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2021 Pennsylvania Impacts Assessment and Climate Action Plan

August 25, 2020

Agenda

Introduction

- The ICF Team
- Project Approach and Scope

CCAC Engagement

2021 Impacts Assessment (IA)

- Focus Areas and Updates for the 2021 IA
- Step-by-Step Approach
- Q&A and Discussion

2021 Climate Action Plan (CAP)

- Executive Order 2019-1
- Focus Areas and Updates for 2021 CAP
- Step-by-Step Approach
- Mitigation List
- Q&A and Discussion

The ICF Team

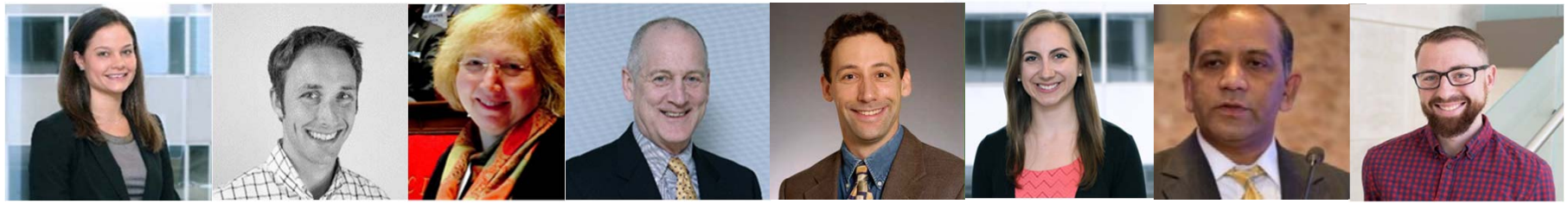
- **Integrated team** of climate risk, adaptation, sectoral, greenhouse gas, and economic experts with **institutional knowledge** and who **understand Pennsylvania**

- Global consulting and technology services provider with more than 7,000 professionals focused on making big things possible for our clients
- National and localized expertise across all energy and climate sectors and topic areas
- Similar leadership team and experts in place as for the 2018 CAP and other ICF support to DEP

- Top 25 Research University and the land-grant institution of higher education in the Commonwealth of Pennsylvania
- Led the development of the first four Climate Impacts Assessments and provides expertise in expert advisors in the areas of agriculture, climate science, climate risk management, energy, and natural systems carbon sequestration

- 38 years of environmental and climate policy experience
- Served the Commonwealth of Massachusetts in the Office for Commonwealth Development to coordinate the policies, budgets, and programs of the Environment, Energy, Transportation, and Housing and Community Development agencies
- Wrote and coordinated all aspects of the first Massachusetts Climate Protection Plan; was the state representative for the early RGGI phases and is currently playing a pivotal role consulting with TCI

Leadership Team



Deb Harris: Project Manager

Tommy Hendrickson: Deputy Project Manager and GHG Reduction Strategies Analysis Lead

Bill Prindle: Senior Advisor, Technologies and Policy

Seth Blumsack (PSU): Senior Advisor, Impacts Assessment

Sonia Hamel (Hamel Environmental): Senior Advisor, Equity, Co-Benefits and Implementation

Cassie Bhat: Impacts Assessment and Adaptation Strategies Lead

Bansari Saha: Economic Assessment Lead

Logan Pfeiffer: Report Development Lead

Experts and Support Team

Experts in:

- Buildings
- Transportation
- Energy Production, Supply and Electricity
- CHP
- Waste
- Agriculture, Land Use, Forestry
- Climate Science and Risk
- Adaptation
- Economics
- GHG Accounting
- Health and Air Quality
- Equity







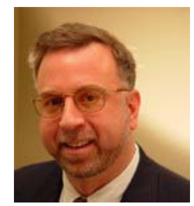













Project Approach and Scope

Key Elements

- Focus on health and economics and equity
- Integrate new data, thinking and information
- Better link the Impacts Assessment and Climate Action Plan through a risk-assessment based approach
- Continually work through drafts of reports to hone messages and thinking
- Create easy to read and understand public reports

