MassDEP GHG Reporting Program Summary Report
For Retail Sellers of Electricity
Emissions Year 2012

April 2015

The information below summarizes the 2012 greenhouse gas (GHG) emissions and megawatt hours (MWh) of electricity sales reported to the Massachusetts Department of Environmental Protection (MassDEP) by the 87 retail sellers that sold electricity in Massachusetts during that year, as required by MassDEP regulation 310 CMR 7.71. Additional information about MassDEP's GHG program is available at http://www.mass.gov/eea/agencies/massdep/climate-energy/climate/approvals/ma-greenhouse-gas-emissions-reporting-program.html; see particularly *Retail Seller of Electricity Reporting*. MassDEP will use the information presented here in considering future measures to reduce emissions from the electric sector. This was the fourth year of reporting under the regulation. 2008 was the initial reporting year. Annual reporting began with the 2010 reporting year. Comparisons of the first four reporting years are provided in this summary.

MassDEP requires retail sellers to report emissions that occur from the generation of the electricity that they sell. The GHGs emitted from power plant smokestacks during combustion of fuels to generate electricity are carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O). Biogenic and non-biogenic GHG emissions are reported separately. Biogenic GHG emissions are emissions of CO_2 that result from the combustion of biogenic (plant or animal) material, excluding fossil fuels. Non-biogenic GHG emissions include CO_2 released from the combustion of non-biogenic fuel, plus CH_4 and N_2O released from the combustion of any fuel.

For 2012, the retail seller reporting process consisted of 4 steps:

Step 1. Some retail sellers chose to report use of MWh from particular generating units, and any associated emissions.

Step 2. MassDEP developed initial GHG emission factors in terms of pounds of non-biogenic and biogenic GHGs in carbon dioxide equivalents per megawatt hour (lb CO_2e/MWh) based on all of the electricity consumed in Massachusetts.

Step 3. MassDEP developed final GHG emission factors for the electricity consumed in Massachusetts that was not reported in Step 1, by removing the MWh and emissions reported in Step 1 from the initial emission factors developed in Step 2.

Step 4. Retail sellers determined their GHG emissions by multiplying the final emission factors in Step 3 by the energy they sold that they did not report in Step 1, and then adding any emissions reported in Step 1.

The purpose of Step 1 is to allow retail sellers to document the use of clean energy. Because MWh associated with this clean energy are included in Step 2 but excluded in Step 3, the final emission factors are greater than the initial emission factors. For more details on the reporting process and development of GHG emission factors for electricity consumed in Massachusetts, see *Draft 2012 Greenhouse Gas (GHG) Emission Factors to be used by Retail Sellers of Electricity Reporting under 310 CMR 7.71(9) "Reporting Requirements for Retail Sellers of Electricity"* (http://www.mass.gov/eea/docs/dep/air/climate/rse12tsd.pdf).

GHG Emission Factors

For 2012, all Massachusetts- and regional-based emission factors continued to decrease from the 2008 through 2011 values, except for the Massachusetts-based Biogenic EF which has varied somewhat.

Table 1 shows the initial (Step 2) and final (Step 3) emission factors upon which retail seller GHG emissions are based. (Please note that Table 1 presents wholesale emission factors. MassDEP recommends that consumers of electricity wishing to use Massachusetts-specific emission factors to report their GHG emissions from use of electricity should see Appendix 3 to this document for appropriate values.) For an explanation of the "Massachusetts-based" and "Regional-based" approaches used to calculate the emission factors in Table 1, see *Draft 2012 Greenhouse Gas (GHG) Emission Factors to be used by Retail Sellers of Electricity Reporting under 310 CMR 7.71(9) "Reporting Requirements for Retail Sellers of Electricity"* (http://www.mass.gov/eea/docs/dep/air/climate/rse12tsd.pdf).

Table 1. GHG Emission Factors for Electricity Consumed in Massachusetts, prior to and after accounting for particular generating units (lb CO_2e/MWh)

	Massachusetts-based approach		**Regional-based approach**	
	Non-Biogenic	**Biogenic**	**Non-Biogenic**	**Biogenic**
Initial Emission Factors: **prior to** accounting for particular generating units (Step 2)				
2008	854	97	700	139
2010	798	97	662	136
2011	686	89	584	122
2012	601	90	535	120
Final Emission Factors: **after** accounting for particular generating units (Step 3)				
2008	871	98	708	141
2010	824	101	672	138
2011	712	93	595	124
2012	628	94	546	123

MWh Sold by Retail Sellers and Reported from Particular Generating Units

For 2012, 3 electric utilities, 1 competitive supplier, and 31 municipal electric departments or light boards chose to report MWh from particular generating units in Step 1. All MWh reported from particular generating units in the first four reporting years have been from non-emitting units. The number of optional reporters, the amount of non-emitting MWh they reported, and the percent of non-emitting MWh to total retail sales all continued to increase from 2008 to 2012.

Tables 2 and 3 show the number of retail sellers reporting in 2008, and 2010 through 2012. Figure 1 shows the amount of non-emitting MWh from particular generating units that they chose to report,[1] Figure 2 shows their total retail sales,[2] and Figure 3 shows the ratio of non-emitting MWh to total retail sales. Figures 4 and 5 show this non-emitting power by fuel type (as MWh and as a percent) and Figures 6 and 7 show the locations of these particular generating units (again as MWh and as a percent).

[1] Several municipalities had minor rounding or reporting errors resulting in a 1 to 4 MWh difference between what the municipalities reported to MassDEP and to DPU; the value reported to MassDEP is used throughout this document.

