Quantifying the Health Benefits of Clean Energy Policies with EPA’s AVERT and COBRA Tools

May 19, 2022
WEBINAR LOGISTICS

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AVoided Emissions and geneRation Tool (AVERT) & CO-Benefits Risk Assessment Health Impacts Screening and Mapping Tool (COBRA)

May 19, 2022

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Outline

• AVERT
  ◦ What, Why, and How: AVERT
  ◦ Demo
• COBRA
  ◦ What, Why, and How: COBRA
  ◦ Demo
• Benefits per kWh (BPK)
• Questions
Our Tools and Resources Support State, Local and Tribal Stakeholders on Climate and Energy

Develop Inventories and Set Goals
- **State Inventory and Projection Tool**: Develop and update inventories for 11 sectors. Forecast emissions through 2050.
- **Local Inventory Tool**: Develop community-wide inventories or inventories of local government operations only.
- **Tribal Inventory Tool**: Develop community-wide inventories or inventories of tribal government operations only.

Design, Compare, or Evaluate Policy
- **AVERT**: Avoided Emissions and generation Tool. Evaluate changes in power plant emissions from energy policy.
- **COBRA**: Co-Benefits Risk Assessment Health Impacts Screening and Mapping Tool. Quantify and monetize health impacts of reducing emissions.
- **ESIST**: Energy Savings and Impacts Scenario Tool. Analyze energy savings, costs, and multiple benefits from energy efficiency programs.

Communicate and Support Policy Implementation
- **Greenhouse Gas Equivalencies Calculator**: Convert a unit of energy to the equivalent amount of CO₂ emissions from using that amount.
- **Heat Island Reduction Program**: Resources to implement heat island mitigation policies and projects.
- **Technical Support**: Provide 1-1 technical support for state, local, and tribal stakeholders.
- **Convene Stakeholders**: Engage state, local, and tribal decision-makers.

Additional Resources
Quantifying Air and Health Impacts of Our Energy Choices

- Energy efficiency (EE) or renewable energy (RE)
- Programs, policies, or projects

Scenarios

- Estimate changes in electricity generation
- Estimate changes in emissions of CO$_2$, NO$_x$, SO$_2$, primary PM$_{2.5}$, VOCs, and NH$_3$

AVERT

- Estimate air quality changes (primary and secondary PM$_{2.5}$)
- Estimate dollar value of public health benefits

COBRA

- Regional factors for estimating the monetized health benefits of kWh saved through EE or generated through RE
Emission Quantification Methods
Basic to Sophisticated

- **Basic Method**
  - eGRID region non-baseload emission rates

- **Intermediate Method**
  - Historical hourly emission rates

- **Sophisticated Method**
  - Energy modeling; dispatch or capacity expansion

**Energy Model**
- Economic parameters
- Environmental regulations
- Fuel data
- End use demand
- Emission factors
- Technologies
- User-defined constraints
Why use AVERT?

- **Quantify** the emissions impacts of EE/RE
- **Calculate** avoided emissions in your grid region, state, or county
  - CO₂
  - Criteria pollutants (NOₓ, SO₂, PM₂.₅, NH₃, VOCs)
    - Inputs for COBRA (health impacts analysis)
- **Compare** emission impacts of EE/RE programs, projects, and policies
  - Hourly (8760)
- **SIP credit** in a National Ambient Air Quality Standard (NAAQS) Clean Air Act Plan
  - Regions in non-attainment can quantify emissions reductions from new EE/RE
  - [Arkansas Regional Haze SIP](#)
- **Near-term** projection tool
  - 5-year time horizon
Poll question

- What type of electricity generator produced the second most electricity in 2021?
  - Electric generator type:
    - Nuclear
    - Renewable
    - Coal
    - Gas
    - Other
Answer to poll

US Electricity Generation by Type

Source: EIA (Net generation for all sectors)
Idealized Grid Mix
Average vs. Marginal Emissions
AVERT is an operational simulation model.

Conceptually, generation is dispatched in a loading order, least expensive generators first.

EE/RE (generally) reduces requirement for fossil generation.

Reduced generation = reduced emissions.
How does AVERT work?