CCAC Engagement

- **Prior to Today**
  - Review of letters attached to the 2018 CAP
  - Review of feedback shared with DEP on the scope
- **Moving Forward**
  - ICF to participate in 6 CCAC meetings
    - Written feedback and input can be provided prior to and after CCAC meetings at DEP with a time window; this is the main channel for feedback and input
    - Notes provided to the CCAC after meetings as reference
  - ICF has dedicated time to have discussions outside of the CCAC bi-monthly meetings
  - Feedback and input will be considered by DEP and ICF and an indication of how feedback was used and incorporated will be provided at the starting of each CCAC meeting
- **All correspondence and interactions with/for ICF should go through DEP (contact: Lindsay Byron)**

2021 Impacts Assessment

2021 IA Focus Areas and Updates

Update: Reflect latest available information on climate science and impacts

Risk-based approach: Understand relative timing and severity of impacts to inform overall risk ratings and priorities for adaptation

Make it actionable: Directly inform priority adaptation actions in the Climate Action Plan (CAP)

Traditional Approach

Impacts by Sector

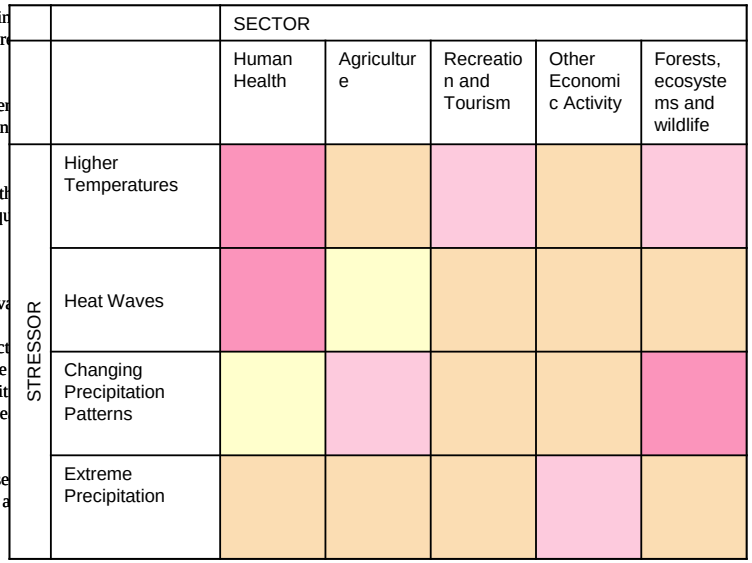
Human Health

- Higher temperatures will in
  related stress, but will decr
  stress.
- Climate change will worse
  would otherwise be, causin
  cardiac illness.
- The risk of injury and death
  could increase as a consequ

Agriculture

- Mixed effects on Pennsylva
- Pennsylvania dairy product
  affected by climate change
  caused by heat stress, addit
  expenditures to mitigate he
  forage quality.
- Forage yields may increase
  and more precipitation on a