[2] The total retail sales reported by competitive suppliers for 2012 differs by 7 MWh from the total reported in DOER's *Massachusetts RPS & APS Annual Compliance Report for 2012* even after several competitive suppliers revised their reports. Several municipalities reported their total retail sales value from a line other than the TOTAL (line 15) from page 57 their *Annual Return* to DPU, or failed to subtract their Sales from Resale (line 18) from the TOTAL, as instructed. The *Annual Return* TOTAL from line 15 is used throughout this document, with Sales from Resale subtracted, as necessary.

Table 2. Number of Retail Sellers Reporting Optional MWh from particular generating units

Optional Reporting (Step 1): Number of Reporters	Electric Utilities	Competitive Suppliers	Municipal Light Depts.	Total Retail Sellers
2008	2	0	17	19
2010	2	1	24	27
2011	3	1	25	29
2012	3	1	31	35

Figure 1. Optional MWh reported from particular generating units

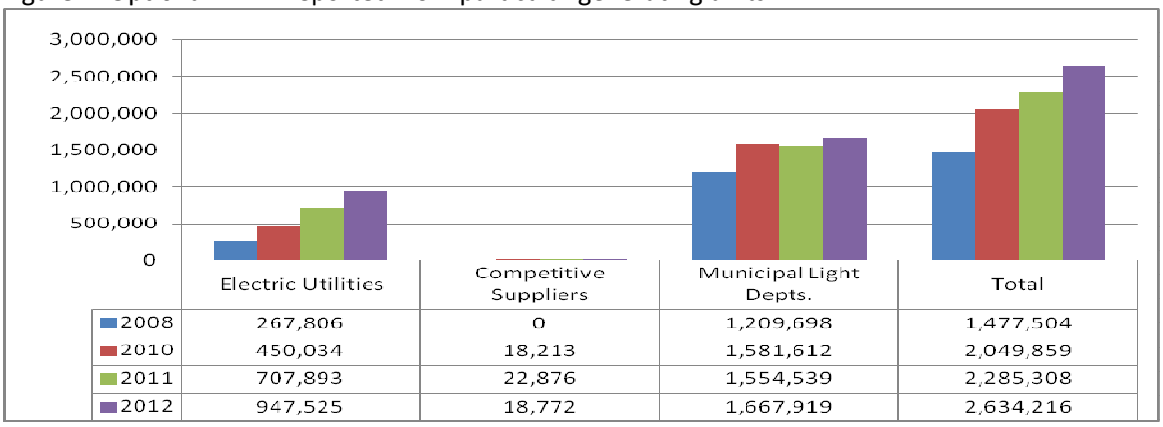


Table 3. Number of Retail Sellers Reporting GHG Emissions

Mandatory Reporting: Number of Retail Sellers	Electric Utilities	Competitive Suppliers	Municipal Light Depts.	Total Retail Sellers
2008	4	22	40	66
2010	4	31	40	75
2011	4	33	40	77
2012	4	43	40	87

Figure 2. Total MWh of Retail Sales of Electricity Reported

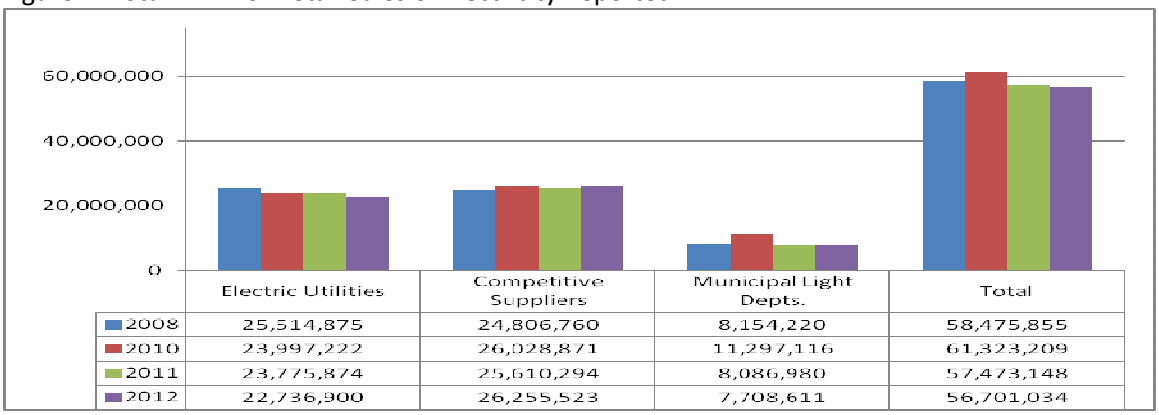
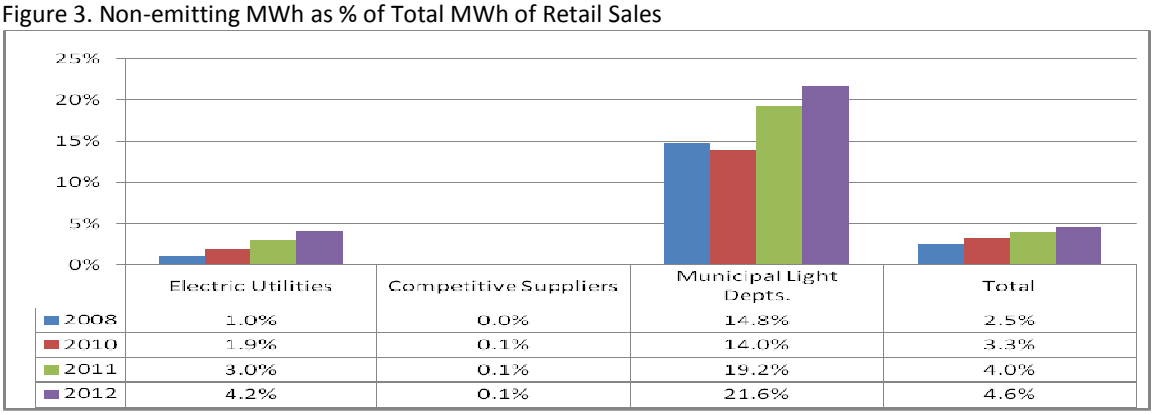
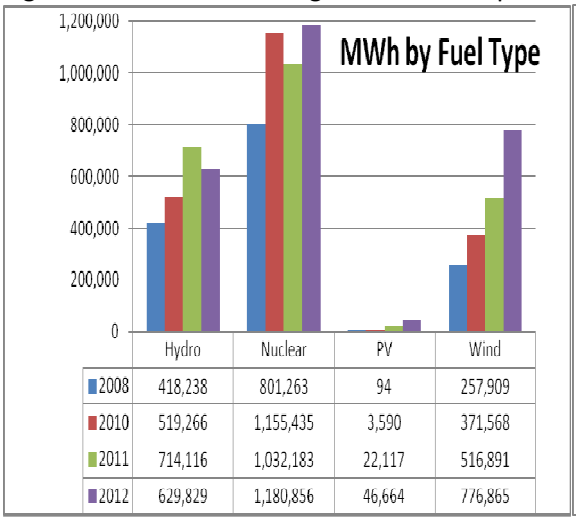


