EPA's Health Impacts and Emissions Quantification Tools

Session D1 - Breathe EEasy: Health and Energy Efficiency

Cassandra Kubes
U.S. Environmental Protection Agency
State and Local Energy and Environment Program

Presented at the 2020 Midwest Energy Solutions Conference

State and Local
Energy and Environment Program

EPA's State and Local Energy and Environment Program

Energy choices matter for air quality and public health

Clean Energy

Energy Efficiency, Renewable Energy, Low Emission Fuels

- Reduce total electricity demand
- Reduce demand for transportation-related fossil fuels
- Displace (or replace) fossil fuel electricity sources with clean distributed generation or renewable energy (RE)
- Displace (or replace) fossil fuel transportation with RE or low emission sources

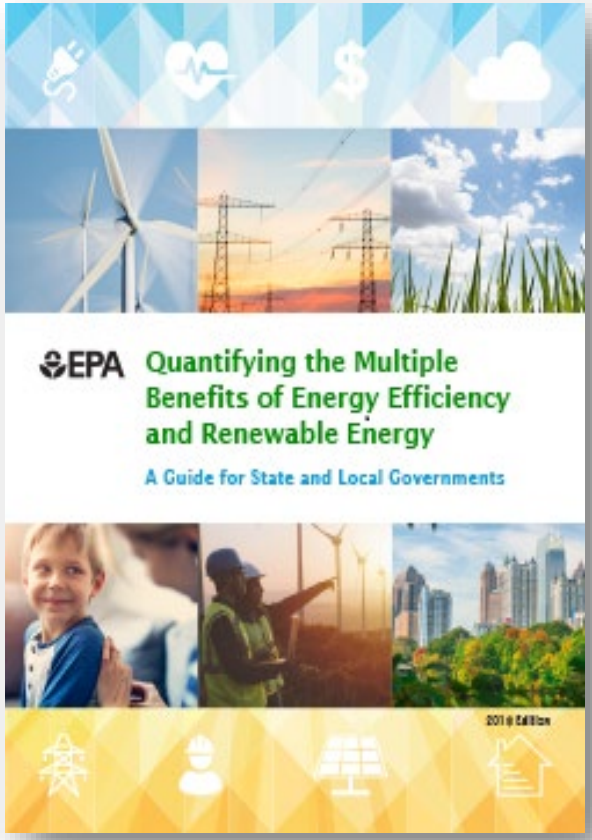
Reduce Emissions

- Reduce air pollution and improves air quality (AQ)
- Reduce GHGs and climate impacts

Deliver Health and Other Societal Benefits

- People avoid premature death and costly illnesses
- Children miss fewer school days
- Businesses benefit from increased worker productivity, fewer employee absences

Emissions, air quality, and health benefits are a key component of EPA's multiple benefits framework



Direct Electricity Impacts (Chapter 2)
- Change in kWh supplied
- Change in kWh consumed

Electricity System Benefits (Chapter 3)

Primary Electricity System Benefits
- Avoided generation costs
- Avoided energy losses
- Avoided capacity costs

Secondary Electricity System Benefits
- Avoided ancillary costs
- Increased reliability
- Improved fuel diversification
- Other secondary benefits

Emissions and Health Benefits (Chapter 4)

Criteria Air Pollutant and/or Greenhouse Gas Emissions Benefits

Reductions in emissions of:
- PM
- CO
- SO_2
- O_3
- VOCs
- CO_2
- CH_4
- N_2O
- HFCs
- SF_6

Air Quality Benefits
- Reductions in concentrations of criteria air pollutants
- Less smog

Human Health Benefits

Changes in incidences of:
- Mortality
- Hospital admissions
- Asthma, bronchitis, and other respiratory illnesses