Risk-based Approach

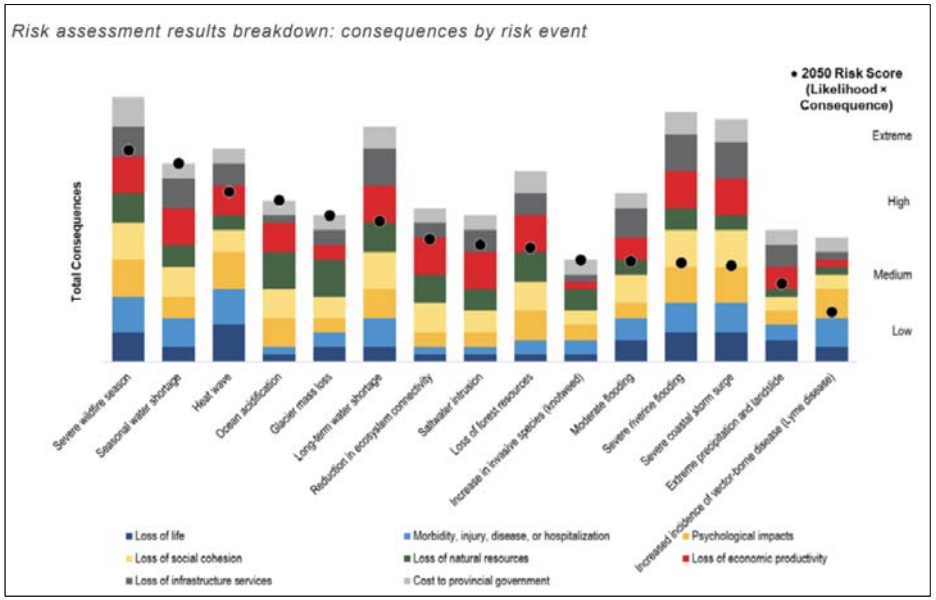


(conceptual diagram – not reflecting risk assessment results)

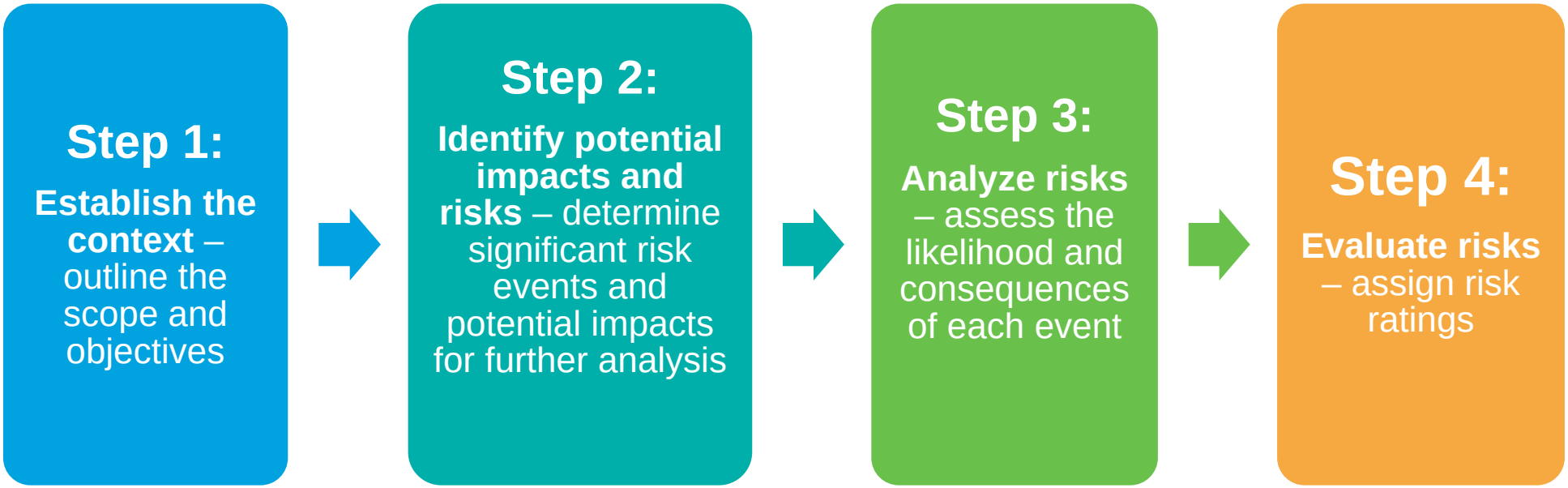
Risk-based Impacts Assessment Approach

- **Identify impacts, by hazard**
- **Rate likelihood of each hazard**
- **Rate impacts/consequences**
  - Human health
  - Economy
    - Agriculture
    - Recreation and tourism
    - Other economic activity
  - Forest, ecosystems, and wildlife
- **Evaluate and prioritize risks (by hazard, sector)**

Example of climate risk ratings, using consequence-likelihood ratings, developed by ICF for the Government of British Columbia, Canada



Steps for Conducting Underlying IA Analyses



Step 1: Establish the context

Rating Scales – What will they look like?

