MassDEP GHG Reporting Program Summary Report
For Retail Sellers of Electricity
Emissions Year 2018

July 2021

The information below summarizes the 2018 greenhouse gas (GHG) emissions and megawatt hours (MWh) of electricity sales in Massachusetts by the 108 retail sellers that sold electricity in Massachusetts during that year. Retail sellers of electricity in Massachusetts are required to report this information to the Massachusetts Department of Environmental Protection (MassDEP) under regulation 310 CMR 7.75.[1] MassDEP uses this information in considering measures to reduce emissions from the electric sector. This was the tenth[2] year of emissions reporting by retail sellers of electricity, and the first year of reporting under regulation 310 CMR 7.75. Data and comparisons from the first nine reporting years under 310 CMR 7.71 are provided in the summary reports for 2010-2017.[3] Changes to the regulation and the methodology for calculating emission factors have resulted in changes in this summary report.

MassDEP requires retail sellers to report emissions that occur from the generation of the electricity that they sell. The GHGs emitted from power plants 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.

The retail seller reporting process consists of 4 steps:

Step 1. Unit-Specific Generation: Retail sellers report the use of MWh from unit-specific generation and any associated emissions.

Step 2. Initial GHG Emission Factors: MassDEP develops 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 the electricity consumed in Massachusetts.

Step 3. Final GHG Emission Factors: MassDEP develops 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. GHG Emissions: Retail sellers report their GHG emissions by multiplying the final emission factors in Step 3 by their electricity sold and not reported in Step 1, and then adding emissions reported in Step 1.

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[1] Additional information about MassDEP's GHG reporting program is available at https://www.mass.gov/guides/massdep-greenhouse-gas-emissions-reporting-program; see particularly *Retail Seller of Electricity Reporting*.

[2] 2017 was the final reporting year under 310 CMR 7.71. Beginning with 2018 calendar year emissions, retail sellers began reporting under 310 CMR 7.75(9).

[3] The summary reports may be found at: https://www.mass.gov/lists/massachusetts-greenhouse-gas-ghg-reporting-program-data#retail-seller-ghg-emissions-reports-.

Two changes occur in Steps 1 and 2 with the 2018 reporting year that affect the final GHG emission factors and GHG emissions in Steps 3 and 4:

- The regulation 310 CMR 7.75 now requires all electric utilities and competitive suppliers to report unit-specific generation "by fuel and by state or province, the number of emitting and non-emitting MWh of electricity generated by emitting and non-emitting electricity generators" as represented by certificates[4] retired for compliance with Massachusetts energy programs.[5] [6]
- The methodology for calculating the initial emission factors now includes all retired certificates in the ISO-New England control area, aligning the retail seller reporting program with the Massachusetts GHG Inventory[7] methodology.

Thus, data from 2018 are not always comparable with data from previous years. Due to challenges from first-time reporting under a new regulation, this summary document reports data as calculated and/or corrected by MassDEP, and not necessarily as reported by retail sellers (as discussed further below).

Step 1: Unit-Specific Generation Reported by Retail Sellers

The purpose of reporting unit-specific generation is to assign to each retail seller the MWh and associated emissions from the unit-specific electricity claimed by each through ownership of the unit, contract for the power, or the purchase of certificates. Under 310 CMR 7.75, this report is mandatory for electric utilities and competitive suppliers and optional for municipal electric departments and light boards (MEDs).[8] Table 1 shows the number of retail sellers reporting MWh from specific generating units in 2018.

Table 1. Number of Retail Sellers Reporting MWh from Unit-Specific Generation

	Electric Utilities[9]	Competitive Suppliers	Municipal Electric Departments	Total Retail Sellers
2018	all 3	62 of 65[10]	all 40	105 of 108

[4] Certificates are created and retired through the New England Power Pool Generation Information System (NEPOOL GIS). NEPOOL GIS "issues and tracks certificates for all MWh of generation and load produced in the ISO New England control area, as well as imported MWh from adjacent control areas." One certificate is generated for each MWh. See https://www.nepoolgis.com/.

