



2018 Pennsylvania Climate Action Plan Updates

June 26, 2018



Prepared for the
Climate Change
Advisory Committee
Meeting

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Agenda

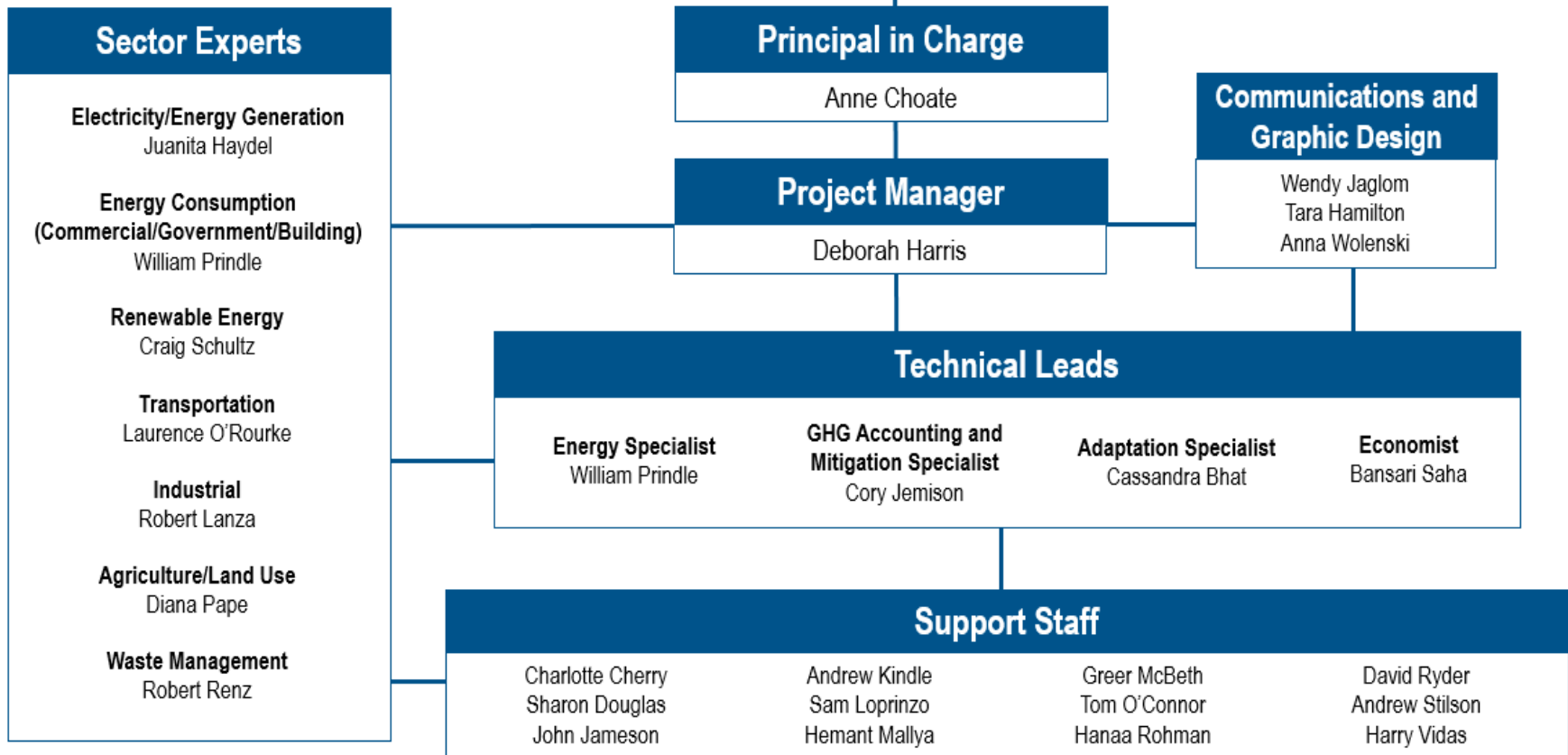
- **Introduction**
 - Presenter Introductions
 - Reminder of Overall Project Approach
- **Energy Assessment Report and Climate Action Plan Schedule**
- **Climate Action Plan Strategies**
- **Draft GHG, Energy, and Microeconomic Modeling Assumptions and Results**
- **Adaptation Strategies Assessment**



