2018 Pennsylvania Climate Action Plan

Climate Action Plan Review and Energy Assessment Updates

December 4, 2017

Prepared for the Climate Change Advisory Committee Meeting

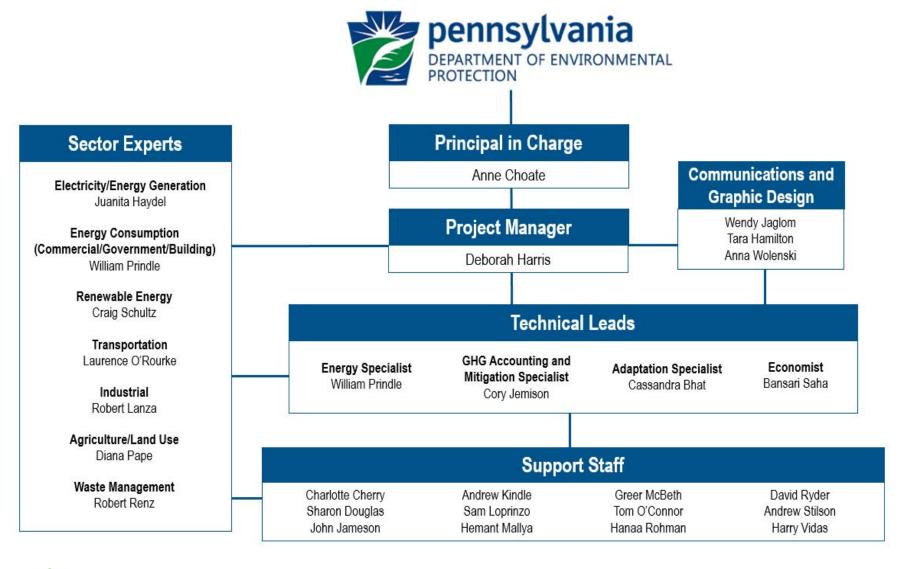Cory Jemison (ICF)
Harry Vidas (ICF)

Agenda

- **Introductions**

- **Reminder of Overall Project Approach (Cory Jemison)**

- **Review of Climate Action Plans (Cory Jemison)**

- **Energy Assessment Update (Harry Vidas)**

ICF Introductions

Team Organization

pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION

Sector Experts

Electricity/Energy Generation
Juanita Haydel

Energy Consumption (Commercial/Government/Building)
William Prindle

Renewable Energy
Craig Schultz

Transportation
Laurence O'Rourke

Industrial
Robert Lanza

Agriculture/Land Use
Diana Pape

Waste Management
Robert Renz

Principal in Charge
Anne Choate

Project Manager
Deborah Harris

Communications and Graphic Design
Wendy Jaglom
Tara Hamilton
Anna Wolenski

Technical Leads

Energy Specialist
William Prindle

GHG Accounting and Mitigation Specialist
Cory Jemison

Adaptation Specialist
Cassandra Bhat

Economist
Bansari Saha

Support Staff

Charlotte Cherry	Andrew Kindle	Greer McBeth	David Ryder
Sharon Douglas	Sam Loprinzo	Tom O'Connor	Andrew Stilson
John Jameson	Hemant Mallya	Hanaa Rohman	Harry Vidas

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Climate Action Plan Review and Energy Assessment Updates

ICF Technical Leads

Cory Jemison—GHG Accounting and Mitigation Specialist

- 10+ years of experience in the energy/carbon accounting
- Philadelphia EMP, Kleinman Center, and MWCOG technical specialist
- Works with numerous states, cities, EPA State and Local branch (including State Inventory Tool)
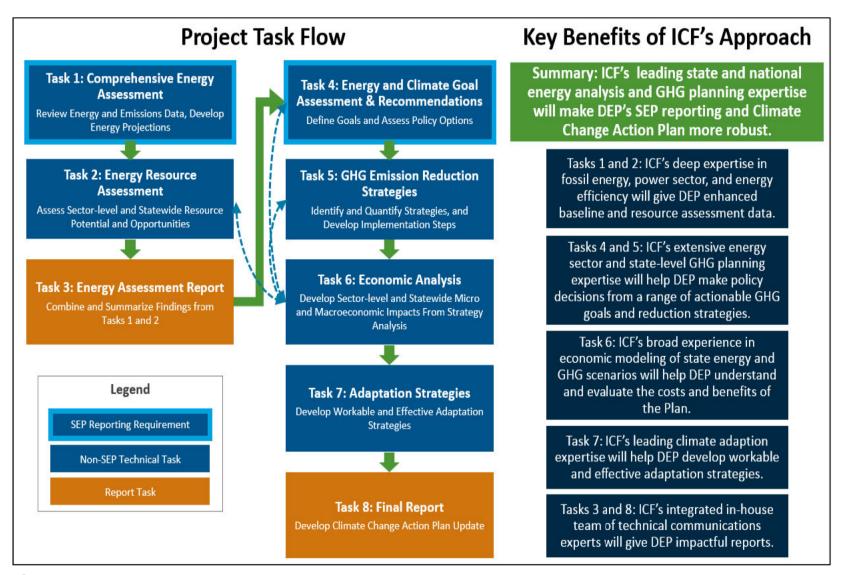

