2021 Pennsylvania Impacts Assessment and Climate Action Plan

CCAC Meeting December 22, 2020

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Agenda

- Updates on Impact Assessment
- Updates on Climate Action Plan
- Next Steps

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Today's Presenters from ICF

Cassie Bhat
Impacts Assessment Lead

Deb Harris
Project Manager, CAP Lead

Tommy Hendrickson
Deputy Project Manager, CAP and IA Technical Expert

Bill Prindle
Sustainable Energy and Climate Expert

Impact Assessment

Updates

- Timeline and status update
- Key findings
- Next steps

Impact Assessment Timeline

Oct 2020
Climate Data Analyzed

Oct/ Nov 2020
Additional Analysis

Nov 2020
Draft Final IA Complete

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Early 2021
Final IA Complete

IA Updates

1) Analyzed latest climate model data

2) Completed the risk assessment for all six hazards

3) Incorporated feedback on preliminary drafts from CCAC, DEP, DCED, DCNR, OEJ, PennDOT, PEMA, and Dept. of Ag.

4) Completed a full draft of the IA, including Executive Summary, key findings, and adaptation priorities

Climate Science Update

- The 2021 IA presents **updated climate projections** based on the latest available downscaled climate model data*
- Overall, the latest projections are **in line with the previous IAs**: Pennsylvania is expected to get **warmer and wetter**
- New to the 2021 IA: **projections for more detailed climate variables and thresholds** pertaining to key sectors and impacts:
  - Cooling and heating degree-days
  - Days above extreme heat thresholds
  - Growing degree days
  - Extreme precipitation
  - …and more

Quick Comparison: Projections from the 2015 IA vs. 2021 IA		
	2015 IA	**2021 IA**
Average annual temperature	+5.4°F	+5.9°F
Average annual precipitation	+8%	+8%
All projections are statewide averages for a mid-century time period of 2041-2070 vs. a baseline time period of 1971-2000.		

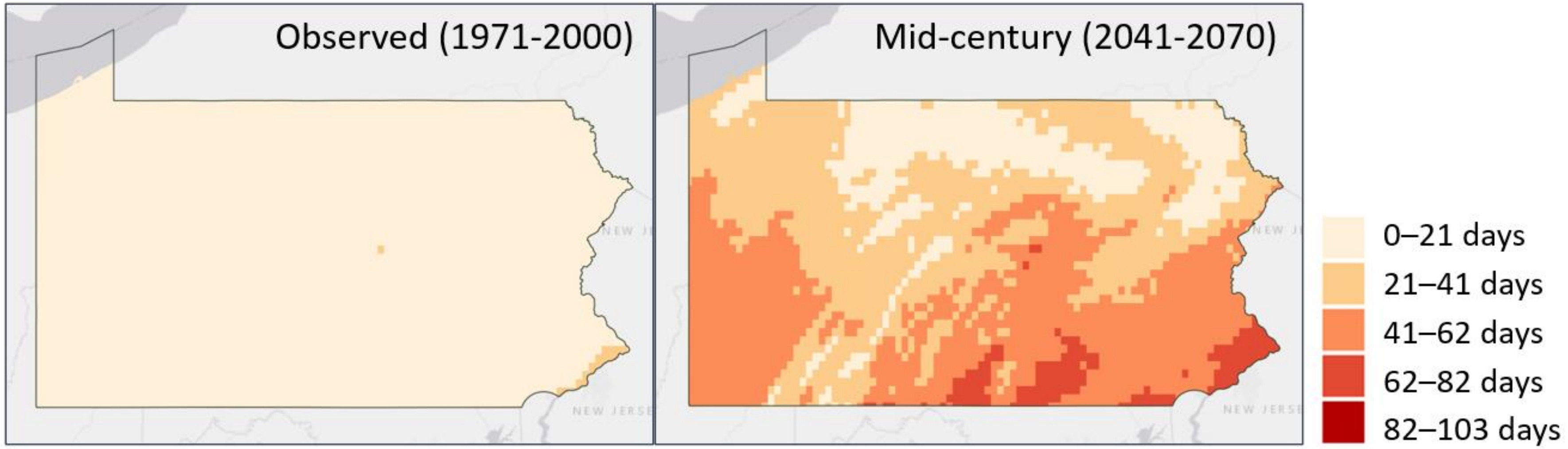
*Climate data analyzed: Ensemble of 32 models downscaled to a 1/16 degree grid (~6 km^2) using the Localized Constructed Analogs (LOCA) method – same dataset used for the most recent National Climate Assessment

Pierce, D., Cayan, D., and B. Thrasher. 2014. "Statistical Downscaling Using Localized Constructed Analogs (LOCA)." Journal of Hydrometeorology, 15, no. 6, p. 2558–2585. https://doi.org/10.1175/JHM-D-14-0082.1.