Example of consequence scores 4 and 5, developed by ICF for a risk assessment for the Government of British Columbia, Canada

	HEALTH		SOCIAL FUNCTIONING		CULTURAL RESOURCES	NATURAL RESOURCES	ECONOMIC VITALITY		COST TO PROVINCIAL GOVERNMENT*
	Loss of life	Morbidity, injury, disease, or hospitalization	Psychological impacts	Loss of social cohesion	Loss of cultural resources	Loss of natural resources	Loss of economic productivity	Loss of infrastructure services	
Catastrophic - 5	100+ people or >25% of a single community	1,000+ people affected or >25% of a single community	Widespread and severe disturbance resulting in long-term psychological impacts (e.g., post-traumatic stress disorder (PTSD))	Months-long disruption to daily life (e.g., inability to access employment, education) Widespread, permanent loss of livelihoods or way of life Severe, widespread erosion in public confidence in government Erosion of community institutions and community cohesion	Resource can never recover; destruction is permanent and irreversible (e.g., destruction of an irreplaceable artifact or knowledge)	Resource can never recover; destruction is permanent and irreversible (e.g., extinction of a species within the province)	Potential direct and indirect economic losses of over $1 billion* Long-term disruption or loss of an economic sector and associated job losses	Months-long disruption in infrastructure services Major impediment to day-to-day life	Added cost is far beyond Contingency Reserve Fund (e.g., > $1.5 billion)
Major- 4	10 to 100 people or > 15% of a single community	100 to 1000 people affected or > 15% of a single community	Localized severe disturbance resulting in long-term psychological impacts (e.g., loss of home, identity, or sense of place)	Weeks-long disruption to daily life (e.g., inability to access employment, education) Localized, permanent loss of livelihoods or way of life Moderate erosion of public trust in government or community cohesion	Recovery of the resource will take decades	Recovery of the resource will take decades	Potential direct and indirect economic losses of over $100 million* Months-long disruption to a major economic sector and associated job losses	Weeks-long disruption in infrastructure services Major impediment to day-to-day life	Significant added cost; up to 2x Contingency Reserve Fund amount (e.g., $750 million to $1.5 billion)

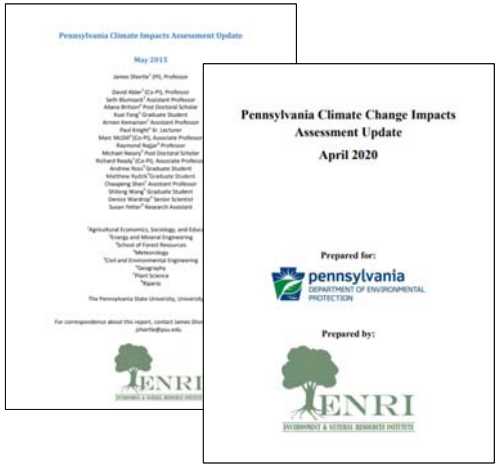
Step 1: Establish the context

Legislation and **prior IAs** help establish the scope and objectives of impacts assessment

- Focus Areas & Scope: **Hazards**
  - **Act 70** outlines key consequence categories that will organize screening of hazards in the risk assessment framework
- Risk Assessment Framework: **1-5 Scales**
  - Goal: to understand the relative timing and severity of impacts, and lead times needed for adaptation
  - Steps: **ICF will draft rating scales** to assess the *likelihood* and *consequence* of hazards described in former IAs

