Estimating the Co-Benefits of Clean Energy Policies

CO-Benefits Risk Assessment (COBRA) Health Impacts Screening and Mapping Tool: **How COBRA Works**

Air Quality | Human Health | Societal Benefits

State and Local
Energy and Environment Program

United States
Environmental Protection
Agency

What is COBRA?

- The CO-Benefits Risk Assessment (COBRA) Health Impacts Screening and Mapping Tool is a peer reviewed screening tool that inexpensively and quickly estimates the air quality, human health, and associated economic impacts of various state- and county-level emission reduction scenarios.
    - The model estimates and maps the health effects and related economic value of the effects by county for state, region, U.S.

- COBRA is based on rigorous methods used by EPA health benefits assessments and adapted for use as a screening model.

- COBRA enables users to obtain a first order approximation of costs and benefits of different emission scenarios that can be used to narrow a long set of promising options to a smaller list which can be evaluated using more sophisticated air quality models.

How Does COBRA Work?

Users enter emissions change(s) and discount rate for 2016, 2023 or 2028

- $PM_{2.5}$, SO_2, NO_x, VOCs

COBRA:

Quantifies Changes in Air Quality

- Uses a simple air quality model, the Source Receptor (S-R) Matrix, to estimate effects of changes on ambient particulate matter and ozone.

Calculates Change in Health Outcomes

- Uses "canned" concentration response functions to link the changes in particulate matter and ozone to epidemiological studies[1]

Calculates Monetary Value

- Uses "canned" values based on willingness-to-pay, cost of illnesses, value of a statistical life and direct medical costs.

Outputs = Tables and maps of illnesses and deaths avoided and the related economic value.

[1] COBRA excludes benefits beyond particulate matter and ozone-related ones and may be conservative in that respect.

Human Health Effects in COBRA

- COBRA estimates the number of health incidences avoided AND the related economic value for the following:
  - Adult and infant mortality,
  - Non-fatal heart attacks,
  - Respiratory and cardiovascular-related hospital admissions,
  - Respiratory, cardiovascular, and asthma-related emergency room visits,
  - Asthma incidences,
  - Lung cancer incidences,
  - Hospitalizations from Alzheimer's and Parkinson's disease,
  - Stroke incidences,
  - Hay fever/rhinitis incidences,
  - Minor restricted activity days, and
  - Work and school loss days

Economic Values of Effects in 2023: Unit Values

Health Incident Avoided	Economic Value (2023$)
Adult Mortality	$14,012,045.11
Infant Mortality	$14,012,045.11
Non-Fatal Heart Attacks	$80,737.90
Hospital Admissions	$16,000.92- $60,285.54
Asthma ER Visits	$738.82
Lung cancer incidence	$19,595.06 - $51,282.80
Stroke incidence	$56,193.55
Asthma incidence	$73,225.83
Minor Restricted Activity Days	$112.00
School and Work Loss Days	$281.80 - $1,630.38

Economic Values of Effects: Sources

Health Incident Avoided	Source of Value
Adult Mortality	VSL*
Infant Mortality	VSL*
Non-Fatal Heart Attacks	Cost of Illness (COI) = Direct medical costs, opportunity cost (OC)
Hospital Admissions	COI = Hospital charges, OC
Asthma ER Visits	COI = Costs to the hospital
Lung cancer incidence	COI = Costs of treatment
Stroke incidence	COI = Costs of treatment
Asthma incidence	COI = Costs of treatment
Minor Restricted Activity Days	WTP = Combination of coughing, throat congestion, and sinusitis
School and Work Loss Days	WTP = Median annual earnings divided by (5 × 52)

For more background on the VSL, see:
https://www.epa.gov/environmental-economics/mortality-risk-valuation