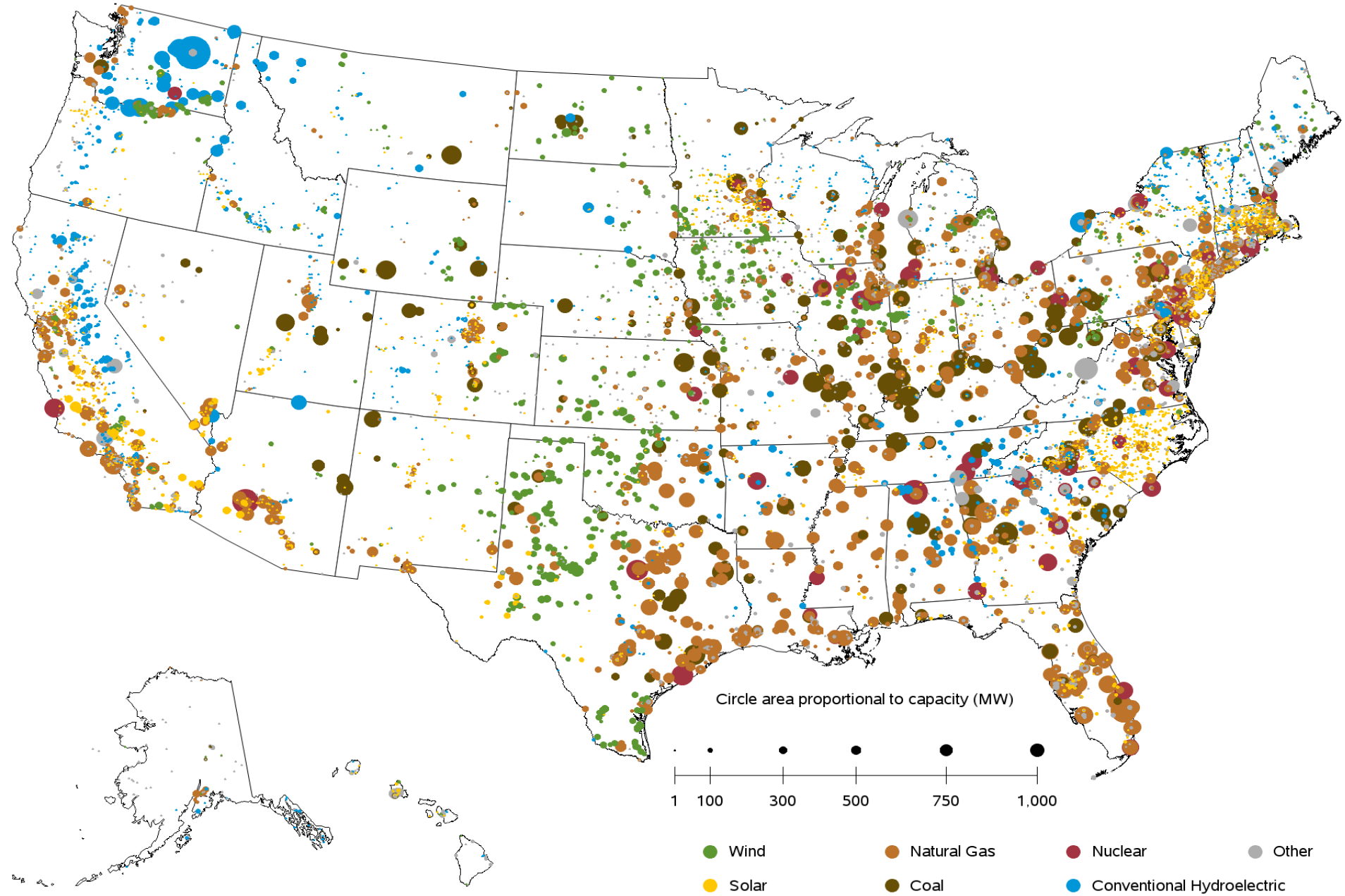
Economic Benefits (Chapter 5)

Direct Effects
- Energy cost, waste heat, or displacement savings
- Program administrative, construction, equipment, and operating costs
- Sector transfers

Indirect Benefits

Changes in:
- Employment
- Gross state product
- Economic output
- Economic growth
- Personal income/earnings

Operable utility-scale generating units as of November 2019



Sources: U.S. Energy Information Administration, Form EIA-860, 'Annual Electric Generator Report' and Form EIA-860M, 'Monthly Update to the Annual Electric Generator Report.'