**Raw Hourly Generation and Emissions Data from Air Markets Program (AMP) Dataset**
- Text files

**Future Year Scenario Template**
- User interface for retirements, additions, and retrofits
- Excel workbook

**AVERT: Statistical Module**
- MATLAB code
- Inputs AMP data, performs statistical analysis, outputs new Regional Data Files

**Regional Data Files**
- Text files
- Contains annual hourly load data and unit-level statistics on generation and emissions data

**AVERT Main Module**
- Excel workbook
- User interface for creating EE/RE load curves, performing displaced emissions analyses, and creating output charts and tables

Most users will only need to use the Regional Data Files and AVERT Main Module to calculate emissions.
AVERT Demonstration

• What if New York increased its energy efficiency by 1.1%?
  ◦ What would be the annual emissions impacts?
Quantifying Air and Health Impacts of Our Energy Choices

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COBRA

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AVERT

- Regional factors for estimating the monetized health benefits of kWh saved through EE or generated through RE
What is COBRA?

Free, easy-to-use, peer reviewed screening model that quickly:

- Estimates county-level **health impacts** from changes in criteria air pollutants that affect PM$_{2.5}$ concentrations
- Monetizes the **economic value** of those benefits
- Presents results in **tables and maps** that facilitate visualization of the results
How does COBRA work?

**USER INPUTS =** Change in Emissions (2016, 2023, or 2028)
- Primary PM$_{2.5}$, SO$_2$, NO$_x$, NH$_3$, VOCs

**COBRA**

- Quantifies Changes in Air Quality
  (Source-Receptor Matrix for PM$_{2.5}$)

- Calculates Change in Health Outcomes
  (Health impact functions for PM$_{2.5}$ changes)

- Calculates Monetary Value of Health Outcomes
  (Economic valuation functions)

**OUTPUTS =** Tables and maps of changes in morbidity and mortality and related economic value
What human health effects are included?

- COBRA estimates the number of health incidences avoided AND the related economic value for:

  - Adult Mortality
  - Infant Mortality
  - Non-fatal Heart Attacks
  - Respiratory Hospital Admissions
  - Cardiovascular-related Hospital Admissions
  - Acute Bronchitis
  - Upper Respiratory Symptoms
  - Lower Respiratory Symptoms
  - Asthma Exacerbations (attacks, shortness of breath, & wheezing)
  - Asthma Emergency Room visits
  - Minor Restricted Activity Days
  - Work Loss Days
How has COBRA been used?

**State-level Climate Action Plans**
- Maryland, New York, and Oregon

**Renewable energy policies and programs**
- Renewable policies in Illinois
- Solar installations in Long Island, NY

**Energy efficiency policies and programs**
- North Carolina’s Clean Energy Plan
- Illinois Energy Efficiency Portfolio Standard

**Transportation policies**
- Analysis of reduced vehicle trips in Utah
- Public transit program in Nevada

**Other analyses**
- Impacts of prescribed fires
- Benefits of urban tree planting

More than 130 citations as of February 2022
COBRA Demonstration

• What if New York increased its energy efficiency by 1.1%?
  ◦ What would be the annual public health impacts and economic valuation?
Quantifying Air and Health Impacts of Our Energy Choices

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- Estimate air quality changes (primary and secondary PM$_{2.5}$)
- Estimate dollar value of public health benefits
- Regional factors for estimating the monetized health benefits of kWh saved through EE or generated through RE
Benefits per kilowatt hour (BPK)

- Regional factors derived from standardized AVERT and COBRA runs.

<table>
<thead>
<tr>
<th>Region</th>
<th>Project Type</th>
<th>3% Discount Rate</th>
<th>7% Discount Rate</th>
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</thead>
<tbody>
<tr>
<td></td>
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<td>2019 $/kWh (low estimate)</td>
<td>2019 $/kWh (high estimate)</td>
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<tr>
<td>New York</td>
<td>Uniform EE</td>
<td>0.99</td>
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<td>EE at Peak</td>
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<td>Utility Solar</td>
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<td>Distributed Solar</td>
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<td>Onshore Wind</td>
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AVERT-COBRA-BPK: One slice of the cake

- Provides a range of options to evaluate energy decisions
  - Energy resources (EE / RE)
  - Emissions (CO₂ + Criteria)
  - Health + Economic $
- Supports cost-benefit analyses
- Supports geographic analyses (EJ considerations)

Source: Regulatory Assistance Project
Connect with the State and Local Climate and Energy Program

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Thank you for attending our webinar

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Upcoming Webinar

Exploring Peaker Power Plant Inequities with Clean Energy Group’s New Mapping Tool

Thursday, June 23, 3-4pm ET

This webinar will introduce CEG’s Peaker Plant Mapping Tool and provide an overview of how it can be used to explore the economic and racial disparities of peaker plants. Speakers from UPROSE, and the Berkshire Environmental Action Team will present.

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