2024 Pennsylvania Climate Impacts Assessment and Climate Action Plan

Presentation to Climate Change Advisory Committee

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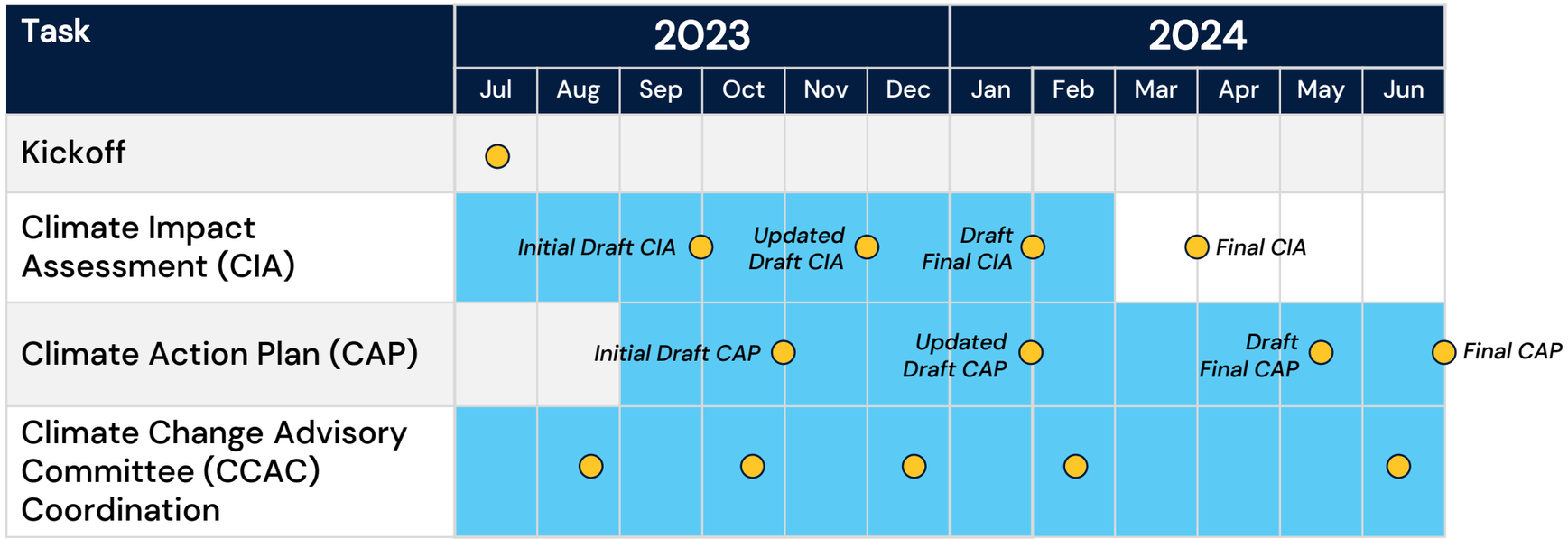
Agenda

1. **Project Status & Schedule Update**
2. **2024 Climate Impacts Assessment (CIA)**
   - Final
3. **2024 Climate Action Plan (CAP)**
   - Findings & Model Results
   - Modeling Refinements
   - Legislative Recommendations
   - Next Steps
   - Q&A and Discussion

Project Status & Schedule Update



While ICF's work on this plan is coming to an end at the end of June, the DEP will continue to make updates to the plan and align it with the upcoming work for Pennsylvania's Climate Pollution Reduction Grant Comprehensive Climate Action Plan (CCAP). Work on the CCAP, including public outreach and updated sections will continue in 2025.

→ 2024 Climate Impacts Assessment

An opportunity to further enhance the risk-based approach to evaluating climate change impacts pioneered in the 2021 CIA.

Final Climate Impact Assessment Submitted in Spring 2024

- Executive Summary
- Key Terms
- Chapter 1: Introduction
- Chapter 2: Expected Climate Changes in PA
- Chapter 3: Risk Assessment Overview
- Chapter 4: Spotlight Issues*
- Chapter 5: Economic Opportunities
- Chapter 6: Conclusions and Recommendations
- Appendix A: Risk Assessment Methodology
- Appendix B: Risk Assessment Details
- Appendix C: Climate Analysis Details

*Spotlight issues focused on:

- Flooding impacts to air quality and health
- Heat impacts to occupational exposure and public health
- Climate change impacts to energy resilience.

Updates made in response to CCAC feedback, state agency review throughout document

2024 Climate Action Plan

An opportunity for DEP to create a bold vision that exceeds goals; dives deeper into assessing the costs, benefits, co-benefits, and impacts for Pennsylvanians, particularly those in disadvantaged communities; and takes a stronger implementation focus with the aim of being a blueprint for action and potential legislative changes.

New Report Items

Executive Summary*

CHAPTER 1 Introduction

CHAPTER 2 The Pennsylvania Climate Landscape

CHAPTER 3 Greenhouse Gas Emissions

CHAPTER 4 Greenhouse Gas Reduction Opportunities

- Updated Modeling and integration with BAU*
- Economic Modeling and Air Quality Results*

CHAPTER 5 Climate Change Impacts

CHAPTER 6 Adaptation Opportunities

- Added Full list of strategies*

CHAPTER 7 Legislative Recommendations

- Change in DEP recommendations*

CHAPTER 8 Implementing Climate Action

APPENDIX A- Key Terms

APPENDIX B- BAU Methodology

APPENDIX C- Federal Funding Opportunities

APPENDIX D- Embodied Carbon*

***Newly Added**

Key Takeaways

- Pennsylvania will make significant progress toward the US Climate Alliance's goal of achieving net zero emissions by 2050 if all the recommended decarbonization strategies are effectively implemented.
- By implementing all modeled strategies, Pennsylvania will reduce GHG emissions in 2025 by more than 33% below 2005 levels, aligning with the US Climate Alliance's short-term emissions reduction goals.
- Pennsylvania will near the path to net zero by 2050, reducing GHG emissions by nearly 80% from 2005 levels with the implementation of all modeled strategies in all sectors.
- More reductions will be needed to meet both short (2030) and long-term (2050) climate goals, however Pennsylvania will near the path to net zero by 2050.
- Decarbonization of electricity is an enabling strategy and central to decarbonization of nearly every sector including buildings, transportation, and industry.