EPA offers a suite of tools for quantifying emissions, AQ, and health impacts of clean energy

United States Environmental Protection Agency

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

Scenarios

AVERT

- Estimates changes in electricity generation
- Estimates changes in emissions of CO_2, NO_X, SO_2, and primary $PM_{2.5}$

COBRA

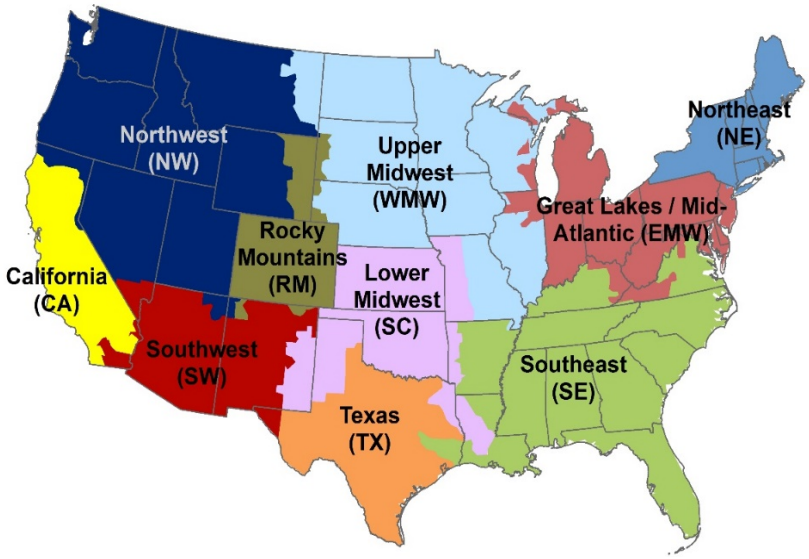
- Estimates air quality changes (primary and secondary $PM_{2.5}$)
- Estimates dollar value of public health benefits

HEALTH BENEFITS per kilowatt hour

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

EPA's AVoided Emissions and geneRation Tool (AVERT)

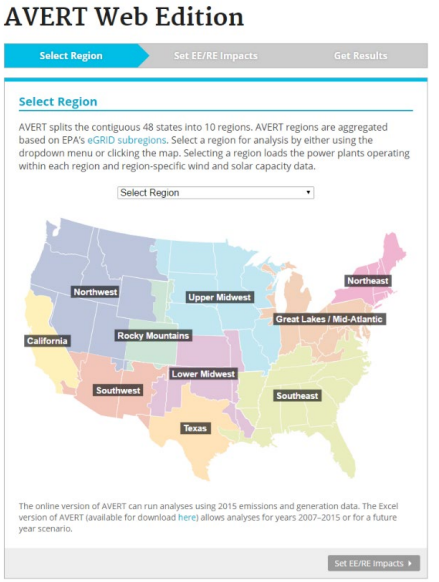
- Translates EE/RE programs to avoided NO_x, SO_2, $PM_{2.5}$, and CO_2 emissions impact
- User friendly, transparent, and credible
- Steps:
  - Locate your AVERT region
  - Obtain energy saved (MWh) for EE programs (portfolio or uniform), or the capacity of wind/solar installation (MW)
  - Chose from multiple scenario options built into the tool
  - Run the model
  - View results in graphical and savable formats



AVERT Regions

Why Use AVERT?

- SIP credit in a state's National Ambient Air Quality Standard (NAAQS) Clean Air Act Plan
- Compare emission impacts of varying levels of EE/RE programs, projects, and policies
- Understand emissions impacts for cost-effectiveness tests
- Calculate emission reductions in your state or county in AVERT's web-based edition
- Use AVERT-generated emission factors to estimate magnitude of emission reductions without running the tool
- This is not a long-term projection tool
  - To conduct analysis more than 5 years from the baseline, users must use AVERT's statistical module and future year scenarios
- Publications that cite AVERT - https://www.epa.gov/statelocalenergy/publications-cite-avert