Introduction



Team Organization



ICF Presenters



Cassie Bhat—Adaptation Specialist

- 8 years of experience in multi-sector adaptation planning at state, local, and regional levels
- Supports City of Philadelphia adaptation efforts
- Involved in Massachusetts Adaptation Plan



Wendy Jaglom—Communications Specialist

- 9 years of experience in climate change communications, impacts and adaptation, and mitigation and sustainability
- Supported report development for Philadelphia adaptation and energy planning efforts
- Supports state and local climate action planning efforts
- Supports EPA State and Local Energy Program

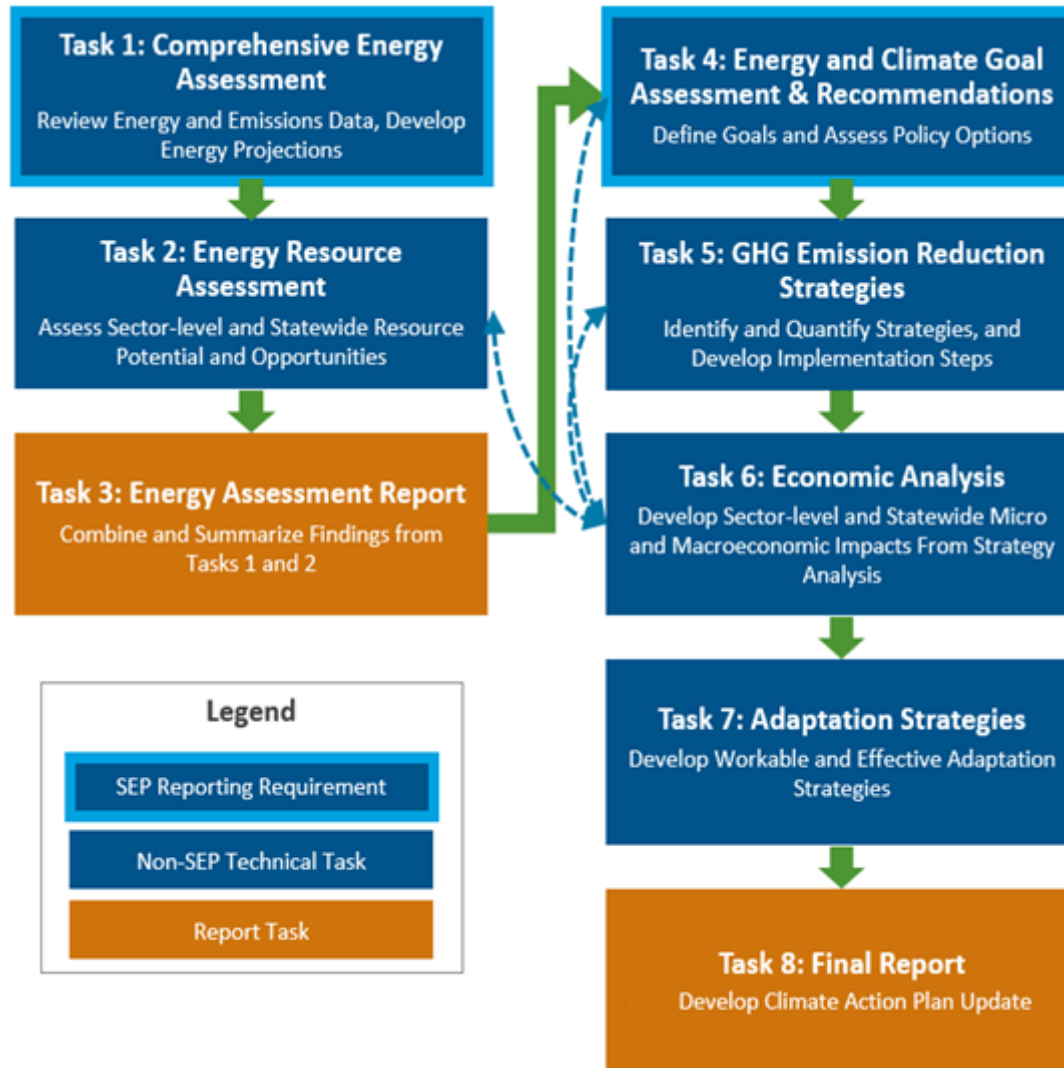
ICF Presenters



Bill Prindle—Energy Specialist

- 40+ years of experience in the energy field
- M.S. in Energy Management and Policy from Penn
- Philadelphia EMP, Kleinman, and MWCOC technical lead
- Works with DVRPC and numerous other cities, municipalities, states, and fed. agencies

ICF's Integrated Project Approach



Energy Assessment Report and Climate Action Plan Schedule

Draft Schedule

- **Energy Assessment Report Finalization:** June 2018
- **Additional Feedback on June CCAC Meeting Materials:** July 3, 2018
- **Draft of CAP Shared with CCAC:** Week of August 13, 2018
- **Presentation of and CCAC Initial Feedback on Draft CAP and Full Modeling Results:** August 28, 2018 (meeting) and two weeks after CAP draft
- **Presentation of Final CAP:** October 23, 2018
- **Publish Final Climate Action Plan:** Late Fall 2018

Climate Action Plan Strategies



Climate Action Plan Strategies

- **Overview of Strategies**
- **Strategy Development Process**
- **Review of Strategies and CCAC Feedback**

Overview of Strategies

- **20 Integrated Strategies across 8 Sectors**
 - Strategies have both mitigation and adaptation benefits
 - 12 Strategies are Considered Mitigation-Focused
 - 14 Strategies are Considered Adaptation-Focused
- **Each strategy covers a wide range of potential actions**
 - Including government, citizen, and business actions
 - 7 Strategies include Quantified Actions

Strategy Development Process



Identified Strategies with Adaptation Benefits

1. Developed extensive list of adaptation-focused policies, programs, and actions based on literature review
