EPA United States Environmental Protection Agency

Estimating the Public Health Benefits of Clean Energy

Using EPA's CO–Benefits Risk Assessment (COBRA) Web Edition and Public Health Benefits per Kilowatt-hour (BPK) Values

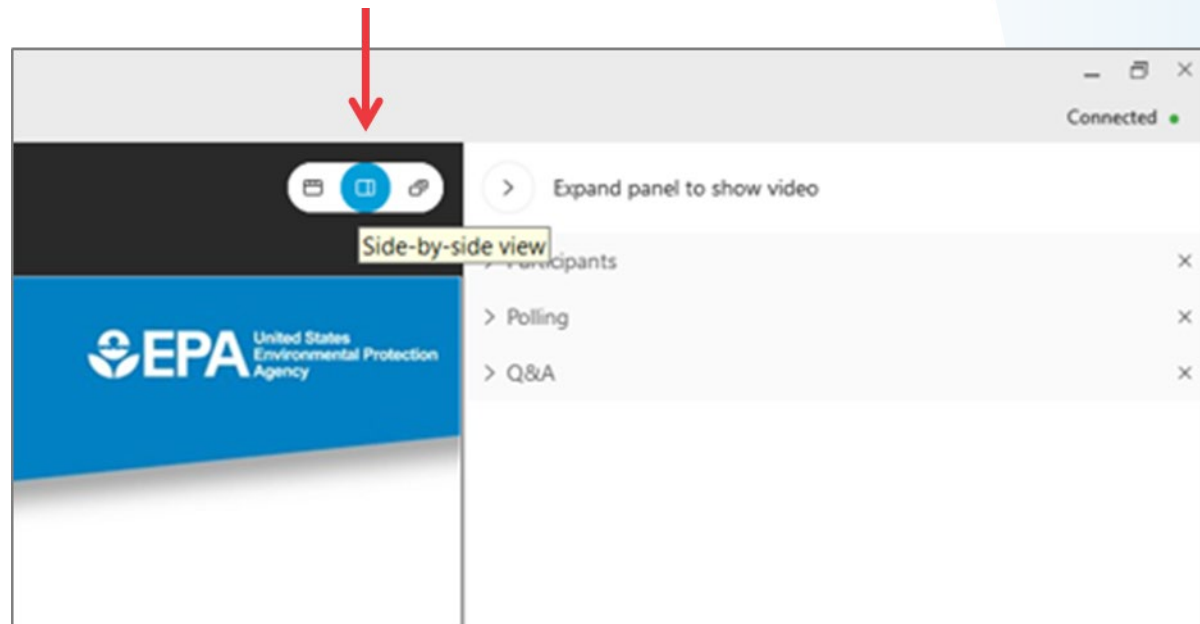June 29, 2021
1:00 pm Eastern

Three audio options:
1. Listen via computer
2. Use the WebEx "Call Me" feature
3. Dial 1-415-655-0002 or 1-855-797-9485
Event number: 161 921 7579

1

Screen View

- There are several layout options
- We recommend the side-by-side view
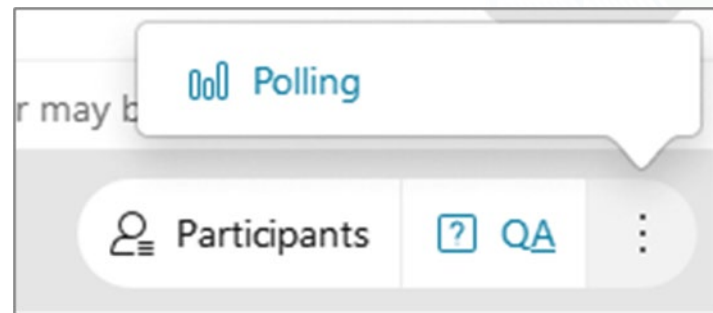
Webinar Panels

We'll use three panels

- Participants, Polling, and Question & Answer (Q&A)
- Use the arrow to expand or collapse the panels

Adding Panels

- If some panels don't appear, hover over the bottom of the screen and select the desired panels
- Select More Options (…) for additional panels
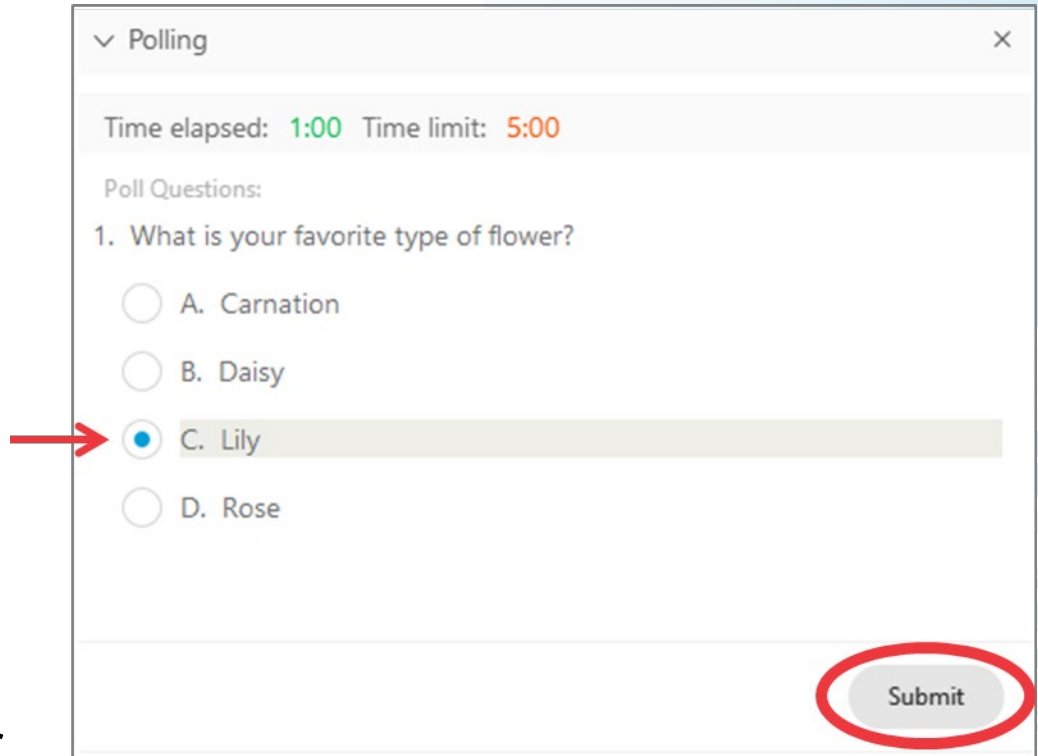- Blue icons indicate active panels

Participants   **Q&A**   **More Options Polling**

Polling and Feedback

Polling

- We'll ask several poll questions during the webinar
- The polling panel will appear when we open the first poll
- Select your desired response and hit "Submit"

Webinar Feedback

- A feedback form will pop-up when you exit today's webinar

EPA United States Environmental Protection Agency

Polling ×

Time elapsed: 1:00 Time limit: 5:00

Poll Questions:

1. What is your favorite type of flower?
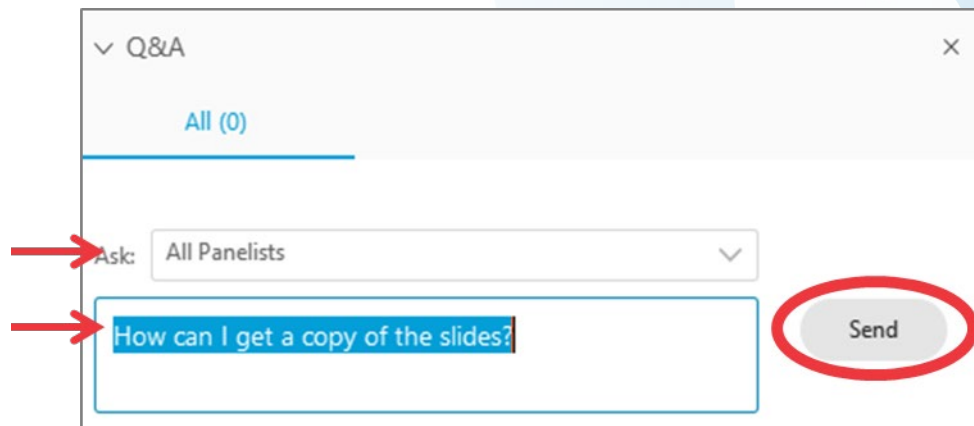
○ A. Carnation

○ B. Daisy

● C. Lily

○ D. Rose

Submit

Q&A

- Participants are muted

- Questions will be moderated at the end

- To ask a question:

  1. Select "All Panelists" from the drop-down menu

  2. Enter your question in the Q&A box

 3. Hit "Send"

- EPA will post final materials on the Webinar Series page:
  www.epa.gov/statelocalenergy/state-local-and-tribal-webinar-series

Today's Agenda

- **Emma Zinsmeister**, Senior Health Analyst and Climate Programs Specialist, U.S. Environmental Protection Agency

- **David Tancabel,** Environmental Policy Analyst, U.S. Environmental Protection Agency

- Question and Answer Session

What experience do you have assessing the health benefits of clean energy programs? (Select any that apply)

- I have not previously assessed the health benefits of clean energy programs

- I have used EPA's Benefits per Kilowatt-hour values

- I have used another simplified approach (e.g., EPA's benefits per ton values)

- I have used EPA's CO-Benefits Risk Assessment (COBRA) tool

- I have used another sophisticated approach [e.g., EPA's Benefits Mapping and Analysis Program (BenMAP) tool]
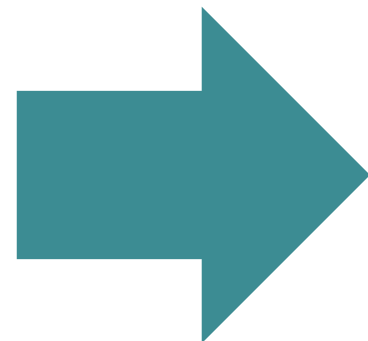
Poll 1

EPA's CO-Benefits Risk Assessment (COBRA) Tool Web Edition

Emma Zinsmeister

Senior Health Analyst and Climate Programs Specialist

U.S. Environmental Protection Agency

State and Local Climate and Energy Program

Today

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

- Introduction to COBRA

- How COBRA works

- Live demonstration of the Web Edition

Our Tools and Resources Support State, Local and Tribal Stakeholders on Clean Energy Policy

www.epa.gov/statelocalenergy

Develop Inventories and Set Goals

Design, Compare, or Evaluate Policy

Communicate and Support Policy Implementation

GHG INVENTORY TOOLS
State / Local / Tribal

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

AVERT

AVoided Emissions and geneRation Tool
Evaluate changes in power plant emissions from energy policy
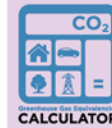
COBRA

Co-Benefits Risk Assessment Health Impacts Screening and Mapping Tool
Quantify and monetize health impacts of reducing emissions

HEALTH BENEFITS per kilowatt hour

Health Benefits per kWh
Estimate the health benefits per kWh of clean energy

Greenhouse Gas Equivalencies Calculator
Convert a unit of energy to the equivalent amount of CO_2 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

Local Action Framework:
A Guide to Help Communities Achieve Energy and Environmental Goals

Energy and Environment Guide to Action: State Policies and Best Practices for Advancing Energy Efficiency, Renewable Energy, and Combined Heat and Power

Quantifying the Multiple Benefits of Energy Efficiency and Renewable Energy:
A Guide for State and Local Governments

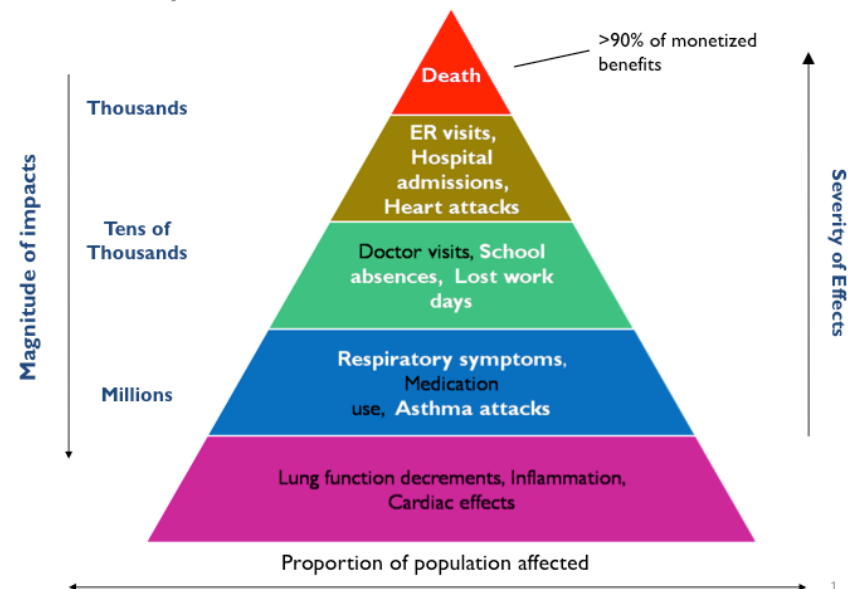**Local Government Climate and Energy Strategy Series:**
A Guide to Developing and Implementing Greenhouse Gas Reduction Programs

kWh (kilowatt-hour) CO_2 (carbon dioxide)

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What is COBRA?

COBRA is a free screening tool that analysts, policymakers, and researchers can use to:

- Explore how emissions reduction policies and programs affect air quality **(fine particulate matter, PM$_{2.5}$)** and human health at the county, state, regional, or national levels

- Estimate the economic value of the health benefits associated with emissions reduction policies and programs to compare against program costs

- Map and visually represent the air quality, human health, and health-related economic benefits from reductions in criteria pollutants

A "Pyramid of Effects" from Air Pollution

>90% of monetized benefits

Death

ER visits, Hospital admissions, Heart attacks

Doctor visits, School absences, Lost work days

Respiratory symptoms, Medication use, Asthma attacks

Lung function decrements, Inflammation, Cardiac effects

Thousands

Tens of Thousands

Millions

Magnitude of impacts

Severity of Effects

Proportion of population affected

ER: Emergency Room

How does COBRA work?

COBRA[1]

USER INPUTS = Change in Emissions (baseline year 2023)

- Primary $PM_{2.5}$, SO_2, NO_x, NH_3, VOCs

Quantifies Changes in Air Quality
(Fine particulate matter, $PM_{2.5}$)