Figure 15. Sector Share of Total GHG Reductions Achieved Through Strategy Implementation in 2025 ($MMTCO_2e$)

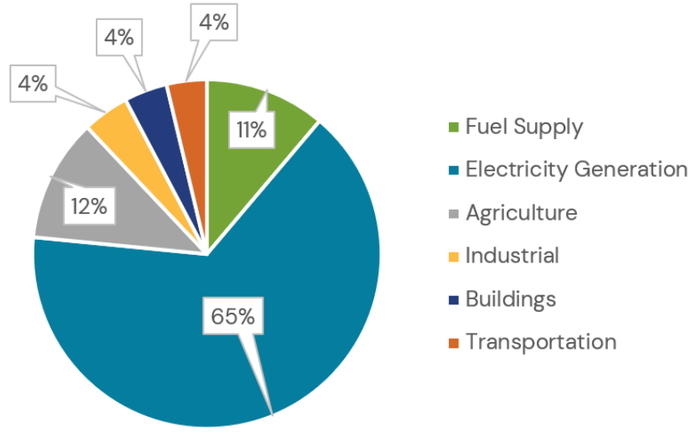
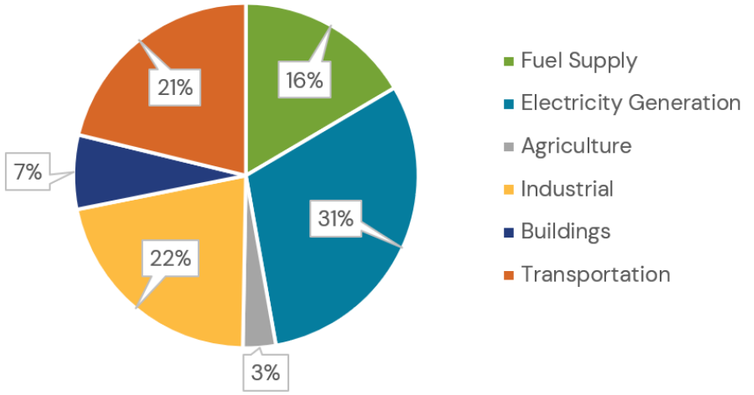
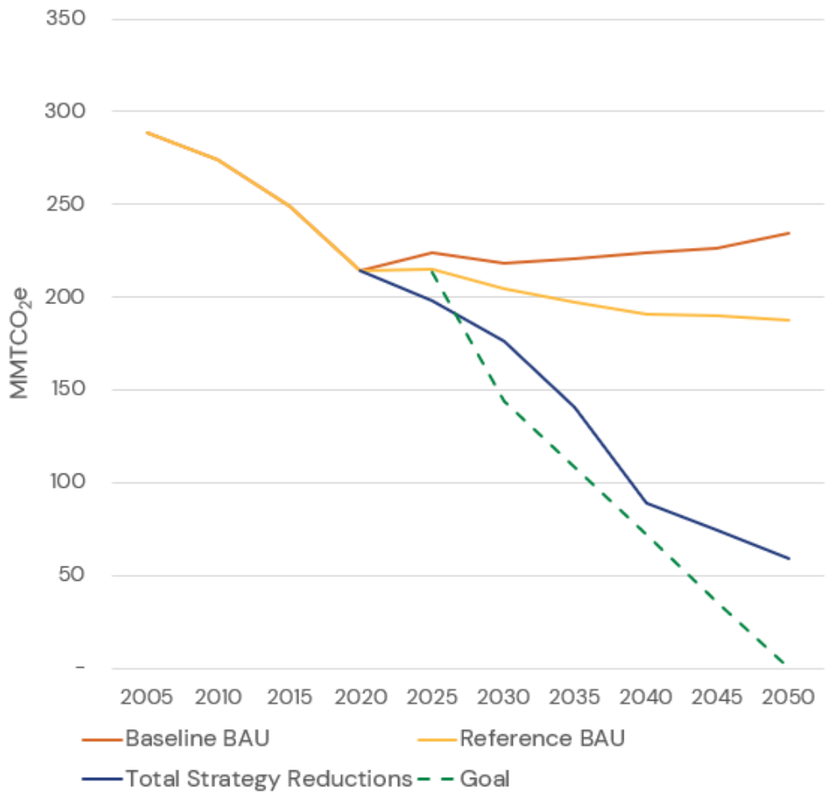


Figure 16. Sector Share of Total GHG Reductions Achieved Through Strategy Implementation in 2050 ($MMTCO_2e$)



Business as Usual Refinements



Year	Strategy	Modeled Results
2025	26-28% reduction	33%
2030	50% reduction	40%
2050	Net zero emissions	80%