Figure 3. Non-emitting MWh as % of Total MWh of Retail Sales

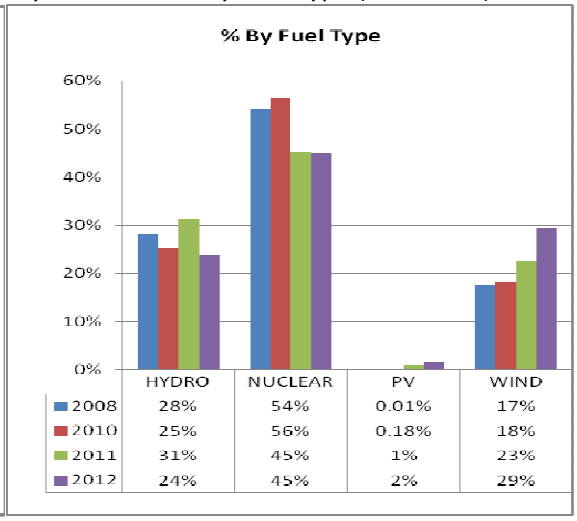


	Electric Utilities	Competitive Suppliers	Municipal Light Depts.	Total
2008	1.0%	0.0%	14.8%	2.5%
2010	1.9%	0.1%	14.0%	3.3%
2011	3.0%	0.1%	19.2%	4.0%
2012	4.2%	0.1%	21.6%	4.6%

Figures 4 & 5. Non-Emitting Generation Reported by Retail Sellers by Fuel Type (MWh & %)

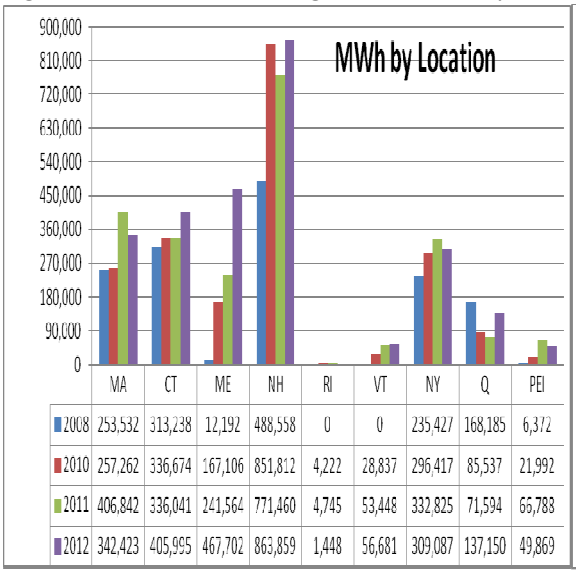


	Hydro	Nuclear	PV	Wind
2008	418,238	801,263	94	257,909
2010	519,266	1,155,435	3,590	371,568
2011	714,116	1,032,183	22,117	516,891
2012	629,829	1,180,856	46,664	776,865

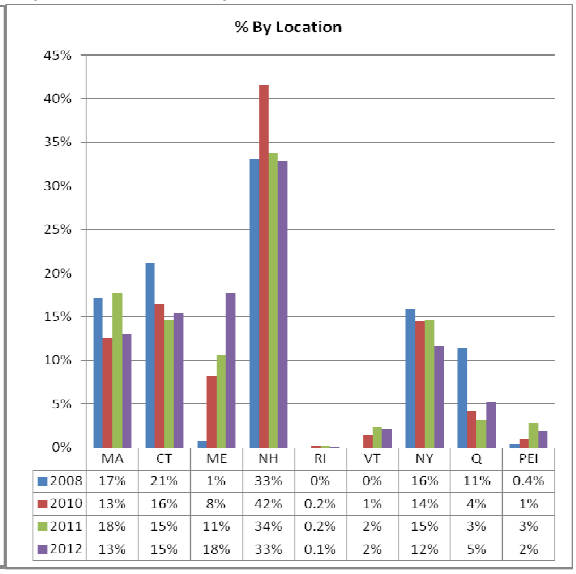


	HYDRO	NUCLEAR	PV	WIND
2008	28%	54%	0.01%	17%
2010	25%	56%	0.18%	18%
2011	31%	45%	1%	23%
2012	24%	45%	2%	29%

Figures 6 & 7. Non-Emitting Generation Reported by Retail Sellers by Location (MWh & %)



	MA	CT	ME	NH	RI	VT	NY	Q	PEI
2008	253,532	313,238	12,192	488,558	0	0	235,427	168,185	6,372
2010	257,262	336,674	167,106	851,812	4,222	28,837	296,417	85,537	21,992
2011	406,842	336,041	241,564	771,460	4,745	53,448	332,825	71,594	66,788
2012	342,423	405,995	467,702	863,859	1,448	56,681	309,087	137,150	49,869



