by 2050.
- 27% of natural gas consumption by refining operations could be replaced with zero emission fuels.
- Carbon capture infrastructure will focus on refining operations and be constructed by 2038.
- In non-refining industrial subsectors, 72% of non-refining industrial gas demand is met using low-carbon fuels by 2050.

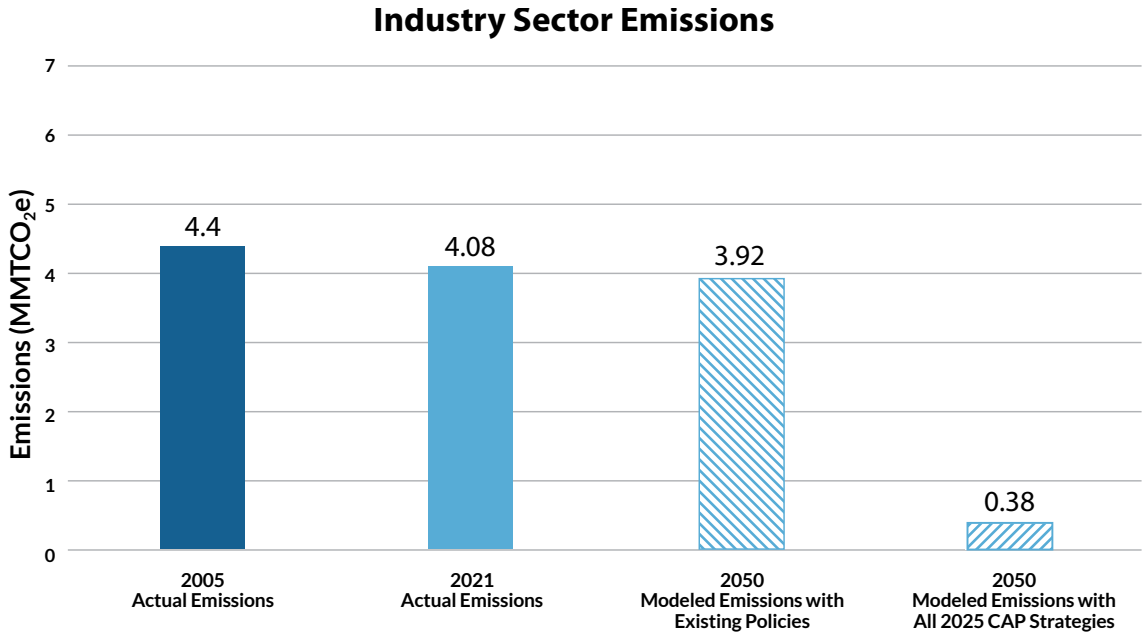


FIGURE 4.6. *Industry sector emissions under modeled scenarios.*

Combined Heat and Power

In some industrial processes, fossil fuels cannot yet be fully eliminated. Pairing these processes with combined heat and power systems can reduce emissions by improving energy efficiency. Diesel combined heat and power generators produce electricity while capturing 60% to 70% of heat energy that would otherwise be lost as waste heat.[48] Fuel cells, which use electrochemical processes instead of combustion, offer cleaner combined heat and power operation, but they are currently more expensive to install than conventional power systems. Microturbines can operate using both combustion and electrochemical processes.[49]

District Heating

District heating involves generating heat in a centralized location and then distributing it through insulated pipes to nearby residences, businesses and industry.[50] In industrial settings, this can include capturing waste heat from manufacturing and supplying it to nearby residential or commercial buildings, reducing both emissions and heating costs. For example, some European steel plants capture process heat and supply it to municipal district heating systems to warm nearby homes, demonstrating how industrial waste heat can be a valuable community resource.

STRATEGIES AND ACTIONS

While industrial facilities vary in type, size, equipment and manufacturing processes, decarbonizing this sector is critical for achieving net-zero emissions by 2050. The industry sector is the third largest emissions source and is projected to be the largest by 2050 if decarbonization strategies are not implemented. These strategies integrate insights from net-zero emissions pathway modeling, research and collaboration with subject matter experts. Beyond emission reductions, these recommended strategies will improve environmental quality, create new industries, improve human and environmental health and advance Delaware's economy.

GOAL: SUPPORT DATA COLLECTION, TECHNICAL ASSISTANCE AND REGIONAL COOPERATION

Technical assistance, incentives and targeted programs can help overcome the financial, workforce, knowledge and time constraints that limit industrial decarbonization. The following strategies reflect input from industrial facilities and organizations on both opportunities and challenges for reducing greenhouse gas emissions in the sector.

Strategy I1: Help industrial facilities decarbonize.

Industrial decarbonization leaders in Delaware and across the mid-Atlantic region often credit early goal-setting and robust support mechanisms as key drivers of success. This strategy focuses on delivering targeted technical assistance to small- and medium-size enterprises that lack the resources to decarbonize independently.

I1.1. Explore the tools and technical assistance needed to assist businesses to create short- and long-term decarbonization plans.

I1.2. Establish a community of practice for industrial organizations and businesses engaged in advancing sustainability.

Strategy I2: Develop comprehensive industrial emissions policies through regional collaboration and improved reporting.

This strategy leverages both new and existing policies and frameworks to improve emissions data collection and management. Better data will strengthen Delaware's understanding of industrial emissions, enabling more effective prioritization and allocation of resources to accelerate decarbonization.

I2.1. Expand State and Local Emissions Inventory System (SLEIS) to require more complete emissions inventories, including greenhouse gases.

I2.2. Evaluate the feasibility of a regional industrial cap-and-trade program, including emissions reduction potential and community and economic costs and benefits.

What is SLEIS?

The State and Local Emissions Inventory System facilitates "the collection and reporting of air emissions inventory information." Facilities emitting certain pollutants submit this data to comply with the federal Clean Air Act. Delaware uses SLEIS to track emissions from industrial sources across the state, helping regulators monitor air quality and ensure facilities meet federal standards.

Industrial smokestacks and flare stacks at the Delaware City Refinery. **PHOTO: ADOBE STOCK**

GOAL: ADVANCE ENERGY EFFICIENCY IN INDUSTRIAL BUILDINGS AND PROCESSES

Energy efficiency involves reducing the energy required to produce the same or greater output. Emissions modeling for this plan shows that improving efficiency in refining processes could reduce industrial-sector emissions by 33%.[51] Opportunities to improve energy efficiency exist today for nearly all industry types and are expected to continue to increase.

Strategy I3: Advance on-site energy storage at industrial facilities.

Energy storage systems reduce energy loss by capturing and reusing waste heat. These systems also support electrification because they reduce reliance on a centralized grid, thereby increasing opportunities for powering operations with clean and renewable on-site energy at industrial facilities.

I3.1. Facilitate pilot projects to develop case studies and proofs-of-concept for energy storage.
I3.2. Support investments and incentives for industrial battery storage to reduce demand charges and improve grid reliability.
I3.3. Explore the feasibility of thermal and chemical energy storage systems.

Strategy I4: Advance deployment of combined heat and power technology and energy-efficient equipment at industrial and manufacturing facilities.

Combined heat and power systems produce both heat and electricity from a single power source, offering significant efficiency gains over separate production. These systems are already in use in the industry sector and adoption can be accelerated through targeted incentives and financing.

I4.1. Explore improved financing mechanisms for energy-efficient combined heat and power systems and large industrial equipment.
I4.2. Conduct feasibility analyses for on-site use of captured waste heat.
I4.3. Explore the potential for industrial district heating systems to share waste heat with nearby buildings.

GOAL: ADVANCE ELECTRIFICATION IN INDUSTRIAL BUILDINGS AND PROCESSES

Electrifying industrial buildings and processes can substantially reduce greenhouse gas emissions, particularly as the electric grid is decarbonized. Many electrified technologies are already commercially available, and ongoing innovation will expand the range of viable applications. Electrification is especially relevant for manufacturing processes, where it can replace less efficient, fuel-based systems.

Strategy I5: Electrify low-temperature industrial heat processes.

Heat generation drives a large share of industrial energy use, much of it through fuel combustion. Commercial-scale technologies already exist to electrify lower temperature processes, reducing emissions and improving efficiency.

I5.1. Support pilot programs for electric and hybrid boiler replacements for low-pressure steam boilers.
I5.2. Support pilot programs for industrial heat pumps.
I5.3. Explore incentives for electric ovens and fryers in industrial food preparation.
I5.4. Explore incentives to replace low-pressure steam boilers with industrial heat pumps.

Strategy I6: Prepare for technology advancements for medium- and high-temperature industrial heat processes.

Medium- and high-temperature processes account for a significant share of industrial energy demand in industries such as refining, but technology is at varying stages of development. As the grid is decarbonized and expands capacity, electrifying these processes will yield substantial emission reductions.

I6.1. Support research, development and pilot projects to replace hydrocarbon-based heat with electricity.
I6.2. Conduct a feasibility analysis of using heat pumps for hot oil heating.

GOAL: ADVANCE LOW-CARBON FUELS, FEEDSTOCKS AND ENERGY SOURCES

Another key to reducing industrial sector emissions is low-carbon fuels, feedstocks and energy sources. These fuels and energy sources are particularly relevant to industrial applications in which electrification is not yet possible.[52]

Extreme flash steam occurring at a power plant. Flash steam recovery is a common energy efficiency measure in industrial settings. Recovery of the flash steam at this site as hot water for the plant's processing systems saves over $10,000/year in natural gas costs. **PHOTO: UNIVERSITY OF DELAWARE**

Strategy I7: Advance the production and use of low-carbon fuels and energy sources.

Low-carbon fuels are needed to reduce emissions where electrification is technologically or economically impractical.

I7.1. Develop incentives for on-site renewable energy systems at industrial facilities.
I7.2. Evaluate the potential for biofuel production and use in applications where emissions reductions are most difficult.
I7.3. Assess renewable natural gas potential and opportunities to expand fueling station infrastructure.

Strategy I8: Advance the use of low-carbon feedstocks.

Low-carbon feedstocks are industrial input materials and chemicals produced through low-emission processes or recovered through reuse and recycling, avoiding the impacts of extracting and processing virgin feedstocks.

I8.1. Provide economic incentives for storing and reusing materials.
I8.2. Facilitate material and waste exchange among facilities via pilot programs and demonstration projects.

Understanding Clean Hydrogen

Hydrogen fuel can be produced using different processes and energy sources, resulting in widely varying greenhouse gas emissions. It can be particularly helpful in hard-to-electrify areas such as heavy industry and chemical manufacturing processes. As Delaware explores potential uses of hydrogen, the method by which the hydrogen fuel is produced matters. Only clean hydrogen produced by methods that generate little to no greenhouse gas emissions should be advanced as part of Delaware's strategies to reach net-zero emissions. Common clean production pathways include:

- Electrolysis powered by renewable energy, which splits water into hydrogen and oxygen, producing zero greenhouse gas emissions.
- Reforming natural gas paired with carbon capture, which can keep emissions very low.
- Other emerging, low-emissions methods, such as hydrogen produced from nuclear energy.

Strategy I9: Encourage technological advancement of clean hydrogen production and applications in industry sector processes.

Delaware's history in chemical manufacturing positions it to be a leader in advancing clean hydrogen technologies. Industrial facilities have shown strong interest in using clean hydrogen to reduce emissions, particularly in processes that cannot be electrified. However, hydrogen deployment should be targeted to applications where it delivers the greatest benefit, ensuring

hydrogen is not diverted from other high-impact sectors such as buildings, power generation and transportation.

I9.1. Support research and development on clean hydrogen production.
I9.2. Support pilot projects for clean hydrogen end-uses.
I9.3. Maintain partnerships to support the emerging regional clean hydrogen innovation industry.

Strategy I10: Prepare Delaware for the clean hydrogen industry.

Advancing clean hydrogen production and use will require close coordination across government, industry and research institutions, along with robust regulatory and safety frameworks to guide development, ensure appropriate end-uses and allocate resources effectively.

I10.1. Conduct a legal analysis to prepare for permitting and regulation of hydrogen production, refining and use, including pipeline readiness.
I10.2. Investigate opportunities and challenges for clean hydrogen production and end-uses in applications where emission reductions are most difficult.
I10.3. Support workforce training and development for clean hydrogen technology and end-uses.
I10.4. Partner with emergency managers to establish clear safety protocols, identify potential emergency response needs, and ensure community safety.

GOAL: ADVANCE DEVELOPMENT OF CARBON CAPTURE, UTILIZATION AND STORAGE

Carbon capture, utilization and storage technologies collect carbon from industrial equipment or the atmosphere. The captured carbon can be reused for fuel, repurposed in other processes or permanently stored. Carbon capture, utilization and storage technologies compensate for emissions from fuel gas combustion and process emissions that remain after other strategies are applied. Without it, Delaware cannot reach net-zero industrial emissions.

Strategy I11: Support the development and scaling of carbon capture, utilization and storage.

Carbon capture, utilization and storage technologies are advancing rapidly. Pilot projects already show their potential to cut industrial emissions. To scale them up in Delaware, coordinated support is needed to address regulations, infrastructure and financing.

I11.1. Conduct a comprehensive assessment of carbon capture technology deployment opportunities across Delaware's industry sector.
I11.2. Develop a regulatory framework and identify suitable sites for carbon capture, utilization and storage as well as pipeline infrastructure.
I11.3. Identify financing mechanisms and incentives for pilot projects and deployment.

ELECTRICITY GENERATION AND GRID INFRASTRUCTURE

High voltage power lines. **PHOTO: SHUTTERSTOCK**

The electricity generation and grid infrastructure sector includes the generation, transmission, distribution and consumption of electricity that powers nearly every aspect of daily life in Delaware, from lighting homes and businesses to heating buildings and charging electric vehicles. Reducing emissions from the generation of electricity undergirds emissions reductions in other high emission sectors, particularly industry, buildings and transportation.

Electricity generation, including imported electricity, accounts for 26.9% of Delaware's total greenhouse gas emissions. Since 2005, emissions from electricity generation and use have declined by 53.7%, the most of any sector in Delaware. These reductions were driven primarily by reduced industrial-sector demand, a shift from coal to natural gas for power generation and expanded renewable energy deployment. At the same time, decreases in the costs of renewable energy technology, coupled with enabling policies such as the Renewable Energy Portfolio Standards Act, have helped drive increases in renewable energy generation statewide.[53]

In 2024, natural gas fueled 83% of Delaware's total in-state electricity generation, while coal-fired generation fell to 3%. Delaware's last coal-fired power plant at Indian River closed in 2025. Approximately 9% of in-state electricity generation came from renewable sources in 2024, including 8% from solar energy.[54] Delaware generates about two-thirds of its peak summer demand in-state, and the remaining third is imported from the PJM Grid.[55] Delaware's net-zero emissions

future relies on increasing in-state clean and renewable energy production and ensuring that imported energy is also clean.

FOUNDATIONAL POLICIES AND PROGRAMS

Delaware's first renewable energy law was enacted in 2005. Since then, state and federal programs have laid the foundation for Delaware's transition to a net-zero electric grid. These policies and programs initially focused on renewable energy, but the scope of recent legislation has expanded to include energy storage and other carbon-free sources, such as nuclear power. Several key policies are highlighted below. A more comprehensive list of state energy policies and programs is available in Appendix A.

Renewable Energy Portfolio Standards

First enacted in 2005, the Renewable Energy Portfolio Standards Act requires Delaware electric utilities to source 40% of their electricity supply from renewable sources such as wind and solar by 2035. The act establishes a market in Delaware that allows utilities to meet the standard by purchasing renewable energy credits and solar renewable energy credits.

Regional Greenhouse Gas Initiative

Delaware, along with nine other states, regulates carbon dioxide emissions from power generators through a regional, market-based program known as the Regional Greenhouse Gas Initiative. This program sets a cap on emissions in the region, which declines over time. Electricity generators must purchase allowances for each ton of carbon dioxide emitted from their facility. Auction proceeds are returned to states to invest in energy efficiency and renewable energy initiatives.

Federal Tax Incentives

The federal government offers several tax incentives or credit programs for qualifying renewable energy projects, including the Renewable Electricity Production Tax Credit, Investment Tax Credit, Residential Energy Credit and Modified Accelerated Cost Recovery System. However, the federal government will end or phase out most of these programs starting in 2025. Without action to extend or replace them, Delaware's ability to scale up renewable energy will be limited and progress toward achieving energy and climate goals will slow.

RECENT PROGRESS

Since the publication of the last Climate Action Plan, Delaware has made progress in transforming the electricity generation sector. From updating the state's comprehensive plan for energy to preparing for new technologies, Delaware is putting in place the foundation for the clean energy grid of the future. Highlights are outlined on the following pages.

Retired in 2025, the Indian River Power Plan near Dagsboro was Delaware's last coal-fired power plant.
PHOTO: MIKE MAHAFFIE

Diamond State Solar Farm in Greenwood, Delaware. PHOTO: CHELSEA WOOTTEN

State Energy Plan

Delaware's State Energy Plan was updated in 2024 for the first time in over a decade, marking a major milestone in Delaware's energy planning and climate policy. The State Energy Plan outlines key strategies for transitioning Delaware's electricity generation to renewable and zero-carbon energy sources, modernizing the state's aging electric grid, and prioritizing equity and energy justice. It also identifies research and market analysis needs to support strategy implementation and help inform future Climate Action Plan updates.[56]

Offshore Wind Procurement

Amendments to the Energy Solutions Act of 2024 establish a framework for Delaware to solicit and approve cost-effective offshore wind projects. The law authorizes the State Energy Office and Public Service Commission to issue solicitations for up to 1,200 megawatts (MW) of offshore wind energy procurement. It also streamlines onshore transmission installations and promotes regional coordination on offshore wind policy and procurement.

Energy Affordability

In 2025, energy affordability emerged as a statewide priority after utility customers experienced high energy bills during an unusually cold winter. In response, lawmakers enacted 11 key energy and consumer protection laws. Summaries of these laws are provided in Appendix A. These laws advance progress in several areas, including increased consumer transparency, discounted utility rates for low-income households, support for transmission upgrades, and exploration of pilot programs for energy storage.

Solar Deployment

Delaware has made significant progress in expanding solar energy statewide, including rooftop, utility-scale and community solar installations, despite persistent delays in the utility interconnection process. Since 2023, the state has added 2,100 new installations totaling an estimated 35 MW of new capacity, bringing Delaware's total installed solar to over 300 MW and reflecting steady growth in its renewable portfolio.[57]

Nuclear Energy

In 2025, the legislature created the Delaware Nuclear Energy Feasibility Task Force to examine the feasibility, economic impact, regulatory considerations, reliability and environmental impacts of deploying small modular reactors in Delaware. This represents an important step in exploring all viable carbon-free energy options to support Delaware's long-term goals to improve grid reliability, energy affordability and emission reductions.

PATHWAY TOWARD NET-ZERO EMISSIONS

Delaware can reduce emissions from the electricity sector to nearly zero by 2050, even as electricity demand increases over the coming decades. Achieving a cleaner electricity grid is especially important because clean and renewable energy also underpins emission reductions strategies in the transportation, buildings and industry sectors.

Between 2005 and 2021, emissions from electricity consumed in Delaware decreased from 10.23 to 4.74 $MMTCO_2e$, a 54% reduction over 16 years. This significant progress is attributable to a few key drivers:

Solar plus storage system. **PHOTO: DEMEC**

state policies and programs such as the Renewable Energy Portfolio Standards Act and Regional Greenhouse Gas Initiative, the shift to natural gas electricity generation, federal regulations, incentive programs and neighboring states' transition to renewable and zero-carbon electricity. These regional trends are accelerating reductions in Delaware's electricity-related emissions.

By 2050, modeling suggests that with the continuation of Delaware's current policies and programs, emissions from the electricity sector could decline to 1.15 $MMTCO_2e$. The existing policies included in this modeling are the Regional Greenhouse Gas Initiative, the Renewable Energy Portfolio Standard and federal regulations. Potential emission reductions from existing policies and programs represent an optimistic outlook due to recent federal actions that rolled back key regulations, tax credits and incentive programs.

To define a pathway toward net-zero emissions by 2050, modeling incorporated the impact of a suite of potential future actions including: increased in-state solar electricity generation, offshore wind energy, battery storage capacity, and clean hydrogen production, declining use of imported

electricity, and keeping some combustion turbine capacity online through 2050. With full implementation, these actions can reduce electricity generation sector emissions to 0.27 $MMTCO_2e$, representing a reduction of 97.3% from 2005 levels. Figure 4.7 shows historic and modeled future emissions in the electricity generation sector.

Modeling Assumptions

The following are key assumptions made in modeling emissions reduction from Delaware's energy sector:[58]

- In-state solar electricity generation capacity would be over 3 GW by 2050.
- Offshore wind would provide 1.6 GW of electricity by 2050.
- 400 MW of wind energy would be dedicated to clean hydrogen production.
- Battery storage capacity would grow alongside new solar capacity with a significant amount also supporting offshore wind after 2040.
- The relative share of energy produced out-of-state decreases over time.

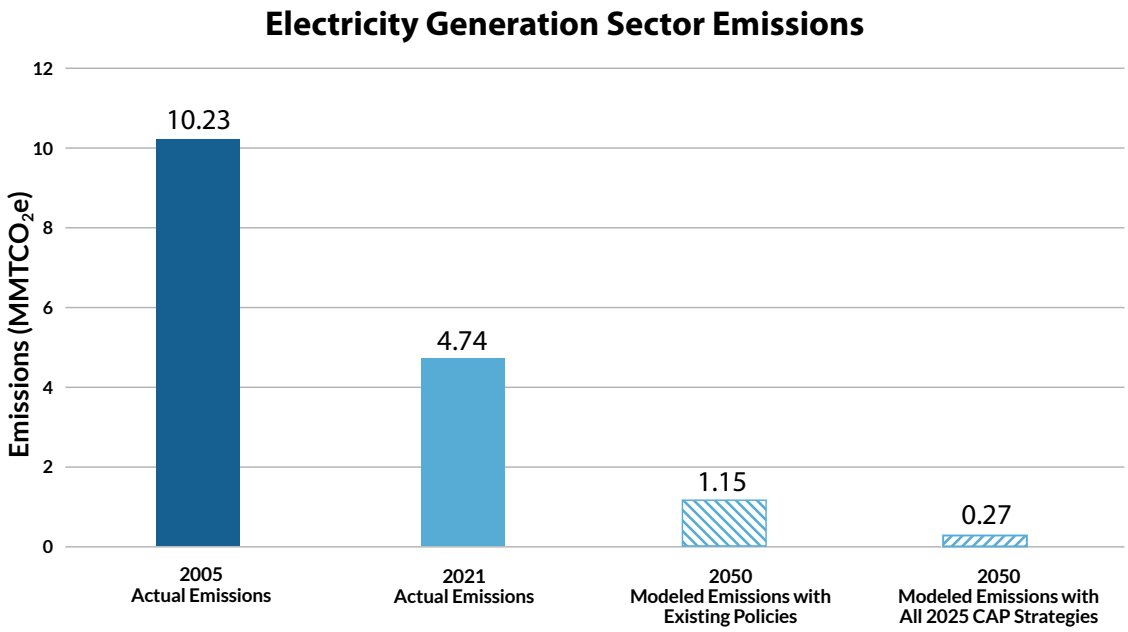


FIGURE 4.7. *Electricity generation sector emissions under modeled scenarios.*

STRATEGIES AND ACTIONS

A decarbonized electric grid is Delaware's largest emission reductions opportunity, as it supports both emission reductions directly from energy production and enables emission reductions in other sectors. This section details strategies and actions that can be implemented in the next

5 years and identifies goals and targets that will accelerate the decarbonization of Delaware's electric grid. These strategies and actions are designed to expand renewable energy deployment; encourage the exploration of new, emerging clean energy technologies; and promote energy equity, all while maintaining grid reliability and resilience.

GOAL: ACCELERATE DEPLOYMENT OF SOLAR AND WIND ENERGY

A net-zero emissions future relies on a clean and renewable electricity grid dominated by wind and solar. While Delaware still relies heavily on fossil fuels for electricity generation, the state has made steady progress in expanding the role of renewable energy in its power mix over the last decade. However, to achieve the state's greenhouse gas emission reductions targets, Delaware must transition to 100% clean and renewable energy by 2050.

Strategy E1: Increase grid-scale solar capacity statewide.

Deploying large-scale solar facilities to generate power increases Delaware's in-state electricity production. By 2050, modeling suggests Delaware would need more than 2,000 MW of utility-scale solar energy to meet its goals. Efforts to expand solar generation will need to balance agriculture, natural resource and economic needs with careful assessment of site suitability before development.

E1.1. Develop a statewide approach to solving interconnection delays and accelerating the permitting, siting and installation of grid-scale solar projects.
E1.2. Expand financing opportunities for solar energy projects with additional incentives for nonprofit and local government ownership of community solar.
E1.3. Develop solar energy project siting guidance to support identification of optimal sites based on site conditions, land use, equity, natural resources and other concerns.
E1.4. Develop new community solar programs with a focus on providing low- to moderate-income customers with improved access to clean energy.

GE Aviation's solar array in Newark, Delaware.
PHOTO: DALE DAVIS, CMI SOLAR & ELECTRIC

Solar panels on Ashland Nature Center.
PHOTO: JESSICA QUINN, DNREC

The University of Delaware's 2 MW wind turbine in Lewes, Delaware. PHOTO: ADOBE STOCK

Strategy E2: Increase distributed solar capacity statewide.

Small-scale, behind-the-meter solar deployments such as rooftop solar save consumers money, reduce grid load during peak times and help reduce electricity prices. By 2050, modeling suggests Delaware would need more than 1,100 MW of distributed solar to reach its goals.

E2.1. Launch an initiative to support developers, property owners and residents that are considering solar and energy efficiency upgrades.
E2.2. Establish solar incentive programs for municipal and cooperative electric customers.
E2.3. Expand existing renewable energy incentive programs to include solar plus storage systems.
E2.4. Establish standards for the safe interconnection of small-scale residential solar units, such as balcony and plug-in solar.

Strategy E3: Advance the development and scaling of offshore wind.

Offshore wind is the most feasible utility-scale renewable power source for coastal states. Modeling suggests Delaware's net-zero emissions future would include at least 1,600 MW of wind energy production, requiring strong partnerships and coordination to make progress on new installations.

E3.1. Engage local governments and communities to maximize participation in offshore wind initiatives.

E3.2. Foster strategic partnerships with neighboring states to enhance regional cooperation on offshore wind development opportunities.

Strategy E4: Adopt new renewable and clean energy adoption targets.

Delaware law requires the state's electric utilities to acquire 40% of their electricity from renewable sources by 2035. However, achieving deeper decarbonization in other sectors will require more ambitious targets that accelerate the reduction of emissions from electricity generation.

E4.1. Amend the Renewable Energy Portfolio Standards Act to establish a 2050 target.
E4.2. Explore a Clean Energy Standard to supplement the Renewable Energy Portfolio Standards.
E4.3. Conduct a net-zero grid study for Delaware to inform target setting.

GOAL: SUPPORT EMERGING CLEAN ENERGY TECHNOLOGIES

Emerging technologies, such as small modular nuclear reactors and thermal energy networks, can improve energy reliability and emissions reduction during the transition to renewable energy. These innovative solutions can provide greater flexibility and reliability, especially for sectors or applications where renewables alone may not be sufficient.

Strategy E5: Evaluate the potential of small modular nuclear reactor technology in Delaware's energy future.

Small modular nuclear reactors are an emerging technology that could contribute to Delaware's long-term energy portfolio. Over the next five years, the state can prepare for deployment of this new technology by assessing its benefits, risks and limitations.

E5.1. Explore feasibility of small modular nuclear reactors, including permitting barriers, human health and safety concerns, air and water quality impacts and waste management strategies.
E5.2. Enhance public awareness of small modular nuclear reactor technology by providing clear, accurate information and analyses.
E5.3. Work with neighboring states on a possible regional approach to new nuclear power development.

Wind turbine nacelle in a research facility at Clemson University, South Carolina. **PHOTO: DNREC**

Electrical transmission lines carry electricity over long distances from power plants to substations for distribution to homes and businesses. **PHOTO: ADRIAN HERNANDEZ, UNSPLASH**

Strategy E6: Explore the feasibility and potential benefits of thermal energy networks and district heating.

Thermal energy networks distribute heating and cooling from a central plant to multiple buildings, such as how water or electricity is distributed. District heating systems can use renewable sources, such as geothermal energy or waste heat from power plants, industrial facilities or even data centers, to distribute heat to nearby buildings, making them more efficient and less carbon-intensive than individual building systems.

- **E6.1.** Conduct a cost-benefit analysis to assess potential benefits of thermal energy networks, focusing on environmental impact and integration with existing infrastructure.
- **E6.2.** Identify key locations, such as urban neighborhoods, university campuses and industrial zones, where district heating systems could be most beneficial.
- **E6.3.** Partner with utilities, local municipalities, businesses and academic institutions to develop pilot projects for thermal energy networks.

GOAL: MODERNIZE DELAWARE'S ELECTRIC GRID

Rising energy demand is straining Delaware's electrical grid, underscoring the need for modernization to support new technologies and future energy needs. Investing in advanced grid systems,

such as automated controls, real-time monitoring, smart inverters and energy storage, will enable two-way energy flow, allowing residents to return power to the grid from homes, solar panels and electric vehicles. A modernized grid will improve reliability, enhance efficiency, and help lower energy costs for Delawareans.

Virtual Power Plants

Virtual power plants are networks of distributed energy resources, such as rooftop solar panels, battery storage systems, electric vehicles and smart appliances, that are digitally connected and managed to act like a single power plant. By coordinating when these resources produce, store, reduce consumption or discharge stored electricity back to the grid, virtual power plants can help balance demand, improve grid reliability and reduce the need for new fossil fuel generation. They are particularly valuable for Delaware because they leverage existing customer-owned resources, reducing the need to build new electric grid infrastructure while also strengthening grid resilience during extreme weather events. Virtual power plants have the potential to support both the state's clean energy and resilience goals.

Strategy E7: Support utility efforts to modernize transmission infrastructure.

Improving the efficiency of power lines increases available power capacity, which supports a clean energy transition. Since transmission lines are owned by multiple entities, regional coordination and support is essential to address reliability concerns, particularly as increasing amounts of renewable energy generation come online.

Chemours Battery Innovation Center in Newark, Delaware. **PHOTO: CHEMOURS**

Students racing solar-powered cars at the annual Solar Racer event hosted by DNREC and the Delaware Technology Student Association. **PHOTO: DNREC**

E7.1. Collaborate with neighboring states to develop a multistate solution for transmission upgrades that improve reliability and support the deployment of clean energy generation.

E7.2. Promote deployment of grid-forming inverters and advanced controls to support grid reliability as more distributed energy resources come online.

E7.3. Support deployment of 'virtual power plants' to leverage renewable and stored energy to reduce costs and increase reliability.

E7.4. Support efforts to incorporate future climate conditions into energy load forecasting.

Strategy E8: Work with utilities to support emission reductions and cost-saving programs.

Utility companies are best positioned to help their customers save money through energy efficiency, and significant opportunities exist for improvement and innovation. Achieving these goals requires updated regulations and innovative utility programs that reflect future climate conditions.

E8.1. Update Delaware's energy efficiency laws to create mandatory energy efficiency goals, including cost recovery.

E8.2. Advance innovative and equitable rate structures for renewables, storage, and cost-saving programs.

Strategy E9: Accelerate battery storage.

Energy storage is increasingly cost-effective for grid reliability and renewable energy integration. Modeling suggests that Delaware should plan for over 1,000 MW of electricity

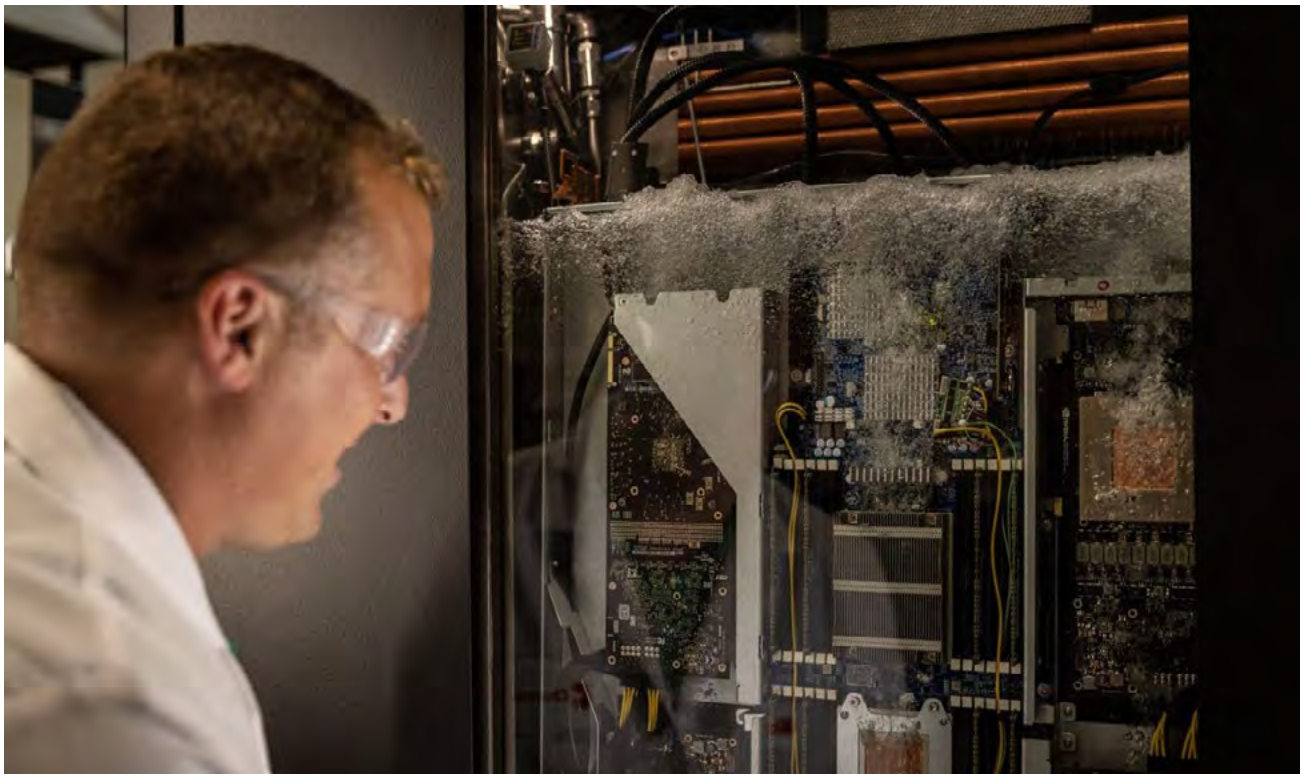
storage by 2045. To achieve this, the state needs a framework that makes battery storage projects easier, faster and more predictable to build and operate.

E9.1. Develop a comprehensive framework to accelerate battery storage deployment by setting targets and streamlining permitting, regulations and grid integration standards.
E9.2. Conduct a battery storage needs assessment to support and inform Public Service Commission and energy utility decision-making.
E9.3. Develop plans to integrate demand response and time of use rates into utility tariffs to optimize the use of battery storage technologies.
E9.4. Support battery storage system adoption through financing opportunities, incentives and the advancement of utility-led demand response programs.

Strategy E10: Ensure electric vehicle technology contributes to enhanced grid stability and resilience.

Electric vehicles offer dual benefits for Delaware's energy system. Beyond transportation, they can serve as mobile battery storage to support the grid. Some EV chargers enable two-way charging, allowing energy to flow from vehicles back to homes and the electric grid. Because most vehicles are parked during off-peak hours, owners can charge when electricity is cheapest and most abundant, reducing grid stress and energy costs for consumers.

E10.1. Develop enhanced time-of-use rates that incentivize electric vehicle charging during off-peak hours.



Two-phase immersion cooling technology improves energy efficiency by more effectively managing heat in data centers.
PHOTO: CHEMOURS

E10.2. Integrate electric vehicle charging demand management and vehicle-to-grid technologies into utility system planning.
E10.3. Launch a vehicle-to-grid pilot program to evaluate grid stabilization benefits, revenue opportunities and the feasibility of broader implementation.
E10.4. Partner with electric utilities to design pilot programs that test various approaches to leveraging electric vehicles for grid stability, ensuring initiatives are evidence-based, cost-effective and scalable.

Strategy E11: Prepare for data center impacts on grid stability, costs and emissions.

Data centers are intensive energy and water users, with some hyperscale data centers using as much energy as a small city. Proactive planning will help ensure that data centers do not disrupt grid reliability and increase costs for other utility customers.

E11.1. Establish minimum on-site clean energy requirements for new data centers.
E11.2. Develop policies and utility rate structures that prevent the costs of data center-driven infrastructure upgrades, energy demand and water consumption from being passed on to ratepayers.
E11.3. Require data centers to provide long-term energy demand forecasts for utility planning.
E11.4. Establish energy efficiency standards and reporting requirements for data centers.
E11.5. Explore the feasibility of implementing waste heat recovery and water reuse technologies at data centers.

RESIDENTIAL AND COMMERCIAL BUILDINGS

Workers examine energy efficiency improvements in new home construction. **PHOTO: DNREC**

Delaware's buildings are diverse, encompassing historic homes, modern apartments, schools, restaurants, offices and industrial facilities. Because buildings vary greatly in age, size, use, construction and energy needs, there is no single path to reducing emissions; strategies in this sector must be flexible and adaptable. This sector includes both residential and commercial buildings, but excludes industrial and agriculture buildings, which are addressed in their respective sections of this plan.

Delaware has nearly 450,000 housing units, along with more than two million registered businesses that occupy over 28 million square feet of office space, nearly 300 schools and more than 2,000 restaurants and bars. As one of the nation's fastest growing states, new development must be carefully planned. Housing and commercial projects should be affordable, sustainable and designed to support the state's net-zero future.

In 2021, the buildings sector generated 13.6% of Delaware's total greenhouse gas emissions. Commercial buildings accounted for slightly more emissions than residential emissions. Since 2005, emissions from the buildings sector have increased by 21.2%, primarily due to a growing population and increasing number of buildings with new development. Weather variability has also contributed to annual emissions spikes by increasing heating and cooling demands. While the shift from petroleum to natural gas for residential heating has moderated this upward trend, the buildings sector remains a significant source of Delaware's emissions.

Building-related emissions come primarily from energy use for heating and cooling systems, as well as cooking, refrigerants, lighting and insulation. Emission reductions strategies in this sector address both existing buildings and new construction. Existing buildings currently rely heavily on fossil fuels, which can be reduced by upgrading appliances and systems. New construction presents an opportunity to set the standard for sustainable construction and design. Reducing building emissions saves energy costs and enhances grid reliability for all Delawareans and is a crucial step toward a net-zero future.

FOUNDATIONAL POLICIES AND PROGRAMS

The State Energy Office guides energy programs and policies and partners with utilities to support a well-managed energy grid in Delaware. The policies and programs listed below have created a framework to help residents and businesses improve energy efficiency, lower energy costs and reduce emissions. A list of buildings sector policies and programs is included in Appendix A.

Energy Conservation Codes

Delaware has adopted national and international standards to guide energy conservation in the buildings sector. The state first established a minimum energy code in 1979, later updating the law in 2009 to require a mandatory statewide code and a 3-year review cycle.[59] The State Energy Office reviews model codes from the International Code Council and ASHRAE, then updates Delaware's energy conservation code and compliance proceures for local governments.[60]

Delaware Energy Act

The Delaware Energy Act establishes a comprehensive framework to ensure an adequate, reliable and continuous energy supply for Delawareans.[61] It defines the

LED lighting installation at the University of Delaware. **PHOTO: UNIVERSITY OF DELAWARE**

Attic insulation demonstration at an energy conservation codes training. PHOTO: DNREC

responsibilities of the State Energy Office and Governor's Energy Advisory Council, as well as the requirements for critical planning documents such as the State Energy Plan. The act created the Delaware Green Energy Fund and expanded cost-effective energy efficiency programs by establishing the Delaware Sustainable Energy Utility (Energize Delaware), the Energy Efficiency Advisory Council and program evaluation requirements to ensure cost-effective program implementation. More recently, the law was amended to include policies for offshore wind procurement, clean energy financing programs, electric vehicles, school buses and charging infrastructure.

Energize Delaware

Delaware's Sustainable Energy Utility was created in 2007 by the Delaware Energy Act. Energize Delaware is a nonprofit organization designed to provide comprehensive energy programs and resources to help residents and businesses access clean energy and energy efficiency upgrades. The organization offers low- or no-cost energy audits and rebates and loans. As Delaware's green bank, it also issues tax-exempt revenue bonds and raises capital to finance energy efficiency and renewable energy projects. In 2022, Energize Delaware programs saved 3.6 million kilowatt-hours of electricity.

RECENT PROGRESS

Delaware has made notable progress toward implementing the 2021 Climate Action Plan by launching new policies, such as the solar-ready buildings law, and scaling-up successful programs, such as the Weatherization Assistance Program. To promote further emission reductions in the buildings sector, the state has advanced sustainable building legislation and deployed funding and assistance through DNREC, Energize Delaware, the Delaware Department of Health and Social Services and energy utilities. Highlights are summarized below, with a more complete list available in Appendix A.

Delaware's Growing Housing Need

A growing population will require 2,400 new units per year through 2030. Demand for vacation rental units adds 5,900 units for a total housing need of 30,230 new units through 2030.[62] The 2024 Delaware Housing Supply Accelerator report identified a need for 20,000 additional affordable homes.[63]

Weatherization Assistance Program

The Weatherization Assistance Program provides free energy efficiency improvements to low-income Delawareans. The program reduces participants' energy costs by 30% to 50% while also improving home comfort. Low-income households are more likely to spend a disproportionately large share of household income on energy bills, which often strains budgets for other basic needs, such as food, housing and healthcare. In 2024, Delaware's Weatherization Assistance Program served more than 400 households.[64]

Solar-Ready Buildings Law

In 2023, Delaware Code was amended to require large buildings over 50,000 square feet to designate a solar-ready zone for at least 40% of the available roof area. This standard requires new buildings to be constructed with solar-ready zones that are free of permanent obstructions and have conduit and electrical paneling available to facilitate easy and cost-effective solar installations in the future. This law applies to commercial buildings, schools and state properties.[65]

Passive House Project in Dover

Passive houses use design principles that minimize energy needed for heating and cooling by combining high insulation, airtight construction and energy-efficient windows with strategies such as solar shading and dehumidified ventilation. In 2025, NeighborGood Partners broke ground on one of Delaware's first passive house projects. Four passive houses are being built in Dover, increasing the availability of safe, affordable, energy-efficient housing in the downtown area.

Passive House and Living Building Challenge

Green building standards ensure that new buildings minimize emissions through high efficiency, electric appliances and sustainable materials. Standards established in recent years reduce a building's environmental impact and lower its long-term energy use. Passive House, which prioritizes energy efficiency and indoor comfort, and the Living Building Challenge, which expands sustainability to human health and wellbeing, are two examples of such standards. Green building standards have the added benefit of increasing climate change resilience by improving indoor air quality and maintaining comfortable temperatures during extreme heat, cold or power outages. By going beyond standard building codes, they help ensure that Delaware's building stock remains sustainable, comfortable and affordable — and better protected against the changing climate.