Key differences between the Baseline and Reference BAUs

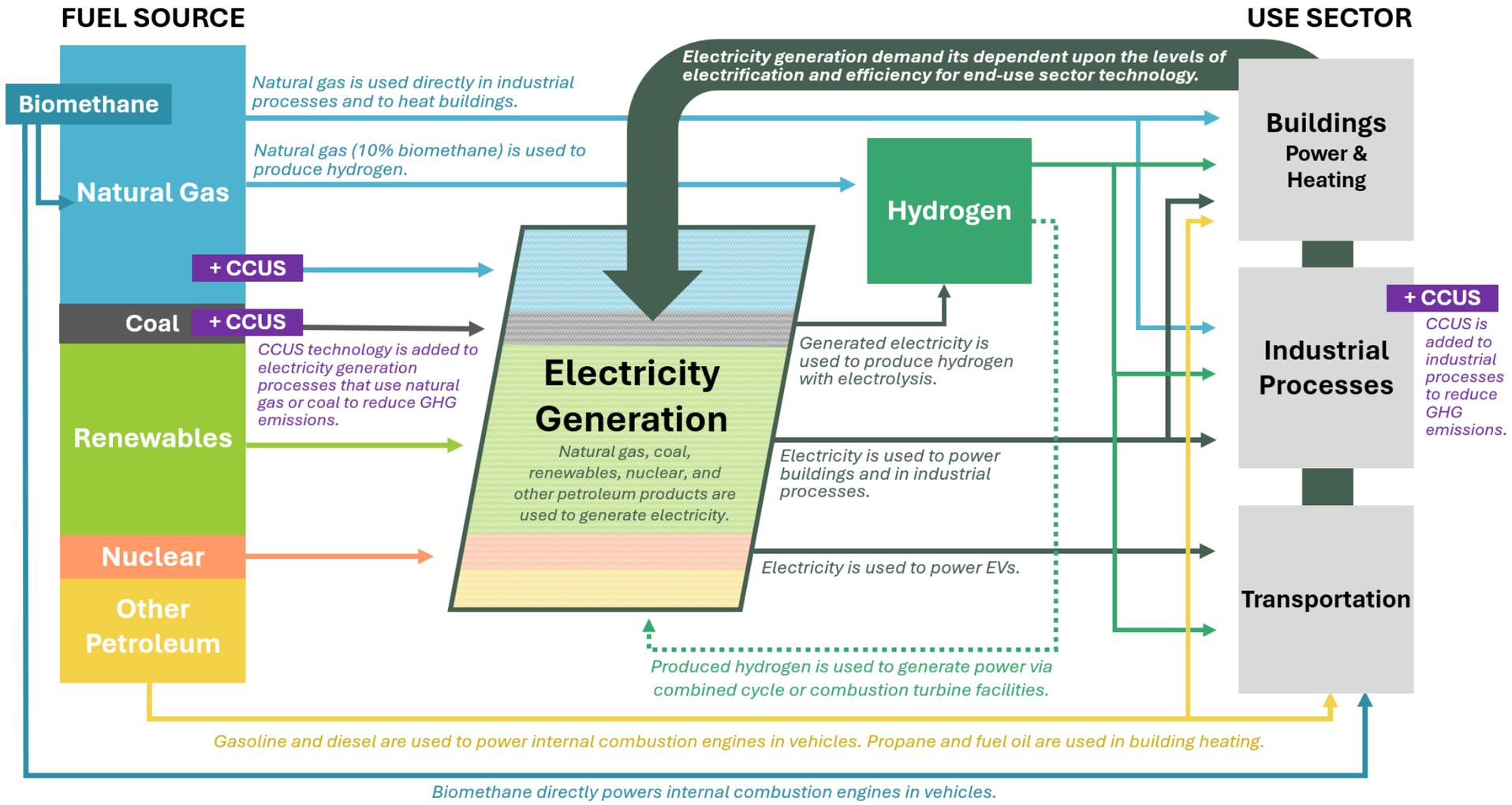
The Reference BAU includes additional policies from IRA and BIL. For example, the Reference scenario includes:

- Greater emissions reductions due to decreased electricity use and emissions in residential and commercial buildings
- Higher transportation emissions savings due to great EV penetration
- A smaller increase in projected industrial emissions due to lower-carbon energy input for industrial processes
- Lower carbon intensity from the electricity grid

BASELINE BAU 19% reduction

REFERENCE BAU 35% reduction

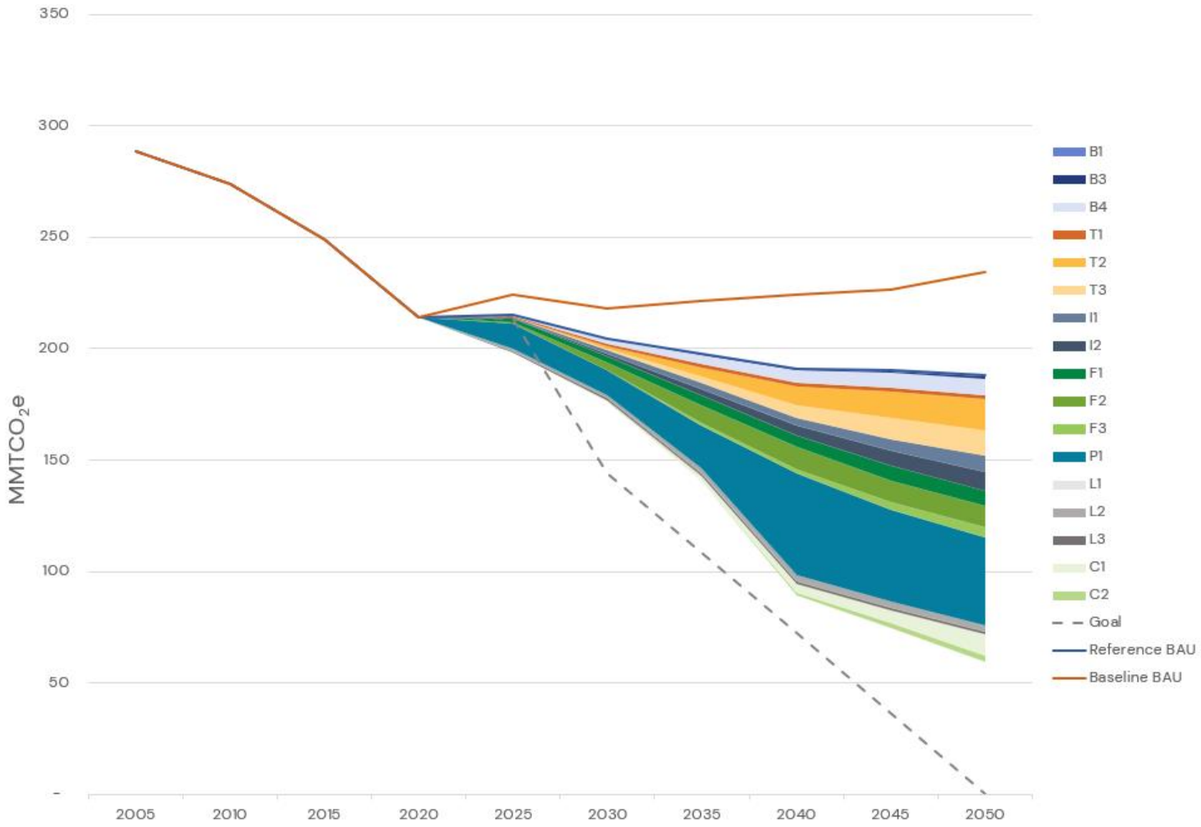
Relationships between fuel sources and end use sectors



