

Prospective Carbon Taxes and their Impacts on Fossil-Fuel Electricity

Some general parameters applying to coal-fired electricity

CO2 (pounds) per MM Btu of utility coal, 1996	208	(Monthly Energy Review)
MM Btu of utility coal that make a ton of CO2	9.6	Calculation (pounds in a ton, divided by prior number)
Ratio, CO2 to C:	3.67	Calculation w/ atomic weights
C (pounds) per MM Btu of utility coal, 1996	56.7	Calculation, dividing first number by prior number
Btu per kWh at coal-fired plants, approx	9,600	CK assumption
kWh whose production makes a ton of CO2	1001.6	Calculation (Btu/ton of CO2, divided by Btu per kWh)

Modified parameters for combined-cycle electric plants burning natural gas

Btu per kWh at gas-fired plants, approx	7,000	CK assumption
Heat rate vs. coal	73%	Calculation (ratio of Btu/kWh for gas, to that for coal)
CO2 per Btu of natural gas, relative to coal	58%	Rule of thumb: gas/oil/coal CO2 is as 7/10/12
CO2 per kWh of natural gas, relative to coal	42.53%	Calculation (product of two prior %'s)

Case Study #1 noted in testimony: European CO2 Limits

NY Times, "New Limits on Pollution Herald Change in Europe," Jan 1, 2005

<http://www.nytimes.com/2005/01/01/business/worldbusiness/01climate.html>

"London is also home to the European Climate Exchange. Some informal trading started on the exchange last summer and increased sharply after Russia ratified the Kyoto Protocol this fall. By some estimates, activity could surge 20-fold after mandatory trading begins in mid-February. The right to release one ton of carbon dioxide into the atmosphere has already risen in price, trading at around 8.50 euros, or \$11.53, on the European exchange's informal market, up from about 6 euros in mid-2003."

\$/ton CO2	\$ 11.53	article quoted above
¢/kWh coal	1.15	Calculation, dividing prior number by kWh/ton of CO2
¢/kWh gas	0.49	Calculation (prior number x gas/coal ratio of CO2/kWh)

Case Study #2 noted in testimony: USA (Minnesota)

Tellus Institute 1997 study, "Ecological Tax Reform: Carbon Taxes with Tax Reductions in Minnesota"

<http://www.tellus.org/energy/publications/mnexecsm.html>

Two different tax levels posited, per ton of CO2	\$10	\$50
¢/kWh coal w/ tax at per-ton level shown	1.00	4.99

Calculations, dividing prior numbers by kWh/ton

Case Study #3 noted in testimony: Japan

Japan Times, Aug. 28, 2003, "Environment panel calls for carbon tax in 2005"

<http://www.japantimes.co.jp/cgi-bin/getarticle.pl?57nn20030828a2.htm>

"A government advisory panel tasked with studying environmental taxes adopted a proposal Wednesday for the introduction of a carbon levy by as early as 2005... Calculations made by the National Institute for Environmental Studies, a ministry affiliate, suggest that if a 3,400 yen tax per ton of carbon is imposed in 2005 ..."

Number of yen equivalent to 1 U.S. dollar	103.581	<u>Live mid-market rates as of 2004.12.24 19:52:07 GMT.</u>
Proposed tax in yen per ton of carbon	3,400	article quoted above
Proposed tax in dollars per ton of carbon	\$ 32.82	Calculation (prior number divided by predecessor)
Proposed tax in dollars per ton of CO2	\$ 8.95	Calculation (prior number divided by C/CO2 ratio)
¢/kWh coal	0.89	Calculation, dividing prior number by kWh/ton w/ coal
¢/kWh gas	0.38	Calculation, dividing prior number by kWh/ton w/ gas

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Case Study #4 noted in testimony: To meet Kyoto accords
IPCC: Climate Change 2001: Working Group III: Mitigation
8.3 Costs of Domestic Policy to Mitigate Carbon Emissions
http://www.grida.no/climate/ipcc_tar/wg3/037.htm

"With no international emission trading, the carbon taxes necessary to meet the Kyoto restrictions in 2010 vary a lot among the models. Note from Table TS.416 that for the USA they are calculated to be in the range US\$76 to US\$322, for OECD Europe between US\$20 and US\$665, for Japan between US\$97 and US\$645, and finally for the rest of OECD (CANZ) between US\$46 and US\$425. All numbers are reported in 1990 dollars. Marginal abatement costs are in the range of US\$20- US\$135/tC if international trading is allowed. These models do not generally include no regrets measures or take account of the mitigation potential of CO₂ sinks and of greenhouse gases other than CO₂."

[Note: first two data columns in table are taken directly from IPCC document noted. Remaining columns are CK calculations.
Only bottom row is used in testimony.]

	Low		High		Low		High		Mean €/kWh coal (geometric) equivalent		
	Cost/ton of C (90 \$)		Cost/ton CO2 (04 \$)								
USA	\$	76	\$	322	\$	27.41	\$	116.14	\$	56.42	5.63
OECD Europe	\$	20	\$	665	\$	7.21	\$	239.84	\$	41.59	4.15
Japan	\$	97	\$	645	\$	34.98	\$	232.63	\$	90.21	9.01
Canada, Australia, NZ	\$	46	\$	425	\$	16.59	\$	153.28	\$	50.43	5.03
Marginal costs w/ trading	\$	20	\$	135	\$	7.21	\$	48.69	\$	18.74	1.87

U.S. GDP Deflator, July 1, 1990

82.031 <http://research.stlouisfed.org/fred2/series/GDPDEF/21/Max>

U.S. GDP Deflator, July 1, 2004

108.482 <http://research.stlouisfed.org/fred2/data/GDPDEF.txt>