Calculates Change in Health Outcomes
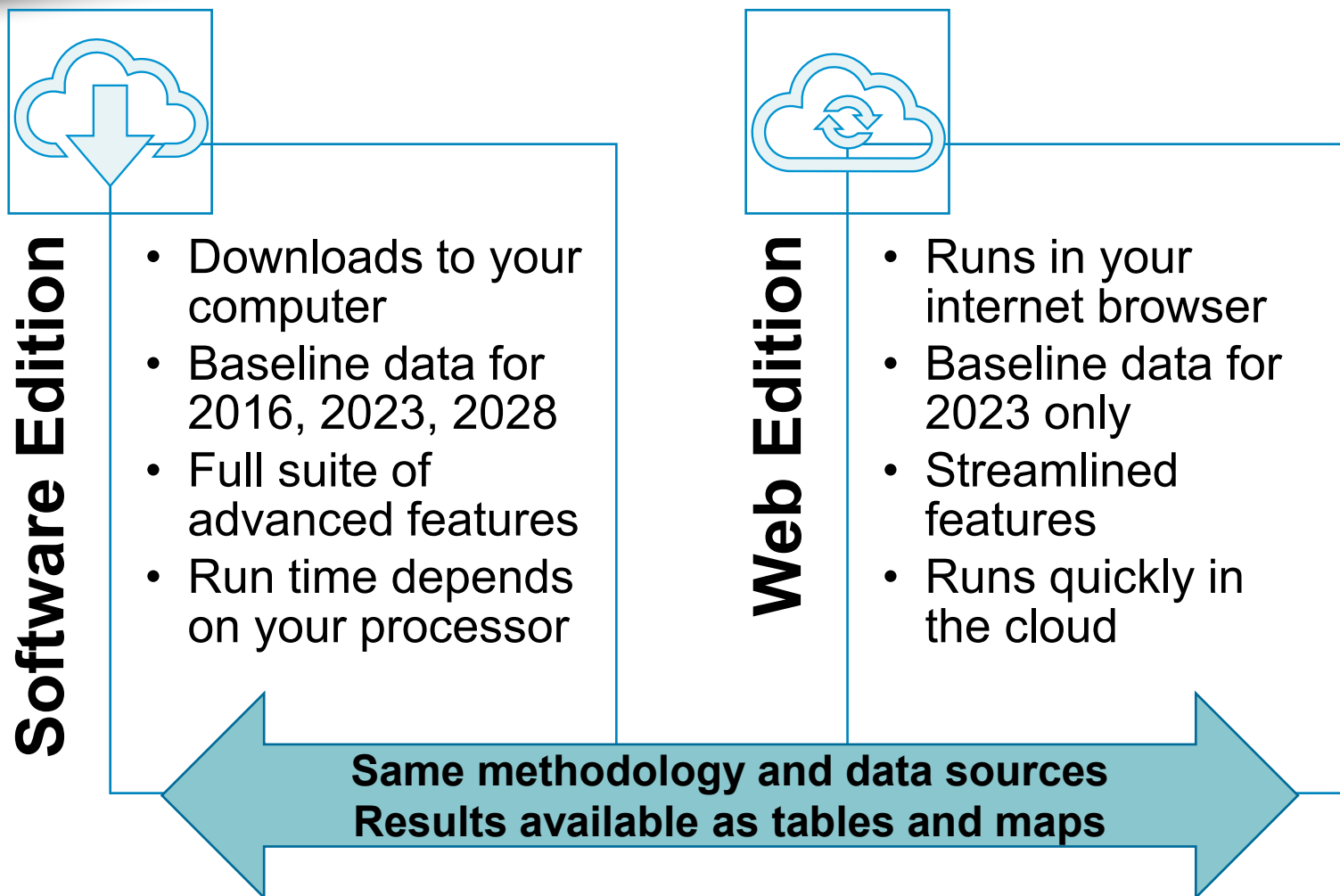(Resulting from $PM_{2.5}$ changes)[2]

Calculates Monetary Value of Health Outcomes

OUTPUTS = Tables and maps of changes in morbidity and mortality and related economic value.

[1]COBRA is a peer-reviewed screening model that based on rigorous methods used by EPA health benefits assessments as described in the User Manual.

[2] COBRA estimates only particulate matter-related benefits and may be conservative in that respect.

SO_2: Sulfur dioxide NO_x: Nitrous oxide NH_3: Ammonia   VOCs: Volatile organic compounds

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What are my options for running COBRA?

Software Edition

- Downloads to your computer
- Baseline data for 2016, 2023, 2028
- Full suite of advanced features
- Run time depends on your processor

Web Edition

- Runs in your internet browser
- Baseline data for 2023 only
- Streamlined features
- Runs quickly in the cloud

**Same methodology and data sources
Results available as tables and maps**

What health effects are estimated and what are their economic values?

Health Incidence Avoided	Economic Value in 2023 ($2017)	
	3% discount rate	**7% discount rate**
Adult Mortality*	$9,748,682	$8,682,996
Infant Mortality	$10,866,012	$10,866,012
Non-Fatal Heart Attacks*	$39,174 - $309,825	$37,038 - $297,494
Hospital Admissions	$17,655 - $47,581	$17,655 - $47,581
Asthma ER Visits	$457 - $547	$457 - $547
Acute Bronchitis	$550	$550
Respiratory Symptoms (upper + lower)	$24 - $38	$24 - $38
Asthma Exacerbations	$66	$66
Minor Restricted Activity Days	$78	$78
Work Loss Days	$178	$178

*Discounted due to time lag between $PM_{2.5}$ exposure and health outcome.

How are results displayed?
Tables & maps

What should I keep in mind when using either the Software or Web Edition?

Strengths

Consistent with EPA's standard practices

Enriches discussion of co-benefits

Free, easy, and quick to run

Visually maps results

Screening tool, not a highly sophisticated model
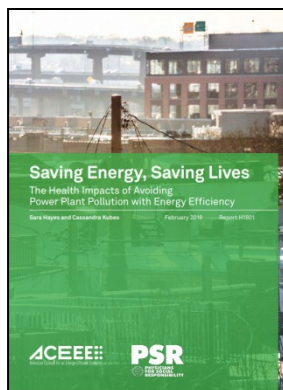
Reduced-form air quality model

Relies upon inputs generated elsewhere

Limitations

How has COBRA been used?
More than **120 citations** as of May 2021

Report by American Council for an Energy Efficient Economy estimates that reducing U.S. electricity consumption by 15% would save **more than 6 lives per day**

Journal article in *Nature Energy* estimates more than **$100 billion in health benefits** from wind and solar between 2007 and 2015

Analysis of the Regional Greenhouse Gas Initiative estimates **$5.7 billion in health benefits** from emission reductions between 2009 and 2014
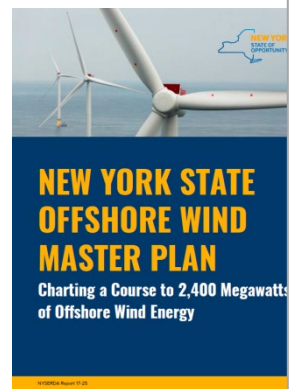
An analysis by New York State found that meeting its renewable energy targets through offshore wind energy could result in up to **18 fewer deaths per year**

Live Example in Web Edition

www.epa.gov/cobra

Step 0. Develop Your Inputs

- When are the emissions changes taking place?

- Where are the emissions changes occuring?

- What is the source of the emissions?

- What emissions are changing and by how much?

Step 0. Develop Your Inputs

Part 1: Woodstove Changeouts

Location: Wisconsin

Sector: Fuel Combustion Other; Residential Wood; Woodstoves

Emissions Changes:
- $PM_{2.5}$: Reduce by 31.5 tons
- VOCs: Reduce by 80.7 tons

Discount Rate: 3%

Part 2: 440 kW Solar Photovoltaic

Location: Wisconsin

Sector: Fuel Combustion Electric Utility

Emissions Changes:
- $PM_{2.5}$: Reduce by 1.7 tons
- SO_2: Reduce by 9.2 tons
- NO_X: Reduce by 6.5 tons
- VOCs: Reduce by 1.2 tons

Discount Rate: 3%

Target completion date: 2024

Emma Zinsmeister, MPH

Senior Health Analyst & Climate Programs Specialist

U.S. EPA State & Local Climate & Energy Program

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www.epa.gov/cobra

# Health Benefits per Kilowatt-hour

David Tancabel

Environmental Policy Analyst

U.S. Environmental Protection Agency

Why do you want to assess the health benefits of clean energy programs? (Select any that apply)

- To inform state/local policy making

- To inform utility regulation or planning

- To help communicate program benefits to stakeholders

- Other (add your response to the Q&A)
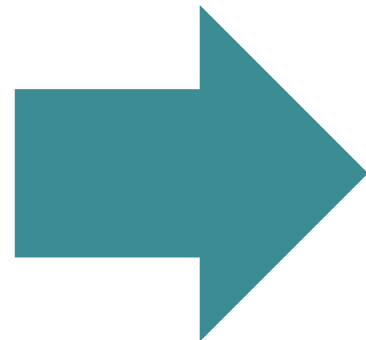
Poll 2

Why did EPA create the BPK values?

- State and local governments, and other analysts, are looking for easy to use **EE/RE health benefits factors (¢/kWh)** to help with planning, assessing cost-effectiveness, and demonstrating value

- *Prior to BPK,* existing estimates:

  ▶ Ranged widely in value

  ▶ Were not available for many regions of the U.S.

