

Energy, Sustainable Medicine and 21st Century Healthcare: Opportunities for the future?

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Health Care Without Harm and Practice Greenhealth

Healthcare's energy use

- 73 billion kWh/year, \$4.8 billion
- All HC energy use =594 trillion BTU's/year
- The 2nd most energy intensive buildings/sq ft



kWh SO₂, NO_x, Hg cause:	Number of Incidents/Year	Societal Value/EPA^{1,7}	Direct Medical & Other Costs^{2,8}
Premature Mortality	675.17	\$4,566,041,380	\$205,796,110 per year
Chronic Bronchitis	429.62	\$204,114,953	\$52,881,811 per year
Hospital + ER Visits	611.90	\$8,163,507	\$6,530,574 per year
Asthma Attacks	13,857.24	\$847,289	\$808,406 per year
Respiratory Symptoms	658,631.3	\$24,368,021	\$24,368,021 per year
Work Loss Days	121,954.8	\$22,548,077	\$20,998,500 per year
Mercury Related	NA	\$289,428,524	\$289,428,524 per year
Health Impact ³			
Total Value/Cost (in 2008) ⁶		\$5,115,511,750	\$600,811,945 per year
Value of Unintended Societal & Direct Health Impacts per kWh		\$ 0.07008	\$ 0.00823

“First, do no harm,” but...

Power plants emit:

- 2/3rds of the sulfur dioxide - premature death of 30,000 citizens/year
- 27% of our nitrogen oxides - ozone/smog, 16MM asthma victims, 6.3MM children, costing \$16 billion, contributes to obesity...



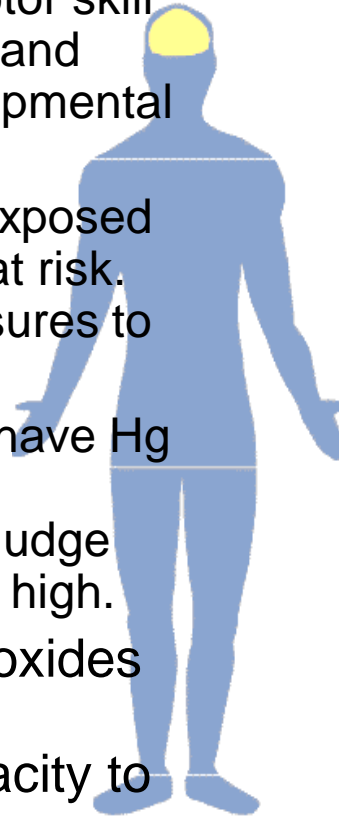
Sadly, there's more...

- Mercury contamination - power plants emit 34%, causing:

- Birth defects, learning disabilities, motor skill impairment, subtle losses of sensory and cognitive ability, and delays in developmental milestones.
- One-in-six children born have been exposed to levels so high they are potentially at risk. An estimated 630,000 prenatal exposures to potentially unsafe levels.
- Approximately 10% of US women to have Hg levels within one tenth of potentially hazardous levels, and many experts judge the “hazardous level” threshold is too high.

- Acid rain: Sulfur dioxide and nitrogen oxides kill aquatic life, damage forests (and buildings) and reduce ecosystem capacity to purify water...

MERCURY HEALTH EFFECTS



- ❑ Deteriorates nervous system
- ❑ Impairs hearing, speech, vision and gait
- ❑ Causes involuntary muscle movements
- ❑ Corrodes skin and mucous membranes
- ❑ Causes chewing and swallowing to become difficult

Climate Change and Human Health



Weather Disasters



Allergies



Infectious Disease



Heat Stress



Red Tides



Asthma

And still more...



- Global warming: Power plants emit 40 percent of U.S. carbon dioxide pollution, the primary cause of global warming.
 - IPCC now forecast temperatures 3-8 degrees F higher by 2100
 - Effects: air pollution worsening, disease vectors shifting and strengthening, sea levels rising, heat waves, storms will be more frequent and intense – some of these already under way
- Many system responses impacting hc:
 - Regulatory: national, and local
 - Heavy fiduciary scrutiny of/by procurement specialists, senior management, trustees, directors, investment asset managers, and communities/3rd sector
 - Financial and insurance pressure

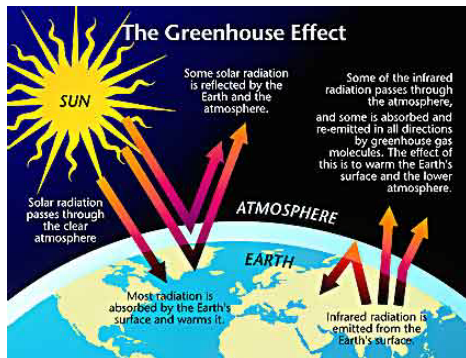
**What's your energy-related pollution?
What is it costing your organization &
community?**

(30% of Boston area nurses have clinical asthma)

What are the emerging risks?