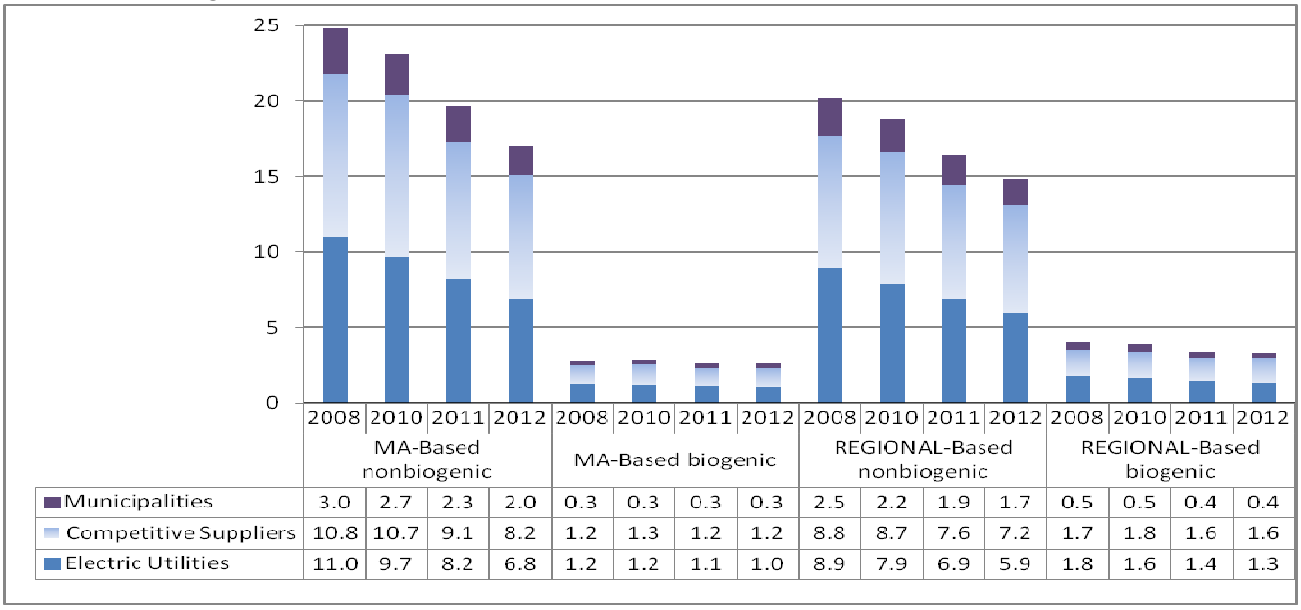
	MA	CT	ME	NH	RI	VT	NY	Q	PEI
2008	17%	21%	1%	33%	0%	0%	16%	11%	0.4%
2010	13%	16%	8%	42%	0.2%	1%	14%	4%	1%
2011	18%	15%	11%	34%	0.2%	2%	15%	3%	3%
2012	13%	15%	18%	33%	0.1%	2%	12%	5%	2%

GHG Emissions Reported by Retail Sellers

For 2012, the total reported GHG emissions in all four categories decreased from earlier years, following the trend of the emission factors. The differences in GHG emissions between 2008, 2010, 2011 and 2012 within each retail seller type would be caused by the changes in total MWh sales and percent of MWh reported from particular generating units in Step 1 by each type of retail seller.

Figure 8 shows the total GHG emissions reported by the three types of retail sellers. GHG emissions were calculated by each retail seller using the reporting process shown on page 1 of this summary. The GHG emissions reported by each retail seller can be found in Appendix 1.

Figure 8. GHG Emissions Reported by Retail Seller Type and Year using the MA-Based and Regional-Based methodologies (Million Short Tons CO_2e)



	2008	2010	2011	2012	2008	2010	2011	2012	2008	2010	2011	2012	2008	2010	2011	2012
	MA-Based nonbiogenic				MA-Based biogenic				REGIONAL-Based nonbiogenic				REGIONAL-Based biogenic			
Municipalities	3.0	2.7	2.3	2.0	0.3	0.3	0.3	0.3	2.5	2.2	1.9	1.7	0.5	0.5	0.4	0.4
Competitive Suppliers	10.8	10.7	9.1	8.2	1.2	1.3	1.2	1.2	8.8	8.7	7.6	7.2	1.7	1.8	1.6	1.6
Electric Utilities	11.0	9.7	8.2	6.8	1.2	1.2	1.1	1.0	8.9	7.9	6.9	5.9	1.8	1.6	1.4	1.3

Individual Retail Seller Reporting for 2012

For each retail seller that chose to submit MWh from particular generating units in 2012, "individual" GHG emission factors were determined. These factors represent individual GHG emission rates for each retail seller based on their reported GHG emissions and MWh of electricity sales. The greater the percentage of total MWh electricity sales reported as non-emitting MWh, the lower a retail seller's individual emission factors. [3]

Figures 9 and 10 show the MWh reported, and the ratio of those MWh to the retail seller's 2012 electricity MWh sales, for each retail seller that chose to report use of particular generating units. To illustrate trends, the figures present the retail sellers in order of increasing percentage of reported non-emitting power. The figures compare optional MWh reported as a percentage of total retail sales, with the second figure showing the variation in total MWh sales. See Appendix 2 below for individual retail values used in these two figures.

[3] In 2011, one municipality reported a greater amount of MWh from particular generating units than its retail sales, resulting in apparently negative total retail sales, negative GHG emissions, and a negative GHG emission rate. The regulation at 310 CMR 7.71(9)(d)5. does not allow a retail seller to claim more generation from particular generating units than it sold to its retail customers. To prevent this situation from occurring again, MassDEP now requires municipalities to submit page 57 of their *Annual Return*, showing their total retail sales, with their optional "Step 1" report on MWh from particular generating units.