Act 70 Categories:

Human health
Economy
Forests
Wildlife
Fisheries
Recreation
Agriculture
Tourism



Step 2: Identify potential impacts and risks; prioritize for further analysis

Draw on previous IAs:

Pull material from previous (2015 and 2020) IAs, working with PSU team to identify additional information as needed

Science Check:

Update material with the latest available science

Prioritize:

Given the wide range of potential climate impacts, ICF and PSU will propose an initial prioritized subset for additional risk analysis for review and feedback

Key Deliverables:

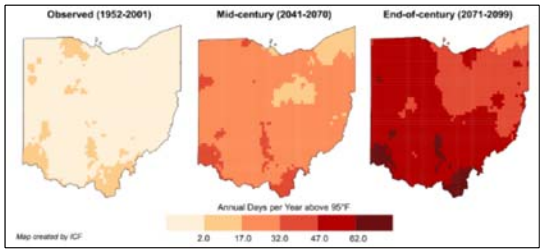
Draft rating scales to assess likelihood & consequences of each hazard; draft list of potential impacts; draft list of prioritized impacts for likelihood/consequence risk analysis

Step 3: Analyze risks

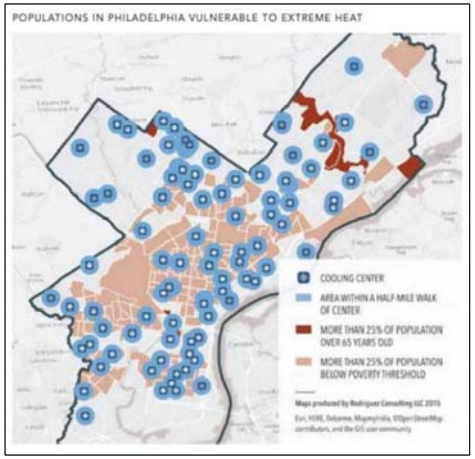
Use **likelihood** and **consequence** rating scales to generate relative risk ratings

- Likelihood of each hazard occurring
  - Ratings will be informed by PSU and ICF climate scientists' expertise and latest available climate science models
  - Ratings will indicate likelihood of discrete (e.g., heat wave) and ongoing (e.g. increasing temperatures) risk events for baseline and future time periods
- Consequences of each hazard occurring
  - PSU experts' input and desktop analyses will inform ratings as needed
- Differential impacts
  - Populations, locations, or other areas in the Commonwealth that could be disproportionately affected

Example of LOCA statistically downscaled Climate projections prepared by ICF for Ohio



Example analysis of heat impacts to public health in Philadelphia



Step 4: Evaluate risks

Generate Overall Risk rating:

Convert likelihood and consequence ratings into an **overall risk rating**

$$Risk = Likelihood \times Consequences$$

Likelihood	Consequences				
	Insignificant	Minor	Moderate	Major	Catastrophic
Almost Certain	Medium	Medium	High	Extreme	Extreme
Likely	Low	Medium	High	High	Extreme
Possible	Low	Medium	Medium	High	High
Unlikely	Negligible	Low	Medium	Medium	Medium
Rare	Negligible	Negligible	Low	Low	Medium

Final Impacts Assessment Report

- Projected climate changes and impacts
- Priority impacts
- Ratings scale
- Risk ratings
- Adaptation priorities

		SECTOR				
		Human Health	Agriculture	Recreation and Tourism	Other Economic Activity	Forests, ecosystems and wildlife
STRESSOR	Higher Temperatures					
	Heat Waves					
	Changing Precipitation Patterns					
	Extreme Precipitation					