**How might you make effective treatment
decisions with more safety and certainty?**

DOE/EIS, EPA



One state, MA: Coal & oil power plants cause:

- 441 premature deaths, 313 hospitalizations, 104 asthma-related ER visits, 8,880 asthma attacks, and approx. 78,000 lost work days from respiratory problems alone*
 - Plus ground-level ozone (linked to birth defects) and acid rain, climate change-induced disease vectors, increased storm intensity, heat events, ice events, etc.



* ABT Associates

Quantifying Energy Impacts on Health...



Healthcare Energy Impact Calculator

Tools for Healthcare Providers



f - ff - (123) 123-1234

4: MAIN

Mid-America Interconnected Network

kWh per Year:

Clean Energy Fraction: %

Pollutants	Annual Quantity	Pollutant Permit Costs
SO2 (Tons):	75.53	\$41,389 per year
NOx (Tons):	18.11	\$53,423 per year
CO2 (Tons):	15,526.02	\$496,833 EU Pricing
Mercury (Tons):	.73	\$47,337 per year

Incidents	Per Year	Societal Value	Direct Medical Costs
Premature Death:	0.24	\$1,603,225	\$71,677
Chronic Bronchitis:	0.15	\$71,572	\$18,426
Hospital Visit Incidents:	0.21	\$2,843	\$2,270
Asthma Attacks:	4.87	\$296	\$282
Respiratory Symptoms:	232.07	\$8,514	\$8,514
Work Loss Days:	42.84	\$7,858	\$7,315
Mercury Related:	N/A	\$102,758	\$102,758
Totals:	N/A	\$1,797,066	\$211,242
Unintended Impacts/kWh:		0.08985	0.01056

Health Info

- + kWh per Year
- + Clean Energy Fraction

- + Pollutant Permit Costs
- + Sulphur dioxide, SO2 (Tons)
- + Nitrous oxide, NOx (Tons)
- + Carbon dioxide, CO2 (Tons)
- + Mercury, Hg (Tons)

- + Societal Value
- + Direct Medical Costs
- + Premature Death
- + Chronic Bronchitis
- + Hospital + ER Visits
- + Asthma Attacks
- + Respiratory Symptoms
- + Work Loss Days
- + Mercury Related Health Impact

<http://www.practicegreenhealth.org/tools/eic/>

7: NEPP/NE

Select from Map

kWh per Year:

120,000,000

Clean Energy Fraction:

0 %

Calculate

Establish baselines

Pollutants	Annual Quantity	Pollutant Permit Costs
SO ₂ (Tons):	172.74	\$94,659 per year
NO _x (Tons):	38.21	\$112,713 per year
CO ₂ (Tons):	50,674.30	\$1,621,578 EU Pricing
Mercury (Tons):	1.21	\$78,853 per year

Incidents	Per Year	Societal Value	Direct Medical Costs
Premature Death:	0.54	\$3,628,204	\$160,891
Chronic Bronchitis:	0.34	\$161,693	\$41,366
Hospital Visit Incidents:	0.49	\$6,393	\$5,097
Asthma Attacks:	11.02	\$663	\$632
Respiratory Symptoms:	525.69	\$19,122	\$19,122
Work Loss Days:	96.99	\$17,650	\$16,417
Mercury Related:	N/A	\$169,715	\$169,715
Totals:	N/A	\$4,003,439	\$413,239
Unintended Impacts/kWh:		0.03336	0.00344

Back

Resources & Take Action

Print ...

7: NEPP/NE

Select from Map

Quantify benefits of efficiency &/or clean energy

kWh per Year: 40,000,000

Clean Energy Fraction: 0 %

Calculate

Pollutants	Annual Quantity	Pollutant Permit Costs
SO2 (Tons):	57.58	\$31,553 per year
NOx (Tons):	12.74	\$37,571 per year
CO2 (Tons):	16,891.43	\$540,526 EU Pricing
Mercury (Tons):	.40	\$26,284 per year

Incidents	Per Year	Societal Value	Direct Medical Costs
Premature Death:	0.18	\$1,209,402	\$53,631
Chronic Bronchitis:	0.11	\$53,898	\$13,789
Hospital Visit Incidents:	0.16	\$2,130	\$1,698
Asthma Attacks:	3.67	\$221	\$211
Respiratory Symptoms:	175.23	\$6,374	\$6,374
Work Loss Days:	32.33	\$5,883	\$5,473
Mercury Related:	N/A	\$56,572	\$56,572
Totals:	N/A	\$1,334,480	\$137,748
Unintended Impacts/kWh:		0.03336	0.00344

Leverage these per kWh costs

Midwestern 40 MkWh - d d - (123) 123-1234

1: ECAR

Select from Map

East Central Area Reliability Coordination Agreement

kWh per Year:

40,000,000

Clean Energy Fraction:

0 %

Calculate

Location
Location
Location!