  ▶ Used inconsistent methodologies across EE/RE technologies and geographic regions

- EPA's BPK values address these issues and fill a critical need for **screening-level estimates**
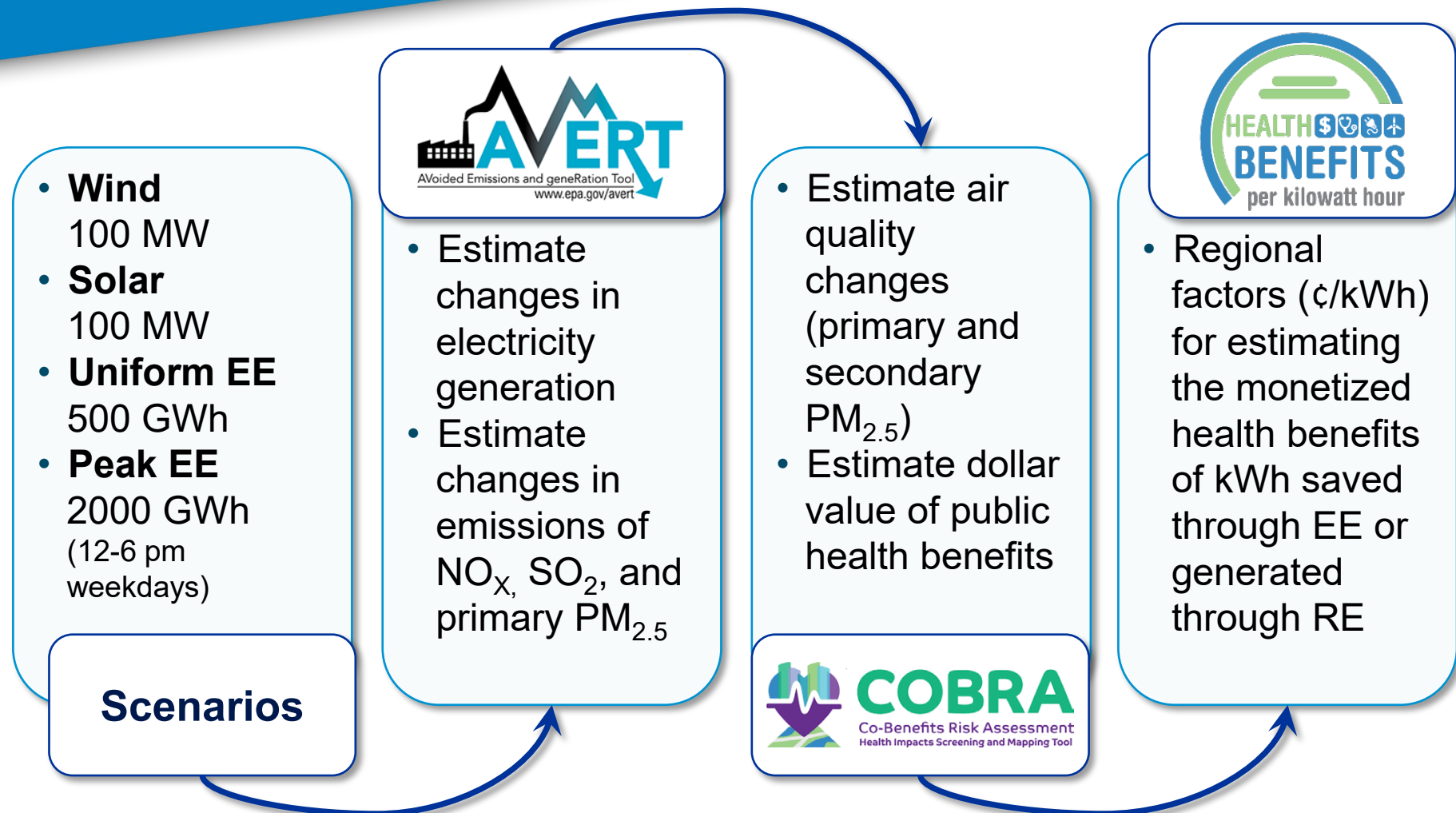
Case in Point:
In 2018, the California Public Utilities Commission proposed a Societal Cost Test, which included a **0.6 ¢/kWh Air Quality Adder** for assessing the health impacts of distributed energy resources

EE: energy efficiency   RE: renewable energy

EPA used existing tools and expert input to develop the BPK values

Scenarios

- **Wind** 100 MW
- **Solar** 100 MW
- **Uniform EE** 500 GWh
- **Peak EE** 2000 GWh (12-6 pm weekdays)

AVERT — AVoided Emissions and geneRation Tool — www.epa.gov/avert

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

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

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

HEALTH BENEFITS per kilowatt hour

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

MW: Megawatt   GWh: Gigawatt-hour

Improvement to BPK Calculations

- <u>Revised regions</u> - Increased number of regions from 10 to 14

- <u>Additional technology types</u> - Added two new technology types: offshore wind and distributed (rooftop) solar

- <u>Avoided transmission and distribution losses in energy efficiency values</u> - Incorporated avoided power sector transmission and distribution losses for energy efficiency technologies

- <u>New 2019 datasets</u> - Based on the most up-to-date data available: 2019 electricity generation data and emissions, population, baseline mortality incidence rate, and income growth projections. BPK values are in 2019 dollars

How to use the BPK Values

BPK x △kWh = Estimated Health Benefits ($)

- **To use:**
  - ▸ **Select appropriate BPK value**
    - • Region, technology, sensitivity, discount rate (3% or 7%)
  - ▸ **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

The BPK Values

View the full list of BPK values:

www.epa.gov/statelocalenergy/estimating-health-benefits-kilowatt-hour-energy-efficiency-and-renewable-energy

Region	Project Type	3% Discount Rate	
		2019 ¢/kWh (low estimate)	2019 ¢/kWh (high estimate)
Mid-Atlantic	Uniform EE	3.10	7.00
	EE at Peak	3.17	7.15
	Utility Solar	3.10	7.00
	Distributed Solar	3.09	6.98
	Onshore Wind	3.04	6.85
	Offshore Wind	3.05	6.88

| Region	Project Type	3% Discount Rate	
		2019 ¢/kWh (low estimate)	2019 ¢/kWh (high estimate)
Midwest	Uniform EE	2.70	6.10
	EE at Peak	2.64	5.97
	Utility Solar	2.65	5.98
	Distributed Solar	2.65	5.99
	Onshore Wind	2.73	6.16

Region	Project Type	3% Discount Rate	
		2019 ¢/kWh (low estimate)	2019 ¢/kWh (high estimate)
Southeast	Uniform EE	0.69	1.55
	EE at Peak	0.84	1.90
	Utility Solar	0.81	1.83
	Distributed Solar	0.82	1.85
	Onshore Wind	0.73	1.65
Southwest	Uniform EE	0.58	1.31
	EE at Peak	0.63	1.43
	Utility Solar	0.61	1.38
	Distributed Solar	0.62	1.39
	Onshore Wind	0.57	1.28