Climate Science Key Findings

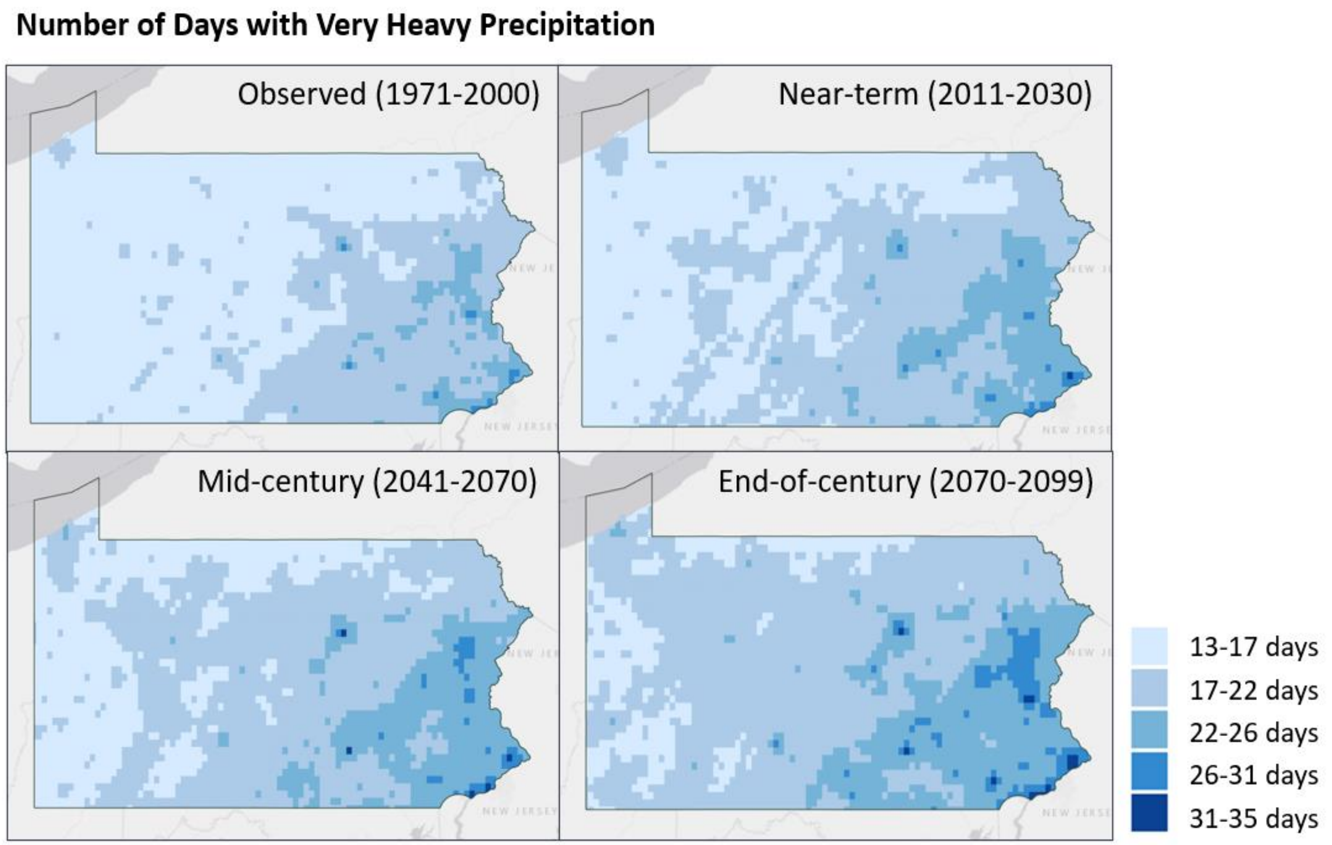
- Although temperatures will continue to be variable year-to-year, the **average temperature is trending upward.** Average annual temperature statewide is expected to increase by 5.9°F (3.3°C) by mid-century.
- With increasing average temperatures come **more frequent and intense extreme heat events** such as hot days or heat waves. For example, Pennsylvania could go from about 5 to 37 days per year where temperatures reach at least 90°F.
- Increasing temperatures will **alter the growing season** across the Commonwealth and **increase cooling degree-days** (while decreasing heating degree-days).

Average Annual Number of Days with Temperatures >90°F



Climate Science Key Findings

- **Extreme rainfall events are projected to increase** in magnitude, frequency, and intensity.
- Consecutive dry days are projected to increase, indicating **more potential for drought conditions**.
- Overall, Pennsylvania could see **more total rainfall**, but occurring in more spaced out heavy rain events.
- Most **increases in precipitation will occur in the winter and spring** months.
- Increase in **tidally-influenced flooding** in the Delaware Estuary coastal zone.
- Significant changes in **Lake Erie**, including related to lake levels, coastal erosion, and water temperatures.



Risk Assessment Process Overview

Climate Science

Recent Literature

Previous IAs

Department Staff Input

Rate Likelihood

(1) Unlikely → (4) Highly Likely

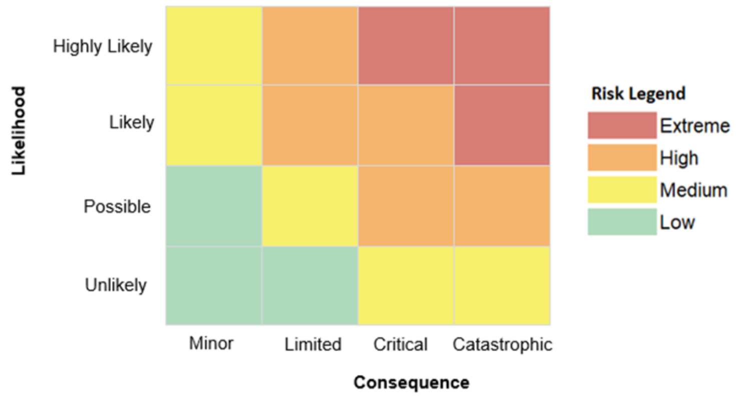
- Discrete events
- Ongoing events

Rate Consequences

(1) Minor → (4) Catastrophic

- Human health
- Environmental justice and equity
- Agriculture
- Recreation and tourism
- Energy and other economic activity
- Forests, ecosystems, and wildlife
- Built infrastructure