EPA's Co-Benefits Risk Assessment (COBRA) Screening Model

EPA United States Environmental Protection Agency

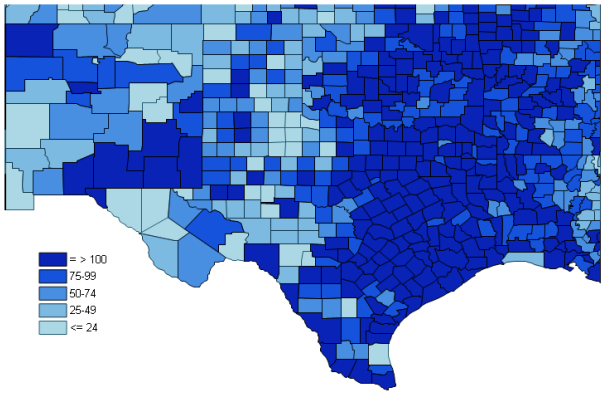
COBRA
Co-Benefits Risk Assessment
Health Impacts Screening and Mapping Tool

- COBRA is a free, easy-to-use, peer reviewed screening model that quickly:
  - Estimates county-level health impacts from user-entered changes in criteria air pollutants from any source in the National Emissions Inventory
  - Monetizes the economic value of those benefits
  - Presents results via tables and maps that facilitate visualization of the results

Health Effects include:

- Adult Mortality
- Infant Mortality
- Non-fatal Heart Attacks
- Respiratory and Cardiovascular Hospital Admissions
- Acute Bronchitis
- Upper and Lower Respiratory Symptoms
- Asthma Exacerbations, Emergency Room visits
- Minor Restricted Activity Days
- Work Loss Days