PATHWAY TOWARD NET-ZERO EMISSIONS

As Delaware's population grows, meeting housing and commercial space needs with affordable, efficient and sustainable buildings is essential. The buildings sector has the potential to reduce 1.53 $MMTCO_2e$ from 2005 levels through electrification of space heating, water heating and appliances.

The greatest opportunities for emission reductions lie in retrofitting existing buildings with high-efficiency electric heating and cooling systems and appliances,

Passive house under construction in Dover, featuring a continuous air barrier system to reduce air leakage.
PHOTO: JESSICA QUINN, DNREC

while ensuring that all new construction is electrified, net-zero energy-ready, and aligned with advanced energy codes. Additional progress can come from expanding distributed renewable energy deployment, such as rooftop solar. These strategies not only cut emissions but also improve indoor air quality, lower lifetime energy costs and deliver health benefits.

From 2005 to 2021, emissions from the buildings sector increased by 21.2%. Emissions from residential buildings declined from 1.21 to 1.10 $MMTCO_2e$ while commercial buildings rose from 0.77 to 1.29 $MMTCO_2e$. A growing population and development trends favoring single-family homes mean that the buildings sector represents an increasing share of statewide emissions. These emissions primarily come from the continued reliance on natural gas and petroleum for space heating, water heating and cooking, combined with growth in building square footage as Delaware's population and economy expand.

Modeling for this plan indicates that, if current policies and programs are implemented but no additional actions are taken, emissions from the buildings sector will decrease by 16% from 2021 to 2050. This is driven by existing federal and state incentive programs and anticipated building energy code updates. However, several of the programs included in the modeling were eliminated or reduced in the 2025 federal budget, so the modeled scenario is optimistic given uncertainties around long-term federal funding and policy durability.

To define a pathway toward a net-zero residential and commercial buildings sector by 2050, modeling considered a suite of potential future actions. These actions

include large-scale retrofits to existing buildings to replace fossil fuel systems with efficient electric technologies, constructing new buildings to high sustainability and electrification standards, and widespread deployment of distributed renewable energy. With full implementation, these measures can reduce buildings sector emissions to 0.45 $MMTCO_2e$ by 2050. Electrification of heating, ventilation and air conditioning (HVAC) systems and appliances represents the largest share of modeled reductions, followed by reductions from embodied carbon in building materials and construction. Figure 4.8 shows historic and modeled future emissions in the Buildings sector.

Modeling Assumptions

Key assumptions for the modeling in the buildings sector include:[66]

1. Regular adoption of the latest International Energy Conservation Code and ASHRAE 90.1 Standard.
2. At their end-of-life replacement, all appliances and HVAC systems are replaced with high-efficiency electric alternatives.
3. All new buildings are built fully electric and to Passive House standards or ASHRAE Zero Energy Design Guide recommendations for commercial buildings starting in 2026.
4. Electricity supply becomes progressively cleaner through increased renewable energy sources over time.

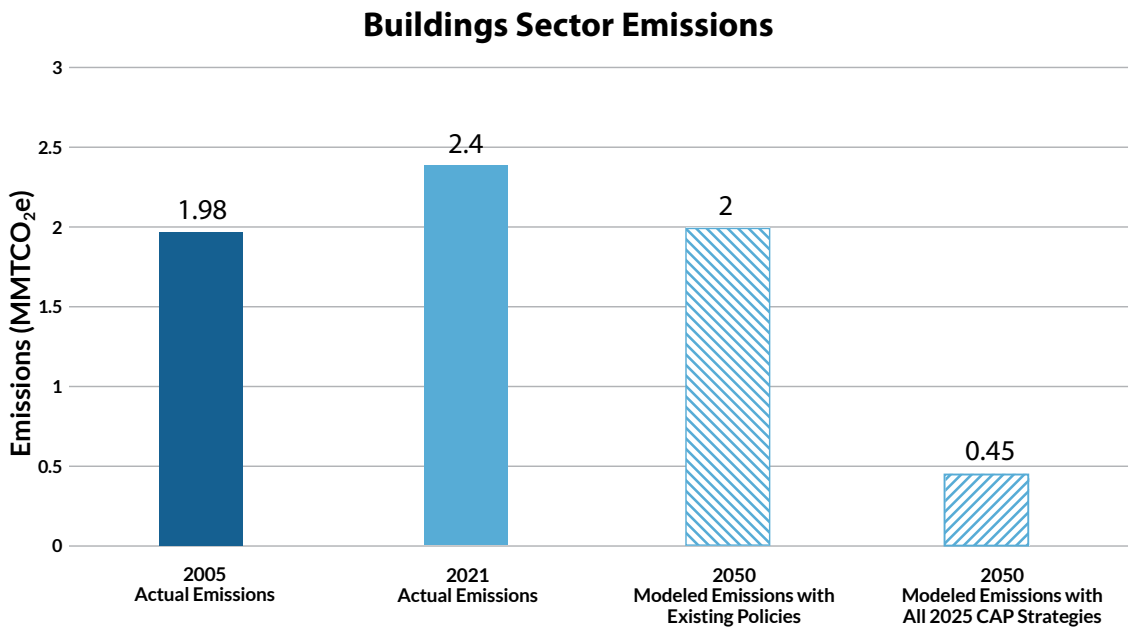


FIGURE 4.8. *Buildings sector emissions under modeled scenarios.*

STRATEGIES AND ACTIONS

Delaware's buildings sector strategies have three focuses: strengthening energy codes and performance standards, increasing energy efficiency and supporting the transition to electrification. These near-term actions, designed for the next 5 years, set the foundation for the state's 2050 net-zero emissions goal by aligning new construction, existing building upgrades and appliance standards with long-term decarbonization pathways. Grounded in emissions modeling conducted for this plan, the strategies reduce emissions while also lowering energy costs, improving indoor air quality, enhancing health and expanding equitable access to efficient, affordable housing.

GOAL: STRENGTHEN BUILDING ENERGY CODES AND ESTABLISH BUILDING PERFORMANCE STANDARDS

These strategies reduce buildings sector emissions by updating codes for new construction, setting performance standards for existing buildings, and integrating sustainability into affordable housing. Together, they ensure both new and existing buildings lower emissions, cut energy costs, and expand access to efficient, affordable housing across all income levels.

Strategy B1: Strengthen building energy codes for new construction.

Energy codes ensure new buildings are energy efficient from the start, locking in long-term emission reductions. Delaware sets the minimum energy code based on international standards every 3 years. This strategy builds the foundation for consistent statewide implementation through regular code updates, compliance monitoring and training for builders and inspectors.

B1.1. Conduct statewide energy code compliance studies every 3 to 5 years to assess implementation effectiveness, inform future code updates and identify technical assistance needs.

B1.2. Use code compliance study findings to set performance targets and develop technical assistance and training resources for builders and code enforcement officials.

B1.3. Support local code adoption by providing counties and municipalities with technical assistance, policy tool kits, model stretch codes and training resources.

B1.4. Explore adopting rigorous green building standards, certifications and incentives.

Strategy B2: Establish building performance standards to improve energy use in existing buildings.

Building performance standards set measurable energy targets, driving efficiency upgrades in existing buildings. Energy benchmarking and disclosure requirements provide owners and tenants with the data needed to make informed, cost-saving decisions.

B2.1. Launch a building energy inventory for all state-owned buildings.

B2.2. Complete an economy-wide energy benchmarking study to establish baseline data for building performance standards.

B2.3. Establish mandatory energy benchmarking, disclosure and building performance standards for large commercial, institutional and multifamily residential buildings to drive continuous energy and emission reductions.

B2.4. Explore a Home Energy Score or residential energy labeling program to provide standardized energy performance information at the time of home sale or rental, empowering homeowners and buyers to make energy-conscious decisions.

Strategy B3: Facilitate sustainable building standards for affordable housing developments.

Integrating sustainable building standards into affordable housing developments reduces emissions while lowering long-term utility costs for residents. Targeted requirements and incentives ensure low-income households have access to healthy, efficient homes that align with statewide climate goals.

B3.1. Require electric appliances and heat pumps in new affordable housing projects supported by state financing programs.

B3.2. Incentivize affordable housing projects that meet rigorous green building standards and certifications for renewable energy and efficiency.

GOAL: INCREASE ENERGY EFFICIENCY IN NEW AND EXISTING BUILDINGS

These strategies target the largest sources of building emissions through electrification of heating and cooling systems, expanded energy efficiency programs and targeted support for low-income communities and small businesses. These strategies lower utility costs, create economic opportunities and establish pathways to deep decarbonization across all building sectors.

Strategy B4: Advance adoption of high-efficiency, low-carbon building heating and cooling systems.

Transitioning buildings from fossil fuel heating to electric heat pumps eliminates

Worker installing air sealing foam to reduce air leaks, increasing energy efficiency and occupant comfort.
PHOTO: DNREC

direct combustion emissions while improving energy efficiency and indoor air quality. This strategy focuses on establishing requirements, incentives and market transformation policies to accelerate heat pump adoption across residential and commercial buildings statewide.

B4.1. Develop new, substantial incentives to encourage voluntary transition to high-efficiency heat pumps for heating and cooling in existing buildings.
B4.2. Assess feasibility of establishing statewide requirements for all-electric HVAC systems sales by 2040.
B4.3. Improve heat pump training opportunities for HVAC professionals, especially for retrofits of existing homes.

Strategy B5: Scale up residential and commercial energy efficiency programs to accelerate building decarbonization.

Expanding efficiency programs reduces energy demand and helps businesses cut costs. This strategy broadens eligibility and creates new tools to integrate energy management into everyday operations.

B5.1. Develop a Strategic Energy Management program to help Delaware businesses integrate energy management strategies into business practices.
B5.2. Expand the Energy Efficiency Investment Fund eligibility to include all Delaware businesses and nonprofits.
B5.3. Encourage expansion of utility-managed energy efficiency programs to include building decarbonization pilot initiatives.

Strategy B6: Enhance access to energy efficiency programs for low- and moderate-income residents and small businesses to reduce energy burdens and support economic opportunity.

This strategy lowers energy costs for vulnerable households and supports disadvantaged businesses by expanding weatherization services, strengthening program education and improving access to financial assistance.

Residential heat pump. **PHOTO: DNREC**

Weatherization Assistance Program contractors installing insulation. **PHOTO: DNREC**

B6.1. Expand the Weatherization Assistance Program to include additional cost-effective measures such as low-cost interior storm windows and reflective roof coatings for older homes.

B6.2. Partner with other agencies and community organizations to provide comprehensive energy efficiency education for clients of assistance programs, empowering residents to maintain savings and improve comfort.

B6.3. Expand existing energy efficiency programs to increase participation and support for minority-, women- and veteran-owned small businesses.

B6.4. Increase energy-related subsidies, including a low-income rate for electricity, to help reduce utility costs for low- and moderate-income households.

GOAL: SUPPORT THE LONG-TERM TRANSITION TO ELECTRIFICATION IN NEW AND EXISTING BUILDINGS

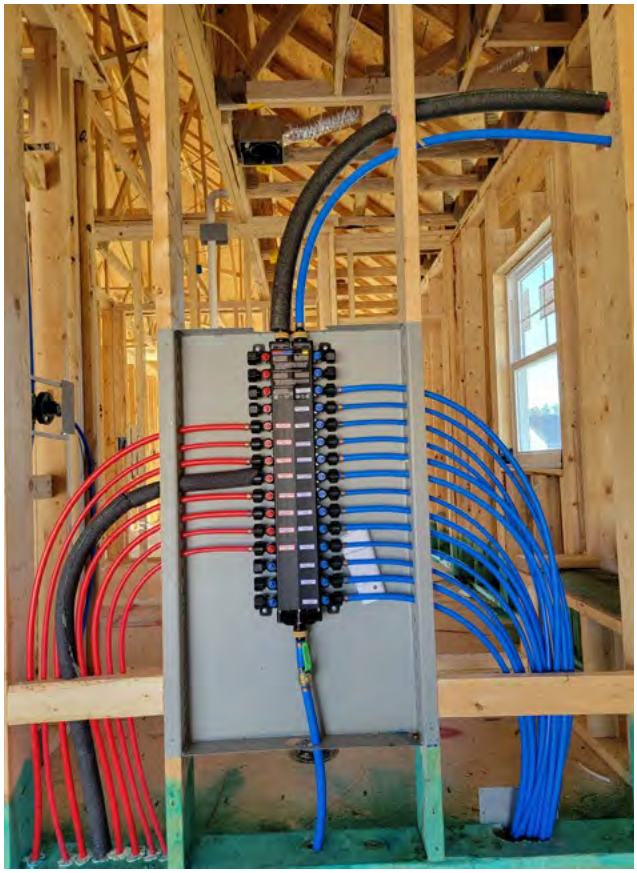
This category focuses on systematically transitioning buildings from fossil fuel appliances to electric alternatives across heating, water heating, and cooking systems. By establishing efficiency standards, phasing out fossil fuel incentives, and expanding electric appliance incentives, this approach creates a comprehensive pathway to building electrification that reduces emissions while supporting market transformation through education and training programs.

Strategy B7: Electrify appliances and systems in residential and commercial buildings.

Transitioning from fossil fuel to electric appliances eliminates direct combustion emissions while improving building efficiency and indoor air quality. This strategy includes actions that support comprehensive building electrification across heating, water heating and cooking systems.

B7.1. Assess feasibility of adopting state appliance efficiency standards, including for space heating, water heating and cooking appliances.

B7.2. Phase out incentives for fossil fuel-powered equipment in state-funded energy programs.



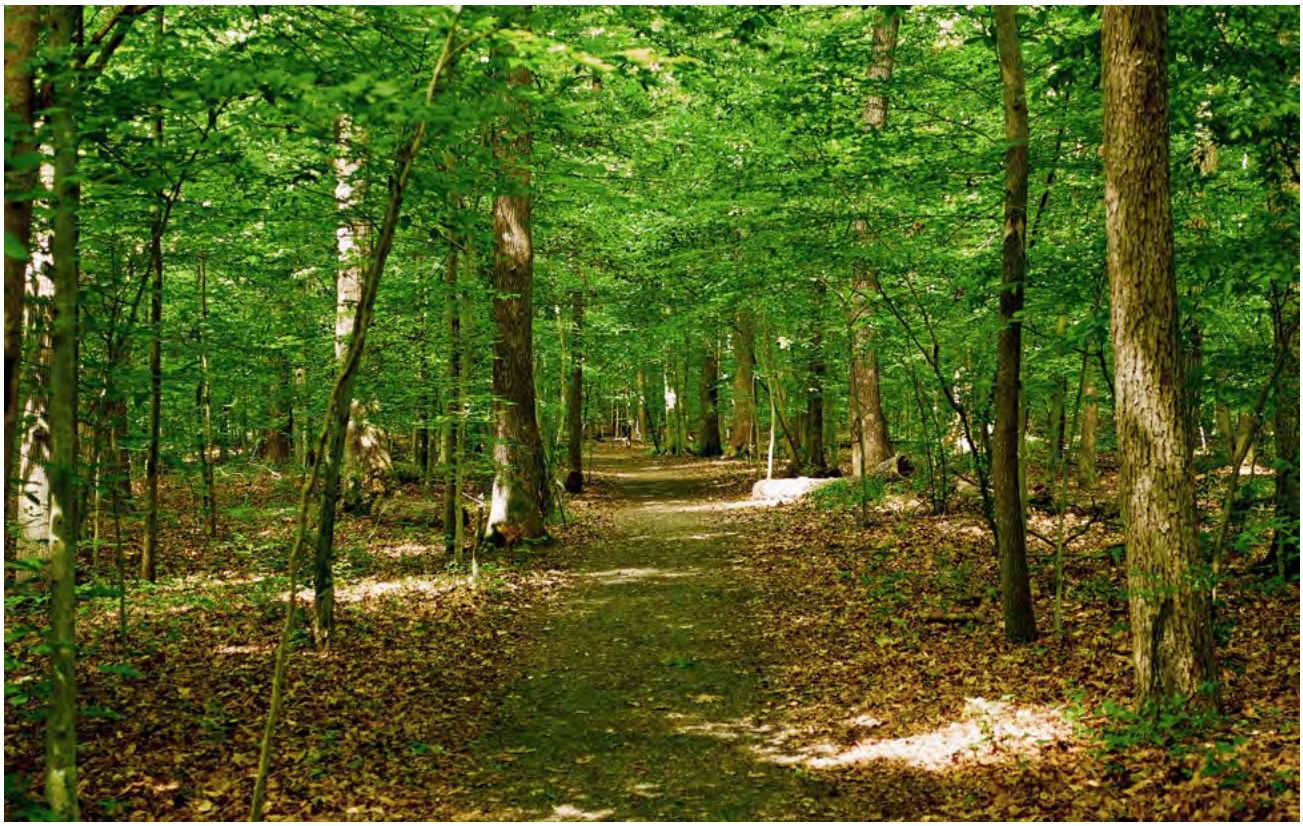
Inside of a tankless water heater. **PHOTO: DNREC**

B7.3. Expand incentive programs for heat pump water heating, clothes dryers, stoves and other high-efficiency appliances.

B7.4. Develop education and training resources on electric cooking appliances for commercial kitchens, residents and contractors by 2030.

Home retrofit training. **PHOTO: DNREC**

FORESTS AND URBAN TREES



Walking path at Fork Branch Nature Reserve. **PHOTO: DNREC**

Forests cover nearly one-third of Delaware's land area, creating a habitat for flourishing wildlife, biodiverse plant life and enhanced water quality. Delaware also has a robust forestry industry that employs nearly 2,000 people and generates over $800 million annually.[67] However, the state is losing over 1,000 acres of forested lands per year due to increasing development.[68] While forested lands can emit some carbon dioxide when soil is disrupted, they are a net carbon sink, making healthy, protected and preserved natural lands, including forests and urban trees, essential for achieving Delaware's net-zero emissions goals.[69]

Trees capture carbon dioxide from the atmosphere and store it in their biomass as they grow.[70] In 2021, Delaware's forests and trees were estimated to remove 0.72 $MMTCO_2e$, a 31.4% decrease in sequestration since 2005, largely due to deforestation from development pressure.[71] However, with preservation, tree planting and improved land management, forests and trees could sequester up to 1.58 $MMTCO_2e$ annually by 2050. Key strategies to maximize carbon sequestration include data collection, land preservation and protection, forest management, planting native species and supporting the forestry industry.[72]

This section reviews Delaware's forest and land preservation policies and progress since the 2021 Climate Action Plan and explores the role of natural lands in achieving net-zero emissions. Because emissions cannot be fully

reduced in other sectors, Delaware's net-zero future depends on protecting and expanding carbon sequestration from forests, trees and natural lands.

FOUNDATIONAL POLICIES AND PROGRAMS

Key policies supporting the Delaware Forest Service and its forest protection programs include the federal Cooperative Forestry Assistance Act of 1978, the Forestland Preservation Program and foundational Delaware laws that address the need to maintain forest resources in perpetuity. Highlights of these foundational policies are below, with a more comprehensive list available in Appendix A.

Forestland Preservation Program

Introduced in 2005, the Forestland Preservation Program is administered by the Delaware Department of Agriculture's Forest Service to protect forested areas through conservation easements. These easements allow landowners to retain ownership of their land but prohibit certain activities, such as development, and ensure all future owners must adhere to the existing guidelines. In return, landowners receive state tax reductions and relief from the realty transfer tax. The program also protects working forests by permitting forest management activities, such as timber harvests, under easements so long as they follow a forest management plan prepared by a professional forester.[73]

Legal Framework for Forest Conservation

Delaware's foundational forestry policies are the Delaware Seed Tree Law, which establishes reforestation requirements for timber harvesting practices, and the Erosion and Sedimentation Law, which addresses best management practice requirements for commodity tree harvesting to protect forest resources and water quality.

Cooperative Forestry Assistance Act of 1978

The Cooperative Forestry Assistance Act of 1978 provides technical and financial assistance to states and private landowners through the U.S. Forest Service. With funding and assistance from this act, Delaware offers several key statewide forestry programs, including Forest Conservation, Forest Health, Forestry Education, Wildland Fire Prevention, and the Urban and Community Forestry Program.[74]

RECENT PROGRESS

Since the publication of the 2021 Climate Action Plan, Delaware has made significant progress in tree planting and conservation of natural and working lands.

Tree Plantings

Since its introduction in 2021, the Tree for Every Delawarean Initiative has planted over 350,000 trees.[75] In addition, over the same period, the Delaware Department of Agriculture's Forest Service planted just over 1 million trees.[76]

Land Conservation

The Delaware Open Space Program allows the state to acquire and protect land from development, enabling the state to expand state parks, protect wildlife habitats and preserve natural corridors. Since 2021, the DNREC Division of Fish and Wildlife and Division of Parks and Recreation purchased

Volunteers plant trees at Blackbird Creek. **PHOTO: DNREC**

over 500 acres and placed 19 acres under conservation easements through the program.

PATHWAY TOWARD NET-ZERO EMISSIONS

Continued loss of forested land limits Delaware's carbon sequestration potential. Improving forest management and increasing tree planting efforts provide opportunities to enhance natural carbon storage and support the pursuit of net-zero emissions by 2050. If all forest and urban tree actions outlined in this plan are implemented, Delaware could achieve a 67% increase in sequestration through forested lands and urban trees, with additional benefits including cleaner air and improved water quality.

Between 2005 and 2021, carbon sequestration in the forests and trees sector decreased from 1.05 to 0.72 $MMTCO_2e$, representing a 31.4% decrease in carbon sequestration.[77] Delaware is losing an estimated 1,192 acres of forested lands annually. This deforestation due to development is the leading cause of reduced carbon sequestration activity.[78]

Modeling for this plan shows that if existing programs are fully implemented and no additional policy actions are taken, carbon sequestration from this sector will increase to 1.15 $MMTCO_2e$ by 2050. It is assumed that even with no additional actions taken there will be an increase in carbon sequestration due to the continuation of forest management practices and trees reaching maturity, which allows them to store additional carbon.

To define a pathway toward net-zero emissions by 2050, two actions were modeled: improving land management and increasing tree planting. With implementation of these actions, Delaware's trees and forests would sequester 1.58 $MMTCO_2e$ annually by 2050. See Figure 4.9 for historic and modeled future emissions in this sector.

Modeling Assumptions

Key assumptions for the pathway toward net-zero modeling in the forests and urban trees sector include:[79]

- Five million trees are planted between 2030 and 2050.
- Starting in 2030, improved land management practices will be applied to an additional 5% of eligible land each year.
- All eligible land types will remain constant in area over the 20-year period due to maximally effective conservation efforts.
- Already conserved forested lands are considered to have reached their maximum carbon sequestration potential.

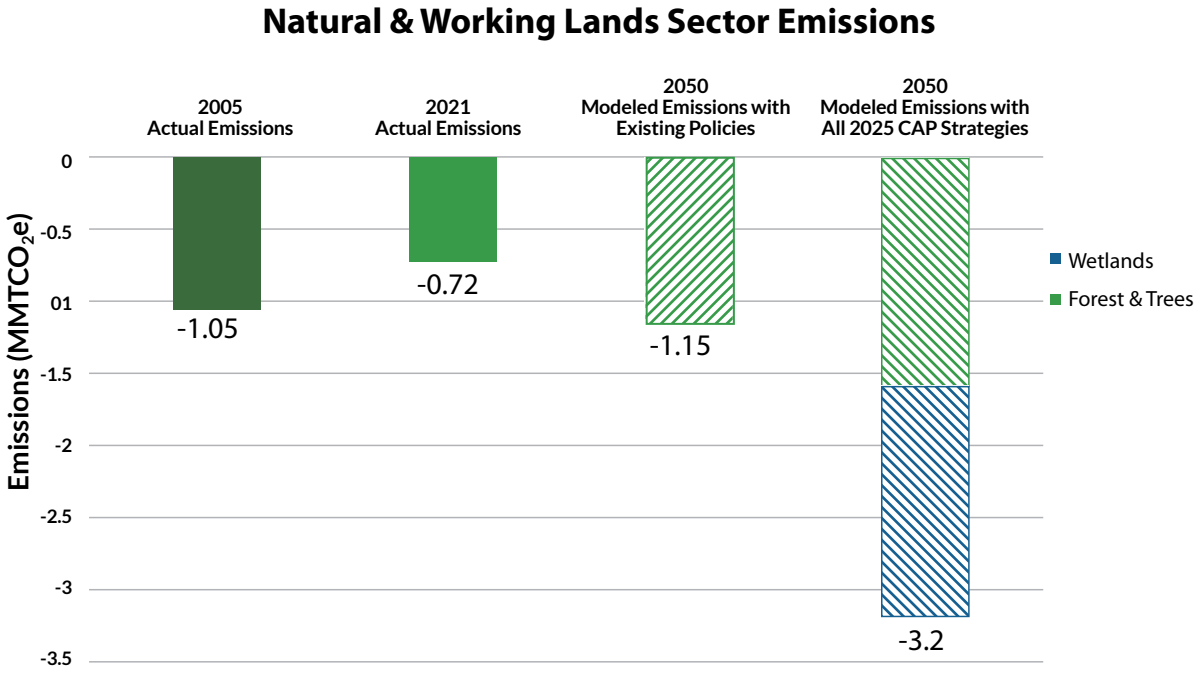


FIGURE 4.9. *Natural & working lands sector emissions under modeled scenarios. Negative numbers demonstrate carbon sequestration potential.*

STRATEGIES AND ACTIONS

This sector focuses on strategies Delaware can pursue to maximize carbon sequestration and conservation of forests and urban trees. Designed to be achievable by 2030, these strategies also advance the state's 2050 net-zero emissions goal. Derived from the emissions modeling above, tree planting and land management are the primary drivers of emission reductions. They will help Delaware sequester emissions, enhance ecosystems in forests and urban areas and provide economic co-benefits through a strengthened forestry industry.

Hilltop view of Ashland Nature Center in Hockessin, Delaware. **PHOTO: DNREC**

GOAL: MAXIMIZE CARBON SEQUESTRATION AND ENVIRONMENTAL CO-BENEFITS POTENTIAL OF DELAWARE'S FORESTS AND URBAN TREE CANOPIES

Improving land management, increasing tree plantings and expanding land conservation can help Delaware increase carbon storage and greenhouse gas sequestration in the short term.

Strategy N1: Protect, conserve and expand forested lands.

Delaware has undertaken significant forest conservation efforts and already met its 2021 Climate Action Plan goal of permanently protecting 3,000 acres of forest. This strategy builds on that success and seeks to maximize sequestration potential by permanently protecting additional forested lands.

N1.1. Identify optimal sites for afforestation and reforestation on public and private lands and prioritize them for investment.

N1.2. Increase conservation efforts through expanded funding for education, outreach and reinstated technical assistance for landowners.

N1.3. Enact a statewide forest preservation and riparian buffer law that includes assistance for municipal governments.

Strategy N2: Expand tree planting and land management in urban and suburban areas.

The Tree for Every Delawarean Initiative and the Delaware Department of Agriculture's Forest Service together have planted over 1.3 million trees since 2021. Modeling suggests Delaware

Volunteers at an urban tree planting event in Wilmington. **PHOTO: DELAWARE CENTER FOR HORTICULTURE**

should aim to plant at least five million more trees between 2030 and 2050. This strategy focuses on expanding urban tree planting to provide carbon sequestration, cleaner air, natural stormwater management, and relief from extreme heat.

N2.1. Provide technical assistance for including tree canopy cover and forest planning targets in municipal and county comprehensive plans.

N2.2. Expand the Urban and Community Forestry Program and the Tree for Every Delawarean Initiative.

N2.3. Provide model ordinances and tools to assist local governments in protecting existing trees and ensure appropriate planting of new trees.

N2.4. Encourage property owners to preserve high-value forests as Nature Preserves in the State's Natural Areas Preservation Program.

N2.5. Support a community assistance program to help municipalities place lands into conservation easements to retain ecosystem services.

Strategy N3: Improve forest management to protect habitats and reduce emissions.

Managing forests and woodlands through practices such as forest thinning, prescribed burns, timber harvesting and tree planting is essential to maintaining healthy forests. This strategy creates a Delaware-specific framework to identify best practices that maximize forest health, habitat protection and carbon benefits.

N3.1. Conduct research, including pilot projects, to determine the optimal silvicultural practices for Delaware for carbon sequestration and storage.

N3.2. Promote proper forest management and silvicultural best management practices to maintain and restore forests for water quality, wildlife and climate resilience.

Strategy N4: Improve forest and tree inventories and metrics tracking.

Conservation partners have advanced tree planting and management, but Delaware lacks a centralized database to track results. Creating a single statewide inventory of plantings across all agencies would strengthen carbon accounting and better track progress toward Delaware's net-zero by 2050 goal.

N4.1. Improve statewide greenhouse gas inventory and emission reduction planning through a synchronized inventory of Delaware's total tree cover.

N4.2. Promote improved urban tree canopy management, tracking and mapping by providing technical assistance to local governments and municipalities.

N4.3. Conduct a baseline forest carbon inventory by using aerial mapping and remote sensing technologies.

GOAL: ADVANCE THE FORESTRY INDUSTRY IN DELAWARE

Expanding Delaware's forestry industry can create jobs, generate revenue from forest products and help maintain healthy forests. In 2020, Delaware Department of Agriculture released a *report* assessing the state's forest conditions and the economic contributions of forest products

DNREC employee distributes trees during a TEDI tree giveaway event. **PHOTO: DNREC**

industries.[80] A stronger market for forestry products creates an incentive to keep forests healthy, as trees then become a commodity. It also helps to create incentives to keep forests intact and discourages selling land to developers.

Strategy N5: Promote traditional and non-traditional forest industries.

While forestry industries exist in Delaware, rising deforestation and a diminishing workforce limit the industry's growth. This strategy identifies near-term actions to strengthen and diversify the industry.

N5.1. Regularly update Delaware's economic impact study for forest products industries in the state.
N5.2. Promote the importance of Delaware forests and forest industries.
N5.3. Support the Governor's Council on Forestry's effort to attract forest industries to Delaware.
N5.4. Create markets for low-quality fiber and biofuels.

Strategy N6: Ensure future native tree supply.

Native trees are best for survivability and habitat value. State law requires state agencies to use native trees in public plantings and forest restoration projects, but native plant nursery closures and rising demand threaten future supply.

N6.1. Assess the feasibility of a state-run native plant and tree nursery to expand availability.
N6.2. Incentivize economic growth of local private native plant and tree nurseries.
N6.3. Support workforce development for the native plant and tree nursery industry.

OCEANS AND WETLANDS

Wading birds in shallow waters of Gordon's Pond, Cape Henlopen State Park. **PHOTO: ALEXANDRA HAY**

In Delaware, no one is ever more than a mile from water, whether a wetland, stream, tidal river or the ocean.[81] The state's 381 miles of coastline and nearly 300,000 acres of wetlands provide immense value to Delaware's economy, recreation and overall quality of life.[82,83] Wetlands and coastal waters also support climate goals by storing and sequestering carbon. Delaware's wetlands contribute an estimated $1–$3 billion in annual economic value and are essential for flood protection, clean drinking water, pollution removal, and fish and wildlife habitat.[84,85]The Atlantic Ocean and Delaware's marine environments also provide critical habitat, support ecosystem services, house key underwater infrastructure, and hold major potential for renewable energy projects.[86]

Research continues to improve our understanding of how wetlands and ocean environments store carbon. National data shows wetlands can store carbon up to ten times more effectively than forests, though Delaware-specific data is not yet available.[87] Because of

this data gap, wetlands' full carbon benefits are not yet reflected in the state's annual greenhouse gas inventory. As data improves, Delaware will be able to more accurately account for their contribution. Delaware's wetlands and ocean are our greatest source of natural emissions sequestration. Thus, protecting and restoring them is essential to achieving net-zero emissions.

FOUNDATIONAL POLICIES AND PROGRAMS

Tidal wetlands in Delaware are protected from many development activities by state law. In addition, a large percentage of Delaware's tidal wetlands are owned and managed by conservation organizations and state and federal agencies. Together, these efforts support conservation of this important resource.

Delaware Wetlands Act

Enacted in 1973, this law protects and preserves Delaware's wetlands by requiring permits for development activities in all tidal wetlands and in large non-tidal wetlands over 400 acres. The types of development activities that are regulated in these wetlands include dredging, draining, filling, construction of any kind, bulkheading, mining, drilling and excavation. The Wetlands Act has been pivotal in conserving tidal wetlands throughout the state.[88,89]

Delaware Subaqueous Lands Act

"Submerged lands" are those that lie below the mean low tide in all tidal water. "Tidelands" are those that lie between the means of high and low tide. This 1969 law encompasses the state's navigable rivers, streams, lakes, bays, estuaries and other underwater lands and prevents degradation of underwater land, including land below the high tide line. It requires permits for activities including drilling, dredging, construction and installation of pipelines and cables. It also established a leasing system for the long-term use of these lands.[90]

Marsh at Bombay Hook National Wildlife Refuge. **PHOTO: JESSICA QUINN, DNREC**

Wetland Surface Elevation Datasets

One way that wetlands can adapt to changing conditions is by growing vertically through sediment accretion. Developing a detailed, long-term wetland elevation dataset helps determine whether vertical growth is sufficient to sustain these ecosystems amid challenges such as sea level rise and land subsidence. It also allows Delaware to compare its progress with that of other states along the East Coast and in the mid-Atlantic region.

RECENT PROGRESS

Delaware has been engaged in several important efforts since the publication of the 2021 Climate Action Plan. Highlights of some of those programs can be found on the following pages.

Submerged Aquatic Vegetation Program

Launched in April 2024, the Submerged Aquatic Vegetation Program builds on efforts that began in 2020 within DNREC's Division of Watershed Stewardship in partnership with Delaware Sea Grant and the Center for Inland Bays. The program leads monitoring and restoration of seagrasses (also called bay grass), while also providing public education on their ecological importance. Delaware's submerged aquatic vegetation efforts are part of the Statewide Submerged Aquatic Vegetation Workgroup, a collaborative initiative that brings together federal agencies, academic institutions and environmental organizations.[91]

Improving Data on Stored Carbon

The Delaware Geological Survey is leading a project to assess carbon stored in wetlands along the St. Jones and Blackbird rivers. This work will improve estimates of stored carbon in Delaware tidal wetlands, identify areas of greater carbon storage within the wetlands and assess areas of high vulnerability to various ecological stressors. The resulting data will improve marsh management and strengthen Delaware's future greenhouse gas inventories.[92]

PATHWAY TOWARD NET-ZERO EMISSIONS

Oceans and wetlands are Delaware's largest natural carbon sinks and have the greatest sequestration potential of all emissions sectors, making them critical to achieving net-zero emissions by 2050. Wetlands and oceans currently hold about 42 times more carbon dioxide than the atmosphere, with wetlands storing it in vegetation, submerged aquatic vegetation, sediments and buried organic matter and oceans absorbing it through biological and chemical processes.[93]

Delaware's greenhouse gas inventory does not yet account for carbon stored in wetlands or ocean systems. DNREC is exploring methodologies to incorporate this in future inventories, recognizing that wetlands can remove carbon up to 10 times faster than forests and store five times more carbon per acre.[94] Oceans also play a significant role, absorbing roughly 31% of global CO_2 emissions, although this uptake contributes to ocean acidification and other environmental impacts.[95,96]

Research exploring marine carbon dioxide removal strategies that could enhance ocean sequestration while protecting ocean health is on-going. Because these approaches and associated data are still emerging, ocean-based carbon sinks, including submerged

aquatic vegetation, were not included in the modeling for this plan. The modeling does include the sequestration impacts of wetlands.

As research advances and Delaware-specific data improves, future climate action plans are expected to more fully capture the mitigation potential of oceans and coastal systems. Protecting and restoring wetlands and marine environments will be critical to maximizing their contribution to the state's net-zero future.

To define a pathway toward net-zero emissions by 2050, modeling (see Figure 4.9) considered the potential carbon storage value of wetlands, revealing that sequestration from wetlands could reach 1.61 $MMTCO_2e$ annually by 2050, and 16.93 $MMTCO_2e$ in cumulative emissions reductions from 2025 to 2050.[97]

Aquatic Resources Education Center in winter.
PHOTO: DNREC

Modeling Assumptions

Key assumptions for the pathway to net-zero model in the oceans and wetlands sector include:[98]

- All wetlands will have improved land management by 2050.
- Approximately 30% of wetlands are pristine wetlands that are considered to have already reached their maximum carbon sequestration potential.

STRATEGIES AND ACTIONS

Carbon sequestration in Delaware's natural sinks, such as oceans and wetlands, must be maximized to achieve net-zero emissions by 2050. Although many actions, such as preservation and improved management, will need to be maintained in perpetuity, the strategies and actions below focus on efforts that can begin within the next 5 years to advance Delaware toward its long-term goals.

GOAL: MAXIMIZE CARBON SEQUESTRATION IN WETLANDS AND MARINE WATERS

Delaware's nearly 300,000 acres of wetlands can be leveraged to meet the state's climate goals.[99] Maximizing their potential to store carbon means prioritizing their preservation and using improved data to manage them for carbon storage potential.

Strategy O1: Protect and preserve existing wetlands.

Wetlands have the potential to serve as Delaware's most significant carbon sinks, offsetting the emissions from all other sectors. Because wetlands are being lost to sea level rise and development trends, it is important to act now to preserve existing wetland areas to ensure that their sequestration potential can be reached. Also see Strategy P2.

O1.1. Assist counties and municipalities with wetland preservation ordinances and practices.
O1.2. Strengthen Delaware's Wetlands Act to increase regulatory protections for tidal wetlands and include non-tidal wetlands.
O1.3. Expand wetland restoration efforts, especially those that increase carbon storage.
O1.4. Integrate carbon sequestration concepts into environmental and wetland education programs.

Strategy O2: Facilitate marsh migration.

As sea levels rise, tidal marshes will be lost to open water, but some upland areas will convert to tidal marsh. This strategy outlines actions to prepare for marshes to migrate inland and to preserve these highly valuable ecosystems. Also see Strategy P2.

O2.1. Identify areas most viable for marsh migration.
O2.2. Ensure that existing conservation and financial incentive programs support marsh migration, with a special focus on incentivizing private landowners.
O2.3. Incorporate marsh migration into comprehensive development plans.

Indian River Inlet. PHOTO: ADOBE STOCK

Strategy O3: Enhance Delaware's ability to manage wetlands for carbon sequestration.

Wetlands are powerful natural carbon sinks, but current data in Delaware do not fully

capture their carbon storage potential for emissions tracking. This strategy focuses on improving understanding of wetland dynamics, including carbon storage processes and potential methane emissions, to better inform climate mitigation and management efforts.

- **O3.1.** Expand existing program for wetland elevation data collection and analysis.
- **O3.2.** Support research to improve understanding of wetland carbon sinks and wetland methane sources.
- **O3.3.** Where feasible, restore tidal wetlands by fully re-establishing tidal connections to reduce methane emissions.

Re-establishing Connection of Tidal Wetlands

Many tidal wetlands have had their tidal connections reduced or eliminated due to human infrastructure. Methane emissions are typically lower in tidal wetlands than in non-tidal wetlands due to salinity. Re-establishing tidal wetland connections may lower net wetland methane emissions.

Strategy O4: Protect and enhance carbon-storage capacity of coastal ecosystems.

Research on coastal and estuarine submerged aquatic vegetation and its role in climate mitigation is still emerging. Expanding and supporting mapping efforts of Delaware's aquatic plant life can help identify historical submerged aquatic vegetation growth areas, opportunities for bed

Bay side at Delaware Beach. **PHOTO: DNREC**

expansion and sites with potential for restoration. These efforts will strengthen understanding of their role in protecting and enhancing blue carbon storage capacity.

O4.1. Map submerged aquatic vegetation and continue habitat suitability research.
O4.2. Continue and expand funding for marine carbon restoration projects and environmental education programs.

Strategy O5: Assess marine carbon dioxide removal technologies.

Marine carbon dioxide removal methods are an emerging opportunity for enhancing the ocean's capacity to sequester carbon from the atmosphere. Expanding scientific understanding of these methods and preparing Delaware for their deployment can help the state reach its emissions reduction goals. This strategy explores actions Delaware can take to position itself for these emerging approaches to achieving net-zero emissions.

O5.1. Monitor outcomes of pilot projects in the region.
O5.2. Advance Delaware-based research on the benefits and trade-offs of marine carbon dioxide removal.
O5.3. Conduct a gap analysis of state regulations and policies for marine carbon dioxide removal projects.

AGRICULTURE

Center pivot irrigation system in a farm field. **PHOTO: UD COOPERATIVE EXTENSION**

Agriculture is critical to Delaware's economy, with the total value of production exceeding $2 billion annually.[100] Delaware's 2,150 farms cover more than a half million acres, or 42% of the state's land area.[101] In addition to feeding our state and nation, Delaware's farmland plays an important role in meeting emissions targets by storing carbon in soils and roots. This benefit is increasingly threatened by residential and commercial development pressures.[102]

Although agricultural lands sequester and store carbon, agricultural operations also emit greenhouse gases, comprising 3.3% of Delaware's emissions. Since 2005, emissions from agriculture have increased 18%. The largest sources are nitrous oxide and methane, which are high global warming potential greenhouse gases that are 273 and 30 times more potent, respectively, than carbon dioxide over 100 years.[103,104]

The agricultural activities that most significantly contribute to these emissions are the energy demands of poultry houses, nutrient and manure applications, and the loss of carbon storage when agricultural land is developed. Strategies in this section emphasize preserving agricultural lands, improving crop management and precision nutrient practices. Given its economic importance, farmland's sequestration values and the high global warming potential of emissions in this sector, agriculture is a critical part of Delaware's net-zero emissions future.

FOUNDATIONAL POLICIES AND PROGRAMS

Delaware is a leader in agricultural preservation and nutrient management practices, which provides a strong foundation for future emission reductions and carbon sequestration. Highlights of the foundational policies are below. Additional policies and programs can be found in Appendix A.

Delaware Aglands Preservation Program

Established in 1991 and managed by the Delaware Department of Agriculture, the *Aglands Preservation Program* enables landowners to voluntarily preserve their land for agricultural use. It also enables permanent preservation by allowing landowners to sell development rights and place land under agricultural conservation easements.[105]

Delaware Nutrient Management Program

The Delaware *Nutrient Management Program*, established in June 1999 by the Delaware Nutrient Management Law, manages nutrient applications to maintain and improve ground- and surface water quality in Delaware to meet or exceed federally mandated water quality standards. Applying nutrients efficiently reduces the risk of greenhouse gas emissions from excess fertilizers and contributes to farm profitability and sustainability.

Federal Farm Bill

The Agriculture Improvement Act of 2018, commonly known as the Farm Bill, is a federal law encompassing a wide range of programs and services to support farmers and the agricultural industry nationwide. Key provisions relevant to Delaware's agricultural sector include those addressing commodity support, conservation, farm credit, research and extension, forestry, energy, crop insurance and livestock.

RECENT PROGRESS

Since the release of the 2021 Climate Action Plan, Delaware has made significant progress, including advances in agricultural land preservation, expanded support for cover crops, and reduced emissions from energy use in agricultural operations.

