

# Evaluating Health and Economic Benefits of Clean Energy Programs

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# Beyond Energy Savings?



# Why do Co-Benefits Matter?



# The Challenge

## Quantification

- Computational
- Participant Surveys
- Statistical Analysis of Revealed Preferences
- Existing Research-other jurisdictions
- Percent Adder

# Incorporating these Values

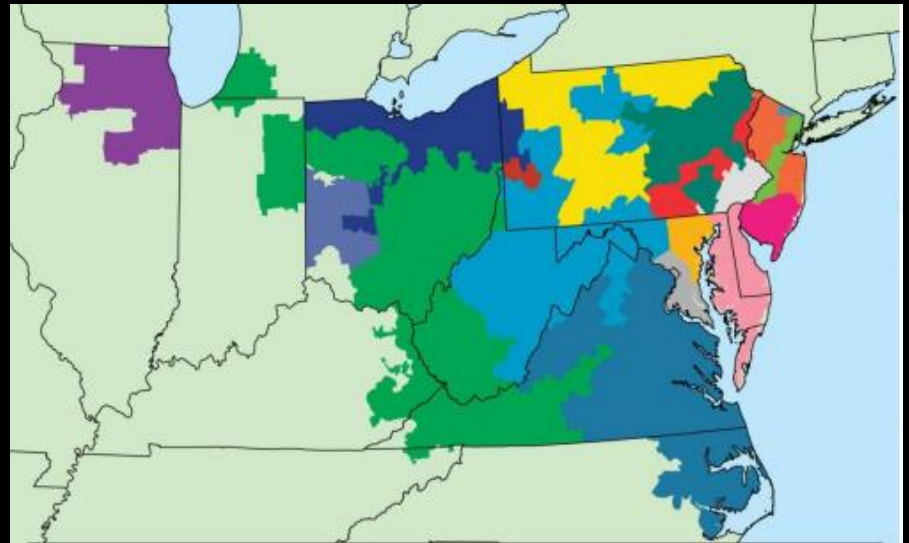


Adapted from Skumatz Report for NRDC/State of Maryland March, 31, 2014

# Research Goal

Identify kWh values in existing research and economic analyses for:

- Health Benefits
- Economic Development / Job Creation



Map Source: [cleantechnica.com](http://cleantechnica.com)

# Health Impacts from Reduced Emissions

Installed PV Capacity (GW)	5	10	70	100
<b>Cases Reduced</b>				
<b>Mortality</b>	22	49	300	437
<b>Chronic Bronchitis</b>	15	34	206	300
<b>Heart Attacks</b>	36	81	493	717
<b>Hospital Admissions-Respiratory</b>				
<b>Chronic Lung, less Asthma (20-64)</b>	1	2	14	21
<b>Asthma (0-64)</b>	2	4	25	36
<b>Pneumonia (65+)</b>	7	17	102	148
<b>Chronic Lung (65+)</b>	1	2	13	18
<b>Total</b>	11	25	153	223
<b>Hospital Admissions - Cardiovascular</b>				
<b>All Cardiovascular (20-64)</b>	4	8	51	74
<b>All Cardiovascular (65+)</b>	5	12	73	106
<b>Total</b>	9	20	124	180
<b>Emergency Room Visits for Asthma</b>	24	53	324	471
<b>Acute Bronchitis</b>	35	78	479	697
<b>Lower Respiratory Symptoms</b>	397	894	5,462	7,945
<b>Upper Respiratory Symptoms</b>	319	718	4,387	6,381
<b>Work Loss Days</b>	2,538	5,710	34,894	50,755
<b>Minor Restricted Activity Days</b>	17,439	39,239	239,791	348,787

National Renewable Energy Laboratory, 2007. "Energy, Economic and Environmental Benefits of the Solar America Initiative" S. Grover ECONorthwest, Portland, Oregon.