Rate Risk



Key Findings – Risk Assessment

- **Increasing average temperatures pose the greatest overall risk to Pennsylvania.**
  - Increased vulnerability to **heat-related illness and mortality risks**, especially for EJ communities
  - Potential increased energy burden for low-income households
  - Gradual shifts in growing seasons, suitable habitat range, and ecosystems
  - Increase in pests, invasive species, and diseases (e.g., Lyme disease)
  - Change in outdoor recreational opportunities (e.g., severe reduction in snow- and ice- based winter recreation and tourism)
- Heat waves will become increasingly common and create **health and economic risks** for vulnerable populations.
- **Flood risks to infrastructure is also a priority risk**. Impacts to built infrastructure have ripple effects throughout the economy.
- Landslides and sea level rise pose relatively low risks statewide, but can cause severe impacts where they occur.
- **Climate change will not affect all Pennsylvanians equally.**
- The gradual nature of many of these changes may create an **opportunity for the Commonwealth to not only reduce potential harms, but also capitalize on potential positive changes.**
- **Risks will continue to grow beyond 2050.**

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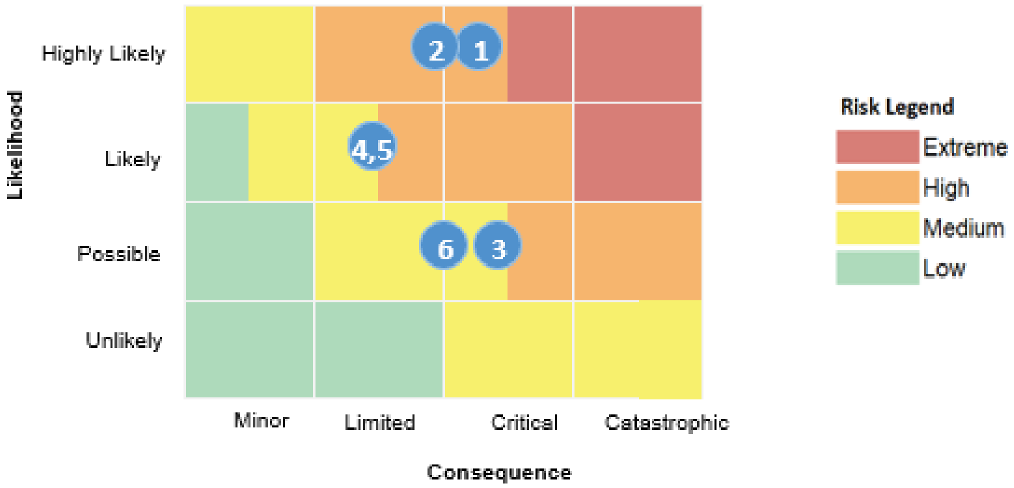
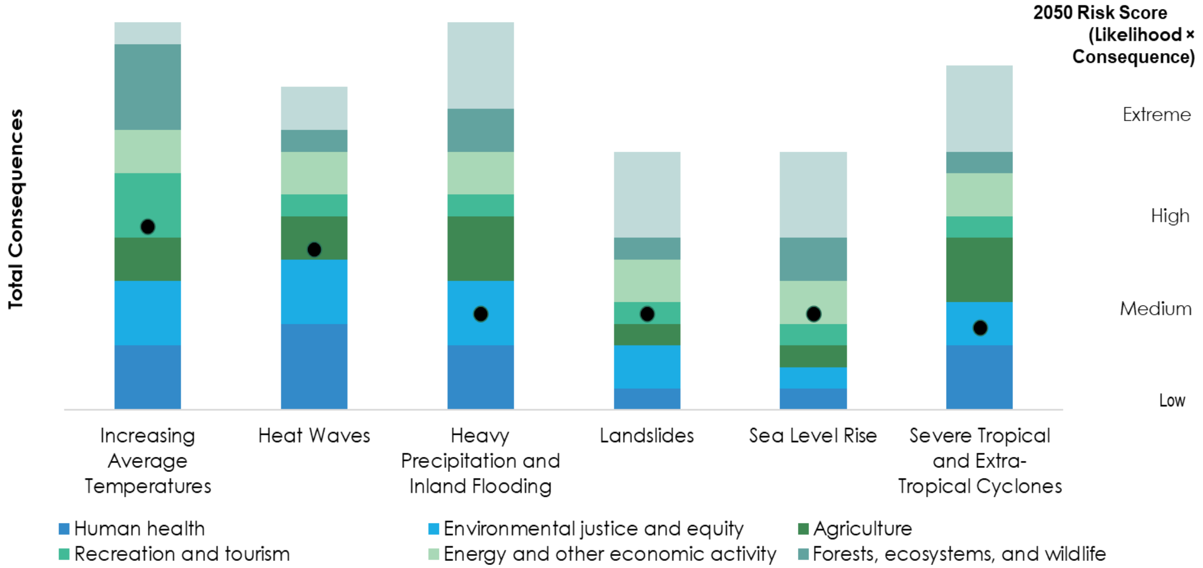
Summary Risk Matrix and Total Consequences and Risks by Hazard



	Climate Hazard	Current Risk Rating (Score)	2050 Risk Rating (Score)
1	**Increasing average temperatures**	Medium (5.3)	High (10.7)
2	**Heat waves**	Medium (4.7)	High (9.3)
3	**Heavy precipitation and inland flooding**	Medium (5.6)	Medium (5.6)
4	**Landslides**	Medium (5.6)	Medium (5.6)
5	**Sea level rise**	Low (1.9)	Medium (5.6)
6	**Severe tropical and extra-tropical cyclones**	Medium (4.8)	Medium (4.8)