Delaware Aglands Preservation Program

Since 2021, the *Aglands Preservation Program* permanently preserved over 15,000 acres and protected 209 farms. In 2025, the total acreage of farmland protected through the program increased to nearly 160,000 acres, allowing Delaware to support farm families while protecting open spaces.

Increased Cover Crop Funding

The DNREC Nonpoint Source Program and Sussex Conservation District increased their commitment to cover crops, expanding funding from $1 million in 2021 to $6 million in 2025 for cover crop cost-sharing programs that promote best practices crucial for soil health benefits and excess nutrient reduction. Delaware's long term commitment to enhancing the nutrient and carbon content of soil is also demonstrated by the Delaware Department of Agriculture's *Nutrient Management Program*.

Increasing Interest in Reducing Agriculture's Energy Intensity

The Delaware Department of Agriculture is exploring opportunities to lower the energy

use and carbon footprint of agricultural operations. Efforts include assessing the integration of solar energy on farms and poultry houses and partnering with Energize Delaware to advance energy efficiency across farm operations.

PATHWAY TOWARD NET-ZERO EMISSIONS

The agricultural sector contributes a relatively small percentage of Delaware's total emissions but strategies to minimize emissions from agriculture practices, coupled with maximizing sequestration are crucial to achieving the state's net-zero emissions target. These strategies also contribute to the economic strength of the agriculture sector. The loss of agricultural land due to development has and will continue to limit the total sequestration potential of the sector. With no further action, emissions from this sector will continue to increase over time, but with efforts to reduce operational emissions and increase carbon sequestration, sequestration can balance remaining emissions such that emissions in this sector remain stable through 2050. These opportunities for emission reductions will also influence overall farm health and can provide farmers with improved crop yields.

Between 2005 and 2021, emissions from the agriculture sector grew from 0.5 to 0.59 $MMTCO_2e$, representing an 18% increase in emissions. The key drivers of emissions include the energy demands for poultry houses and emissions associated with nutrient and manure applications. The loss of agricultural lands due to increased development also reduced the carbon sequestration ability of this sector.

Modeling conducted in support of this plan shows that, if existing programs are fully implemented and no additional policy actions are taken, emissions from this sector will increase to 0.72 $MMTCO_2e$ by 2050, a relatively modest increase.

To define a pathway toward net-zero emissions by 2050, modeling included increased cover crops and adoption of nitrification inhibitors. With these additional actions, emissions in this sector would remain relatively stable through 2050.

See Figure 4.10 for historic and modeled future emissions in this sector.

Modeling Assumptions

The following are key assumptions made for reducing potential emissions from agriculture:

- Adoption of cover crops increases from 30% in 2025 to 80% in 2039.
- Urbanization reduces total planted acreage of key field crops.
- Increased adoption of nitrification inhibitors for corn, wheat and soybeans.

Common vetch planted as a cover crop. **PHOTO: UD COOPERATIVE EXTENSION**

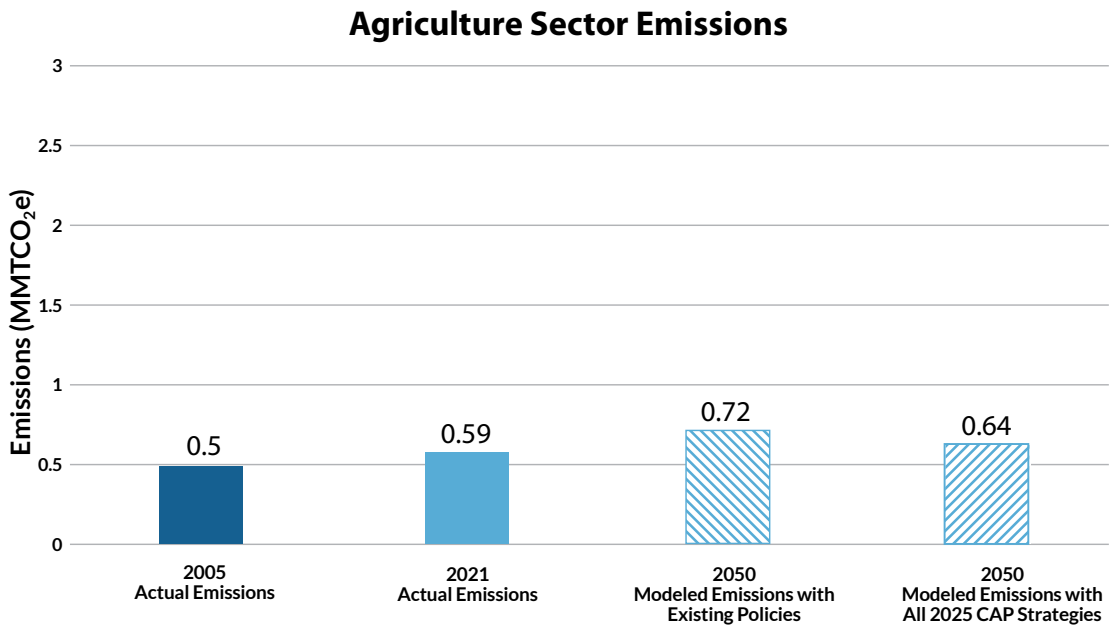


FIGURE 4.10. *Agriculture sector emissions under modeled scenarios.*

STRATEGIES AND ACTIONS

This sector focuses on strategies that reduce emissions in Delaware's agricultural sector through crop and livestock practices. It also includes strategies for land preservation. The actions in the sector can be implemented within the next 5 years and further assist the pursuit of net-zero emissions by 2050. They are derived from the modeling described above as feasible goals the state can pursue. Achieving these goals will not only help reduce emissions in Delaware but can also provide benefits to farmers through healthier farms and improved crop yields.

GOAL: REDUCE EMISSIONS AND SUPPORT CARBON SEQUESTRATION ON CROP LANDS

The main sources of emissions from croplands are primarily from the use of soil nutrients and fertilizers and the operational emissions associated with on-farm equipment such as tractors or irrigation systems. Soil on croplands serves as a carbon sink by storing carbon from plant roots and decomposed organic matter. Cover crops enhance this process by adding organic matter to the soil, preventing erosion, and keeping living roots in the ground year-round, which increases the ability of soil to capture and store carbon from the atmosphere. These strategies focus on potential actions to both reduce emissions and enhance carbon sequestration on Delaware's croplands.

Strategy A1: Encourage cropland management practices that increase and maintain soil carbon sequestration.

Climate-friendly cropland management practices can reduce and offset emissions from agricultural lands and provide farmers with healthier soils and improved crop yields. These actions are aligned with Delaware's existing commitments and programs such as the Chesapeake Bay

Watershed Implementation Plan and the Delaware State Forestry Strategy.

Soybeans are among Delaware's most important crops.
PHOTO: UD COOPERATIVE EXTENSION

A1.1. Launch research program on soil carbon changes and sequestration to inform best management practices.
A1.2. Continue to support no-till and low-till practices in Delaware.
A1.3. Cover an additional 3,000 acres with cover crops through cost share programs and conservation district partnerships.
A1.4. Expand support for agricultural producers to adopt practices that increase soil carbon.
A1.5. Promote emission reductions by encouraging and supporting practices that enhance irrigation efficiency.

Strategy A2: Encourage adoption of agroforestry practices.

Agroforestry is the practice of intentionally introducing forestry practices onto agricultural lands or integrating trees and shrubbery into crop farming systems. Agroforestry can increase carbon sequestration beyond what is already captured on agricultural fields by soil and cover crops.

A2.1. Expand agroforestry practices used in Delaware, with a goal of adding 1,000 acres.
A2.2. Increase use of forest or grass buffers adjacent to croplands.

Strategy A3: Reduce emissions from nutrient and manure management.

Organic fertilizers, such as chicken litter, are used on many agricultural fields in Delaware to promote soil health and crop yields. When organic fertilizer is not available, enhanced efficiency synthetic nitrogen fertilizers could be used as a best management practice. Key best practices include splitting nitrogen applications across the growing season (rather than as a single application), which improves nutrient uptake and reduces emissions.

A3.1. Expand adoption of enhanced efficiency fertilizers.
A3.2. Study benefits of slow-release synthetic nitrogen fertilizer.
A3.3. Support and expand the adoption of in-season soil nitrate sampling and plant tissue testing.
A3.4. Expand the practice of seasonally splitting nitrogen fertilizer applications.
A3.5. Incentivize adoption of in-furrow soil application of nutrients with seeds to improve nutrient uptake efficiency and reduce runoff.

Strategy A4: Reduce emissions and energy demand through precision agriculture practices.

Precision agriculture uses technology to control agricultural production for optimized crop yields and energy efficiency. Variable rate technologies, common in precision agriculture practices, allow farmers to vary rates of fertilizers and irrigation water across their fields so

they can apply optimal and variable amounts. This can save farmers money and improve crop yields while reducing their energy and resource usage.

A4.1. Support the use of variable rate technologies for all nutrient applications.
A4.2. Expand Delaware-based research and demonstration projects for precision agriculture methods applications.
A4.3. Support integration of precision agriculture methods into education and training for workforce development.
A4.4. Develop and enhance partnerships to collaborate with the private sector on expanding precision agriculture adoption.

Strategy A5: Preserve agricultural lands.

Agricultural lands have great potential to serve as carbon sinks, storing carbon in soil and roots. Development pressure is resulting in loss of viable farmland, increasing costs to purchase land and hindering growth of the agricultural sector in the state. Permanently protecting at least 50% of existing agricultural land by 2045 ensures continuing carbon storage benefits, essential to meeting net-zero emission goals.

A5.1. Support research and pilot programs on innovative agrivoltaics to balance land use between agricultural production and energy solutions.
A5.2. Support increased voluntary agricultural land preservation to help achieve the agricultural land preservation goals.
A5.3. Update and increase funding for the Aglands Preservation Fund to keep pace with rising costs of land over time.
A5.4. Explore zoning mechanisms to incentivize conservation of agricultural lands.

Commercial poultry farm. **PHOTO: DDA**

GOAL: REDUCE EMISSIONS FROM THE LIVESTOCK INDUSTRY

The livestock industry in Delaware primarily consists of broiler chickens. There are over 700 commercial poultry facilities throughout the state. Livestock operations for cattle and pork also exist in the state but at a much smaller scale. There are viable, cost-effective ways to reduce emissions from poultry operations, primarily through energy and waste management, and for beef production through pasture management.

Strategy A6: Reduce operational emissions in the poultry industry.

Poultry production has small but meaningful greenhouse gas emissions, primarily due to energy use for heating and ventilation. Actions that optimize energy efficiency, nutrient management and waste management are important for emission reductions in this sector.

A6.1. Expand voluntary programs for solar panel installation on or adjacent to poultry houses.
A6.2. Research contribution and management of nitrous oxide emissions from poultry houses.
A6.3. Research the impact of routine mortality poultry composting on emission reductions.
A6.4. Investigate the feasibility and community impacts of on-site anaerobic digestion of organic waste from poultry houses to offset energy demand.

Strategy A7: Improve management of and reduce emissions from pasturelands.

Pasturelands are lands grazed by cows and horses. Managers of these lands can use best management and climate-smart practices to capitalize on their co-benefits, including carbon sequestration potential.

A7.1. Expand silvopasture practices in Delaware to encompass at least 500 acres of pasturelands.
A7.2. Support practice of seasonal split nutrient applications and reduce applications based on soil nitrate sampling.
A7.3. Encourage practices of minimal soil disturbance in fertilizer application.

Feed bins at commercial poultry farm. **PHOTO: DDA**

Broiler chickens. **PHOTO: DNREC**

WASTE

Active face landfill compactor spreading and compressing solid waste. **PHOTO: DSWA**

Delaware manages its waste locally within state borders — Delaware's waste stays in Delaware. The state has four landfills: three municipal solid waste management facilities (one per county) and one construction, demolition and industrial waste facility that is scheduled to close by 2030. The three municipal solid waste facilities are owned and operated by the Delaware Solid Waste Authority and the fourth landfill is operated by a private company. Delaware also has several recycling and resource recovery facilities that process specific waste materials to create new products. Wastewater is processed at several small and a few large wastewater treatment facilities in Delaware. Most use aerobic digestion, which is energy intensive. The largest facility is the Wilmington Wastewater Treatment Plant, which uses an anaerobic digester.

In 2021, the waste sector contributed 3.1% of Delaware's total greenhouse gas emissions. Of this total, 1.9% came from municipal solid waste landfills and 1.2% from wastewater treatment. These emissions are primarily methane and nitrous oxide, both gases with high global warming potential. Since 2005, waste-sector emissions have increased by 1.8%, largely due to population growth, which drives higher volumes of municipal waste and wastewater.

Solutions in this sector can be found in industrial facilities as well as at home. Small but meaningful emissions reductions can be attained through composting and recycling in schools, homes and residential centers. For industrial facilities, state regulations require methane generated under anaerobic conditions in solid waste and wastewater to be captured, making

fugitive emissions the main source of methane at these facilities. Nitrous oxide emissions occur primarily under anaerobic conditions in wastewater treatment and are difficult to measure and manage because much of the gas is dissolved in treated water discharged from facilities. As in other sectors, a significant portion of emissions also comes from the operational energy required to move and treat waste.

Household hazardous waste collection event. **PHOTO: DSWA**

FOUNDATIONAL POLICIES AND PROGRAMS

Delaware's waste sector has benefited from legislation and programs that have reduced methane emissions and increased the diversion of non-organic solid waste. Highlights of these foundational policies are summarized below, with a more comprehensive list in Appendix A.

Universal Recycling Law

Enacted in 2010, the Universal Recycling Law requires solid waste haulers to provide biweekly single-stream recycling collection to single-family homes and businesses with on-premises sales, such as restaurants and retail stores. Haulers must supply separate containers and charge customers a single, combined charge for waste and recycling collection. Multifamily residential buildings are required to have centralized recycling containers on the premises. The law greatly expanded access to recycling services and today all Delaware households and businesses have access through private haulers, municipal programs or Delaware Solid Waste Authority drop-off facilities.

Landfill Gas Capture Requirements

Federal and state regulations play a key role in reducing landfill methane emissions in Delaware. The EPA's 2015 New Source Performance Standards set requirements for controlling methane emissions from municipal solid waste landfills.[107] Federal guidelines from 1996 and updates made in 2016 have also influenced Delaware's state-level landfill gas capture regulations.[108,109]

Recycling truck unloading materials. **PHOTO: DSWA**

Clean Water State Revolving Fund

Administered by DNREC's Environmental Finance Office, this fund offers loans and grants for various water quality and pollution reduction projects, including upgrades for wastewater treatment plants, such as green infrastructure, water efficiency, energy efficiency and environmentally innovative projects.[110]

RECENT PROGRESS

Since the 2021 Climate Action Plan, Delaware has advanced waste-sector decarbonization by increasing solid waste diversion and maintaining high landfill gas capture rates. Highlights of recent progress can be found below:

Landfill Gas Capture

Methane is captured at Delaware's three municipal solid waste landfills and is used to generate electricity. At these sites Delaware Solid Waste Authority also works with private companies to operate 15 beneficial-use engines and three boilers that generate up to 16 MW of electricity and heat for local businesses and homes. Captured gas is processed and reused for energy, producing both economic and environmental benefits. The Delaware Solid Waste Authority also promotes public awareness of landfill gas capture initiatives through its Environmental Education Program.[111]

Solid Waste Diversion: Recycling and Composting

Delaware has steadily increased landfill waste diversion over the past 5 years. The state's single-stream recycling program raised municipal recycling rates from 36% in 2020 to 38% in 2023, above the national average of 32%. In 2021, DNREC launched *Recyclopedia*, an online tool that helps residents and businesses identify proper recycling methods. This Climate Action Plan targets a 47% recycling rate by 2050. Community composting is also expanding, including a site operated by Plastic Free Delaware in New Castle County.

PATHWAY TOWARD NET-ZERO EMISSIONS

Although the waste sector is a relatively small source of Delaware's emissions, decarbonizing it is necessary to achieve Delaware's net-zero emissions goals and reduce reliance on carbon sequestration by natural lands or carbon capture technologies. The primary emissions reduction strategy for solid waste is increasing waste diversion, particularly of organic waste. For wastewater management,

Bald eagle perched on landfill gas collection system piping at Sandtown Landfill. **PHOTO: DSWA**

Large bales of sorted and compacted plastic waste at a commercial recycling facility. **PHOTO: DSWA**

Community compost site volunteers at Talley Day Park in Wilmington, Delaware **PHOTO: PLASTIC FREE DELAWARE**

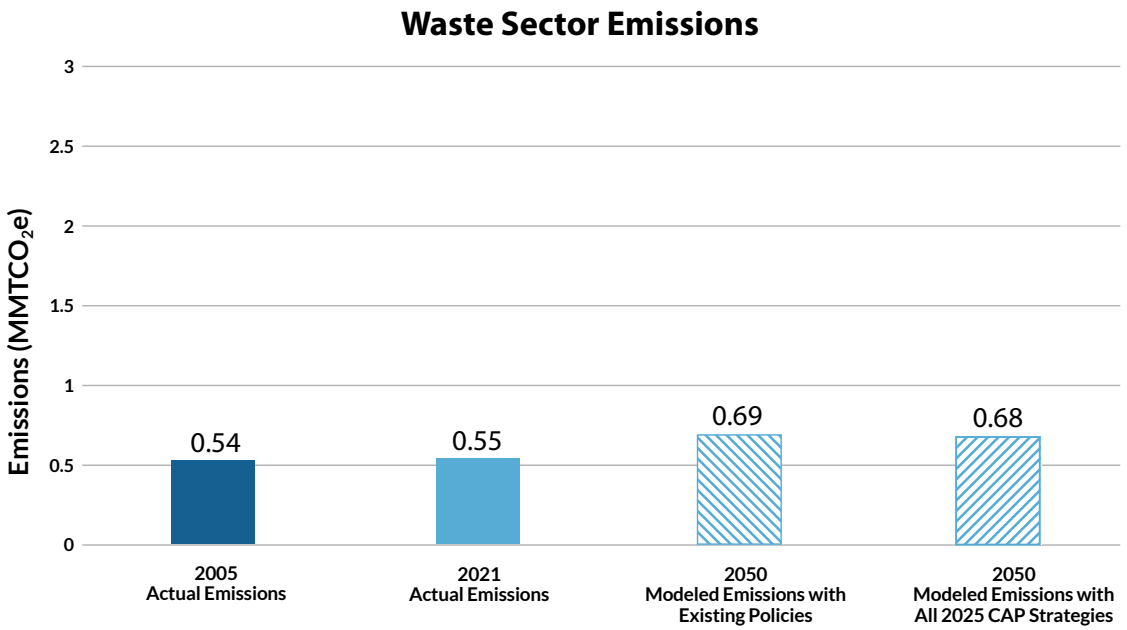


FIGURE 4.11. *Waste sector emissions under modeled scenarios.*

reductions will rely on shifting to lower carbon processes, such as anaerobic digestion, increasing energy efficiency and the use of low-carbon energy sources. These strategies will also improve Delaware's air, water and soil quality, enhance community health and benefit natural and working lands.

Between 2005 and 2021, waste-sector emissions increased slightly from 0.54 $MMTCO_2e$ to 0.55 $MMTCO_2e$, representing a 1.8% increase, driven by higher waste volumes from population growth.

Modeling conducted for this plan indicates that, if existing programs are fully implemented and no additional policy actions are taken, emissions from this sector will increase to 0.69 $MMTCO_2e$ by 2050. Population growth is expected to drive this increase by producing more solid waste and wastewater, along with emissions from processing and treatment. This projection may be optimistic, as emerging waste types could require new infrastructure and additional energy use, which would result in emissions not currently accounted for in the model.

To define a pathway toward net-zero emissions by 2050, the impact of increasing solid waste diversion was modeled. The modeling assumes Delaware's landfill gas capture rates remain stable and composting and recycling increases solid waste diversion to 60% by 2050. With full implementation of the modeled actions, emissions would decrease by only 1%, falling to 0.68 $MMTCO_2e$ by 2050. See Figure 4.11 for historic and modeled future emissions in the waste sector.

Modeling Assumptions

Key assumptions for the net-zero modeling in the waste sector include:[112]

- Landfill gas capture rates remain stable.
- Waste diversion from recycling and composting increases to 60% by 2050.

STRATEGIES AND ACTIONS

Over the next 5 years, Delaware can take steps to further reduce waste-sector emissions by improving landfill and wastewater treatment operations and diverting more solid waste from landfills. While these strategies are expected to have small emissions benefits, they can deliver meaningful environmental and public health benefits.

GOAL: REDUCE OPERATIONAL EMISSIONS AT LANDFILLS AND WASTEWATER TREATMENT PLANTS

Most operational emissions in waste management come from high global warming potential gases (primarily as methane and nitrous oxide) and from the energy to operate solid waste and wastewater treatment facilities. Methane is a particularly potent greenhouse gas and is largely produced by the breakdown of organic material. Reducing these emissions as much as possible remains a key goal.

Strategy W1: Reduce methane emissions from solid waste and wastewater treatment operations.

At wastewater treatment plants, methane from anaerobic digestion can be used as an energy source. However, it is necessary to address methane leaks from floating roof infrastructure through repairs and replacements with less leak-prone infrastructure. For solid waste,

Aerial view of Wilmington wastewater treatment plant. PHOTO: CITY OF WILMINGTON

Digester tank covers at the Wilmington Wastewater Treatment Plant. **PHOTO: CITY OF WILMINGTON**

all Delaware municipal landfills currently capture methane as landfill gas, but ongoing improvements in monitoring and control technologies can further reduce fugitive emissions.

W1.1. Assess anaerobic digesters to plan maintenance or replacement of floating roofs with fixed roofs.

W1.2. Encourage stringent methane monitoring programs and technologies to promote timely repair or replacement of leaking floating anaerobic digester roofs.

W1.3. Promote on-site anaerobic wastewater treatment at manufacturing facilities to reduce outflow to wastewater treatment plants and energy use.

W1.4. Continue landfill gas capture and beneficial reuse practices.

Strategy W2: Reduce energy consumption and fossil fuel use at solid waste and wastewater treatment operations.

Landfills require significant energy for transporting materials and facility operations. Wastewater treatment is particularly energy-intensive, especially for pumping and aerobic treatment of organic material. Improving efficiency can lower overall energy demand, ease grid strain and cut emissions from energy generation.

Electronic waste collection at a Delaware Solid Waste Authority collection site. **PHOTO: DNREC**

W2.1. Promote use of anaerobic digestion at public wastewater treatment plants over aerobic digestion.
W2.2. Explore Delaware-specific standards for reduced motor sizes at pumps and sewer lift stations to increase energy efficiency.
W2.3. Increase use of incentives such as DNREC's Clean Water State Revolving Fund for energy efficiency upgrades and on-site renewable energy.
W2.4. Investigate feasibility of establishing single-hauler districts to reduce emissions from transporting house-hold waste.
W2.5. Explore electrification of on-site vehicles and equipment.

GOAL: REDUCE AND DIVERT SOLID WASTE

The Delaware Solid Waste Authority has set a 50% waste diversion goal by 2040. Waste diversion means keeping materials out of landfills and redirecting them to more beneficial uses. Repair, reuse and recycling reduce energy demand, emissions and costs associated with extracting and processing new raw materials. Expanding markets and incentives for material reuse at the time of disposal can support broader emission reductions.

Recycling and the Need for Organic Waste Diversion

Delaware has a 72% recycling participation rate but has only a 38% waste diversion rate. The 2020 Statewide Solid Waste Management Plan reported that even perfect recycling participation would not achieve the state's diversion goal without additional efforts to divert organic waste.

Wastewater in the final stages of the treatment process is held in effluent ponds. PHOTO: CITY OF WILMINGTON

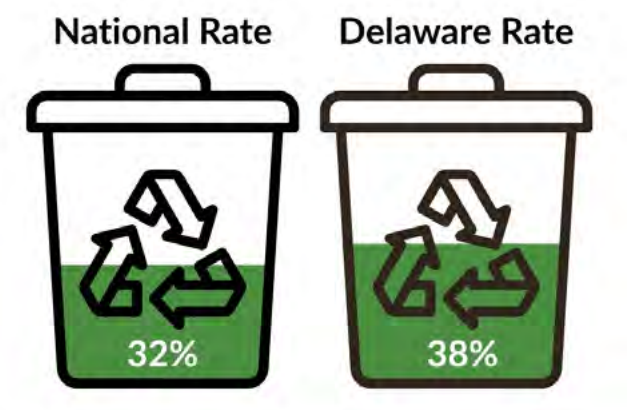


FIGURE 4.12. *Recycling diversion rates in Delaware.*

Strategy W3: Divert non-organic waste to recycling and other measures.

Delaware's recycling rate is already above the national average. This strategy builds on existing programs and explores new opportunities to reduce non-organic waste through partnerships and expanded initiatives.

W3.1. Enhance program participation and effectiveness through recycling assessments and public education.
W3.2. Update state agency procurement requirements for recycled products.
W3.3. Develop material-specific recycling targets for glass, metal, paper and plastics.
W3.4. Prepare for emerging high-impact waste streams, such as e-waste from data centers, solar panels and electric vehicle batteries.
W3.5. Explore regional waste management strategies, such as Extended Producer Responsibility programs.

Strategy W4: Divert organic material to composting and other management methods.

Organic waste is the leading source of methane emissions in municipal solid waste landfills. Diverting this material can meaningfully reduce waste-sector emissions.

W4.1. Expand community composting access, zoning, education and pilot programs through schools, farmers markets and community partnerships.
W4.2. Assess the need for an industrial-scale composting facility in Delaware.
W4.3. Study the feasibility of a centralized industrial-scale sludge management facility.

Capped landfill at the Sandtown Landfill in Felton, Delaware. PHOTO: WYLIE FEASTER, DNREC

Chapter 5: Land Use Intersections

Delaware strives toward sustainable growth, including expanded economic opportunity, improved housing availability, improved transportation systems and conservation of natural resources. Achieving sustainable growth requires coordinated land use decisions, strategic investments and careful consideration of climate change. This chapter outlines the connections between land use and climate change, the roles of local and state government, and highlights how the strategies outlined throughout this plan connect to land use decisions.

A roundabout at Five-Points helps ease traffic congestion near Delaware's beaches. **PHOTO: DELDOT**

Land use refers to the policies and decisions governing how land is allocated for development, agriculture and conservation. The land use choices made today about where and how to build homes, businesses and industries shape the state's future greenhouse gas emissions and the resilience of communities to climate change impacts. With thoughtful planning and coordination, Delaware's population growth and economic growth can support both its climate goals and improved quality of life.

Delaware's land use patterns are primarily dictated by decisions of its three counties and

57 municipalities. Each of these jurisdictions establishes their own rules about where certain types of development can occur through its zoning code. They also establish their own rules about how development will occur, including through building codes, architectural standards and environmental requirements. This local control means there is limited consistency between jurisdictions on rules for development. It also means there is no single statewide standard for housing density, parking requirements, forest preservation, buffers and floodplains.

Local government decisions about where and how to build homes, commercial and industrial developments have implications for neighboring jurisdictions and for the state, including for climate change. Development patterns affect state goals for economic development, housing availability and affordability, conservation of natural lands and agriculture. New developments must be supported by infrastructure including roads, schools and emergency services. Improperly sited or designed development projects can also exacerbate flooding and drainage issues. Because state agencies, rather than local governments, often provide funding for infrastructure and services, land use decisions at the local level have significant implications for state budgets and state spending.

Local Decisions, State Coordination

While local governments make land use decisions, significant coordination occurs with state agencies to make sure those decisions are consistent with state goals.

Delaware's Land Use Planning Act requires each county and municipality to develop comprehensive development plans every 10 years. These plans highlight future growth needs, proposed zoning changes, necessary investments and potential ordinance revisions. Each comprehensive development plan must align with the State Strategies for Policies and Spending. The Office of State Planning Coordination and state agencies review these plans, which the governor certifies.

The Land Use Planning Act was amended in 2024 to provide an additional planning tool to reduce Delaware's vulnerability to the impacts of climate change, including extreme weather events. It requires comprehensive development plans for cities over 2,000 residents and counties to account for climate change and be informed by the Climate Action Plan. For municipalities under 2,000 residents, incorporating climate change is recommended but not required.

The State Strategies for Policies and Spending is the statewide guiding document for land use policies and state infrastructure investments in Delaware. The Strategies define four investment levels along with areas off-limits for development, such as preserved or publicly owned lands.

- **Levels 1 and 2:** Already developed or growth-ready areas where further development and state investments for infrastructure upgrades are prioritized.
- **Level 3:** Areas identified for longer-term growth, or where new development is not immediately needed to accommodate growth.
- **Level 4:** Rural or natural areas where development is discouraged, and state funding prioritizes conservation and agricultural preservation.

In addition, state agencies provide feedback on development projects, rezonings, ordinances and comprehensive plans through the Preliminary Land Use Service. This early coordination step allows developers and local governments to receive state agency feedback before decisions are finalized. It also allows the state to identify inconsistencies between land use requests and the local comprehensive plan, as well as potential inconsistencies with the State Strategies.

Land Use Intersections with Climate Change

Land use patterns and practices have a powerful intersection with climate change in Delaware. Patterns of growth and development influence current and future greenhouse gas emissions in the transportation, buildings and electricity sectors, and determine whether the state can maximize carbon storage in natural lands. Decisions about where to locate homes and businesses also define the state's flood vulnerability, communities' disaster recovery capacity and ultimately Delaware's potential exposure to losses from climate impacts.

These intersections are explored below and reflected in strategies presented in other chapters. These concepts, coupled with the strategies and actions throughout the plan, can help inform future planning, including local government comprehensive development plans.

Three primary intersections exist between land use choices and climate change:

1. Development patterns and transportation greenhouse gas emissions

An aerial view of suburban residential development. **PHOTO: ADOBE STOCK**

2. Preservation of agricultural and natural lands for carbon sequestration and resilience benefits
3. Avoidance of development in high-risk, vulnerable areas

Current Challenges

These land use intersections have driven Delaware's greenhouse gas emissions, especially from transportation, and challenge the state's resilience to flood events. Delaware's specific challenges are outlined below.

SUBURBAN DEVELOPMENT PATTERNS INCREASE CAR DEPENDENCY AND EMISSIONS FROM TRANSPORTATION

Development trends in Delaware continue to show an increase in large, single-family homes farther away from town and city centers. This type of sprawling development pattern increases driving distance to schools, work, stores and services, often making transit, walking and biking impractical. Traffic congestion, especially in fast-growing communities, such as Middletown and eastern Sussex County, is a common complaint and growing concern. The car dependency of many places in Delaware is evident in our emissions; in 2021 nearly half of transportation sector emissions were from passenger vehicles, and progress abating those emissions has been slow (see *Transportation* section of Chapter 4).[113] Suburban development patterns make reducing emissions by improving transit or walkability challenging and explain why state plans typically focus on transitioning to electric vehicles as the most feasible way to abate transportation emissions in the short term.

LOSS OF FARMLAND AND FORESTS REDUCES OPPORTUNITIES TO STORE AND SEQUESTER CARBON DIOXIDE

Converting farms and forests for residential and commercial development reduces the ability to store and sequester carbon dioxide. Urban sprawl is consuming forests and farmland at a rapid pace; the rate of development was one of the most common concerns shared by Delawareans during the development of this plan.[114,115] In 2050, there will inevitably still be greenhouse gas emissions in Delaware, especially from gas-powered vehicles still on the road and from industrial processes. To reach Delaware's net-zero emissions target, the state must enhance the ability of wetlands, forests and farm fields to absorb and store carbon dioxide, which starts by protecting and preserving that land. Using natural lands to capture carbon dioxide is the most cost-effective way to offset future emissions. Delaware has already lost ground with respect to carbon sequestration and storage. Between 2005 and 2021, the ability of our agricultural and natural lands to store and sequester carbon decreased by 36%, from 1.1 to 0.7 $MMCO_2e$.[116]

LOSS OF FORESTS, TREES AND WETLANDS REDUCES RESILIENCE OPPORTUNITIES

Natural lands provide significant benefits for flood attenuation and shading. Wetlands act like sponges to absorb floodwaters during coastal storms and heavy precipitation events. Wetlands can also help to break up and slow down waves, helping to reduce erosion and infrastructure damage. Forests and meadows also provide significant value in absorbing

excess rainfall and reducing potential for flooding. Forests also provide shade and cooling benefits. In urban areas in particular, forests and trees help absorb floodwaters and reduce stormwater runoff while also providing cooling benefits and respite from heat.[117]

CONTINUED DEVELOPMENT IN OR NEAR FLOODPLAINS EXACERBATES FLOOD VULNERABILITY

Delaware's history is tied to the water. Most of Delaware's cities and towns are located next to a river, bay or the Atlantic Ocean. Seventeen percent of Delaware's landmass and more than 25,000 properties lie within a 100-year floodplain.[118,119] Increasing heavy downpours and sea level rise will put more properties at risk in the coming decades. Yet, development pressure is high in coastal areas because people want to live and recreate near the water. Although risk of flooding is increasing with climate change, new homes and businesses continue to be constructed in, or near risky areas. Two of Delaware's counties and numerous municipalities prohibit most development activities in the floodplain due to these risks.

Emerging Opportunities

There is momentum in Delaware to address the severe housing shortage, protect farmland and natural areas, improve resiliency to flooding and create better transportation options. Generally, solutions to these issues are promoted in separate silos of professionals and advocates working together toward their goals. Now there are opportunities to make links between these separate goals under the umbrella of climate change.

PROMOTE DENSE, CONNECTED, MULTIMODAL-FRIENDLY COMMUNITIES

Longer term planning and policies implemented by counties and municipalities can encourage denser and more connected development. This would increase safe and reliable access to transit, walking and biking and offer an alternative to vehicle trips, which could help reduce transportation emissions. Dense housing consumes less energy and uses fewer materials. It also reduces lot sizes, requiring less lawn maintenance. Creating dense, vibrant communities helps reduce greenhouse gas emissions from transportation and energy use. It can also promote affordable and diverse housing choices while directing housing development away from farms and forests.[120]

REMOVE BARRIERS TO INFILL DEVELOPMENT

Infill development refers to developing abandoned or under-utilized spaces in already developed areas. Redeveloping already developed land can be challenging due to building codes, outdated parking standards, historic preservation requirements, contaminated soils or other requirements. People wary of changes to their neighborhood can also present barriers for infill development. But redeveloping and revitalizing under-used properties reduces blight and excessive stormwater runoff from abandoned parking lots, creates jobs and community amenities and increases local tax revenues. Most importantly, it also helps drive new development away from landscapes that Delawareans want to see preserved.[121]

PRESERVE DELAWARE'S FARMS, FORESTS AND WETLANDS

More than 80% of Delawareans support actions to protect forested land in development projects.[122] They recognize that forested lands, along with Delaware's farms and wetlands, provide significant benefit to Delaware communities. While Delaware has a strong foundation for preservation, there are many opportunities to accelerate land preservation practices. Indirectly, easing the path to denser development and infill development is one way to help reduce development pressures on farms and forests over the long term.

AVOID NEW DEVELOPMENT IN FLOOD-PRONE AREAS

Developing in or near flood-prone areas increases the state's vulnerability and liability for future damage. Avoiding new development in flood-prone areas is the best way to avoid flood damage.[123] Some county and municipal governments already have stringent requirements for development activities in floodplains; some do not. Where new development in flood-prone areas is still allowed, most do not yet incorporate future climate conditions in their requirements.

In certain places, especially downtown areas in Delaware's historic river towns, development or redevelopment in flood-prone areas is unavoidable. In those cases, developers and municipal officials can strive to employ practices that enhance flood resiliency and keep people safe in the event of a hazard or disaster. Updating aging stormwater and drainage infrastructure to withstand larger quantities of water can prevent additional stormwater runoff. Proactive evacuation plans that appropriately consider future risks provide additional community resiliency.

The Charles Emerson Pedestrian and Bicycle Bridge in Newark connects neighborhoods and improves safety and walkability. **PHOTO: DELDOT**

The Mispillion Riverwalk winds through the heart of downtown Milford and allows walkers to enjoy the Mispillion River.
PHOTO: DNREC

Intersections with the Climate Action Plan

The four emerging opportunities for land use practices outlined above are reflected throughout the Delaware Climate Action Plan. Strategies focused on preservation of natural lands can be found in the Forests and Urban Trees and Agriculture sections of Chapter 4 and the Extreme Heat section of Chapter 6. Strategies focused on building practices can be found throughout the transportation and buildings sections of Chapter 4.

The following Climate Action Plan strategies specifically support the emerging opportunities highlighted above.

R3: Provide technical assistance to local governments to incorporate climate change into planning efforts.

T1: Improve bus transit ridership by improving travel times, service frequency, efficiency and coverage.

T3: Expand multimodal transportation options in communities.

T4: Adopt a plan to complete a statewide multimodal network.

T5: Improve access to bikes.

T6: Design communities for pedestrian and cyclist safety.

A5: Preserve agricultural lands.

N1: Protect, conserve and expand forested lands.

O1: Protect and preserve existing wetlands.

P2: Protect and preserve tidal and non-tidal wetlands.

H5: Support infrastructure and building designs that reduce heat impacts.

P4: Create or enhance green spaces.

P7: Protect homes and buildings from flooding.
R1: Enhance the resilience of natural landscapes and agricultural lands.
R2: Invest in nature-based solutions and infrastructure improvements that support resilience to multiple hazards.

Opportunities Moving Forward

Land use decisions offer an opportunity to bring together partners for affordable housing, equity, transportation, economic development, emergency management, land preservation and other concerns to ensure that the four emerging opportunities described above are considered together as Delaware plans for and builds its future. There are many synergies between the land use strategies in this Climate Action Plan and other planning initiatives in Delaware, including the Strategies for State Policies and Spending. Moving forward, the Cabinet Committee on State Planning Issues, together with local governments, conservation organizations, housing developers and businesses, will play important roles in achieving compact mixed-use development and land preservation to enhance climate resiliency in Delaware.

Chapter 6: Protecting Our Communities

Delaware faces a distinct set of climate challenges shaped by its geography. The state's most pressing hazards include extreme heat and flooding driven by rising temperatures, shifting precipitation patterns and accelerating sea level rise. Climate change is also introducing emerging threats that were historically less common but are expected to grow in significance, such as increased wildfire risk, prolonged drought, ocean and coastal acidification, more frequent extreme weather, invasive species and expanding vector-borne diseases. Preparing for both established and emerging hazards is critical to safeguarding Delaware's residents, economy and environment.

Lewes Ball Field living shoreline. **PHOTO: DNREC**

While there is no one-size-fits-all solution, strategic action delivers measurable returns. Research from the U.S. Chamber of Commerce shows that every dollar invested in climate resilience and disaster preparedness saves communities $13 in avoided economic losses.[124] Beyond financial benefits, holistic adaptation solutions can address multiple hazards simultaneously while generating co-benefits such as improved public health, enhanced ecosystem services and stronger social cohesion.

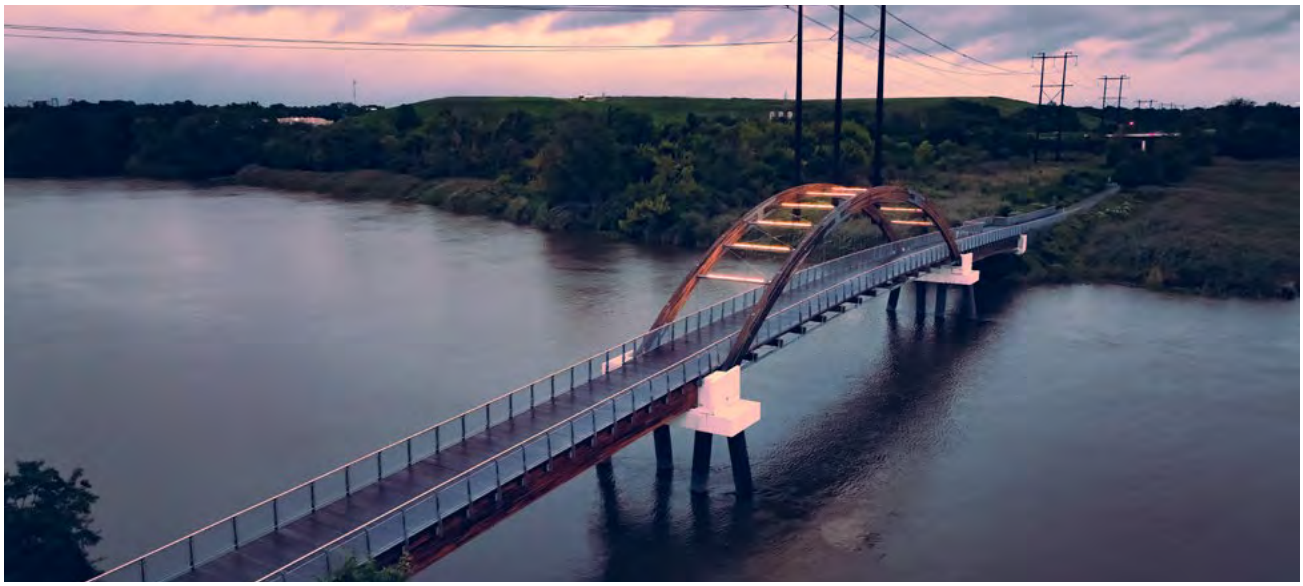
What Are Co-benefits?

Co-benefits include intended climate benefits and other "secondary" or unintended positive side effects. For instance, wetland restoration undertaken for carbon storage and flood protection can also improve water quality, create habitat, enhance aesthetics and support mental health. Each strategy in this plan highlights its potential co-benefits.

This chapter evaluates Delaware's near- and long-term vulnerabilities to a range of climate hazards. Sections are organized by hazard type and describe current vulnerabilities, summarize foundational policies and ongoing efforts, and present adaptation strategies and actions designed to deliver measurable resilience benefits. The chapter concludes with a discussion of comprehensive resilience, emphasizing preparedness across multiple, interconnected hazards.

Climate adaptation is a continuous process that requires ongoing monitoring, learning and adjustment. By building on the 2021 Climate Action Plan, the goals, strategies and actions presented here will protect people, places, and infrastructure; accommodate changing conditions; avoid future risk; and help communities strategically retreat from areas that cannot be safely protected.

The hazard-specific strategies and actions are organized into broad goals, creating a flexible toolkit for state agencies, local governments and communities to prepare for and respond to climate change. Because the Climate Action Plan is updated every five years, the strategies and actions presented in this chapter focus on actions that can feasibly be initiated or accomplished within that timeframe. Refer to Chapter 1 for additional information about how strategies and actions are used in this plan. Long-term resilience will depend on sustained coordination, adequate resources and a shared commitment to building a more resilient Delaware.