Impacts Assessment Q&A and Discussion

2021 Climate Action Plan

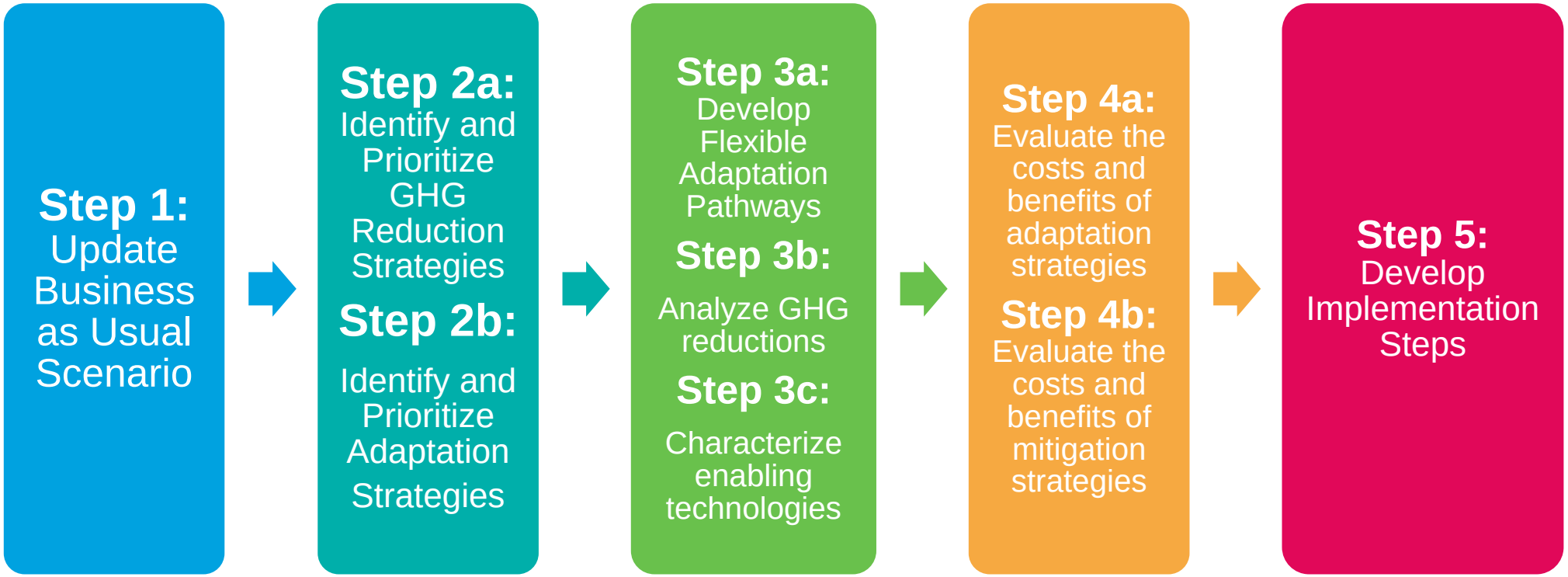
2021 CAP Focus Areas and Updates

- Create a more publicly accessible report with targeted information and messages
- Make clear distinctions between GHG reduction and climate adaptation actions in the report
- Integrate flexible adaptation pathways and strategies tied directly back to the risk assessment
- Show viable options to meet or exceed GHG reduction goals by 2025 and 2050 (Executive Order 2019-1)
- Consider a wide range of GHG reduction strategies based on current and emerging trends and relevance in Pennsylvania
- Look deeper and more broadly at economic benefits by highlighting job opportunities and additional co-benefits such as health and equity

Executive Order 2019-1

- Establishes a climate goal of achieving a **26%** reduction of net greenhouse gas emissions by **2025** and an **80% reduction by 2050**
- Re-establishes the **Governor's Green Government Council**, to incorporate environmentally sustainable practices into the Commonwealth government's policy, planning, and operations
- Sets performance goals for state agencies:
  - Reduce energy consumption by 3% per year, and 21% by 2025
  - Replace 25% of the government's passenger car fleet with battery electric and plug-in electric hybrid cars by 2025
  - Procure renewable energy to offset at least 40% of the Commonwealth's annual electricity use
  - Includes high performance building requirements
- Sets specific responsibilities for Commonwealth agencies in meeting goals

