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DEPARTMENT OF ENVIRONMENTAL PROTECTION

Energy Programs Office

Climate Change Advisory Committee Meeting

February 23, 2021

Tom Wolf, Governor

Patrick McDonnell, Secretary

Agenda

- **Introduction**
  - Approval of December minutes
- Summary of CCAC Feedback
- ICF Presentation on 2021 Climate IA
  - 2021 IA discussion
- Break (10 min)
- ICF Presentation on 2021 CAP
  - 2021 CAP discussion
- Public Comment (15 minutes)
- New Business
- Next Steps/Next meeting

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Tentative 2021 IA/CAP Review Timeline

Meeting Date	Materials	Shared w/ CCAC	Feedback Requested
2/23/2021	- Final IA with refined findings - Updated Draft CAP with supporting analysis information incorporated (GHG mitigation results, enabling technologies, adaptation pathways) - Initial economic and co-benefits information, as available	2/9/2021	3/2/2021
4/27/2020	- Draft Final CAP and supporting analysis information, including all near final economic and co-benefits analyses	4/13/2021	5/4/2021
6/22/2021	- Final CAP	6/15/2021	TBD (letters)

Outcomes of CCAC Dec. Feedback

Materials Provided for Review	Committee Members Who Provided Feedback	# of Written Comments and Questions
2021 Impacts Assessment Draft Final	7	Written – 39
2021 Climate Action Plan Initial Draft	7	Written – 61
December 2020 Meeting Slides	2 written 8 verbal	Written – 12 Verbal ~ 23

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Outcomes of CCAC Dec. Feedback

Impacts Assessment:

- ***Feedback: Clarify and add information about how much climate change has already impacted Pennsylvania since the "baseline" period (1970-2000).***
  - **Resulting changes:** Explained the extent of climate changes that the Commonwealth has experienced from 2000 to 2020. Added observed trends for increasing temperature, increasing annual precipitation, and changing drought conditions.
- ***Feedback: Discuss projected changes in snowfall.***
  - **Resulting changes:** Added information on projected changes in snowfall to the section on projected changes in precipitation.

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Outcomes of CCAC Dec. Feedback

Impacts Assessment:

- ***Feedback: Ensure definition of impact considers positive and negative impacts.***
  - **Resulting changes:** Revised definition of climate hazard (which was already correct in one place in the report) to remove mention of potential to cause harm.
- ***Feedback: Reconsider scoring for some hazard consequence category pairs.***
  - **Resulting changes:** Several changes were made in the IA, which include:
    - Raised the rating for flooding's impact on built infrastructure
    - Increased the rating for the impact of cyclones on extra-tropical and tropical cyclones on recreation and tourism and forests, ecosystems, and wildlife
    - Clarified the score for the impact of sea level rise on the economy

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Outcomes of CCAC Dec. Feedback

Climate Action Plan:

- ***Feedback: Requests for additional breakouts of the GHG inventory (e.g., subsectors and gases).***
  - **Resulting Changes:** A number of changes were made in the CAP, which include:
    - The inventory graphics split energy supply fugitive emissions from other industrial emissions.
    - The GHG inventory report is referenced for additional information.
    - Discussion is added in the GHG inventory to provide additional details about sector and subsector emissions (e.g., for oil and gas fugitive emissions and coal mining emissions, and other industrial emissions including quantified metrics).
    - Discussion is added into the inventory section on what is covered by industrial and fugitive emissions sectors, including which market segments are included in the estimates)
    - Where specific gases are addressed in the inventory (e.g., high global warming potential industrial process emissions or methane from oil and gas systems) this is noted. Each GHG reduction strategy also includes a note on which GHGs are reduced through the strategy.

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Outcomes of CCAC Dec. Feedback

Climate Action Plan:

- ***Feedback: The largest generating source has shifted from 2017, and this was not apparent in the GHG Inventory and BAU discussion.***
  - **Resulting Changes:** The CAP now includes as sentence that reiterate the data are historical and have and will continue to change, leading into a new section in the BAU discussion which shows and discussions how the generation mix changes over time. Discussion on historical changes about generation shifts and related emissions reductions were also clarified.
- ***Feedback: The nuclear phase out in the BAU does not seem reasonable.***
  - **Resulting Changes:** DEP and the modeling team analyzed this further and provided additional detail in the CAP around what is driving the replacement of nuclear with natural gas.

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Outcomes of CCAC Dec. Feedback

Climate Action Plan:

- ***Feedback*: *The CAP should discuss and incorporate the impacts of COVID-19.***
  - **Resulting Changes:** DEP and the modeling team have determined to not incorporate the impacts of COVID-19 in the modeling at this point in time given 1) The lack of robust data (e.g., COVID is not even a year in, we do not know how long it will last or the lasting impacts), and 2) The high level of uncertainty. The CAP has an expanded section on COVID-19 now though which discussions job impacts, health impacts, etc. as referenced and found in news and other studies. This CAP also references incorporating COVID-19 impacts in modeling for the 2024 CAP when data is more certain and robust.

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Outcomes of CCAC Dec. Feedback

Climate Action Plan:

- ***Feedback*: *Explain how a low carbon fuel standard is different than the Transportation and Climate Initiative.***
  - TCI and LCFS are different programs – LCFS is aimed directly at reducing the carbon content of transportation fuels, TCI is a cap and invest program. Both are separate programs that would operate differently. TCI isn't off the table for Pennsylvania at this point in time – the Commonwealth is involved in the development, outreach, and engagement of the program. Because Pennsylvania is not acting on TCI in immediate also does not other options to address the emissions from the third largest sector in Pennsylvania and the largest in the region/nation are not being evaluated.

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2021 Pennsylvania Impacts Assessment and Climate Action Plan

CCAC Meeting February 23, 2021

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Agenda

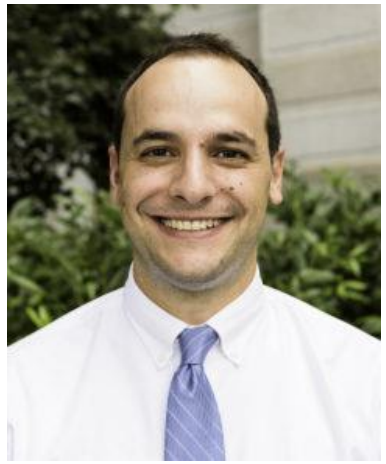
- Updates on Impacts Assessment
- Updates on Climate Action Plan
- Next Steps