Pennsylvania's Path to 2050

GHG Reduction Strategy	Reductions $MMTCO_2e$ 2030	2050
B1. Building codes[a]	0.02	0.43
B2. Electricity efficiency in buildings[b]	N/A	N/A
B3. Gas energy efficiency in buildings[a]	0.11	1.07
B4. Building electrification[a]	1.96	7.43
B5. Onsite solar[b]	N/A	N/A
Buildings Total	**2.09**	**8.94**
T1. Transit & Multimodal Improvements	1.27	1.88
T2. Light Duty Vehicle Electrification [a]	.92	13.86
T3. Zero Carbon Medium- & Heavy-Duty Vehicles[a]	.76	11.49
Transportation Total	**2.94**	**27.24**
I1. Industrial Efficiency[a]	1.67	7.1
I2. Gas, Fuel, and Process Decarbonization[a]	1.43	8.39
Industrial Total	**3.09**	**15.49**
F1. Operational Efficiency	2.67	7.25
F2. Biomethane	3.46	9.49
F3. Plug Inactive & Marginal Wells	0	4.48
Fuel & Gas Systems Total	**6.13**	**21.22**
P1. Net Zero Grid	10.91	39.42
P2. Distribution & Transmission	N/A	N/A
Power Generation Total	**10.91**	**39.42**
L1. Agricultural Best Practices – Emissions Reduction	.02	.02
L2. Agricultural Best Practices – Carbon Sequestration	1.52	2.78
L3. Land & Forest Management	1.14	1.16
Agriculture/ Land Use Total	**2.68**	**3.96**

GHG Reduction Strategy	Reductions $MMTCO_2e$ 2030	2050
C1. Hydrogen	0.46	9.41
C2. CCUS	0.02	2.8
Cross Cutting Total	**.49**	**12.21**



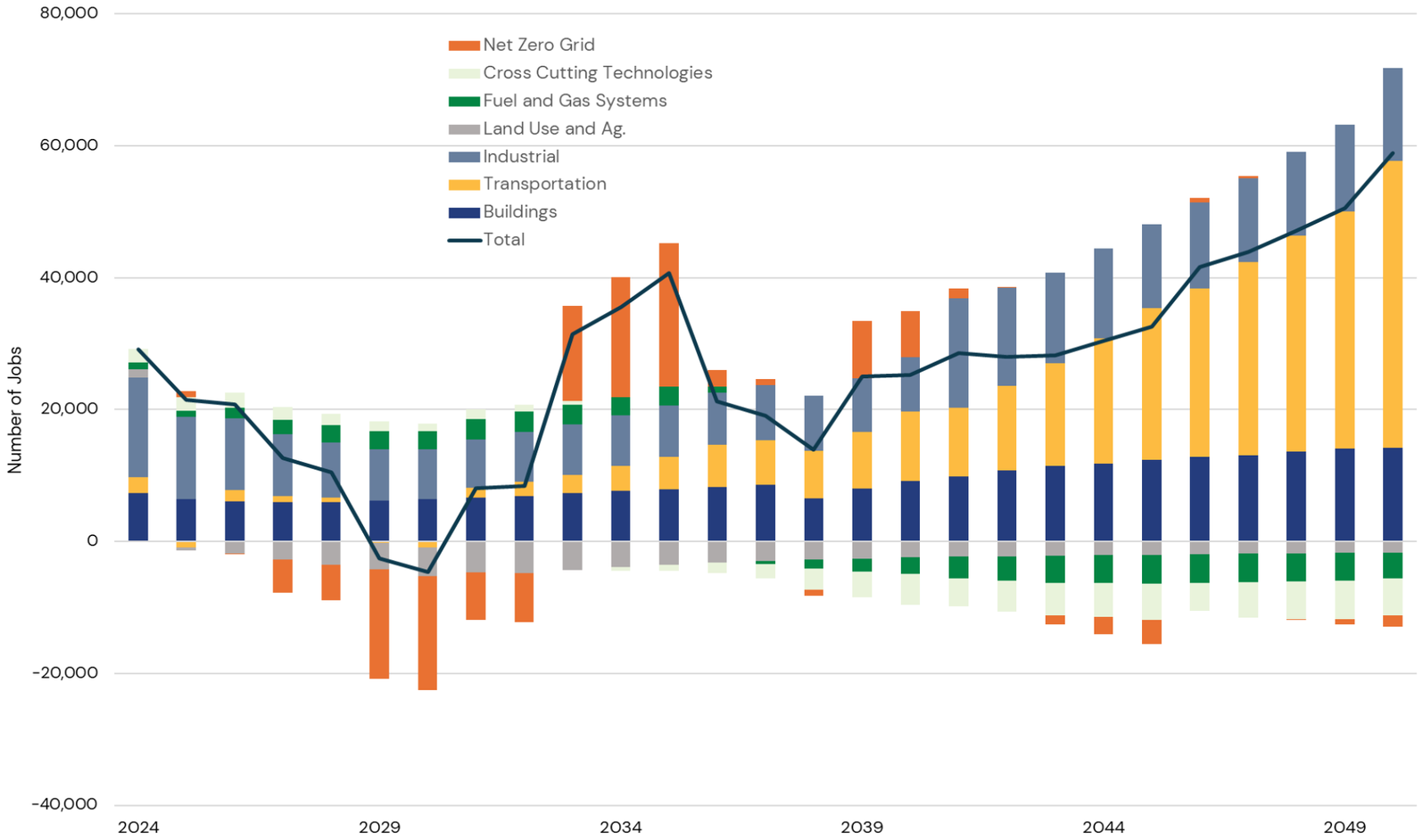
N/A = Not Applicable.
[a] A portion of GHG reduction from this strategy is captured in the electricity generation sector.
[b] The GHG reductions from this strategy are captured in the electricity generation sector.

Macroeconomic Modeling Results

- Employment results represent change in jobs from the BAU
  - Annual average increase of about 26,000 jobs from all strategies combined
  - Roughly 0.3% increase from BAU employment levels

- Industrial, Transportation, and Building strategies provide consistently positive employment impacts
  - Investments in capital and fuel savings drive job increases
  - Somewhat offset by associated costs but overall net positive