[5] Certificates are required for compliance with DOER's Renewable Energy Portfolio Standard (RPS) https://www.mass.gov/renewable-energy-portfolio-standard and Alternative Energy Portfolio Standard (APS) https://www.mass.gov/alternative-energy-portfolio-standard programs, and MassDEP's Clean Energy Standard (CES) program https://www.mass.gov/guides/clean-energy-standard-310-cmr-775.

[6] For more details on Step 1 of the GHG reporting process in Massachusetts, see https://www.mass.gov/how-to/aq-31-32-retail-seller-of-electricity-greenhouse-gas-emissions-reporting.

[7] See Massachusetts GHG Inventory documents at https://www.mass.gov/lists/massdep-emissions-inventories#greenhouse-gas-baseline,-inventory-&-projection-.

[8] In this document, Municipal Electric Departments and Municipal Light Boards are collectively referred to as municipal electric departments (MEDs).

[9] Two electric utilities (NSTAR and WMECO) now report under the single entity of Eversource, reducing the number of electric utilities in Massachusetts to three as compared to the four in previous years.

[10] Sixty-five competitive suppliers sold retail electricity in Massachusetts in 2018. Seven of these competitive suppliers (Agera, Blue Rock, East Avenue, BPCC/Great Eastern Energy, Hampshire Council of Governments, Union Atlantic and Utility Expense Reduction) failed to report their 2018 GHG emissions. It is MassDEP's understanding that these competitive suppliers no longer operate in MA.

As noted above, electric utilities and competitive suppliers must now report all electricity generating certificates retired in their Massachusetts subaccounts as part of their GHG reporting. This results in several differences from the previous reporting years:

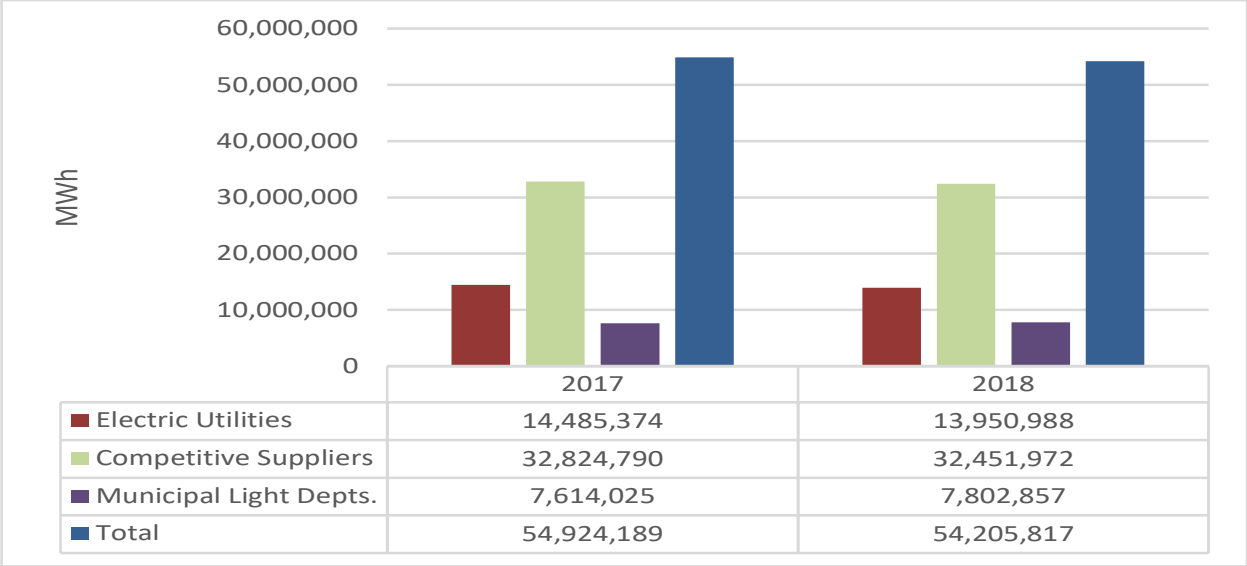
- retail sellers are now claiming emitting as well as non-emitting MWh, affecting the final emission factors, and
- these emitting MWh are almost exclusively claimed by electric utilities and competitive suppliers, affecting all retail sellers' GHG emissions.