Today's Presenters from ICF

Cassie Bhat
Impacts Assessment Lead

Deb Harris
Project Manager, CAP Lead

Bill Prindle
Sustainable Energy and Climate Expert



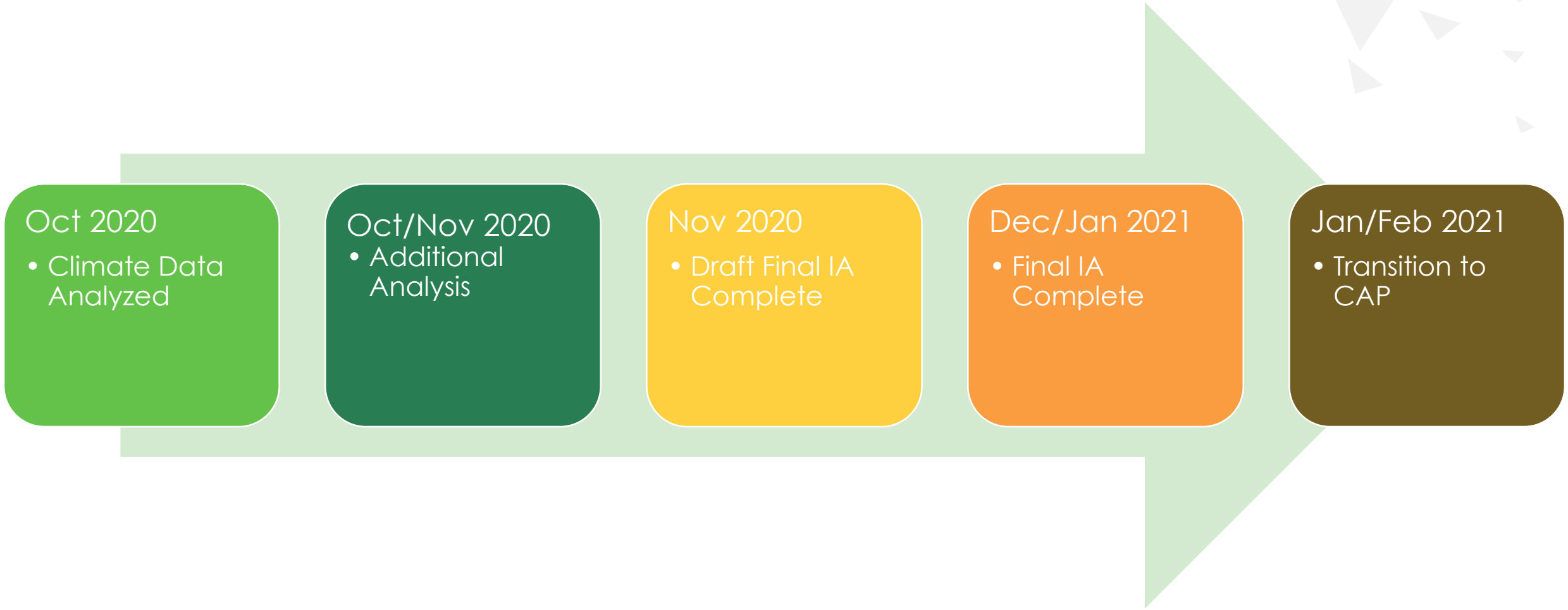
Adam Agalloco
Energy and Climate Expert

Impacts Assessment

Updates

- Updates
- Key findings
- Adaptation planning

Impacts Assessment Timeline



IA Updates

1) Incorporated feedback on final draft from CCAC and DEP

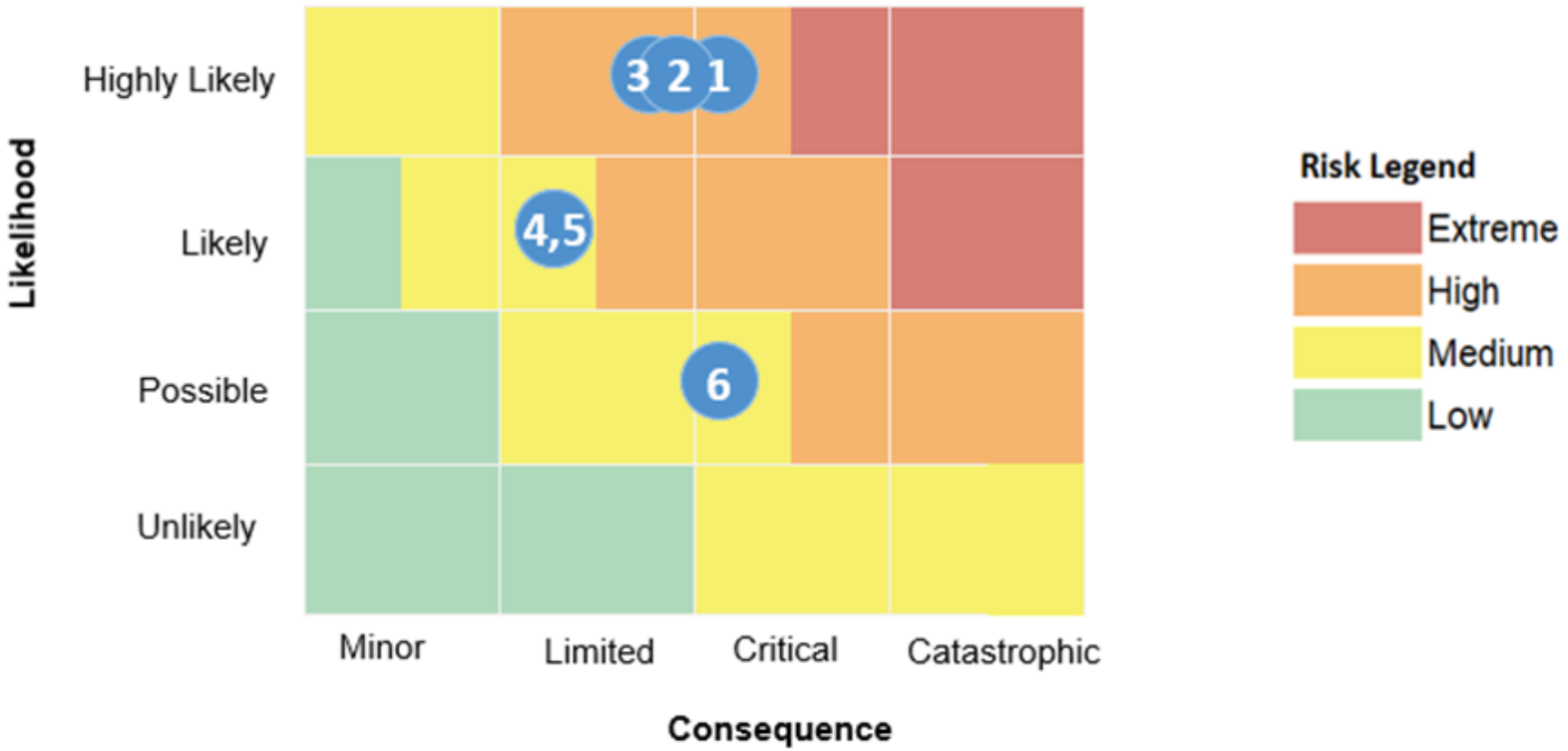
a) Bolstered health consequences sections

b) Updated flooding scores, which in turn made flooding the hazard with the highest risk scores currently

c) Added info on recently observed climate trends (e.g., 2000-2020), and climate change effects on sinkholes and landslides

2) Finalized IA

Final Risk Assessment Results for 2050



1 = Increasing average temperatures

2 = Heavy precipitation and inland flooding

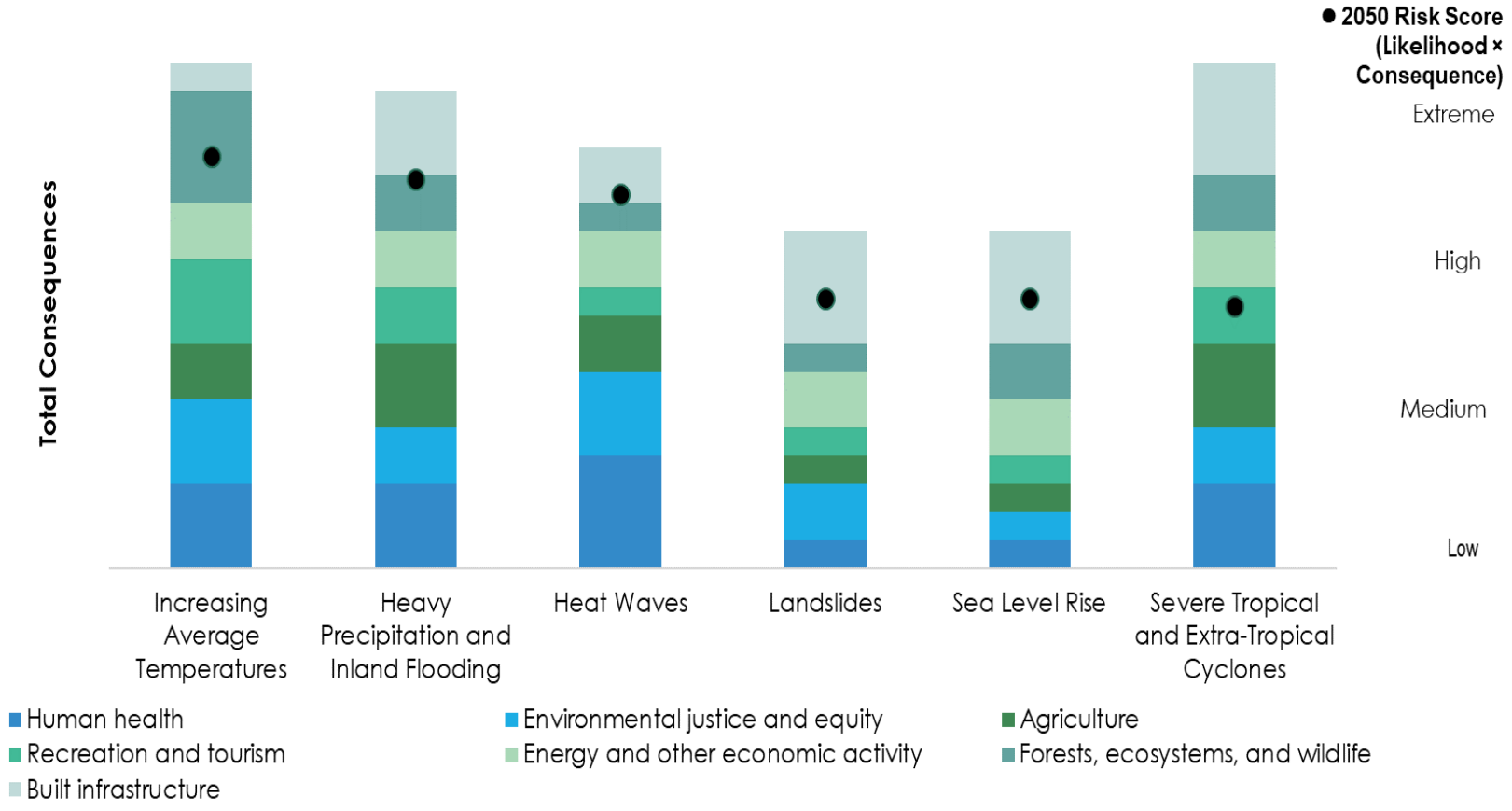
3 = Heat waves

4 = Landslides

5 = Sea level rise

6 = Severe tropical and extra-tropical cyclones

Final Risk Assessment Results for 2050



Key Findings – Risk Assessment

- **Flooding is currently the highest-risk hazard** facing Pennsylvania, and flood risks are projected to increase; at the same time, risks from **increasing average temperatures and heat waves** could rise to be as high as flooding is today by mid-century
  - Flooding from heavy rain events affects built infrastructure, human health, and agriculture, with ripple effects throughout the economy
  - Increasing average temperatures could affect nearly every aspect of life
- **Heat waves will become increasingly common** and will create particular health and economic risks for vulnerable populations
- **All hazards could affect public health negatively**—especially heat waves, increasing temperatures, and flooding
- **Climate change will not affect all Pennsylvanians equally**. Some may be more at risk because of their location (and inability to relocate), income, housing, health, or other factors
- **Landslides and sea level rise can cause severe impacts in the locations where they occur**, but pose relatively low risks statewide
- **Severe tropical storms, flooding, and landslides already pose risks**, and these could become more likely or severe in the future