In coal
country, same
usage, 5X more
impact

Pollutants	Annual Quantity	Pollutant Permit Costs
SO2 (Tons):	243.09	\$133,214 per year
NOx (Tons):	62.99	\$185,811 per year
CO2 (Tons):	42,555.27	\$1,361,769 EU Pricing
Mercury (Tons):	1.84	\$119,819 per year

Incidents	Per Year	Societal Value	Direct Medical Costs
Premature Death:	0.77	\$5,214,494	\$233,130
Chronic Bronchitis:	0.49	\$232,769	\$59,928
Hospital Visit Incidents:	0.70	\$9,251	\$7,388
Asthma Attacks:	15.83	\$960	\$916
Respiratory Symptoms:	754.39	\$27,675	\$27,675
Work Loss Days:	139.33	\$25,558	\$23,788
Mercury Related:	N/A	\$260,099	\$260,099
Totals:	N/A	\$5,770,806	\$612,924
Unintended Impacts/kWh:		0.14427	0.01532

Radiology Dept - ff - (123) 123-1234

1: ECAR

Select from Map

East Central Area Reliability Coordination Agreement

kWh per Year:

50,000

Clean Energy Fraction:

0 %

Calculate

Modest
Radiology
Dept – 1st
approximation

Pollutants	Annual Quantity	Pollutant Permit Costs	
SO ₂ (Tons):	.30	\$167	per year
NO _x (Tons):	.08	\$232	per year
CO ₂ (Tons):	53.19	\$1,702	EU Pricing
Mercury (Tons):	.00	\$150	per year

Incidents	Per Year	Societal Value	Direct Medical Costs
Premature Death:	0.00	\$6,518	\$292
Chronic Bronchitis:	0.00	\$291	\$75
Hospital Visit Incidents:	0.00	\$12	\$10
Asthma Attacks:	0.02	\$1	\$1
Respiratory Symptoms:	0.94	\$35	\$35
Work Loss Days:	0.17	\$32	\$30
Mercury Related:	N/A	\$325	\$325
Totals:	N/A	\$7,216	\$768
Unintended Impacts/kWh:		0.14432	0.01537

What about thermal equipment?



**Boilers, Chillers,
Backup Generators...**



EIC Pro (alpha) includes kWh & thermal

Electrical Emissions & Impacts			
Total kWh	51,565,000	= in MMBTU	175,940
	Annual Quantity	Generator's Costs for the Right to Emit Pollutants⁴	
	-----	-----	
SO ₂ (Tons):	59.38	32500	
NO _x (Tons):	13.13	38700	
CO ₂ (Tons):	17420.14	557400	
Carbon (Metric Ton	4310.03	N/A	
Mercury (lbs):	0.42	27100	
	Number of Incidents/Year	Societal Value/EPA^{1,2}	Direct Medical & Other Costs^{2,3}
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Premature Mortality	0.185	\$1,247,145	\$55,261
Chronic Bronchitis	0.118	\$55,694	\$14,270
Hospital + ER Visits	0.167	\$2,327	\$1,819
Asthma Attacks	3.788	\$280	\$280
Respiratory Symptc	180.713	\$6,575	\$6,575
Work Loss Days	33.341	\$5,977	\$5,596
Mercury Related Health Impact ³	NA	\$58,338	\$58,338
Total Value/Cost ('08 \$)		\$1,376,336	\$142,138
Unintended Societal & Direct Health Impact Costs per kWh		\$0.02669	\$0.00276

Thermal Emissions & Impacts			
Total MMBTU	392,567		
	Annual Quantity		

SO _x (Tons):	52.42		
NO _x (Tons):	76.95		
CO ₂ (Tons):	33429.07		
Carbon (Metric Tonnes):	8270.90		
Mercury (lbs):	0.00		
	Number of Incidents/Year	Societal Value/EPA^{1,2}	Direct Medical & Other Costs^{2,3}
	-----	-----	-----
Premature Mortality	0.27	\$1,856,238	\$82,261
Chronic Bronchitis	0.17	\$82,498	\$21,125
Hospital + ER Visits	0.25	\$3,293	\$2,658
Asthma Attacks	5.64	\$280	\$280
Respiratory Symptoms	262.98	\$9,513	\$9,513
Work Loss Days	49.60	\$9,029	\$8,394
Mercury Related	NA	\$0	\$0
Total Value/Cost ('08 \$)		\$1,960,852	\$124,231
Unintended Societal & Direct Health Impact Costs per MMBTU		\$4.99	\$0.32

In development

Clean power purchases can save \$ and protect health



“The site is brutally effective at driving down the price to the market-clearing level.”
- Manager, C...

RFP Bid History: 1206 - Electricity

Auction Information

Auction Start Time: 10/6/2006 10:00 AM
 Auction End Time: 10/6/2006 11:15 AM
 Opened: 10/6/2006 11:15 AM
 Low Bidder: **Supplier G**

Price Drop Graph