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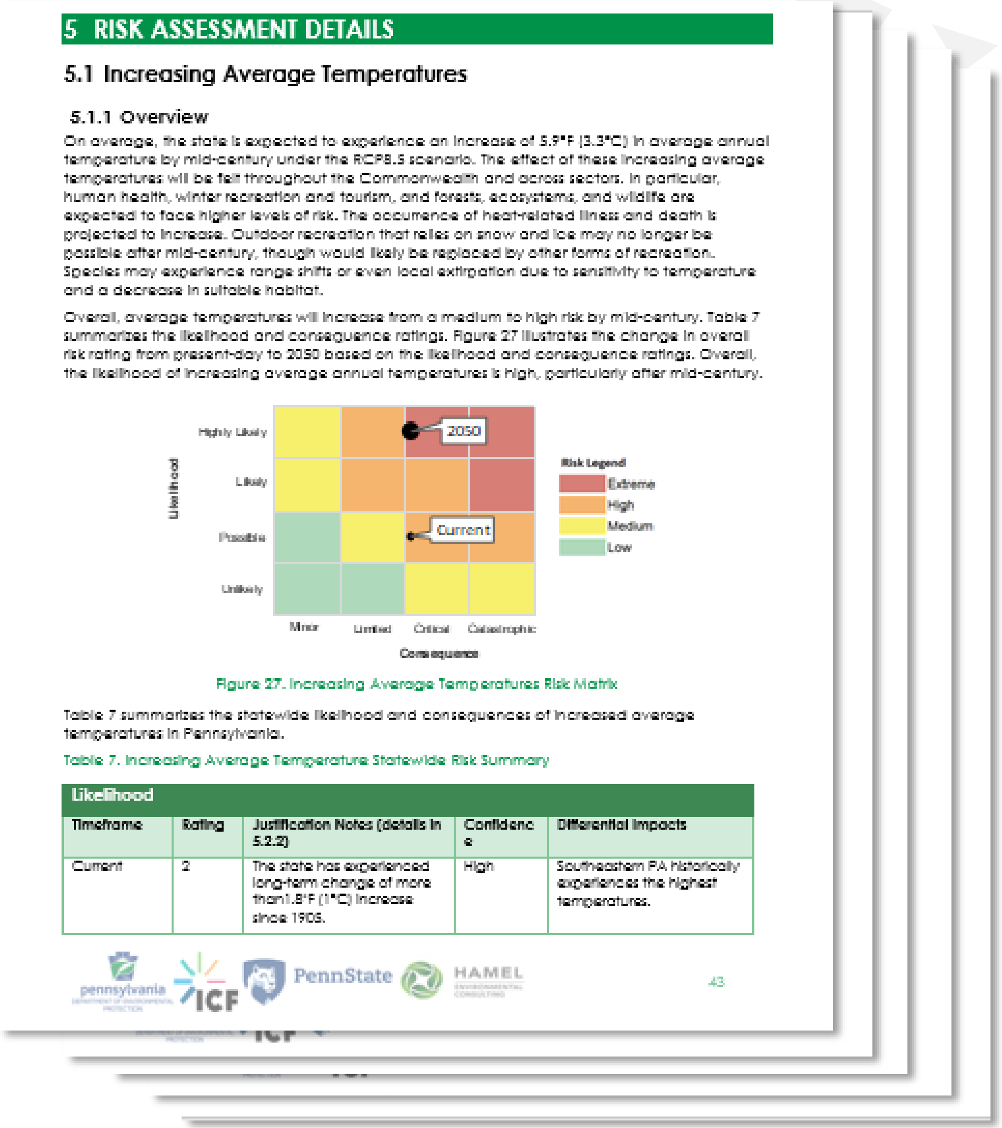
Risk Rating Matrix

	Human health	Environmental justice and equity	Agriculture	Recreation and tourism	Energy and other economic activity	Forests, ecosystems, and wildlife	Built infrastructure
Increasing average temperatures	12	12	8	12	8	16	4
Heat waves	16	12	8	4	8	4	8
Heavy precipitation and inland flooding	6	6	6	2	4	4	8
Landslides	3	6	3	3	6	3	12
Sea level rise	3	3	3	3	6	6	12
Severe tropical and extra-tropical cyclones	6	4	6	2	4	2	8

Detailed Risk Profiles for each Hazard

Including:

- Risk matrix
- Summary table of likelihood and consequence ratings
- Discussion of differential impacts (e.g., locations or populations most at risk)
- Confidence ratings
- Overall risk ratings
- Summary of possible opportunities
- Likelihood rating and detailed justification
- Consequence ratings and detailed justifications



5 RISK ASSESSMENT DETAILS

5.1 Increasing Average Temperatures

5.1.1 Overview

On average, the state is expected to experience an increase of 5.9°F (3.3°C) in average annual temperature by mid-century under the RCP8.5 scenario. The effect of these increasing average temperatures will be felt throughout the Commonwealth and across sectors. In particular, human health, winter recreation and tourism, and forests, ecosystems, and wildlife are expected to face higher levels of risk. The occurrence of heat-related illness and death is projected to increase. Outdoor recreation that relies on snow and ice may no longer be possible after mid-century, though would likely be replaced by other forms of recreation. Species may experience range shifts or even local extirpation due to sensitivity to temperature and a decrease in suitable habitat.

Overall, average temperatures will increase from a medium to high risk by mid-century. Table 7 summarizes the likelihood and consequence ratings. Figure 27 illustrates the change in overall risk rating from present-day to 2050 based on the likelihood and consequence ratings. Overall, the likelihood of increasing average annual temperatures is high, particularly after mid-century.