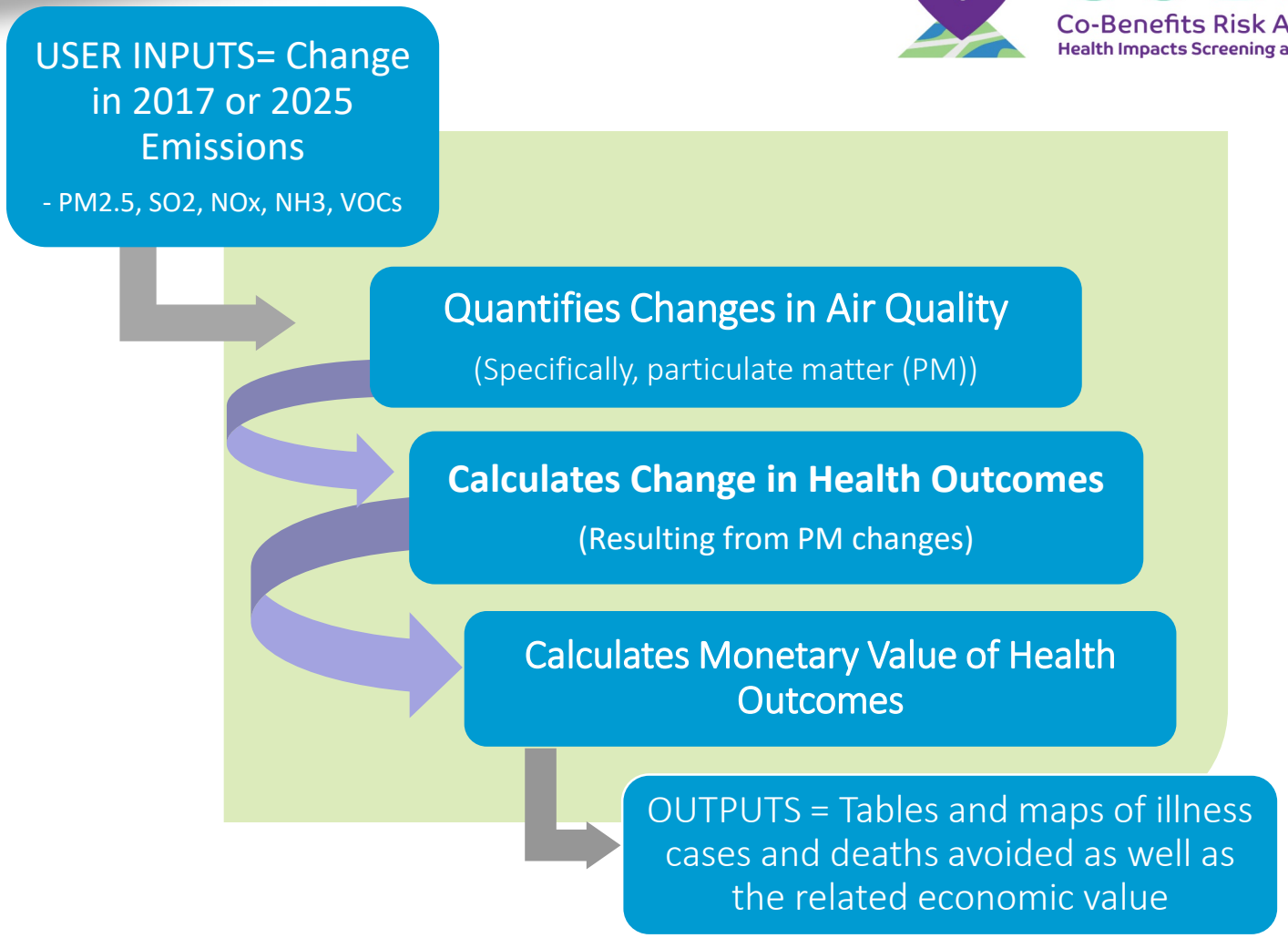
Number of Asthma Exacerbations Avoided



COBRA Screening Model: User Steps

EPA United States Environmental Protection Agency

COBRA
Co-Benefits Risk Assessment
Health Impacts Screening and Mapping Tool

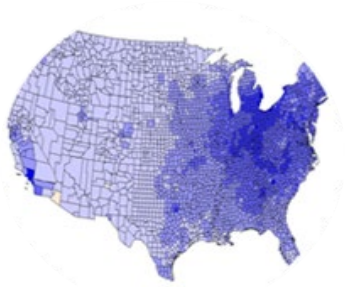


Why Use COBRA?

EPA United States Environmental Protection Agency

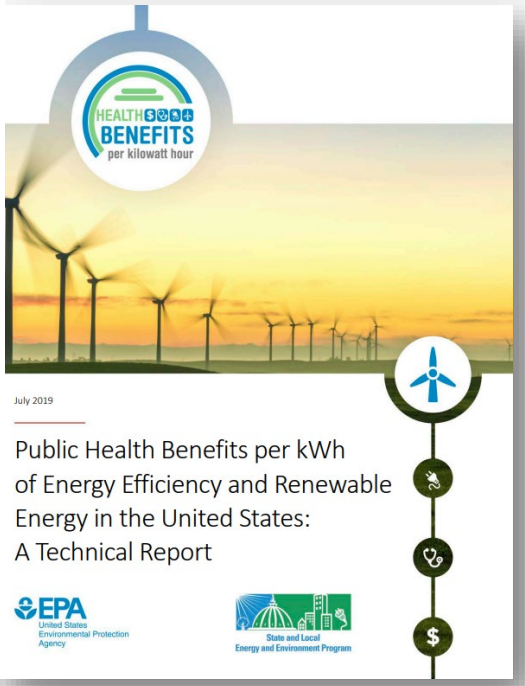
COBRA
Co-Benefits Risk Assessment
Health Impacts Screening and Mapping Tool

- Analysts, planners, and officials from environmental, health, energy, transportation, and economic development agencies can use COBRA to:
  - Quickly and inexpensively compare different clean energy policies and identify those that:
    - Are likely to result in the greatest health benefits
    - Are expected to reduce health risks in the most cost-effective manner
  - Estimate and promote improvements in air quality and economic value of associated human health benefits of:
    - Clean and/or renewable energy projects
    - Other types of projects, such as transportation or municipal waste
  - Convey how clean energy benefits can go beyond a single county and impact people at the state, regional, and national levels
- Publications that cite COBRA - https://www.epa.gov/statelocalenergy/publications-cite-cobra



EPA's health benefits per kilowatt-hour (BPK) values

- Use to quickly estimate the monetary value of health benefits from reductions in fine particulate matter ($PM_{2.5}$) due to EE/RE
- Helps to indicate direction and relative magnitude when comparing across state and local EE/RE policies
- Free, Easy to use, Peer-reviewed
- BPK values (¢/kWh) are available for:
  - Wind, solar, portfolio EE, and uniform EE programs
  - 10 regions of the United States
  - Solar, wind, uniform and peak EE
- Technical report provides details on EPA's methodology and appropriate uses for the values