Markell Trail Bridge. **PHOTO: DELDOT**

Extreme Heat

Extreme heat is an increasing hazard in Delaware. **PHOTO: NATHAN HURST, UNSPLASH**

IN DELAWARE, annual and seasonal temperatures have increased by about 3 degrees F since 1895,[125] with 2010 to 2019 marking Delaware's hottest decade on record.[126] Climate projections show continued warming, with average temperatures expected to rise 3 degrees F to 4 degrees F by midcentury and 5 degrees F to 9 degrees F by 2100. The number of days above 90 degrees F is projected to increase by 35 to 75 additional hot days per year by 2100.[127] Nighttime temperatures are also expected to rise. Elevated nighttime heat increases the risk of heat-related illness and mortality, as the body cannot cool and recover overnight.[128] Fewer freezing days and more high-heat days over 90 degrees F will also extend Delaware's growing season, creating both opportunities and challenges for agriculture and habitat restoration.

What Is an Urban Heat Island?

Throughout this section, there are references to urban heat islands and the effects they have on extreme heat. Urban heat islands are developed areas, such as cities, that experience higher temperatures due to the prevalence of heat-trapping surfaces, such as pavement and asphalt, and a lack of trees or green spaces to provide shade and cooling.[129] Daytime high temperatures in an urban heat island can be as high as 15 degrees F to 20 degrees F hotter than surrounding vegetated areas.[130] Because of this heat island effect, the places people live can have a major impact on how they experience heat waves, even from neighborhood to neighborhood. A 2023 urban heat mapping study in Wilmington found a difference of 11.1 degrees F between its coolest and hottest neighborhoods on a hot July afternoon.[131]

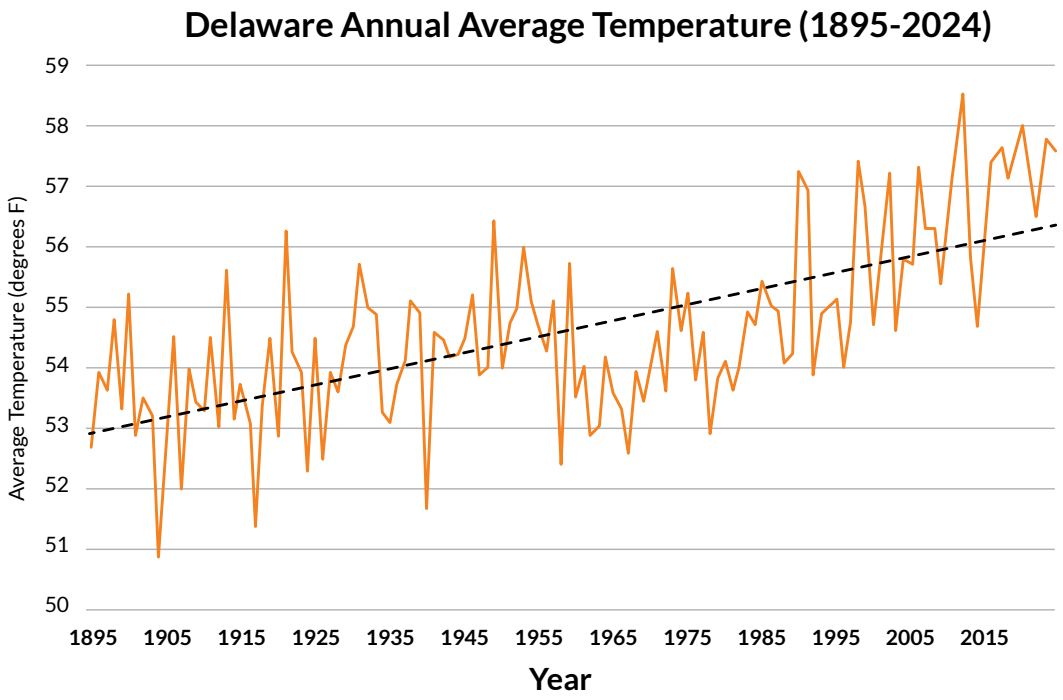


FIGURE 6.1. *Annual average temperatures for Delaware, 1895 to 2024.* **SOURCE: NOAA CLIMATE AT A GLANCE.**

FOUNDATIONAL POLICIES AND PROGRAMS

Only a few states currently have specific heat exposure standards. Most, including Delaware, follow the Occupational Safety and Health Administration (OSHA) guidelines for workplace safety. As summer temperatures continue to set new records, more states are developing programs to monitor and address heat-related illnesses both at work and in the community. The following foundational policies establish the framework for Delaware's heat resilience efforts.

Occupational Safety and Health Act (1970)

OSHA's *General Duty Clause* requires employers to provide workplaces that are "free from recognized hazards that are causing or likely to cause death or serious harm to employees." This includes heat-related hazards.[132] In 2025, OSHA released draft text for a proposed *federal heat standard*, opening it for public comment. The proposed rule would require employers to assess and control heat hazards, develop heat illness prevention plans, and take specific actions to protect workers from dangerous heat conditions.[133]

Delaware Workplace Safety Regulation

The Delaware Department of Insurance manages the Workplace Safety Program, which offers insurance premium discounts to employers who maintain safe conditions and pass safety inspections. This program can help encourage stronger heat safety practices in workplaces statewide.[134]

RECENT PROGRESS

As temperatures have risen over the past several decades, Delaware has begun

implementing strategies to better track and respond to extreme heat, including the key efforts highlighted next.

Heat Mapping in Wilmington and Surrounding Townships (WiST)

The University of Delaware's Climate Change Hub, DNREC, community partners and residents collaborated on a heat data collection and mapping project to improve understanding of how heat changes throughout the day in urbanized Wilmington and surrounding townships. (See Figure 6.2)[135]

Heat-related Illness Emergency Department Visits in Delaware, 2019 to 2023

In 2024, Delaware Health and Social Services (DHSS) released its first 5-year surveillance report on heat-related morbidity in Delaware. The report identifies trends and populations most at risk, providing data to inform future heat preparedness and response planning.[136]

Community Cooling Centers

In response to rising temperatures, local governments and organizations began opening cooling centers at community facilities such as

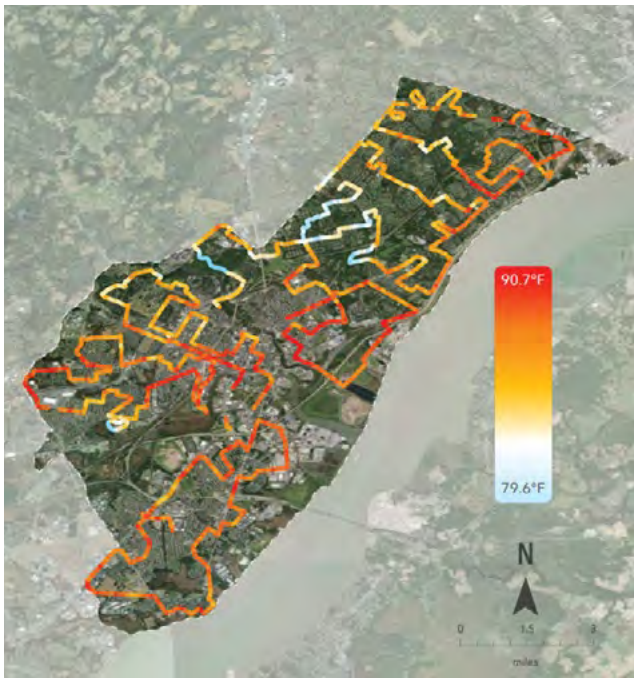


FIGURE 6.2. *Wilmington neighborhood temperature data gathered by community volunteers during the WiST Heat Watch urban heat mapping campaign.* **SOURCE: WIST HEAT WATCH 2023 SUMMARY REPORT.**

WiST Urban Heat Watch Volunteers from the Delaware Resilience Hub, University of Delaware's Climate Change Hub, and DNREC. **PHOTO: JESSICA QUINN, DNREC**

Construction worker on a boom lift shelters under improvised shade during heat wave. **PHOTO: DNREC**

Delaware's First Resilience Hub and Friendship House in Wilmington. Beginning in summer 2024, New Castle County, DNREC, DHSS, emergency managers, NGOs and community groups collaborated to plan for extreme heat days, activate cooling sites and prepare residents for dangerous heat conditions.

RISKS AND VULNERABILITIES

Extreme heat is sometimes referred to as a "silent killer," because its health impacts can be subtle but deadly, making it difficult to recognize and prevent. Rising temperatures can overwhelm the body's ability to regulate itself, leading to heat exhaustion and heat stroke. High temperatures also put greater strain on the heart and lungs, and certain medications can reduce the body's ability to regulate temperature. As a result, people with cardiovascular or respiratory disease, chronic illnesses or other conditions may find themselves at greater risk.[137] Heat health effects are particularly acute in densely populated urban areas such as Wilmington, Dover and Seaford, where the urban heat island effect makes heat waves more severe. Children, adults over 65, outdoor workers, pregnant people, people without access to air conditioning at home, people with disabilities or pre-existing conditions, incarcerated people and unhoused communities face heightened risk.[138] Minority and low-income communities experience greater exposure due to inequalities in healthcare access and built environment.[139]

Higher temperatures will also lead to increased demand for energy to cool buildings and homes, placing further stress on energy infrastructure. Under the high emissions

scenario described in Chapter 2, cooling degree days — a measure of air conditioning demand based on temperature — are expected to double by the end of the century.[140] Electrical components such as transformers and conductors can experience increased stress, reduced efficiency and shortened lifespan from prolonged exposure to extreme high temperatures.[141] Similarly, extreme temperatures can cause buckling of roads and railways. Extreme heat can also delay infrastructure repairs due to health concerns for workers during heat waves.

Outdoor workers face disproportionate exposure to extreme heat, often during the hottest parts of the day. Farm workers must be particularly mindful of heat exhaustion while working outdoors, especially in late spring and summer. Additionally, while longer growing seasons and milder winters may sound beneficial for farmers, they can also increase incidence of pests and weeds.[142] Higher average temperatures and extreme heat waves, especially combined with variable precipitation and risk of drought, mean that agricultural producers could see reductions in harvest yields and an increase in water demand for irrigation. Livestock are also affected by heat stress; high temperatures can reduce milk production in dairy cattle, and poultry producers will face higher cooling costs to keep poultry houses at a safe temperature for their birds.[143]

Table 6.1. Summary of extreme heat impacts.

Public Health	· Heat stress and illness · Mental health impacts · Increased mortality risk · Increased vector-borne disease risk
Energy	· Higher AC demand and higher energy bills · Potential damage to electrical components, reduced efficiency
Transportation	· Buckling roadways and tracks · Heat exposure for pedestrians, cyclists and public transit users
Infrastructure	· Urban heat island effect · Damage to buildings
Labor	· Health threats to outdoor workers · Heat-related work accidents · Decreased work capacity and productivity
Agriculture	· Reduced crop production · Livestock impacts such as reduced milk production · Higher irrigation demands · Higher pest management costs
Natural Resources	· Shifts in plant and wildlife ranges and habitats · Reduced food availability · Increase in pests and diseases in ecosystems

An intense heat wave in June 2025 caused Delaware roads to buckle. PHOTO: DELDOT

STRATEGIES AND ACTIONS

The following strategies provide a roadmap for building resilience to extreme heat. Key priorities include raising awareness and improving emergency response, improving data collection on heat events and heat-related illness, creating more resilient and heat-informed urban communities, and protecting the safety of Delaware's outdoor workers.

GOAL: IMPROVE DATA COLLECTION, RESEARCH AND DECISION SUPPORT TOOLS FOR EXTREME HEAT

Strategy H1: Strengthen understanding of how extreme heat affects human health and well-being.

While extreme heat can occur statewide, impacts from any single event are localized and do not affect communities uniformly. Local variables can influence heat intensity and exposure, such as paved surface area, access to green space and tree cover, and availability of cooling technologies such as air conditioning. Enhanced temperature monitoring and tracking would improve heat warnings and help prioritize protections for vulnerable populations, including older adults and people with disabilities.

H1.1. Create a statewide heat exposure and urban heat island map that integrates social and public health data to establish a heat risk index for prioritizing adaptation actions.

H1.2. Explore using new and existing heat sensors through the Delaware Environmental Observing System (DEOS) at key locations, such as urban areas, to monitor temperatures and improve extreme heat alerts.

H1.3. Conduct heat vulnerability assessments focused on public transit riders and pedestrians, identifying opportunities for heat relief measures such as shade structures.

H1.4. Expand knowledge of extreme heat effects on worker health and safety by conducting a preliminary study to estimate Delaware's workforce that is exposed to extreme heat and map concentration of outdoor or heat-prone workers throughout the state.

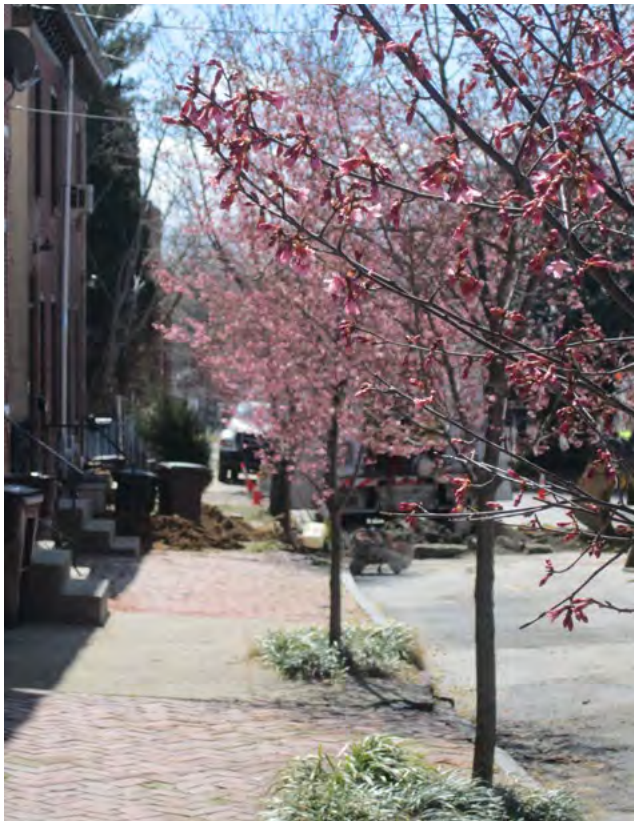
H1.5. Conduct vulnerability assessments on Delaware's prisons and correctional facilities to address extreme heat exposure among incarcerated individuals.

Strategy H2: Improve data tools for tracking excessive heat impacts on natural resources and agriculture.

Hotter temperatures threaten agriculture, natural landscapes and wildlife. Extreme heat stresses crops and species ill-suited to withstand these conditions, increasing management demands. Shifts in growing seasons and seasonal patterns, particularly when coupled with drought (discussed in the Emergent Hazards section) and unpredictable extreme weather, can increase risks for farmers.[145] Increased water temperatures in Delaware's oceans and bays also harm fisheries, coastal ecosystems and the communities that depend on them.[146] The following actions aim to strengthen agricultural and fishery economies while securing Delaware's food supply.

H2.1. Work with Delaware Cooperative Extension to develop heat risk assessments for workers and crops. Incorporate into existing guidance for natural resource professionals and farmers.

WiST Heat Watch volunteers and vehicle with car-mounted temperature sensor. **PHOTO: DNREC**



Well-maintained street trees reduce the urban heat island effect. **PHOTO: DELAWARE CENTER FOR HORTICULTURE**

H2.2. Conduct vulnerability studies to understand the impacts of extreme heat on poultry, livestock, fisheries and aquaculture.

GOAL: FOSTER COLLABORATION TO SUPPORT EXTREME HEAT PREPAREDNESS

Strategy H3: Strengthen collaboration with healthcare providers and other trusted partners to advance heat monitoring and risk prevention.

Anyone exposed to high temperatures risks heat exhaustion or heatstroke, but people with chronic medical conditions face heightened danger. High temperatures stress the body and worsen respiratory and cardiovascular diseases, diabetes and kidney disease.[147] Certain medications can also interfere with the body's ability to regulate temperature. Additionally, hot sunny days increase ground-level ozone formation, intensifying air pollution that aggravates asthma and other respiratory conditions.[148] Given these complex interactions between heat and health, close collaboration with healthcare providers is critical to fully understand heat impacts in Delaware and raise public awareness.

H3.1. Continue to support collaborations with hospitals and emergency departments to improve data sharing on critical heat illness metrics such as *My Healthy Community* and the *Heat-related Illness in Delaware Report*.[149]

H3.2. Reconvene the *Delaware Climate + Health Conference* to share findings and address climate change impacts exacerbating public and environmental health.[150]

H3.3. Collaborate with professional associations to disseminate existing training materials on heat-related illnesses, prevention, identification and treatment prior to upcoming heat seasons.

H3.4. Work with partners to create brochures or posters for clinics and hospital waiting rooms with practical heat prevention messaging: hydration reminders, recognizing heat illness symptoms, and safe medication management during extreme heat.

H3.5. Encourage medical providers to review patient medication lists — particularly for drugs that affect thermoregulation (e.g. SSRIs, diuretics) - to provide preventative counseling ahead of heat season.

GOAL: SUPPORT HEAT-RESILIENT DESIGN AND COMMUNITIES

Strategy H4: Support a coordinated network of community cooling centers to ensure all Delawareans have access to safe cooling spaces.

On extremely hot days, localized cooling options are essential to protect public health. Cooling centers provide air-conditioned spaces for respite, education and resources — especially for vulnerable populations and those who cannot cool in place. While emergency managers, non-governmental organizations and community organizations in some Delaware communities

already operate cooling sites, a coordinated statewide effort with leadership by health providers can expand access and improve communication.

H4.1. Incorporate community-building activities to engage residents in vulnerable neighborhoods and urban heat islands in the planning and creation of cooling centers that meet local needs.
H4.2. Prioritize outfitting designated cooling centers in vulnerable neighborhoods with cooling technology, like high-efficiency heat pumps.
H4.3. Ensure accessible information about heat-health and cooling options reaches vulnerable populations, such as older adults, houseless individuals and people living with disabilities.
H4.4. Improve communications from agencies to the public around cooling center opportunities with identifiable heat thresholds and protocols for activating heat relief services statewide.
H4.5. Increase resources and capacity to operate cooling centers to extend hours of relief as needed.

Strategy H5: Support infrastructure and building designs that reduce heat impacts.

Built environments such as roads, roofs and buildings absorb and radiate heat more than natural landscapes, increasing local temperatures and straining infrastructure.[151] Extreme temperatures can cause roads and train tracks to buckle, create travel disruption and additional unplanned maintenance. The demand for energy to cool buildings and homes increases on hot days, placing further stress on energy infrastructure and potentially leading to power outages. Expanding green space and shade helps reduce urban heat, prevent damage and improve community well-being.

H5.1. Support collaboration to develop cool roof programs for buildings, bus stops and other structures.
H5.2. Evaluate opportunities to retrofit paved areas with reflective or cooling coatings and use sustainable materials in new construction.
H5.3. Increase availability of publicly accessible shade structures and water stations in parks, at transit stops and near sidewalks.
H5.4. Explore minimum shade requirements for new parking lots and car parks.

GOAL: ENHANCE TECHNICAL SUPPORT FOR COMMUNITY COOLING

Strategy H6: Advance heat-informed planning through research and data sharing.

Many effective extreme heat adaptations, such as green space, shade and cooling centers, are best implemented locally. Recent legislation requires municipal comprehensive plans to address the impacts of climate change and increase community resiliency.[152] Up-to-date, localized climate data can guide planning decisions and strengthen community resilience. Delaware's

White roof coatings reflect sunlight and reduce heat absorption, lowering indoor temperatures and supporting climate resilience. **PHOTO: ADOBE STOCK**

2025 climate planning scenarios update includes new temperature projections to support this work.

H6.1. Develop guidance and technical support for local land use laws that incorporate extreme heat mitigation and accelerate cooling strategies for outdoor environments, such as landscaping standards.

H6.2. Help municipalities create urban tree inventories and forestry plans emphasizing native species and long-term maintenance.

H6.3. Provide climate planning scenarios, including temperature projections to support heat-informed planning.

Strategy H7: Educate the public and businesses about heat risks and potential solutions.

In the United States, heat is the leading cause of weather-related deaths, many of which are preventable through awareness campaigns and timely medical intervention.[153] Increasing public and workplace awareness can save lives and promote safer environments for employees and visitors.

H7.1. Provide accessible public education, messaging and training in English, Spanish and Haitian Creole, focusing on recognizing symptoms of heat illness and prevention strategies, leveraging resources available through *PrepareDE*.

H7.2. Educate visitors at parks, wildlife areas, forests and historic sites about extreme heat risks and encourage protective measures.

H7.3. Provide education to homeowners and property managers about the value of tree canopies in reducing climate impacts such as heat.

GOAL: ENHANCE OUTREACH AND ENGAGEMENT ABOUT EXTREME HEAT, ESPECIALLY TO VULNERABLE POPULATIONS

Strategy H8: Target education and risk reduction in vulnerable communities, such as those located in urban heat islands.

Extreme heat affects all of Delaware but is unevenly distributed, with higher exposure in urban heat islands. Communities can reduce these risks through actions such as planting trees, expanding green spaces, using reflective materials on roofs and roads, and improving home energy efficiency to keep homes cool and make power bills more affordable.[154]

H8.1. Expand outreach and participation in Delaware's Weatherization Assistance Program and the Low-Income Home Energy Assistance Program (LIHEAP).
H8.2. Target tree planting and maintenance programs to urban heat islands.
H8.3. Pilot cool roof and cool street programs in areas with urban heat islands.
H8.4. Fund and support sustainable building design and redevelopment at brownfield sites, incorporating solar energy, native landscaping and ecological restoration to minimize heat impacts.
H8.5. Work with partners to advance cooling in place through educational materials and resource giveaways like air conditioning units and fans, for vulnerable communities.

Strategy H9: Conduct targeted efforts to protect Delaware's workforce, especially outdoor workers, from adverse extreme heat impacts.

Outdoor workers and those without access to air conditioning are at increased risk of heat stress and heat-related illness during extreme heat events.[155] In Delaware, the construction industry employs more than 24,000 workers, many of whom regularly work outdoors.[156] A DHSS report on heat-related illness in Delaware found that 42% of heat exposure incidents recorded in the emergency department occurred in the workplace.[157] Strengthening worker protections and awareness can significantly reduce heat-related injuries and illnesses.

H9.1. Review and update policies and regulations to improve outdoor worker safety during extreme heat.
H9.2. Identify and promote best practices to reduce heat risks in high-exposure industries such as agriculture, transportation and construction.
H9.3. Develop heat safety outreach materials for outdoor workers and ensure they are widely available to Delaware businesses.

Sea Level Rise, Precipitation and Inland Flooding

Flooding caused by high tides and a coastal storm event resulted in a dune breach at the Indian River Inlet. **PHOTO: DNREC**

SEA LEVEL RISE

Global sea levels are rising due to climate change, but Delaware's low average elevation, flat terrain and ongoing land subsidence — the slow sinking of land over time due to natural and human-induced factors — already make the state more susceptible to coastal impacts. Tide gauges in and around Delaware show sea levels rising at roughly twice the global average rate.[158] Over half of the state's cities and towns are at risk or are already feeling the impacts of sea level rise and flooding.[159]

Sea level rise refers to the increase in ocean height relative to land, driven by climate-related factors such as the thermal expansion of warming seawater and the melting of glaciers and ice sheets.[160] More than half of Delaware's cities are already experiencing the effects of sea level rise or face a heightened risk.[161]

Average sea level has risen about 10 inches since 1956 at the Reedy Point tide gauge in New Castle County and about 15 inches since 1919 at the Lewes tide gauge in Sussex County. Both sites show accelerating rates of sea level rise and more frequent flooding. Projections indicate an additional 1.2 to 1.5 feet of rise by midcentury and as much as 4 feet to 6 feet under the "high emissions" scenario by 2100.[162]

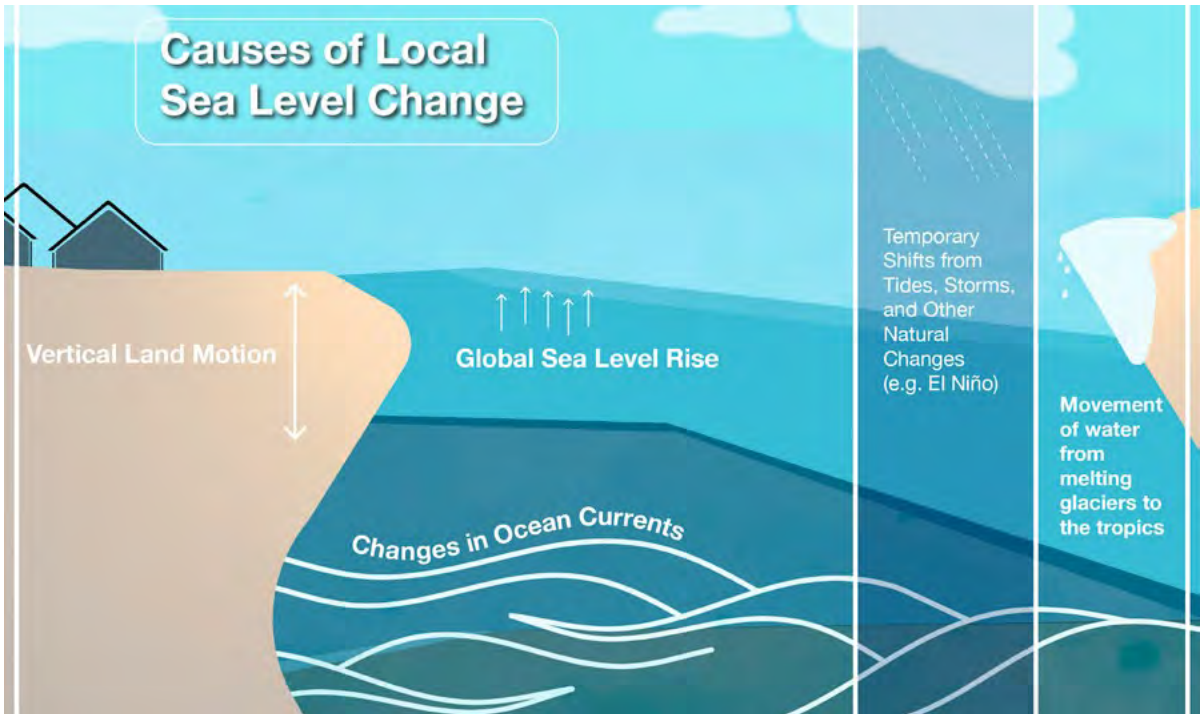


FIGURE 6.3. *Causes of local sea level change.* **SOURCE: EARTH INFORMATION CENTER.**

Sunny Day Flooding

Sunny day flooding can occur when high tides inundate low-lying areas, without additional water from storms or precipitation. Sunny day flooding is often associated with tidal changes and is expected to become more frequent as sea levels continue to rise. However, many coastal communities are already experiencing the effects of sunny day floods which cause road closures and traffic delays.

Sunny day flooding at Mispillion Harbor. **PHOTO: LYNNE PUSEY, DNREC**

A ghost forest is an area of once-healthy trees that have died due to rising sea levels, saltwater intrusion or persistent flooding. **PHOTO: DNREC**

Saltwater Intrusion

Saltwater intrusion is the movement of water from the ocean and bay farther inland, affecting future land use. Saltwater intrusion occurs both during storm surges and high tides, when saltwater floods low-lying areas and underground, as saltwater infiltrates freshwater aquifers farther inland. Saltwater intrusion may result in acres of lost farmland, loss of wetlands, infiltration into freshwater irrigation systems, septic systems and drinking water. Changes in salinity can also have negative impacts on plant communities, like creating ghost forests.

PRECIPITATION AND INLAND FLOODING

Even a few inches of rain can trigger flash flooding, pose serious safety risks and cause costly damage to homes and businesses. It takes only 6 inches of fast-moving floodwater to knock over an adult and only 12 inches of water to float most cars.[163] Flooding is especially hazardous in urban areas where natural floodplains have been replaced by paved surfaces and undersized drainage systems that limit the absorption of rainfall.

From 1991 to 2020, Delaware averaged about 46 inches of precipitation annually, distributed fairly evenly throughout the year.[164] Since 1895, annual precipitation has increased by roughly 3 inches (about 0.23 inches per decade). Precipitation changes linked to climate warming account for over one-third of inland flood damage in the United States since 1988. Delaware's annual precipitation is projected to increase by an additional 2 inches to 4 inches by midcentury.[165,166]

Flood Risk Beyond the Floodplain

Sea level rise, heavy rainfall and sunny day flooding can combine to create compound flooding — flooding worsened by multiple contributing factors. Flooding can occur almost anywhere, yet only properties with federally backed mortgages located in high-risk, or Special Flood Hazard Areas, are required to carry flood insurance.

Federal Emergency Management Agency (FEMA) flood maps define the 100-year flood zone as areas with a 1% annual chance of flooding. While 1% may seem small, the cumulative risk grows over time. A property in a 100-year floodplain has about a 26% chance of flooding at least once during a 30-year mortgage.

Flood maps are useful for understanding current flood risk, but they are based on historical data and typically do not account for future changes from climate change or sea level rise. Because standard homeowners' insurance does not cover flood damage, even properties outside high-risk areas remain vulnerable. Property owners in low- and moderate-risk zones are encouraged to purchase flood coverage through the National Flood Insurance Program, when available, or private insurers. Notably, about 40% of National Flood Insurance Program claims come from properties outside designated high-risk flood zones.[167]

FOUNDATIONAL POLICIES AND PROGRAMS

The highlights below include foundational policies and programs established to protect Delaware's beaches and wetlands and improve resilience to impacts from sea level rise, precipitation and flooding.

Delaware Beach Preservation Act

The Beach Preservation Act (1972) authorizes DNREC to protect and manage the state's beaches and dunes as vital natural defenses against coastal storms and flooding. The Act establishes the State Building Line, which regulates construction and other activities in erosion-prone coastal areas. Through these provisions, DNREC works to preserve beach and dune systems that reduce flood risk and strengthen Delaware's long-term coastal resilience.[168]

Delaware Wetlands Act

The Wetlands Act (1973) authorizes DNREC to protect, regulate and manage all tidal wetlands, as well as non-tidal wetlands that include 400 or more contiguous acres, as critical natural resources that buffer storm impacts, reduce flooding and improve water quality. The Act regulates activities such as dredging, filling, bulkheading and construction within designated wetlands to prevent loss and degradation of these vital ecosystems. By conserving wetland areas, the law enhances Delaware's natural resilience to sea level rise and extreme precipitation.[169] The locations of State-regulated wetlands are published on a set of maps maintained by DNREC: *State-regulated Wetland Map Index*.

Delaware Subaqueous Lands Act

The Delaware Subaqueous Lands Act grants DNREC the authority to manage and regulate

Rainstorm over the Delaware Bay. PHOTO: LYNNE PUSEY, DNREC

the use of submerged lands, including rivers, bays and coastal waters, to protect public resources and environmental quality. The Act requires permits for activities such as dredging, filling or construction in subaqueous areas, ensuring that development does not harm aquatic habitats or increase flood and erosion risks. By regulating these activities, the law helps preserve natural waterway functions that support resilience to sea level rise, storm surge and flooding.[170]

National Flood Insurance Program

After a series of major flood disasters, Congress passed the National Flood Insurance Act of 1968, creating the National Flood Insurance Program which provides federally backed flood insurance to property owners in participating communities. In exchange, communities adopt and enforce floodplain management regulations that reduce flood risk and guide safer development. The Federal Emergency Management Agency (FEMA) administers the program and develops mapping and insurance standards that help Delaware communities plan for flood hazards, reduce financial losses and strengthen resilience to increasing precipitation and flooding.

Flood Mitigation Standards

The DNREC Floodplain Management Program develops guidance and minimum flood mitigation standards to assist local communities participating in the National Flood Insurance Program. The flood mitigation standards encourage appropriate construction practices to minimize flood damage, protect critical infrastructure, maintain natural drainage, and discourage development in flood-prone areas to reduce risk to people and property. They also require local governments to adopt and enforce floodplain ordinances

consistent with federal criteria, and support participation in the National Flood Insurance Program. The program offers planning and technical assistance support to local governments for flood mitigation projects, including acquisition, elevation and flood proofing of flood-prone properties. The flood mitigation standards help communities limit flood damage and strengthen resilience to increasing precipitation and flooding.[171]

RECENT PROGRESS

Delaware has taken proactive steps to monitor and prepare for sea level rise and increased precipitation and flooding impacts. The initiatives below highlight key progress and resilience efforts implemented over the past 5 years.

Brandywine Flood Study

Following the severe flooding caused by Tropical Storm Ida in 2021 that devastated many communities in the watershed, the Brandywine Conservancy partnered with the University of Delaware and other partners to conduct a comprehensive study of the Brandywine Creek watershed. Published in 2025, the *Brandywine Flood Study* analyzed flood patterns and modeled stormwater flows to identify vulnerable areas and develop prioritized strategies to reduce future flood risk in the watershed.[172]

Resilient Community Partnership

In the past 5 years, the *Resilient Community Partnership* has assisted the communities of Lewes, Fenwick Island, Little Creek and Milton to assess coastal hazards, prioritize adaptation actions and plan resilience-building projects. Through Delaware Coastal Programs the partnership program offers technical support, outreach, training and staffing to help communities develop and carry out local plans to reduce flooding and minimize sea level rise impacts. For example, Fenwick Island

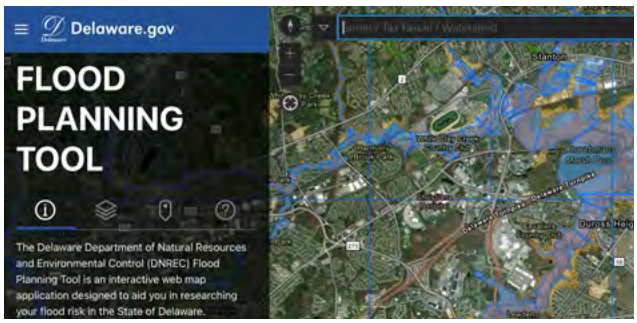
Flooding at the Delaware State Fair following a short but high-intensity precipitation event. **PHOTO: JESSICA QUINN, DNREC**

Severe flooding in Northeast Wilmington following Tropical Storm Ida. **PHOTO: DEMA**

completed a vulnerability assessment and adaptation plan to address sea level rise and drainage challenges, while Milton evaluated flood-prone areas to guide future development and stormwater improvements.[173]

I-ADAPT: Individual Adaptation Decision And Planning Tool (*I-ADAPT*)

In 2024, DNREC launched I-ADAPT, an interactive, web-based tool that helps Delaware homeowners, renters and business owners evaluate personalized flood adaptation strategies. Users enter information about their property and preferences, and the tool generates recommendations for both short-term actions that can be implemented immediately and long-term strategies to work toward that reduce individual flood risk.



The Delaware Flood Planning Tool can be used to determine if your property is located in a flood zone. **IMAGE: DNREC**

Waterways Infrastructure and Investment Network

The *Waterways Infrastructure & Investment Network* is a coalition of state, nonprofit, academic, and local partners that secured grant funding to develop a stakeholder-led investment strategy supporting resilience and economic vitality in Slaughter Beach and Milford. The coalition produced a vulnerability assessment, economic valuation and an "Ecotourism & Resilience Investment Strategy" for the Mispillion River and Cedar Creek watersheds. Their work helps guide nature-based investments and future infrastructure decisions to balance conservation, community benefit and flood resilience.[174]

Flood damage in Seaford, Delaware. PHOTO: DNREC

RISKS AND VULNERABILITIES

Flooding caused by heavy rains, high tides, and coastal storm surges can lead to injury or death from debris in floodwaters and drowning. Urban areas are especially prone to flash floods due to the large amounts of concrete and asphalt surfaces that do not allow water to penetrate the soil easily.[175] When inundation occurs through rainfall, storm surge, or rising sea levels, sewer systems may become overwhelmed and wells overtopped, causing floodwaters to mix with sewage and runoff. This contaminates homes, streets and public spaces with disease-causing microorganisms.[176]

Electrical substations and transmission lines located in flood-prone areas face heightened risk of damage and inaccessibility during storms, raising the likelihood of lengthy power outages during storm events. Storm surges and flash floods can lead to inundation of low-lying roads — hindering the ability to evacuate safely and efficiently during emergencies. Flooding can also compromise roads, bridges and railways, which can result in loss of access to goods and services and create a need for costly repairs.[177]

Saltwater intrusion from rising sea levels significantly increases groundwater salt content, contaminating freshwater aquifers and making water unsafe for consumption and costly to treat. Saltwater intrusion also decreases crop yields, damages irrigation equipment and raises farmers' costs to access usable water. When saltwater floods agricultural fields, even temporarily increased salt content undermines soil health and its ability to support crops, such as corn and soybeans.[178]

Delaware's beaches bring more than $3 billion in tourism to the state every year.[179] However, sea level rise and coastal storms could put the future of these beaches and communities in jeopardy. Regular beach nourishment projects are needed to combat erosion and restore the recreational and coastal protection benefits of our dunes and beaches. In 2023, DNREC nourished the Atlantic Coast beaches at a total cost of over $30 million, paid with federal and state funding. The demand for nourishment has become more widespread as development has put more infrastructure in areas exposed to coastal hazards. Rising costs and rising sea levels mean that DNREC may struggle to maintain current levels of beach nourishment in the future without additional funding.[180]

Delaware's wetlands provide habitat for commercially important species, sediment and pollutant removal. By 2100, sea level rise could impact between 84% and 98% of Delaware's total freshwater and tidal wetland acreage statewide.[181] Coastal wetlands face loss due to submergence under rising seas and soil erosion from frequent severe storms. Development and infrastructure along the coastline create barriers that prevent wetlands and beaches from naturally moving inland in response to sea

level rise, resulting in less wildlife habitat, carbon storage and protection for coastal residents and businesses. Meanwhile, freshwater wetlands are impacted by increasing salinity, as rising high tides alter wetland composition and the plants and wildlife relying on these systems.

Table 6.2: Summary of impacts from sea level rise, precipitation and inland flooding.

Public Health	• Flash flooding (especially in urban areas) • Drowning, injury or death from debris in floodwater • Contaminant releases • Mold growth
Energy	• Damage to energy infrastructure and electricity transmission systems • Power outages
Transportation	• Pavement, bridge and culvert damages • Road closures and delays • Dangerous conditions for drivers • Reduced access to public transit • Evacuation route congestion and/or closures
Infrastructure	• Stormwater and sewer system overload • Reduced drainage efficacy • Damage and/or loss of buildings
Agriculture	• Crop damages and reduced yields • Facility damages • Lost revenue and wages
Natural Resources	• Wetland loss • Habitat loss for wildlife and aquatic species

Beach replenishment project in Bowers Beach, Delaware. **PHOTO: DNREC**

STRATEGIES AND ACTIONS

The following strategies and actions have been compiled to address goals to improve data collection; protect and preserve Delaware's wetlands, wildlife, fisheries and drinking water; maintain stormwater infrastructure and green spaces; and prevent contaminant migration due to sea level rise, precipitation and flooding.

GOAL: BOLSTER RESEARCH AND MONITORING EFFORTS ON SEA LEVEL RISE AND FLOODING

Strategy P1: Increase awareness and understanding of impacts from sea level rise, precipitation and flooding through technical research and monitoring.

Understanding climate-related flood risks, impacts, projections and scenarios is crucial for protecting property, ecosystems, natural resources, infrastructure and lives. Research and long-term monitoring are needed to better identify and plan for flood vulnerability and impacts at both the state and local level. Comprehensive data can be used to plan for associated flood risks, and ultimately protect critical infrastructure, buildings and lives.

P1.1. When conducting flood vulnerability assessments for management or planning, consider future flood conditions.

P1.2. Conduct a risk analysis and resiliency assessment for Delaware's affordable housing properties.

A beneficial use dredging project with a hand-built perimeter designating 15 acres for tidal wetland restoration in the Indian River near Millsboro. **PHOTO: DNREC**

P1.3. Assess the economic and social impacts of frequent flooding events on critical infrastructure, including drinking water and wastewater infrastructure.
P1.4. Pursue a state probable maximum precipitation study to be used in designs of critical facilities.
P1.5. Conduct research and a feasibility study on state Fortified Building Programs for potential implementation in Delaware.

GOAL: INCORPORATE CLIMATE CHANGE CONSIDERATIONS TO ENHANCE THE RESILIENCE OF NATURAL RESOURCES AND HABITATS

Strategy P2: Protect and preserve tidal and non-tidal wetlands.

Healthy wetlands provide habitat for important plant and animal communities, as well as buffers for storm runoff, precipitation absorption that can reduce inland flood impacts, and protection against coastal shoreline flooding and erosion. Non-tidal, or freshwater, wetlands make up more than half of Delaware's wetlands.[182] However, their acres have declined over time due to threats such as sea level rise, development and agricultural practices. Tidal wetlands along Delaware's coastline are vulnerable to development and coastal erosion from storms and high tides. In addition, recent decisions by the federal government and the U.S. Supreme Court have reduced protections for wetlands across the country.[183] The current and projected losses of quality wetland habitat have direct impacts to plant and animal communities, and without these critical habitats, residents and businesses will experience significantly less protection from flooding caused by storm events and sea level rise.

P2.1. Strengthen the Delaware Wetlands Act to increase regulatory protections for tidal wetlands and include non-tidal wetlands.
P2.2. Preserve and acquire land as necessary to allow for landward marsh migration and connectivity.

Strategy P3: Protect and preserve wildlife and fisheries.

Delaware's diverse landscapes provide habitat to more than 2,800 animal species. A quarter of these animals are designated Species of Greatest Conservation Need.[184] As such, climate change impacts should be reviewed and considered in the development of management plans for wildlife, fisheries, natural areas and agricultural land.

P3.1. Incorporate climate change considerations into wildlife and fisheries management plans using the best science, including planning documents like the *2025 Delaware Wildlife Action Plan*.
P3.2. Incorporate climate change considerations into agriculture and natural areas management.

Strategy P4: Create or enhance green spaces.

Paved and built surfaces like roads, parking lots and sidewalks in urban and suburban watersheds prevent water from soaking into the ground, leading to drainage challenges and increased flooding especially during heavy rainfall. In contrast, green spaces, such as parks, gardens and urban forests, absorb water and contribute to environmental health by reducing air pollution, lowering urban temperatures, managing stormwater, increasing rainwater infiltration and supporting biodiversity. Green spaces also provide areas for exercise, relaxation and social connection, contributing to improved mental and physical well-being.

P4.1. Develop model ordinance language to prevent unnecessary deforestation for development; when unavoidable, require reforestation or inclusion of green space.
P4.2. Integrate stormwater management and wetland restoration into municipal plans, focusing on urban parks and flood-prone areas.
P4.3. Create green spaces on vacant lots through the DNREC Brownfield Program.

Strategy P5: Protect and maintain Delaware's shorelines.

With an estimated 381 miles of shoreline, no part of the state is more than 8 miles away from tidal waters.[185] Atlantic Ocean and Delaware Bay dunes and marshes provide shoreline protection against high tides, rising sea levels and coastal storms. That frontline defense also protects inland areas and infrastructure from destructive and potentially dangerous flooding. Protecting and preserving Delaware's shorelines is critical to maintaining safe communities, integral agricultural fields and operations, natural areas and habitats for wildlife and aquatic communities.

P5.1. Incorporate future climate conditions into the Beach Preservation Act.
P5.2. Support financial programs that promote living shorelines as a nature-based approach for shoreline management.