Final Risk Assessment Results for 2050

	Human health	Environmental justice and equity	Agriculture	Recreation and tourism	Energy and other economic activity	Forests, ecosystems, and wildlife	Built infrastructure	Overall Risk Rating
Increasing average temperatures	12	12	8	12	8	16	4	10.7
Heavy precipitation and inland flooding	12	8	12	8	8	8	12	9.9
Heat waves	16	12	8	4	8	4	8	9.3
Landslides	3	6	3	3	6	3	12	5.6
Sea level rise	3	3	3	3	6	6	12	5.6
Severe tropical and extra-tropical cyclones	6	4	6	4	4	4	8	5.3

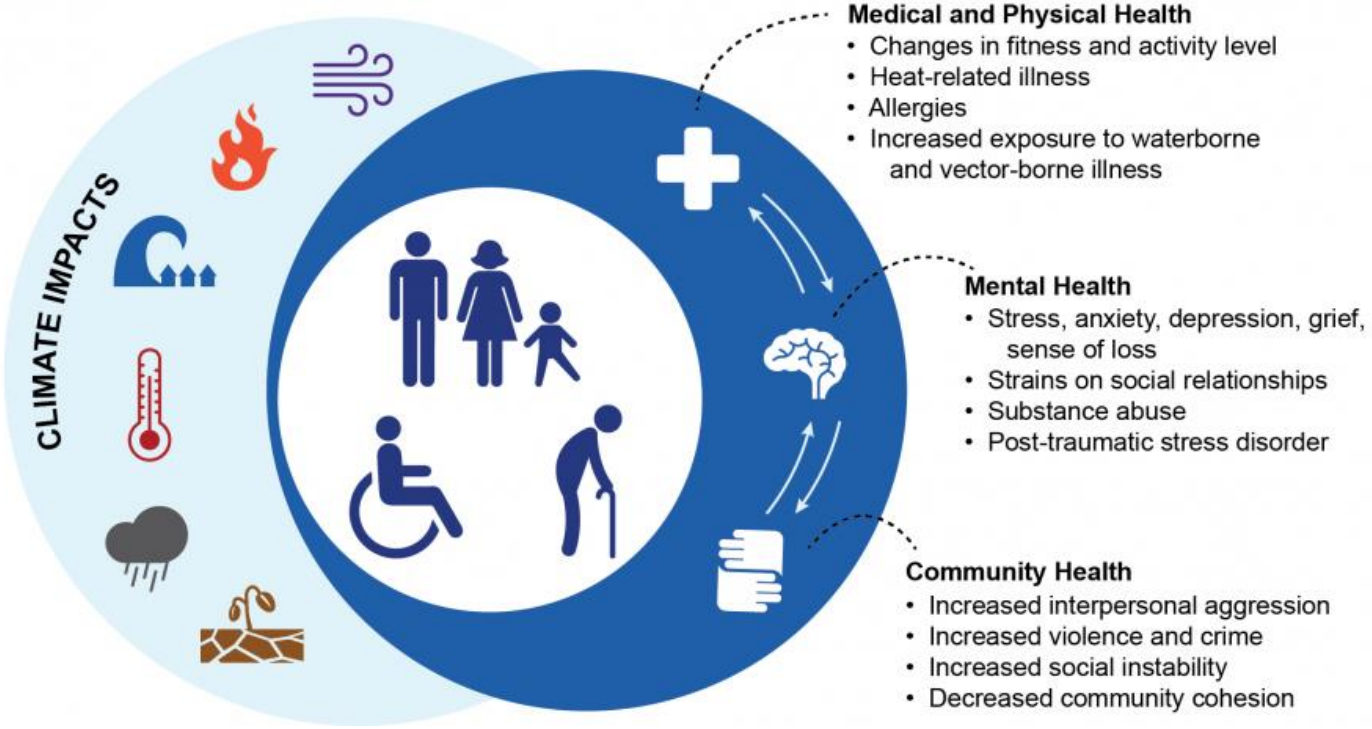
Impacts to human health are one of the greatest risks

Increasing average temperatures and heat waves are projected to increase:

- heat-related illnesses or deaths
- allergies
- violence and crimes
- anxiety and mood disorders

Flooding and severe cyclones can also have severe health impacts such as:

- disrupting critical services
- making conditions are more hazardous



Impacts to human health will not affect Pennsylvanians equally

Underlying health conditions, age, race, limited access to air conditioning, outdoor employment (e.g., farm labor or logging), and living in urban areas can all increase risk to heat-related health conditions

Populations at greater risk from heat include:

- The elderly
- Low-income communities
- Pregnant women
- Individuals with cardio-vascular disease
- Outdoor workers

Next Step: Begin adaptation planning in the CAP

- For each adaptation priority, develop an "adaptation pathway" – a recommended sequence of strategies to adapt to and prepare for climate change impacts
- Environmental justice and equity focus areas prioritize reducing impacts on already overburdened and vulnerable populations
- Adaptation priority areas by hazard and consequence category:
  - Primary focuses: health, environmental justice and equity, and built infrastructure
  - Primary hazards: increasing average temperature, heat waves, and flooding

1. Impacts of Increasing Average Temperatures and Heat Waves on Health

2. Impacts of Flooding and Storms on Health

3. Impacts of Increasing Average Temperatures on Environmental Justice and Equity

4. Impacts of Flooding on Environmental Justice and Equity

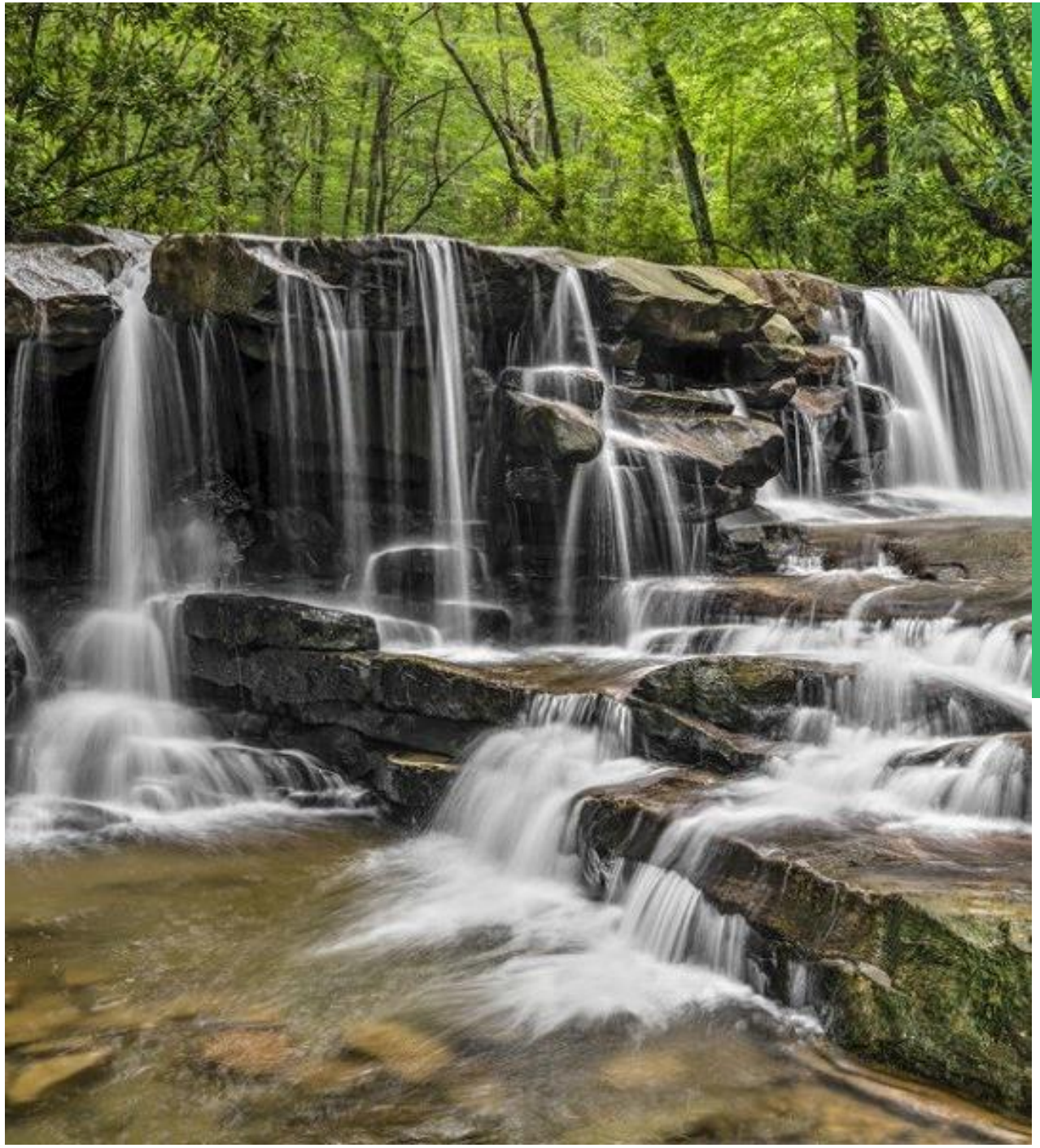
5. Impacts of Increasing Average Temperatures on Forests, Ecosystems, and Wildlife

6. Impacts of a Warmer and Wetter Climate on Agriculture

7. Impacts of Increasing Average Temperatures on Recreation and Tourism

8. Impacts of a Changing Climate on Built Infrastructure

9. Impacts of Landslides on Built Infrastructure



Discussion

Break (10 min)