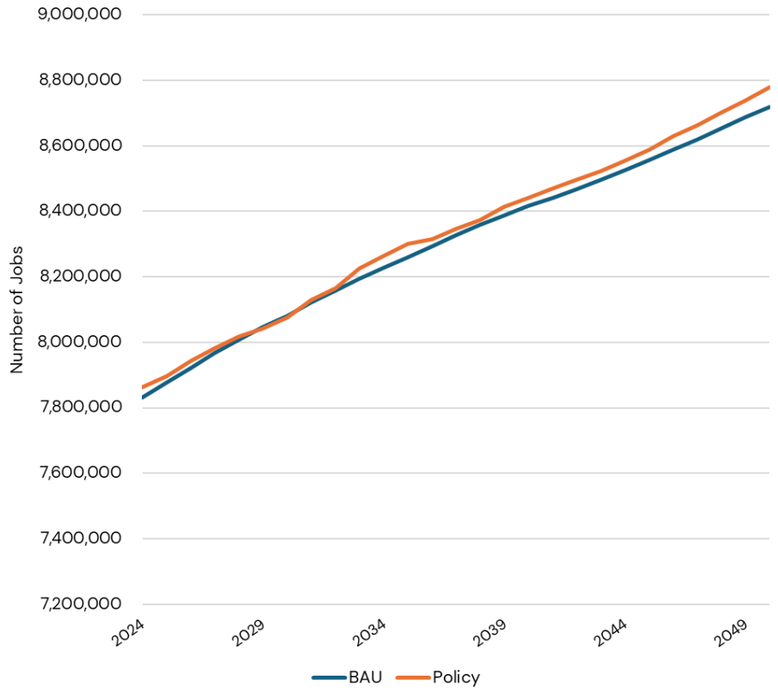
- Net Zero Grid strategy job has a net average increase of 250 jobs per year
  - Net impacts reflect changing grid from BAU:
    - Shifting timelines (some generation deferred until 2033)
    - Large increases in jobs required for solar, battery, and natural gas with CCS generation
    - Declines in jobs due to a shift away from conventional natural gas



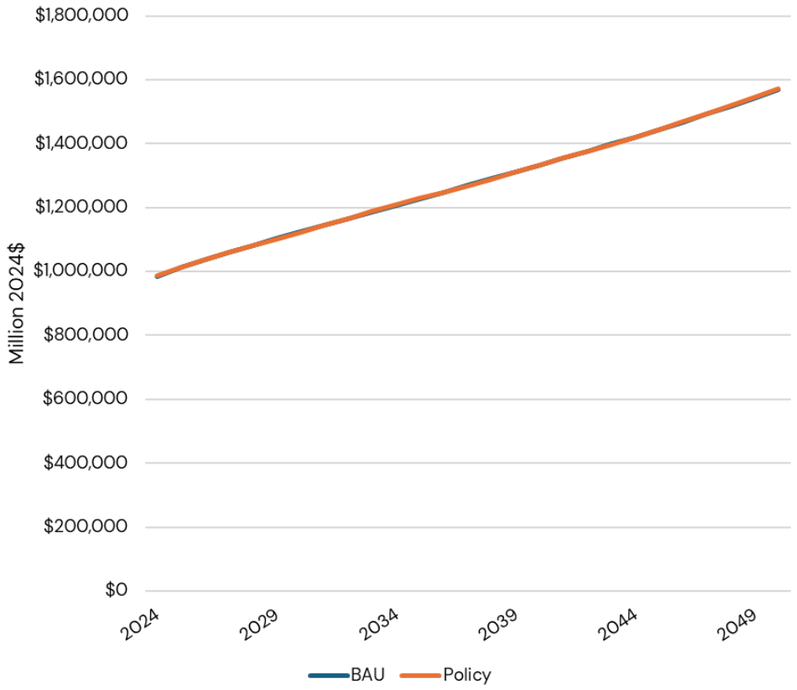
Macroeconomic Modeling Results

- Average annual employment increases by only 0.3% compared to the BAU
- Gross State Product (GSP) annual average increase by 0.02%
- Slight decrease in annual disposable personal income (DPI) by about 0.26%
  - Cumulative impacts of energy rates from all strategies combined result in possibility for residents to pay slightly more for energy needs
- Employment, GSP, and DPI all projected to robustly grow through 2050

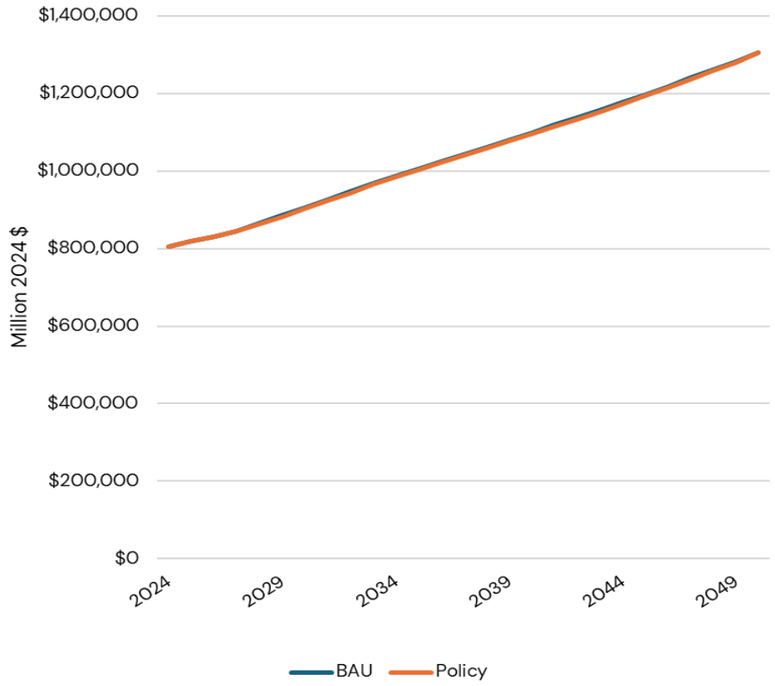
Employment Levels under the BAU and Combined Strategies