Figure 9. 2012 Electricity Sales Reported as Non-Emitting by Retail Seller (MWh and % of sales)
(retail sellers not shown chose not to report MWh from particular generating units)

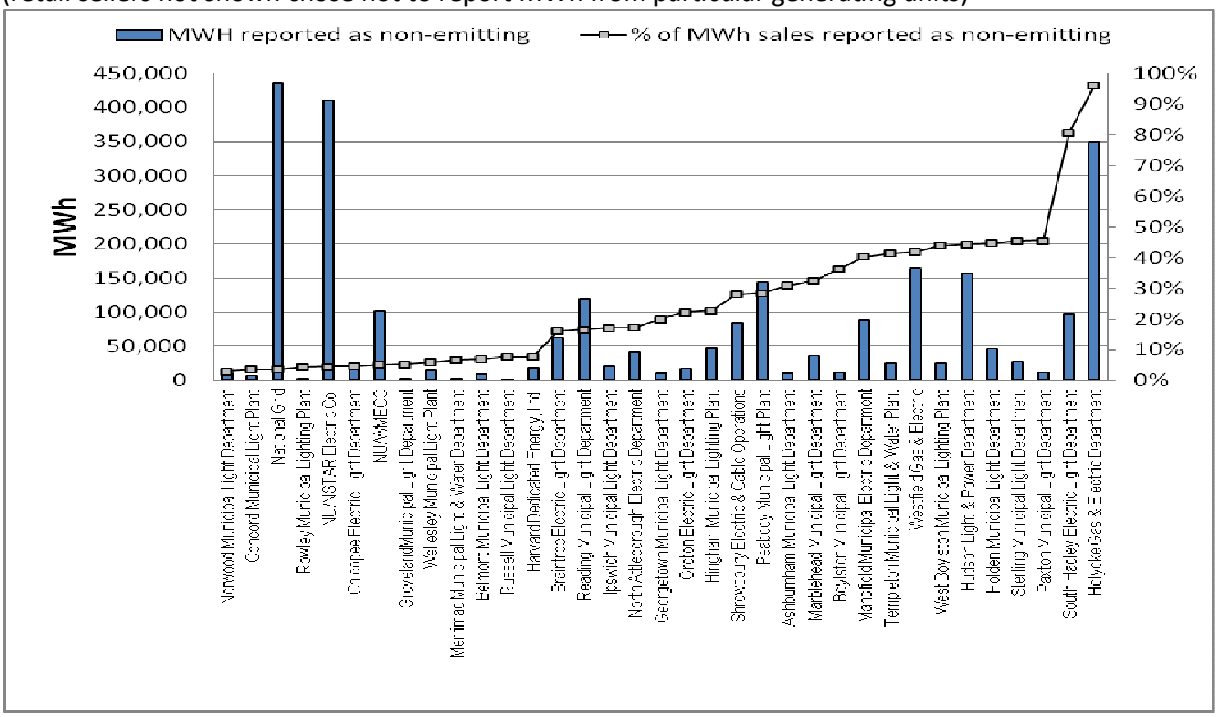
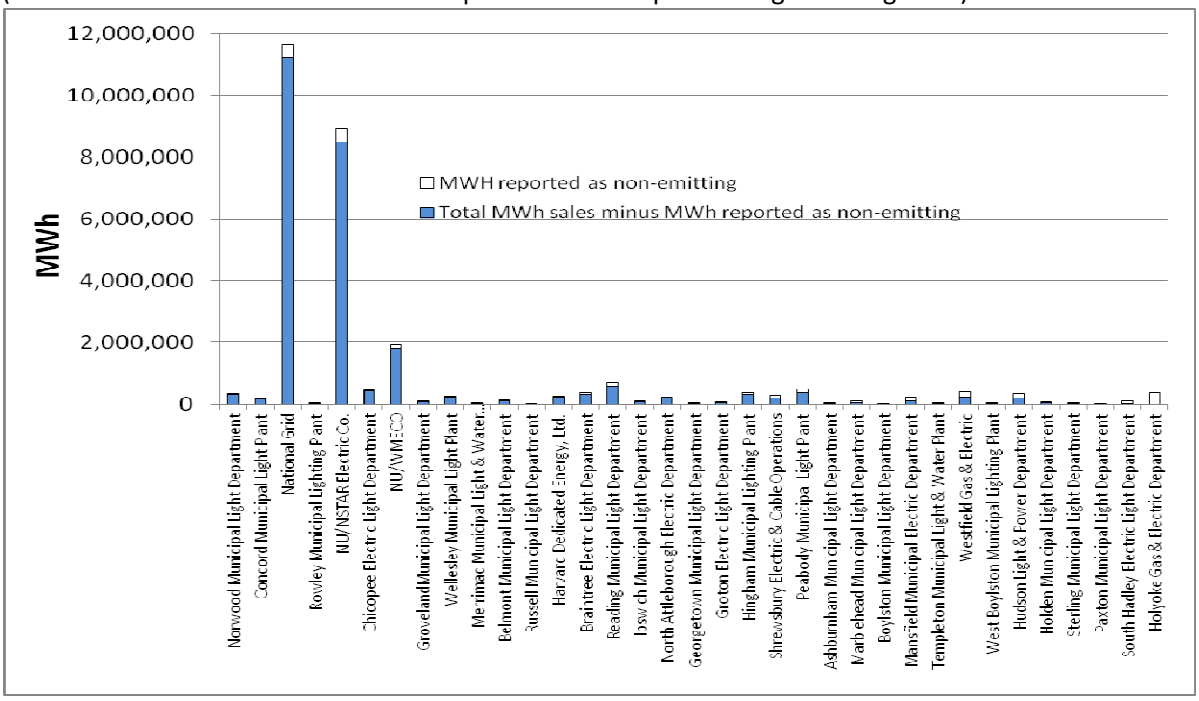