How to use BPK values

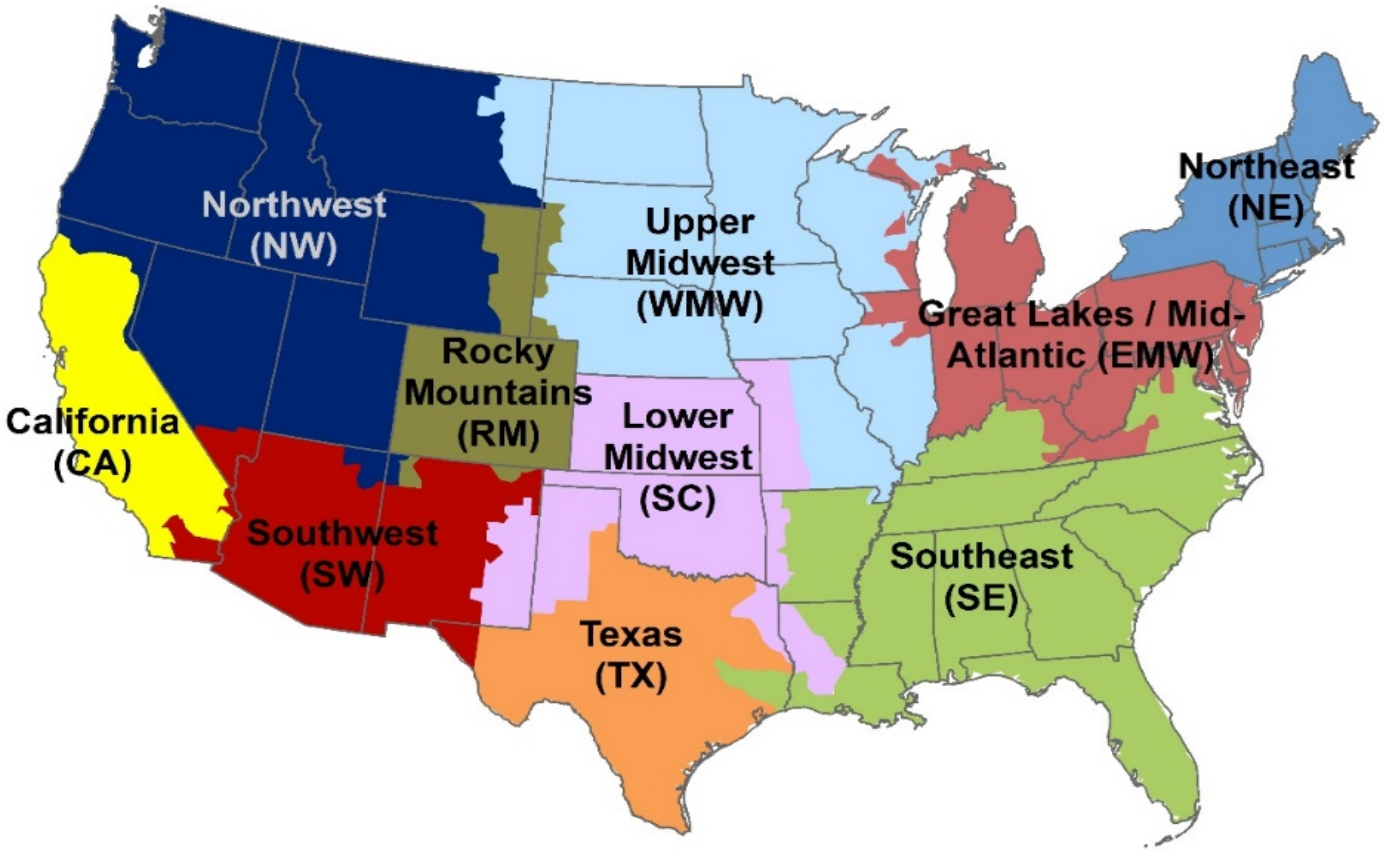
BPK x ΔkWh = Estimated Health Benefits ($)

1. Select appropriate BPK value
   - Region, technology, sensitivity, discount rate (3% or 7%)
2. Multiply BPK value by
   - kWh saved from EE
   - kWh generated by RE