Harry Vidas—Energy Specialist

- Over 35 years of experience in analyzing and forecasting energy supply, demand and prices
- Specialized expertise in natural gas & oil resource assessment; upstream economic analysis; and the forecasting of drilling and production activity and related demands for E&P services, equipment and materials
- Participated in several studies related to upstream oil & gas environmental impacts and the economics of alternative environmental mitigation methods

Reminder of Overall Project Approach

ICF's Integrated Project Approach

Project Task Flow

Task 1: Comprehensive Energy Assessment
Review Energy and Emissions Data, Develop Energy Projections

Task 2: Energy Resource Assessment
Assess Sector-level and Statewide Resource Potential and Opportunities

Task 3: Energy Assessment Report
Combine and Summarize Findings from Tasks 1 and 2

Task 4: Energy and Climate Goal Assessment & Recommendations
Define Goals and Assess Policy Options

Task 5: GHG Emission Reduction Strategies
Identify and Quantify Strategies, and Develop Implementation Steps

Task 6: Economic Analysis
Develop Sector-level and Statewide Micro and Macroeconomic Impacts From Strategy Analysis

Task 7: Adaptation Strategies
Develop Workable and Effective Adaptation Strategies

Task 8: Final Report
Develop Climate Change Action Plan Update

Legend
- SEP Reporting Requirement
- Non-SEP Technical Task
- Report Task

Key Benefits of ICF's Approach

Summary: ICF's leading state and national energy analysis and GHG planning expertise will make DEP's SEP reporting and Climate Change Action Plan more robust.

Tasks 1 and 2: ICF's deep expertise in fossil energy, power sector, and energy efficiency will give DEP enhanced baseline and resource assessment data.

Tasks 4 and 5: ICF's extensive energy sector and state-level GHG planning expertise will help DEP make policy decisions from a range of actionable GHG goals and reduction strategies.

Task 6: ICF's broad experience in economic modeling of state energy and GHG scenarios will help DEP understand and evaluate the costs and benefits of the Plan.

Task 7: ICF's leading climate adaption expertise will help DEP develop workable and effective adaptation strategies.

Tasks 3 and 8: ICF's integrated in-house team of technical communications experts will give DEP impactful reports.

Review of Climate and Energy Plan Goals

Review of Climate and Energy Plan Goals - Agenda

Purpose

Approach

Findings

Key Decisions

Purpose

Purpose

- **Inform selection of goals for Pennsylvania's 2018 updated Climate Action Plan**

- **Provide an understanding of the goals being set across the country, including the motivation and approach for setting them**
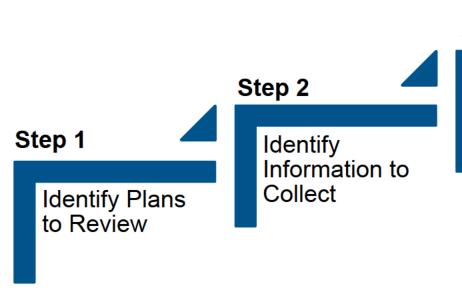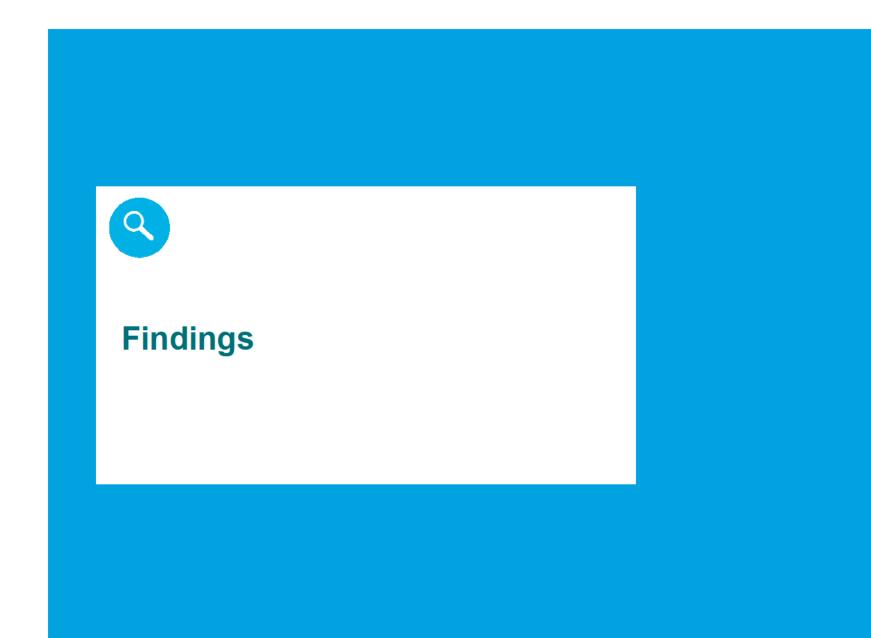
Approach