2. Consolidated actions based on:
 - Feedback from PA agencies
 - Evaluation against criteria
 - Opportunities to eliminate redundancies
3. Refined based on DEP feedback

Identified Strategies with Mitigation Benefits

1. Developed framework in line with CAP outline
2. Compiled list of strategies from:
 - Previous PA CAPs
 - DEP and CCAC suggestions
 - Draft adaptation strategy list
 - Other jurisdictions' strategies
 - Objective review
3. Refined based on DEP and CCAC feedback



Iteratively Prioritized and Integrated Strategies

Review of Strategies

1	Increase end-use energy efficiency	Energy Consumption	#	A	M
2	Promote sustainable transportation planning and practices	Energy Consumption	#	A	M
3	Develop and promote clean energy financing options	Energy Consumption			M
4	Promote clean, distributed electricity generation resources	Energy Production	#	A	M
5	Promote a diverse portfolio of clean, utility-scale electricity generation	Energy Production	#		M
6	Reduce upstream impacts of fossil fuel energy production	Energy Production	#		M
7	Promote the production and use of alternative fuels	Energy Production	#		M
8	Promote agricultural best practices	Agriculture	#	A	M
9	Provide resources and technical assistance to farmers to support adaptation	Agriculture		A	
10	Promote protection and optimal use of ecosystems, including for outdoor rec and tourism	Ecosystems		A	M
11	Monitor and identify ecosystem vulnerabilities	Ecosystems		A	
12	Help the outdoor tourism industry manage shifting climate patterns	Outdoor Rec & Tourism		A	
13	Reduce and use waste sent to landfills	Waste			M
14	Promote stormwater management best practices	Water		A	
15	Promote integrated water resources management and water conservation	Water		A	
16	Improve reliability and accessibility of public information about climate-related health risks	Human Health		A	
17	Bolster emergency preparedness and response	Human Health		A	
18	Lead by example in Commonwealth and local government practices and assets	Cross-cutting		A	M
19	Incorporate historical and projected climate conditions into siting and design decisions for long-term infrastructure	Cross-cutting		A	
20	Conduct deeper dive analyses to inform further decision-making	Cross-cutting			M

