

MEMO



To: Regional Greenhouse Gas Initiative Stakeholders
From: Derek Murrow
Date: October 6, 2004
Re: Historical CO₂ Data for the RGGI Region

The RGGI process needs to develop cap levels and cap decline pathways that are built on a thorough understanding of what the regulated units emit today. Modeling of the electricity sector will also help with this process, but actual emissions levels must be understood with some level of certainty. The regulators are discussing regulating CO₂ emissions from power generation units in a nine state region (New England, NY, NJ, and DE) with a name plate capacity greater than or equal to 25 MWs. The regulators have posted a list of plants to be regulated on the RGGI web site. Understanding and gathering data on the historical emissions from these plants turns out to be more complicated than you might think. There are a number of different data sources available but they compile the data differently and include different facilities in their totals.

The following are potential sources of data for northeastern electric power plants:

- **EPA CEMS:** US Environmental Protection Agency, Acid Rain Program (Clean Air Markets Division) collects data reported by the regulated sources from continuous emissions monitors (CEMS); these data cover all units regulated by EPA under the acid rain program, which covers most RGGI units but not all; CO₂ emissions are reported by these units but a number of different monitoring and calculation options are available to facilities in reporting this information (<http://cfpub.epa.gov/gdm/>)
- **EIA Form 906 Data:** The US Department of Energy's Energy Information Agency collects fuel use and generation data from power plants on an annual basis through Form 906 (old version was called Form 920); this data source can be queried to select information only on the RGGI plants; however, emissions have to be calculated using fuel use and emissions factors; these data are also reported at the plant or facility level and not the unit level, which may mean small units are included at some facilities that would not be regulated under RGGI (another data source is EIA Form 767, which is at the unit level but only covers steam generating plants) (http://www.eia.doe.gov/cneaf/electricity/page/eia906_920.html)

- **EIA Electric Power Annual:** The US Department of Energy's Energy Information Agency publishes an annual report on the electric power industry that includes consumption, production, and emissions data for most electric power generators; this data set is reported at the state level – not the unit level and it includes plants that would not be regulated by RGGI (http://www.eia.doe.gov/cneaf/electricity/epa/epa_sum.html)

In an effort to understand the trends in emissions over the period from 1990 to today ENE has compiled data from all three of these sources.

EPA CEMS data were downloaded from EPA and summarized by state and year using an MS Access database. The results are shown in Table 1 (Page 4).

The EIA Form 906 data were downloaded from EIA and ENE calculated emissions based on annual fuel consumption (weight or volume by fuel type) and fuel specific emissions factors from EIA and EPA (lbs per ton, Mcf, etc). An MS Access database was built that allowed us to calculate emissions for each plant and fuel type on an annual basis. The emissions factors used are from EIA's Fuel and Energy Source Codes and Emission Coefficients (<http://www.eia.doe.gov/oiaf/1605/coefficients.html>). The plants were then screened based on the plant list from the RGGI state agencies and plant totals were then summed to yield annual totals by state. These results are shown in Table 2 (Page 4).

The EIA Electric Power Annual data were downloaded from EIA and summarized by state and year using an MS Access database. The results are shown in Table 3 (Page 4).

As Tables 1, 2, and 3 illustrate there is significant variability in the final emissions numbers from the three sources. The trends in terms of regional totals are also shown in Figure 1 on Page 5. Table 2 represents data from only RGGI sources, and it is surprising that there are periods when these emissions are lower than the totals from EPA CEMS data. The emissions data calculated by ENE from EIA 906 data is most problematic in the early 1990s which was the period when merchant plants started reporting separately from utility owned plants. In the early 1990s all plant data was reported by EIA in one file and most plants were utility owned making us more confident with that data. In 2002 and 2003 EIA started reporting all the plant data in a combined format again and we feel more confident with these numbers as well. This is consistent with what NESCAUM discovered when compiling the CT GHG Emissions Inventory, in that some of the non utility owned plants (especially coal units) were reporting to EIA and being classified as industrial sector sources. Essentially the 1990 data and 2002 and 2003 data appear to be the most reliable and the emissions numbers compiled for the early 1990s are too low, as it misses some emitters who were classified as industrial units.

There seems to be confidence in the EPA CEMS data (Table 1) among regulators but not all RGGI sources are covered and some sources use O₂ monitors or base their reporting on fuel use and emissions

factors. The EPA CEMS data should be fairly accurate but should also be under reporting the total emissions for RGGI sources in each year. This is consistent with the trends seen in Figure 1.

The emissions numbers from EIA's Electric Power Annual should be fairly accurate but they include more units than will be regulated by the RGGI program so the emissions should exceed those from RGGI sources.