# Quantified Health Benefits of Reduced Fossil Fuel Generation

Estimated Cost of Health Impacts				
Fuel Type	2012 PJM Marginal Generation	Machol and Rizk 2013	National Research Council (2010)	Epstein et al. 2011
Coal	58%	32¢/kWh	3.2¢/kWh	14¢/kWh
Natural gas	30%	2¢/kWh	.16¢/kWh	-
Oil	6%	13¢/kWh	-	-
Weighted average		20¢/kWh	2¢/kWh	-
Mid-Range Value		11¢/kWh		

[1] All values presented in 2013 \$.

[2] 2012 Marginal Fuel Type Mix Table 2-16, page 62 of the 2012 State of the Market Report from PJM, Volume 2: Detailed Analysis, March 14, 2013, by Monitoring Analytics, LLC, Independent Market Monitor for PJM. From Memorandum from Tetra Tech to VEIC dated October 14, 2014.

[3] Includes SO<sub>2</sub>, NO<sub>x</sub>, and PM emissions.

[4] National Academy of Sciences (2009). [http://dels.nas.edu/resources/static-assets/materials-based-on-reports/reports-in-brief/hidden\\_costs\\_of\\_energy\\_Final.pdf](http://dels.nas.edu/resources/static-assets/materials-based-on-reports/reports-in-brief/hidden_costs_of_energy_Final.pdf)

[5] Paul R. Epstein, et al. 2011. Full cost accounting for the life cycle of coal in "Ecological Economics Reviews."



# Economic Benefits of Clean Energy

Energy Source	Direct job creation	Direct+ Indirect job creation	Direct+ Indirect+ Induced job creation
	(# of jobs per \$1 million in output)		
Oil And Natural Gas	0.8	3.7	5.2
Coal	1.9	4.9	6.9
Solar	5.4	9.8	13.7
Building retrofits	7.0	11.9	16.7
Mass Transit/ Freight Rail	11.0	15.9	22.3

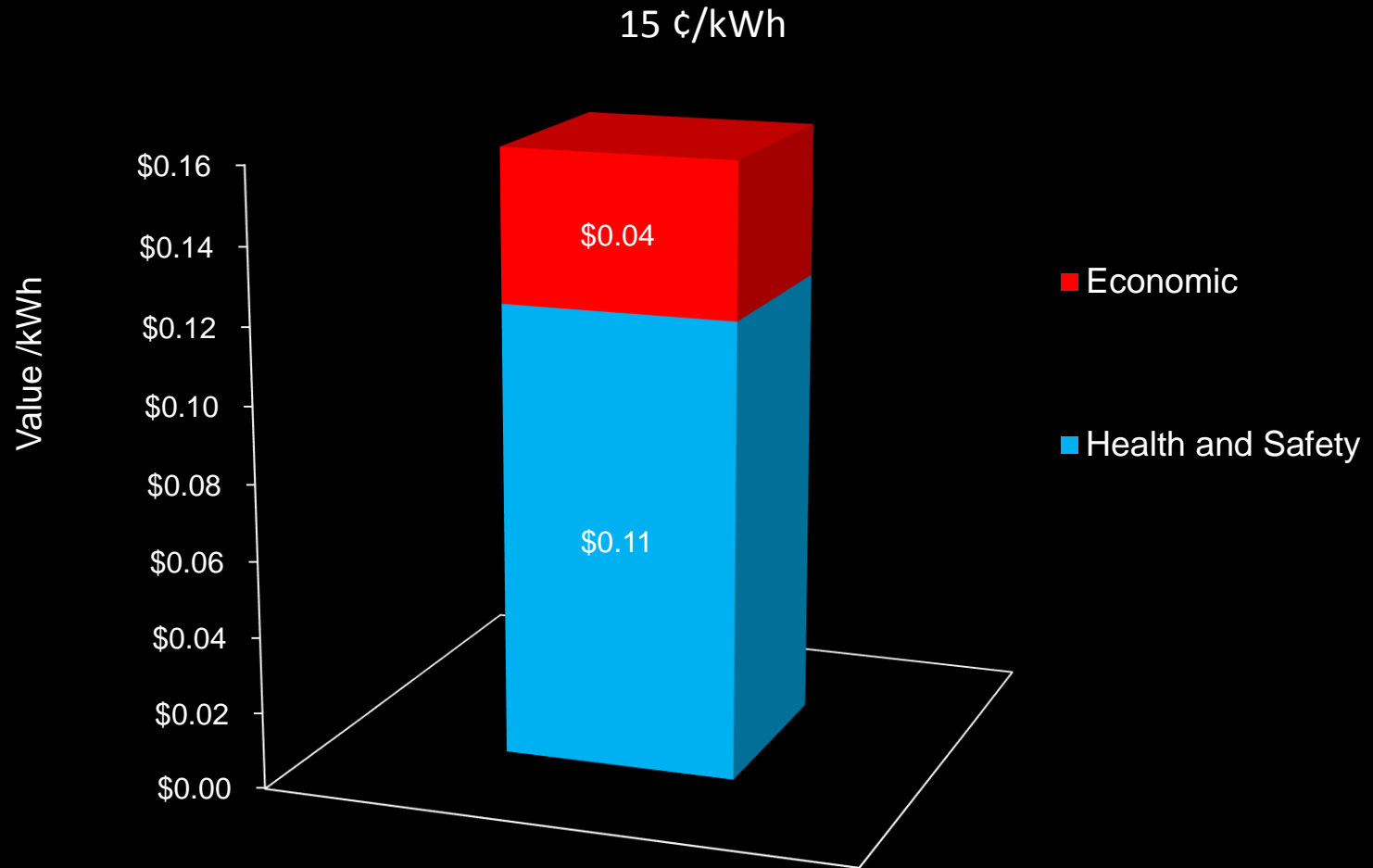
Source: Pollin, Robert, Heintz, James and Garrett-Peltier, Heidi. "The Economic Benefits of Investing in Clean Energy", Political Economy Research Institute, Center for American Progress. June 2009 p.28-29.