- quantified, A – Adaptation-focused, M – Mitigation-focused





Draft GHG, Energy, and Microeconomic Modeling Assumptions and Results



Draft GHG, Energy, and Microeconomic Modeling Assumptions and Results

- **Assumptions, data, and methods for each modeled action**
- **Preliminary draft action results provide in separate Word document or appendix slides**

Strategy: Promote a diverse portfolio of clean, utility-scale electricity generation

Actions:

- **Increase Alternative Energy Portfolio Standards (AEPS) Tier 1 targets, and further increase in-state generation and use of renewables**
 - Ramp up Tier 1 from 8% to XX% by 2030 and YY% by 2050
 - Assumes solar carveout from PA Solar Future; solar AECs assumed in-state only
 - Costs from NREL 2017 Annual Technology Baseline Data
- **Limit carbon emissions through a power sector cap & trade program**
 - Assumes 30% reduction in emissions 2020-2030
 - CO2 prices derived from relative cost of marginal generation resources
 - REMI assumes allowance revenues recycled to electricity customers
- **Promote Utility-scale CHP**
 - Based on high-load-factor sites >20 MW electricity capacity from ICF's database
 - Assumes \$5/MCF gas prices

Strategy: Promote clean, distributed generation resources

Actions:

- **Incentivize and encourage CHP for large campuses, hospitals, infrastructure, mass transit, and industry**
 - Based on high-load-factor sites ≤ 20 MW electricity capacity from ICF's database
 - Assumes \$5/MCF gas prices
- **Invest in and promote building-scale solar**
 - Assumes same parameters as PA Solar Future Scenario B, with building-scale systems accounting for 10% of state total solar generation



Strategy: Reduce upstream impacts of energy production

Actions:

- **Promote policies and practices to reduce methane emissions across natural gas systems**
 - Assumes emissions from well heads, abandoned wells, leakage in distribution system
 - Other assumptions TBD

Strategy: Promote the production and use of alternative fuels

Actions:

- **Coal mine methane**
 - Quantities from Energy Assessment Report, emissions from EPA SIT, costs from EPA CMOP and other sources
- **Ag waste, landfill gas, wastewater gas**
 - Assumes AEPS linkage; AEC prices based on historic linkages; costs from ORNL CHP report, consistent with Energy Assessment Report

Strategy: Increase end use energy efficiency

Actions:

- **Update building codes**
 - Assumes 2009 IECC (res) and ASHRAE 90.1-2007 (comm) as base codes
 - Uses ICF's codes calculator to project impacts of stringency increases every 6 years through 2050
 - Cost assumptions from PECO database (res) and PNNL (comm)
- **Expand Act 129 to include more eligible measures, increase targets, increase or eliminate cost caps**
 - Savings estimates from PA SWE 2012 potential study
 - Assumed 1.1% (res) and 0.5% (comm) annual electric savings 2021-2015, then 1%/0.5% annually
 - Assumed costs from PA SWE study

Strategy: Increase end use energy efficiency

Actions:

- **Create similar program to Act 129 for natural gas**
 - Used ACEEE data on state gas EERS to develop assumptions of 1.1% (res and comm) annual savings through 2025, then 1% 2026-50
 - Used ACEEE assumption of \$0.35/therm cost of saved energy
- **Expand energy assessments and provide more trainings for commercial and industrial sector**
 - Assumed PA SWE and Georgia Tech meta-review estimates to project savings of 0.6% annually for electricity and gas
 - Used ACEEE and LBNL sources to estimate cost of saved energy