GOAL: UPDATE DESIGNS AND PLANS TO PROTECT INFRASTRUCTURE AND PREPARE FOR ADDITIONAL FLOOD RISK

Strategy P6: Maintain and protect stormwater, wastewater and drinking water infrastructure.

Many stormwater systems have been designed to accommodate past rainfall and weather patterns, without consideration of future conditions. Precipitation from heavier downpours, which the state is now experiencing in shorter periods of time, can exceed the capacity of current stormwater systems and lead to dangerous flash flooding.

Bagged oyster shells like these are an example of natural materials used in living shorelines. PHOTO: DNREC

Living shorelines with oysters can act as a natural barrier against erosion and storm surges. **PHOTO: LYNNE PUSEY, DNREC**

Wastewater infrastructure may be overloaded, resulting in backups, overflows and the discharge of sewage into waterways. This is particularly problematic for areas of the state with combined sewer systems, which carry both wastewater and stormwater. In addition, protecting the safety and availability of groundwater is vital, as increased precipitation and sea level rise pose significant threats to this critical resource. Delaware municipalities will need to support the availability of a safe and adequate water supply that can meet the needs of future demand.

P6.1. Evaluate the current tax ditch laws for needed changes and new regulations to account for future development and impacts of increased flooding and drainage issues.
P6.2. Revisit stormwater regulations to consider future precipitation conditions.
P6.3. Update stormwater models to incorporate projected precipitation patterns, drainage constraints and capacity issues.
P6.4. Develop a plan for municipalities to evaluate the vulnerability of sewer line check valves.
P6.5. Ensure all new construction of wastewater treatment plants occurs outside of the 100-year floodplain.
P6.6. Develop a plan adapting all groundwater uses (agricultural irrigation, wells, etc.) to saltwater intrusion and salinization.

Strategy P7: Protect homes and buildings from flooding.

As coastal areas become more vulnerable to flooding, storm surges and extreme weather events, resilient construction can help protect lives, reduce property damage, reduce energy interruptions and minimize costly disaster recovery efforts. Designing structures with elevated

The Southbridge Wilmington Wetlands Park reduces flooding in nearby neighborhoods, restores natural wetland habitats, and connects neighborhoods via a boardwalk. **PHOTO: JESSICA QUINN, DNREC**

foundations, flood-resistant materials and reinforced systems can make communities more adaptable to changing environmental conditions. Additionally, safer buildings can reduce displacement, maintain critical infrastructure and ensure long-term habitability in high-risk areas.

P7.1. Evaluate and update as needed building safety guidelines outlined by local floodplain ordinance and building codes, using best practice models, including the International Code Council Hazard Mitigation Building Code.
P7.2. Elevate energy infrastructure to be resilient to flooding.
P7.3. Explore ways to fund community-based flood mitigation projects.
P7.4. Consider how the state and communities can facilitate disclosure of risks and hazards on properties being sold.

Strategy P8: Prevent contaminant releases from occurring during flooding or inundation.

Preventing contaminant releases is crucial as sea level rise and changing precipitation heighten the risk of flooding and water intrusion into hazardous substance release sites. This not only threatens drinking water supplies and aquatic ecosystems but also poses serious health risks to nearby communities. Proactively incorporating sea level rise and climate change considerations into investigations and remediation of hazardous substance release sites is essential for protecting environmental and public health in the face of climate change. This will also reduce long-term maintenance costs due to monitoring and repairs and reduce liability for future remedy revisions.

P8.1. Implement best practices for hazardous substance investigation and cleanup plans to prevent contaminant release due to increased precipitation, inundation, flooding, sea level rise, or changing groundwater geochemistry.

P8.2. Prioritize assessing and remediating flood-prone properties in areas subject to flooding and future inundation.

P8.3. Incorporate climate change planning and flooding considerations into the remedial action process and regulations.

Strategy P9: Prepare a multi-decadal strategy for potential strategic retreat from areas highly vulnerable to persistent and repetitive flooding.

It is important to evaluate resilience options for communities, especially those located in hazardous areas. The costs of updating infrastructure, raising buildings and roads and armoring coastlines can be an extremely expensive and lengthy process. While these efforts may effectively reduce risks, the long-term sustainability must be weighed in comparison to other solutions — like creating long term plans to potentially move development and infrastructure out of harm's way.

P9.1. Partner with interdisciplinary groups to begin a statewide public education campaign about the concept of strategic retreat.

P9.2. Establish a multiagency statewide coastal resilience plan that includes robust community engagement and feedback from experts to investigate logistical and financial long-term options for adaptation and protection of communities and infrastructure, including options for strategic retreat from high-risk areas.

The historic Bancroft Bridge was damaged by floodwaters during Tropical Storm Ida. The pedestrian bridge was replaced in 2025. **PHOTO: DNREC**

Emergent Hazards

In 2020, Tropical Storm Isaias struck Delaware and several tornadoes caused widespread damage.
PHOTO: JESSICA QUINN, DNREC

In summer 2020, Tropical Storm Isaias brought high winds and heavy rain to Delaware, causing flooding, power outages and a record-breaking tornado.[186] The storm produced the state's longest-tracking tornado in more than 70 years, spanning nearly 30 miles from Kent County to Middletown.[187]

While Delaware regularly experiences hazards such as extreme heat and flooding, emergent hazards including tornadoes, severe storms and other extreme events are becoming increasingly important to monitor. Historically less common in the region, these hazards may intensify or occur more frequently as the climate warms, posing new challenges for communities with limited familiarity and preparedness.

This section addresses emerging threats such as drought from changing precipitation and temperatures; wildfires; extreme weather including hurricanes, tropical storms and tornadoes; vector-borne diseases and invasive species; and ocean and coastal acidification.

DROUGHT

Drought at the Prime Hook National Wildlife Refuge. **PHOTO: LYNNE PUSEY, DNREC**

Twenty-three years ago, Delaware experienced its most severe drought on record.[188] The 2002 drought of record, preceded by major droughts in 1995 and 1999, led to a governor-declared drought emergency.[189] Since 1950, Delaware has experienced 64 drought events lasting one month or longer, with the longest spanning 18 months from February 2007 through August 2008.

Drought occurs when extended periods of limited rainfall affect a large region.[190] Its severity depends on factors such as climate, land use and water demand. Development can alter watershed hydrology and reduce groundwater recharge, while high temperatures, wind and low humidity can intensify drought conditions and increase wildfire risk.

Drought severity is evaluated using indicators such as reservoir storage, precipitation, streamflow, groundwater levels and chloride concentrations in surface water. Each stage of Delaware's Drought Advisory Guidelines corresponds to specific conservation goals for public and private water supplies.

Drought Advisory Levels

The Water Supply Coordinating Council recommends three stages of drought advisory in Delaware:

1. Watch: The potential for drought suggests that voluntary water demand reductions could be requested soon.
2. Warning: An imminent (but not certain) drought recommends increased water demand reductions, primarily on a voluntary basis.
3. Emergency: With declining water conditions, there is no alternative but to declare a drought emergency with mandatory water use restrictions.

In the mid-Atlantic, droughts are expected to persist despite rising average annual precipitation, due to higher temperature extremes, more variable rainfall, and reduced soil moisture from declining spring snowmelt.[191] Increased water demand caused by population growth could exacerbate drought conditions when they occur. The University of Delaware Water Resources Center estimates that demand for drinking water in Kent and Sussex counties could increase to 83 million gallons per day by 2030, as compared to 61 million gallons per day recorded in 2010.[192] During periods of extreme heat, water resources may also be strained to accommodate increased irrigation needs on agricultural lands.

FOUNDATIONAL POLICIES AND PROGRAMS

The drought of 2002 and subsequent record low streamflow changed water supply management in Delaware and spurred efforts to reduce drought vulnerability. In response, the state established the Water Supply Coordinating Council, built new reservoirs, required large water users to maintain drought contingency plans, and invested in interconnections between water suppliers to improve reliability.

Water Supply Coordinating Council

Originally created as a temporary council in 2000 to manage and protect water supplies in New Castle County, the Council's scope was later expanded to include Kent and Sussex counties. Working closely with the *Water Infrastructure Advisory Council*, it includes representatives from state and county government, climatology and geology experts, agriculture, utilities and business sectors.[193] By 2010, the Council achieved water supply self-sufficiency in northern New Castle County and completed a water supply plan for southern New Castle County. It continues to plan and manage Delaware's water resources to meet peak demand during shortages.

Drought Indicators for New Castle County

Following the 2002 drought of record, formal indicators were developed to track drought conditions, including six- and twelve-month precipitation totals, streamflow, chloride concentrations in rivers and streams, and reservoir capacity. These metrics provide early warning and guidance for drought response in northern New Castle County.[194]

Delaware Source Water Protection Act

The Source Water Protection Act helps ensure that the state's drinking water remains clean and reliable, even during drought. The law requires state and local governments to identify and protect areas where groundwater and surface water are replenished, such as wellhead and recharge areas. Through the DNREC Source Water Assessment and Protection Program, Delaware maps these critical zones, evaluates potential contamination risks and works with counties and towns to guide land use and planning decisions. While DNREC has the lead role in implementing the program, it does so in partnership with the Delaware Division of Public Health and the University of Delaware's Water Resources Center. By safeguarding water recharge areas, the law strengthens the state's ability to maintain safe and sufficient water supplies during dry periods and a changing climate.[195]

RECENT PROGRESS

Drought Resources and Awareness Website

In April 2025, the Delaware Climate Office at the University of Delaware launched the Drought Resources and Awareness website to help residents and decision-makers stay informed about the state's water conditions. The site provides regular updates on precipitation, streamflow, soil moisture and groundwater levels across Delaware, along with county and municipal summaries. It also links related reports and tools, including resources from the Water Supply Coordinating Council, to support water management and drought preparedness.[196]

RISKS AND VULNERABILITIES

Table 6.3 highlights major impacts that drought can have on public health, energy, transportation, agriculture and natural resources. Droughts place significant stress on water supplies, jeopardize crop yields and threaten the health of natural ecosystems. In the late months of 2024, many areas in Delaware and across the Northeast U.S. experienced extended drought, going more than a month without measurable rainfall. Both Wilmington and Georgetown broke records for consecutive dry days between October and November: Wilmington saw 34 rainless days, while Georgetown went 35 days without rain.[197] This drought was followed by a period of intense rainfall, underscoring how average precipitation figures can mask the growing variability of extreme weather patterns.

Delaware's 2023 Hazard Mitigation Plan estimates that direct impacts to public health and safety due to drought are generally minimal.[198] If an area experiencing a drought also faces a drinking water shortage, residents face increased risk of dehydration. Additionally, drought conditions can worsen water quality by concentrating pollutants in rivers and streams; droughts can also create stagnant water, increasing breeding opportunities for disease-bearing mosquitoes.[199]

Utilities and infrastructure also have water needs that can be impacted by drought. Power plants and data centers require large volumes of water for cooling purposes; an average of 25 gallons of water are required to produce one kilowatt-hour of electricity.[200] When water availability is limited, as with drought conditions, this can reduce efficiency and lower generation capacity in thermoelectric plants.[201] In transportation, droughts can reduce roadway stability due to soil subsidence.[202]

Drought has the potential to severely impact Delaware's agricultural sector operations. The state could experience crop losses and pasture losses. Water use restrictions could impact farmers' abilities to adequately irrigate crops, while livestock could suffer from water shortages or inability to graze.[203] A 2022 economic impacts report estimated that statewide annual costs associated with increased irrigation needs due to drought and other climate changes could total $2 million each year by the end of the century.[204] This in turn can drive up prices for local produce, reducing access to healthy food and disproportionately impacting low-income communities.[205]

Table 6.3. Summary of impacts from drought.

Public Health	• May affect supply of safe drinking water • Water use restrictions • Dehydration, in extreme cases • Higher prices and lower availability for local produce
Energy	• Increased energy demand for pumping and irrigation • Less availability for cooling water-intensive power plants and data centers
Transportation	• Pavement damages due to soil instability • Greater maintenance and repair costs • Reduced depth in rivers and canals, potentially affecting navigability • Potential cargo delays
Infrastructure	• Soil subsidence can cause cracks in foundations and pipelines
Agriculture	• Reduced harvest yields • Crop and pasture losses • Reduced ability for livestock grazing • Increased demand and cost of irrigation
Natural Resources	• Dry conditions • Water scarcity • Increased risk of wildfire • Potential loss of vegetation and wildlife • Soil erosion

STRATEGIES AND ACTIONS

Delaware has made progress toward a resilient water supply, but continued action is needed to protect water quality, meet future demand and prepare for the impacts of a changing climate. The strategies below build upon adaptation goals to improve data collection, support community resilience, and enhance collaboration to safeguard this vital resource.

GOAL: ENHANCE DROUGHT PREPAREDNESS AND WATER MANAGEMENT

Strategy D1: Incorporate drought considerations into state operations, plans and policies.

Drought can strain water supplies, impact agriculture, harm ecosystems and increase wildfire risks. Proactive planning strengthens water infrastructure, protects food production and natural habitats and reduces economic and public health impacts. Integrating drought resilience into decision-making supports essential services and long-term sustainability.

D1.1. Support water supply management committees and programs, including those overseeing agricultural irrigation, to manage water sources under future climate conditions.

D1.2. Maintain forums, such as the agriculture irrigation well advisory committee, for partner organizations to address irrigation challenges.

D1.3. Develop county-level drought indicators and metrics to determine drought cessation, enabling targeted monitoring of water tables and reservoirs.

D1.4. Integrate drought emergency plans into future water allocation permits with provisions for emergency supply purchases and established interconnection/distribution processes.

Strategy D2: Enhance understanding of drought risks and vulnerabilities.

Improving understanding of drought risks will help Delaware anticipate, assess and respond more effectively. This includes expanding public awareness, advancing data analysis, and supporting informed resource management — particularly in agriculture and water infrastructure planning.

D2.1. Increase the visibility and functionality of the *Drought Resources Page* hosted by the Delaware Climate Office at the University of Delaware to raise public awareness of drought preparedness and water conservation efforts.[206]

D2.2. Continue geospatial analyses to map water infrastructure and assess drought vulnerabilities.

D2.3. Research water demand trends, including potential increases from longer growing seasons and greater landscape irrigation.

D2.4. Provide trainings through the agriculture irrigation well advisory committee, on how to best use the *Delaware Irrigation Management System*, as well as other tools and best practices related to irrigation management.[207]

WILDFIRE

Wildfire in a Delaware marsh. **PHOTO: JAY DAVIS**

Wildfires are unplanned fires in natural areas such as grasslands, forests or brushlands and are distinct from prescribed burns.[208] Although wildfires have historically played a natural role in ecosystem management, most fires today are caused by human negligence, such as discarded cigarettes or unattended campfires.

The timing, intensity and frequency of droughts can impact wildfire occurrence. When combined with warm temperatures, drought can reduce snowpack and stream-flow, dry soils, increase evaporative demand and can cause large-scale tree mortality, all of which create favorable conditions for wild-fires.[209] Drought conditions and other natural disasters (e.g., hurricanes, tornadoes) can also create additional fuel sources by downing trees and spreading debris. When conditions are especially dry, the state may issue burn bans to reduce wildfire risk, as occurred in 2024 following a dry fall season.[210]

Prescribed Burns

Prescribed burns are intentionally ignited under controlled conditions as part of forest and land management efforts. These burns reduce the buildup of highly flammable vegetation, help prevent more severe wildfires, improve wildlife habitat and manage pests or invasive species.[211]

According to the Delaware Fire Service, the state's greatest wildfire danger occurs in wetland areas along the Delaware Bay, where large stands of highly flammable phragmites (reed grass) grow. Between 2000 and 2022, Delaware experienced 14 days of wildfire events affecting areas of 100 acres or more.[212] The *Wildfire Risk to Communities* tool indicates

that Delaware has, on average, a low likelihood of wildfire in any given year, with slightly higher risk along the eastern coastline.[213]

FOUNDATIONAL POLICIES AND PROGRAMS

Delaware has several foundational policies and programs to prevent wildfires, manage prescribed burning and reduce smoke-related air quality impacts. Together, these efforts help protect public health, ecosystems and property while supporting responsible land and forest management.

Delaware Forest Service

Established under the Delaware Department of Agriculture, the Delaware Forest Service is responsible for managing and protecting the state's forests. Delaware Code outlines the responsibilities of the Forest Service for managing and protecting the state's forests. It authorizes the State Forester to oversee forest conservation, tree planting, fire prevention and suppression efforts. It also allows the state to cooperate with landowners, other states, and federal agencies on forest management and wildfire control. Overall, it establishes the legal framework for statewide coordination and resource sharing to reduce wildfire risk, maintain healthy forests and promote sustainable forestry practices.[214]

Delaware Fire Prevention Regulation

The Delaware Fire Prevention Regulation (*1 Del. Admin. C. §705*), administered by the State Fire Marshal, establishes statewide fire safety standards and authorizes restrictions on outdoor burning during hazardous

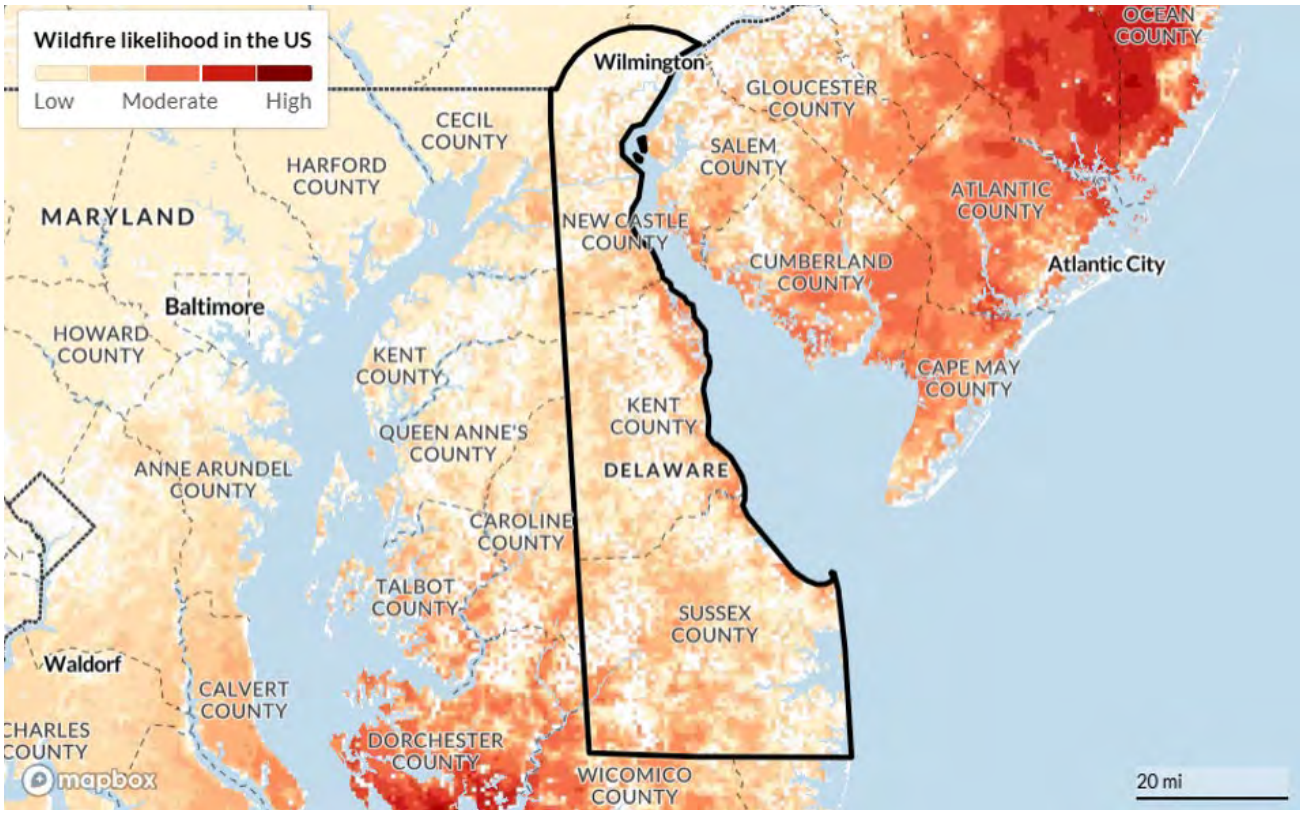


FIGURE 6.4. *Wildfire likelihood in Delaware.* SOURCE: WILDFIRE RISK TO COMMUNITIES.

Prescribed burn at Blackbird Creek Reserve. **PHOTO: RACHAEL PHILLOS, DNREC**

conditions. It ensures coordination with local fire departments and requires notification before open burning, helping prevent accidental ignitions that could lead to wildfires. This regulation provides an essential framework for minimizing wildfire hazards and protecting public safety.[215]

Open Burning Regulations

DNREC Division of Air Quality is charged with establishing and implementing state regulations for open burning, including prescribed fires, agricultural burning and open burning activities conducted by fire departments. This regulation controls air emissions by establishing rules for open burning activities in the state. Open burning is prohibited during ozone season (May 1 through September 30), on air quality action days, and when the Delaware State Fire Marshal issues a ban against open burning. DNREC manages the permitting process for open burning activities.[216]

Delaware Prescribed Fire Council

Consisting of state wildfire experts, the *Delaware Prescribed Fire Council* provides educational resources on prescribed fires, fire safety and forest management. The council hosted a Learn and Burn in January 2025 to teach about the ecological effects of prescribed fires and considerations for prescribed burns.[217]

RECENT PROGRESS

Delaware's risk of wildfire increases each year as sprawl increases. Sprawl makes many wildfire prevention activities, including prescribed burns, challenging to implement. Federal and state governments have been responding to wildfire emergencies, creating programs and

guidance, such as the recent highlights included below, to reduce the risk and occurrence of wildfires and other fire types.

Wildland Fire Program

The Delaware Forest Service manages the state's Wildland Fire Program to minimize damage from wildland fires in Delaware through education, prevention and suppression activities. The program also provides staff and equipment to help firefighters control wildfires and administers the Volunteer Fire Assistance Grant Program which provides funding to Delaware volunteer fire departments. The Wildland Fire Program also offers cost-share assistance grants and technical assistance through the Hazard Mitigation Program to help communities reduce the danger of wildland fires by controlling phragmites in high-priority areas. In 2024, the program treated 5,200 acres in Delaware.[218]

Wildland Fire Mitigation and Management Commission

Established in 2021 through the Infrastructure Investment and Jobs Act, the Wildland Fire Mitigation and Management Commission was tasked with forming federal policy recommendations and strategies to address all aspects of the wildfire crisis, including mitigation, management and recovery.[219] In September 2023, the Commission published its findings in "*ON FIRE: The Report of the Wildland Fire Mitigation and Management Commission*."[220]

Prescribed Fire Program

The Delaware Forest Service implements the Prescribed Fire Program using low-intensity, prescribed burns to reduce wildfire risk and benefit the environment. These fires eliminate fuel loads that could spark larger wildfires, enrich soil with nutrients for vegetation and create habitat for a variety of animal species. In 2024, the program conducted 24 prescribed fires, totaling at least 566 acres. These burns took place on federal, state and private lands and included new partnerships with U.S. Fish and Wildlife Service and The Nature Conservancy.[221]

RISKS AND VULNERABILITIES

While wildfires are not traditionally common in Delaware, increasing temperatures and dry spells are increasing fire risk for the state and neighboring regions. Drought-stressed vegetation becomes more flammable, raising concerns for forests, parks, and nearby communities. Beyond local risks, smoke from wildfires outside the region is becoming a growing concern. In recent years, Delaware has experienced degraded air quality from wildfire smoke originating from the western United States and Canada. During summer 2023, Canadian wildfires significantly impacted the Northeast region in the United States, including Delaware, triggering multiple air quality alerts due to smoke and fine particulate matter; Delaware had significant smoke impacts on nearly every day of June 2023.[222,223] Wildfire smoke is not easily confined and can travel across state and regional boundaries, meaning that wildfires in high-risk areas in neighboring states can bring significant smoke impacts to Delaware.

Wildfire smoke contains air pollutants like particulate matter, nitrogen dioxide, ozone and lead. Inhaling particulate matter from wildfire is associated with premature deaths and can exacerbate existing health conditions related

Wildfires in eastern Canada emitted particulate matter into the atmosphere, affecting air quality and visibility throughout Delaware. **PHOTO: JESSICA QUINN, DNREC**

to the respiratory system, heart, nervous system, skin, digestive system, kidneys, eyes and liver. Exposure to air pollution from wildfire may lead to memory loss and cognitive issues.[224] Firefighters and emergency workers are especially vulnerable to health complications due to burns and exposure to wildfire-related air pollution. Outdoor workers are also vulnerable to health complications from inhaling polluted air for extended periods.

Wildfires can damage electric utilities' infrastructure, causing disruptions in energy availability and leading to financial losses for impacted businesses and residents.[225] Energy infrastructure can also start wildfires in some cases; for instance, downed power lines can spark fires if they encounter dry vegetation, as occurred with wildfires in Texas in 2024.[226] Fires can also cause disruptions to transportation systems. In 2024, a wildland fire near Newark, Delaware, caused the closure of two lanes of Interstate 95 and the exit onto Route 273.[227] Smoke from the fire reduced visibility in the area, leading to unsafe driving conditions.

Additional risks and impacts associated with wildfires are listed in Table 6.4 above.

Table 6.4. Summary of impacts from wildfire.

Public Health	· Injury or death from fire · Health impacts due to poor air quality
Energy	· Damage to power lines and potential outages
Transportation	· Pavement and bridge damage · Road closures · Unsafe driving conditions due to poor visibility
Infrastructure	· Property damage or loss
Labor	· Health risks to outdoor workers, firefighters and emergency workers
Agriculture	· Crop and livestock losses
Natural Resources	· Loss of vegetation and wildlife · Air and water pollution · Damage to soil structure and loss of habitats

STRATEGIES AND ACTIONS

The following strategies and actions support efforts to improve data collection and enhance understanding of wildfires, increase awareness of wildfire hazards and support community resilience and preparedness.

GOAL: REDUCE WILDFIRE RISK AND ENHANCE FIRE MANAGEMENT

Strategy F1: Increase understanding of urban fires and wildfire risk.

Understanding the drivers and dynamics of wildfire risk and vulnerability in Delaware is essential to developing effective wildfire risk reduction measures. Research, risk assessments and leveraging existing knowledge are critical to guiding future planning, resource allocation and emergency preparedness.

F1.1. Use existing research, state agency expertise, the Delaware Prescribed Fire Council, and Indigenous Knowledge to create Delaware-specific best management practices to reduce wildfire fuel load through prescribed burns.

F1.2. Conduct wildfire risk assessments to better understand the relationship between wildfire risk and energy infrastructure.

Strategy F2: Reduce wildfire risk through landscape and invasive species management.

The Delaware Forest Service manages a prescribed burn program. Low-intensity prescribed fires reduce fuel loads, lowering the risk of severe wildfires, enriching soils, supporting healthy regeneration for trees and plants, and enhancing habitat for a variety of wildlife species.

F2.1. Work with the Delaware Prescribed Fire Council, public and private partners to expand prescribed fire programs for wildfire reduction and invasive species management, focusing on fuel breaks and buffers at wildland and urban interfaces.

Strategy F3: Increase readiness and preparedness for wildfires.

Enhancing community readiness helps ensure an effective wildfire response and supports long-term prevention and recovery. Through partnerships and stakeholder collaboration, communities can identify risks, prioritize actions and strengthen local capacity to manage wildfire hazards.

F3.1. Adapt policies to promote best practices in fire management while protecting the wildland fire workforce by scaling up equipment and firefighting personnel.

F3.2. Increase awareness of community wildfire protection plans and provide technical assistance to assist communities with plan development.

F3.3. Work with the Delaware Prescribed Fire Council and DNREC Division of Air Quality to evaluate and implement best communication practices for informing the public about smoke conditions.

EXTREME WEATHER

Downed trees in Dover caused by a tornado following Tropical Storm Isaias. **PHOTO: JESSICA QUINN, DNREC**

Over the past 5 years, Delaware has experienced a growing number of extreme weather events, including tornadoes, coastal storms and flooding. In 2020, Tropical Storm Isaias produced a tornado that traveled nearly 30 miles, the longest path ever recorded in the state.[228] The following year, remnants of Hurricane Ida caused record rainfall that inundated Brandywine Creek, leading to historic flooding in Wilmington's northeastern communities.

While thunderstorms, strong winds and hail remain Delaware's most common forms of severe weather, the state is now facing a broader range of emerging hazards. Tornadoes, midlatitude coastal storms (commonly known as "nor'easters") and hurricanes, once relatively rare, are becoming more frequent and intense. These escalating hazards require Delaware to strengthen its preparedness and resilience.

This trend mirrors a national pattern of increasingly destructive and costly weather disasters. In 2024 alone, the United States experienced 27 weather-related climate disasters that resulted in losses of over $1 billion each.[229] The National Oceanic and Atmospheric Administration (NOAA) has been a critical resource for tracking these events since 1980, with resources including their Billion-Dollar Weather and Climate Disasters dataset. However, in May 2025 NOAA's National Centers for Environmental Information announced it will stop tracking the cost of extreme weather and climate disasters "in alignment with evolving priorities, statutory mandates and staffing changes" of the federal government.[230] Moving forward, this dataset will be maintained by Climate Central, a climate science non-profit organization. Delaware also has the Center for Environmental

Monitoring and Analysis (CEMA), which tracks severe weather and has records for coastal storms dating back to 1851. CEMA collects information about the storm track, intensity and weather when data is available.

Watches vs. Warnings: Know the Difference

Effective communication is critical during extreme weather events. Watches and warnings are issued to inform the public of potential danger during extreme weather events:

- A **watch** means hazardous weather is possible within a specific timeframe and people in the watch area should prepare for potential danger.
- A **warning** indicates hazardous weather is imminent or occurring and requires immediate action.[231]

When a tornado warning is issued, individuals should seek shelter immediately in a basement, interior room, safe room or tornado shelter until an official "all clear" is given. Mobile homes and vehicles are extremely vulnerable projectiles during a tornado and do not make safe shelters for severe weather events. Nationwide, 72% of tornado fatalities occur in homes, with 54% occurring in mobile or manufactured homes, highlighting the critical need for secure, permanent shelter during severe weather events.[232]

TORNADOES

Delaware's strongest recorded tornado occurred on April 1, 2023, when a cold front brought thunderstorms and hail. The Bridgeville–Ellendale tornado traveled 14 miles, damaged more than 60 structures and resulted in the state's first tornado-related fatality in 40 years.[233]

Tornadoes are destructive storms with strong rotating winds that extend to the ground,

Tornado damage to roof of Dover home following Tropical Storm Isaias. **PHOTO: JESSICA QUINN, DNREC**

Boat carried by tornado. **PHOTO: WAYNE BARRALL, USA TODAY NETWORK**

forming a funnel-shaped cloud. Tornadoes can form from severe thunderstorms or during tropical storms and hurricanes.[234] In Delaware, tornadoes are most common in spring and summer but have been documented in every season since recordkeeping began in 1950.[235]

According to the Fifth National Climate Assessment, while the average number of tornadoes in the U.S. remains relatively stable, outbreaks are becoming more frequent and intense. Tornado activity is also increasing in the fall, and the traditional "Tornado Alley" is shifting eastward bringing more risk to states like Delaware.[236] From 1950 to 2024, NOAA recorded 78 tornadoes in Delaware.[237] Between 2000 and 2022, the state experienced 12 tornadoes, causing $1.45 million in reported property damage and five injuries.[238,239]

COASTAL STORMS AND HURRICANES

Delaware is vulnerable to a range of coastal storms, particularly nor'easters and tropical cyclones. Nor'easters are the most common coastal storms in the mid-Atlantic. Forming outside the tropics, they bring strong northeasterly winds, heavy precipitation and sometimes snow or ice. In Delaware, nor'easters occur most frequently in March.[240]

Tropical cyclones, including tropical depressions, tropical storms and hurricanes, form over warm ocean waters. The Atlantic hurricane season runs from June 1 to November 30, peaking in September. Delaware has experienced significant impacts from tropical cyclones in recent years, including Hurricane Irene in 2011, Sandy in 2012 and Tropical Storm Isaias in 2020. Due to climate change, these storms are becoming more intense and more frequent, placing low-lying areas of Delaware at increasing risk.[241,242]

As coastal development and population growth continue, the potential for severe damage and loss of life along Delaware's

Osprey lands on boat debris during a coastal storm at Port Mahon. PHOTO: JESSICA QUINN

coast also increases. In addition to wind and storm surge, these systems often bring heavy rainfall, leading to flash flooding and damage well beyond the immediate coastlines, posing a risk to inland communities as well.

FOUNDATIONAL POLICIES AND PROGRAMS

The following policy and plan outline emergency management authorities in Delaware. The most recent Delaware Hazard Mitigation Plan includes an analysis of 12 natural hazards, including those summarized in the Climate Action Plan, and makes recommendations for increasing resilience of Delaware communities.

Delaware Emergency Management Act

This law establishes the Delaware Emergency Management Agency (DEMA) and outlines the state's authority and responsibilities for preparing for, responding to, and recovering from emergencies and disasters. It empowers the Governor to coordinate emergency responses, mobilize resources and issue emergency orders during declared disasters. The Act provides the foundation for Delaware's statewide emergency management system and supports coordinated action to protect public safety during extreme weather events and other hazards.[243]

Delaware Hazard Mitigation Plan

Updated every five years by the State Hazard Mitigation Council, which includes state agencies, the University of Delaware and community representatives, the Delaware Hazard Mitigation Plan lays out Delaware's statewide strategy for identifying natural and human-caused hazards, assessing vulnerabilities and implementing strategies to reduce future losses. It aligns with federal requirements and helps the state and local jurisdictions qualify for federal funding. The plan serves as a living roadmap for embedding hazard-resilient policies, coordinating mitigation activities and periodically updating priorities as risks evolve. The most recent update, the *2023-2028 Hazard Mitigation Plan*, was published in 2023.[244]

RECENT PROGRESS

Delaware has advanced several initiatives and planning efforts to strengthen preparedness and resilience to extreme weather and other disasters. Extreme weather events threaten community safety, damage infrastructure and disrupt essential services, underscoring the need for coordinated awareness, planning and recovery strategies. The following highlights reflect recent progress in addressing vulnerabilities and building capacity for recovery following disasters.

Delaware Disaster Housing Strategy

Released in June 2025, this strategy provides a comprehensive framework for disaster housing preparedness and recovery to ensure displaced Delawareans have access to safe, temporary and long-term housing options after a disaster. It outlines roles, responsibilities and coordination mechanisms among agencies

to accelerate recovery and reduce housing insecurity during disaster recovery.[245]

Delaware Energy Security Plan

The Delaware Energy Security Plan establishes a comprehensive roadmap to enhance the resilience, reliability and security of Delaware's energy systems in the face of climate-related stressors, infrastructure threats, and evolving demand. It emphasizes modernization of the grid, deployment of microgrids and clean energy technologies, and coordination across government, utilities and stakeholders. This strategic plan helps ensure that disruptions to energy supply are minimized, response and recovery capabilities are strengthened, and energy services remain reliable during extreme weather events.[246]

RISKS AND VULNERABILITIES

Climate change is contributing to a rise in the intensity of hurricanes and tropical storms.[247] Nor'easters, hurricanes and tornadoes can bring strong winds and sweeping damage to agricultural fields and infrastructure such as buildings, homes, bridges, electrical grids and water supply systems. Disruptions to transportation or communications systems can cause delays in emergency response.[248]

Within Delaware, coastal regions are most susceptible to coastal storms, which also cause storm surge and flash flooding that compounds infrastructure damage. Inland areas remain susceptible to coastal storm impacts and can experience flooding in low-lying areas due to intense rainfall. Within Delaware, coastal regions — particularly Sussex County, which has become a retiree haven — face heightened vulnerability. This consolidates one of the most vulnerable groups, older adults, in the most vulnerable part of the state for flooding and storms. Older adults are particularly vulnerable to hurricanes and other disasters due to pre-existing health conditions, reduced mobility and isolation.[249]

Table 6.5. Summary of impacts from tornadoes, coastal storms and hurricanes.

Public Health	· Injury or death from debris · Downed communication systems · Delays in emergency response · Evacuation of homes
Energy	· Damage to energy infrastructure · Power outages
Transportation	· Pavement and bridge damage · Road closures due to flooding and/or debris
Infrastructure	· Property damage or loss (mobile or manufactured homes are exposed to increased risk) · Flood damage
Agriculture	· Crop and livestock losses
Natural Resources	· Uprooted trees · Destruction of wildlife habitat · Increased soil erosion and potential for invasive species

STRATEGIES AND ACTIONS

Extreme weather can take many forms, but there are general steps everyone can take to reduce risk, such as preparing emergency plans and kits. The strategies below build on individual preparedness and aim to enhance statewide awareness, resilience and response through improved data collection, monitoring and warning systems.

GOAL: ENHANCE SEVERE WEATHER AWARENESS AND PREPAREDNESS IN DELAWARE

Strategy S1: Improve communications and response to severe weather.

Clear communication and accessible emergency information reduce risks to public safety, infrastructure and vulnerable populations during extreme weather events. Personal preparedness or getting involved with a Community Emergency Response Team (CERT) are ways to learn more about hazards and receive disaster preparedness training. The following actions support continuity of operations and strengthen community resilience statewide.

S1.1. Encourage small businesses to develop emergency response and resilience plans.
S1.2. Enhance accessible warning systems, public alerts and emergency communications to increase reach and effectiveness.
S1.3. Develop standardized procedures for impacts and responses to ensure continuity of operations for critical facilities and government agencies during disasters.

Strategy S2: Monitor severe weather conditions to inform emergency alerts and policies.

Expanding data collection and monitoring systems allows Delaware to provide more accurate, timely emergency alerts and supports evidence-based policy and planning. Improved monitoring helps agencies allocate resources, design resilient infrastructure and strengthen emergency response systems in a changing climate.

S2.1. Expand monitoring by the Center for Environmental Monitoring and Analysis (CEMA) and the Office of the State Climatologist to track frequency and severity of tropical and extratropical cyclones and tornadoes in the mid-Atlantic region.

Strategy S3: Understand how tornadoes affect forest ecosystems.

Tornadoes can disrupt ecosystems by uprooting trees, altering forest structure and destroying wildlife habitat. These disturbances open the door for invasive species, increase soil erosion and change the composition of plant and animal communities. While some ecosystems can naturally recover, more frequent or severe tornadoes may cause
lasting changes to ecosystems.

S3.1. Increase invasive species monitoring and management in habitats disturbed by tornadoes.

VECTOR-BORNE DISEASE AND INVASIVE SPECIES

Adult spotted lanternfly on maple tree, an invasive insect species in North America. PHOTO: DDA

As Delaware's climate continues to warm, the state faces growing threats from vector-borne diseases and invasive species, both of which are intensified by shifting temperatures, precipitation patterns and longer growing seasons.

Vector-borne diseases are illnesses caused by germs spread by infected vectors, such as mosquitoes and ticks.[250] Vector-borne diseases, while preventable, make up 17% of all infectious diseases, causing more than 700,000 deaths each year worldwide.[251] Tick-borne diseases can have serious human health consequences. In 2023, Delaware experienced increased cases of vector-borne diseases, particularly West Nile virus and Lyme disease.[252] Delaware already has one of the highest incidences of Lyme disease in the country, according to the Centers for Disease Control and Prevention.

Warmer winters and wetter conditions are expanding the range and activity of ticks and mosquitoes, increasing the risk of Lyme disease, West Nile virus and others. At the same time, invasive plants and pests are outcompeting native species, threatening ecosystems, agriculture and infrastructure. Some of the ticks and mosquitoes carrying emerging vector illnesses are also invasive, including the Asian tiger mosquito, the Asian longhorned tick and the Gulf Coast tick.

These climate-driven pressures pose serious health, economic and environmental risks, particularly for vulnerable populations such as children, the elderly, rural residents and

outdoor workers, underscoring the need for proactive adaptation and coordinated response efforts across Delaware.

FOUNDATIONAL POLICIES AND PROGRAMS

Delaware has laws and regulations to prevent the introduction and spread of invasive species, which can quickly wreak havoc on the state's natural lands, wildlife and agriculture. Certain pests, such as mosquitoes, are also regulated to prevent public health outbreaks.

Prohibition on Sales of Invasive Plants

This law prohibits the import, export, sale, transport, distribution or propagation of any plant identified by the Secretary of the Department of Agriculture, with the advice of the Delaware Native Species Commission, as an invasive plant. It also requires that plants identified as potentially invasive be sold with a tag that identifies the plant as potentially invasive and bans the sale of 37 invasive plant species statewide. By 2026, state agencies must prioritize native plants in landscaping projects.

Non-native Wildlife Law

Under this law, DNREC is directed to regulate non-native and invasive wildlife species. The law authorizes DNREC to promulgate rules, issue permits and take management actions to prevent, control, or eradicate non-native wildlife that threaten ecosystems, property or human interests. Through this authority, DNREC can intervene when introduced species cause harm, balancing ecological protection with practical measures under state oversight.[253]

The Tiger Mosquito (Aedes Albopictus) is a very aggressive biting mosquito that originated in Southeast Asia. Delaware's changing climate and dense population has created a large breeding ground for this invasive species.
PHOTO: DAVID MOORE, DNREC

DNREC Mosquito Control Section

The DNREC Division of Fish and Wildlife provides mosquito control services statewide to maintain quality of life and protect public health by reducing the possibility of mosquito-borne illnesses. Mosquito Control Section staff are authorized by Delaware law to eradicate mosquitoes, treat nuisance pools of water, purchase necessary equipment and administer treatments.[254] In 2015, the Section's mission was expanded to include tick control based on recommendations from the Lyme Disease Prevention Task Force.[255]

RECENT PROGRESS

Population growth and development into previously natural areas can create new

opportunities for diseases to pass on to animals, Delawareans and beyond. Below is select progress made in Delaware to monitor disease-carrying pests and the impact they, and other invasive species, have on the health and well-being of natural areas and humans.

DNREC Tick Program

The DNREC tick program conducts statewide surveillance for ticks, including species distribution and disease prevalence (e.g., Lyme, emerging Asian longhorned ticks). The program also collaborates with Delaware Technical Community College for pathogen testing and public outreach on tick control and prevention.[256]

One Health Approach — Department of Health and Social Services

The One Health approach integrates human, animal and environmental health to monitor zoonotic (infectious illnesses that spread between animals and humans) and vector-borne diseases — recognizing climate-driven expansion of mosquito and tick habitats.[257]

Delaware Native Species Commission

The commission was created by the Delaware General Assembly to continue the work started by the Statewide Ecological Extinction Task Force and to implement recommendations made in the final report of the task force. Part of the commission's mission is to reverse decline and extinction trends for Delaware native plants and animals, and to provide expertise and assistance on related matters. DNSC releases an annual report and in 2024 contributed to the development of SB 197 which revises State procurement rules to require that beginning January 1, 2026, state agencies under Chapter 69 of Title 29 must purchase only native plants when developing or rehabilitating new landscaped areas.