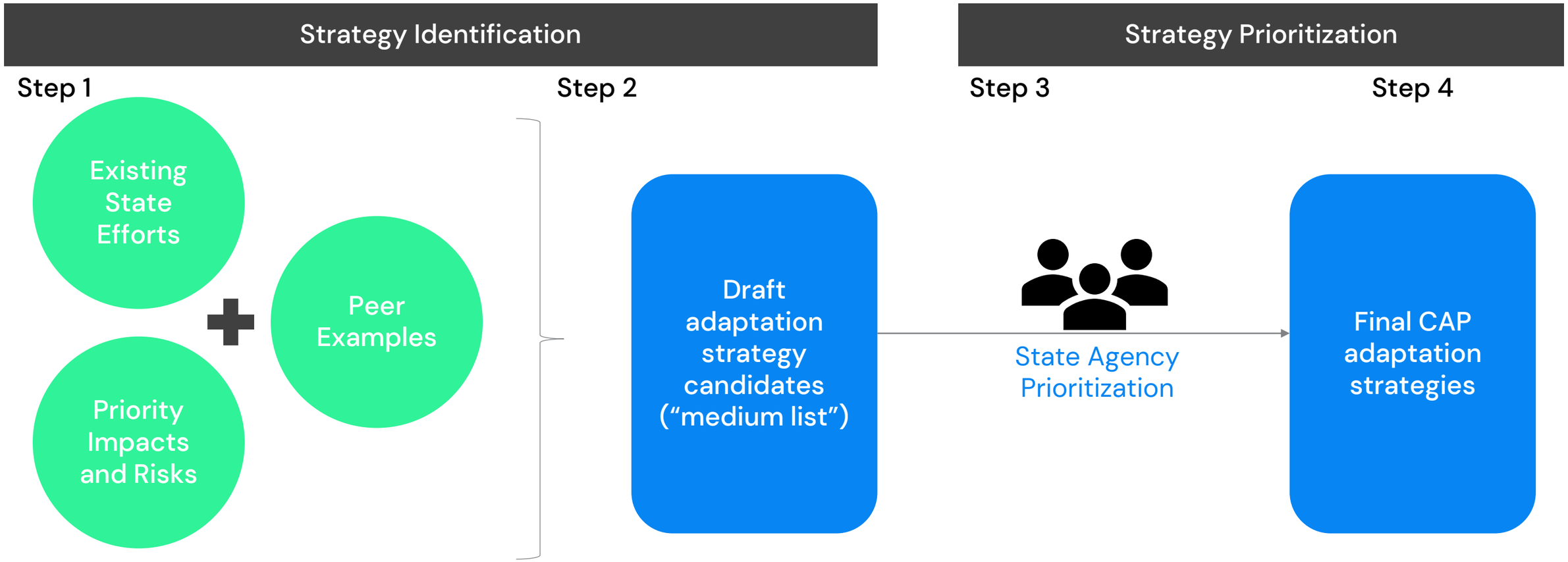
GSP Levels Under the BAU and Combined Strategies



DPI Levels Under the BAU and Combined Strategies



Adaptation Strategy Identification and Prioritization Process



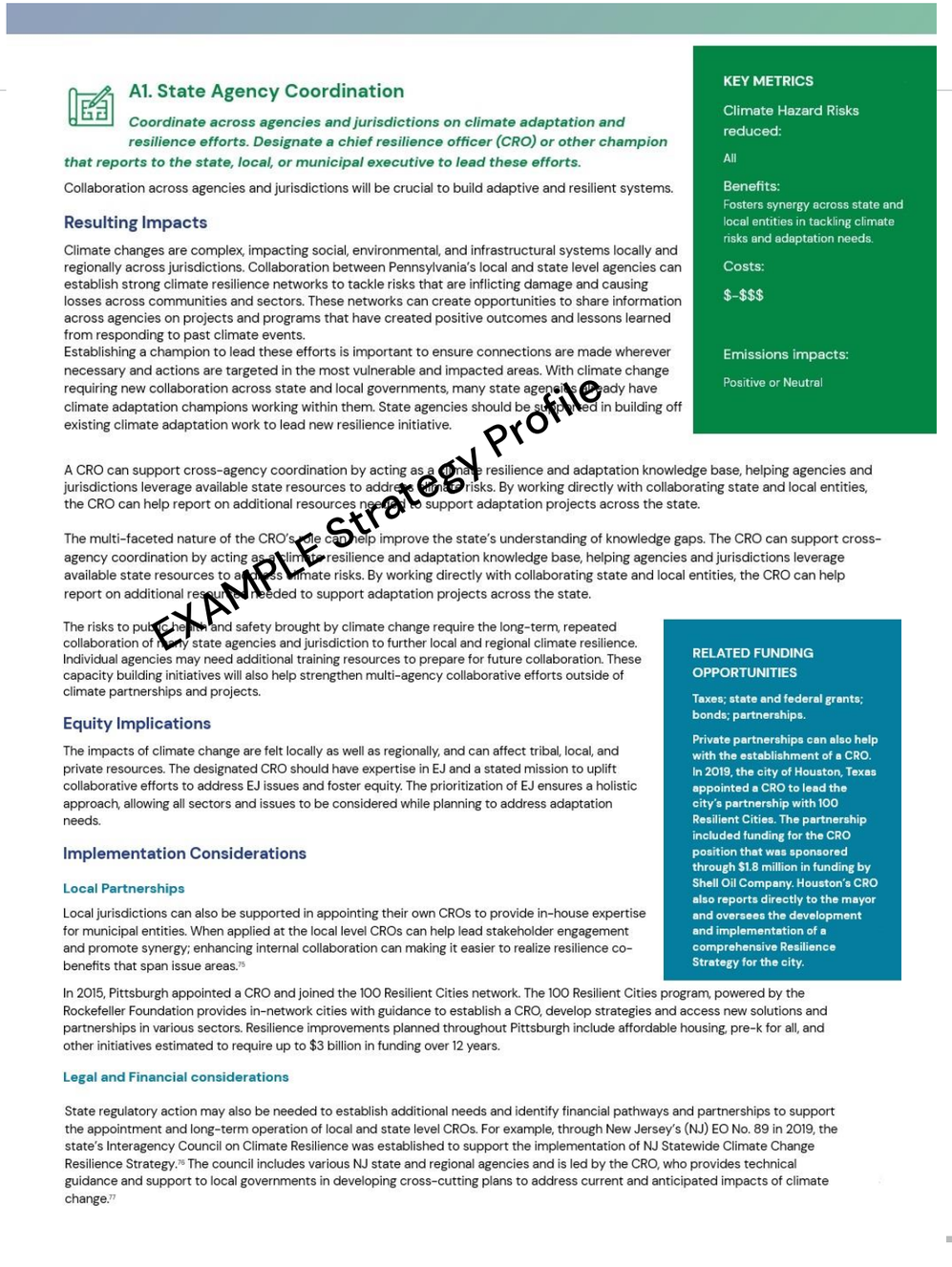
Identify state-level policies or actions that can address key risks or enable adaptation by other actors