Strategy: Promote sustainable transportation planning and practices

Actions:

▪ Reduce VMT for SOVs

- Assumed VMT reduction of **7.5%** from BAU by 2050, from DEP's *Energy Assessment Report of the Commonwealth of Pennsylvania*, MOVES data, EIA Annual Energy Outlook 2018, and Federal Highway Administration VMT projections

▪ Provide a strategic plan and incentives for increasing EV use for light-duty vehicles

- Assumed EVs will represent **20%** of the light-duty market share by 2050, based on draft PA EV Roadmap and EIA/AEO
- Cost assumptions taken from DOE/Argonne, EIA, and NREL sources
- Assumes state funding from AFIG/other phasing down from \$2M annually

Strategy: Promote sustainable transportation planning and practices

Actions:

- **Promote clean public transportation (Support electrification of municipal bus fleets)**
 - Assumed **25%** of new transit bus purchases will be zero emission buses (i.e., hydrogen fuel cell or all-electric) by 2030, increasing to **60%** in 2050, based on CALSTART and other state initiatives
 - Cost assumptions taken from DOE/Argonne, EIA, other sources

Strategy: Promote agricultural best practices

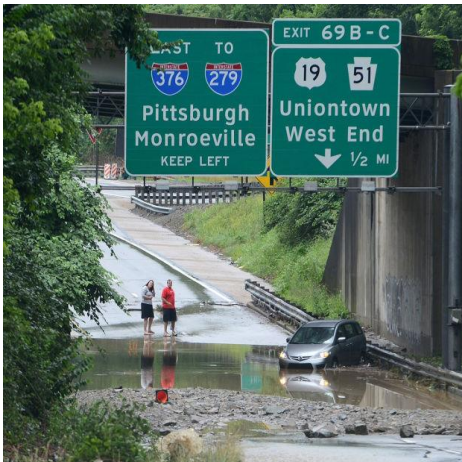
Actions:

- **Implement and provide training for no-till farming practices, especially those that sequester carbon in soils and plants**
 - Assumed no-till acres in PA will increase 6 percent annually to a maximum of 98 percent of acres planted by 2024
 - Assumed emission reductions for USDA's Northeast region from ICF's 2013 Mitigation Options Report
 - Estimated decreases in revenue from reduced yield, we multiplied estimates of reduced production by weighted revenue in dollars per short ton of production
 - Energy and cost savings assumptions came from USDA and EPA sources
 - Cost estimates were obtained from University of Illinois and USDA sources

Adaptation Strategies Assessment

Need for Adaptation

- Pennsylvania is already experiencing higher temperatures, more frequent extreme events and flooding, and other climate changes – and those trends are expected to accelerate over the next several decades
- Changes could fundamentally impact how infrastructure, governments, and businesses operate