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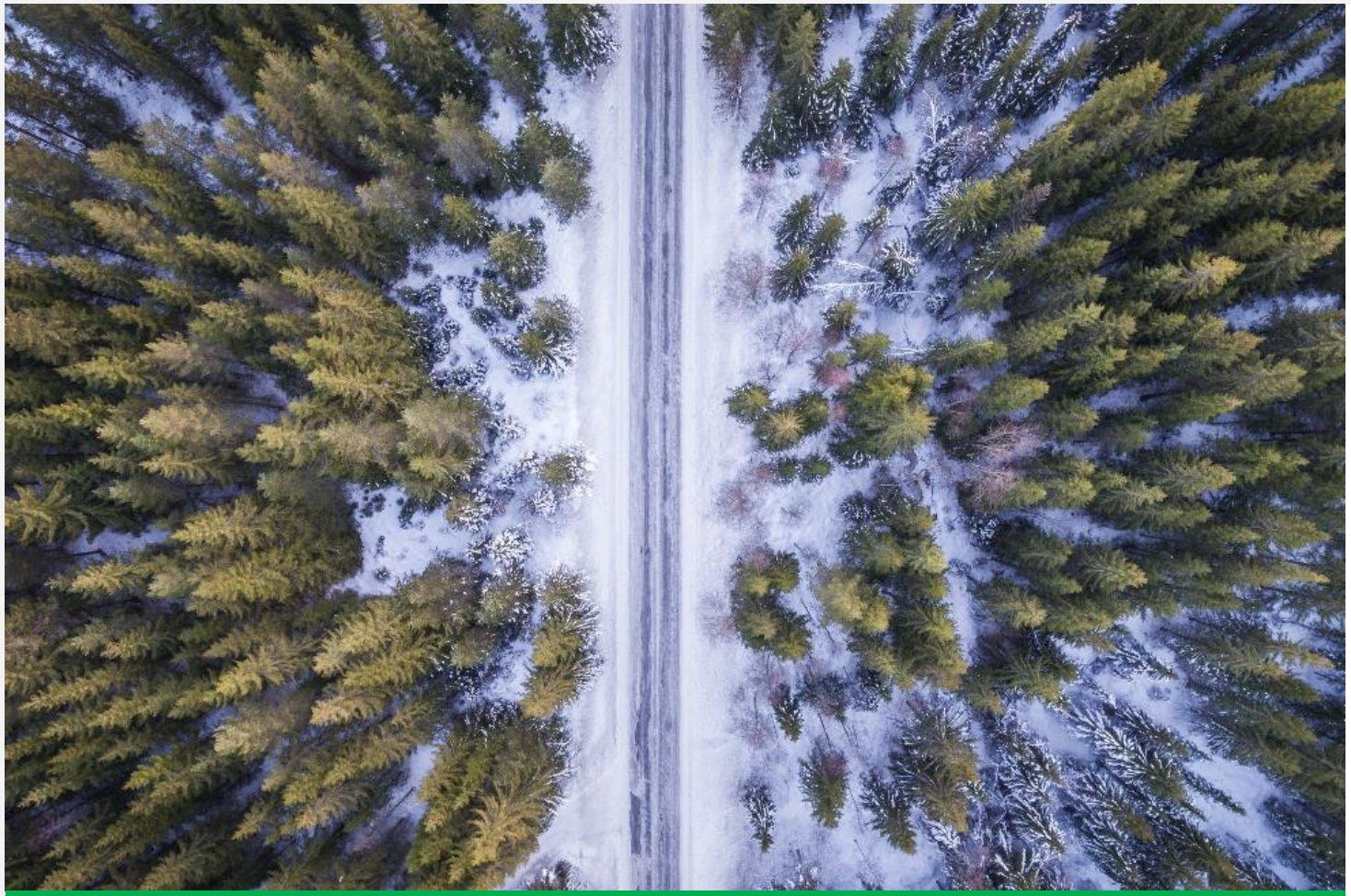
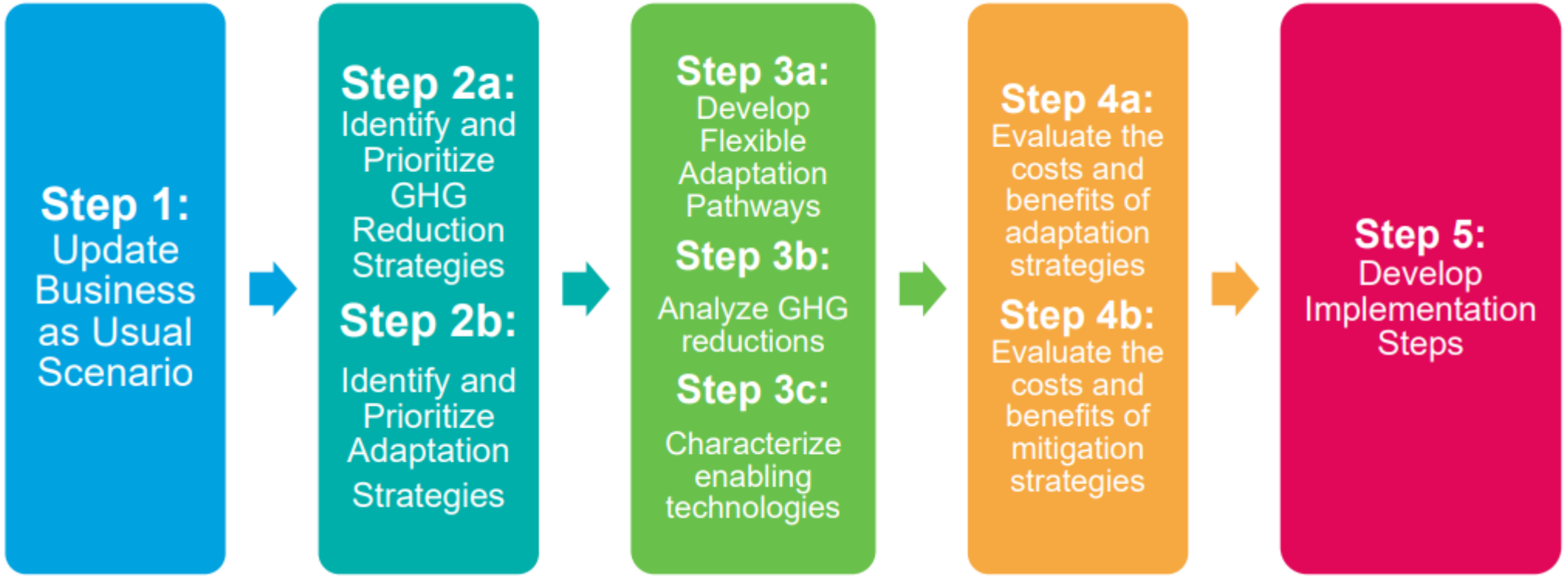


Climate Action Plan

Updates

- Overview of Updates
- Integration from IA
- BAU
- GHG Reduction Strategies
- Next steps

Climate Action Plan: General Approach



CAP Updates

1) Reviewed and addressed CCAC feedback as determined with DEP

2) Began integrating Impacts Assessment results into the CAP

3)Modeled a draft scenario to outline a path to achieve 80% GHG emission reductions by 2050 and began cost modeling