Adaptation Strategies

Adaptation Strategy	Hazard Addressed
A1. State Agency Coordination	Cross-cutting
A2. Local Adaptation Program	Cross-cutting
A3. Utility Climate Risk Analysis	Flooding; Extreme heat; Power Outages
A4. Evaluation of Equity Impacts	Cross-cutting
A5. Nature-based Solutions	Flooding; Extreme Heat
A6. Climate Resilient Design Guidelines	Cross-cutting
A7. Property Risk Disclosure	Flooding
A8. Health Impacts Tracking	Extreme Heat; Flooding
A9. Enhanced Workplace Health and Safety Precautions	Extreme Heat; Flooding; Tropical Storms
A10. Enhanced Emergency Management	Extreme Heat; Flooding; Tropical Storms

Adaptation Strategy Profile

- Resulting Impacts
- Equity Implications
- Implementation Considerations
  - Local partnerships
  - Legal and financial considerations
- Related Funding Opportunities
- Key Metrics:
  - Climate Hazards Reduced
  - Benefits
  - Costs (relative)
  - Emissions impacts



A1. State Agency Coordination

Coordinate across agencies and jurisdictions on climate adaptation and resilience efforts. Designate a chief resilience officer (CRO) or other champion that reports to the state, local, or municipal executive to lead these efforts.

Collaboration across agencies and jurisdictions will be crucial to build adaptive and resilient systems.

KEY METRICS

Climate Hazard Risks reduced:

All

Benefits:
Fosters synergy across state and local entities in tackling climate risks and adaptation needs.

Costs:

$–$$$

Emissions impacts:

Positive or Neutral

Resulting Impacts

Climate changes are complex, impacting social, environmental, and infrastructural systems locally and regionally across jurisdictions. Collaboration between Pennsylvania's local and state level agencies can establish strong climate resilience networks to tackle risks that are inflicting damage and causing losses across communities and sectors. These networks can create opportunities to share information across agencies on projects and programs that have created positive outcomes and lessons learned from responding to past climate events.
Establishing a champion to lead these efforts is important to ensure connections are made wherever necessary and actions are targeted in the most vulnerable and impacted areas. With climate change requiring new collaboration across state and local governments, many state agencies already have climate adaptation champions working within them. State agencies should be supported in building off existing climate adaptation work to lead new resilience initiative.

A CRO can support cross-agency coordination by acting as a climate resilience and adaptation knowledge base, helping agencies and jurisdictions leverage available state resources to address climate risks. By working directly with collaborating state and local entities, the CRO can help report on additional resources needed to support adaptation projects across the state.

The multi-faceted nature of the CRO's role can help improve the state's understanding of knowledge gaps. The CRO can support cross-agency coordination by acting as a climate resilience and adaptation knowledge base, helping agencies and jurisdictions leverage available state resources to address climate risks. By working directly with collaborating state and local entities, the CRO can help report on additional resources needed to support adaptation projects across the state.

EXAMPLE Strategy Profile

The risks to public health and safety brought by climate change require the long-term, repeated collaboration of many state agencies and jurisdiction to further local and regional climate resilience. Individual agencies may need additional training resources to prepare for future collaboration. These capacity building initiatives will also help strengthen multi-agency collaborative efforts outside of climate partnerships and projects.

RELATED FUNDING OPPORTUNITIES

Taxes; state and federal grants; bonds; partnerships.

Private partnerships can also help with the establishment of a CRO. In 2019, the city of Houston, Texas appointed a CRO to lead the city's partnership with 100 Resilient Cities. The partnership included funding for the CRO position that was sponsored through $1.8 million in funding by Shell Oil Company. Houston's CRO also reports directly to the mayor and oversees the development and implementation of a comprehensive Resilience Strategy for the city.

Equity Implications

The impacts of climate change are felt locally as well as regionally, and can affect tribal, local, and private resources. The designated CRO should have expertise in EJ and a stated mission to uplift collaborative efforts to address EJ issues and foster equity. The prioritization of EJ ensures a holistic approach, allowing all sectors and issues to be considered while planning to address adaptation needs.

Implementation Considerations

Local Partnerships

Local jurisdictions can also be supported in appointing their own CROs to provide in-house expertise for municipal entities. When applied at the local level CROs can help lead stakeholder engagement and promote synergy; enhancing internal collaboration can making it easier to realize resilience co-benefits that span issue areas.[75]

In 2015, Pittsburgh appointed a CRO and joined the 100 Resilient Cities network. The 100 Resilient Cities program, powered by the Rockefeller Foundation provides in-network cities with guidance to establish a CRO, develop strategies and access new solutions and partnerships in various sectors. Resilience improvements planned throughout Pittsburgh include affordable housing, pre-k for all, and other initiatives estimated to require up to $3 billion in funding over 12 years.

Legal and Financial considerations

State regulatory action may also be needed to establish additional needs and identify financial pathways and partnerships to support the appointment and long-term operation of local and state level CROs. For example, through New Jersey's (NJ) EO No. 89 in 2019, the state's Interagency Council on Climate Resilience was established to support the implementation of NJ Statewide Climate Change Resilience Strategy.[76] The council includes various NJ state and regional agencies and is led by the CRO, who provides technical guidance and support to local governments in developing cross-cutting plans to address current and anticipated impacts of climate change.[77]

Energy Rates Analysis- Approach

ICF's Energy Rate Analysis Approach provides separate modeling for gas and electricity:

Both models take strategy inputs from ICF's sector modeling to inform changes in energy use and demand.

Gas rate modeling look at specific aspects (unit costs, use, and demand) across multiple consumer categories (residential, commercial industrial) and a set of assumptions on gas utilities' future operations. The costs of gas for consumers is broken down into three components:

- Gas pipeline and storage costs
- Utility service costs
- Gas supply costs

Electricity rate modeling leverages ICF's Integrated Planning Model outputs to develop electricity supply costs for the PJM market affecting consumers and further transmission and distribution indicative cost changes. The three components considered for the electric markets are i) electricity supply (energy, capacity & RECs), ii) transmission (PJM network service charges, iii) and distribution (customer charges, delivery charges, and distribution system improvement charges).

Results shown are initial and a snapshot of what the final work will include.

Legislative Criteria

Meets a need established in the 2024 CAP to achieve GHG reduction goals (e.g., clean energy grid, building decarbonization, EV deployment, etc.)

Meets needs communicated by stakeholders since the inception of the Act 70, with particular focus on findings from stakeholder engagement conducted since the publishing of the 2021 CAP. Sources of stakeholder needs included:

- Identified impacts to/opportunities for EJ communities, provided from recent Pennsylvania Climate Action: Strategies for Environmental Justice Communities report
- Input received via CPRG outreach
- Input from other applicable existing outreach received by DEP

Advances a cost-effective strategy recommendation that shows a net benefit to stakeholders and/or the public

- Net cost/benefits vs. social cost of carbon were identified to be beneficial to participants.