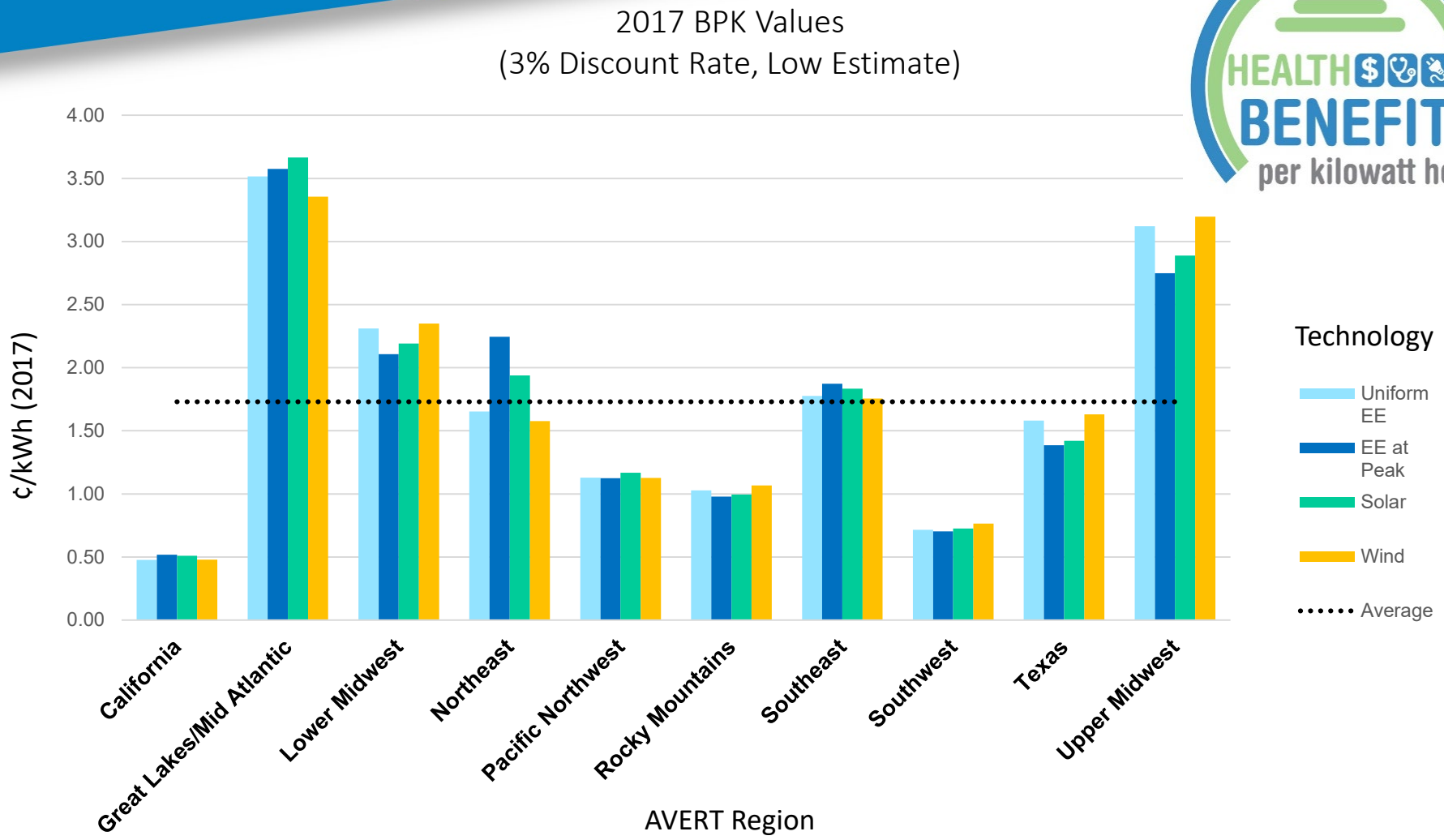
Example analyses:

- Estimating the public health benefits of regional, state, or local-level investments in EE/RE
- Understanding the cost-effectiveness of regional, state, or local-level EE/RE projects, programs, and measures
- Incorporating health benefits in short-term regional, state, or local policy analyses and decision-making

AVERT Regions



BPK values vary more by region than technology, reflecting existing fuel mix and population