4) Further developed the CAP draft

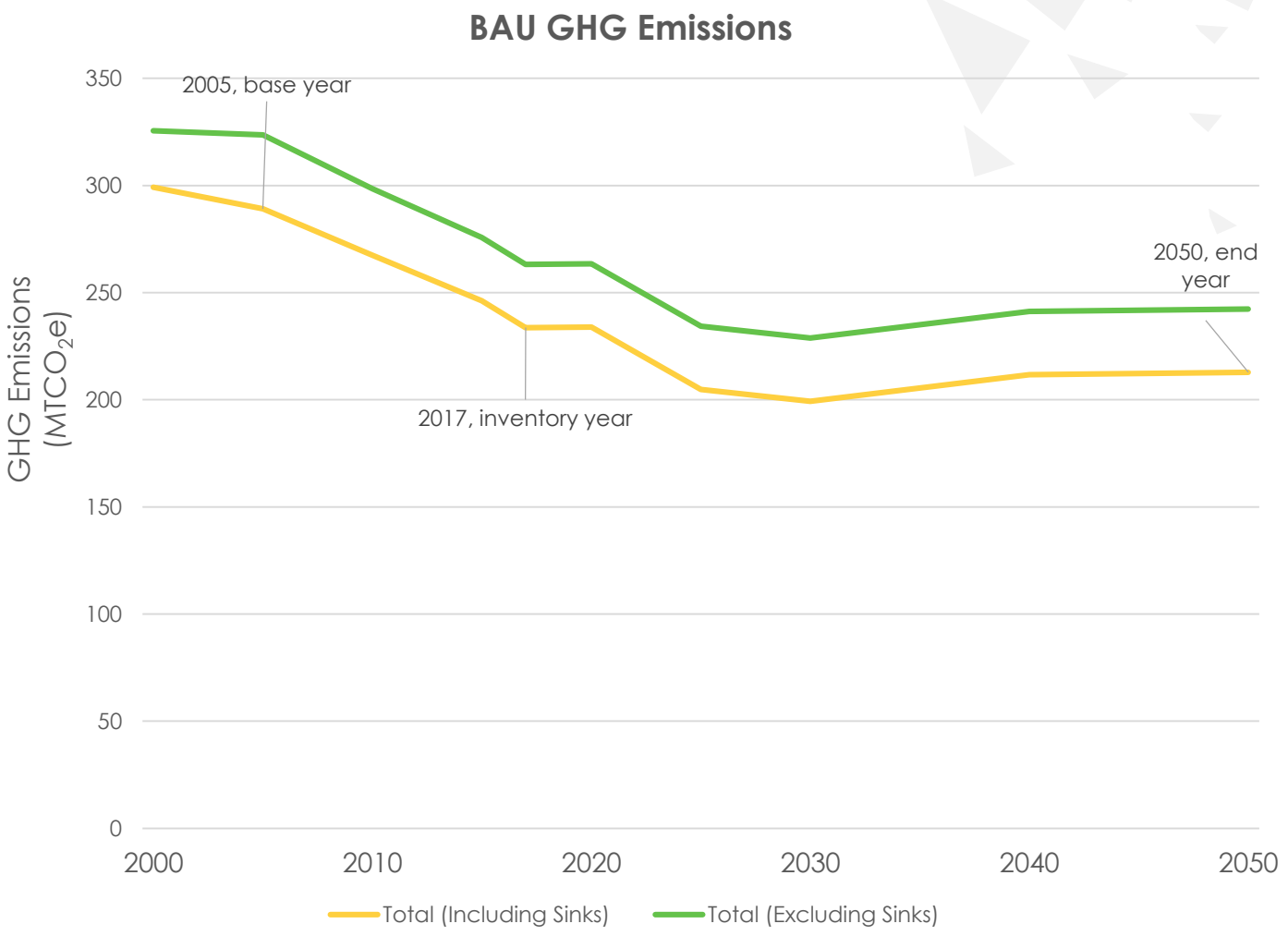
Begin adaptation planning in the CAP

- For each adaptation priority, develop an "adaptation pathway" – a recommended sequence of strategies to adapt to and prepare for climate change impacts
- Adaptation priority areas by hazard and consequence category:
  - Primary focuses: health, environmental justice and equity, and built infrastructure
  - Primary hazards: increasing average temperature, heat waves, and flooding

1. Increasing average temperatures risk to health	2. Increasing average temperature risk to environmental justice and equity	3. Increasing average temperature impacts to forest, ecosystems, and wildlife	4. Increasing average temperature and flooding impacts to agriculture	5. Increasing average temperature impacts to recreation and tourism
6. Heat waves risk to health	7. Heat waves disproportionate impacts related to environmental justice and equity	8. Flooding impacts to environmental justice and equity	9. Flooding impacts to built infrastructure	10. Landslides impacts to built infrastructure

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, and these programs are carried through to 2050
- Pennsylvania will achieve its 2025 reduction goal but will not meet the 2050 goal (80% reduction from 2005 levels)
- Emissions are projected to decrease 26% by 2050 from 2005 levels – this equates to net emissions of 212.82 MT CO_2e
- The projected decrease in emissions is driven largely by the market transition to natural gas-based electricity generation and reduced energy demand. These will not be enough though to continue a decreasing emissions trend.

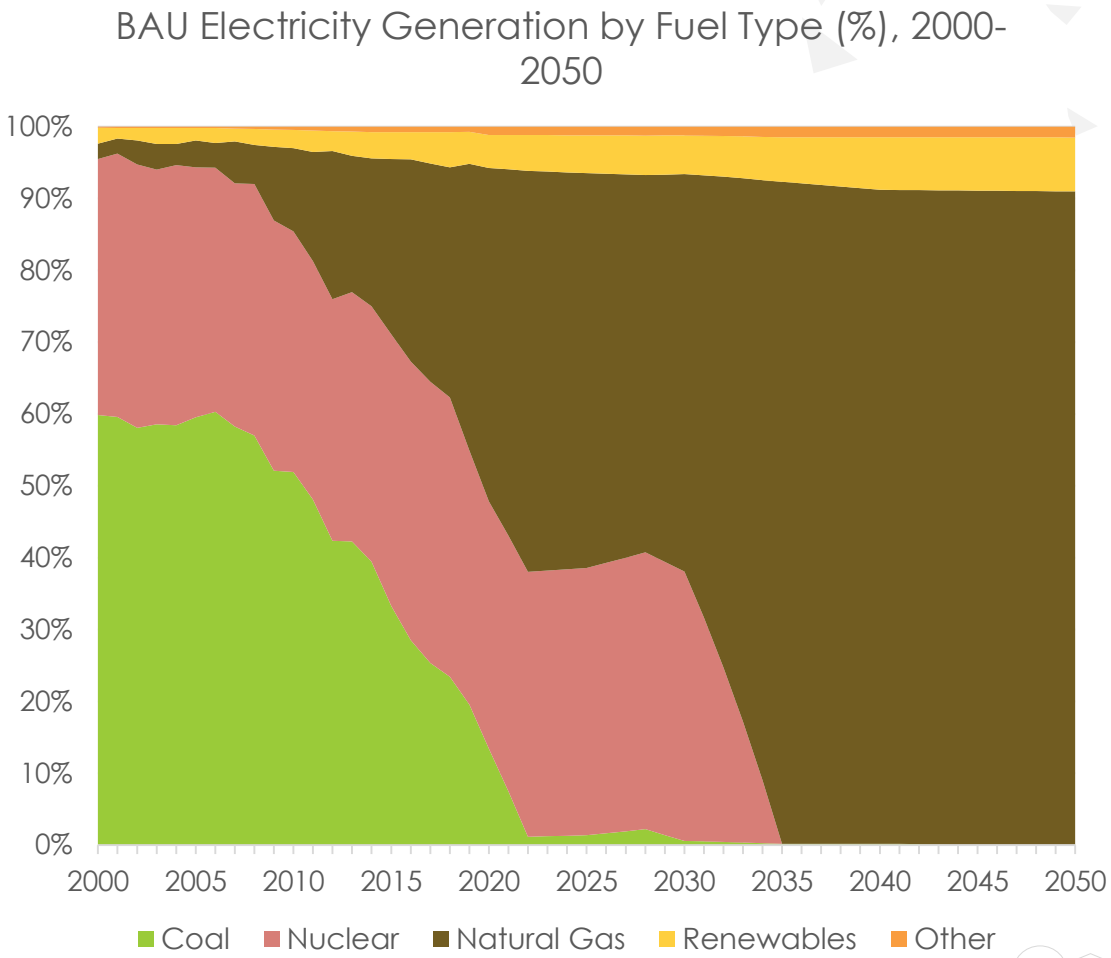


GHG Inventory and BAU Updates

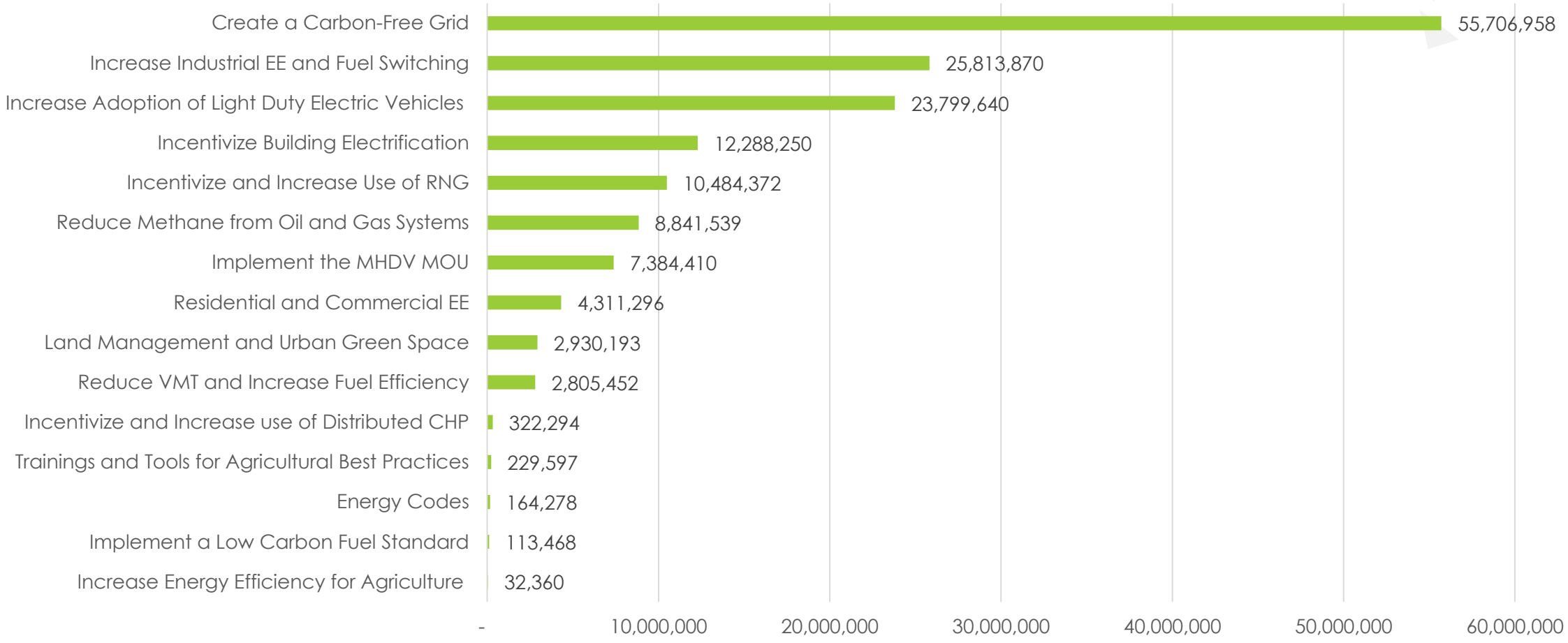
- Added discussion around what industrial emissions are comprised of in the CAP
- Provided a breakout of emissions from oil and gas production as available in the SIT
- Added reference to the GHG inventory report so readers can find additional information
- Further analyzed and provided more information on electricity generation trends
- To create consistency with the strategy section of the CAP:
  - Added qualitative information in each strategy about what types of GHGs are being reduced
  - Added information in each strategy about industry segments that are being addressed (mainly in the strategy on reducing methane from oil and gas systems)