Approach

Step 1
Identify Plans to Review

Step 2
Identify Information to Collect

Step 3
Review Plans

Step 4
Review Other Resources

- **By Jurisdiction:** 22 State, 2 Regional, and 5 Local
- **By Type of Plan:** 14 Climate Action Plans, 12 Energy Plans, and 3 Other (e.g., climate reports, general regional planning documents)
- **By Publication Year:** 19 published 2015 or later, 6 published 2010 – 2014, and 3 published before 2010
- **Other:** IPCC, President Obama's 2016 Climate Action Plan, Under 2 MOU, The GHG Protocol Mitigation Goal Standard
- Global Protocol for Community-Scale GHG Inventories (GPC)

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Findings

Overview of Key Findings

Plan Findings

Goal Findings

Findings from Other Resources

Name of Plan	Publication Year	Type of Plan	State/City Region	Includes Adaption/	Notes on Adaptation/ Resilience	Sector Targe
2008 Texas State Energy Plan	2008	Energy	Texas	No		No
2015 Climate Change Action Plan Update	2016	CAP	Pennsylvania	Yes	There is discussion in the climate change impacts section on the impact of extreme weather events.	No
Alaska Regional Energy Plans	Various	Energy	Alaska	No		No

Climate Action Plan Review and Energy Assessment Updates

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Plan Findings

- Just under half include sector-specific goals

- Roughly 2/3 included a discussion of adaptation and resilience

- States and municipalities designate sectors differently

Goal Findings: Approach

- **Plans have two key attributes when discussing goals:**
  - Focused on one main goal (typically emission-focused)
  - Wide range of goals related to mitigating or adapting to climate change impacts

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Goal Findings: Goal Types

- **Most common goal type: Base year emissions goal**
  - Most commonly used target years: 2020 (5), 2025 (2), 2030 (6), 2050 (9)
  - Most commonly used base years: 1990 (6), 2005 (5)
  - Seven plans included 80 x 50 goals

> **80% reduction in GHG emissions by 2050 relative to an established base year**
>
> 1990 ⟷ 2050

Goal Findings: Goal Development

- **Goal Development Methods**
  - **Top-Down:** Nearly all plans reviewed (as interpreted)
  - **Bottom-Up**: Seemingly none of plans reviewed (hard to tell)
  - **Science-Based**: Only two of plans reviewed (explicitly) + Under2 Coalition Guiding Principle

Goal Findings: Goal Development

Top-down goals (including science-based)

Nearly all plans reviewed (as interpreted)

Seemingly none of plans reviewed (hard to tell)

Bottom-up goals

Goal Findings: Goal Characterization

- **Attainability**
  - \> 75% of GHG reduction goals with target years of 2030 or earlier → considered **attainable**
  - 90% of goals with target years of 2040 or later → considered **aspirational**

- **Other Observations**
  - Only one plan included gas-specific targets
  - Sector-specific targets for GHG reductions are uncommon (sector-specific activity targets more common)

Goal Findings: Other Goals

- **Sector-Specific Goals: Relatively Common**
  - Transportation (most common sector) – includes goals related to transit, alternative fuels, zero emission vehicles
  - Waste (a few) – includes goals related to diversion, reuse
  - Land Use (DC) – includes goals related to tree canopy, open space

- **Adaptation/Resilience Goals: Not Common**
  - DC included one
  - Adaptation/resilience strategies were common; quantitative goals were not

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Findings from Other Resources

Intergovernmental Panel on Climate Change (IPCC)

- Scenarios keeping atmospheric concentrations at or below 450 ppm CO_2eq. by 2100 (2 degrees)
  - Require global GHG emission reductions of 40-70% relative to 2010 by 2050.
- Delaying beyond 2030 is too late.