# Value of Distributed Solar Electric Generation by Location

Category	Value (¢/kWh)										
	Pittsburgh, PA	Harrisburg, PA	Scranton, PA	Philadelphia, PA	Jamesburg, NY	Newark, NJ	Atlantic City, NJ	ME	NY	MA	CT
<b>Fuel cost savings</b>	4.1	4.1	4.1	3.8	4.2	3.9	4.1	8.1			
<b>O&amp;M cost savings</b>	2.0	2.0	2.0	1.8	2.1	1.9	2.0				
<b>Security enhancement value</b>	2.3	2.3	2.3	2.2	2.3	2.2	2.2		2.5		
<b>Long-term societal value</b>	2.8	2.9	2.9	2.7	2.8	2.8	2.8		3.5		
<b>Fuel price hedge value</b>	3.1	4.2	4.2	4.7	2.4	4.4	2.5	3.7	4.0		
<b>Generation capacity value</b>	2.2	1.6	1.7	2.2	1.9	2.6	1.8	4.0			
<b>T&amp;D capacity Value</b>	0.6	0.1	0.1	0.3	0.1	0.8	0.2	1.6	6.0		
<b>Market price reduction value</b>	3.5	6.7	6.9	5.4	5.2	5.1	5.4	6.6			
<b>Environmental value</b>	5.4	5.5	5.5	5.2	2.3	2.2	2.3	9.5	4.5	6.5	6.6
<b>Economic development value</b>	4.4	4.5	4.5	4.2	4.5	4.4	4.5		3+		
<b>(Solar penetration cost)</b>	2.3	-2.3	-2.3	-2.2	-2.3	-2.2	-2.3	0.5	2.5		
<b>Total Value</b>	29.0	29.0	29.0	29.0	29.0	29.0	29.0	33.7		24.3	22.6

