Value Added: Measuring the Health Benefits of Energy Efficiency and Renewables
Questions?

Please send questions through the Questions pane
EPA Report: Benefits per Kilowatt Hour
Our Experts

Emma Zinsmeister  Nancy Seidman  Jim Lazar
Estimating the Monetary Value of Outdoor Air Quality Health Benefits from Energy Efficiency and Renewable Energy

Emma Zinsmeister, MPH CPH
RAP Webinar
December 5, 2019
EPA’s State and Local Energy and Environment Program

Helps state and local governments reduce emissions to meet their environmental, energy, and economic goals.
EPA’s new 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 energy efficiency (EE) and renewable energy (RE)

- Free
- Easy to use
- Peer-reviewed

BPK values (¢/kWh) are available for:
- 10 regions of the United States
- Solar, wind, uniform and peak EE

Technical report provides details on methodology and appropriate uses
Efficiency and renewables provide air quality and health benefits

- **EE and RE deliver health and environmental benefits** by avoiding fossil-fired power plant emissions, which improves air quality and enhances public health.

- State and local governments, and others are increasingly looking to quantify and document the **air quality and health benefits** of EE and RE, driven by:
  - **Policymaker and planner** interests in addressing local air quality and health concerns
  - **Energy regulators** seeking comprehensive assessments of costs and benefits of energy choices
  - **Green banking and EE/RE industries** looking to demonstrate public health benefits of investments
Air pollution is the 8th leading risk factor for mortality, accounting for almost 4% of deaths (107,500) in the United States in 2017 alone.*

**Health outcomes associated with PM$_{2.5}$ assessed and monetized in BPK values:**

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

*State of Global Air 2019, USA Country Profile*
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**
  - 200 GWh (12-6 pm weekdays)

**AVERT**
- Estimate changes in electricity generation
- Estimate changes in emissions of NO$_x$, SO$_2$, and primary PM$_{2.5}$

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

**Health Benefits**
- Regional factors (¢/kWh) for estimating the monetized health benefits of kWh saved through EE or generated through RE
BPK values show greater variation by region than technology, based on existing fuel mix and population density.
How to use the BPK Values

BPK x \(\Delta kWh\) = 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

View the full list of BPK values at:
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

More tools and resources are available on EPA’s website: [www.epa.gov/statelocalenergy](http://www.epa.gov/statelocalenergy)

Sign up for our Newsletters: [www.epa.gov/statelocalenergy/state-local-tribal-energy-newsletters](http://www.epa.gov/statelocalenergy/state-local-tribal-energy-newsletters)
Thank you!

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RAP’s “Layer Cake” Approach

Source: https://www.raponline.org/knowledge-center/recognizing-the-full-value-of-energy-efficiency/
Energy Efficiency Improves Air Quality

- Complying with public health standards
- Complying with visibility standards
- Developing implementation plans
- Demonstrating “permanent, quantifiable, surplus, enforceable” reductions
Example: Arkansas EE Programs

Incremental Savings (GWh)

<table>
<thead>
<tr>
<th>Year</th>
<th>Incremental Savings</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
<td>40</td>
</tr>
<tr>
<td>2011</td>
<td>40</td>
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<tr>
<td>2012</td>
<td>110</td>
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<td>2013</td>
<td>150</td>
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<td>2014</td>
<td>210</td>
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<tr>
<td>2015</td>
<td>240</td>
</tr>
<tr>
<td>2016</td>
<td>260</td>
</tr>
<tr>
<td>2017</td>
<td>280</td>
</tr>
</tbody>
</table>
Arkansas EE and BPK Benefits

- EE program cost: $73.5 million in 2017
- BPK health benefits in 2017: $5.6 to $12.7 million
- With 10-year measure life, the benefits likely exceed the costs!

Source for program costs: Arkansas PSC, Docket No. 07-077-TF
Air Quality Ideas for BPK

• EE is the first fuel!
  • What test does your state use for EE cost/benefit analysis?
  • Can BPK be used in that test?

• Ozone planning

• Regional haze planning

Caney Creek Wilderness
AR– WinHAZE 2015
Modeled Visibility Conditions
What’s 100 MW Worth in Health Benefits?

Annualized Capital Cost: $20.2 million (37% capacity factor)

Annualized Capital Cost: $12.2 million (27% capacity factor)

<table>
<thead>
<tr>
<th>Annual Health Benefits</th>
<th>Low values, 3% discount ($ millions)</th>
<th>High value, 3% discount ($ millions)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Upper Midwest (Wind)</td>
<td>$10.1</td>
<td>$22.8</td>
</tr>
<tr>
<td>Upper Midwest (Solar)</td>
<td>$6.8</td>
<td>$15.4</td>
</tr>
</tbody>
</table>
BPK and the Power of Collaboration
EPA Provides Range Estimates

- Efficiency, solar, and wind
- Regional values
- Low to high estimates
- Different discount rates

<table>
<thead>
<tr>
<th>Region</th>
<th>Project Type</th>
<th>3% Discount Rate</th>
<th>7% Discount Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>2017 C/kWh (low estimate)</td>
<td>2017 C/kWh (high estimate)</td>
</tr>
<tr>
<td>California</td>
<td>Uniform EE</td>
<td>0.48</td>
<td>1.08</td>
</tr>
<tr>
<td></td>
<td>EE at Peak</td>
<td>0.52</td>
<td>1.17</td>
</tr>
<tr>
<td></td>
<td>Solar</td>
<td>0.51</td>
<td>1.15</td>
</tr>
<tr>
<td></td>
<td>Wind</td>
<td>0.48</td>
<td>1.09</td>
</tr>
<tr>
<td>Great Lakes/ Mid-Atlantic</td>
<td>Uniform EE</td>
<td>3.51</td>
<td>7.95</td>
</tr>
<tr>
<td></td>
<td>EE at Peak</td>
<td>3.57</td>
<td>8.08</td>
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<tr>
<td></td>
<td>Solar</td>
<td>3.67</td>
<td>8.29</td>
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<tr>
<td></td>
<td>Wind</td>
<td>3.35</td>
<td>7.59</td>
</tr>
</tbody>
</table>
Utility Procurement – Efficiency