Figure 10. 2012 Electricity Sales by Retail Seller: Non-Emitting vs. All Other MWh Sales Reported
(retail sellers not shown chose not to report MWh from particular generating units)



Appendix 1: 2012 Individual Retail Seller GHG Emissions

Below are 2012 GHG emissions for each retail seller calculated by MassDEP based on:

- the final GHG emission factors from Step 3 above, and
- MWh reported to Department of Energy Resources by electric utilities and competitive suppliers and to DPU by municipal electric departments and light boards, less MWh from any particular generating units that a retail seller reported in Step 1. See footnote 1 and 2 regarding the retail sales and emissions of competitive suppliers and municipalities.

Table 4. 2012 MA Retail Seller GHG Emissions (Short Tons CO_2e)

	Massachusetts-based approach		Regional-based approach	
	Non-Biogenic	**Biogenic**	**Non-Biogenic**	**Biogenic**
Electric Utilities				
NGRID (Mass. and Nantucket Elec.)	3,531,529	528,605	3,070,406	691,685
NU/NSTAR Electric Co.	2,673,189	400,127	2,324,142	523,570
NU/Western Mass. Electric Co.	571,883	85,600	497,211	112,009
Unitil (Fitchburg Gas & Electric Co.)	65,262	9,769	56,741	12,782
Competitive Suppliers				
Cianbro Energy, LLC	228	34	198	45
Consolidated Edison Solutions, Inc.	888,768	133,032	772,719	174,074
Constellation Energy Power Choice.	48,872	7,315	42,490	9,572
Constellation NewEnergy, Inc.	1,376,051	205,969	1,196,375	269,513
Devonshire Energy	31,933	4,780	27,763	6,254
Direct Energy Business, LLC	1,138,424	170,401	989,777	222,972
Direct Energy Services, LLC	66,591	9,967	57,896	13,043
Dominion Retail, Inc.	457,787	68,522	398,012	89,662
East Avenue Energy, LLC	301	45	262	59
Easy Energy of MA	11,087	1,660	9,640	2,172
Energy Plus	8,155	1,221	7,090	1,597
First Point Power	10,250	1,534	8,911	2,007
GDF Suez Energy Resources	821,583	122,976	714,306	160,915
GDF Suez Retail Energy of MA, Inc. (dba Think Energy)	3,701	554	3,218	725
Glacial Energy of Massachusetts, Inc	165,161	24,722	143,595	32,348
Great Eastern Energy (BBPC, LLC)	49	7	42	10
Gulf Oil LP	785	117	682	154
Hampshire Council of Governments	13,770	2,061	11,972	2,697
Hannaford Energy	12,484	1,869	10,854	2,445
Harvard Dedicated Energy, Ltd.	69,172	10,354	60,140	13,548
Hess Corporation	729,886	109,250	634,582	142,955
HOP Energy	60	9	52	12
Hudson Energy Services	66,050	9,886	57,426	12,937
Integrys Energy Services, Inc.	147,788	22,121	128,491	28,946
Just Energy Massachusetts	119,964	17,956	104,300	23,496
Liberty Power Holdings	168,684	25,249	146,658	33,038
Massachusetts Gas & Electric Co.	6,370	953	5,538	1,248
Mint Energy, LLC.	9,177	1,374	7,978	1,797
NextEra Energy	273,032	40,868	237,381	53,476
Noble Americas Energy Solutions	458,898	68,689	398,978	89,880
OBE Electric	2,098	314	1,824	411

	Massachusetts-based approach		Regional-based approach	
	Non-Biogenic	Biogenic	Non-Biogenic	Biogenic
Open Book (ECM Energy Management)	9,219	1,380	8,016	1,806
Peoples Power & Gas	5	1	4	1
Pepco Energy Services, Inc.	12,630	1,891	10,981	2,474
Public Power & Utility, Inc.	16,948	2,537	14,735	3,319
Reliant Energy Northeast	24,854	3,720	21,609	4,868
REP Energy	17,642	2,641	15,339	3,455
South Jersey Energy	21,663	3,243	18,835	4,243
Spark Energy, LP	5,152	771	4,480	1,009
Texas Retail Energy	17,100	2,560	14,868	3,349
TransCanada Power Marketing Ltd.	983,629	147,231	855,193	192,653
Viridian	14,767	2,210	12,839	2,892
Xoom Energy Massachusetts LLC	7,571	1,133	6,582	1,483
Municipalities				
Ashburnham Muni. Light Dept.	7,597	1,137	6,605	1,488
Belmont Municipal Light Dept.	38,912	5,824	33,831	7,621
Boylston Municipal Light Dept.	6,356	951	5,526	1,245
Braintree Electric Light Dept.	100,172	14,994	87,092	19,620
Chester Muni. Electric Light Dept.	1,752	262	1,523	343
Chicopee Electric Light Dept.	137,916	20,644	119,908	27,012
Concord Municipal Light Plant	54,571	8,168	47,446	10,688
Danvers Electric Division	104,988	15,715	91,280	20,563
Georgetown Municipal Light Dept.	12,919	1,934	11,232	2,530
Groton Electric Light Dept.	18,490	2,768	16,075	3,621
Groveland Municipal Light Dept.	11,238	1,682	9,771	2,201
Hingham Municipal Lighting Plant	50,124	7,503	43,579	9,817
Holden Municipal Light Dept.	18,189	2,723	15,814	3,563
Holyoke Gas & Electric Dept.	4,527	678	3,936	887
Hudson Light & Power Dept.	62,146	9,302	54,031	12,172
Hull Municipal Lighting Plant	16,717	2,502	14,534	3,274
Ipswich Municipal Light Dept.	31,398	4,700	27,299	6,150
Littleton Electric Light & Water	91,880	13,753	79,883	17,996
Mansfield Municipal Electric Dept.	41,296	6,181	35,904	8,088
Marblehead Municipal Light Dept.	23,712	3,549	20,616	4,644
Merrimac Muni. Light & Water	9,015	1,349	7,838	1,766
Middleborough Gas & Elec. Dept.	83,962	12,568	72,899	16,445
Middleton Muni. Electric Dept.	31,810	4,761	27,656	6,230
North Attleboro Electric Dept.	62,422	9,343	54,271	12,226
Norwood Municipal Light Dept.	100,267	15,008	87,175	19,638
Paxton Municipal Light Dept.	4,346	650	3,778	851
Peabody Municipal Light Plant	113,703	17,019	98,856	22,270
Princeton Municipal Light Dept.	5,166	773	4,492	1,012
Reading Municipal Light Dept.	185,059	27,700	160,896	36,246
Rowley Municipal Lighting Plant	13,472	2,017	11,713	2,639
Russell Municipal Light Dept.	1,497	224	1,301	293
Shrewsbury Electric & Cable Ops.	67,764	10,143	58,916	13,272
South Hadley Electric Light Dept.	7,220	1,081	6,277	1,414
Sterling Municipal Light Dept.	10,530	1,576	9,155	2,062
Taunton Municipal Lighting Plant	203,466	30,455	176,899	39,851