Steps for Conducting Underlying CAP Analyses



Step 1: Update Business as Usual Scenario

Confirm the Context:

Pull from 2018 Energy Assessment and CAP; confirm sectors, energy types, base and target years, and metrics and indicators

Update the Data:

Update analysis with latest information (e.g., GHG inventory, AEO, emission factors, IPM runs for PA)

Develop new/updated assumptions:

Confirm approach for GHG accounting; determine range of assumptions for inclusion, such as RGGI, state agency goals, federal policies (e.g., CAFÉ), economic growth

Evaluate a limited set of scenarios and select 1:

Project energy and emissions for the Commonwealth for a limited set of scenarios and work with EPO and CCAC to determine the most appropriate for the GHG reduction analysis

Step 2a: Identify and prioritize GHG Reduction Strategies

Initial list of GHG Reduction Strategies based on:

- CCAC input to DEP
- Input from DEP and its stakeholders
- Review of actions already being taken or suggested in previous CAPs
- ICF's knowledge of trending and common strategies used across the country

Qualitative Screening of GHG Reduction Strategies to Prioritize:

- Strategies will be organized with identifying information (e.g., strategy versus enabling technology, actor)
- ICF will propose a set of criteria to screen strategies for review and feedback
- List of strategies will be refined based on screening and prioritized to those modeled, those discussed in the CAP
- Enabling technologies will be separated and researched/analyzed for applicability within PA

Sample Criteria:

- GHG Mitigation Effectiveness
- Potential Net Benefits
- Stakeholder Support
- Initial Investment
- Ease of Implementation
- Resilience Benefits
- Health or Other Benefits

Step 2b:

Identify and prioritize Adaptation Strategies

Adaptation Strategies

Adaptation strategies will be proposed and developed based on:

- The 5-10 critical climate impacts identified in the IA
- Existing PA climate strategies and other plans developed by DEP and other Pennsylvania state agencies
- Input and revisions with DEP and stakeholders

Step 3a: Develop Flexible Adaptation Pathways

Flexible Adaptation Pathways

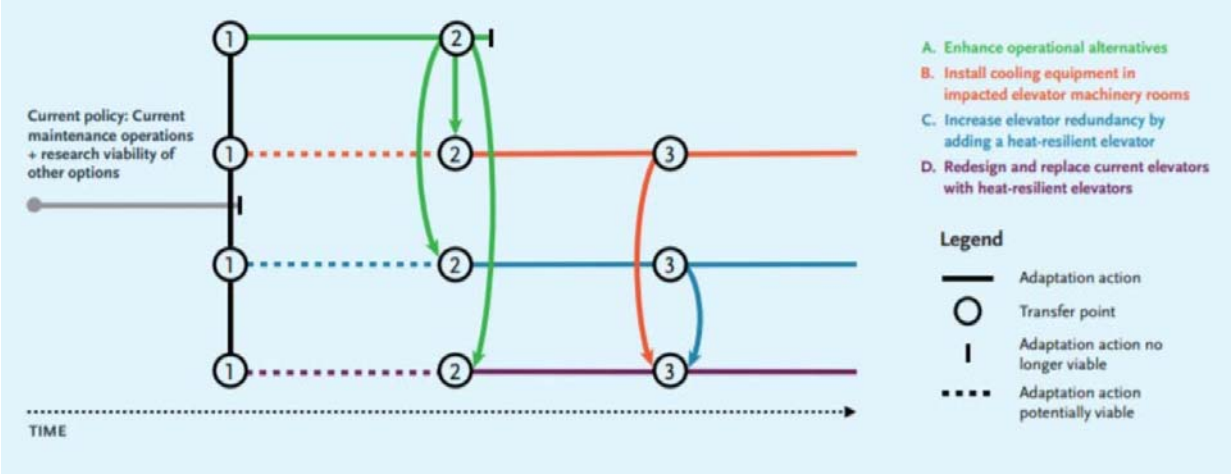
- Group the relevant adaptation actions for each critical impact to develop Flexible Adaptation Pathways
- Each Pathway will identify a robust suite of potential adaptation actions to address a wide range of potential futures and provides flexibility to select and implement adaptation actions over time in response to changing conditions