BPK 2019 Values – One of Six Technologies (EE at Peak)
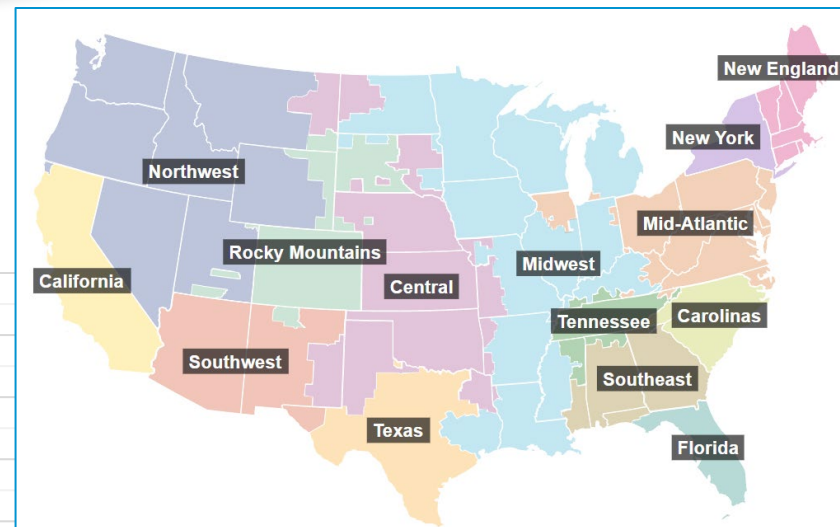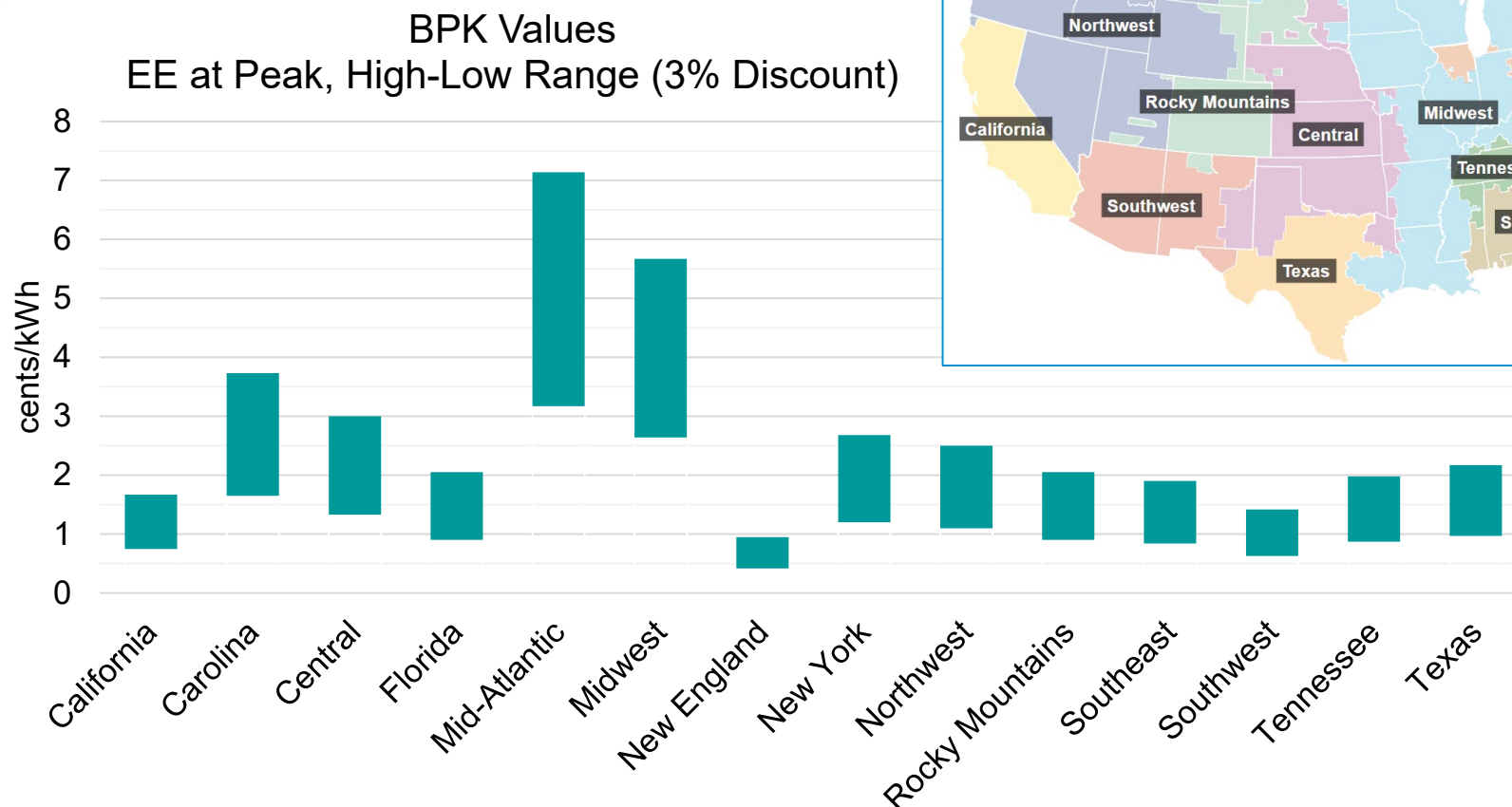
Bars represent the high – low range. EPA guidance dictates to report both values

A closer look

2019 Benefits-per-kWh (3% Discount Rate, Low Estimate)
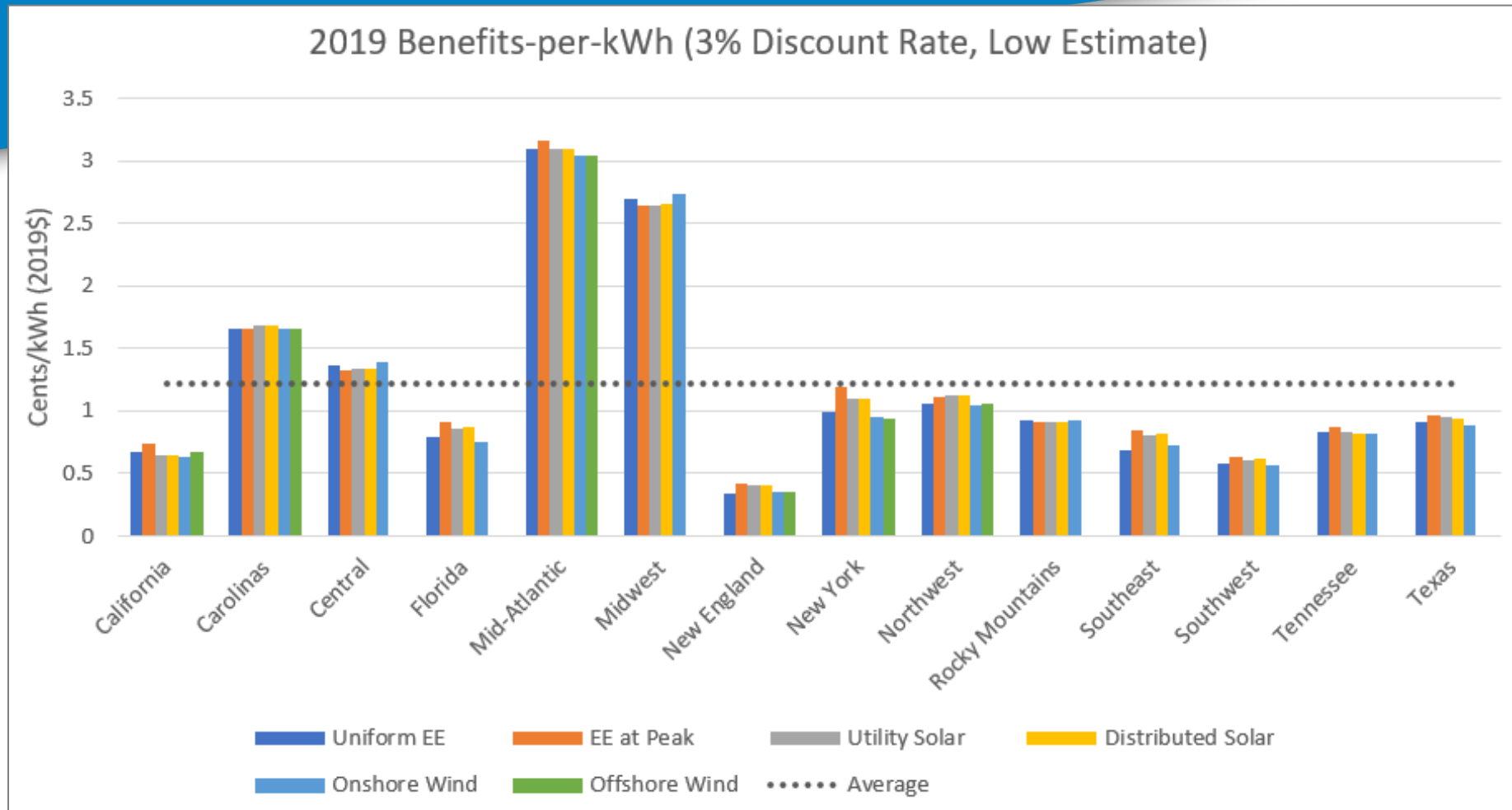
BPK values show greater variation by region than by technology, based on existing fuel mix and population density/proximity

Example: What are the health benefits associated with installing 10 MW of solar energy in North Carolina?