Under 2 MOU

- Guiding principle: limit global temperature change to less than 2 degrees Celsius.

- Pursue long term targets of 80 to 95% below 1990 by 2050, or per capita emissions of less than 2 metric tons.

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Key Decisions

Questions on Key Decisions

What goal timeframes are most appropriate?

Start from a bottom-up or top-down perspective?

Set broad and/or sector-specific goals?

What goal motivation is most appropriate?

DEP Initial Thoughts on Goals

✓Long-term aspirational goal: 80 by 50 (80% reduction in GHGs by 2050)

✓Short-term goal: Reduction 28% below 2005 levels by 2025

  ✓*Consistent with U.S. Paris Accord commitments*

✓U.S. commitments are well documented and based on scientific evidence and expert agreement

Progress Update on Energy Assessment

Agenda

Update on Comprehensive Energy Analysis

Questions and Input

Next Steps

Comprehensive Energy Analysis

Objectives

➢ Summarize and present state-wide historical and projected (2000 through 2050) BAU energy production and consumption data by sector and fuel type.

➢ Reflect existing policies and identify key trends and patterns in state energy production and consumption, including assessing Pennsylvania's gap between production and consumption.

Approach

Steps

1. Review existing energy production and consumption data

2. Develop updated historical and projected production and consumption baseline estimates

3. Produce task summary and spreadsheets

Key Components

❖ Use existing state and federal data sources (State Inventory Tool, EIA, USDA, BLM, NREL, etc.)

❖ Covers energy production and consumption, including transportation

Relationship with CAP and PA Inventory

- Energy Assessment provides the foundation for the energy portion of the CAP inventory and projections

- Alignment with EPA State Inventory Tool estimates

- Allows for tracking progress towards CAP

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Energy Assessment Data Elements: Consumption

Historical and Future Energy Consumption/Expenditures (2000 through 2050)

- Energy/Electricity Consumption
- Energy Prices (by fuel type)
- Energy Expenditures
- GHG/Criteria Air Pollutants
- Sector break down for each fuel type
  - Residential/Commercial/Industrial/Transportation
- Pennsylvania GSP and Energy Consumption (Btu/$ GSP)

Energy Assessment Fuel Types: Consumption

- **Fossil Fuels**
  - Electricity (Mix of Fuels)
  - Natural Gas
  - Coal
  - Motor Gasoline
  - LPG
  - Distillate Fuel Oil
  - Residual Fuel Oil
  - Jet Fuel
  - Kerosene
  - Other Fuels

- **Non-Fossil Fuels**
  - Biodiesel
  - Ethanol (Corn)
  - Ethanol (Cellulosic)
  - Wood and Waste
  - Biogas

Consumption: General Approach

Historical

- State Energy Data System (SEDS) provides annual consumption data for PA from 1960-2015. Annual pricing and expenditure data also available for PA from 1970-2015.

- Consumption of fuel for electricity generation by fuel type _not_ provided by SEDS

- EIA provides this data from 1990 to 2015, which is used in addition to the SEDS data

Projections

- Regional AEO data was used to forecasted historical data from SEDs. Consumption was forecasted using the Middle Atlantic Census Region

- ICF took the regional growth rates for a particular energy resource from the AEO from 2015, and applied this growth rate to the historical state data from SEDS to project Pennsylvania energy resource data.

U.S. Census Regions

Figure from EIA

Consumption: Data Sources for Historical Energy Consumption/ Expenditures

Key data sources

- Energy Consumption: SEDS, EIA
- Prices: SEDS
- Expenditures: SEDS
- Emission Factors: EPA State Inventory and Projection Tool. CO_2 FFC Module, Stationary Combustion Module, Mobile Combustion Module.

Additional data sources

- Energy Consumption: LMOP, CMOP, PA Biodiesel Standard, ARIPPA

- Prices: U.S. Department of Energy. Clean Cities Alternative Fuel Price Reports. Alternative Fuels Data Center.

- Emission Factors: EPA Emissions & Generation Resource Integrated Database (eGRID); 2006 IPCC Guidelines for National Greenhouse Gas Inventories; EPA AP-42: Compilation of Air Emission Factors.

Consumption: Data Sources for Future Energy Consumption/ Expenditures

Key data sources

- Energy Consumption: SEDS, AEO
- Prices: AEO
- Expenditures: AEO
- Emission Factors: EPA State Inventory and Projection Tool. CO2 FFC Module, Stationary Combustion Module, Mobile Combustion Module.

Additional data sources

- Emission Factors: EPA Emissions & Generation Resource Integrated Database (eGRID); 2006 IPCC Guidelines for National Greenhouse Gas Inventories; EPA AP-42: Compilation of Air Emission Factors.