BAU In-State Electricity Generation Trends

- Early emissions savings were a result of the switch from coal to natural gas, mainly between 2000 and 2015
- After 2035, BAU modeling projects nuclear retirements, replaced with NGCC
  - Primary driver is low power prices, driven by low gas prices in Pennsylvania
  - The RGGI 2030 cap is held constant, but the prices are not significant enough to provide material support to nuclear units
  - Without the RGGI cap in place more of the nuclear backfill may have been met by increased in-state gas generation, raising emissions even higher
- Emissions for the electricity sector hit their lowest projected levels between 2030 and 2035, followed by increases through 2050



GHG Reductions from Strategies in **2050**, Compared to BAU ($MTCO_2e$)



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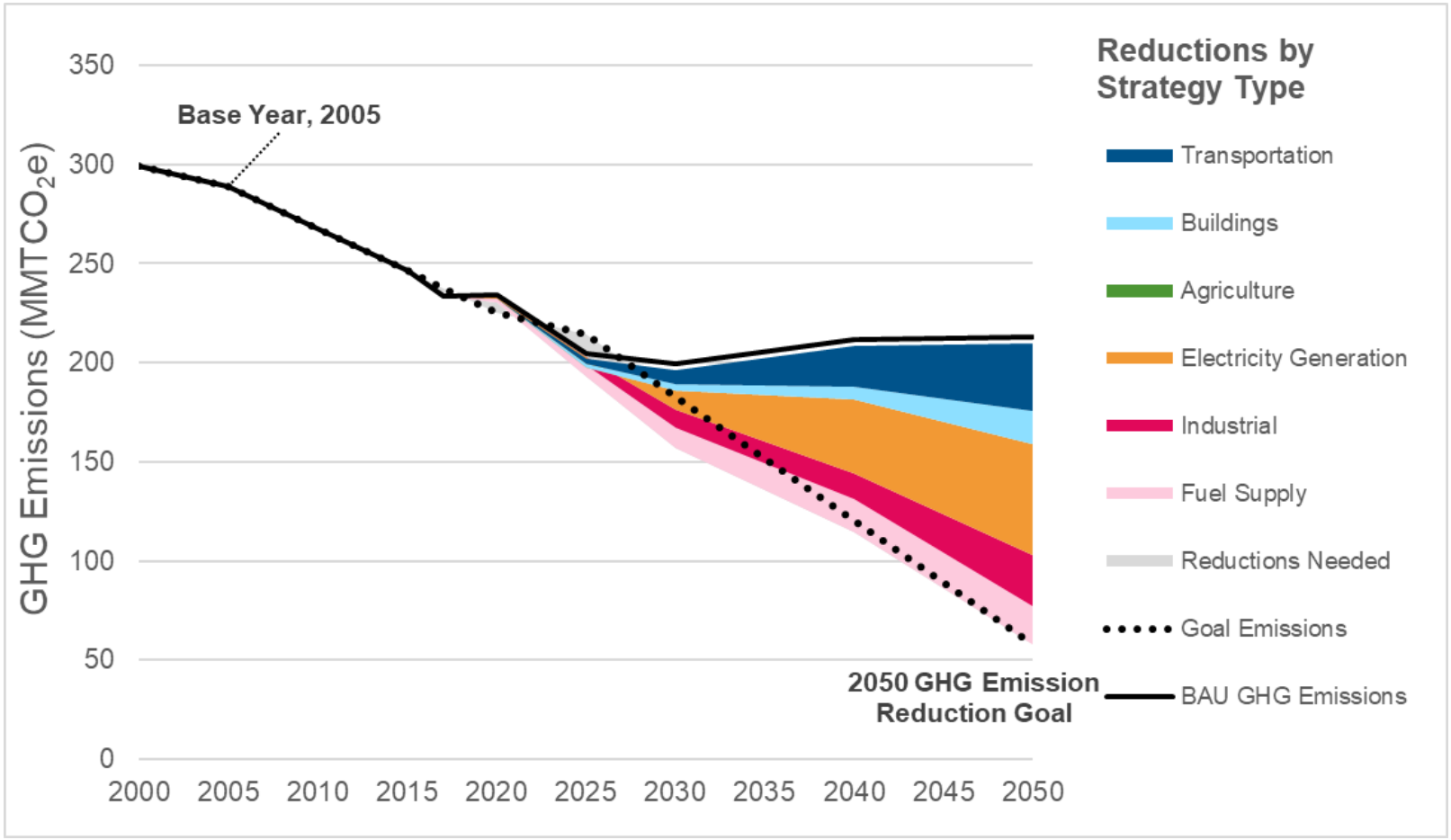
Note that this chart excludes strategies for which emissions reductions are not estimated. Reductions associated with electricity consumption are not included.

GHG Reductions from Strategies – Pathway to Achieve 80% Reduction in 2050



Note that this chart excludes strategies for which emissions reductions are not estimated. Reductions associated with electricity consumption are not included.

Initial Insights

- The reductions estimate represent a *potential pathway* or options to reduce emissions by 80% from 2005 in 2050; these are not the only options to reduce GHG emissions
- The reductions estimated do not represent specific policy recommendations, instead a suite of options that when considered together reduce emissions by 80% from 2005 in 2050 and contain a lot of the components needed for deep reductions
- Like other studies and growing consensus, a decarbonized grid and energy supply, along with fuel switching are large potential driver of reductions, but a full suite of options is needed

Initial Insights

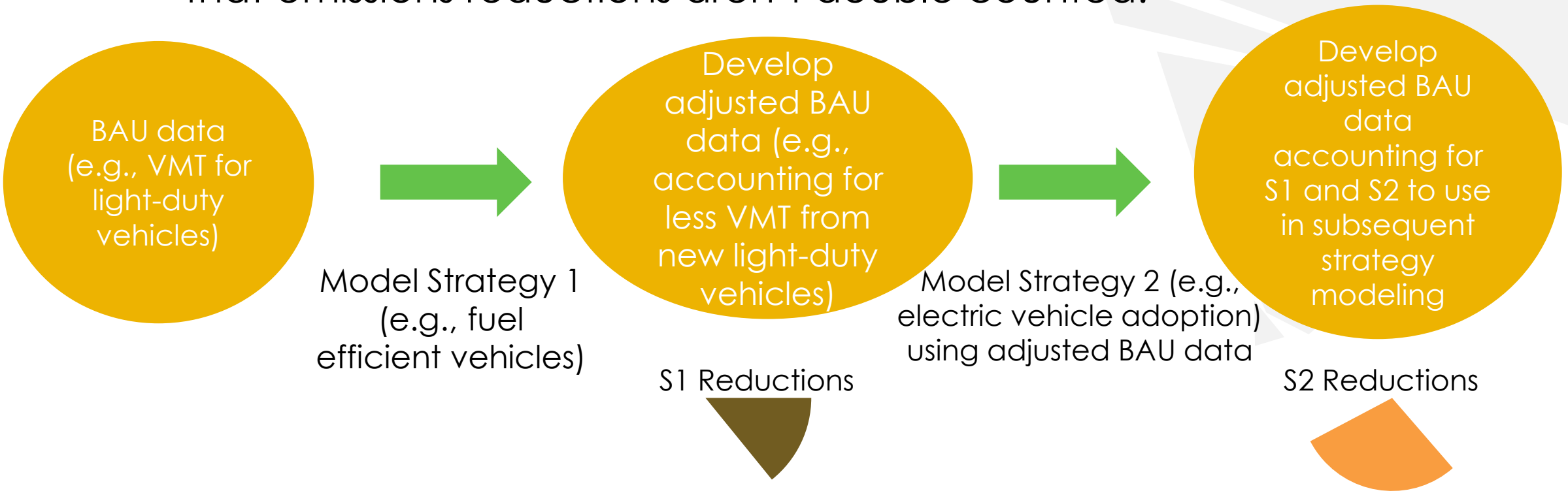
- 30% of the total reductions from 2005 to 2050 are driven by reductions seen in the BAU, mainly from the shift from coal to natural gas electricity generation and increased efficiency in buildings and cars seen in earlier parts of the time series
- 70% of total reductions from 2005 to 2050 are as a result of actions between 2018 and 2050
- Deep reductions are needed across all sectors (see table)
  - Energy supply needs to be decarbonized, both through low or no carbon gases and carbon-free electricity
  - Efficiency needs to be a part of the solution
  - Innovation and changes in the industrial sector are required
  - Fuel switching (e.g., fuel oil to gas or electrification), particularly for transportation and the buildings sector plays a major role in reductions

Sector	Modeled Reductions (2005-2050)
Transportation	77%
Buildings	65%
Electricity Generation	100%
Agriculture	1%
Fuel Supply*	83%
Industrial	29%
LULUCF**	-6%

*Includes RNG
**Represents a 6% decrease in sequestration

How to Interpret Results

Strategy Layering: Layering adjusts the BAU data to ensures that emissions reductions aren't double counted.