ENE feels that the numbers we have calculated based on EIA Form 906 data are the closest we have to the actual emissions numbers in 1990 and in 2002 and 2003. The following are those emissions totals for the nine RGGI states:

1990 Emissions: ~131 million short tons of CO₂

2002 Emissions: ~128 million short tons of CO₂

2003 Emissions: ~131 million short tons of CO₂

Total CO₂ emissions in 1990 and 2003 are the same for power plants in the RGGI region that are greater than or equal to 25 megawatts in size. This same emissions level was achieved even though generation (MWh) increased between 1990 and 2002 by 16% (ENE calculation based on EIA Electric Power Annual, 2002 data) indicating an overall improvement or decrease in emissions intensity.

The difference between the total emissions from EIA's Electric Power Annual (all sources) and the emissions calculated by ENE for RGGI units (25 MW and above) should also be noted. This represents the emissions that are excluded from the program (units under 25 MW) and makes up almost 7% of the total. Future expansion of the program to include smaller units should be seriously considered.

The trends in emissions over the last 14 years presented in this memo should help to inform the decision making around RGGI cap levels and rates of cap decline with time.

We appreciate the help and advice we received in compiling this information from: David Schoengold, MSB Energy Associates, Inc.; Chris Nelson, CT DEP; Joe Chaisson, The Clean Air task Force; and Marco Buttazzoni, Environmental Resources Trust.

Regional Greenhouse Gas Initiative

Table 1: Acid Rain Units - EPA CEMS CO₂ Emissions (Short Tons)

State	1995	1996	1997	1998	1999	2000	2001	2002
Connecticut	6,194,220	8,902,979	12,545,499	10,884,326	9,493,527	9,747,715	8,827,575	7,827,884
District of Columbia	218,461	47,044	70,567	258,462	267,436	173,186	164,577	279,433
Delaware	7,095,370	8,826,473	6,471,061	6,662,618	5,812,771	6,573,659	6,731,719	6,438,984
Massachusetts	19,139,278	19,922,153	26,119,467	27,435,470	24,133,632	21,470,003	21,571,463	21,486,936
Maryland	32,612,487	32,490,171	32,826,632	36,546,795	36,880,305	32,770,264	31,799,380	31,420,498
Maine	848,139	695,978	1,462,946	1,735,924	2,453,038	3,156,289	5,517,286	5,784,562
New Hampshire	4,859,100	4,629,377	5,938,808	5,612,438	5,578,224	5,178,731	4,862,446	5,556,992
New Jersey	10,351,850	10,252,066	9,591,473	9,430,467	10,749,668	11,194,723	10,948,596	12,440,663
New York	54,000,913	45,348,891	48,793,273	57,552,454	58,507,245	57,114,441	53,196,846	51,546,526
Pennsylvania	141,620,885	113,664,108	116,182,125	118,878,912	106,780,897	112,322,937	109,700,662	110,887,336
Rhode Island	270,330	1,635,736	1,736,192	1,487,341	1,301,185	1,182,345	1,775,894	2,025,068
Vermont	209,528	232,991	245,483	246,784	319,976	404,811	295,121	294,459
9 RGGI States	102,968,728	100,446,644	112,904,202	121,047,822	118,349,266	116,022,715	113,726,944	113,402,074
RGGI & PA	244,589,613	214,110,752	229,086,327	239,926,734	225,130,163	228,345,652	223,427,606	224,289,410
RGGI & All Observers	277,420,561	246,647,967	261,983,526	276,731,991	262,277,904	261,289,102	255,391,563	255,989,340

Table 2: ENE Calculations for RGGI Plants - EIA 906 Fuel Consumption Based CO₂ Emissions (Short Tons)