Figure 27. Increasing Average Temperatures Risk Matrix

Table 7 summarizes the statewide likelihood and consequences of increased average temperatures in Pennsylvania.

Table 7. Increasing Average Temperature Statewide Risk Summary

Likelihood				
Timeframe	Rating	Justification Notes (details in 5.2.2)	Confidence	Differential Impacts
Current	2	The state has experienced long-term change of more than 1.8°F (1°C) increase since 1905.	High	Southeastern PA historically experiences the highest temperatures.

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Next Steps

1) Finalize IA based on DEP/CCAC comments

2) Transition to adaptation planning in the CAP

- For each adaptation priority, develop an "adaptation pathway" – a recommended sequence of strategies
- Adaptation priorities tied to priority risks. For example:
  - Support agriculture sector, forestry, ecosystems, other natural resources, and recreation sector in transition to warmer climate
  - Reduce extreme heat risks to human health, particularly for vulnerable populations
  - Reduce flood risks to infrastructure and communities
  - Help low-income households cope with potential increased energy burden
  - Enhance tropical storm and landslide risk mitigation

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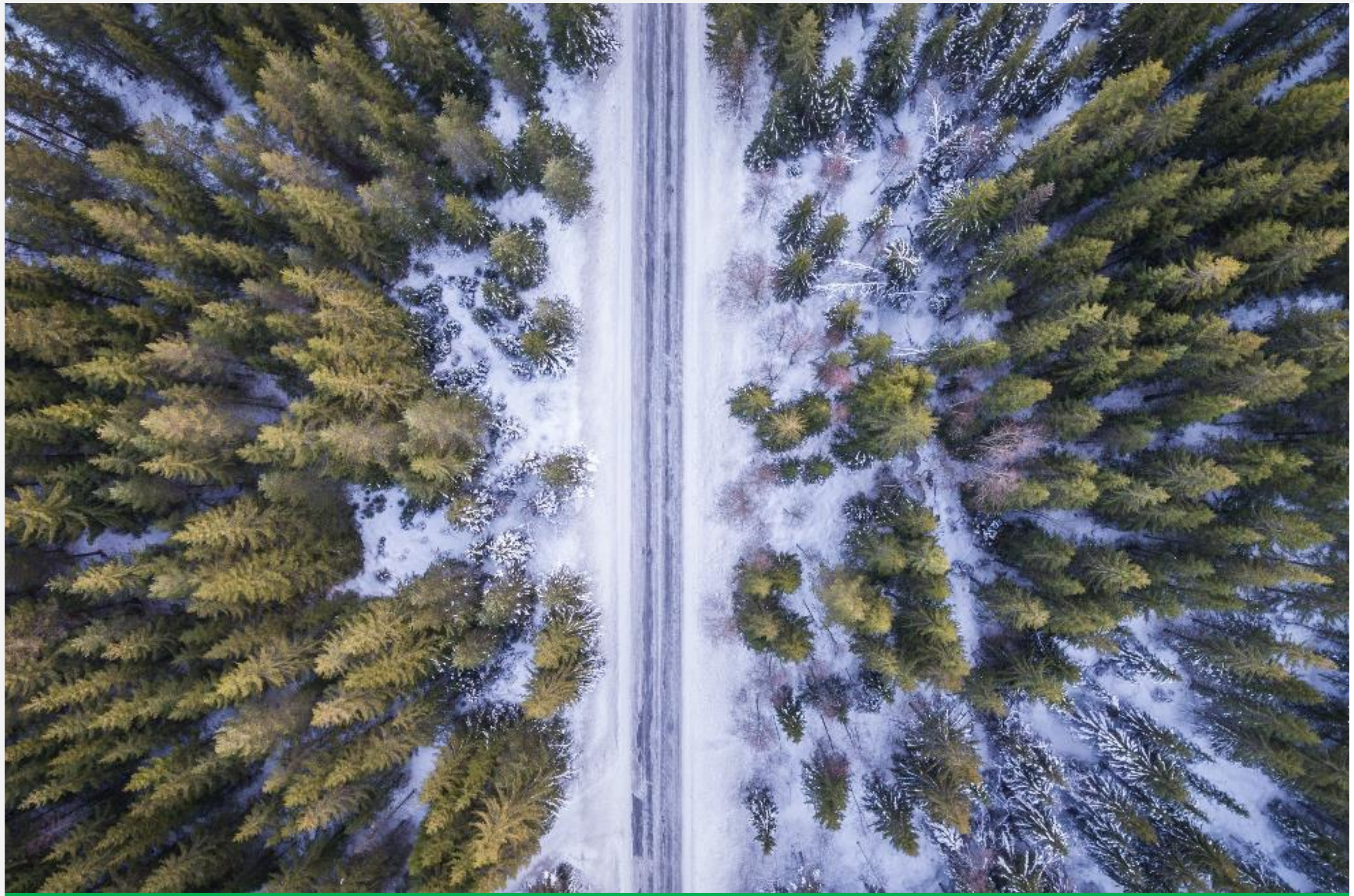
Discussion