Total Reductions = S1 Reductions + S2 Reductions

Additional Assumptions to Chart Path to 80% Reduction in 2050

- To chart a path to 2050, additional levers needed to be pulled in the modeling
- Energy efficiency improvements for the industrial sector were not enough, DEP and ICF also analyzed a new strategy on fuel switching for industrial, including
  - Pushed on efficiency assumptions
  - Considered fuel switching from fuel oil to natural gas and very targeted electrification efforts (based on Renewable Thermal Collaborative study)
- Implemented fuel efficiency increases for vehicles
- Decarbonizing energy supply
  - Increased aggressiveness of RNG supply assumptions (i.e., how much technical potential can be realized)
  - Driving additional reductions from power generation

Support Energy Efficiency through Building Codes

Description	Key Assumptions
Adopt the most current building codes, enforce existing codes, encourage local adoption of stretch codes, and educate and train code officials and inspectors on code enforcement. Work to educate municipalities on their ability to implement and require codes beyond the State Code including "stretch codes" such as IaCC, Zero Code and NetZero Codes.	**Residential Energy Savings:** • IECC 2015 base code • Future IECC code versions every six years through 2050 • 90% code compliance for all new construction homes with a 30-year measure life **Commercial Energy Savings:** • ASHRAE 2007 base code • Future ASHRAE code versions every six years through 2050 • 90% code compliance for all new construction, renovations, and additions with a 30-year measure life
Reductions from BAU in 2050	• **164,278 MTCO$_2$e* (CO$_2$, CH$_4$, N$_2$O)** • **654 GWH of electricity, and** • **2,975 Bbtu of gas**

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*GHG emissions associated with decreased electricity consumption from this strategy are not included in totals – a generation-based GHG accounting approach is used in line with the state inventory.

Improve Residential and Commercial Energy Efficiency (Electricity)

Description	Key Assumptions
Require increasing residential and commercial energy efficiency improvements targeted at kWh savings either within the existing Act 129 framework or a modified framework. Put in place a Building Performance Policy for all commercial buildings over 50,000 square feet, initially requiring facility ENERGY STAR benchmarking and ramping up to full retro commissioning requirement, beginning in 2033.	**Residential Electricity Savings:** • Annual maximum achievable potential energy savings from per year 2021-2050 (1.5%), based on the SWE Energy Efficiency Potential Study • Measure lifetime of 10 years **Commercial Electricity Savings:** • Annual maximum achievable potential from 2021-2025 (0.8%) followed by 1.0% annual incremental savings for years 2026-2050 • Benchmarking program is in place from 2021-2026, followed by a building retuning program from 2027-2032, and then a building retro-commissioning program starting in 2033 • Savings from these programs are 7%, 12%, and 20%, respectively, across all forms of energy
Reductions from BAU in 2050	**21,948 GWH***

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Improve Residential and Commercial Energy Efficiency (Gas)

Description	Key Assumptions
Create a new energy efficiency program focused on reducing gas consumption that is similar to the voluntary gas demand side management (DSM) programs already in place with some Pennsylvania gas utilities. Targets large commercial buildings through a gradually expanding Commercial Building Energy Performance Program. Also includes energy benchmarking of large facilities, and retro-commissioning or energy efficiency requirements and an allocation of a certain portion of funds for LMI individuals, and reform cost-effectiveness tests, e.g., by adding climate mitigation and resilience benefits to the tests.	**Residential Gas Savings:** • 1.1% annual incremental natural gas savings from 2020-2025 followed by 1.0% annual incremental savings from 2026-2050 (based on the Massachusetts EERS target • Measure lifetime of 10 years **Commercial Electricity Savings:** • Same approach as used for residential The analysis team used the same approach used for residential gas savings, with savings percentages mirroring electricity
Reductions from BAU in 2050	**4,311,296 MTCO$_2$e (CO$_2$, CH$_4$, N$_2$O)** **80,973 Bbtu of gas**

Incentivize Building Electrification

Description	Key Assumptions
Incentivize building electrification (e.g., heating and hot water). Create a new energy efficiency program focused on beneficial electrification, possibly modeled on the New York Clean Heat program. Incentivize converting fuel oil and natural gas to electricity in existing buildings and electrification of entire new buildings where there are large natural gas infrastructure costs or where fuel oil is the alternative.	• Set share of residential and commercial buildings will be retrofitted with electric heating at least by 2050, • Set share of new residential and commercial buildings will be all-electric by 2050

Sector	Existing Buildings	New Buildings
Residential Single Family	75%	90%
Residential Multi-Family	60%	80%
Commercial	50%	75%

Reductions from BAU in 2050	**12,288,250 $MTCO_2e$* (CO_2, CH_4, N_2O)** **-181,905 GWH of electricity *(increase)*** **222,699 Bbtu of gas**

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*GHG emissions associated with decreased electricity consumption from this strategy are not included in totals – a generation-based GHG accounting approach is used in line with the state inventory.

Increase Fuel Efficiency for Light-Duty Vehicles and Reduce Vehicle Miles Traveled for Single-Occupancy Vehicles and

Description	Key Assumptions
Reduce vehicle miles traveled (VMT) for single-occupancy vehicles by implementing travel demand strategies such as shifting travel time, mode choice, and route, and increasing the frequency of telecommuting. Paired with land-use and development policies that promote sustainable transportation modes (walking, biking, transit, carpool) and development in existing population centers. Includes increased fuel efficiency standards.	• VMT reduction target of 3.4% by 2030 and 7.5% of total VMT from BAU by 2050 • 20% improvement for light-duty vehicles between 2026 and 2050 beyond the existing CAFÉ standards in place today
Reductions from BAU in 2050	**2,805,452 MTCO$_2$e (CO$_2$, CH$_4$, N$_2$O)** **38,573 Bbtu of gasoline**

Implement the Multi-State MDHV MOU

Description	Key Assumptions
Implement the medium- and heavy-duty vehicles memorandum of understanding (MHDV MOU) with the goal of reaching net zero emissions from MHDVs by 2050, of which the State of Pennsylvania is a co-signatory. Achieved through a mix of fuel switching to electric and other alternative fuel vehicles and would eliminate vehicles that have a disproportionate impact on air quality due to diesel emissions and/or that have a relatively low fuel economy.	• 30% of new medium- and heavy-duty vehicles will be alternative fuel vehicles by 2030, and 100% of new medium- and heavy-duty vehicles will be alternative fuel vehicles by 2050 • Aligns with Pennsylvania's commitment in the MHDV MOU
Reductions from BAU in 2050	**7,384,410 MTCO$_2$e by 2050* (CO$_2$, CH$_4$, N$_2$O)** **91,732 Bbtu of distillate fuel oil** **-6,132 GWh of electricity *(increase)***

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*GHG emissions associated with decreased electricity consumption from this strategy are not included in totals – a generation-based GHG accounting approach is used in line with the state inventory.

Increase Adoption of Light Duty Electric Vehicles

Description	Key Assumptions
Increase adoption of light-duty electric passenger vehicles (including private and municipal fleet vehicles) by following the EV Roadmap, using a ZEV mandate, providing education and outreach, and offering additional or modified incentives through AFIG, AFV, and the Driving Pennsylvania Forward program. Includes approaches for reaching low-income communities, multi-family units, and workplaces.	• EVs will represent 20% of on-road light-duty by 2030, rising to 70% by 2050 • Based on the Pennsylvania DEP Pennsylvania Electric Vehicle Roadmap report, with consideration for the current market share
Reductions from BAU in 2050	**23,799,640 MTCO_2e* (CO_2, CH_4, N_2O)** **327,301 Bbtu of gasoline** **-33,178 GWH of electricity *(increase)***

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Implement a Low Carbon Fuel Standard

Description	Key Assumptions
Program focused on decreasing the carbon intensity of transportation fuels and provide an increased supply and range of alternative fuels through a system of credits, similar to the California LCFS Program. Expands on the ethanol and biodiesel requirements already in place in Pennsylvania.	• 8% and 20% carbon intensity reduction targets by 2030 and 2040, respectively • Total fuel consumption was assumed to be equivalent to BAU fuel consumption
Reductions from BAU in 2050	**113,468 MTCO$_2$e* (CO$_2$, CH$_4$, N$_2$O)** **1,866 Bbtu of distillate fuel oil** **-476 GWH of electricity *(increase)***

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Increase Industrial Energy Efficiency and Capitalize Opportunities to Switch Fuels

Description	Key Assumptions
Leverage existing programs from DEP (e.g., the Energy Efficiency, Environment, and Economics [E4] Initiative) and the types of actions outlined in the Clean Energy Program Plan developed by DEP's Energy Programs Office. Includes a focus on specific industries or sizes of industries, but also leverage broader tools such as virtual trainings and expanded partnerships to reach smaller and hard to access industries.	• 25% energy efficiency potential, ramped up to 2050 with a lifetime of 10 years • Fuel oil transitioned to natural gas for 80% of the total fuel oil use by 2050 • Electrification of industrial natural gas use was applied for 20% of total natural gas use by 2050
Reductions from BAU in 2050	**25,813,870 MTCO$_2$e* (CO$_2$, CH$_4$, N$_2$O) 7,467 GWH of electricity, and 407,242 Bbtu of gas**

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Increase Production and Use of Biogas/Renewable Gas

Description	Key Assumptions
Increase the production and use of biogas/renewable gas from sources such as coal mines, agriculture, wastewater, and landfills. Fuels will be supplied through the existing pipeline network.	• Use 75% of the technical potential of various feedstock options for biogas and renewable gas from an evaluation conducted for the American Gas Foundation in 2019 • Thermal gasification feedstocks are not available in the analysis team's modeling until 2030 • WWTP feedstocks for RNG are used in direct CHP applications • Majority of available RNG supply will be injected into the pipeline to decarbonize the gas supply in Pennsylvania
Reductions from BAU in 2050	**10,484,372 MTCO$_2$e (CO_2, CH_4, N_2O)**

Incentivize and Increase Use of Distributed Combined Heat and Power (CHP)

Description	Key Assumptions
Incentivize and increase the use of distributed CHP with microgrids, particularly for high-value applications such as industrial applications or building campus-style settings.	• Opportunities to use CHP potential and expected adoption according to economic factors, utility incentives, and technical potential for new CHP installations in Pennsylvania, referenced from ICF's CHP Technical Potential Database • Opportunities focus on critical facilities, such as hospitals and other health care facilities and industrial applications
Reductions from BAU in 2050	**322,294 $MTCO_2e$*** **8,764 GWH of electricity** **-48,906 Bbtu of gas *(increase)***