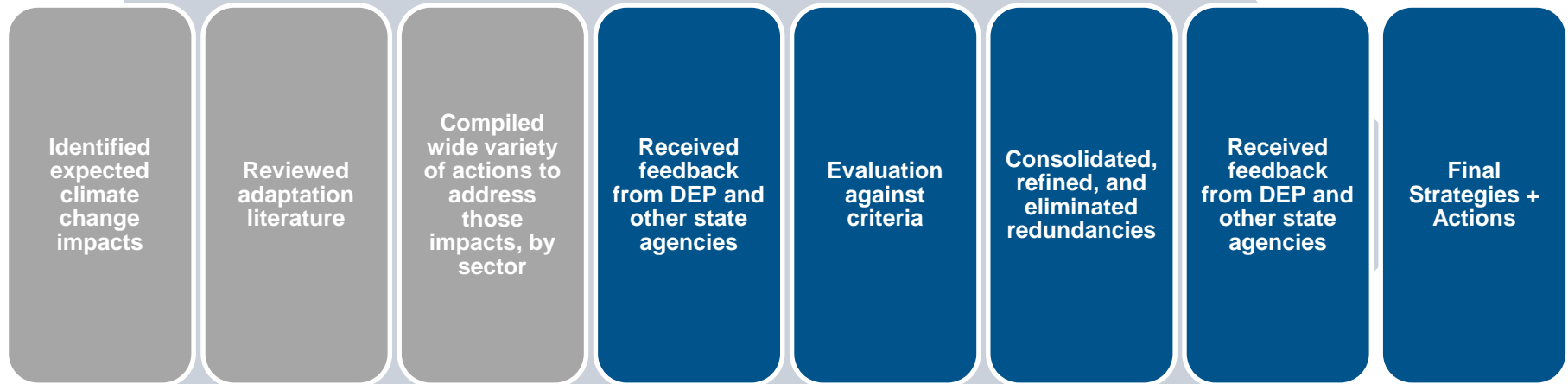
Need for Adaptation

- **With change comes opportunity to mitigate risks and capitalize on opportunities**
- **Everyone has a role to play, including state and local leadership, businesses, and citizens**

Developing Adaptation Strategies



Developing Adaptation Strategies



Strategies that:

- Address expected impacts across sectors
- Are appropriate for early action due to:
 - Addressing existing vulnerabilities
 - Addressing near-term decisions w/ long lifetimes
 - Filling current knowledge gaps
- Have greenhouse gas mitigation co-benefits

	Energy Consumption	Energy Production	Agriculture	Ecosystems	Outdoor Rec & Tourism	Water	Human Health
Increase end-use energy efficiency	*				●	●	●
Promote sustainable transportation planning and practices	*			●			●
Promote clean, distributed electricity generation resources	●	*					●
Provide resources and technical assistance to farmers to support adaptation			*	●		●	●
Promote agricultural best practices			*	●		●	●
Monitor and identify ecosystem vulnerabilities				*	●		●
Promote protection and optimal use of ecosystems, including for outdoor recreation and tourism				*	●	●	●
Help the outdoor tourism industry manage shifting climate patterns				●	*	●	●
Promote stormwater best management practices						*	
Promote integrated water resources management and water conservation						*	
Improve reliability and accessibility of public information about climate-related health risks							*
Bolster emergency preparedness and response							*
Incorporate historical and projected climate conditions into siting and design decisions for long-term infrastructure	●	●	●	●	●	●	●
Lead by example in Commonwealth and local government practices and assets	●	●	●	●	●	●	30 ●

Anatomy of a Strategy

- **Sector**
 - Climate Impacts
- **Strategy**
 - Description of the strategy
- **Actions**
 - Relevant Policies, Programs, and Actions
 - What You Can Do
 - What Businesses Can Do
- **Strategy Benefits and Costs**
 - Resilience Impacts
 - Environmental Impacts
 - Economic Impacts

2.1 Energy Consumption

Climate Change Impacts

The expected impacts of climate change on energy consumption in Pennsylvania (Shuttle et al. 2015) include:

Opportunities to Adapt

Increase End-use Energy Efficiency

Description of strategy.

Relevant Policies, Programs, and Actions

Most of the activities that state leadership can take to improve energy efficiency involve improvements to the building stock and regulations that require more efficient design standards. For example, leaders can:

What You Can Do

Pennsylvania citizens can support this strategy by taking the following actions:

What Businesses Can Do

Pennsylvania businesses can support this strategy by increasing the energy efficiency of business operations. See examples of actions in the “What You Can Do” box above.

Strategy Benefits and Costs

Resilience Impacts



Environmental Impacts

Increasing end-use efficiency also has many environmental benefits, including reduced greenhouse gas emissions. The CAP will provide more information on these benefits.

Economic Impacts

As noted above, increasing end-use efficiency can reduce energy costs for Pennsylvania citizens and businesses. The CAP will provide more information on these and other economic impacts associated with this strategy.



Increase End-use Energy Efficiency



■ Description

- Increase the efficiency of appliances, lighting, heating and cooling systems, and buildings to reduce energy use, to help offset expected increases in energy demand

■ Example Actions

- Update building codes
- Expand Act 129 to include more eligible measures, increase targets, and increase or eliminate cost caps

Resilience Impacts



- ✓ Reduced strain on the energy system and increased grid reliability.
- ✓ Increased building resilience during power outages and droughts.