Climate Action Plan

Updates

- Overview of Updates
- BAU
- GHG Reduction Strategies

Climate Action Plan: General Approach

Step 1: Update Business as Usual Scenario

Step 2a: Identify and Prioritize GHG Reduction Strategies

Step 2b: Identify and Prioritize Adaptation Strategies

Step 3a: Develop Flexible Adaptation Pathways

Step 3b: Analyze GHG reductions

Step 3c: Characterize enabling technologies

Step 4a: Evaluate the costs and benefits of adaptation strategies

Step 4b: Evaluate the costs and benefits of mitigation strategies

Step 5: Develop Implementation Steps

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CAP Updates

1) Finalized BAU Scenario

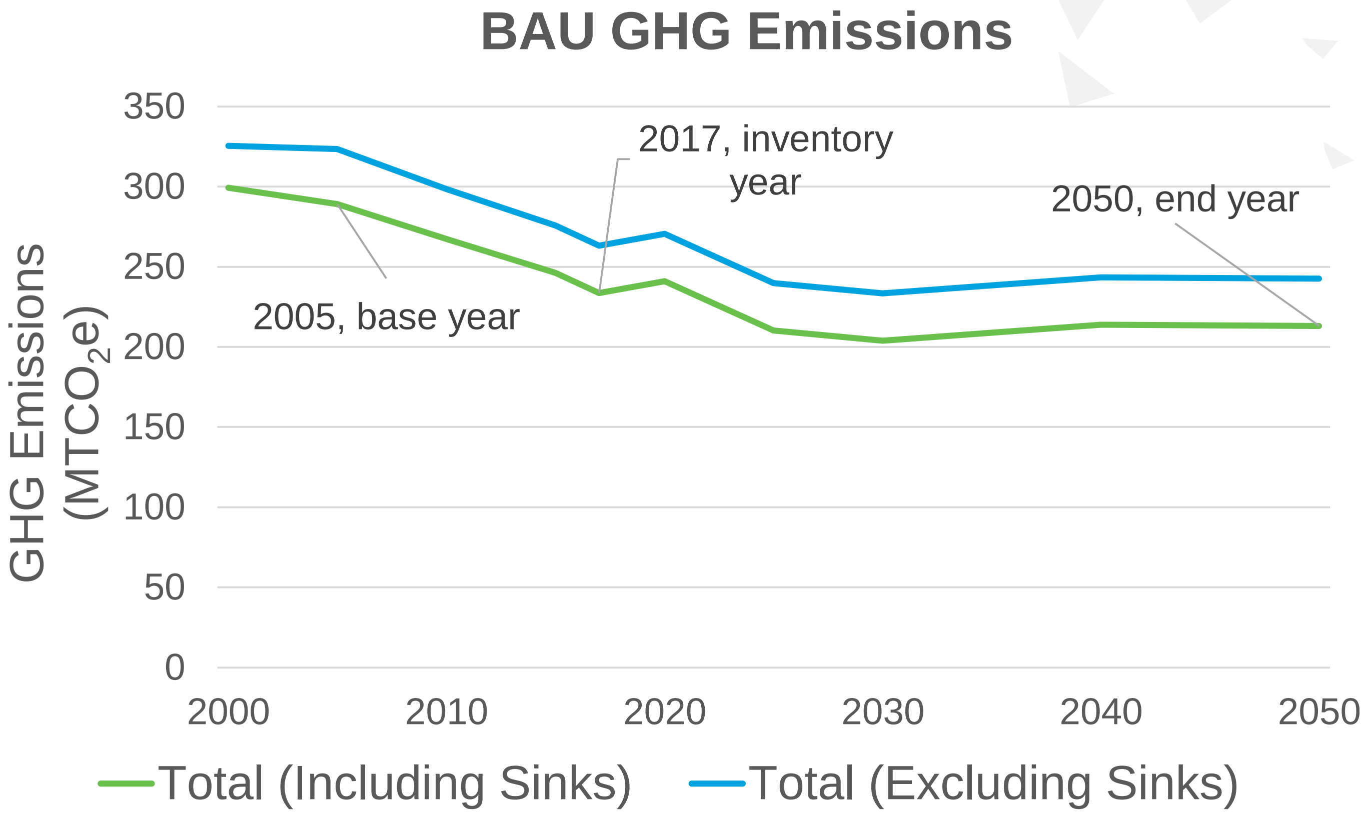
2) Refined and finalized GHG reduction strategies