State	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Connecticut	10,336,119	9,437,477	6,927,523	5,695,364	5,594,658	6,415,752	7,812,868	11,257,115	10,044,231	10,017,585	11,106,832	10,387,514	9,626,129	8,461,183
District of Columbia	443,092	251,930	110,677	249,903	326,663	230,302	140,544	72,184	255,927	251,025	179,194	159,350	228,496	63,614
Delaware	6,560,329	6,898,337	5,671,238	7,844,789	7,455,549	6,768,361	6,868,220	5,889,890	5,725,730	5,866,743	6,273,235	5,838,981	6,047,914	5,379,335
Massachusetts	26,645,920	26,333,735	23,880,351	20,591,022	20,145,109	19,033,202	18,769,486	24,468,811	17,473,921	26,152,870	24,178,536	24,453,924	22,791,796	27,020,394
Maryland	26,705,364	26,321,088	25,598,917	28,054,689	28,741,947	27,549,526	27,984,962	27,903,312	31,043,901	32,035,045	30,651,753	31,082,060	30,348,188	32,602,536
Maine	1,928,136	1,243,732	1,210,985	739,336	696,001	800,079	628,961	1,371,295	1,619,976	989,895	3,235,003	6,691,265	6,433,813	5,470,925
New Hampshire	5,019,573	4,537,229	4,384,872	4,583,129	4,561,909	4,441,800	4,197,902	5,226,122	4,915,130	4,792,212	4,595,143	4,261,051	4,349,890	5,834,698
New Jersey	12,212,964	11,604,713	9,161,407	8,816,995	9,163,542	9,413,071	8,589,843	9,745,618	8,633,330	22,825,776	24,124,029	23,804,806	22,056,361	21,848,589
New York	67,386,746	61,166,964	52,611,469	44,444,641	41,447,818	41,366,241	37,147,903	41,821,855	48,630,435	58,988,269	58,816,958	57,787,101	53,101,079	54,616,951
Pennsylvania	105,277,996	103,052,114	101,147,225	103,314,763	98,649,430	100,339,199	103,967,654	106,721,287	109,359,981	119,045,489	134,377,441	136,148,658	133,162,961	139,646,110
Rhode Island	516,841	166,532	116,766	53,150	68,575	336,171	1,545,973	1,641,435	940,283	3,092,689	2,836,933	3,526,500	3,194,037	2,365,354
Vermont	43,555	70,120	50,403	21,488	17,541	18,509	6,937	10,075	48,279	34,115	112,800	34,868	8,810	20,655
9 RGGI States	130,650,182	121,458,839	104,015,013	92,789,914	89,150,701	88,593,186	85,568,094	101,432,215	98,031,315	132,760,153	135,279,470	136,786,010	127,609,827	131,018,085
RGGI & PA	235,928,178	224,510,953	205,162,238	196,104,677	187,800,131	188,932,385	189,535,748	208,153,502	207,391,296	251,805,643	269,656,911	272,934,668	260,772,788	270,664,195
RGGI & All Observers	263,076,635	251,083,971	230,871,831	224,409,270	216,868,740	216,712,214	217,661,254	236,128,998	238,691,124	284,091,713	300,487,858	304,176,078	291,349,472	303,330,345

Table 3: All Electricity Generation - EIA Electric Power Annual (2002) - Fuel Consumption Based CO₂ Emissions (Short Tons)

State	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Connecticut	12,355,225	11,828,841	9,613,170	8,376,456	8,175,205	9,246,416	10,656,645	13,990,897	12,731,519	11,532,880	12,129,307	10,606,925	9,719,038
District of Columbia	438,884	249,532	124,779	241,310	333,737	238,637	145,467	97,680	282,032	273,536	184,503	175,610	288,010
Delaware	9,114,823	8,762,486	8,177,043	8,897,551	8,546,390	7,975,760	8,005,238	6,890,566	6,487,500	6,047,411	6,138,608	6,183,945	5,989,050
Massachusetts	28,661,215	29,433,860	27,669,200	25,054,472	25,283,912	24,237,026	23,627,897	29,552,342	30,285,640	27,174,107	24,844,838	24,729,790	25,698,713
Maryland	29,003,471	28,558,140	27,935,966	30,640,570	31,405,126	30,581,728	31,129,788	30,928,721	33,996,412	34,995,173	36,351,035	33,357,823	34,311,855
Maine	3,478,308	2,931,457	2,932,866	2,583,619	2,679,166	2,657,055	2,255,746	3,163,790	3,719,949	5,221,124	4,720,937	6,649,469	7,359,723
New Hampshire	5,398,298	4,922,459	4,769,520	4,944,809	4,890,664	4,805,893	4,565,156	5,639,446	5,322,579	5,187,965	5,067,705	4,715,524	4,986,000
New Jersey	13,939,703	14,045,720	14,889,480	15,706,088	17,660,959	18,914,442	18,103,926	19,125,759	18,032,316	18,702,496	21,291,125	21,797,149	22,339,468
New York	71,821,515	67,241,367	62,120,683	55,410,375	54,852,194	58,515,211	53,352,810	58,752,212	63,156,062	63,541,094	62,126,018	61,612,309	56,694,535
Pennsylvania	116,582,806	115,236,198	115,385,403	119,165,872	114,582,406	117,460,208	121,051,710	122,790,082	125,855,920	121,806,589	130,156,130	119,894,176	125,224,638
Rhode Island	794,603	1,485,232	2,408,685	2,275,216	2,412,601	2,249,214	3,862,356	3,751,213	3,692,147	3,355,037	3,010,912	3,620,499	3,293,668
Vermont	44,524	69,814	49,987	23,626	20,948	26,088	9,102	17,945	61,821	46,578	155,674	47,488	16,812
9 RGGI States	145,608,214	140,721,236	132,630,634	123,272,212	124,522,039	128,627,105	124,438,876	140,884,170	143,489,533	140,808,692	139,485,124	139,963,098	136,097,007
RGGI & PA	262,191,020	255,957,434	248,016,037	242,438,084	239,104,445	246,087,313	245,490,586	263,674,252	269,345,453	262,615,281	269,641,254	259,857,274	261,321,645
RGGI & All Observers	291,633,375	284,765,106	276,076,782	273,319,964	270,843,308	276,907,678	276,765,841	294,700,653	303,623,897	297,883,990	306,176,792	293,390,707	295,921,510

Figure 1: RGGI States - Total Annual CO₂ Emissions