Energy Assessment Data Elements: Electricity Generation

Historical and Future (through 2050) Electricity Generation

- Fossil Fuels: Coal, Natural Gas, Oil, Petroleum Coke
- Renewable Electricity
  - Solar
  - Hydro
  - Wind
  - Biomass Solids
  - Biogas
- Pumped Storage
- Nuclear
- CHP
- Includes GHG / criteria air pollutant emissions and economic characteristics
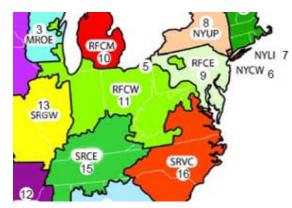
Electricity Generation: General Approach

Historical

- State Energy Data System (SEDS) provides annual consumption data for electricity generation for PA from 1960-2015. Annual pricing and expenditure data also available for PA from 1970-2015.

- Net generation of electricity by fuel type is provided by SEDS but only for certain renewable fuel types.

- EIA provides net electricity generation or capacity of fossil fuel generators from 1990 to 2015, which will be used in addition to the SEDS data

Projections

- Regional AEO data was used to forecast historical data from EIA and other sources. Electricity generation was forecasted using the Reliability First Corporation East and West Regions.

- ICF took the regional growth rates for a particular energy resource from the AEO from 2015, and applied this growth rate to the historical state data from EIA to project Pennsylvania energy resource data.

U.S. NERC Regions

Figures from EIA

Electricity Generation: Historical Electricity Generation

Key data sources

- Electricity Generation: SEDS, AEO
- Prices: SEDS
- Expenditures: SEDS
- Emission Factors: EPA State Inventory and Projection Tool. CO2 FFC Module, Stationary Combustion Module.

Additional data sources

- Energy Generation: EIA Electric Power Monthly (Solar Breakout)

- Emission Factors: EPA Emissions & Generation Resource Integrated Database (eGRID); 2006 IPCC Guidelines for National Greenhouse Gas Inventories; EPA AP-42: Compilation of Air Emission Factors.

Electricity Generation: Projected Electricity Generation

Key data sources

- Electricity Generation: SEDS, AEO
- Prices: AEO
- Expenditures: AEO
- Emission Factors: EPA State Inventory and Projection Tool. CO2 FFC Module, Stationary Combustion Module.

Additional data sources

- Emission Factors: EPA Emissions & Generation Resource Integrated Database (eGRID); 2006 IPCC Guidelines for National Greenhouse Gas Inventories; EPA AP-42: Compilation of Air Emission Factors.

Energy Assessment Data Elements: Production

Historical and Future Production Energy Projections (through 2050)

- Fossil Fuels: Bituminous & Anthracite Coal, Natural Gas, Crude Oil
- Renewable and Alternative Fuels
  – Biogas, Methane: Landfill Gas, Coal Mine, Digesters (wastewater & agricultural waste)
  – Biomass solids (wood waste)
  – Biodiesel
  – Ethanol (corn)
  – Waste coal production
- Includes estimates of GHG and criteria air pollutant emissions

Energy Assessment Data Elements: Energy Imports and Exports

- Electricity

- Comparison of Fossil Fuel Consumption and Production
  - Natural gas
  - Coal
  - Crude Oil

- Comparison of Electricity Consumption and Production

- Comparison of Renewable Fuels Consumption and Production
  - Landfill Gas Methane
  - Coal Mine Methane
  - Biodiesel
  - Ethanol

Policies Considered

- Consolidated Appropriations Act of 2016 (H.R. 2029)

- Energy Improvement and Extension Act of 2008 (EIEA2008)

- American Recovery and Reinvestment Act of 2009 (ARRA2009)

- Energy Independence and Security Act of 2007 (EISA2007)

- Energy Policy Act of 2005 (EPACT2005)

- Energy Policy Act of 1992 (EPACT1992)

- Clean Air Act Amendments of 1990 (CAAA1990) and Cross State Air Pollution Rule (CSAPR)

- Maximum Achievable Control Technology for Industrial Boilers (Boiler MACT)

- Light-Duty Vehicle Combined Corporate Average Fuel Economy (CAFE) Standards

- Heavy-Duty Vehicle Combined Corporate Average Fuel Economy Standards

- Emission Control Areas in North America and U.S. Caribbean Sea waters under the International Convention for the Prevention of Pollution from Ships (MARPOL)

- Low-Emission Vehicle Program (LEVP)

- FERC Orders 888 and 88

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Questions and Input from the CCAC on the Energy Assessment

Energy Assessment Next Steps

Thank You

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