3) Developed draft characterization of enabling technologies

4) Further developed the CAP draft

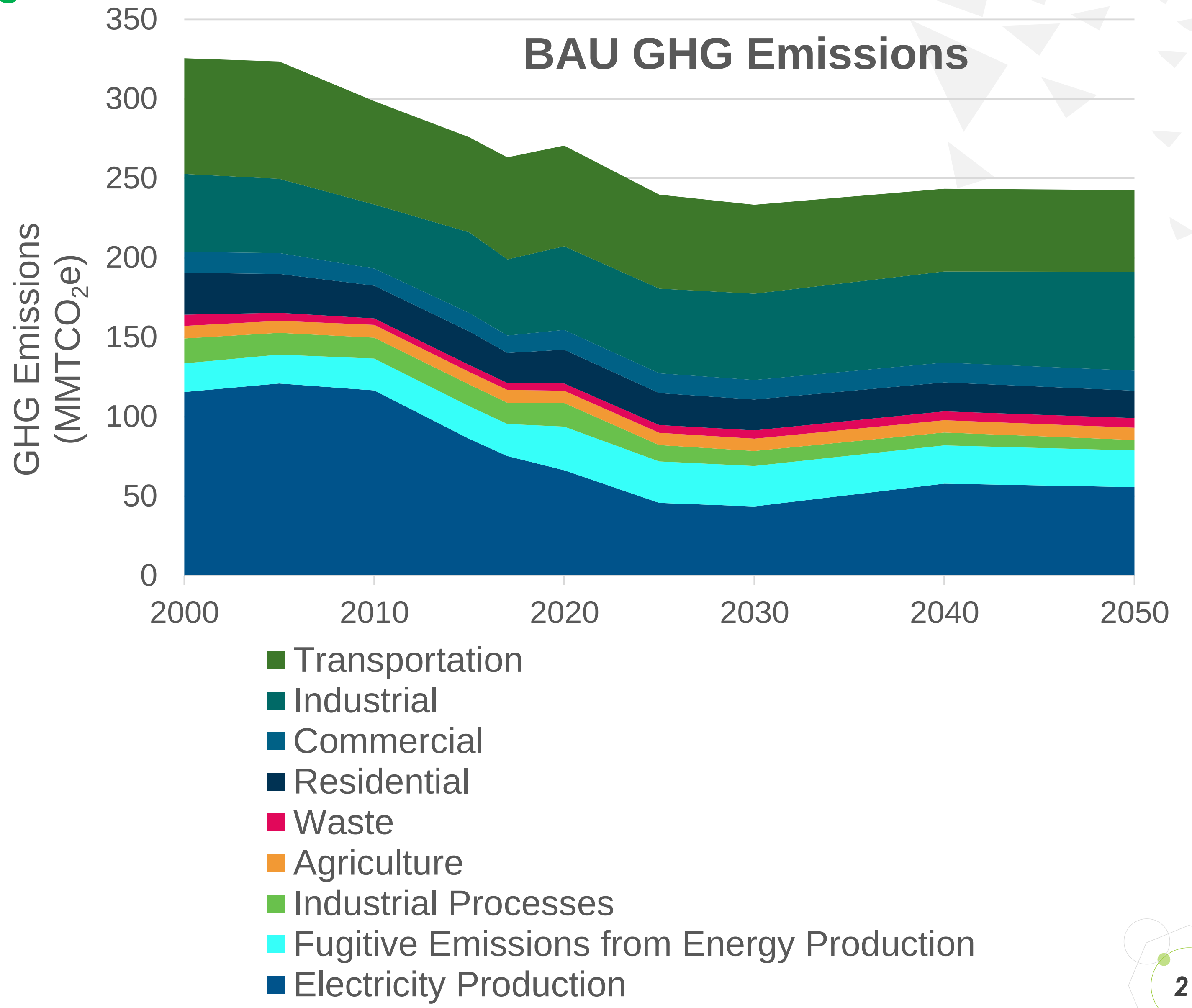
BAU Scenario

- Used the most recent (2017) Pennsylvania GHG Inventory as a starting point and projected GHG emissions from 2018 - 2050.
- BAU assumes no changes to current GHG reduction policies and programs.
- Pennsylvania may achieve its 2025 reduction goal but will not meet the 2050 goal (80% reduction from 2005 levels).
- Emissions are projected to decrease 25% by 2050 from 2005 levels, excluding carbon sinks.
- The projected decrease in emissions is driven largely by reduced electricity generation and lower-emitting fuel used.



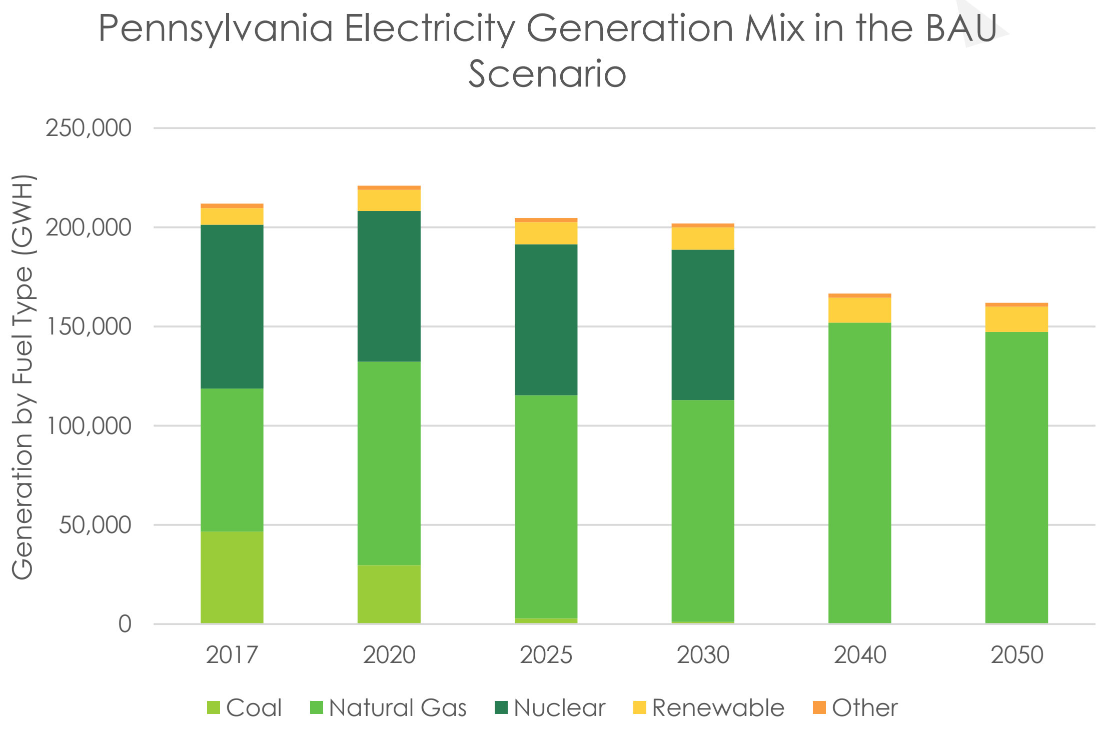
Projected Sector Trends

- Fugitive emissions from energy production decrease by 2050, driven by a reduction in coal production.
- Emissions from direct fuel consumption decrease by 9% from 2005 - 2050.
- 2050 emissions from electricity generation decrease by 54% from 2005 due to a cleaner energy generation mix between 2000 and 2015, and due to reduced electricity generation as a result of energy savings across the entire time series.
- Agricultural emissions very slightly increase across the time series.
- Waste emissions remain fairly constant.