Delaware's Wildlife Action Plan

Delaware's most recent Wildlife Action Plan (2025–2035) serves as a comprehensive, science-based strategy to conserve the state's diverse fish and wildlife populations and the habitats they depend on. Developed by DNREC's Division of Fish and Wildlife, in collaboration with conservation partners, stakeholders and the public, the plan identifies species of greatest conservation need and outlines proactive measures to sustain their populations and deal with threats, like invasive species. By focusing on habitat protection, research, monitoring and public engagement, the Wildlife Action Plan provides a 10-year roadmap for preserving Delaware's natural heritage for current and future generations.[258]

RISKS AND VULNERABILITIES

Delaware faces concerns from multiple tick species, including the American dog tick, which

Some tick species can grow to 100x their size when full.
PHOTO: DNREC

Tick sweeping is a field sampling method in which a light-colored cloth is dragged through vegetation to collect ticks.
PHOTO: DNREC

transmits Rocky Mountain spotted fever and tularemia.[259] Lone star ticks have become the predominant species in Delaware; once primarily a southeastern species, their range has expanded northward all the way up to New England.[260] Mild winters are also known to extend the active season for the most dangerous tick in Delaware, the blacklegged or deer tick. Deer ticks are associated with Lyme disease, the most common tick-borne infection in Delaware, but can also lead to babesiosis, anaplasmosis and tick-borne relapsing fever.[261] Mosquito-borne diseases also pose risks to Delaware, with West Nile virus, eastern equine encephalitis and Zika virus among the diseases of concern.[262] Delaware's Division of Public Health tracks cases of 19 vector-borne diseases, including those transmitted by ticks and mosquitoes, and provides resources on associated risks and vulnerabilities.[263]

Across North America, invasive species cost the economy over $26 billion annually.[264] This includes damage to property values, agricultural productivity, public utilities, fisheries, tourism and more, as well as costs for management and invasive species control programs. Many invasive pests, such as the spotted lanternfly, which was first detected in Delaware in 2017, can reproduce more rapidly in a warming climate with milder winters.[265,266] One study identified 32 high-impact invasive plant species expected to move into one or more mid-Atlantic states by 2040, with two species predicted to reach all eight mid-Atlantic states including Delaware.[267]

Table 6.6: Summary of impacts from vector-borne diseases and invasive species.

Public Health	• Increased risk of illness such as West Nile virus or Lyme disease
Energy	• Excessive growth of invasive species can damage energy infrastructure, disrupting power generation and increasing maintenance costs
Infrastructure	• Severe spread of invasive species can impact buildings with excessive growth or lead to damaging tree falls
Labor	• Occupational risks for outdoor workers
Agriculture	• Crop and livestock losses • Increased invasive species management • Risks for farmers
Natural Resources	• Ecosystem disruption • Loss or weakening of native species • Increased management requirements

STRATEGIES AND ACTIONS

These strategies strengthen Delaware's ability to adapt to climate-driven changes in vector populations and disease patterns by enhancing both community awareness and institutional capacity. Through investment in education, monitoring infrastructure and proactive planning, Delaware can build an adaptive framework prepared to respond to emerging vector-borne threats.

GOAL: ADVANCE VECTOR-BORNE ILLNESS PREVENTION AND INVASIVE SPECIES MANAGEMENT

Strategy V1: Increase public understanding of vector-borne diseases.

As disease-carrying vectors expand their range and activity, public understanding is essential for protecting community health. Educating residents about transmission, symptoms and prevention can significantly reduce infection rates and ease pressure on health systems. Informed communities also enable earlier detection and more effective responses as new diseases emerge.

V1.1. Increase awareness of human health impacts associated with livestock diseases and mortality.

V1.2. Develop accessible educational materials, including information in English, Spanish and Haitian Creole, on tick safety, mosquito control and the connection between warmer winters and insect-borne illness.

Strategy V2: Increase technical understanding of vector-borne diseases.

Strengthening technical knowledge among health officials, environmental scientists and land managers is critical for data-driven surveillance and prevention. As climate shifts vector behavior and distribution, enhanced expertise in species identification, pathogen tracking and testing supports more accurate risk assessment and targeted interventions. Building this capacity across agencies ensures Delaware can adapt effectively, protect public health and allocate resources efficiently.

V2.1. Expand tick testing to include a broader range of tick-borne illnesses in Delaware to better track and prevent transmission to humans in the state.

V2.2. Conduct needs assessments with local health providers and public health clinics to strengthen preparedness for emerging disease risks.

Strategy V3: Support further data collection and research to inform invasive species management.

Effective management of invasive species under changing climate conditions depends on reliable data and science-based decision-making. Enhancing biological indicators, expanding pest and invasive species monitoring, and conducting forward-looking scenario planning will help Delaware anticipate and manage new threats to biodiversity, public health and natural resources.

V3.1. Continue to use and improve biological indicators to track changes in Delaware's ecosystems and wildlife.

V3.2. Increase the scope and frequency of pest and invasive species monitoring and implement management plans as needed.

V3.3. Conduct scenario planning for longer mosquito breeding seasons and rising nuisance wildlife complaints.

OCEAN AND COASTAL ACIDIFICATION

Sunset at Cape Henlopen State Park. PHOTO: JACK SHIH

Ocean and coastal acidification are emerging environmental challenges with far-reaching consequences for Delaware's ecosystems, economy and communities. Ocean acidification refers to the ongoing decrease in the pH of the Earth's oceans caused primarily by the uptake of atmospheric carbon dioxide (CO_2). As carbon dioxide dissolves in seawater, it forms carbonic acid, lowering the pH and reducing the availability of calcium carbonate minerals ($CaCO_3$), a key mineral that many marine organisms use to build shells and skeletons.[268]

Coastal acidification is a related but more complex phenomenon that occurs in nearshore environments such as bays, estuaries and tidal rivers. In addition to atmospheric carbon dioxide, coastal acidification is influenced by local factors, including nutrient pollution which drives algal blooms, freshwater input and runoff, all of which can alter the water's chemistry more rapidly and unpredictably than in the open ocean.[269]

Climate change amplifies both ocean and coastal acidification. Rising global carbon dioxide levels intensify acidification in all marine environments. Warmer water temperatures can also worsen the effects by accelerating biological processes such as respiration and decomposition, releasing more carbon dioxide into coastal waters. Sea level rise and increased precipitation can also increase nutrient and freshwater input into estuaries, compounding acidification in coastal zones.[270]

FOUNDATIONAL POLICIES AND PROGRAMS

While Delaware does not have any policies or regulations that explicitly address coastal or ocean acidification, the policies below have been used to manage nutrients, pollution and

overall water quality in rivers, bays and the ocean. Robust monitoring is needed to identify acidification hotspots, vulnerabilities, resources and at-risk ecosystems. Monitoring and data collection are needed to inform development of policies to address this emerging climate hazard.

The National Pollutant Discharge Elimination System (NPDES) Program

The NPDES Program is a federal permit program under the Clean Water Act that regulates point-source discharges of pollutants into U.S. waters. Industrial facilities, wastewater treatment plants and stormwater systems must obtain permits limiting pollutant types and quantities to ensure water quality standards that protect human health and aquatic life.

Regulations Governing the Control of Water Pollution

Administered by the DNREC Division of Water, these regulations establish standards for discharges into state waters and require permits demonstrating compliance with federal NPDES and Delaware water quality criteria. Permitted projects must address all potential environmental impacts on water resources and associated ecosystems.

Delaware's Surface Water Quality Standards

These regulations govern surface water quality, shellfish sanitation and implementation of *Total Maximum Daily Loads (TMDLs)* - the maximum amount of a pollutant allowed to enter a waterbody so that the waterbody continues to meet water quality standards.[271] Delaware's EPA-approved water quality standards include an antidegradation policy to maintain necessary pH and alkalinity levels that support the marine carbonate system. TMDLs and related pollution control strategies set enforceable limits for point and nonpoint sources, while shellfish sanitation standards maintain water quality protections in areas particularly vulnerable to acidification impacts.

Delaware and Ocean Acidification: Preparing for a Changing Ocean

Published by DNREC and the University of Delaware in 2015, this report assessed the status of ocean and coastal acidification in the state and provided recommendations for action to mitigate future impacts.[272]

Mid-Atlantic Coastal Acidification Network

Since joining the Mid-Atlantic Coastal Acidification Network in 2016, Delaware has coordinated with other mid-Atlantic states to address acidification impacts. This regional network connects researchers, industry stakeholders and resource managers, serving as an information hub to improve understanding of acidification's effects on coastal waters and marine species.

RECENT PROGRESS

Delaware continues to invest in science and partnerships to better understand, track and

Acidification reduces carbonate available for shell-forming organisms like crabs. **PHOTO: JACK SALVAGGIO, DNREC**

prepare for ocean and coastal acidification. By collaborating with scientists, policymakers and industry experts, the state is building capacity to address this emerging challenge. Through regional partnerships such as the Mid-Atlantic Coastal Acidification Network,[273] and a focus on vulnerable areas, such as estuaries, shellfish habitats and the Mid-Atlantic Cold Pool, Delaware is contributing to a more comprehensive and adaptive monitoring framework that supports science-based management and resilience planning.

Tidal Creek Alkalinity Study

The Delaware National Estuarine Research Reserve examined how alkalinity in small tidal creeks can buffer against ocean acidification. A year-long study at Blackbird Creek and the St. Jones River found that alkalinity levels varied with watershed development, with higher levels in urbanized areas, and were not consistently linked to salinity. The findings highlight the need for precise laboratory monitoring and suggest exploring mitigation strategies such as aquaculture or direct alkalinity additions to help reduce acidification in Delaware's coastal waters.[274]

Ocean Acidification Alliance - U.S. State Working Group

In 2025, Delaware joined the U.S. State Working Group of the International Alliance to Combat Ocean Acidification. Membership facilitates engagement among states on acidification impacts, water quality linkages and vulnerability assessments. Representatives from Delaware Coastal Programs and the Delaware National Estuarine Research Reserve participate in "Sister State" exchanges to share data, strategies and best practices.

RISKS AND VULNERABILITIES

The oceans are one of the largest sources of carbon storage, absorbing 30% of global carbon dioxide emissions and acting as a vital buffer against the impacts of climate change.[275] However, this same buffering capacity also makes them vulnerable, as absorbing excess carbon dioxide contributes to ocean acidification. Delaware's coastal economy is susceptible to the impacts of ocean acidification. The state's prized seafood industry, specifically blue crabs, oysters, and clams, relies on healthy waters at the correct pH for shell formation and survival. Acidified waters can impair shell growth, reduce larval survival, and disrupt entire food webs.[276] Additionally, warming waters can increase the growth of bacteria that harm aquaculture as and contribute to harmful algal blooms.

Oyster farming along Delaware's shoreline supports local jobs, helps restore oyster populations, and improves coastal water quality. While some impacts on shellfish have been documented and studied, the future impacts to coastal communities and industries that rely on these species are largely unknown. A 2015 study estimated that ocean acidification could cost the U.S. shellfish industry hundreds of millions of dollars annually in the coming decades, with the mid-Atlantic region, Delaware included, among the areas most at risk.[277] Proactive monitoring, regional coordination through networks like the Mid-Atlantic Coastal Acidification Network and strategic adaptation planning are essential to mitigate these impacts and protect Delaware's valuable marine resources and communities that depend on them.

Table 6.7. Summary of impacts from ocean and coastal acidification

Economy	• Losses to aquaculture seafood industry (blue crabs, oysters, clams) • Losses to commercial and recreational fishing
Public Health	• Reduction in food supply, especially for subsistence harvesting • Increase in harmful algal blooms • Reduced quality of seafood
Infrastructure	• Weakened coastal defenses (reefs/shellfish habitats) may lead to flooding and damage to roadways and bridges in coastal areas • Disruptions to navigation
Labor	• Loss of jobs (tourism, aquaculture, fisheries) • Loss of recreational opportunities and cultural heritage
Natural Resources	• Impaired shell growth and larval survival • Food chain impacts • Reduced water quality

STRATEGIES AND ACTIONS

Addressing ocean and coastal acidification requires a science-based and coordinated approach. Expanding monitoring, advancing research and developing an ocean acidification action plan are essential for understanding and mitigating impacts on marine ecosystems, coastal economies, and communities. These efforts ensure that decision-makers have the information needed to reduce acidification drivers, increase awareness and build resilience for Delaware's marine resources and the industries that depend on them.

GOAL: INCREASE COASTAL ACIDIFICATION MONITORING AND PLANNING

Strategy OCA1: Research and monitor the impacts of coastal acidification.

Expanding research and monitoring helps Delaware understand and respond to the growing risks that acidification poses to marine ecosystems, coastal communities and economic sectors such as fisheries, aquaculture and tourism. Continuous, high-resolution monitoring, particularly near shorelines, enables scientists to distinguish long-term trends from short-term events.

OCA1.1. Expand continuous, high-resolution coastal acidification monitoring, particularly near shorelines. Collaborate with the Mid-Atlantic Coastal Acidification Network and regional partners to ensure consistency, establish a data repository and improve understanding of long-term acidification.

OCA1.2. Conduct ocean and coastal acidification vulnerability assessments for shellfisheries, aquaculture and related industries, such as tourism and seafood processing.

OCA1.3. Identify gaps in monitoring, policies and regulations addressing the drivers of ocean and coastal acidification.

Strategy OCA2: Use ocean acidification research to inform planning and preparedness efforts.

Scientific research provides the foundation for planning and responding to acidification impacts on Delaware's marine environments and blue economy. Understanding how acidification affects fisheries, aquaculture and ocean health enables proactive, targeted strategies. Developing an ocean acidification action plan ensures that research translates into concrete measures to reduce risks, support sustainable seafood industries and strengthen ecosystem resilience.

OCA2.1. Develop an ocean acidification action plan to guide actions addressing fisheries, aquaculture and ocean resilience.

Acidification could impact horseshoe crab spawning. **PHOTO: LYNNE PUSEY, DNREC**

Comprehensive Resilience

RASCL meeting at St. Jones Reserve. **PHOTO: DNREC**

Compounding climate risks occur when multiple climate hazards and stressors interact and amplify each other, leading to cascading effects.[278] As climate change impacts continue to intensify, Delaware can expect to experience more compounding risks. For example, an extreme heat wave that occurs during a drought could exacerbate heat stress on crops, strain water supplies, and create ideal conditions for wildfires. Compounding climate risks can be particularly dangerous when extreme events coincide with or follow one another, straining emergency response and impacting vulnerable populations most acutely.

Multidimensional problems require holistic solutions. Building comprehensive climate resilience requires a system-wide approach to prepare for, respond to, and recover from compounding and cascading effects. Unlike the hazard-specific strategies presented earlier in this chapter, this section focuses on the cross-cutting partnerships needed to address multiple adaptation goals simultaneously. Strategic initiatives — such as preserving green space to reduce heat and flooding, strengthening collaboration between state agencies, connecting local communities with resilience funding, and providing quality environmental education — advance multiple adaptation goals at once. This plan includes six adaptation goals in this section:

- Protect Natural and Agricultural Resources
- Enhance Technical Support and Design for Resiliency Planning
- Promote Collaborative Governance and Policy Alignment

- Strengthen Climate Resilience Across Systems and Infrastructure
- Improve Data Collection, Research and Decision Support Tools
- Enhance Outreach, Engagement and Collaboration

PARTNERSHIPS FOR RESILIENCE

In lieu of a Risks and Vulnerabilities section as is included for other hazards, the comprehensive resilience section focuses on the partnerships needed to reduce hazard risks and build state resilience. A robust partner network is crucial to climate resilience; just as climate hazards do not respect political boundaries, solutions may cross jurisdictions or require resources beyond what a single community can provide. State and local partnerships enable Delaware's smaller communities to access technical expertise, funding opportunities and proven solutions that they may lack the capacity to develop independently. These networks also help coordinate responses across interconnected systems and disseminate success stories that can be implemented on a broader scale.

Several groups and programs are already established in Delaware to facilitate and coordinate resiliency efforts. Working with a network of partners across the state, region and country can help address overlapping hazards and advance holistic solutions that address multiple dimensions. Resilience partners take a variety of actions, including:

1. Connecting local governments to technical assistance and funding
2. Providing up-to-date climate science and data to decision-makers
3. Coordinating acquisition and preservation of natural lands
4. Promoting climate scholarship and training the next generation of climate leaders
5. Authentically engaging vulnerable communities on climate impacts and potential solutions

A table highlighting many of Delaware's resiliency partners and programs can be found in Appendix B.

FOUNDATIONAL POLICIES AND PROGRAMS

Comprehensive resilience requires coordination and incorporation of climate change impacts across all levels of government and in all sectors. The following policy highlights outline efforts to cooperatively manage and protect Delaware lands.

Delaware Planning Act

This statute establishes provisions for the coordination of growth and development in Delaware. It establishes the Cabinet Committee on State Planning Issues and directs them to recommend the best land use patterns for the state, in part through the Strategies for State Policies and Spending. This Act also establishes a process for review and certification of county and municipal comprehensive development plans.[279]

Delaware Quality of Life Act

This Act authorizes and directs Delaware's county governments to plan for future development and growth through adoption of land development regulations, zoning and comprehensive development plans. It requires each County to establish a local planning

Rehoboth Beach drawbridge over the Lewes-Rehoboth Canal. PHOTO: DNREC

agency and to coordinate growth with municipalities, other counties and state agencies. The Act outlines the content, timing and approval process of required comprehensive development plans. It also clarifies that the state is not obligated to provide financial assistance or infrastructure improvements for land use actions that are not consistent with state policies for growth.[280,281,282]

Delaware Land Protection Act 1990

To protect natural lands from population growth and urban encroachment, this law created the Delaware Open Space Program which enables state agencies to acquire land or water bodies for permanent protection from development. The act also created the Delaware Open Space Council to advise the DNREC Secretary on all matters relating to the administration, implementation and financing of the Delaware Open Space Program.[283]

Delaware Climate Change Solutions Act of 2023

In addition to setting greenhouse gas emissions targets, this law establishes a whole-of-government response to climate change. The law requires state agencies to consider climate impacts, including resilience, in their decision-making for procurement, planning and grant-issuing processes.[284]

RECENT PROGRESS

This section highlights recent, innovative or collaborative efforts to build community resilience to climate impacts spanning from the town level to watersheds and beyond. The progress below is characterized by strong networks that bring people together to holistically understand complex climate problems and generate unique solutions.

Former State Climatologist, Dr. Dan Leathers, presenting at the 2025 RASCL Summit. **PHOTO: PARTNERSHIP FOR THE DELAWARE ESTUARY**

Christina-Brandywine River Remediation Restoration Resilience Project (*CBR4*)

The CBR4 project brings together public- and private-sector partners to address legacy contamination, restore native ecology and prepare for changing climate and other threats to river health in the lower Christina River and tidal Brandywine River. A central goal of the project is to make the rivers fishable, swimmable and drinkable in the shortest timeframe possible.[285] In 2023, the project team developed a planning document for how to proceed with remediation, restoration and resilience: *A Plan for Restoring Wilmington's Rivers*.

Resilient And Sustainable Communities League (RASCL)

RASCL is a collaborative network of state, nonprofit and academic partners working to create more resilient and sustainable Delaware communities. Each year, RASCL hosts a summit to bring together resilience practitioners, elected officials, government agencies and community members to discuss the issues that matter to Delawareans. In March 2025, the summit focused on climate change, with the theme "AIMing for Action: Adapting, Innovating and Mitigating the Impacts of Delaware's Changing Climate." In addition to the summit, RASCL offers opportunities for community members and officials to attend educational coffee hours, obtain free technical support on many topics, including resilience projects, and access guidance to increase local capacity to adapt, mitigate and respond to environmental change.

Lewes Resiliency Fund

During budget meetings for fiscal year 2026, the mayor and city council of Lewes voted to implement a resiliency fund for their

city. Lewes already experiences flooding and damage from coastal storms and will use the resilience fund to adapt to climate impacts. The goal is to provide sustainable funding for proactive projects that enhance disaster preparedness, strengthen climate resilience, protect natural resources, promote sustainable development and support community engagement.

STRATEGIES AND ACTIONS

The following comprehensive resilience strategies and associated actions align with, and expand upon, the plan's adaptation goals to improve data collection and support tools, support community resilience and natural resource protection, and enhance technical support, collaboration and engagement.

GOAL: PROTECT NATURAL AND AGRICULTURAL RESOURCES

Strategy R1: Enhance the resilience of natural landscapes and agricultural lands.

Natural landscapes can form a protective barrier against the impacts of climate change. For instance, forests can absorb floodwaters, mitigate heat and provide a range of ecosystem and health benefits. However, natural environments and agricultural lands are also threatened by climate change. To maintain healthy natural and agricultural systems, Delaware must leave space for them and incorporate climate change effects into management.

R1.1. Continue to use and improve the state's Natural Areas Preservation System, Conservation Easement Program, Open Space Program, Aglands Preservation Program and Land Evaluation Site Assessment scores to prioritize and protect natural and agricultural lands.

R1.2. Continue to support the Community Conservation Assistance Program, the Land Conservation Loan Program and other programs to help municipalities put lands into conservation easements to retain ecosystem services.

R1.3. Create an urban forest conservation easement program that aligns with proposed state flood mitigation grants to maximize funding availability and resiliency.

R1.4. Work with farmers to explore programs or other voluntary approaches that provide an economic benefit to allowing sea-level rise to occur naturally to restore tidal flow, wetlands and other nature-based systems.

R1.5. Create guidance outlining next steps for landowner assistance programs to encourage farmers, foresters and other resource managers to incorporate future climate conditions into their management practices.

Strategy R2: Invest in nature-based solutions and infrastructure improvements that support resilience to multiple hazards.

Nature-based solutions can be used to effectively and sustainably reduce climate change impacts. Nature-based solutions examples include marsh restoration, tree plantings and other green space initiatives. Nature-based solutions come with a host of co-benefits to address other community priorities, including natural cooling, habitat for wildlife, flood retention and improved water quality. Using nature-based solutions along with other infrastructure upgrades can help increase community resiliency to climate change-induced hazards.

Saltmarsh cordgrass (Spartina alterniflora) being transplanted for wetland restoration. PHOTO: DNREC

R2.1. Provide opportunities for communities to share best practices and lessons learned for implementing green infrastructure and ecosystem-based adaptation projects.

R2.2. Install appropriate cooling, heating and/or sheltering infrastructure in state natural and recreational areas to protect visitors from climate hazards.

R2.3. Establish landscape linkages to connect habitats and increase protection for natural lands, open spaces and parks.

R2.4. Support educational efforts by the Delaware Native Species Commission and the Invasive Species Council to plant and maintain native plants.

R2.5. Seek funding to develop new ways to design and manage coastal impoundments for recreation, mosquito control and habitat provision.

GOAL: ENHANCE TECHNICAL SUPPORT AND DESIGN TO ADVANCE RESILIENCY

Strategy R3: Provide technical assistance to local governments to incorporate climate change into planning efforts.

Climate change requires long-term planning and systems change. Adaptation solutions may look different from one community to the next depending on location, unique vulnerabilities and capacity. The state can provide technical assistance to support communities to use available data, science, programs and resources to advance resiliency goals that align with local conditions.

R3.1. Provide technical assistance and trainings, through the Coastal Training Program, on the use of state climate planning scenarios.
R3.2. Coordinate with the counties and municipalities to identify technical assistance resources needed for updating county hazard mitigation plans.
R3.3. Support local governments and small communities with creating county- and municipal-level plans that support climate resilience.
R3.4. Continue to support statewide resilience coordination and technical assistance programs (such as RASCL, Resilient Community Partnership and Grant Assistance Program) to build programs' capacity to ensure resilient technical assistance services.
R3.5. In partnership with the Office of State Planning Coordination, provide technical assistance to support implementation of the new comprehensive plan requirements, including helping counties steer new development away from areas vulnerable to sea-level rise and flooding.

GOAL: PROMOTE COLLABORATIVE GOVERNANCE AND POLICY ALIGNMENT

Strategy R4: Align state investments with long-term resilience goals.

Climate change will impact all jurisdictions and agencies regardless of their location or focus, requiring a unified effort to prioritize resilience planning. State investments that do not align with resiliency goals create maladaptive solutions, which can increase vulnerability to compounding climate hazards and make adaptation initiatives harder to achieve. Solutions to climate change will require consideration, support and collaboration from all agencies.

R4.1. Incorporate funding criteria into state-sponsored grant and loan programs that require applicants to consider projected climate conditions in project proposals.
R4.2. Assist towns and municipalities in developing their own funding mechanisms for resilience projects.
R4.3. Expand the Open Space Program to include a grant mechanism backed by new, increased funding to assist county, local governments and non-governmental organizations with land acquisition efforts.
R4.4. Analyze the vulnerability of the state's insurance market to generate responsive recommendations to climate change risks and opportunities.

GOAL: STRENGTHEN CLIMATE RESILIENCE ACROSS SYSTEMS AND INFRASTRUCTURE

Strategy R5: Incorporate climate considerations into wastewater and hazardous waste remediation processes.

During a climate disaster, risks can be multiplied due to the release of hazardous materials. To prevent contaminant release, it is important to ensure that climate change considerations are incorporated into the waste remediation process as well as wastewater systems and processes.

This may involve updating systems to withstand increasing inundation from precipitation and flooding, or damage from storms.

R5.1. Ensure future climate change impacts are incorporated and implemented into waste, wastewater and hazardous substance plans and procedures.

R5.2. Work with businesses managing hazardous materials in industrial areas to assess climate change impacts for incorporation into facility emergency action plans.

R5.3. Encourage brownfield redevelopment through public and private partnerships to convert vacant brownfield sites to open, green spaces and parks to improve air quality, potential flood hazard mitigation and quality of life.

R5.4. Work with federal, state and local entities on emergency management planning for waste and waste-water facilities.

R5.5. Plan for future climate hazard exposure when replacing equipment at waste facilities and implement appropriate green and gray infrastructure to protect facilities from natural hazards.

Strategy R6: Support resilient transportation structures and systems.

Resilient transportation structures and systems are essential for maintaining operational efficiency and safety of transportation networks. Evaluating risks and incorporating climate data will ensure transportation systems are designed to withstand and recover from disruptions, reducing infrastructure costs and improving safety.

R6.1. Continue to update and integrate climate resilience into bridge and highway design manuals to address climate impacts.

R6.2. Review and adopt measures to improve evacuation flow and operations, sheltering and security concerns, such as identifying evacuation routes that are resilient to hazards, including flooding.

R6.3. Increase areas designated as Transportation Improvement Districts across the state.

This brownfield restoration project at a former University of Delaware residence hall complex culminated in the creation of Hillside Park and improvements to stormwater management. **PHOTO: DNREC**

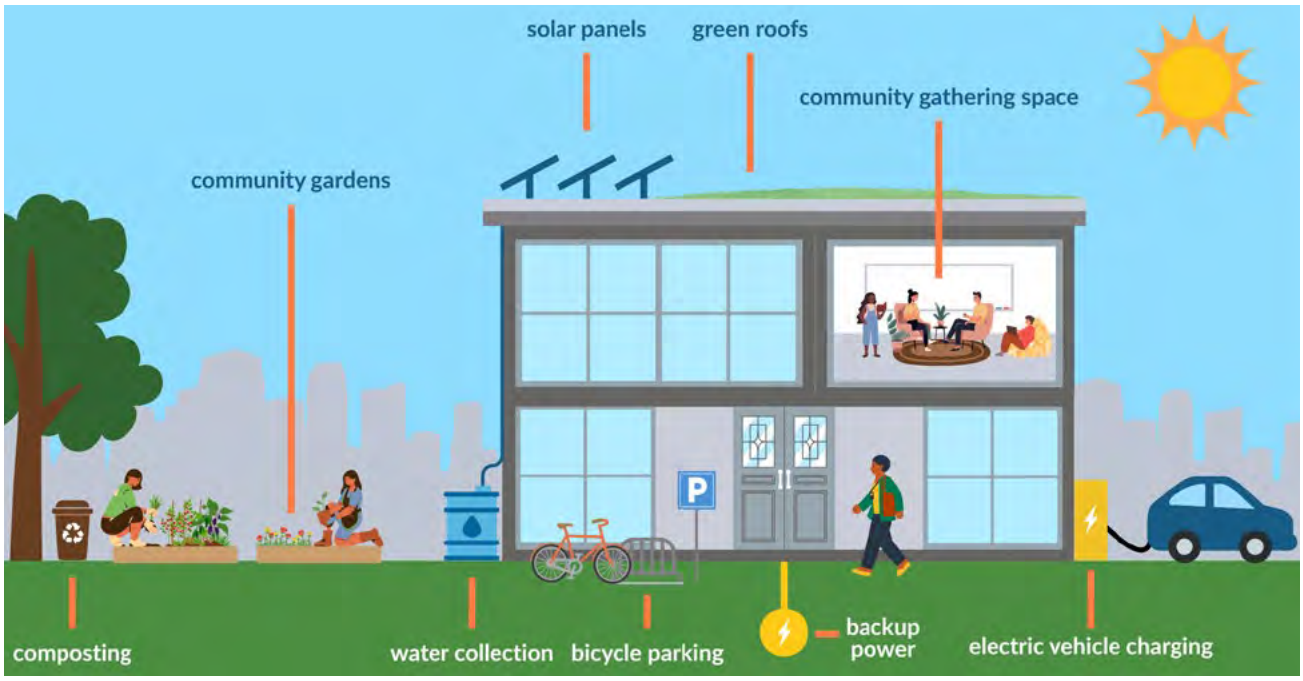


FIGURE 6.5. *Components of a resilience hub.*

R6.4. Review transportation system preservation plans to maximize long-term cost savings and reduce hazardous situations, particularly where climate risk is high.

R6.5. Protect transportation infrastructure and advance planning to redesign or relocate the most vulnerable transportation infrastructure where necessary.

Strategy R7: Support resilient buildings and design.

Safe and resilient buildings can help reduce risk of climate hazards. Updating building codes can provide a framework for building safety and disaster preparedness to a variety of hazards. Ensuring that safe spaces, such as resilience hubs (see Figure 6.5) are available for communities to access during a disaster enhances community preparedness and assistance during the recovery process.

R7.1. Ensure resilience of buildings to natural hazards by reviewing the International Code Council's Hazard Mitigation Code and relevant expertise to create a model statewide building code to improve consistency and safety.

R7.2. Assess critical facilities to identify the most vulnerable sites to climate change impacts and the state's response capacity.

R7.3. Install emergency power sources in identified critical state-owned facilities.

R7.4. Support partnerships to establish resilience hubs at trusted community-run facilities to enhance local resiliency and provide resources on climate hazards and preparedness.

R7.5. Facilitate state-utility collaboration to identify and assess critical infrastructure projects, focusing on areas most at risk from extreme weather and climate impacts.

GOAL: IMPROVE DATA COLLECTION, RESEARCH AND DECISION SUPPORT TOOLS

Strategy R8: Support accessible and transparent data collection and research to implement resilience strategies.

Up-to-date data empowers individuals and agencies to make informed resiliency decisions that are place-specific. Monitoring progress and changes over time is a critical part of data collection efforts, and coordinating and sharing data helps reduce data gaps and improve response strategies.

R8.1. Continue to develop an inventory of Delaware-specific data needs to support communities' resilience.
R8.2. Support easy-to-use tools and resources that provide accurate and detailed data for planning and decision-making for conservation, including foundational high-resolution geospatial data on land use types and high-resolution elevation datasets.
R8.3. Maintain *Delaware's Climate Information Center* as a publicly available tool to access up-to-date data on state climate projections.
R8.4. Assist property owners in assessing the vulnerability of their buildings to climate hazards.
R8.5. Continue to research the socio-economic and cumulative impacts of climate change on local communities, including quantifying community benefits of resiliency projects and the costs of inaction.
R8.6. Use GIS mapping tools to identify and prioritize urban forest patches with the greatest climate resilience and equity benefits for conservation.

GOAL: ENHANCE OUTREACH, ENGAGEMENT AND COLLABORATION

Strategy R9: Coordinate with health care institutions to track and provide a holistic response to the health impacts of climate change.

Climate change can exacerbate public health challenges and cause new health threats to emerge. Collaborative efforts with public health practitioners are critical to expanding public awareness of risks, data tracking and development of resilient solutions for health care systems.

R9.1. Monitor statewide changes and trends in health relating to environmental and climate hazards through health impact assessments.
R9.2. Continue to integrate climate and health data tracking from *Delaware Environmental Public Health Tracking Network* into community planning efforts to further understand how climate change impacts public health.
R9.3. Continue developing and enhancing electronic reporting procedures for hospitals, laboratories and other health-sector partners to quickly identify climate-related health impacts, such as heat stroke or Lyme disease.
R9.4. Promote targeted education on the health impacts of climate change to vulnerable populations.

The Delaware National Estuarine Research Reserve supports ongoing research and monitoring, including research stations like this one. **PHOTO: DNREC**

R9.5. Create educational materials on maintaining health during climate emergencies, managing chronic conditions during disruptions, and accessing care when infrastructure is compromised.

Strategy R10: Continue to build relationships with Delaware's Tribal and Indigenous communities, partnering in climate planning, land stewardship and conservation.

Delaware's original land stewards included the Lenni-Lenape and Nanticoke tribes. Tribal communities have been practicing conservation methods such as prescribed burns for centuries. Delaware's route to resiliency must include the voices and ideas of the Tribal and Indigenous communities.

R10.1. Acknowledge Traditional Ecological Knowledge (TEK) as a valuable resource in areas such as agroforestry, wildfire management and watershed health.
R10.2. Identify opportunities to replicate and use the Fork Branch model where appropriate.
R10.3. Include Indigenous partners in planning and implementation discussions around climate-aligned land use, fire practices and ecosystem monitoring.
R10.4. Support capacity-building for tribal-led conservation initiatives that contribute to biodiversity, resilience and long-term land stewardship.

Strategy R11: Increase access and resources to climate change educational materials and involvement opportunities for students.

To sustain and improve upon resilience initiatives, it is critical to engage with and educate all generations about climate science. Creating pipelines for engagement and work opportunities

prepares the next generation of environmental stewards, equipping them with the knowledge and tools needed to develop innovative climate solutions.

R11.1. Identify possible funding sources to provide scholarships for students to attend educational programming about climate change outside of the classroom.

R11.2. Support interdisciplinary climate education opportunities for lifelong learners.

Lenape forest garden. **PHOTO: RUTHANN PURCHASE**

Chapter 7: Preparing Delaware's Workforce for Climate and Clean Energy Jobs

Achieving Delaware's resilient and net-zero future requires a trained workforce and presents an important opportunity to expand access to well-paying jobs across the economy. Reaching net-zero emissions by midcentury is not possible without a workforce prepared to support the clean energy transition. Throughout the development of this Climate Action Plan, workforce development and training opportunities were routinely cited as barriers to progress, particularly for clean and renewable energy, agriculture, forestry and environmental restoration.

Worker at solar farm. PHOTO: W.L. GORE AND ASSOCIATES

Across the United States, job growth in the clean energy sector is outpacing overall job growth by more than double.[288] Clean energy jobs also pay higher wages and provide better benefits than the national average, making them a pathway toward both economic security and climate progress.[289]

Delaware will see opportunities to create new jobs in renewable energy, energy efficiency and advanced technologies, while also reskilling workers in existing occupations. By 2050, modeling indicates the state should prepare for nearly 3,000 MW of solar and 1,600 MW of wind energy to meet clean energy goals. These will be paired with widespread installations of charging stations,

Battery technology worker at Chemours. **PHOTO: CHEMOURS**

high-efficiency heat pumps, electric appliances and sustainable building practices. Emerging technologies such as hydrogen production and carbon capture will also bring new career opportunities to the state.

Clean Energy Workforce Assessment

To better understand opportunities and barriers related to workforce needs, DNREC completed the *2024 Delaware Clean Energy and Climate-Related Jobs Workforce Development Assessment*. The assessment combined labor market data, stakeholder input and national research to identify gaps and opportunities in Delaware's clean energy and climate economy. The results will inform workforce planning efforts among a variety of partners working to build a robust and highly trained workforce in Delaware.[290]

The assessment found that there is strong momentum in Delaware's clean energy economy with recent job growth. The clean energy industry makes up 2.5% of total employment in the state, with over 12,400 workers in 2022. The largest sector of clean energy workers is in the energy efficiency specialization with nearly 10,800 workers in 2022. Electric power generation, alternative transportation, grid and storage, and fuels represented just over 1,000 jobs during the same period.[291]

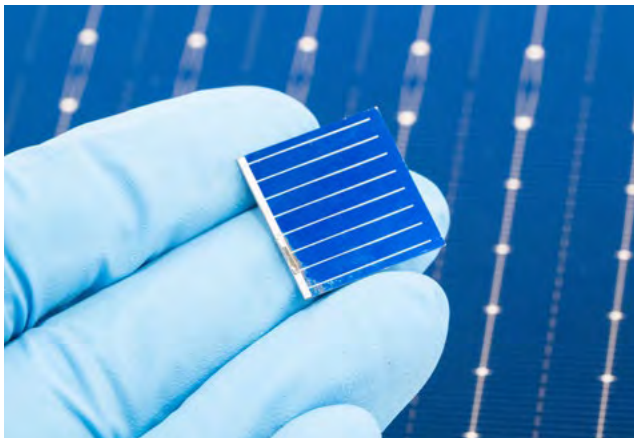
The report also found that while Delaware has a solid foundation of clean energy employment, targeted investment and coordination are needed to scale up. Many existing occupations will require new training to incorporate emerging technologies, while entirely new roles will demand the creation of fresh education and

credentialing pathways. The assessment also emphasized that success depends on more than technical training: Wraparound services such as childcare, transportation and mentoring are essential to recruit and retain workers, and equity must remain central to ensure underserved and overburdened communities share in the benefits of clean energy job growth.[292]

Workforce development is equally important in agriculture, forests and urban trees sectors, where an aging workforce underscores the need to develop pipelines for younger workers. These sectors provide critical opportunities for carbon sequestration and the implementation of nature-based climate solutions. Fully achieving the strategies in this Climate Action Plan requires strengthening Delaware's workforce across all sectors, ensuring both technical training and support services are in place.

OCCUPATION FINDINGS

The Workforce Development Assessment shows that demand for clean energy jobs will grow sharply across both traditional trades and new clean energy occupations, highlighting the importance of scaling-up training, education and supportive services to meet future needs. Significant potential future employment gaps were found for several job categories.



Close-up view of solar photovoltaic cell. PHOTO: U.S. DEPT. OF ENERGY

Key occupation findings include:

- **Demand is highest in the skilled trades.** Construction workers, electricians and pipefitters are the most urgently needed occupations. These roles are central to building renewable energy infrastructure, installing electric vehicle charging stations and electrifying buildings.
- **HVAC technicians are critical.** Delaware's transition to high-efficiency electric heat pumps and building retrofits will require significant growth in HVAC training and certification.
- **Specialized clean energy roles are emerging.** Jobs for solar photovoltaic installers, offshore wind technicians, battery and storage specialists and hydrogen engineers are expected to grow rapidly as Delaware scales new technologies.
- **Aging workforces in traditional sectors pose risks.** Agriculture, forestry and natural lands management are vital to Delaware's climate and sequestration strategies, but these sectors face significant retirements without new pipelines to engage young workers.
- **Workforce development must be comprehensive.** Delaware cannot meet clean energy and climate goals without combining technical training with supportive services that allow workers to enter and stay in these fields.

By 2030, Delaware is projected to face severe shortages in critical clean energy jobs, from wind technicians to electricians and construction laborers. A 21% gap in solar installers, for example, means that with the current growth of the workforce, one-fifth of available jobs may go unfilled. Without major expansion of training programs, apprenticeships and recruitment pipelines, the state will lack the skilled workforce required to build renewable energy projects, retrofit homes and businesses and install efficient systems. Addressing these gaps is essential for Delaware to meet its clean energy goals and implement many strategies in the Climate Action Plan.

Clean Energy Workforce Gaps

Five job categories are projected to have large gaps in available workers to fill future jobs by 2030. These findings were based on labor market projections tied to anticipated clean energy deployment in Delaware and modeled impacts of federal investments under the Bipartisan Infrastructure Law and the Inflation Reduction Act.

Job	Gap (%)
Wind turbine service technicians	31
Solar photovoltaic installers	21
HVAC technicians and mechanics	10
Electricians	10
Construction laborers	10

Workforce Actions in Delaware

The Clean Energy and Climate-Related Jobs Workforce Development Assessment emphasized that building and sustaining a climate-ready workforce requires more than just technical training. Delaware must take a comprehensive approach that blends education, equity and support systems. The report contains a series of recommendations, developed from a robust stakeholder process.

Key recommendations from the report include:

- **Expand training, credentialing and apprenticeships** to ensure workers are prepared for clean energy and climate-related careers, including retraining for existing occupations.
- **Develop strong workforce pipelines** by connecting high schools, technical education and universities to clean energy pathways, and by providing internships, fellowships and early-career opportunities.
- **Ensure equitable access and diversity** by reducing barriers to entry and intentionally recruiting workers from underserved and overburdened communities.
- **Provide wrap-around services** such as childcare, transportation assistance, mentoring and career navigation to help workers succeed and remain in clean energy jobs.
- **Support incumbent worker reskilling** so that current employees can transition into new and evolving roles as technologies advance.
- **Invest in professional development and continuous learning** to keep the workforce current with new codes, standards and technologies.

Utility workers. PHOTO: DEMEC

- **Strengthen partnerships** among government, educational institutions, labor organizations, community-based organizations and industry to align training with actual labor market demand. Work with the Delaware Workforce Development Board to formally integrate clean energy and climate-related careers into state planning.[293]
- **Improve workforce data and tracking** to monitor job growth, program outcomes and equity impacts, ensuring Delaware's approach stays adaptive and responsive.
- **Develop a statewide clean energy workforce roadmap** that outlines steps, timelines and partnerships needed to coordinate training and employment opportunities across sectors.

The Clean Energy and Climate-Related Jobs Workforce Development Assessment was the first step in understanding the landscape of job opportunities and workforce gaps in clean energy sectors. This assessment highlighted the clean energy opportunities in Delaware and brought workforce development and labor partners together for the first time to begin to leverage these opportunities. The partnerships and data developed during this process provide the foundation for future action and program development.

For example, participants in this effort identified a need to better understand curriculum gaps. A second phase could identify where Delaware's education and training programs need updates or expansions to prepare workers for occupations with the greatest projected shortages, such as electricians, HVAC technicians and construction laborers. By addressing curriculum gaps, Delaware can strengthen the alignment between labor market demand and the state's training pipeline.

Utility workers on a transmission line. **PHOTO: DEMEC**

Executive Order #1: Expanding Youth Apprenticeships and Earn-and-Learn Opportunities

Delaware Governor Matthew Meyer's first executive order committed Delaware to expanding youth apprenticeships and earn-and-learn opportunities to strengthen the state's workforce.

This initiative will help prepare young people for careers in clean energy, sustainability and other high-demand industries by providing hands-on experience, industry credentials and pathways to stable, well-paying jobs.

The Clean Energy and Climate-Related Jobs Workforce Development Assessment is being used as part of this effort, ensuring alignment with the state's clean energy workforce initiatives and broader climate goals.