BPK Value, Utility Solar	Carolinas Region		
	HEALTH BENEFITS per kilowatt hour (¢/kWh)	Energy Savings (kWh)	Health Benefits (Million $)
Low estimate, 3% discount rate	1.69	13.9 million kWh	$234,910
High estimate, 3% discount rate	3.80		$528,200
Low estimate, 7% discount rate	1.50		$208,500
High estimate, 7% discount rate	3.39		$471,210
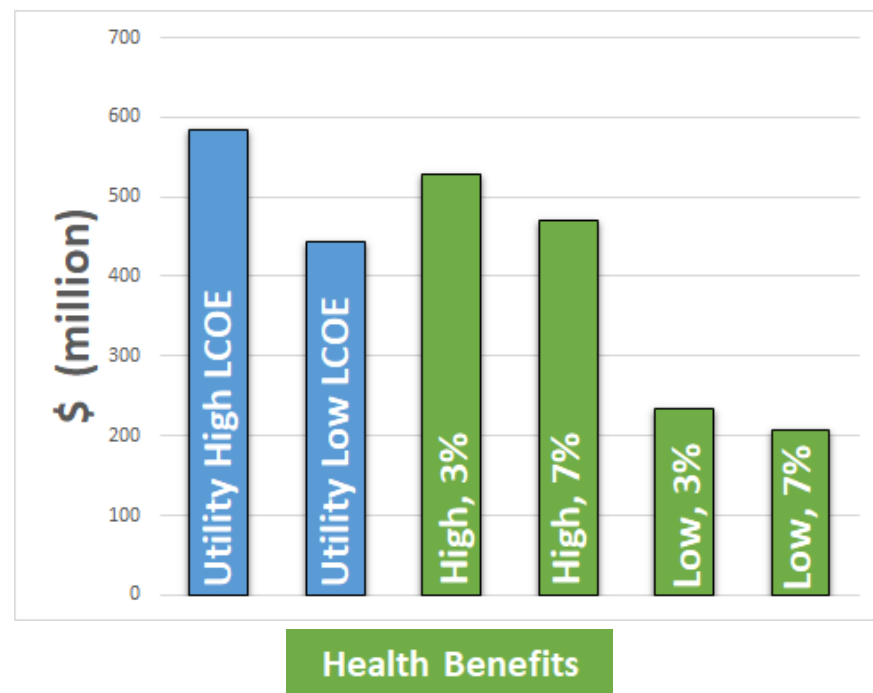
Health Benefits

13.9 million kWh of RE = **$471 million - $528 million** in health benefits

Example: What are the health benefits associated with utility EE investments in Illinois in 2019?
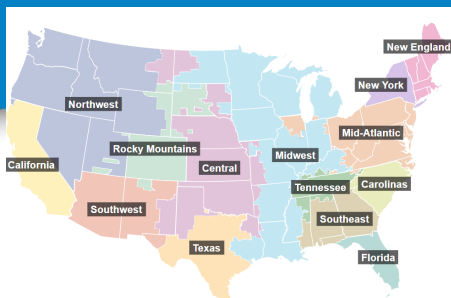
Region	Portion of Generation	2019 Energy Savings Reported in Energy Information Administration 861 (kWh)	Energy Savings in Each Region (kWh)
Mid-Atlantic	65%	2.5 billion	1.6 billion
Midwest	35%		0.875 billion

Type of BPK Value	Great Lakes/Mid-Atlantic			Upper Midwest			Total Health Benefits
	BPK Value HEALTH BENEFITS per kilowatt hour (¢/kWh)	Energy Savings (kWh)	Health Benefits (Million $)	BPK Value HEALTH BENEFITS per kilowatt hour (¢/kWh)	Energy Savings (kWh)	Health Benefits (Million $)	
Low estimate, 3% discount rate	3.10	1.6 billion	49.6	2.70	0.875 billion	23.6	$73.2 million
High estimate, 3% discount rate	7.00		112.0	6.10		53.4	$165.4 million
Low estimate, 7% discount rate	2.78		44.5	2.41		21.1	$65.5 million
High estimate, 7% discount rate	6.26		100.2	5.43		47.5	$147.7 million

1.6 billion kWh saved = $73.2 million - $147.7 million in health benefits

Important considerations to keep in mind when using these factors

- Timeframe of the health benefits factors
  - ➤ ± 5 years
- Project, program, or policy evaluated
  - ➤ Limited to less than 15% of fossil generation in a region
  - ➤ EE programs that are significantly different from those modeled
- Limitations related to curtailment of renewables
- Pollutants beyond the scope of the tools
  - ➤ Does not include ozone or CO_2
- Benefits beyond the scope of the analysis
  - ➤ Does not include ecosystem impacts or other welfare benefits beyond public health

HEALTH BENEFITS per kilowatt hour

Example use: Demonstrate the value of health benefits of a pilot solar program for low- and moderate-income customers

COMMERCE DEPARTMENT
ENERGY RESOURCES

Energy Policy and Conservation Quadrennial Report, 2020

3/1/2021

Prepared by
Minnesota Department of Commerce, Division of Energy Resources

Pursuant to Minnesota Statute § 216C.18

- Report by the Minnesota Department of Commerce, Division of Energy Resources (March 2021)

- Weatherization Assistance Program pilot to install solar PV on 50 homes

- Estimated health benefits per array was $134 to $303 per year

Example use: Estimated health benefits associated with renewable energy credit procurement
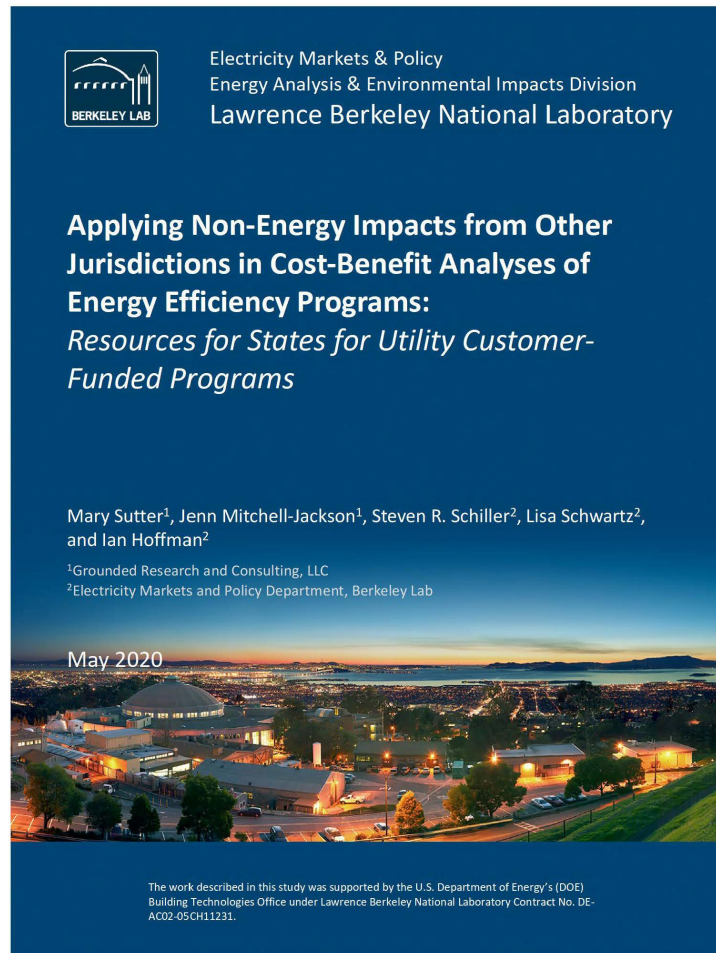
FISCAL YEAR 2020

IPA
ILLINOIS POWER AGENCY

ANNUAL REPORT

FEBRUARY 16, 2021

- Illinois Power Agency (IPA) Annual Report (February 2021)

- Uses BPK values to estimate the environmental benefits of the IPA's renewable resource procurements

Example use: Non-Energy Impacts (NEI) for Cost-Benefit Analysis

Electricity Markets & Policy
Energy Analysis & Environmental Impacts Division
Lawrence Berkeley National Laboratory

Applying Non-Energy Impacts from Other Jurisdictions in Cost-Benefit Analyses of Energy Efficiency Programs:
Resources for States for Utility Customer-Funded Programs

Mary Sutter[1], Jenn Mitchell-Jackson[1], Steven R. Schiller[2], Lisa Schwartz[2], and Ian Hoffman[2]

[1]Grounded Research and Consulting, LLC
[2]Electricity Markets and Policy Department, Berkeley Lab

May 2020

The work described in this study was supported by the U.S. Department of Energy's (DOE) Building Technologies Office under Lawrence Berkeley National Laboratory Contract No. DE-AC02-05CH11231.