Demonstrates practice of similar policies in other states and jurisdictions, as identified by the literature review

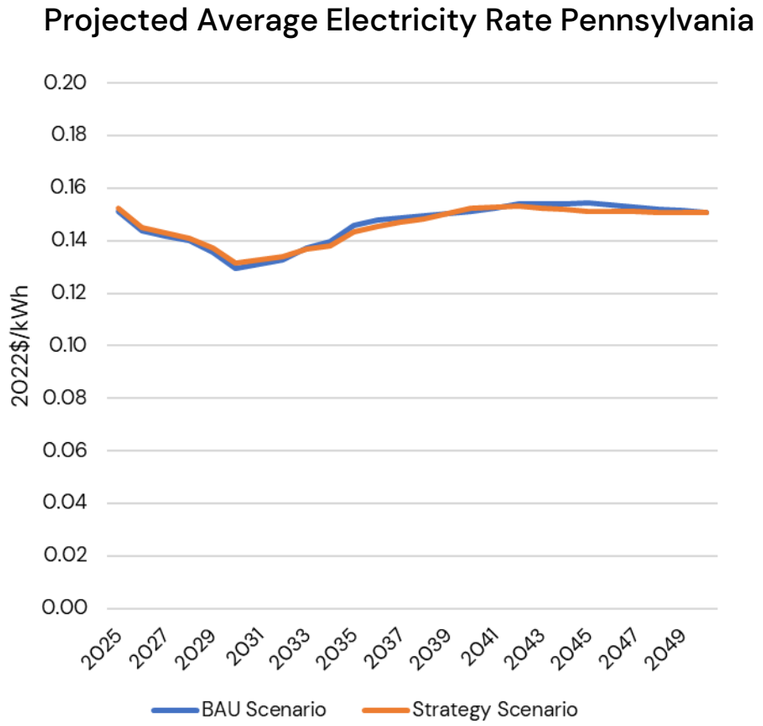
Leverages existing clean energy and other climate programs and policies

Introduces a new consideration or fills a gap left by existing and currently proposed legislation

Energy Rates Analysis- Electricity

The average electricity rate for Pennsylvania was calculated for the BAU and Strategy scenarios with each following a similar trend and with the Strategy case slightly above the BAU in most years.

- The electric supply costs in this analysis are highly dependent on the ability to access federal subsidies and incentives for clean energy technology.
- The efficiency of new appliances is a large driver in limiting load growth in the Strategy scenario. Adoption of efficient space heating and cooling measures and phasing out of less efficient sources such as resistance heating is critical to managing load growth.
- The load growth further impacts the bulk and distribution sector infrastructure needs. In the Strategy scenario, overall energy demand for electricity in Pennsylvania is expected to decrease, but the consumption pattern changes, which drives much of the difference in the power system needs and forward costs.
- No future change in power market construct or rate design were assumed.



DEP Legislative Recommendations

- Seven recommendations across a range of sectors including: Built Environment, Transportation, Fuels and Gas, Power Sector and Cross Cutting

- Aims to promote ideas that are either ready for legislative committee discussion, or where further development is needed.

- For each recommendation, outlines:
  - Key Policy Considerations
  - Connection to Criteria
  - Existing Examples
  - Connections to Recommended Strategies

Legislative Recommendations

Building Energy Code Reform

- Amends processes related to energy code renewals.
- Seek to limit the effects of resistance in delaying or denying code upgrades.
- Rules in New Jersey, Maryland, and Virginia have led to faster adoption of energy codes.
- Aligned with Strategy B1, Building Codes.

Enable Community Solar

- Authorizes community solar in the commonwealth.
- A range of different methods exist to implement community solar, including changes to net metering and/or utility ownership restrictions.
- Recommends measures to increase low-and-moderate income participation, use instate labor, and site projects on abandoned mine lands, brownfields, large rooftops, or other lower value lands.
- Every state in the Mid-Atlantic and New England has enabling legislation, many have active programs and projects.*
- Aligned with Strategies P1 and B5.

*https://www.energy.gov/eere/solar/community-solar-basics

DEP Legislative Recommendations

Zero-Emissions Vehicle Targets

- Sets targets for ZEV adoption throughout the commonwealth and supporting vehicle markets as they move to decarbonize.
- Considers ZEV percentages of sale for 2030 and 2050 to fit within transportation space and could include technology specific goals (ie: battery electric), or technology neutral goal.
- Targets in Michigan, Texas and a range of other states.
- Aligned with Strategies T2 and T3.

Low Carbon Fuel Standard

- Transportation focused program to reduce emission.
- LCFS is a technology agnostic, market-based method to reduce GHG emissions through a credit market that incentivizes the use of lower-carbon fuels.
- Incentivizes the least-cost achievement of the targeted carbon intensity.
- Programs exist in California, Oregon and Washington.
- Aligned with Strategies T3, F2 and C1.

DEP Legislative Recommendations

Pennsylvania Reliable Energy Sustainability Standard

- PRESS requires Pennsylvania to get 50% of its electricity from a diverse range of energy resources by 2035, including:
  - 35% from current and future clean energy sources, like solar, wind, small modular reactors, and fusion,
  - 10% from sustainable sources like large hydropower and battery storage, and
  - 5% from low emission forms of natural gas and other alternative fuels.
- Incentivizes the least-cost achievement of the targeted carbon intensity baseline.
- Similar to PA's AEPS and programs in NJ, MD, and DE.
- Aligns with Strategy P1 and B5.

Pennsylvania Climate Emissions Reduction

- PA Specific cap-and-invest program focused on reducing emissions through its own credit auction for carbon emissions.
  - 70% of the program proceeds will go toward electric bill rebates for ratepayers. The remaining 30% will support projects that reduce air pollution and other policy objectives in PA.
- Similar to programs in MA, CA and NY
- Aligns with a range of strategies outlined in the CAP.

DEP Legislative Recommendations

Hydrogen & CCUS

- Incentives, regulation, and permitting of emerging technologies, such as hydrogen & CCUS.
- Emerging technologies, so there are limited examples, but significant potential.
- Aligned with Strategy C1 & C2.

Climate Action Plan Q&A and Discussion