Region	Project Type	3% Discount Rate	
		2017 ¢/kWh (low estimate)	2017 ¢/kWh (high estimate)
California	Uniform EE	0.48	1.08
	EE at Peak	0.52	1.17
	Solar	0.51	1.15
	Wind	0.48	1.09
Great Lakes/ Mid-Atlantic	Uniform EE	3.51	7.95
	EE at Peak	3.57	8.08
	Solar	3.67	8.29
	Wind	3.35	7.59
Lower Midwest	Uniform EE	2.31	5.23
	EE at Peak	2.11	4.77
	Solar	2.19	4.96
	Wind	2.35	5.32
Northeast	Uniform EE	1.65	3.73
	EE at Peak	2.24	5.07
	Solar	1.94	4.38
	Wind	1.58	3.56
Pacific Northwest	Uniform EE	1.13	2.55
	EE at Peak	1.12	2.54
	Solar	1.17	2.64
	Wind	1.13	2.55
Rocky Mountains	Uniform EE	1.03	2.32
	EE at Peak	0.98	2.21
	Solar	0.99	2.25
	Wind	1.07	2.41
Southeast	Uniform EE	1.78	4.02
	EE at Peak	1.87	4.24
	Solar	1.83	4.15
	Wind	1.76	3.98
Southwest	Uniform EE	0.71	1.62
	EE at Peak	0.70	1.59
	Solar	0.73	1.64
	Wind	0.77	1.73
Texas	Uniform EE	1.58	3.58
	EE at Peak	1.39	3.13
	Solar	1.42	3.22
	Wind	1.63	3.69
Upper Midwest	Uniform EE	3.12	7.06
	EE at Peak	2.75	6.22
	Solar	2.89	6.53
	Wind	3.20	7.23

HEALTH $ BENEFITS per kilowatt hour

Closing Questions

- Do you have examples where quantifying health benefits would be useful in your work?
- Would these tools be helpful for your efforts?
- What other resources on quantifying emissions and health impacts would be helpful?

Resources

GHG Inventory Tools

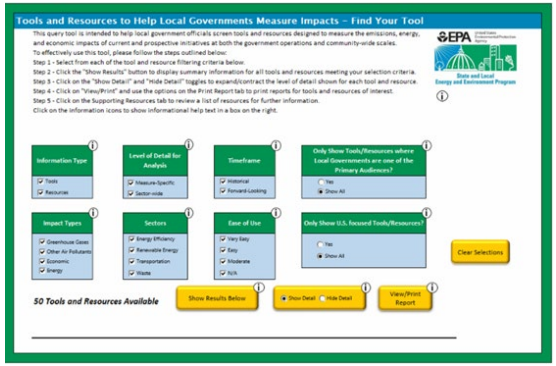
Provides frameworks and default data for comprehensive GHG inventories of state, local, and tribal government activities
https://www.epa.gov/statelocalenergy/state-local-and-tribal-inventory-tools

Greenhouse Gas Equivalencies Calculator

Translates GHG reduction numbers into easily understood terms (e.g. gallons of gasoline, etc.)
https://www.epa.gov/energy/greenhouse-gas-equivalencies-calculator

Tool Finder for Local Government Clean Energy Initiatives

Screens the tools/resources that measure the emissions, energy, and economic impacts of clean energy policies and programs
https://www.epa.gov/statelocalenergy/tool-finder-local-government-clean-energy-initiatives



Resources (cont.)

AVoided Emissions and geneRation Tool (AVERT)

Estimates the emissions benefits of clean energy polices and programs
https://www.epa.gov/statelocalenergy/avoided-emissions-and-generation-tool-avert

CO-Benefits Risk Assessment (COBRA)

Estimates the economic value of the air quality-related health benefits associated with clean energy policies and programs
https://www.epa.gov/statelocalenergy/co-benefits-risk-assessment-cobra-health-impacts-screening-and-mapping-tool

Health Benefits per kilowatt hour (BPK)

Provides screening-level regional values to help estimate the health benefits associated with clean energy policies and programs
https://www.epa.gov/statelocalenergy/estimating-health-benefits-kilowatt-hour-energy-efficiency-and-renewable-energy

Cassandra Kubes
Senior Policy Specialist
U.S. Environmental Protection Agency
State and Local Energy and Environment Program
kubes.cassandra@epa.gov

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