Quantification of externality costs

Vermont Energy Efficiency Savings Value
Updated Externality and NEB Values, $/MWh

- Risk
- DTQ NEB
- Other Fuel
- O&M
- Other Resources
- Externalities
- Avoided Reserves
- Line Losses
- Distribution Capacity
- Transmission Capacity
- Capacity
- Energy

Created with assistance from Efficiency Vermont, based upon data from their annual reports and personal communications.
Add the Health Benefit of Efficiency to the Cost-Effectiveness Threshold

- Should change what measures are eligible under TRC and Societal Cost Test.
- May not change the amount the utility will pay.
Peak-Oriented Efficiency
Utility Procurement: Consider Health Impacts in Avoided Cost
Utility Dispatch

Avoided Cost

Availed Cost

- Fuel
- O&M

- Fuel
- O&M
- Health
New Wind and Solar Are More Than Cost-Effective

Health Benefits of Renewable Energy

- **Northeast**: 4 cents per kWh
- **Southeast**: 3 cents per kWh
- **Mid-Atlantic**: 8 cents per kWh
- **Upper Midwest**: 7 cents per kWh
- **Texas**: 2 cents per kWh
## Rate Design: Residential

<table>
<thead>
<tr>
<th>Rate Element</th>
<th>Typical Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Customer Charge</td>
<td>$10.00</td>
</tr>
<tr>
<td>Energy Charge</td>
<td>$0.12/kWh</td>
</tr>
</tbody>
</table>
## Option 1: Higher Energy Charge

<table>
<thead>
<tr>
<th>Rate Element</th>
<th>Typical Rate</th>
<th>Alternative Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Customer Charge</td>
<td>$10.00</td>
<td>$3.00</td>
</tr>
<tr>
<td>Energy Charge</td>
<td>$0.12/kWh</td>
<td>$0.13/kWh</td>
</tr>
</tbody>
</table>
Option 2: Resource-Based Rates
Example: Puget Sound Energy

<table>
<thead>
<tr>
<th>Rate Element</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Customer Charge</td>
<td>$7.49</td>
</tr>
<tr>
<td>First 600 kWh (Hydro, Wind)</td>
<td>$0.09/kwh</td>
</tr>
<tr>
<td>Energy Charge</td>
<td>$0.11/kWh</td>
</tr>
</tbody>
</table>
## Typical Large Commercial Rate

<table>
<thead>
<tr>
<th>Rate Element</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Demand Charge</td>
<td>$10.00/kW</td>
</tr>
<tr>
<td>Energy Charge</td>
<td>$0.10/kWh</td>
</tr>
</tbody>
</table>
Rate Reflecting Health Costs: Limit Demand Charges to Key Hours

<table>
<thead>
<tr>
<th>Rate Element</th>
<th>Application</th>
<th>Amount</th>
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<tbody>
<tr>
<td>Demand Charge</td>
<td>5 – 8 PM ONLY</td>
<td>$10.00/kW</td>
</tr>
<tr>
<td>Energy Charge</td>
<td>Off-Peak</td>
<td>$0.10/kWh</td>
</tr>
<tr>
<td></td>
<td>On-Peak</td>
<td>$0.13/kWh</td>
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State Tax Incentives: Efficiency

- Sales tax exemption
- Investment tax credit
- Direct purchase incentive grants from state funds
- Direct install program for low-income consumers
State Tax Incentives: Renewables

- Tax credit
- Property tax exemption
- Sales tax exemption
Bottom Line: More Frosting!

Source: https://www.raponline.org/knowledge-center/recognizing-the-full-value-of-energy-efficiency/
Questions?

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BPK: A Very Useful Tool

- This report reveals the sizable health benefits of efficiency and renewables.
- Regulators and policymakers can incorporate this data into planning, rate design, and more.
- EPA is interested in information about how these values are being used and welcomes questions.
Resources

- Estimating the Health Benefits per Kilowatt-hour of Energy Efficiency and-Renewable-Energy
- Recognizing the Full Value of Energy-Efficiency
- Value Added: Measuring the Health Benefits of the Layer Cake
- Smart Rate Design for a Smart Future
- Smart Non-Residential Rate Design
- Avoided Emissions and Generation Tool (AVERT):
  - Home page | User manual
- Co-Benefits Risk Assessment (COBRA) Health Impacts Tool:
  - Home page | User manual
About RAP

The Regulatory Assistance Project (RAP)® is an independent, non-partisan, non-governmental organization dedicated to accelerating the transition to a clean, reliable, and efficient energy future.

Learn more about our work at raponline.org

Contact us at:
jlazar@raponline.org
nseidman@raponline.org
What’s 100 MW Worth in Health Benefits?

Three AVERT Regions

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</tr>
<tr>
<td>Southeast (Wind)</td>
<td>5.5</td>
<td>12.5</td>
</tr>
<tr>
<td>Southeast (Solar)</td>
<td>4.3</td>
<td>9.8</td>
</tr>
<tr>
<td>Northeast (Wind)</td>
<td>5.0</td>
<td>11.2</td>
</tr>
<tr>
<td>Northeast (Solar)</td>
<td>4.6</td>
<td>10.4</td>
</tr>
</tbody>
</table>

Assume 315,360,000 kWh/year for wind and 236,520,000 kWh/year for solar