Promote Sustainable Transportation Planning and Practices

Mitigation
-focused

■ Description

- Consider climate change in long-range transportation planning and infrastructure design

■ Example Actions

- Continue and expand PennDOT's efforts to assess climate risks to transportation infrastructure
- Improve coordination between agencies and other stakeholders

Resilience Impacts



- ✓ Improved reliability of the transportation network during extreme events.
- ✓ Reduced dependence on gasoline-based transportation.



Promote Clean, Distributed Electricity Generation Resources

Mitigation
-focused

■ Description

- Promote renewable or alternative energy, such as solar and wind, to generate electricity on-site and reduce reliance on centralized power

■ Example Actions

- Incentivize and encourage combined heat and power (CHP) for large campuses, hospitals, infrastructure, mass transit, and industry
- Invest in and promote building-scale solar energy

Resilience Impacts



- ✓ Reduced strain on utility-scale power generation and transmission facilities resulting in reduced frequency or length of power outages.



Promote Agricultural Best Practices



■ Description

- Encourage best practices that allow farmers to maintain or increase productivity sustainably into the future while also accounting for expected climate changes

■ Example Actions

- Provide training for no-till farming practices, especially those that sequester carbon in soils and plants
- Encourage the use of digesters for methane capture and recovery
- Develop incentives for the use of advanced irrigation systems

Resilience Impacts



- ✓ Increased agricultural productivity.
- ✓ Reduced erosion and protected soil quality.



Provide Resources and Technical Assistance to Farmers to Support Adaptation

■ Description

- Provide technical assistance and other support to help farmers make better decisions about sustainable farm management

■ Example Actions

- Provide access to improved data about local weather information and seasonal climate forecasts
- Conduct or sponsor research to understand topics such as how climate change will affect the intensity and distribution of weeds, insects and diseases

Resilience Impacts



- ✓ Improved soil health and crop yields.
- ✓ Reduced crop losses and economic losses due to heat stress.



Monitor and Identify Ecosystem Vulnerabilities

■ Description

- Research how climate change may affect Pennsylvania's ecosystems and monitor environmental impacts to establish adaptive thresholds

■ Example Actions

- Develop a central database to store relevant data
- Establish a statewide monitoring and research network of academics, civil society, and citizen scientists to monitor ecosystem factors

Resilience Impacts



- ✓ Better informed management to reduce threats to habitat.
- ✓ Improved ecosystem protection for ecosystem services.



Promote Protection and Optimal Use of Ecosystems, Including for Outdoor Recreation and Tourism

Mitigation
-focused

■ Description

- Maintain healthy ecosystems capable of supporting fish and wildlife, as well as preserving ecosystem function and recreational use

■ Example Actions

- Conserve areas representing the full range of habitats and build and conserve corridors and transitional habitats
- Protect strongholds of fish habitat

Resilience Impacts



- ✓ Protected resources and ecosystem services for recreation, fishing, and drinking water.
- ✓ Improved habitat for wildlife.
- ✓ Maintenance of key migration routes for vulnerable species.



Help the Outdoor Tourism Industry Manage Shifting Climate Patterns

■ Description

- Provide assistance and support to the industry to understand and manage anticipated impacts, so they can prepare for potential damages and take advantage of opportunities

■ Example Actions

- Establish a formal climate change working group building on existing partnerships
- Explore developing new collaboratives with surrounding states

Resilience Impacts



- ✓ Reduced economic impacts to snow-based winter tourism.
- ✓ Reduced public health impacts.



Promote Stormwater Management Best Practices

■ Description

- Stormwater management is critical for reducing the likelihood and impact of floods

■ Example Actions

- Provide incentives for the installation and use of gray water and rainwater harvesting
- Revise stormwater regulations to accommodate increases in precipitation and run-off

Resilience Impacts



- ✓ Improved water quality, groundwater resources, and recharge areas.
- ✓ Reduced flooding.