Strengths of COBRA

- Enriches discussion of co-benefits and supports a balanced decision-making process that considers both the potential costs and benefits of policy choices.
- Easy-to-Use screening tool
  - Requires minimal inputs
  - Includes "canned" equations and approaches generally consistent with EPA practices
  - Detailed User's Guide describes all assumptions and equations
- Flexible for User
  - Can enter data for a single county, statewide, group of counties, outside of state, and/or group of states
  - Can enter reductions in absolute terms or as percentage change
  - Can import custom databases on emissions, population, and disease incidence, which allows the user to vary time timeframe for analysis
  - Can import custom equations (C-R functions, economic values)
  - Can save scenarios to reuse or modify later

Strengths of COBRA

- Inexpensive (free!) compared to rigorous air quality models
  - Results from COBRA approach have fared well in informal comparisons;
  - Enables analysts to narrow a list of options at no/low cost and then devote resources to analyzing only those options with the best prospects using more expensive air quality models.
- Quick to generate results
- Mapping of results facilitates visualization of impacts
  - Provides very localized health effects and valuations: county level
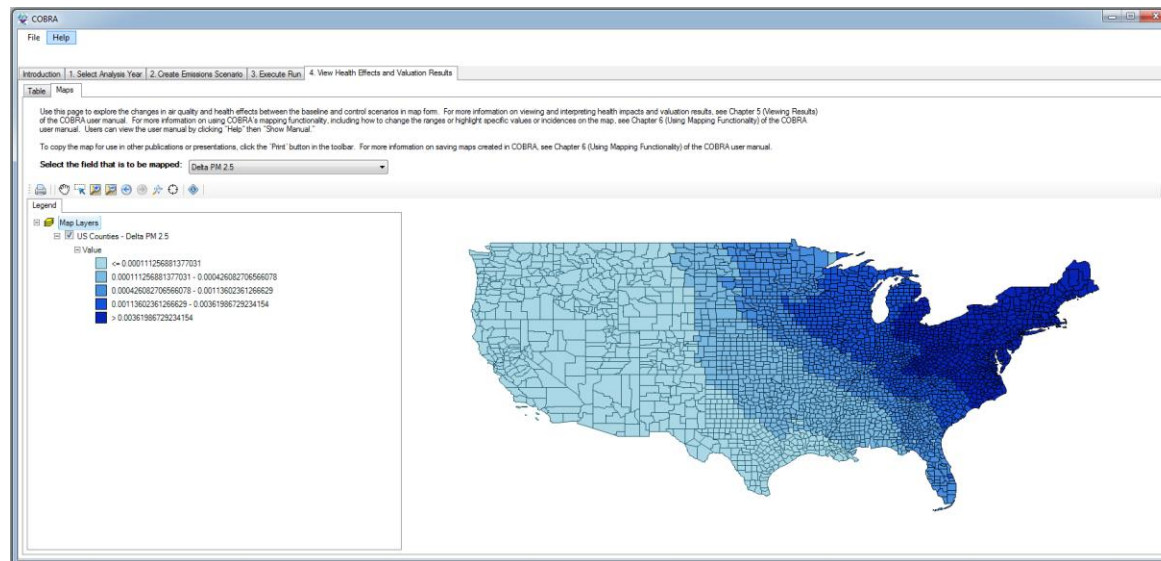
Limitations of COBRA

- EPA is a free, screening tool not a highly sophisticated model.
    - Air Quality (AQ) model is "quick and dirty"
        - COBRA is best used as <u>screening</u> tool, followed up with comprehensive AQ analysis and health impact assessment

    - Relies upon inputs generated elsewhere
        - Assumptions about statewide % reductions may be an oversimplification

- While there are limitations that users should understand, technical peer reviewers found COBRA to be "a valuable model that produces a screening tool that can contribute to policy analysis and public dialogue."

How can I learn more?

Visit Our Website to find all of the documentation for COBRA and to download the model:

https://www.epa.gov/cobra

Contact EPA:

EPA State and Local Energy and Environment Program

cobra@epa.gov