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Reduce Methane Emissions Across Oil and Natural Gas Systems

Description	Key Assumptions
Practices to reduce methane emissions from upstream and midstream oil and gas operations. Reflects reductions of methane emissions as a co-benefit of the ongoing rulemaking to curb VOC emissions from oil and gas operations. Includes voluntary mitigation technologies that would be implemented across operations to further reduce methane emissions beyond regulatory requirements	• Used a DEP methane analysis which quantified reductions using a base year of 2017 • Utilized oil and gas company data, provided through DEP's Air Emissions Report, and assumptions which determine expected reduction impacts from the implementation of the proposed regulations on individual emission sources • Conventional estimates were assumed to match that of unconventional sources
Reductions from BAU in 2050	**8,841,539 $MTCO_2e$ (CH_4)**

Create a Carbon Emissions Free Grid (Includes Nuclear)

Description	Key Assumptions
Increase Alternative Energy Portfolio Standard (AEPS) to achieve a carbon free grid. Tier 1 targets and the solar carve are expanded, and additional eligible sources are added including nuclear, storage, and fossil with carbon capture and sequestration; Tier 2 sources are maintained.	• The solar carve is in line with the Finding Pennsylvania's Solar Future Plan initially, and then will go beyond it in 2030 through 2050 • Generation for other eligible renewables from 2020 through 2050 were developed using IPM, which optimizes on cost • All solar AECs for solar and Tier 2 resources come from in-state generation • 80-year lifetime extensions for nuclear power plants currently in operation; all plants currently in operation would stay online through 2050 at least with this extension • The RGGI cap is held constant at 2030 levels
Reductions from BAU in 2050	**55,706,958 MTCO$_2$e (CO_2, CH_4, N_2O)**

Use Programs, Tools, and Incentives to Increase Energy Efficiency for Agriculture

Description	Key Assumptions
Offer programs, tools, and incentives to increase energy efficiency for agricultural end uses such as refrigeration, ventilation, and lighting. This strategy will build off recent EnSave report and strategies.	• Annual baseline farm energy consumption used data from EnSave report, which provides estimates for annual electricity and fuel usage for dairy, beef, poultry, swine, orchard, greenhouse, and crop farming • Selected energy efficiency strategies with the most potential for energy savings and emission reductions from EnSave's report such as implementing LED lighting and lighting controls, high efficiency circulation fans, wall insulation, etc
Reductions from BAU in 2050	**32,360 MTCO$_2$e* (CO$_2$, CH$_4$, N$_2$O)** **96 GWh of electricity, and** **256 BBtu of distillate fuel oil**

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Provide Trainings and Tools to Implement Agricultural Best Practices

Description	Key Assumptions
Provide trainings and tools to implement agricultural best practices, such as those focused on no-till farming practices, integrated farm management and conservation planning, and soil management. Practices could include rotational grazing, silvopasture, and organic and regenerative agricultural methods. Additionally, research crops that will be most appropriate for future climate conditions.	• Total agricultural acres planted in Pennsylvania will increase by approximately 2% annually • Percent of acres planted by crop is consistent with the average percent of acres planted by crop from 2011 to 2019 • Conventional tillage acres will transition to reduced tillage acres, and reduced tillage acres will transition to no-tillage acres • Emission reductions by crop/tillage practice are based on Pennsylvania's average share of acres planted by crop from 2011 to 2019.
Reductions from BAU in 2050	**229,597 $MTCO_2e$ (CO_2, CH_4, N_2O)** **75 BBtu natural gas, and** **237 BBtu of distillate fuel oil**

Land Management for Natural Sequestration and Increased Urban Green Space

Description	Key Assumptions
Expand forest and crop lands and improve soil management to sequester carbon naturally. This includes increasing urban green space.	• Carbon sequestration potential was evaluated for two types of land: abandoned mine land and marginal croplands. For each land-use, two forest types were quantified: oak-hickory and maple-beech-birch • Modeling is based on the oak-hickory scenario, as most of the mining land in Pennsylvania occurs within this forest habitat • Future updates will be made to evaluate the specific breakdown of forest types in PA
Reductions from BAU in 2050	**2,930,193 MT CO_2**

Next Steps

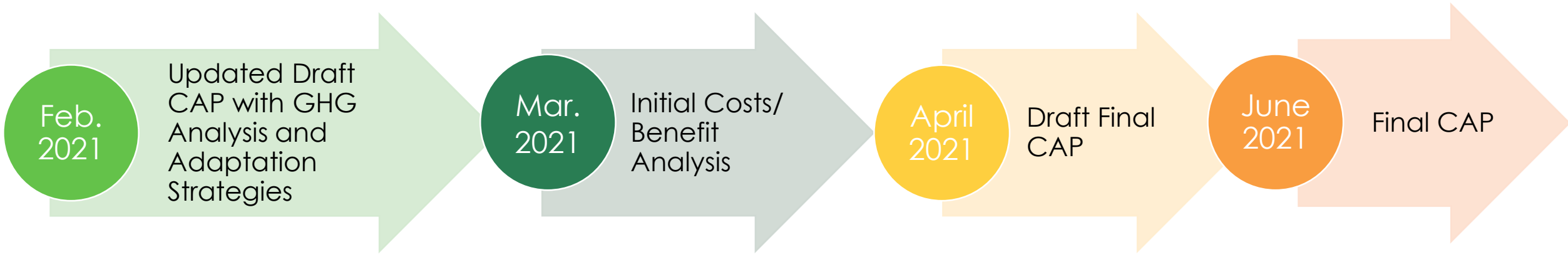
1) Model costs and benefits of strategies

i. Air quality emissions and health costs, as available
ii. Strategy costs
iii. Macro-econ modeling (GSP, jobs, disposable income)
iv. Refer to CAP Appendix B for assumptions and approach

2) Integrate adaptation analyses into CAP

3) Continue to draft the CAP report, including implementation information, as the analysis proceeds

Climate Action Plan Timeline



Next Steps

Next Steps

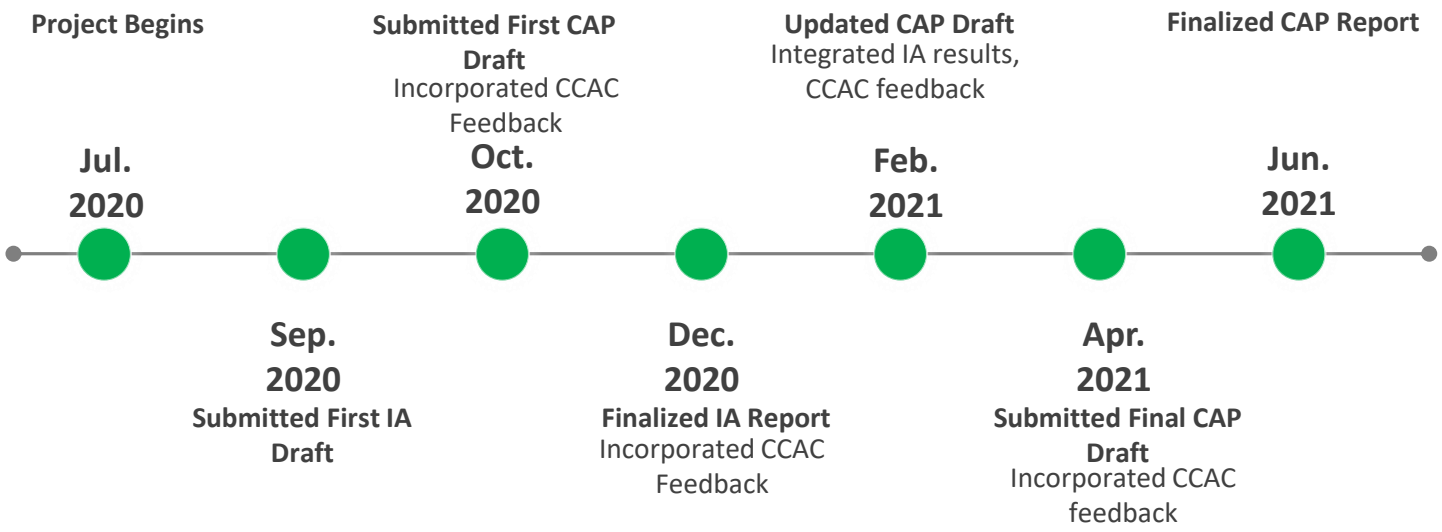
- Please review these slides and the latest CAP document. Then submit any written feedback to lbyron@pa.gov by March 2, 2021.
- DEP and ICF will review feedback and incorporate it into the CAP development process.
- Next CCAC meeting is April 27, 2021
  - Will share latest updates, including:
    - Final GHG modeling results
    - Costs and benefits modeling results
    - Adaptation pathways
    - The latest CAP draft


Thank You

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.

Project Timeline



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Public Comment (15 min)

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Agenda

- Introduction
  - Approval of December minutes
- Summary of CCAC Feedback
- ICF Presentation on 2021 Climate IA
  - 2021 IA discussion
- Break (10 min)
- ICF Presentation on 2021 CAP
  - 2021 CAP discussion
- Public Comment (15 minutes)
- **New Business**
- Next Steps/Next meeting

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Next Meeting

2021 Regular Meeting Dates:

- Tuesday February 23
- **Tuesday April 27**
- Tuesday June 22
- Tuesday August 24
- Tuesday October 26
- Tuesday December 14

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