Promote Integrated Water Resources Management and Water Conservation

■ Description

- Coordinate development and management of water, land, and other resources to maximize economic and social wellbeing without compromising the environment

■ Example Actions

- Support additional research on climate change impacts on water supply
- Conduct a statewide assessment of long-term changes to basin hydrology

Resilience Impacts



- ✓ Improved water quality threatened by extreme precipitation runoff.
- ✓ Improved conservation of water resources.



Improve Reliability and Accessibility of Public Information about Climate-related Health Risks

■ Description

- Provide better information on climate-related health trends, and ensure that the public has the information it needs to take necessary precautions

■ Example Actions

- Support efforts to increase data quality and availability and to develop new surveillance databases
- Help local health departments assess their capacity to respond to health threats to integrate climate preparedness into planning and operations

Resilience Impacts



- ✓ Reduced illness and mortality.
- ✓ Increased capacity to manage the incidence of vector-borne disease.



Bolster Emergency Preparedness and Response

■ Description

- Prepare for emergency situations taking climate change into account, in order to reduce the impacts of floods, extreme heat, disease outbreaks, and other extreme events

■ Example Actions

- Review existing emergency response, preparedness, and management plans to ensure that events that will become more likely with climate change are adequately addressed
- Evaluate the adequacy and effectiveness of current early-warning systems for extreme events.

Resilience Impacts



- ✓ Improved capacity to respond to emergency situations.
- ✓ Reduced heat-related morbidity and mortality.



Incorporate Historical and Projected Climate Conditions into Siting and Design Decisions for Long-term Infrastructure

■ Description

- When siting and designing infrastructure, including buildings, bridges, roads, and power plants, consider climate conditions throughout the life of a new infrastructure project to ensure the asset will remain functional

■ Example Actions

- Develop or update floodplain mapping using the best available science
- Establish statewide design guidelines for incorporating climate change

Resilience Impacts



- ✓ Reduced exposure of infrastructure to extreme events and flooding and continued infrastructure services during climate extremes.
- ✓ Increased reliability of critical infrastructure services (e.g., transportation, energy, water, communications).



Lead by Example in Commonwealth and Local Government Practices and Assets



■ Description

- The Commonwealth and local governments can take a leading role in developing a more resilient Pennsylvania by taking action and demonstrating best practices in government operations and projects

■ Example Actions

- Conduct a statewide comprehensive climate change risk assessment
- Implement strategies identified in department-level adaptation plans
- Adopt climate resilience design guidelines for all new public infrastructure

Resilience Impacts



- ✓ Increased resilience of public services to disruptive events.
- ✓ Demonstrate resilience strategies to citizens and businesses.

Key Resilience Benefits

	Energy Consumption	Energy Production	Agriculture	Ecosystems	Outdoor Rec & Tourism	Water	Human Health
Increase end-use energy efficiency	✓				✓	✓	✓
Promote sustainable transportation planning and practices	✓			✓			✓
Promote clean, distributed electricity generation resources	✓	✓					✓
Provide resources and technical assistance to farmers to support adaptation			✓	✓		✓	✓
Promote agricultural best practices			✓	✓		✓	✓
Monitor and identify ecosystem vulnerabilities				✓	✓		✓
Promote protection and optimal use of ecosystems, including for outdoor recreation and tourism				✓	✓	✓	✓
Help the outdoor tourism industry manage shifting climate patterns				✓	✓	✓	✓
Promote stormwater best management practices						✓	
Promote integrated water resources management and water conservation						✓	
Improve reliability and accessibility of public information about climate-related health risks							✓
Bolster emergency preparedness and response							✓
Incorporate historical and projected climate conditions into siting and design decisions for long-term infrastructure	✓	✓	✓	✓	✓	✓	✓
Lead by example in Commonwealth and local government	✓	✓	✓	✓	✓	✓	✓

Thank You

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