- Included in 2020 Lawrence Berkeley National Laboratory report on estimating NEI from EE programs

- BPK values were given the highest "Transferability Rating," meaning they can be utilized quickly and accurately without expertise

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When to use COBRA or BPK?

	COBRA	BPK
Estimates	Changes in morbidity and mortality (incidence) due to changes in ambient $PM_{2.5}$ μg/m³) and monetizes results. Covers all sectors in EPA's National Emissions Inventory.	Monetized health benefits per kilowatt-hour (kWh) of fossil generation avoided by 6 types of EE/RE for 14 U.S. regions.
Based on	A source-receptor matrix that estimates how changes in emissions affect air quality in other areas and health impact and economic valuation functions used in EPA's regulatory impact analyses.	Modeling using EPA's AVoided Emissions and geneRation Tool (AVERT) and COBRA.
Requires inputs	On the **change in emissions (tons) of NO_x, SO_2, $PM_{2.5}$, VOC, and NH_3** at the county or state-level.	On the **amount of electricity (kWh)** produced by RE or avoided due to EE.
Produces	National, state-level, and county-level estimates of change in **incidence** and **monetary value ($)** of health benefits.	A **monetary value ($)** of health benefits by simply multiplying the kWh of fossil generation avoided by the corresponding BPK value for the type of EE/RE and region.

BPK values demonstrate that the health benefits of EE/RE are substantial and quantifiable

- Air pollution remains an important health challenge in the United States

- EE and RE are critical strategies for improving air quality and public health

- EPA's new **BPK values are a free, credible, and easy-to-use resource** for incorporating the health benefits of EE and RE into decision making

	AVERT	COBRA — Co-Benefits Risk Assessment Health Impacts Screening and Mapping Tool	HEALTH BENEFITS per kilowatt hour
Estimates	Changes in emissions of CO_2, NO_x, SO_2, and $PM_{2.5}$ from EE/RE policies and projects.	Changes in morbidity and mortality due to changes in ambient $PM_{2.5}$ and monetizes results.	Monetized health benefits per kilowatt-hour (kWh) of fossil generation avoided by 4 types of EE/RE for 10 U.S. regions.
Based on	Historical hourly electricity generation and emissions data from power plants in the U.S.	A source-receptor matrix that estimates how changes in emissions affect air quality in other areas and health impact and economic valuation functions used in EPA's regulatory impact analyses.	Modeling using AVERT and COBRA.
Requires inputs	On size of RE installation or amount of energy consumption avoided due to EE.	On the change in NO_x, SO_2, $PM_{2.5}$, VOC, and NH_3 emissions at the county or state-level.	On the amount of electricity produced by RE or avoided due to EE.
Produces	Regional, state-level, and county-level estimates of fossil generation and emissions avoided.	County-level estimates of change in incidence and monetary value of health benefits.	An economic value of health benefits by simply multiplying the kWh of fossil generation avoided by the corresponding BPK value for the type of EE/RE and region.

Question and Answer Session

Contact Information

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State and Local Climate and Energy Program

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Sign Up for Our Newsletter | www.epa.gov/statelocalenergy/state-and-local-energy-newsletters
Join Our LinkedIn Group | www.linkedin.com/groups/12129811/

Appendix

COBRA Web Edition
Step-by-Step

Step 0. Develop Your Inputs

Part 1: Woodstove Changeouts

Location: Wisconsin

Sector: Fuel Combustion Other; Residential Wood; Woodstoves

Emissions Changes:
- PM$_{2.5}$: Reduce by 31.5 tons
- VOCs: Reduce by 80.7 tons

Discount Rate: 3%

Part 2: 440 kW Solar Photovoltaic

Location: Wisconsin
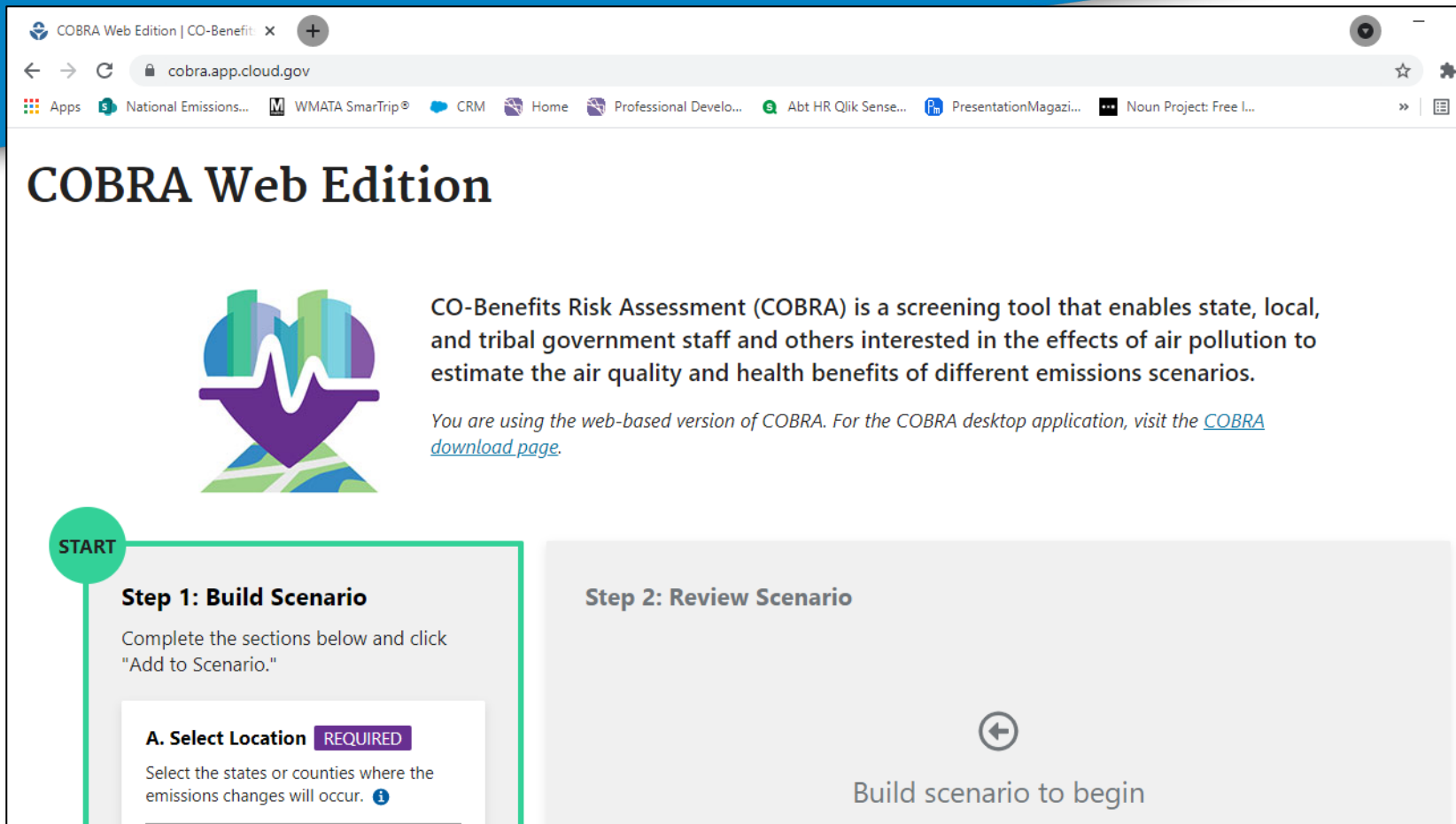
Sector: Fuel Combustion Electric Utility

Emissions Changes:
- PM$_{2.5}$: Reduce by 1.7 tons
- SO$_2$: Reduce by 9.2 tons
- NO$_X$: Reduce by 6.5 tons
- VOCs: Reduce by 1.2 tons

Discount Rate: 3%

Step 1. Access COBRA

The new COBRA Web Edition can be accessed at:
www.epa.gov/cobra

Step 2. Select Location

Scroll through the list of locations to select the one you are interested in. Check the box to make a selection

START

Step 1: Build Scenario

Complete the sections below and click "Add to Scenario."