Projected Electricity Trends

- Early emissions savings were a result of the switch from coal to natural gas between 2000 and 2015 mainly.
- After 2035, BAU modeling projects nuclear retirements, on an economic basis. These baseload units are being replaced by natural gas new combined cycle combustion.
- As a result, emissions for the electricity sector hit their lowest projected levels between 2030 and 2035, with continued increases through 2050.
- Without additional policy or incentives, and with RGGI expiring in 2030 in the BAU, renewable generation levels stay stagnant from 2017 through 2050.



Refined and finalized GHG reduction strategies

- Developed modeling assumptions and identified data sources.
- Began updating modeling framework.
- Developed a template to succinctly present each strategy in a uniform format.

Buildings and Industrial Sectors	Transportation and Fuel Supply Sectors	Electricity Generation, Agriculture, LULUCF, and Waste Sectors
Support Energy Efficiency through Building Codes	Implement the MHDV MOU	Maintain Nuclear Generation at Current Levels
Residential and Commercial Energy Efficiency Improvements (Electricity)	Increase Adoption of Light Duty Electric Vehicles	Create a carbon free grid
Residential and Commercial Energy Efficiency Improvements (Gas)	Implement a Low Carbon Fuel Standard	Use Programs, Tools, and Incentives to Increase Energy Efficiency for Agriculture
Incentivize Building Electrification	Reduce Vehicle Miles Traveled for Single-Occupancy Vehicles	Provide Trainings and Tools to Implement Agricultural Best Practices
Introduce State Appliance Efficiency Standards	Increase Production and Use of Biogas/Renewable Gas	Land Management for Natural Sequestration and Increased Urban Green Space
Take actions to promote and advance C-PACE financing and other tools for NZB and high-performance buildings	Incentivize and increase use of distributed Combined Heat and Power	Reduce food waste
Increase Industrial Energy Efficiency	Reduce Methane Emissions Across Oil and Natural Gas Systems	Reduce waste generated by citizens and businesses and expand beneficial use of waste

GHG Reduction Strategy Contents

A 1-page description will be included for each strategy in the main report. Methodology details for each strategy will be provided in the appendix.

- **Strategy Description**
  - Broad description of the strategy
  - Specific industries it may apply to
  - Key assumptions
  - Key metrics
  - Implementation considerations
- **Methodology**
  - Description of methods, data sources, and assumptions
  - Strategy layering (how the strategy will be integrated with other strategies)
  - Emissions accounting
  - Applicable GHG and air quality emission factors

Enabling Technologies Characterization

- Drafted initial write-up of each enabling technology.
- Added a sub-section about why the technology is relevant to Pennsylvania.

Enabling Technologies	Why it Matters for Pennsylvania
Encourage and incentivize battery storage at grid level.	Increases capacity to counter peak load days and can be paired with the AEPS
Analyze the potential role of power-to-gas (P2G) and hydrogen (blue and green) across sectors in meeting PA's goals.	Provides alternative fuel options which can potentially displace hydraulically fractured or conventional gas
Analyze the potential role of carbon capture, utilization, and geologic sequestration in meeting PA's goals.	Pennsylvania has significant geologic and nature-based sequestration potential. Captured CO2 can be utilized for EOR.
Provide resources and education on Direct Air Capture.	Can serve as a bridge technology as hard-to-decarbonize industries transition.
Implement peak load and balancing strategies.	Increases resiliency of energy systems, especially as more variable sources like wind are added to the mix.
Analyze the potential role of carbon offsets in meeting Pennsylvania's goals.	PA can purchase or sell offsets via RGGI and voluntary markets, depending on which is more beneficial.
Provide resources and education on disruptive digital technologies.	Increase efficiency and optimization, leading to reduced energy costs, emissions, and negative environmental impacts.

Next Steps

1) Identify and prioritize adaptation strategies (Step 2a), analyze GHG reductions (Step 3b), and characterize enabling technologies (Step 3c)

2) Develop Flexible Adaptation Pathways (Step 3a)

3) Evaluate costs and benefits of mitigation and adaptation strategies (Steps 4a and 4b)

4) Continue to draft sections of the CAP report, as the analysis proceeds

Climate Action Plan Timeline

- **Feb 2021** — Updated Draft CAP with GHG Analysis and Adaptation Strategies
- **April 2021** — Initial Costs/ Benefit Analysis
- **April 2021** — Draft Final CAP
- **June 2021** — Final CAP

Next Steps

Next Steps

- Please submit any written feedback to lbyron@pa.gov by January 12, 2021
- DEP and ICF will review feedback and incorporate it into the IA and CAP development process
- Next CCAC meeting is February 23, 2020
  - Will share latest updates, including:
    - Final Impacts Assessment
    - GHG Modeling Results
    - Costs and Benefits Assessment Assumptions


Happy Holidays!

Key Definitions

Climate hazard	• Climate related events or indicators, such as temperature and precipitation. Climate hazards can be discrete (e.g., heat wave) or ongoing (e.g., increasing average temperature).
Risk	• The chance a climate hazard will cause harm. Risk is a function of the likelihood of an adverse climate impact occurring and the severity of its consequences.
Likelihood	• The probability or expected frequency a climate hazard is expected to occur.
Consequence	• A measure of the severity of impacts from a climate hazard.