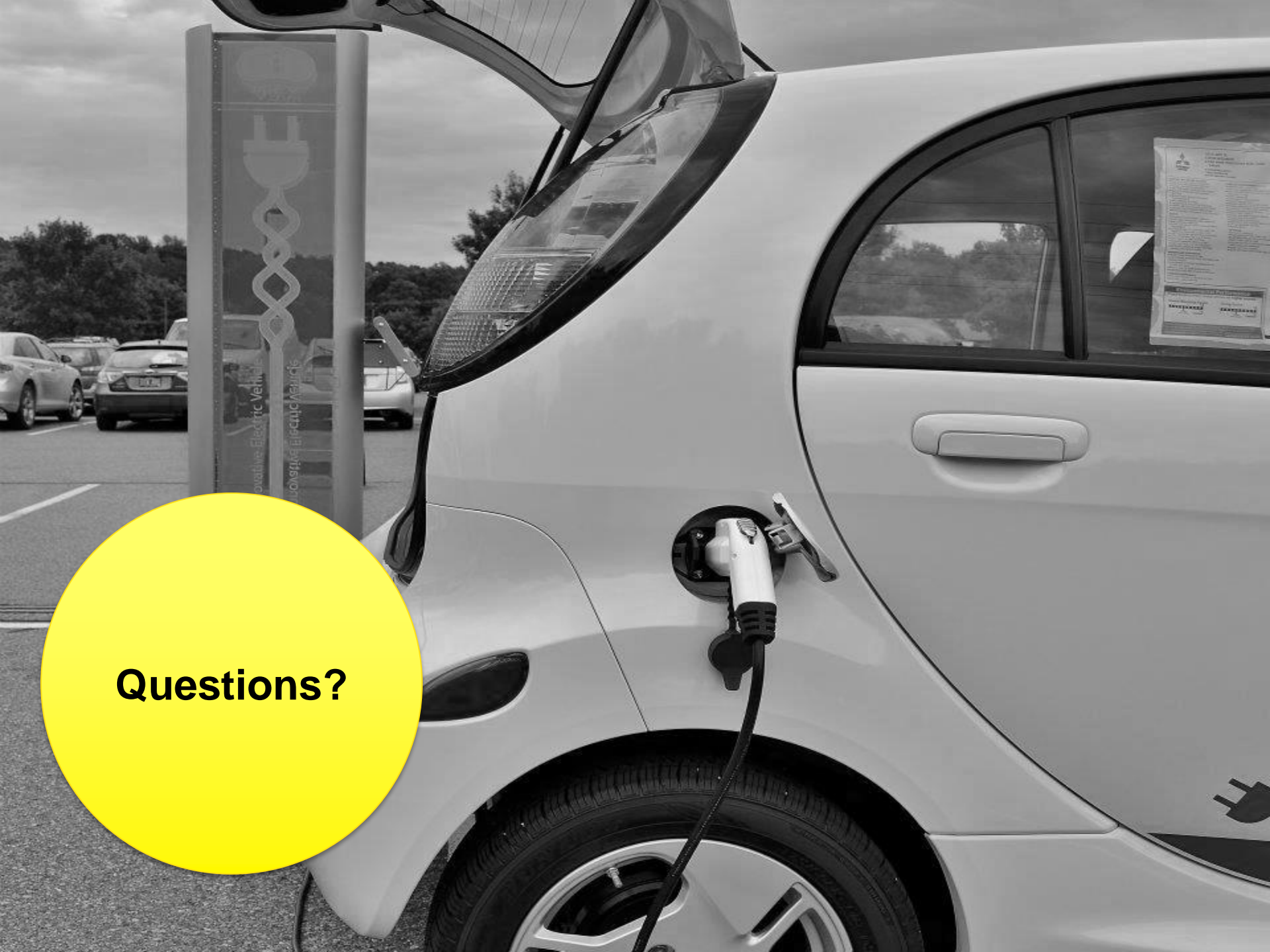
Sources: Perez et al., Maine PUC, Acadia Center

# Proposed Adder



# Next Steps





**Questions?**

# Thank You

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