A. Select Location REQUIRED

Select the states or counties where the emissions changes will occur. ⓘ

- ▸ ☐ South Dakota
- ▸ ☐ Tennessee
- ▸ ☐ Texas
- ▸ ☐ Utah
- ▸ ☐ Vermont
- ▸ ☐ Virginia
- ▸ ☐ Washington
- ▸ ☐ West Virginia
- ▸ ☑ Wisconsin

Select All | Deselect All

B. Select Sector REQUIRED

Select the industry or sector where the emissions changes will occur. ℹ

Sector

Fuel Combustion: Other ⇕

Select the sector you are interested in from the dropdown menu

Subsector (optional)

Residential Wood ⇕

Subsector (optional)

All subsectors ⇕

All subsectors
Fireplaces
Other
Woodstoves

Select any subsectors you are interested in from the dropdown menus

Step 5. Modify Emissions

C. Modify Emissions REQUIRED

Enter emissions changes for **at least one** of the five pollutants below. ⓘ

PM$_{2.5}$ (Baseline = 11,730.15 tons)

| reduce by | increase by |

| 31.5 | ● tons | ○ percent |

SO$_2$ (Baseline = 281.57 tons)

| reduce by | increase by |

| enter # | ● tons | ○ percent |

NO$_x$ (Baseline = 1,112.44 tons)

| reduce by | increase by |

| enter # | ● tons | ○ percent |

NH$_3$ (Baseline = 600.4 tons)

| reduce by | increase by |

| enter # | ● tons | ○ percent |

VOC (Baseline = 11,793.29 tons)

| reduce by | increase by |

| 80.7 | ● tons | ○ percent |

PM$_{2.5}$ (Baseline = 11,730.15 tons)

| reduce by | increase by |

| 31.5 | ● tons | ○ percent |

VOC (Baseline = 11,793.29 tons)

| reduce by | increase by |

| 80.7 | ● tons | ○ percent |

Enter your emissions information and select ADD TO SCENARIO

ADD TO SCENARIO

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Step 6. Review Scenario

Step 2: Review Scenario

Review the scenario below. To add changes to more locations or sectors, repeat Step 1 to continue building your scenario.

Location(s)	Sector	Emissions Modification(s)	
Wisconsin - All Counties	Fuel Combustion: Other Residential Wood	$PM_{2.5}$ reduce by 31.5 tons VOC reduce by 80.7 tons	✕

← Need to continue adding emissions changes to locations or sectors? Repeat Step 1.

Discount rate: ⓘ
- ● 3%
- ○ 7%
- ○ Custom: [enter %]

Review your scenario and ensure the correct discount rate is selected

RUN SCENARIO

Step 7. Add Additional Location Information

Step 1: Build Scenario

Complete the sections below and click "Add to Scenario."

A. Select Location `REQUIRED`

Select the states or counties where the emissions changes will occur. ⓘ

- › ☐ South Dakota
- › ☐ Tennessee
- › ☐ Texas
- › ☐ Utah
- › ☐ Vermont
- › ☐ Virginia
- › ☐ Washington
- › ☐ West Virginia
- › ☑ Wisconsin

Select All | Deselect All

Scroll through the list of locations to select the one you are interested in. Check the box to make a selection

Step 8. Add Additional Sector Information

B. Select Sector REQUIRED

Select the industry or sector where the emissions changes will occur. ⓘ

Sector

Fuel Combustion: Electric Utility ⬍

Subsector (optional)

All subsectors ⬍

Subsector (optional)

All subsectors ⬍

Select the sector you are interested in from the dropdown menu

Select any subsectors you are interested in from the dropdown menus

PM$_{2.5}$ (Baseline = 1,351.15 tons)

| reduce by | increase by |

1.7 ● tons ○ percent

NO$_x$ (Baseline = 12,175.19 tons)

| reduce by | increase by |

6.5 ● tons ○ percent

SO$_2$ (Baseline = 5,795.31 tons)

| reduce by | increase by |

9.2 ● tons ○ percent

VOC (Baseline = 912.96 tons)

| reduce by | increase by |

1.2 ● tons ○ percent

Enter your emissions information and select ADD TO SCENARIO

ADD TO SCENARIO

Step 10. Review Scenario

Step 2: Review Scenario

Review the scenario below. To add changes to more locations or sectors, repeat Step 1 to continue building your scenario.

Location(s)	Sector	Emissions Modification(s)	
Wisconsin - All Counties	Fuel Combustion: Other Residential Wood	$PM_{2.5}$ reduce by 31.5 tons VOC reduce by 80.7 tons	✕
Wisconsin - All Counties	Fuel Combustion: Electric Utility	$PM_{2.5}$ reduce by 1.7 tons SO_2 reduce by 9.2 tons NO_x reduce by 6.5 tons VOC reduce by 1.2 tons	✕

Review your scenario and ensure the correct discount rate is selected. If you are satisfied with your scenario, select RUN SCENARIO

Discount rate: ⓘ
- ⦿ 3%
- ◯ 7%
- ◯ Custom: [enter %]

RUN SCENARIO

You will see the following screen as your results are calculating…

Calculating…

Step 11. View Results

View the Summary of Health Effects Results. Look to the bottom of the chart to find the Total Health Effects

Step 3: View Results

BUILD NEW SCENARIO

A. Summary of Health Effects Results

Below is a table with the health effects results based on your scenario.

ℹ️ **You are viewing results for all contiguous U.S. states.** This is because changes in air quality can impact health endpoints in multiple locations due to the transportation of emissions across state and county lines.

Use the filters below to see health effects for a specific state or county.

1. Filter by state:
All contiguous U.S. states

2. Filter by county: (optional)
All counties

Results for: All Contiguous U.S. States

Export: All results | Current filter

Health Endpoint ℹ️	Change in Incidence ℹ️ (cases, annual)		Monetary Value ℹ️ (dollars, annual)	
	Low	High	Low	High
Mortality *	0.435	0.984	$4,757,095	$10,765,302
Nonfatal Heart Attacks *	0.045	0.415	$7,136	$66,308
Infant Mortality	0.002	0.002	$24,826	$24,826
Hospital Admits, All Respiratory	0.084	0.084	$4,806	$4,806
Hospital Admits, Cardiovascular **	0.094	0.094	$3,395	$3,395
Acute Bronchitis	0.550	0.550	$339	$339
Upper Respiratory Symptoms	9.930	9.930	$424	$424
Lower Respiratory Symptoms	6.985	6.985	$189	$189
Emergency Room Visits, Asthma	0.189	0.189	$107	$107
Asthma Exacerbation	10.375	10.375	$770	$770
Minor Restricted Activity Days	292.579	292.579	$25,649	$25,649
Work Loss Days	49.376	49.376	$9,885	$9,885
💜 **Total Health Effects**			**$4,834,620**	**$10,901,999**

* The Low and High values represent differences in the methods used to estimate some of the health impacts in COBRA. For example, high and low results for avoided premature mortality are based on two different epidemiological studies of the impacts of $PM_{2.5}$ on mortality in the United States.
** Except heart attacks.

💜 **Total Health Effects** $4,834,620 $10,901,999

Step 11. View Results (continued)

Select the map's data layer:

Total Health Benefits ($, low estimate) ⇕

Displaying: Total Health Benefits ($, low estimate)

Monetary value ($)

$0.08 $364,887.48

Leaflet | © OpenStreetMap contributors

You can also view your results on a map. Use the filter to see other data displayed