	Massachusetts-based approach		Regional-based approach	
	Non-Biogenic	**Biogenic**	**Non-Biogenic**	**Biogenic**
Templeton Muni. Light & Water	11,477	1,718	9,978	2,248
Wakefield Muni. Gas & Light	63,853	9,558	55,516	12,506
Wellesley Municipal Light Plant	74,495	11,151	64,768	14,591
West Boylston Muni. Light. Plant	10,014	1,499	8,707	1,961
Westfield Gas & Electric	68,393	10,237	59,462	13,395
2012 RETAIL SELLER TOTAL GHGs	**17,043,034**	**2,551,027**	**1,706,537**	**3,338,046**

Appendix 2: Individual 2012 Retail Seller Emission Factors

Below are the 2012 GHG emission factors for each retail seller that chose to report use of non-emitting MWh from particular generating units. These factors represent individual GHG emission rates for each retail seller based on their reported GHG emissions and MWh of electricity sales.

Table 5. Individual 2012 Retail Seller Emission Factors

	MWh reported as non-emitting	Massachusetts-based emission factors (lb CO_2e/MWh)		Regional-based emission factors (lb CO_2e/MWh)		% of sales reported as non-emitting MWh
		Non-Biogenic	Biogenic	Non-Biogenic	Biogenic	
Electric Utilities						
NGRID (Mass. and Nantucket Elec.)	435,512	605	90	526	118	3.7%
NU/NSTAR	410,713	599	90	521	117	4.6%
NU/WMECO	101,300	595	89	517	117	5.3%
Competitive Suppliers						
Harvard Dedicated Energy	18,772	579	87	503	113	7.9%
Municipalities						
Ashburnham Muni. Light Dept.	10,796	434	65	378	85	30.9%
Belmont Municipal Light Department	9,320	584	87	508	114	7.0%
Boylston Municipal Light Dept.	11,548	400	60	348	78	36.3%
Braintree Electric Light Dept.	62,192	526	79	457	103	16.3%
Chicopee Electric Light Dept.	20,952	598	90	520	117	4.8%
Concord Municipal Light Plant	6,715	605	91	526	118	3.7%
Georgetown Municipal Light Department	10,285	502	75	437	98	20.0%
Groton Electric Light Dept.	16,920	488	73	424	96	22.3%
Groveland Municipal Light Dept.	2,035	594	89	517	116	5.4%
Hingham Municipal Lighting Plant	47,111	485	73	422	95	22.8%
Holden Municipal Light Dept.	46,815	347	52	302	68	44.7%
Holyoke Gas & Electric Dept.	349,431	25	4	22	5	96.0%
Hudson Light & Power Dept.	157,570	350	52	304	68	44.3%
Ipswich Municipal Light Dept.	20,626	521	78	453	102	17.1%

	MWh reported as non-emitting	Massachusetts-based emission factors (lb CO_2e/MWh)		Regional-based emission factors (lb CO_2e/MWh)		% of sales reported as non-emitting MWh
		Non-Biogenic	Biogenic	Non-Biogenic	Biogenic	
Mansfield Municipal Electric Dept.	89,079	374	56	326	73	40.4%
Marblehead Municipal Light Department	36,142	425	64	369	83	32.4%
Merrimac Municipal Light & Water Dept.	2,097	585	88	509	115	6.8%
North Attleboro Electric Dept.	41,257	520	78	452	102	17.2%
Norwood Municipal Light Dept.	10,051	609	91	529	119	3.0%
Paxton Municipal Light Dept.	11,633	341	51	297	67	45.7%
Peabody Municipal Light Plant	143,724	450	67	391	88	28.4%
Reading Municipal Light Dept.	118,703	524	78	455	103	16.6%
Rowley Municipal Lighting Plant	2,004	600	90	522	118	4.5%
Russell Municipal Light Dept.	401	579	87	504	113	7.8%
Shrewsbury Electric & Cable Ops.	84,197	452	68	393	88	28.1%
South Hadley Electric Light Dept.	96,789	121	18	105	24	80.8%
Sterling Municipal Light Dept.	27,945	343	51	298	67	45.5%
Templeton Municipal Light & Water Plant	25,826	368	55	320	72	41.4%
Wellesley Municipal Light Plant	15,016	591	88	513	116	6.0%
West Boylston Municipal Lighting Plant	25,866	352	53	306	69	44.0%
Westfield Gas & Electric	163,873	365	55	317	71	41.9%
All Other Retail Sellers	0	628	94	546	123	**0%**