Chapter 8: Implementing the Climate Action Plan

This plan is intended to be a living document. It lays out a path for Delaware to continue work preparing for the impacts of climate change on our economy, communities and natural resources, while meeting ambitious but achievable greenhouse gas emission targets. The plan does not create new mandates or requirements but lays out the actions that can be taken over time as resources, data and partnerships develop and evolve. The plan does not specify precisely how or when each action should be undertaken, or by whom.

Delaware Legislative Hall. PHOTO: ADOBE STOCK

The goals, strategies and actions highlighted in this plan encompass all economic sectors and climate change impacts. State agencies will play a leading role in implementing these actions, but not all actions can be accomplished by state agencies, or by state agencies alone. As such, the success of this plan depends on continued collaboration and conversation with residents, communities and stakeholders across the state.

The sections below describe principles for implementation, principles for achieving climate action that is equitable, the role of partnerships and state agencies' key roles moving forward. It also outlines how progress will be tracked and reported over time.

Two volunteers pot native tree seedlings at the St. Jones Reserve. **PHOTO: DNREC**

Guiding Principles for Implementing Climate Action

How the actions outlined in this document are undertaken is just as important as which actions are undertaken. In implementing the actions in this document, a thoughtful, future-oriented and community-based approach must be taken. Principles for implementing the strategies and actions in this document are below; principles specifically focused on equity are in the following section.

IMPLEMENTATION ACTIONS SHOULD BE AMBITIOUS YET ADAPTABLE.

The changes Delawareans are experiencing from climate change are accelerating and worsening. At the same time, the pace of technological advances is quickening, and costs of technology are coming down. It is imperative to act quickly to improve resiliency and reduce emissions. Flexibility must be built into any action to ensure that forward progress can be made while accounting for changes in climate conditions or technology.

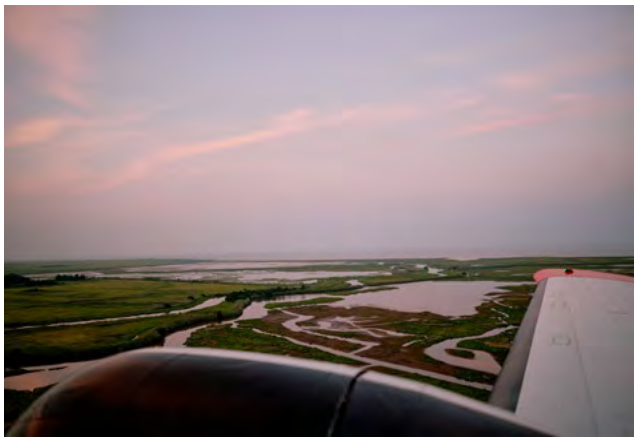
IMPLEMENTATION ACTIONS SHOULD CONSIDER AND REFLECT ALL COSTS AND BENEFITS.

Climate actions are investments in the future and have near-term costs and long-term benefits. When assessing the monetary cost of a particular action, it is important to assess not just the upfront cost but the long-term costs and benefits. Economic modeling shows that shifting to a low-carbon economy provides considerable net-positive benefits to society, especially when the costs of damage from climate change and savings gained from energy efficiency are included.[294,295] A recent study found that climate change will cost the state's economy over $69 billion cumulatively between now and 2090, not including damage from storm surge.[296]

PARTNERSHIPS AND COLLABORATIONS ARE NECESSARY FOR SUCCESSFUL ACTION.

Businesses, families, local governments, conservation organizations and community service providers all have important roles in implementing this plan. A diversity of voices and experiences is necessary to ensure that

2025 Tree and Climate Workshop. **PHOTO: PRIYA ARYA, DNREC**



DNREC Mosquito Control Section conducts aerial mosquito spraying to reduce large mosquito populations and lower the risk of mosquito-borne diseases. **PHOTO: ERROL EBANKS, DNREC**

implementation actions are designed and executed in a way that has the widest benefit. Forging new partnerships will also be necessary to solve emerging state priorities in a way that incorporates climate goals, especially making links between climate initiatives, housing, workforce development, economic development, transportation and human health.

Equity Principles for Implementing Climate Action

Delaware's path forward on climate action must be guided not only by ambition, but by an earnest commitment to community, fairness and long-term success. The following principles define how Delaware can achieve its climate goals while protecting people, strengthening communities and ensuring durable results:

PRIORITIZE COMMUNITY PERSPECTIVES IN DECISION-MAKING.

Those most affected by flooding, extreme heat and other climate impacts must have a meaningful role in shaping solutions. Early and continuous engagement with the most impacted communities helps ensure that climate strategies reflect lived experience and address the needs of communities facing the greatest risks.

ENSURE FAIR TRANSITION FOR WORKERS AND COMMUNITIES.

As Delaware advances clean energy and resiliency, climate action must ensure workers, households and communities are lifted up, not left behind. This includes workforce support, reinvestment of clean energy benefits into vulnerable areas and policies that expand housing and transportation options while protecting community stability.

PROTECT HEALTH AND SAFETY.

Climate action must safeguard public health, reduce pollution and improve resilience against extreme weather events. Strategies should prevent new harm while addressing long-standing challenges such as outdated infrastructure, recurring flooding and limited access to reliable services that place heavier burdens on certain communities.

Community volunteers support habitat restoration during a 2025 seedling potting event at the St. Jones Reserve. **PHOTO: DNREC**

DNREC staff conducting field inspection for mosquito larvae in used tires and other debris. **PHOTO: DAVID MOORE, DNREC**

ENSURE TRANSPARENCY, ACCOUNTABILITY AND USE OF KNOWLEDGE.

Public trust depends on open reporting, clear benchmarks and regular progress updates. Policies should be grounded in evidence-based decisions, while also drawing on local knowledge and traditional practices that strengthen solutions.

These principles form the foundation of Delaware's climate strategy. By approaching this work with urgency, fairness and responsibility, Delaware can reduce emissions, strengthen resilience and build a future that is healthier, safer and more sustainable for all.

State Agency Leadership

State agencies will lead by example in implementing the strategies in this plan. Delaware's state government is the largest single employer and landowner in the state. State properties include state agency buildings, state parks, schools and over 4,000 miles of roadway. Delaware's state agencies operate more than 3 million square feet of building space at over 100 facilities. The state of Delaware also manages a fleet of over 3,000 vehicles.

Because of the scale of state government facilities and operations, actions by state agencies to improve energy efficiency of buildings, deploy electric vehicles and install solar photovoltaic systems can have an enduring effect, not just on the state's overall emissions profile, but also by leading by example to showcase the benefit-cost savings of these measures.

The land, buildings and vehicles owned by state agencies, as well as the daily behaviors of more than 46,000 people employed by the state, provide an opportunity to make progress toward emission reductions and increasing resilience across the First State.

Leading by example in state agencies offers opportunities to successfully implement this plan in three key ways:

- Reduce emissions and increase resilience at state properties.
- Encourage state employees to engage in sustainable practices.
- Promote a climate-forward decision-making ethos at state agencies.

Delaware's commitment to leading by example dates back to *Executive Order 18*, titled *Leading*

By Example Towards a Clean Energy Economy & Sustainable Natural Environment. Issued in 2010, this directive required state agencies to prioritize sustainability through energy conservation and efficiency, renewable energy adoption, sustainable building construction, recycling, clean transportation and environmentally responsible procurement. This executive order formed the basis for collaborative working relationships among state agencies that endure through today.[297]

The State Agency Climate Change Officers will play a critical role in coordinating improvements to the resiliency of state agency operations, increasing energy efficiency and reducing emissions from state agency operations.

Federal Uncertainty

There is considerable uncertainty about the federal government's continuing role in actions to address climate change. Although the threat of climate change has never been more evident and its solutions more feasible, the federal government is retreating from responsible and common-sense climate actions. In some cases, the federal government is taking actions that will exacerbate climate impacts and increase the cost of climate solutions for state and local governments, businesses and individuals.

Historically, the federal government has been a reliable partner for climate action. Federal agencies provide critical data and analysis on air quality, greenhouse gas emissions, sea level rise, river levels and human health for state and local decision-makers. Federal agencies have provided technical assistance for on-the-ground resiliency projects and provided annual grants for transportation improvements, emergency management, public health and coastal management, among many other programs. The federal government has also helped accelerate investments in clean energy through loan programs and tax incentives. Federal regulations for industrial and tailpipe

Teams from the Climate, Coastal, and Energy Sections of DNREC collaborating on 2025 planning activities. **PHOTO: DNREC**

emissions, flood protection, energy efficiency, water quality and wetland protections are essential backbones to Delaware's ability to meet climate goals.

The federal government has recently canceled or delayed millions of dollars in grants to Delaware agencies and nonprofits for resiliency and clean energy efforts. It has also revoked clean energy tax credits for developers and homeowners alike. While canceling funding, it is also amending and rolling back regulations that guard human health.

This presents a significant barrier to action in Delaware, but it will not stop forward progress. New partnerships, programs and innovations will be necessary to clear hurdles being placed by the federal government, and Delaware is ready for the challenge.

Tracking and Reporting Progress

DNREC serves as the lead agency for coordinating implementation of this plan and for tracking progress. DNREC will work through the State Agency Climate Change Officers, the Governor's Energy Advisory Council and others to gauge and track progress related to the strategies and actions outlined in this plan.

DNREC will also compile and publish the state greenhouse gas inventory on an annual basis. The inventory, as described in other chapters of this plan, compiles data on actual emissions and will enable the state to benchmark progress toward short- and long-term emission reductions targets. The most up-to-date greenhouse gas inventory report can be found on the DNREC website.[298]

The *Delaware Energy Hub* can also be used to track on-going progress specifically for energy-related actions.[299] The Energy Hub, established shortly after the release of the *2024-2028 State Energy Plan*, hosts information about energy consumption, generation, grid modernization and more.[300]

Progress reports for this Climate Action Plan will be issued every 2 years — in 2027 and 2029 — leading up to the publication of the next Climate Action Plan due in 2030. Progress reports will highlight new activities that have been undertaken, progress on existing initiatives and emerging issues or threats.

Conclusion

Delaware is prepared for this moment and is ready to take continuing and evolving actions to address the causes and consequences of climate change in the state. Actions will require partnership and keen attention to opportunities to improve equity through community-based climate actions. Progress for climate change will be tracked in a transparent and continuing way, showcasing Delaware's leadership in resiliency and sustainability.

This plan does not create new mandates or requirements; rather, its success depends on ongoing collaboration and conversation among residents, communities, and stakeholders across the state. DNREC looks forward to continued dialogue with Delawareans to ensure that the actions outlined in this plan are designed, implemented and refined in ways that deliver equitable benefits and opportunities for all.

Together, we can build a Delaware that not only withstands the challenges of a changing climate but thrives because of our shared commitment to a safer, stronger and more resilient future.

Glossary of Terms

Active transportation: Human-powered transportation such as walking, cycling, skateboarding, and using a wheelchair.[301]

Adaptation: The process of adjusting to new or changing climate conditions, both to reduce (or prevent) negative impacts to people, property and ecosystems, and to take advantage of emerging opportunities.[302]

Aerial mapping technology: Technology that acquires high-resolution imagery and geospatial data from an aerial perspective.[303]

Aerobic digestion: A microbial process which occurs in the presence of oxygen. Organic material is oxidized under *aerobic conditions*, and products like nitrate, phosphate and carbon dioxide are produced.[304]

Affordable housing: Housing on which the occupant pays no more than about 30% of their gross income on housing costs, including utilities.[305]

Agricultural conservation easements: A voluntary legal agreement that allows landowners to preserve farmland permanently by selling the land's development rights.[306]

Agrivoltaics: The practice of installing solar panels above or alongside crops on the same land. This dual-use approach to land use allows farmers to continue agricultural production while generating clean energy.[307]

Agroforestry: The intentional planting of trees and shrubs among crops and/or animal production systems to enhance environmental, economic, and social outcomes.[308]

Anaerobic digestion: The natural process by which microorganisms break down organic material in closed spaces where there is no oxygen. Anaerobic digestion can occur in a built system, known as a digester, which can be refined into renewable natural gas.[309]

Aquaculture: The breeding, rearing and harvesting of fish, shellfish, algae and other organisms in fully or partially controlled conditions.[310]

Battery storage technology: Technology that stores electricity for later use, helping manage power supply and demand. It also can support renewable energy systems by storing energy produced by these systems until it is needed.[311]

Biofuel: Liquid fuels produced from renewable biological sources, including plants and algae.[312]

Biological indicators: Living organisms such as microbes, animals and plants used to monitor changes in environmental health.[313]

Blue carbon: Carbon captured and stored by the world's ocean and coastal ecosystems. [314]

Blue economy: The sustainable use of ocean resources for economic growth, improved livelihoods and jobs while preserving ocean ecosystems.[315]

Brownfield: A property where redevelopment or reuse may be complicated by the presence or potential presence of a hazardous substance.[316]

Building code: Legally enforceable regulations that set minimum standards for the design, construction and maintenance of buildings.[317]

Building performance standards (BPS): Performance-based standards aimed at reducing energy use and operational costs in existing buildings and improving overall comfort, durability, and resilience for occupants.[318]

Bus rapid transit: High-quality bus-based transit that provides faster, more reliable service and may include dedicated lanes, busways, traffic signal priority, off-board fare collection, elevated platforms and enhanced stations.[319]

Cap-and-trade: An emissions reduction system in which the government sets a maximum allowable level of emissions and a corresponding quantity of emission allowances consistent with that maximum. Emitters must hold allowances for every ton of greenhouse gas they emit. Companies may buy and sell allowances, creating a market-based emissions price.[320]

Carbon sequestration and storage: The process by which plants remove carbon dioxide from the atmosphere and convert it to another form of carbon, such as plant tissues, roots and leaves. Carbon can then be stored in vegetation or in soils.[321]

Carbon sink: An activity or process that sequesters carbon from the atmosphere, either naturally or artificially. Plants, the ocean and soil are examples of the Earth's most significant carbon sinks.[322]

Chemical energy storage: The capture and storage of energy in chemical bonds. Chemical energy offers significant opportunities for lowering emissions to combat climate change.[323]

Clean energy workforce: A workforce equipped and trained to meet the demands of jobs related deploying and maintaining renewable energy technologies, energy efficiency improvements and climate resilience applications.[324]

Clean hydrogen production: The production of hydrogen with minimal or no greenhouse gas emissions. Types include green hydrogen, produced from renewable energy; turquoise hydrogen, produced from natural gas with most emissions captured; and pink hydrogen, produced from nuclear energy.[325]

Coastal acidification: The increased acidity in coastal waters due to freshwater inputs and excess nutrient runoff from land. Excess nutrients can increase acidity of coastal waters. Excess nutrients can cause water to become more acidic. Greater acidity impacts ecosystems and wildlife, particularly when combined with ocean acidification.[326]

Coastal erosion: The process where local sea level rise combined with strong wave action and coastal flooding wear down or carry away rocks, soils and/or sands along the coast.[327]

Coastal impoundments: An impounded (usually diked) area adjacent to tidal waters, within which water levels are actively managed to benefit wildlife.[328]

Co-benefits: Additional social, environmental, economic and health benefits that come with climate action, such as reduced traffic, cost savings, water quality improvements and improved mental health.[329]

Combined heat and power: Energy systems that produce heat and electricity simultaneously to improve energy efficiency and reduce emissions. Also called co-generation.[330]

Combined sewer system: A system that collects rainwater runoff, domestic sewage and industrial wastewater in the same pipe. During periods of heavy precipitation, the wastewater volume can exceed capacity, discharging untreated wastewater directly into nearby streams, rivers or other water bodies. When capacity is overwhelmed, backups may occur.[331]

Community solar: A solar energy development model in which multiple participants share, invest in and benefit from a single solar energy system (often a larger, off-site development). Individuals either own or lease a portion of the system and receive bill credits from the solar energy generated. Enables access to solar energy in areas not well-suited to installation, like apartment buildings.[332]

Complete communities: Communities planned to support safe mobility, efficient land use, access to basic needs, and healthy, inclusive, and resilient living conditions.[333]

Complete streets: Transportation policy and design approach that requires streets to be planned, designed, operated and maintained for safe, convenient and comfortable travel for users of all ages, abilities and transportation types. Supports improved safety, health, economic and environmental outcomes.[334]

Comprehensive resilience: A holistic approach to prepare for, respond to, and recover from compounding and cascading effects of climate change.[335]

Construction and demolition (C&D) waste: Waste generated from the construction, renovation, demolition and reconstruction of buildings. C&D waste accounts for a significant share of total waste and must be disposed of properly to avoid environmental pollution.[336]

Decarbonization: Long-term strategies to reduce carbon dioxide emissions by phasing out fossil fuel combustion. This is primarily done by eliminating the combustion of fossil fuels as an energy source, with the goal being a carbon-free economy.[337]

Delaware Irrigation Management System (DIMS): An online system that provides Delaware agricultural producers with access to localized irrigation scheduling software.[338]

Demand (or load) management: Balancing electricity supply and demand by adjusting when or how much power is used. Reduces the need for new power generation and backup generation devices. It is also a key strategy for grid reliability, lower energy costs, integrate renewable energy resources, and reduce greenhouse gas emissions.[339]

Distributed energy resources (DERs): Energy generation and storage technologies located at or near the point of use rather than centralized power plants. Encompass a wide range of systems — including solar, wind, fuel cells, microturbines and reciprocating engines — along with energy storage, load reduction, and other energy management technologies. Rely on power electronic interfaces, communications and control devices to enable the efficient dispatch, coordination and operation of individual units or aggregated

systems. When powered by renewable sources, referred to as distributed renewable energy.[340]

Ecosystem services: The benefits people receive from ecosystems and the species within them.[341]

Electric vehicle (EV): A zero-emission vehicle that has a battery instead of a gasoline tank and an electric motor instead of an internal combustion engine. Also known as a battery-electric vehicle. For the purposes of this plan, an electric vehicle is in a separate category than plug-in hybrid electric vehicles.[342]

Electrification: The process of replacing technologies that use fossil fuels with technologies powered by electricity. Decarbonization through electrification assumes that electricity will increasingly be generated using clean or renewable energy.[343]

Embodied carbon: The greenhouse gas emissions associated with the extraction, manufacture, transportation, construction, maintenance and end-of-life disposal of building materials.[344]

Emergent hazard: A hazard or risk such as extreme weather or tornadoes, that may have occurred in a geographic area with less frequency but is being amplified by climate change. Such risks arise from the interaction of the evolving exposure and vulnerability of human, socioeconomic, and biological systems with changing physical characteristics of the climate system. Unlike traditional hazards, their probability and impact may be difficult to assess using standard methods.[345]

Energy burden: The percentage of gross household income spent on energy costs calculated by dividing the average housing energy cost by the average annual household income. A household with an energy burden of 6% or greater is considered a "high energy burden household".[346]

Energy Conservation Codes: Standards that set minimum efficiency requirements for new and renovated buildings to reduce energy use and emissions over the life of the building. Energy codes are a subset of building codes, which establish baseline requirements and govern building construction. Also known as building energy codes.[347]

Enhanced efficiency fertilizers: Fertilizers that control their release and/or reactions with soil to decrease nutrient losses into the environment.[348]

Environmental justice: The fair treatment and meaningful involvement of all people, regardless of race, color, national origin or income, with respect to the development, implementation and enforcement of environmental laws, regulations and policies; and the equitable access to green spaces, climate resilience, affordable energy, public recreation opportunities and information and data on potential exposures to environmental hazards.[349]

Equity: Just and fair inclusion in a society where all can participate, prosper and reach their full potential.[350]

Freshwater input: The introduction of freshwater into an estuary, primarily through rivers or surface runoff, but also includes groundwater springs that can enhance water mixing and contribute nutrients and pollutants.[351]

Fuel switching: Fuel switching refers to the practice of replacing a heating or cooling technology or appliance with one driven by a different energy source, e.g., displacing oil and propane by installing an electric air-source heat pump.[352]

Geospatial data: Geospatial data describes location-based data, used for maps, navigation, managing utility networks and monitoring the environment.[353]

Global warming potential (GWP): Measurement that was developed to compare the warming effect of a specific greenhouse gas to that of carbon dioxide, where high global warming potential signifies a greater ability to trap heat compared to carbon dioxide and a low global warming potential signifies a lesser ability to trap heat compared to carbon dioxide.[354]

Green infrastructure: Infrastructure that absorbs, captures and reduces runoff, filters stormwater and provides other environmental, social and economic benefits. Examples include permeable pavement, rain gardens, bioretention cells (or bioswales), vegetative swales, infiltration trenches, green roofs, planter boxes, rainwater harvesting (rain barrels or cisterns), rooftop (downspout) disconnection and urban tree canopies.[355,356]

Greenhouse gas: The release of greenhouse gases into the atmosphere from human activities, particularly the burning of coal, natural gas and oil for energy and heat.[357]

Grid stability: Reliability, consistency and balance in the generation and use of power in the electrical grid. Must consider the integration of individual- and utility-scale renewable energy in the grid and an increasing need to power devices, such as electric vehicles, electric heatpumps and induction stoves. Strategies that can help achieve grid stability include distributed energy, microgrids, battery storage, time-of-use rates, off-peak charging and vehicle-to-grid technology. Also called grid reliability.[358]

Ground-level ozone: Ozone (O_2) occurs both in the upper atmosphere and near the surface. Ground-level ozone is a harmful air pollutant that causes breathing issues and is a major component of smog. Most ground-level ozone forms when pollutants from cars, power plants, and industrial sources react with sunlight.[359]

Groundwater recharge potential: The capacity for water to infiltrate into soils and replenish groundwater aquifers, which supports water supply and baseflow in streams.[360]

Heat pump: A high-efficiency HVAC system that uses electricity to move heat rather than generate it, providing both heating and cooling for homes and other buildings.[361]

Heat waves: Extended periods of unusually high temperatures lasting more than two days that may pose health and safety risks.[362]

High-tide flooding: Flooding that occurs during high tides without storms or rainfall, resulting in standing water on low-lying roads or saltwater in stormwater systems. Also known as sunny-day or nuisance flooding.[363]

Hydrofluorocarbons (HFCs): Potent greenhouse gases with global warming potentials hundreds to thousands of times higher than CO_2. Commonly used in

refrigerants, air-conditioning and insulation materials, hydrofluorocarbons are also emitted from gas-powered vehicles.[364]

Hydrogen fuel cell vehicle: A zero-emission vehicle powered by hydrogen that emits only water vapor. A fuel cell converts hydrogen into electricity to power the motor, like an electric vehicle.[365]

Hydrologic characteristics: The features and behavior of water bodies and systems in a geographic area, including rivers, lakes, streams, reservoirs, and wetlands and man-made or natural and the factors that affect water movement and distribution.[366]

In-furrow nutrient application: Applying fertilizer directly into the seed furrow during planting to support germination and early growth.[367]

Internal combustion engine vehicle: Vehicle powered by the combustion of gasoline, diesel, natural gas, propane, biodiesel or ethanol.[368]

Invasive species: Plants, animals or other organisms that are non-native to a specific ecosystem and cause or are likely to cause environmental, economic or human health harm.[369]

Land subsidence: The gradual or sudden sinking or settling of the Earth's surface when soils or underground materials lose support and compact or collapse.[370]

Lifecycle emissions: The total direct and indirect greenhouse gas emissions associated with a product or fuel from extraction and processing through transportation, use and end-of-life.[371]

Light-duty / passenger vehicles: Vehicles that transport passengers and cargo with a gross vehicle weight rating of less than 10,000 pounds, e.g., cars, pick-up trucks, SUVs, and vans. The most common vehicles on the road.[372]

Living Building Challenge: A performance-based certification program by the International Living Future Institute that promotes net-positive buildings across categories including place, water, energy, health, materials, equity and beauty.[373]

Living shoreline: A shoreline stabilization approach using natural or nature-based materials such as native plants, oyster shells or biodegradable structures to reduce erosion and support habitat.[374]

Low-carbon energy sources and fuels: Energy sources with a smaller carbon footprint than traditional fossil fuels, often from renewable or recycled resources (e.g., wind, solar, geothermal, nuclear energy, renewable diesel, hydrogen and renewable natural gas).[375]

Low-carbon feedstocks: Materials used in industrial processes that produce fewer greenhouse gas emissions during manufacturing and use than conventional feedstocks.[376]

Marine carbon dioxide removal (mCDR): This refers to any ocean-based process or technique to remove carbon dioxide from the atmosphere and store it for long periods of time in the ocean.[377]

Marine carbonate system: A network of chemical reactions and biological processes that regulate the cycling of inorganic carbon in the ocean, influencing acidity (pH), alkalinity, and the global carbon cycle. Includes CO_2

absorption, formation and dissolution of calcium carbonate, and interactions that affect marine ecosystems.[378]

Marsh migration: The landward shift of tidal wetlands to higher and drier ground as sea levels rise, helping them avoid drowning and maintain ecological function.[379]

Medium- and heavy-duty vehicles: Vehicles that transport people or goods with a gross vehicle weight over 10,000 pounds, such as school buses, garbage trucks, and tractor-trailers.[380,381]

Methane (CH_4): A potent greenhouse gas and the main component of natural gas, with about 28 times the heat-trapping effect of carbon dioxide over 100 years. Released by landfills, oil and gas systems and wastewater treatment, methane is the second most emitted greenhouse gas.[382]

Microgrid: A group of interconnected loads and distributed energy resources that can operate with or independently from the main electric grid. Improves resilience during grid disruptions. A microgrid can connect to and disconnect from the grid to operate in both grid-connect or island-mode.[383]

Micromobility: An umbrella term for human or electric-powered transportation devices, including bicycles, scooters, electric bicycles and electric scooters.[384]

Microturbine: A type of Combined Heat and Power system that uses both combustion and electrochemical processes to produce energy.[385]

Morbidity: The condition of having a disease, or the rate of disease within a population.[386]

Multimodal network plan: A transportation plan that incorporates multiple travel modes, such as walking, biking, scooters, public transit and cars to improve connectivity, accessibility and efficiency in a community.[387]

Multimodal transportation: Using two or more modes of transportation in a single trip to move people or goods to their final destination.[388]

Natural and working lands: Forests, grasslands, croplands, wetlands and urban greenspaces that store carbon and support cost-effective strategies to reduce or offset greenhouse gas emissions.[389]

Nature-based solutions: Actions that protect, restore or sustainably manage natural or modified ecosystems to address environmental, social and economic challenges while enhancing biodiversity, resilience and ecosystem services.[390]

Net-zero building: A building or home that combines high energy efficiency with on-site renewable energy generation so that it produces as much energy as it consumes over a specified period. Also called a zero-energy building.[391]

Net-zero emissions: A balance where human-caused greenhouse gas emissions are reduced as much as possible and remaining emissions are offset by carbon removal.[392]

Nitrification inhibitors: Additives in enhanced-efficiency fertilizers that delay the nitrification process.[393]

Nitrification: A biological oxidation process that converts ammonia or ammonium (NH_4*) into nitrite and then nitrate.[394]

Nitrogen-splitting application: Applying nitrogen fertilizer in multiple stages during the growing season to better match crop needs and reduce nutrient losses.[395]

Nitrous oxide: A naturally occurring greenhouse gas that increases due to agriculture, fuel combustion, wastewater and industrial activities. One pound of nitrous oxide has about 265 times the warming impact of one pound of carbon dioxide.[396]

Non-tidal wetlands: Freshwater wetlands that are not influenced by tides. They are fed by precipitation or groundwater and may be wet in winter and spring but dry in summer or fall.[397]

Nutrient pollution/ nutrient input: A process where excess nutrients, primarily nitrogen and phosphorus, enter bodies of water, acting like fertilizer and potentially causing harmful ecological impacts.[398]

Ocean acidification: Refers to the ongoing decrease in ocean pH primarily caused by the absorption of carbon dioxide (CO_2) from the atmosphere.[399]

Off-peak charging: Charging an electric or plug-in hybrid electric vehicle electricity demand, and typically cost is lower.[400]

Offshore wind energy: Electricity generated by wind turbines located offshore and delivered to the onshore grid through subsea cable systems.[401]

Open burning: Any outdoor fire or smoke-producing activity.[402]

Operational carbon: Greenhouse gas emissions resulting from the energy used to operate a building, including heating, cooling, ventilation, hot water, lighting and equipment.[403]

Passive House: A voluntary building performance standard for very high energy efficiency and thermal comfort that significantly reduces a building's carbon footprint, typically using minimal energy for heating and cooling.[404]

Pathogen: An infectious microorganism or agent, such as a virus or bacterium, that can cause disease or damage in a host.[405]

Peak demand: The highest level of electricity demand experienced on the grid over a specified period.[406]

Petroleum refining: The industrial process of converting crude oil into more usable petrochemical products, such as gasoline, diesel, aviation fuel and asphalt.[407]

Plug-in hybrid electric vehicle: A type of vehicle which operates with an internal combustion engine and an electric motor that can be plugged into an external electric power source to charge the internal battery.[408]

Precision agriculture: Farming practices that use data and technology to monitor and respond to variability within fields to optimize crop production.[409]

Prescribed burn or prescribed fire: The planned and controlled burning of vegetation to meet land-management goals such as habitat restoration, fuel reduction, or pest

and disease control; also referred to as a "controlled burn" or "controlled fire."[410]

Process emissions: Greenhouse gas emissions released from chemical reactions during industrial processes (e.g., CO_2, CH_4, N_2O and PFCs), rather than from fuel combustion.[411]

Public Service Commission (PSC): Regulates investor-owned utilities to ensure safe, reliable and reasonably priced cable, electric, natural gas, wastewater and telecommunications services in Delaware.[412]

Pump station: A structure that lifts and moves wastewater or sewage from lower to higher elevations when it cannot be transported by gravity alone.[413]

Reflective roof coating: A coating applied to roofs to reflect heat and sunlight away from a building, improving energy efficiency and building comfort. When installed, the roof is considered a "cool roof."[414]

Remediation: The process of removing pollution or contaminants from groundwater, surface water, or soil to protect human health and restore environmental conditions.[415]

Remote sensing technology: The use of sensors on satellites, aircraft or drones to detect and monitor physical characteristics of an area by measuring reflected or emitted radiation from a distance.[416]

Renewable energy credit (REC): A tradable instrument representing the environmental and other non-power attributes of 1 megawatt-hour of renewable electricity delivered to the grid. RECs can be sold or retained by the generating entity.[417]

Renewable Energy Portfolio Standards (RPS): Regulatory requirements that increase the share of electricity produced from renewable resources. Delaware's RPS mandate that utilities derive 40 percent of their energy from renewable sources such as wind and solar by 2035.[418,419]

Renewable energy: Energy derived from naturally replenishing resources such as biomass, hydropower, geothermal, solar and wind.[420]

Renewable natural gas: Methane-rich gas produced from the decomposition of organic materials or other renewable sources (e.g., landfills, wastewater treatment plants, agricultural operations). When sourced from decomposition, it is considered a type of biogas and can replace fossil natural gas.[421]

Reservoir: A large natural or artificial lake used as a source of water supply.[422]

Resilience: The ability of people and communities to anticipate, accommodate and positively adapt to or thrive amidst changing climate and hazard conditions.[423]

Riparian buffer: Vegetated areas along waterways that help filter runoff, absorb high flows, stabilize banks and provide wildlife habitat.[424]

Salinization: The buildup of soluble salts in soil, which can degrade soil and water quality.[425]

Saltwater intrusion: The movement of saltwater into freshwater systems, including aquifers and surface waters due to factors such as sea level rise, high tides and storm surge.[426]

Sea level rise: An increase in the average height of the ocean relative to land, driven primarily by warming-related expansion of seawater and melting of land-based ice.[427]

Sewer lift station: A wastewater system component that pumps sewage from low-lying areas to higher elevations for conveyance and treatment.[428]

Sludge: The solid, semi-solid or liquid byproduct generated from municipal, commercial or industrial wastewater treatment. Sludge must be properly managed and disposed of to protect human health and the environment.[429]

Small modular nuclear reactor: Advanced nuclear reactors that have a power capacity of up to 300 MW, about one-third the generating capacity of a traditional nuclear power plant. SMRs are compact, factory-assembled units transported to sites for installation and use nuclear fission to generate electricity.[430]

Soil Carbon: Carbon stored in soils through the decomposition of organic material and other natural processes, contributing to carbon sequestration.[431]

Solar-ready: A building or structure designed with dedicated space, orientation, and electrical infrastructure to support future solar panel installation.[432]

Strategic retreat plan: A plan supporting the voluntary relocation of people and ecosystems away from areas vulnerable to sea level rise and other coastal hazards. Also known as a managed retreat plan.[433]

Stretch codes: Energy codes or compliance pathways that exceed base building energy code requirements to improve energy performance. Stretch codes may be voluntary or mandatory and are sometimes referred to as reach codes.[434]

Submerged Aquatic Vegetation (SAV): Underwater plants that grow in shallow areas of bays, rivers, streams, and ponds. Found in both freshwater and brackish waters in Delaware. Also called bay grass or seagrass.[435]

Sustainable aviation fuel (SAF): Renewable jet fuel that can reduce lifecycle greenhouse gas emissions by up to 80% compared to conventional jet fuel and represents the largest near-term emissions reduction opportunity for aviation.[436]

Tax ditch: A legally established governmental subdivision formed to manage drainage within a watershed. Tax ditch organizations consist of landowners in the watershed and maintain infrastructure designed to move normal water flows off agricultural lands to keep them productive.[437]

Thermal energy storage: A system or material that stores heat or cold for later use, helping shift energy demand from peak to off-peak periods and improve energy system efficiency.[438]

Thermal expansion: The increase in volume of matter due to rising temperature. Regarding sea level rise, ocean warming causes seawater to expand, contributing to higher sea levels.[439]

Tidal wetlands: Coastal wetlands influenced by daily tidal cycles where oceans, bays, rivers and streams meet the land. They range from freshwater to saltwater and provide critical habitat and flood protection. These wetlands

are commonly referred to as marshes or swamps.[440]

Time-of-use (TOU) rates: Electricity pricing that varies based on when energy is used, with higher rates during peak demand and lower rates during off-peak periods, encouraging customers to shift consumption to times when the electric grid is less strained.[441]

Traditional ecological knowledge (TEK): Cumulative knowledge, practices, and beliefs held by Indigenous peoples about relationships among living beings and their environments, developed over generations through direct experience.[442]

Transmission infrastructure: The high-voltage lines and related systems that transport electricity over long distances from generating sources to population centers. In some regions, these networks are managed by Independent System Operators (ISOs) or Regional Transmission Organizations (RTOs). Individual investor-owned utilities (IOUs) are regulated by state public utility commissions (PUCs), while RTOs and ISOs are regulated by the Federal Energy Regulatory Commission (FERC) but may also be subject to state regulation.[443]

Transportation improvement district (TIDs): A defined geographic area used to coordinate and fund necessary transportation upgrades to support existing and planned development.[444]

Urban heat island: An effect in developed areas where buildings, asphalt, and other heat-absorbing surfaces cause higher temperatures compared to surrounding rural areas, often worsened by limited tree cover and green space to provide shade and cooling.[445]

Urbanization: The concentration of populations that transforms land for residential, commercial, industrial and transportation uses. Includes dense urban centers and adjacent suburban or peri-urban areas.[446]

Utility-scale renewable energy: Large renewable energy systems, typically 10 megawatts or greater, that generate electricity for the grid and often rely on supportive state and local policies for deployment.[447]

Vector: A living organism that can carry and transmit infectious diseases between animals and humans or among humans (e.g., mosquitoes, ticks).[448]

Vehicle emissions standards: Regulations that limit the amount of pollution a vehicle or engine is allowed to emit.[449]

Vehicle miles traveled (VMT): A measure of total roadway travel within a region, calculated by summing the miles traveled by all vehicles over a set period.[450]

Vehicle-to-Grid (V2G) technology: Technology that allows electricity to flow from the grid to electric vehicles and back from vehicles to the grid.[451]

Waste diversion: Reducing the amount of waste sent to landfills through strategies such as reduction, reuse, recycling and composting.[452]

Water table: The underground boundary where water saturates the soil and rock,

forming the upper surface of the saturated zone or aquifer.[453]

Watershed: An area of land that drains precipitation to streams, rivers, wetlands, bays or the ocean.[454]

Weatherization: A range of building improvement practices aimed at weatherproofing and installing energy-efficient measures in a building or home to improve the building envelope, heating and cooling systems, electrical system and electricity and fuel consumption.[455]

Wetland: An area where prolonged saturation at or near the surface supports plant and animal communities adapted to wet conditions. Common types include swamps, marshes and bogs.[456]

Wraparound services: A coordinated, person-centered approach that provides comprehensive support to individuals or families to help overcome barriers, address needs, and achieve stability and self-sufficiency.[457]

Zero-emission vehicle: A vehicle capable of operating without tailpipe emissions. Examples include electric vehicles, plug-in hybrid electric vehicles and hydrogen fuel cell vehicles.[458]

Zoonotic: Describing diseases that can spread between animals and humans, caused by viruses, bacteria, fungi or parasites.[459]

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Appendix A. Policies, Programs and Partnerships Supporting Climate Mitigation

This appendix provides an overview of the policies, programs, partnerships, and other resources that support Delaware's climate mitigation efforts across the emissions sectors described in Chapter 4. These include state legislative authorities, federal grant programs, utility initiatives, and collaborations among agencies, nonprofits, and academic institutions.

The list encompasses both longstanding policies established in the late 1990s and more recent legislative advances in areas such as utility reform, offshore wind development, and energy assistance. The following sections organize these resources by sector to help readers identify relevant authorities, funding opportunities and technical assistance programs that can advance climate action in Delaware.

A key funding mechanism supporting many of these initiatives is Delaware's participation in the Regional Greenhouse Gas Initiative (RGGI), a multi-state cap-and-invest program that limits carbon dioxide emissions from power plants. Proceeds from Delaware's quarterly RGGI allowance auctions are reinvested across the sectors covered in this appendix to fund energy efficiency, renewable energy, transportation electrification, and climate resilience projects. This provides a vital revenue stream that strengthens Delaware's capacity to implement effective climate solutions.

Transportation and Land Use

Policies	Description
Residential Dwelling Electric Vehicle Charging Infrastructure (*16 Del.C. §8001*)	Requires newly constructed single-family and multi-family residential dwellings to include certain electric vehicle charging infrastructure. The law also provides county and municipal government enforcement authority for the new electric vehicle charging infrastructure requirements.
Delaware Advanced Clean Car Program (*7 Del. Admin. C. §1140*)	This is a tailpipe emissions regulation that reduces emissions from new vehicles and improves air quality.[1]
Diesel Emissions Reduction Act (DERA)	This program provides grants and rebates for replacement or retrofit of diesel engines with cleaner alternatives.[2]
Volkswagen Environmental Mitigation Trust	The Environmental Mitigation Trust was created following a settlement between VW and the federal government to help fund environmental projects that reduce NOx emissions. Delaware used the funds for lower emissions vehicles and public electric vehicle fast charging equipment.[3]

Programs	Description
Clean Transportation Incentive Program (DNREC)	Provides rebates for new and used electric vehicles and plug-in hybrid electric vehicles, as well as vehicle charging equipment for multi-family housing and workplace charging stations.[4]
Climate Pollution Reduction Grant (CPRG) (DelDOT)	New Jersey, Delaware, Connecticut, Maryland were awarded $248 million through the CPRG Implementation Grant Program. The funded project will reduce emissions from gasoline and diesel fuel by deploying electric vehicle charging infrastructure for commercial zero-emission medium- and heavy-duty vehicles travelling along the Interstate-95 freight corridor from Connecticut to Maryland.[5]
EV Supply Equipment Rebate Program (Delaware SEU)	Provides rebates for electric vehicle charging equipment, with incentives for both income-eligible customers and market-rate customers.[6]
Maritime Environmental and Technical Assistance (META) Program (U.S. DOT)	The Maritime Administration at the U.S. Department of Transportation (U.S. DOT) supports shipping, ports, vessel operations, environmental initiatives and the maritime workforce through technical assistance, grants and loans.[7] The META Program funds research, demonstration projects, and emerging technologies that address environmental concerns and reduce emissions.[8]

1 7 Del. Admin. C. §1140 "Delaware Advanced Clean Car Program"
2 U.S. Environmental Protection Agency, Diesel Emissions Reduction Act Funding. https://www.epa.gov/dera.
3 Delaware DNREC, VW Mitigation Plan. https://dnrec.delaware.gov/air/mobile-sources/vw-mitigation-plan/.
4 Delaware DNREC, Clean Fuel and Transportation Initiatives. https://de.gov/cleantransportation.
5 U.S. EPA, Climate Pollution Reduction Grants: https://www.epa.gov/inflation-reduction-act/states-new-jersey-connecticut-delaware-and-maryland
6 Energize Delaware, EVSE Rebate Program: https://energizedelaware.org/residential
7 U.S. Department of Transportation Maritime Administration, https://www.maritime.dot.gov.
8 MARAD Maritime Environmental and Technical Assistance Program, https://maritime.dot.gov/innovation/meta/maritime-environmental-and-technical-assistance-meta-program.

Energy Generation, Grid Infrastructure, and Buildings

Policies	Description
Delaware Energy Act (*29 Del. C. § 8051-§ 8064*)	• The Delaware Energy Act establishes Delaware's energy policy framework and creates key institutions to advance clean energy and efficiency programs statewide.[9] • Establishes the State Energy Office within DNREC's Division of Climate, Coastal, and Energy to coordinate energy planning. • Directs the State Energy Office to develop and update the State Energy Plan every 5 years and establishes its role as the state's central repository for energy data and defines its role in coordinating with other agencies and monitoring offshore wind transmission planning. • Establishes regulatory authority for DNREC to promulgate the regulations necessary to implement the Delaware Energy Act. • Creates the Governor's Energy Advisory Council to provide recommendations on updates to the energy plan and monitoring and proposing actions to enhance Delaware's energy system, including actions to lessen climate change impacts. • Creates the Energy Efficiency Advisory Council to expand cost-effective energy efficiency programs and establish energy savings targets. • Creates Delaware's Sustainable Energy Utility (operating as Energize Delaware), a nonprofit entity to develop and coordinate programs promoting sustainable energy use and defines role of the SEU Oversight Board. • Establishes statewide Energy Conservation Code, directs DNREC to promulgate regulations triennially to update the statewide energy codes. • Establishes the Green Energy Fund to provide grants for small-scale and residential renewable energy systems, support for research and development, and education. • Directs development of a state emergency energy shortage contingency plan.[10]
Renewable Energy Portfolio Standards Act (*26 Del. C. § 351-365*)	Requires that a growing share of Delaware's electricity sales come from renewable sources. The current target is 40% by 2035, with a 10% solar carve-out. The law also establishes the Renewable Energy Taskforce to support the growth of renewable energy. Delaware's Public Service Commission is responsible for certification of compliance, establishing reporting requirements for the electric utilities, and developing rules and implementation procedures.[11]
Electric Utility Restructuring Act of 1999 (*26 Del. C. §1001-§1017*)	Modernized the state's electric sector by enabling competition and customer choice by deregulating generation and supply functions of electric utilities. The law allows customers to choose their electricity supplier while utilities continue to own and operate the poles, wires, and other infrastructure that deliver electricity to homes and businesses. It also established rules to ensure a reliable transition from a fully regulated system to a competitive market.[12] • Electric customers have the option to select their electricity supplier. • Retains local electric utilities' role in transmission & distribution. • Creates a certification process for competitive electricity suppliers. • Allows utilities to recover some "stranded costs" during market transition.