Developing Adaptation Pathways

Flexible adaptation pathways approach: visual representation of a set of actions for adapting to a given vulnerability, showing how different actions can be implemented over time as new information emerges

- Identifies a suite of potential adaptation actions to address a range of potential futures
- Provides flexibility to select and implement adaptation actions over time in response to changing conditions

Example of a Pathways output for elevator operations recently produced by ICF and LA Metro, as part of Metro's recent Climate Action and Adaptation Plan.



(This pathway suggests that Metro can use operational strategies to manage climate impacts in the near-term, and then make heavier infrastructure investments)

Step 3b:

Analyze GHG reductions

Setting the path to achieve Pennsylvania's long-term goal to reduce emissions by at least 80% from 2005 levels by 2050:

Quantify each measure's potential emission reduction, incorporating new analyses (e.g., land sequestration potential)

Assess progress towards meeting the goal and determine where to push the envelop within technical feasibility limits

Provide an aggregate analysis to visualize the contribution of each strategy towards the overall reduction goals in 2025 and 2050, and summary of assumptions and results by strategy for feedback

Key Elements:

- Use a GHG accounting approach to look at both electricity generation and consumption
- Capture interactive effects of strategies
- Incorporate the latest data and information

Step 3c:

Characterize enabling technologies

Enabling Technologies – what is their role in the CAP?

- Technologies that are not available to-scale or commercially in the short term but will be essential to achieving large-scale carbon reductions
- Particularly important in the content of a net zero emission goals.
- ICF will draft write ups for each technology and where appropriate couch these technologies or approaches within the context of a “what would it take scenario” discussion should the modeled strategies to meet or exceed an 80% by 2050 GHG reduction goal

Initial Considerations

- Hydrogen
- Power-to-gas
- Energy storage
- Carbon capture and geologic sequestration
- Direct air capture
- Land and forest carbon sequestration
- District energy systems
- Carbon offsets

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

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

Adaptation Costs and Benefits

- Up to seven financial, social, and environmental benefits (e.g., public health, workforce development) for each of adaptation actions
- ICF will estimate a rough order of magnitude of the dollar value of the benefit (e.g. low, medium, high), total value of the action, including consideration of the costs of planning and implementing the action
- Compare value against the costs of unmitigated impacts and adaptation actions with potentially high benefit-to-cost ratio

GHG Reduction Costs and Benefits

Look at multiple factors to assess cost-effectiveness:

- **Microeconomic:** NPV and cost-per-ton of GHG emission reductions
- **Macroeconomic (using REMI):** change in GSP, income, jobs, output
- **Other Costs and Benefits:** Air quality, health, equity
  - Note: co-benefits can be monetized using economic techniques like benefit transfer or rule-of-thumb multipliers or using back-of -the envelope tools

Step 5: Develop Implementation Steps

For a select set of strategies Implementation Steps may include:

- Description of the step
- The responsible agency or department,
- Potential general assembly legislative changes needed to implement the strategies
- Potential or actual funding sources
- Strategy priority
- Implementation timeframe

Final Climate Action Plan Report

- Summarize GHG reduction strategies/enabling technologies and adaptation strategies in separate sections
- Discuss and present modeling results of what it will take to meet or exceed 80% reduction for GHG emissions by 2050
- Analyze the cost-effectiveness (economic, health, air quality, equity) of strategies
- Present information in an easy to understand format

Climate Action Plan Q&A and Discussion