Appendix 3: 2012 Retail Level Emission Factors to be Used by Consumers of Electricity to Report Greenhouse Gas Emissions

Some electricity consumers have expressed interest in using MA-specific greenhouse gas (GHG) emission factors (EFs) to report their GHG emissions from use of electricity. The EFs shown earlier in this document are often not appropriate for use by electricity consumers for two reasons: first, the EFs earlier in this document are for the combination of CO_2, CH_4 and N_2O when many electricity consumers seek EFs for the individual gases and, second, the EFs earlier in this document are per wholesale MWh, rather than per retail meter MWh (or kWh) that electricity consumers see on their electric bill. In order to assist electricity consumers in reporting GHGs, this appendix presents the 2012 EFs that consumers of electricity would use to report their GHG emissions at a retail electricity level.

Combined, Biogenic & Non-Biogenic EFs: Progress on achieving the *Massachusetts Clean Energy and Climate Plan for 2020* limit of a 25% reduction in GHG emissions from 1990 by 2020 is determined using MA-based emission calculations. Thus, it is MA-Based EFs that consumers of electricity should use to determine GHG emissions. This includes all CO_2, CH_4 and N_2O emissions from non-biogenic (fossil) and biogenic (non-fossil) fuels combusted to generate the electricity sold by retail sellers of electricity in Massachusetts. The Combined EF can be determined by adding the Non-Biogenic and Biogenic EFs together.

2012 RS Wholesale Non-Biogenic MA-Based EF	601 lb Non-Biogenic CO_2e/Wholesale MWh
+ 2012 RS Wholesale Biogenic MA-Based EF	+ 90 lb Biogenic CO_2e/Wholesale MWh
2012 RS Wholesale Combined MA-Based EF	691 lb Combined CO_2e/Wholesale MWh

Wholesale v. Retail EFs (line losses): Power lines lose 7% (on average) of the electricity they carry. The amount of wholesale MWh needed to deliver a particular amount of electricity at the retail level is, therefore, 7% greater than the amount shown on a retail meter. The emissions released to produce the electricity can be spread out over either the larger number of wholesale MWh or the smaller number of retail MWh, such that the retail lb/MWh EF will always be higher than the wholesale lb/MWh EF:

Wholesale Combined EF / (100% of MWh – 7% of MWh due to line losses) = Retail Combined EF
Specifically: 691 lb CO_2e/Wholesale MWh / (1 - 0.07) = 743 lb CO_2e/Retail MWh

Table 6. 2012 MA-Based CO_2e GHG Emission Factors

	Retail Seller Wholesale Level (lb CO_2e/Wholesale MWh)	Electricity Consumer Retail Level (lb CO_2e/Retail MWh)
Non-Biogenic	601	646
Biogenic	90	97
Combined	691	743

Individual CO_2, CH_4, and N_2O EFs: If the entity to which you are reporting requires EFs by individual gas, then the lb CO_2e/MWh value needs to be separated into the individual components: lb CO_2/MWh, lb CH_4/MWh, and lb N_2O/MWh. MassDEP has separated the three gases by alternately zeroing out the other two gases on the 'Calculating CO2e' tab of the retail seller EF spreadsheet at http://www.mass.gov/eea/docs/dep/air/climate/rse12calc.xls. For the 2012 retail level Combined EF, this results in 740 lb of CO_2e from CO_2, 0.8 lb CO_2e from CH_4, and 2 lb of CO_2e from N_2O. The global warming potential (GWP) of each gas must then be taken into account to determine the EF for each gas. The GWPs used in recent years by MassDEP are: 1 for CO_2, 21 for CH_4, and 310 for N_2O.

lb CO_2e/MWh = ((lb CO_2 *1) + (lb CH_4 * 21) + (lb N_2O * 310)) / MWh

Specifically: 0.8 lb CO_2e from CH_4 / 21 = 0.038 lb CH_4 *and* 2 lb CO_2e from N_2O / 310 = 0.006 lb N_2O,

therefore

743 lb CO_2e/Retail MWh = (740 lb CO_2 + (0.038 lb CH_4 * 21) + (0.006 lb N_2O * 310)) / Retail MWh

The breakdown of the 743 lb CO_2e/Retail MWh value from Table 8 into individual gases, at various scales of electricity, is shown in Table 9.

Table 7. 2012 Electricity Consumers Retail-level MA-Based CO_2e GHG Emission Factors by Individual Gas

	CO_2e		
	CO_2	**CH_4**	**N_2O**
lb/Retail kWh	0.740	0.000038	0.000006
lb/Retail MWh	740	0.038	0.006
lb/Retail GWh	740,000	38	6

The lb/Retail kWh values in the upper row of Table 9 may be the values most likely to be used by electricity consumers since most electric bills show kWh use. The CO_2, CH_4, and N_2O EFs in lb/Retail GWh shown in the bottom row in Table 9 are used by MassDEP when voluntarily reporting emissions from its operations to The Climate Registry.

The breakdown of the 740 lb CO_2/Retail MWh value from Table 9 into its non-biogenic and biogenic components is shown in Table 10. All CH_4 and N_2O emissions are considered non-biogenic and thus cannot be further broken down.

Table 8. 2012 Electricity Consumers Retail-level MA-Based
Non-Biogenic and Biogenic CO_2 Emission Factors

	CO_2	
	Non-Biogenic CO_2	**Biogenic CO_2**
lb/Retail kWh	0.643	0.097
lb/Retail MWh	643	97
lb/Retail GWh	643,000	97,000