9 29 Del.C. § 8051, https://delcode.delaware.gov/title29/c080/sc02.
10 29 Del. C. §8051-§8064, https://delcode.delaware.gov/title29/c080/sc02/index.html.
11 26 Del. C. §351-§364, https://delcode.delaware.gov/title26/c001/sc03a/index.shtml.
12 26 Del. C. §1001-§1017, https://legis.delaware.gov/SessionLaws/Chapter?id=19398.

Policies	Description
Prohibitions on Use of Certain Hydrofluorocarbons in Specific End-Uses (*7 Del. Admin. C. §1151*)	Hydrofluorocarbons (HFCs) are potent greenhouse gases that have global warming potentials that range from hundreds to thousands of times that of carbon dioxide. They are also the fastest growing GHGs emitted globally. The DNREC Division of Air Quality developed this regulation which phased out the use of HFCs in air conditioning and refrigeration systems, aerosol propellants and foam applications in Delaware. Most chemicals were phased out by September 2021, with full implementation effective January 1, 2024.[13]
Code for Energy Conservation (16 Del. C. § 7602)	Delaware adopts statewide residential and commercial building energy codes to ensure that new construction and major renovations meet modern energy-efficiency standards aligned with the International Energy Conservation Code (IECC) and ASHRAE standards. State law requires DNREC to review updated IECC and ASHRAE codes every three years and authorizes the agency to adopt revised energy conservation code regulations. Enforcement of the energy code is carried out by local governments.[14]
Utility Rate Reform Act *Senate Bill No. 59*, 153rd General Assembly (Del. 2025)	Reforms utility rate-setting in Delaware by replacing the "business judgment" standard with a stricter "prudence" standard, empowering the Delaware Public Service Commission to deny or limit cost recovery. Enhances oversight of utility spending, capital investment, and cost-recovery mechanisms to improve affordability and accountability for ratepayers.[15]
Utility Spending Accountability Act *Senate Bill No. 60*, 153rd General Assembly (Del. 2025), amending Title 26 of the Delaware Code.	This law prohibits regulated utilities using customer funds to subsidize unregulated activities such as lobbying, political contributions, and certain advertising or public relation efforts not tied to statutory or regulatory mandates. It also imposes a $125 million cap on annual capital expenditures by electric utilities to help control costs for ratepayers.[16]
Net Energy Metering Amendments *Senate Bill No. 175*, 153rd General Assembly (Del. 2025), amending Title 26 of the Delaware Code.	Amends Delaware's net energy metering law to require that electric utilities, municipal electric companies, electric cooperatives, and electric distribution companies must credit or carry over any "Excess kWh Credits" for netmetering customers at the end of the annualized billing period, instead of immediately reverting those credits to utility ownership.[17]
PJM Voting Disclosure Requirements *Senate Bill No. 61*, 153rd General Assembly (Del. 2025), amending Title 26 of the Delaware Code.	This law requires Delaware's electric utilities and Division of the Public Advocate to annually report all their votes at PJM Interconnection (the regional power grid operator) and explain how each vote serves the public interest, ensuring transparency in decisions that affect Delaware's electricity system.[18]

13 7 Del. Admin. C. §1151 "Prohibitions on Use of Certain Hydrofluorocarbons in Specific End-Uses"
14 16 Del. C. §7602, https://delcode.delaware.gov/title16/c076/index.html#7602.
15 Senate Bill No. 59 (Utility Rate Reform Act), 153rd General Assembly (Del. 2025), amending Title 26 of the Delaware Code.
16 Senate Bill No. 60 (Utility Spending Accountability Act), 153rd General Assembly (Del. 2025), amending Title 26 of the Delaware Code.
17 Senate Bill No. 175 (Net Energy Metering Amendments), 153rd General Assembly (Del. 2025), amending Title 26 of the Delaware Code.
18 Senate Bill No. 61 (PJM Voting Disclosure Requirements), 153rd General Assembly (Del. 2025), amending Title 26 of the Delaware Code.

Policies	Description
Net-Metering Cost-Benefit Study *Senate Joint Resolution No. 3* (Net-Metering Cost-Benefit Study), 152nd General Assembly (Del. 2023-2024).	Directs electric utilities that offer net metering to solar customers to participate in a comprehensive cost-benefit study and analysis managed by the Delaware Sustainable Energy Utility (DESEU). The study must evaluate issues such as cost burdens, cost shifting to non-solar customers, and the proper credit value for exported solar energy.[19]
Grid-Enhancing Technologies Study *House Joint Resolution No. 3*, (Grid-Enhancing Technologies Study) 153rd General Assembly (Del. 2025).	Directs electric utilities to participate in a study conducted by DNREC and the Delaware Sustainable Energy Utility to conduct a study of grid-enhancing technologies.[20] Study must assess benefits, cost burdens, cost shifting to ratepayers, feasibility, barriers, and potential for demand-side or distributed energy resources (e.g., smart inverters, vehicle-to-grid, advanced conductors). Final report is due July 31, 2026. Mandates that utilities provide necessary data and participate.
Energy Assistance Fund *House Bill No. 50*, 153rd General Assembly (Del. 2025), amending Titles 7 and 29 of the Delaware Code	Creates the Delaware Energy Fund to provide direct financial assistance to households with incomes under 350% of the federal poverty level. The bill also redirects state funds from alternative compliance payments toward the existing Low Income Home Energy Assistance Program (LIHEAP) and prioritizes energy-savings program participation for recipients. The program sunsets after three years.[21]
Low-Income Utility Rate Relief *House Bill No. 116* (Low-Income Utility Rate Relief), 153rd General Assembly (Del. 2025), amending Title 26 of the Delaware Code.	Allows electric utilities to offer a discounted distribution rate for low-income customers who qualify for LIHEAP, helping reduce monthly energy bills for households facing the greatest financial burden.[22]
Termination of Utility Services *House Sub. No.1 for House Bill No. 62*, 153rd General Assembly (Del. 2025), amending Titles 22 and 26 of the Delaware Code.	Revises provisions in Delaware's utility statutes to strengthen consumer protections before termination of water, gas, or electric services to dwelling units. Key changes include requiring utilities to give at least 72 hours' notice prior to termination; prohibiting shut-offs during extreme cold or heat; mandating additional contact attempts and outreach during heating and cooling seasons.[23]
Delaware Energy Solutions Act of 2024 *Senate Bill No. 265*,152nd General Assembly (Del. 2024), amending Titles 17, 26, and 29 of the Delaware Code.	Creates a framework for Delaware to procure 800–1,200 megawatts of offshore wind energy and to streamline interconnection of renewable resources, helping the Delaware meet the netzero emissions target set in the Climate Change Solutions Act of 2023.[24]

19 Senate Joint Resolution No.3 (Net-Metering Cost-Benefit Study), 152nd General Assembly (Del. 2023).
20 House Joint Resolution No.3 (Grid-Enhancing Technologies Study), 153rd General Assembly (Del. 2025).
21 House Bill No.50 (Energy Assistance Fund), 153rd General Assembly (Del. 2025), amending Titles 7 and 29 of the Delaware Code.
22 House Bill No.116 (Low-Income Utility Rate Relief), 153rd General Assembly (Del. 2025), amending Title 26 of the Delaware Code.
23 House Substitute. No.1 for House Bill No. 62 (Termination of Utility Services), 153rd General Assembly (Del. 2025), amending Titles 22 and 26 of the Delaware Code
24 Senate Bill No. 265 (Delaware Energy Solutions Act of 2024), 152nd General Assembly (Del. 2024), amending Titles 17, 26, and 29 of the Delaware Code.

Policies	Description
Delaware Nuclear Energy Feasibility Task Force *Senate Concurrent Resolution No. 18*, 153rd General Assembly (Del. 2025).	Establishes a "Delaware Nuclear Energy Feasibility Task Force" to examine whether deploying small modular reactors (SMRs) in Delaware is technically feasible, economically viable, environmentally acceptable and aligned with state energy & regulatory needs.[25]
SolarReady Commercial Buildings *House Bill No. 11*, 152nd General Assembly (Del. 2023), amending Title 16 of the Delaware Code	Requires new commercial buildings in Delaware with a foundation footprint of 50,000 square feet or more to include a designated "solar-ready zone" on their roof or building overhang, reserved for future installation of solar photovoltaic or solar thermal systems.[26]

Programs	Description
40101(d) Grid Resilience Grant Program (DNREC)	The 40101(d) Grid Resilience Grant Program provides funding to utilities for projects that strengthen the electric grid against disruptions and improve overall reliability and resilience. Administered by DNREC, the program supports infrastructure upgrades that help reduce the impacts of extreme weather and enhance energy security.[27]
Cool Switch Low-Impact Refrigerant Program (DNREC)	The Cool Switch Low-Impact Refrigerant Program's goal is to incentivize the use of refrigerants with lower Global Warming Potential impacts. Delaware non-residential consumers that use at least 50 pounds of refrigerants are eligible to participate in the program.[28]
Efficiency Smart (DEMEC)	Efficiency Smart helps participating Delaware Municipal Electric Corporation (DEMEC) communities, and their residential and business customers, reduce energy use and save money through technical assistance and financial incentives. The program offers multiple options, including expert guidance and funding for municipalities, businesses, and individuals to implement energy-saving improvements.[29]
Energize Delaware (Delaware SEU)	Operated by the Delaware Sustainable Energy Utility (SEU), Energize Delaware is a nonprofit organization offering a suite of programs and resources to help residents and businesses access a suite of programs that provide energy assessments, energy efficiency rebates, solar energy incentives, ratepayer assistance, and other grant and loan programs to make sustainable energy solutions more affordable and attainable. Key programs offered by Energize Delaware include: • Home Energy Check-Up & Counseling: • Home Performance with ENERGY STAR® • Residential Energy Efficiency and Solar Loans • Low-Interest Commercial Loans • Affordable Multifamily Housing Program • Energy Assessments for Nonprofits and Local Governments • Empowerment Grant Program • Pathways to Green Schools • Solar for School Districts Grant Program • Energize Delaware Farm Program • Commercial Property Assessed Clean Energy (C-PACE) Program.[30]

25 Senate Concurrent Resolution No. 18 (Delaware Nuclear Energy Feasibility Task Force), 153rd General Assembly (Del. 2025).
26 House Bill No. 11 (SolarReady Roofs for New Commercial Buildings), 152nd General Assembly (Del. 2023), amending Title 16 of the Delaware Code.
27 Delaware DNREC. "40101(D) Grid Resilience Grant Program." https://de.gov/40101d.
28 Delaware DNREC, Cool Switch Low-Refrigerant Program: https://de.gov/coolswitch.
29 DEMEC, Efficiency Smart: https://www.demecinc.net/sustainability/programs.
30 Energize Delaware: https://energizedelaware.org.

Programs	Description
Energy Efficiency Investment Fund (EEIF) (DNREC)	The program is operated by DNREC and provides funding for non-residential customers (commercial/industrial) in Delaware to replace or upgrade inefficient equipment and systems, lowering energy use and emissions. Rebates for energy assessments, lighting, HVAC equipment, combined heat and power systems, appliances, water heating equipment and other technologies.[31]
Green Energy Fund (GEF) (DNREC)	Provides grants for renewable energy projects, supporting homeowners, businesses, and other organizations that install a variety of renewable energy technologies like solar, wind and geothermal. The Green Energy Fund was created by the legislature in 1999 to accelerate deployment of renewable energy in Delaware. Funding is collected by Delmarva Power and transferred to DNREC for administration of the Fund. The program has funded over 6,000 renewable energy projects through the state's Green Energy Program and issued grants to research and development projects. Other eligible uses of the Fund include support for energy efficiency, green building, and clean energy education initiatives. The fund supports installations, research and development, and energy efficiency initiatives.[32]
Low- to Moderate-Income (LMI) Solar Program (DNREC)	This program expands access to solar energy for low- to moderate-income households in Delaware. existing state programs. Applicants can qualify for cost-free or cost-reduced solar installations. For low-income applicants, the program partners with the state's Weatherization Assistance Program so the home's energy efficiency opportunities are addressed. .[33]
Renewable Energy & Energy Efficiency Grant Programs (Delaware Electric Cooperative)	The Cooperative offers grants for members that install certain renewable energy or energy efficiency technologies. They also have a Community Solar Program.[34]
Weatherization Assistance Program (WAP) (DNREC)	WAP offers free weatherization assistance programs by assessing households and providing weatherstripping, insulation, energy efficient lightbulbs and other energy saving measures.[35]

31 Delaware DNREC, Energy Efficiency Investment Fund: https://de.gov/eeif.
32 Delaware DNREC, Green Energy Program: https://de.gov/greenenergy.
33 Delaware DNREC, Low- to Moderate-Income Solar Pilot Program: https://dnrec.delaware.gov/climate-coastal-energy/renewable/lmi-solar-pilot-program.
34 Delaware Electric Cooperative, Renewable Energy and Energy Efficiency Programs: https://www.delaware.coop/energy-savings-programs.
35 Delaware DNREC, Weatherization Assistance Program: https://de.gov/wap.

Industry

Policies	Description
Greenhouse Gas Mandatory Reporting Program (GHGRP) (U.S.EPA)	Requires reporting of annual greenhouse gas emissions by facilities that produce emissions that exceed 25,000 $MTCO_2e$ per year. States, cities, and other communities can use this data to find high-emitting facilities in their area, compare emissions between similar facilities, and develop common-sense climate policies.[36]
Prohibitions on Use of Certain Hydrofluorocarbons in Specific End-Uses (*7 Del. Admin. C. §1151*)	Hydrofluorocarbons (HFCs) are potent greenhouse gases that have global warming potentials that range from hundreds to thousands of times that of carbon dioxide. They are also the fastest growing GHGs emitted globally. The DNREC Division of Air Quality developed this regulation which phased out the use of HFCs in air conditioning and refrigeration systems, aerosol propellants and foam applications in Delaware. Most chemicals were phased out by September 2021, with full implementation effective January 1, 2024.[37]

Programs	Description
Better Buildings Initiative (U.S. DOE)	U.S. Department of Energy's Better Buildings Initiative includes the Better Buildings Challenge and the Better Plants Program. Through this program, more than 900 commercial, public, industrial and residential organizations share their proven energy efficiency strategies and inspire others to tap into the continued potential for energy efficiency.[38]
Better Climate Challenge (U.S. DOE)	Facilities participating in this program commit to reducing direct and indirect greenhouse gas emissions by at least 50% within 10 years. Several companies in Delaware are participants.[39]
Cool Switch Low-Impact Refrigerant Program (DNREC)	The Cool Switch Low-Impact Refrigerant Program's goal is to incentivize the use of refrigerants with lower Global Warming Potential impacts. Delaware non-residential consumers that use at least 50 pounds of refrigerants are eligible to participate in the program.[40]
Mid-Atlantic Clean Hydrogen Hub (MACH2)	MACH2 distributes funding to support the production, consumption, and connective infrastructure of hydrogen in Delaware, Southeastern Pennsylvania, and South Jersey to commercialize generation and use of clean hydrogen for decarbonizing heavy industry and transportation. Delaware's Hydrogen Hub was created by federal Bipartisan Infrastructure Law funding, through the Regional Clean Hydrogen Hubs Program.[41]
Mid-Atlantic Industrial Assessment Center (University of Delaware)	The Mid-Atlantic Industrial Assessment Center supports industrial decarbonization by identifying cost-saving energy efficiency and waste minimization projects.[42]

36 U.S. Environmental Protection Agency. https://www.epa.gov/ghgreporting/what-ghgrp
37 7 Del. Admin. C. §1151 "Prohibitions on Use of Certain Hydrofluorocarbons in Specific End-Uses"
38 U.S. Department of Energy. https://betterbuildingssolutioncenter.energy.gov/partnerships.
39 U.S. Department of Energy. https://betterbuildingssolutioncenter.energy.gov/sites/default/files/attachments/FactSheet_Better_Climate_Challenge.pdf.
40 Delaware DNREC, Cool Switch Low-Refrigerant Program: https://de.gov/coolswitch.
41 Mid-Atlantic Clean Hydrogen Hub, Inc. https://mach-2.com/.
42 Mid-Atlantic Industrial Assessment Center. https://sites.udel.edu/iac/about-us.

Natural & Working Lands

Policies	Description
The Cooperative Forestry Assistance Act of 1978 (*Public Law 95-313; 16 U.S.C. §§2101-2114*)	This federal law redefined the U.S. Forest Service's authority to allow it to provide technical and financial assistance to states and private landowners for forest management. The programs cover forest conservation, health, education, wildland fire prevention, and the urban and community forestry program.[43]
Delaware Seed Tree Law (*3 Del. C. §1006*)	Enacted in 1989, this law requires reforestation following timber harvests of 10 acres or more in stands containing at least 25% pine or yellow poplar. Landowners must reestablish at least 400 healthy trees per acre through natural regeneration or planting of the same species.[44]
Delaware Erosion and Sedimentation Law (*7 Del. C. §4001*)	This law establishes best management practices for commercial tree harvesting to protect forest resources and water quality. It also created the Governor's Council on Forestry and the Delaware Community Forestry Council to support the Delaware Forest Service's forestry and urban forestry programs.[45]

Programs	Description
Urban and Community Forestry Program (Delaware Dept. of Agriculture, Forest Service)	This program provides financial and technical assistance to municipalities, nonprofits, community associations, and private landowners to plant, maintain, and enhance urban tree canopy across Delaware.[46]
Tree for Every Delawarean Initiative (TEDI) (DNREC)	This program accelerates tree plantings in the state, with the goal of planting 1 million trees by 2030 by holding tree giveaways and supporting plantings for reforestation, afforestation, and urban trees.[47]
Delaware Forestland Preservation Program (*3 Del. C. §931-941*) (Delaware Dept. of Agriculture, Forest Service)	Administered by the Delaware Department of Agriculture, this program protects working forests through voluntary conservation easements that keep land in forest use while offering landowners tax benefits and long-term preservation incentives under a forest management plan.[48]

43 Public Law 95–313; 16 U.S.C. §§ 2101–2114, "The Cooperative Forestry Assistance Act of 1978" https://www.congress.gov/95/statute/STATUTE-92/STATUTE-92-Pg365.pdf
44 3 Del. C. §1006, https://delcode.delaware.gov/title3/c010/sc01/index.html/.
45 7 Del. C. §4001, https://delcode.delaware.gov/title7/c040/index.html/.
46 Delaware Department of Agriculture, Urban and Community Forestry, https://agriculture.delaware.gov/forest-service/urban-and-community/.
47 Delaware DNREC, Tree for Every Delawarean Initiative, http://de.gov/tedi/.
48 Delaware Department of Agriculture, Forestland Preservation Program, https://agriculture.delaware.gov/forest-service/forest-conservation-programs/.

Oceans and Wetlands

Policies	Description
Delaware Subaqueous Lands Act (7 Del. C. §7201)	First enacted in 1969, this law governs the use and management of Delaware's submerged lands and tidelands. It establishes permit and leasing requirements for activities such as dredging, drilling, construction, and installation of pipelines or cables to prevent ecological degradation.[49]
The Wetlands Act (7 Del. C. §6601)	Enacted in 1973, this law protects and preserves Delaware's tidal wetlands and certain non-tidal wetlands by requiring state permits for dredging, filling, or construction activities. It ensures wetlands are managed for ecological integrity and flood protection.[50]

Programs & Workgroups	Description
Carbon Monitoring System (Delaware National Estuarine Research Reserve)	Led by James Holmquist from the Smithsonian Environmental Research Center, the NASA Carbon Monitoring System project "Data-Model Integration for Monitoring and Forecasting Coastal Wetland Carbon Exchanges" aims to improve tidal wetland methane flux measurements across the contiguous United States using remote sensing. The Delaware National Estuarine Research Reserve serves as a ground-truthing site, providing field data to calibrate predictive models for methane emissions, a major source of uncertainty in tidal marsh carbon exchange estimates.[51]
Coastal Carbon Collaborative (Regional)	Established in 2024, this regional partnership of states, federal agencies, tribes, researchers and industry focuses on understanding carbon storage and marine carbon dioxide removal across the mid-Atlantic region.[52]
Delaware Coastal Programs (DNREC)	DCP conducts tidal marsh research, including soil carbon sampling, to support carbon inventories and modeling that improve understanding of blue carbon storage in Delaware's coastal wetlands.[53]
Delaware Living Shoreline Committee (Multi-agency, voluntary)	This committee convenes twice yearly to advance living shoreline projects through education, information sharing, and coordination among scientists, engineers, and policymakers.[54]
Delaware Statewide Submerged Aquatic Vegetation Workgroup (Multi-organization)	Established 2024, this collaborative group provides strategic guidance on SAV research, monitoring, and restoration by bringing together federal agencies, academic institutions and environmental organizations.[55]
Delaware Wetland Monitoring and Assessment Program (DNREC)	The Delaware Wetland Monitoring and Assessment Program is dedicated to improving and maintaining the health of wetlands. The collected data is used planning wetland design and restoration and to evaluate the impacts of land-use decisions on wetland health.[56]

49 7 Del. C. §7201, https://delcode.delaware.gov/title7/c072/index.html.
50 7 Del. C. §6601, https://delcode.delaware.gov/title7/c066/index.html.
51 NASA Carbon Monitoring System: https://carbon.nasa.gov/cms.
52 Mid-Atlantic Regional Council on the Ocean (MARCO), Coastal Carbon Collaborative Work Group: https://www.midatlanticocean.org/ocean-planning/work-groups-collaborative-efforts/coastal-carbon-collaborative.
53 Delaware DNREC, Delaware Coastal Programs: https://de.gov/coastal.
54 Delaware Living Shorelines Committee: https://www.delawarelivingshorelines.org/what-is-a-living-shoreline.
55 Delaware Statewide Submerged Aquatic Vegetation (DESSAV) Workgroup: https://www.delawaresav.org.
56 Delaware DNREC, Division of Watershed Stewardship, Wetland Monitoring and Assessment: https://dnrec.delaware.gov/watershed-stewardship/wetlands/monitoring-assessment.

Programs & Workgroups	Description
Delaware Wetland Restoration Workgroup	A collaborative network of practitioners and educators promoting best practices and knowledge sharing to enhance wetland restoration and management across Delaware.
Submerged Aquatic Vegetation Program (DNREC)	Established in 2024, this program monitors, restores, and promotes awareness of submerged aquatic vegetation (SAV), coordinating with the Delaware Statewide SAV Workgroup and regional partners to improve coastal habitat health.[57]
Watershed Stewardship Program (DNREC)	This program supports wetland restoration and research through the Wetland Monitoring and Assessment Program, which evaluates wetland health and informs restoration and management strategies statewide.[58]

Research Projects	Description
Research: Assessing Spatial Distribution and Vulnerability of Stored Soil Carbon in St. Jones and Blackbird Marshes (Delaware Geological Survey)	This modeling project maps and quantifies carbon stocks in Delaware's tidal marshes to identify high-value and high-risk areas for conservation and restoration to inform marsh preservation and mitigation strategies.[59]
Research on Wetland Carbon Flux (DNREC and Univ. of Del.)	Ongoing research at the Delaware National Estuarine Research Reserve site examines greenhouse gas exchanges in tidal marshes to improve understanding of carbon cycling and climate mitigation potential.[60]

57 Delaware DNREC, Submerged Aquatic Vegetation Program: https://dnrec.delaware.gov/watershed-stewardship/assessment/sav.

58 Delaware DNREC, Division of Watershed Stewardship: https://dnrec.delaware.gov/watershed-stewardship.

59 Delaware Geological Survey, "Assessing Spatial Distributions and Vulnerability of Stored Soil Carbon in St. Jones and Blackbird Marshes." https://www.dgs.udel.edu/projects/assessing-spatial-distributions-and-vulnerability-stored-soil-carbon-st-jones-and.

60 Thomas, Adam. "Vargas Uses St. Jones Lab to Investigate Blue Carbon." UDaily, October 20, 2017. https://www.udel.edu/udaily/2017/october/rodrigo-vargas-NSF-faculty-award.

Agriculture

Policies	Description
Delaware Nutrient Management Law (*3 Del. C. §2240-2247*)	Passed in 1999, this law established the Delaware Nutrient Management Program to regulate nutrient generation and application. It aims to protect surface and groundwater quality and reduce greenhouse gas emissions from excessive fertilizer use.[61]
Farm Bill (*7 U.S.C. §8701*)	This multiyear federal law, renewed periodically since the 1930s, authorizes a wide range of agricultural, food, conservation, and rural development programs that influence farm practices, soil health, and emissions reductions.[62]

Programs	Description
Aglands Preservation Program (Delaware Dept. of Agriculture)	Created in 1991, this program allows landowners to voluntarily preserve farmland through time-limited agreements or permanent conservation easements that maintain agricultural use and prevent development.[63]
Delaware Nutrient Management Program (Delaware Dept. of Agriculture)	Established by Delaware's Nutrient Management Law in 1999, this program implements regulations for nutrient application, waste management and animal feeding operations to meet state and federal water quality standards.[64]
UD Cooperative Extension (University of Delaware)	The University of Delaware Cooperative Extension This statewide outreach program provides research-based education and technical assistance on agriculture, natural resources and climate-resilient farming practices.[65]

Research Projects	Description
UD Agrivoltaics Study (University of Delaware and SolAgra Corporation)	This ongoing research tests the co-location of uniquely designed solar panels and food crops to evaluate energy generation, crop yield and land-use efficiency at sites in Newark and Georgetown. Once built, these sites will have the potential to demonstrate how solar energy and agricultural production can be symbiotic.[66]

61 Delaware Department of Agriculture, State Nutrient Management Program, 3 Del. C. §2240-2247.
62 Johnson, Renée, and Jim Monke. "Farm Bill Primer: Background and Status." Congress.gov, December 27, 2024. https://www.congress.gov/crs-product/IF12047.
63 Delaware Department of Agriculture, Aglands Preservation Program, https://agriculture.delaware.gov/agland-preservation-planning/the-preservation-program.
64 Delaware Department of Agriculture, Nutrient Management Program, https://agriculture.delaware.gov/nutrient-management.
65 University of Delaware Cooperative Extension, https://www.udel.edu/canr/cooperative-extension.
66 Agrisolar Clearinghouse. "Case Study: University of Delaware Agrisolar Research," October 16, 2023. https://www.agrisolarclearinghouse.org/case-study-university-of-delaware-agrisolar-research.

Waste

Programs/Policies/Research	Description
EPA New Source Performance Standards (NSPS) Clean Air Act, 42 U.S.C. §7411; 40 C.F.R. Part 60 (amended 2015)	These federal standards establish technology-based emission limits for new and modified stationary sources, including landfill gas systems. They ensure application of the best demonstrated technology to control air pollutants and greenhouse gases.[67]
National Emissions Standards for Hazardous Air Pollutants (NESHAP) Clean Air Act, 42 U.S.C. §7412; 40 C.F.R. Part 63 (2003, amended 2022)	These federal standards regulate emissions of hazardous air pollutants, including those from wastewater treatment facilities. The rules protect public health by limiting pollutants linked to cancer and other serious health and environmental effects.[68]
Regulations Governing Solid Waste (*7 Del. Admin. C. §1301*)	This regulation governs solid waste management to reduce environmental impacts. By requiring permits for landfills, transfer stations and recycling facilities, and mandating proper waste handling and disposal practices, this regulation supports climate action by minimizing methane emissions from decomposing waste, promoting recycling and diversion from landfills, and protecting natural carbon sinks like soil and groundwater from contamination.[69]
Universal Recycling Law (*7 Del. C. §6053*)	Under Delaware's Universal Recycling Law, all waste haulers who provide residential trash collection services must include recycling collection service. The law also requires businesses, schools, non-profits and governments to participate in a comprehensive universal recycling program.[70]
Universal Recycling Regulations (*7 Del. Admin. C. §1305*)	This regulation mandates recycling participation by all residential, commercial, institutional, and multi-family properties. By requiring waste haulers to provide recycling services, businesses to conduct annual waste stream reviews, and diverting recyclables from landfills, this regulation supports climate action through reduced methane emissions from decomposing waste, conservation of natural resources and energy needed for virgin material production, and decreased emissions from manufacturing and disposal processes. Delaware's Universal Recycling Law *7 Del. C. §6053* provides the statutory authority for this regulation.

67 Nebraska Dept. Of Water, Energy, and Environment. "New Source Performance Standards (NSPS) Program." https://dee.nebraska.gov/air/new-source-performance-standards-nsps-program.

68 U.S. Department of Energy. "National Emission Standards for Hazardous Air Pollutants (NESHAP) Compliance Monitoring," July 23, 2024. https://www.energy.gov/ehss/articles/national-emission-standards-hazardous-air-pollutants-neshap-compliance-monitoring.

69 Delaware DNREC, Regulations Governing Solid Waste, *https://regulations.delaware.gov/AdminCode/title7/1301* Waste Management Section." Delaware Department of Natural Resources and Environmental Control. Office of the Registrar of Regulations. https://regulations.delaware.gov/api/AdminCode/title7/1301/7fc84925-72a9-4710-83f4-c3659da4e84e.

70 Delaware DNREC, "Delaware Recycles." https://dnrec.delaware.gov/waste-hazardous/recycling.

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Appendix B. Partners, Organizations, Programs and Resources Supporting Climate Adaptation

This appendix catalogs many of the partners, organizations, programs and policies that support Delaware's climate adaptation and resilience efforts. These resources include collaborative networks like the Resilient And Sustainable Communities League (RASCL) and the Resilient Communities Partnership, state agencies, federal entities including FEMA and NOAA, academic institutions like the University of Delaware and Delaware Sea Grant, and regional partnerships. Together, these organizations contribute to the technical assistance, data and monitoring systems, grant funding, conservation programs, and planning tools that help Delaware prepare for and respond to climate hazards including flooding, coastal erosion, extreme weather and ecosystem changes. This appendix includes many of the partners and programs referenced in Chapter 6 of this plan, but it does not represent an exhaustive list of all the organizations making vital contributions to Delaware's climate resilience.

Organization	Description
Urban Sustainability Directors Network (USDN)	USDN brings local government sustainability practitioners together to learn, collaborate, and accelerate the work of local sustainability. USDN takes a holistic approach to resilience and developed the USDN Resilience Hub Guidance Document to assist local government, community-based organizations and other partners.[71]
Federal Emergency Management Agency (FEMA)	FEMA is an agency of the United States Department of Homeland Security committed to helping people before, during and after disasters. Manages the National Flood Insurance Program as well as emergency and disaster related grants.[72]
Delaware Emergency Management Agency (DEMA)	DEMA leads the coordination efforts for emergency preparedness, training, response, recovery and mitigation services to support the State of Delaware.[73]
Delaware Health and Social Services (DHSS)	DHSS has a mission to improve the quality of life for Delaware's citizens by promoting health and well-being, fostering self-sufficiency, and protecting vulnerable populations.[74]
Delaware Department of Transportation (DelDOT)	DelDOT is responsible for maintaining the state's transportation infrastructure, including roads, bridges and public transit systems like DART First State. The Department's duties include planning, constructing, and maintaining transportation systems, managing the state's highway and road network, and ensuring safety for all modes of travel.[75]

71 Urban Sustainability Directors Network, https://www.usdn.org/index.html#/.
72 Federal Emergency Management Agency, FEMA.gov.
73 Delaware Emergency Management Agency (DEMA), https://dema.delaware.gov/.
74 Delaware Health and Social Services, https://dhss.delaware.gov/.
75 Delaware Department of Transportation, https://deldot.gov/

Organization	Description
Resilient And Sustainable Communities League (RASCL)	RASCL is a collaborative network of state agencies, nonprofits and academic institutions that convenes partners, leverages limited resources, and coordinates efforts to support communities in building a more resilient and sustainable Delaware.[76]
Delaware Sea Grant	Delaware Sea Grant helps Delaware communities wisely use, manage, and conserve the state coastal resources by fostering sustainable coastal economies, developing resilience to coastal hazards, and preparing the next generation of coastal leaders.[77]
University of Delaware Cooperative Extension	The University of Delaware Cooperative Extension connects the public to university knowledge, research and resources to address various needs, including agriculture, health and youth development. It offers a range of programs such as agriculture education, 4-H youth development, health and well-being and horticulture.[78]
Grant Assistance Program (GAP)	The Grant Assistance Program is a state-funded initiative that provides free technical grant assistance to local governments for infrastructure initiatives and other competitive and formula grant opportunities.[79]
University of Delaware Climate Change Hub (UD Climate Change Hub)	This hub connects faculty, staff, students, government, and non-government practitioners to promote climate education, scholarship and action. It aims to build a community to better understand and address climate change and its effects on ecosystems and people.[80]
Natural Areas Preservation System	This system was established to ensure that Delawareans understand and appreciate natural communities and benefit from the natural, scientific, educational, historic, aesthetic, recreational and cultural values they possess.[81]
Delaware Native Species Commission	This commission was established by the Delaware General Assembly to address the decline and extinction of local plant and animal species.[82]
Delaware Invasive Species Council (DISC)	DISC is a non-regulatory organization formed in 2002 to prevent the introduction of invasive species and mitigate their effects on local ecosystems.[83]
Resilient Communities Partnership (RCP)	The Partnership is a collaborative initiative aimed at enhancing the resilience of communities to coastal hazards and climate change. This partnership leverages federal funding from NOAA to support Delaware communities in developing planning strategies and reducing the effects of hazards.[84]

76 Delaware RASCL. https://www.derascl.org/.
77 University of Delaware, Delaware Sea Grant. https://www.udel.edu/academics/colleges/ceoe/delaware-sea-grant.
78 University of Delaware, Cooperative Extension, https://udel.edu/canr/cooperative-extension.
79 University of Delaware, Grant Assistance Program at IPA, https://www.udel.edu/academics/colleges/biden-school/research-public-service/ipa/public-service/gap.
80 University of Delaware, Climate Change Hub, https://sites.udel.edu/climatechangehub.
81 Delaware DNREC, Natural Areas and Nature Preserves. https://dnrec.delaware.gov/parks/natural-areas.
82 Delaware DNREC, Delaware Native Species Commission, https://dnrec.delaware.gov/delaware-native-species-commission.
83 Delaware Invasive Species Council, https://delawareinvasives.net/.
84 Delaware DNREC, Resilient Communities, https://dnrec.delaware.gov/coastal-programs/planning-training/resilient-communities.

Organization	Description
My Healthy Community (Delaware's Public Health Data Portal)	My Healthy Community is a software platform launched by DHSS to help state agencies and the public understand issues that impact health. My Healthy Community provides community-level statistics and data that can be used to understand and explore various factors that influence health, such as environmental and social determinant data.[85]
University of Delaware Water Resources Center	The University of Delaware Water Resources Center provides water science and policy assistance to governments in Delaware and Delaware Valley through the public service, education, and research role of the University.[86]
Center for Environmental Monitoring and Analysis (CEMA)	CEMA is an environmental data services center within the College of Earth, Ocean, and Environment (CEOE) at the University of Delaware. CEMA provides real-time monitoring and maintains a historical environmental data repository, provides weather and climate outreach and expertise, as well as engineered environmental data products and solutions.[87]
National Oceanic and Atmospheric Administration (NOAA)	NOAA's mission is to understand and predict changes in climate, weather, ocean, and coasts; to share that knowledge and information with others; and to conserve and manage coastal and marine ecosystems and resources. NOAA provides daily weather forecasts, severe storm warnings, and climate monitoring.[88]
Mid-Atlantic Regional Council on the Ocean (MARCO)	MARCO is the Mid-Atlantic Regional Council on the Ocean, formed in 2009 by a governors' agreement among New York, New Jersey, Delaware, Maryland, and Virginia. MARCO uses regional ocean planning to help states understand and support ocean industries, address inequities, prepare for climate change, and improve our ocean and coasts' health.[89]
Mid-Atlantic Coastal Acidification Network (MACAN)	MACAN seeks to answer basic questions about the intensity, frequency, and location of acidification events. MACAN also works to educate managers, elected officials, industry representatives, and the public about solutions to reduce those sources of acidification.[90]
Christina-Brandywine River Remediation Restoration Resilience (CBR4)	The Christina-Brandywine River Remediation Restoration Resilience (CBR4) project is an initiative to address legacy toxic contamination, restore the native ecology and prepare for the changing climate as well as other threats to river health in the lower Christina River and tidal Brandywine River.[91]

85 My Healthy Community, https://myhealthycommunity.dhss.delaware.gov/home.
86 University of Delaware, Water Resources Agency (WRA), https://wrc.udel.edu/about-wra.
87 University of Delaware, Center for Environmental Monitoring and Analysis (CEMA), https://cema.udel.edu.
88 National Oceanic and Atmospheric Administration (NOAA), https://www.noaa.gov.
89 Mid-Atlantic Regional Council on the Ocean (MARCO), https://www.midatlanticocean.org/.
90 Mid-Atlantic Coastal Acidification Network, https://midacan.org.
91 Delaware DNREC, Christina-Brandywine River Remediation Restoration Resilience (CBR4), https://dnrec.delaware.gov/waste-hazardous/remediation/watar/cbr4.

Programs and Systems	Description
DNREC Open Space Program	The DNREC Open Space Program, guided by the Delaware Open Space Council, coordinates the acquisition of parks, open space, natural areas, forests and other parts of the landscape by expanding state parks and preserves, fish and wildlife areas, state forests and cultural resource sites.[92]
Delaware Environmental Observing System (DEOS)	The Delaware Environmental Observing System (DEOS) serves as a support tool for decision makers in emergency management, natural resource monitoring, transportation, and other activities to provide state agencies and the citizens of Delaware with immediate information about environmental conditions in and around the State.[93]
Coastal Training Program (CTP)	The Coastal Training Program addresses critical coastal resource management issues in Delaware by providing current scientific information and access to technologies and skill-building opportunities to Delawareans responsible for making decisions about the state's coastal resources.[94]
DNREC Land Conservation Loan Program	The DNREC Land Conservation Loan Program is a financing initiative designed to fund conservation easements and land-preservation purchases through the Water Pollution Control Revolving Fund (WPCRF) municipal loans.[95]
Delaware Community Conservation Assistance Program (DeCAP)	The Delaware Community Conservation Assistance Program is a cost-share program that provides financial incentives, technical, and education assistance to property owners for installing eligible best management practices in Delaware's Chesapeake Bay Watershed.[96]
Land Evaluation and Site Assessment (LESA)	The LESA system helps state and local officials make sound decisions about land use. Combined with Forest measures and Rangeland parameters, LESA can provide a technical framework to numerically rank land parcels based on local resource evaluation and site considerations.[97]

Policy	Description
Tax Ditch Law (*7 Del. C. § 4101 et seq.*)	This law enables landowners to form governmental subdivisions that manage drainage and flood protection infrastructure. This supports climate adaptation by providing engineered systems to handle increased flooding from extreme rainfall and sea-level rise, protecting agricultural land and property from intensifying storms, and allowing communities to cooperatively upgrade drainage infrastructure in response to changing precipitation patterns and flood risks in Delaware's low-lying coastal areas.[98]

92 Delaware DNREC, Delaware Open Space Program, https://dnrec.delaware.gov/parks/open-space.
93 University of Delaware, Delaware Environmental Observing System, https://www.deos.udel.edu.
94 Delaware DNREC, Coastal Training Program, https://dnrec.delaware.gov/coastal-programs/planning-training/coastal-training.
95 Delaware DNREC, Land Conservation Loan Program, https://dnrec.delaware.gov/environmental-finance/land-conservation.
96 Delaware DNREC, Community Conservation Assistance Program, https://dnrec.delaware.gov/watershed-stewardship/chesapeake/decap.
97 U.S. Department of Agriculture, Land Evaluation and Site Assessment, https://www.nrcs.usda.gov/conservation-basics/natural-resource-concerns/land/evaluation-and-assessment.
98 Delaware Code, 7 Del. C. § 4101 et seq., Delaware Tax Ditch Law.

Appendix C. Core Team Membership

Developing the strategies and actions outlined in this plan required extensive collaboration between state agencies, regional organizations and dedicated professionals. This appendix recognizes the individuals who served on the Climate Action Plan core teams convened during the development of this plan. Their expertise and dedication were critical to developing the mitigation and adaptation strategies presented in Chapters 4 and 6 that chart a path toward climate resilience.

Transportation Core Team

LEADS:

- Sabrina Shultz, DNREC CCE, Climate and Transportation Policy Specialist
- Alysha Ulrich, DNREC CCE, Climate Change Project Specialist

TEAM MEMBERS:

- Tricia Arndt, DelDOT, Assistant Director of Transportation, Resilience & Sustainability
- Taylor Englert, DNREC AQ, Engineer III
- Kathleen Grier, Delaware Commute Solutions, Program Manager
- Grace Hammond, DNREC AQ, Engineer I
- Stephanie Johnson, DelDOT, Director of Planning
- Pamela Keeney, DNREC AQ, Environmental Program Manager II
- Tina Merrill, DNREC AQ, Planner II
- Paul Moser, DelDOT, Engineer IV
- Breanne Preisen, DNREC CCE, Environmental Program Manager
- Catherine Smith, DelDOT, Deputy Chief Customer Experience Officer
- Bill Swiatek, WILMAPCO, Principal Planner

Industry Core Team

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- Tina Merrill, DNREC AQ, Planner II
- David Potter, DNREC AQ, Engineer Program Manager I
- Yagna Shah, DNREC AQ, Engineer I

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- Wylie Feaster, DNREC CCE, Planner

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- Annina Northridge, DNREC CCE, Climate Planner IV
- David Potter, DNREC DAQ, Engineer Program Manager I
- Jessica Quinn, DNREC CCE, Principal Planner
- Yagna Shah, DNREC DAQ, Engineer I

Natural and Working Lands Core Team

Contributed to the Forests & Urban Trees and Agriculture sections

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- John Reynolds, DNREC CCE, Climate Change Project Specialist

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- Scott Blaier, DNREC CCE, Kent Conservation District Planner
- Nikko Brady, Delaware Department of State, Deputy Chief of Staff
- Chris Brosch, Delaware Department of Agriculture, Deputy Secretary for Agriculture
- Kristi Lieske, DNREC CCE, Planner IV
- Mollie Yacano, Ph.D., DNREC CCE, Environmental Scientist V

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- David Edgell, Office of State Planning Coordination, State Planning Director
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- Jimmy Kroon, Delaware Department of Agriculture, Chief of Planning
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Sea Level Rise, Precipitation and Inland Flooding Core Team

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- Katharyn Potter, DNREC Division of Watershed Stewardship, Environmental Scientist IV
- Jennifer Pongratz, DNREC Division of Watershed Stewardship, Environmental Scientist IV
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- Ashley Kennedy, DNREC FW, Environmental Scientist IV
- Gerald Mood, DNREC AQ, Environmental Scientist III
- Sam Topper, Delaware Forest Service, Senior Forester/Wildland Fire Supervisor
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Comprehensive Resilience Core Team

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Coastal view at Cape Henlopen State Park.
PHOTO: DNREC

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