MWh and emissions from specific electricity generating units retired by electric utilities and competitive suppliers are reported through their annual 'Renewable Portfolio Standard/Alternative Portfolio Standard/Clean Energy Standard (RPS/APS/CES) Workbook' to the Massachusetts Department of Energy Resources (DOER). Retail sellers are then required to include these MWh and emissions in the mandatory GHG Emissions report.[11] The reporting of MWh from specific electricity generating units by MEDs is still done through the submittal of an optional unit-specific generation report to MassDEP.

Figures 1 through 3 show the total retail sales and unit-specific generation by retail seller type for 2017 and 2018: Figure 1 shows the total retail sales; Figure 2 shows the total MWh from unit-specific generation; and Figure 3 shows the ratio of unit-specific generation to total retail sales. The large increase in total MWh from unit-specific generation retired by competitive suppliers from 2017 and 2018 (Figures 2 and 3) is a result of the change in the reporting regulation from optional to mandatory reporting of unit-specific generation. Figures 4 and 5 show the amount of emitting and non-emitting unit-specific generation retired by retail seller type for 2018 in MWh and as a percent of total.

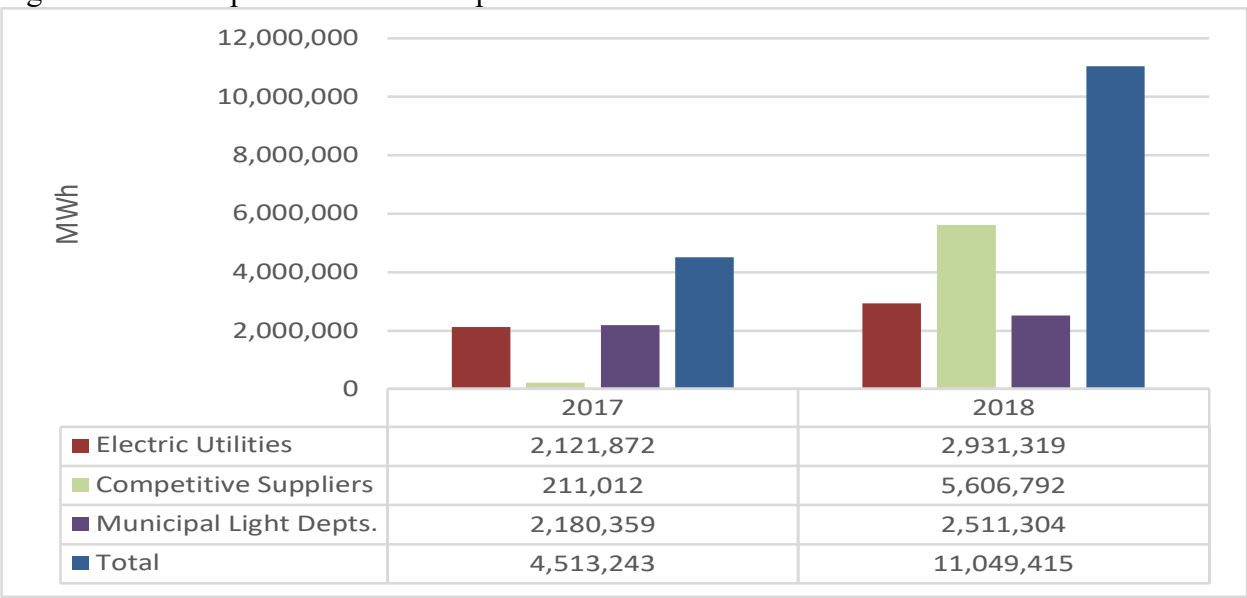
[11] Several complications arose during this initial year of reporting under 310 CMR 7.75 including: missing information in the spreadsheet templates that calculate emissions from unit-specific generation, failure by competitive suppliers to report their unit-specific generation, or a lack of understanding by retail sellers on which certificates to include with their unit-specific generation. Corrected spreadsheets were emailed to each retail seller with instructions to use the information in the corrected spreadsheets in their GHG emissions reports.

Figure 1. Total MWh of Retail Sales of Electricity



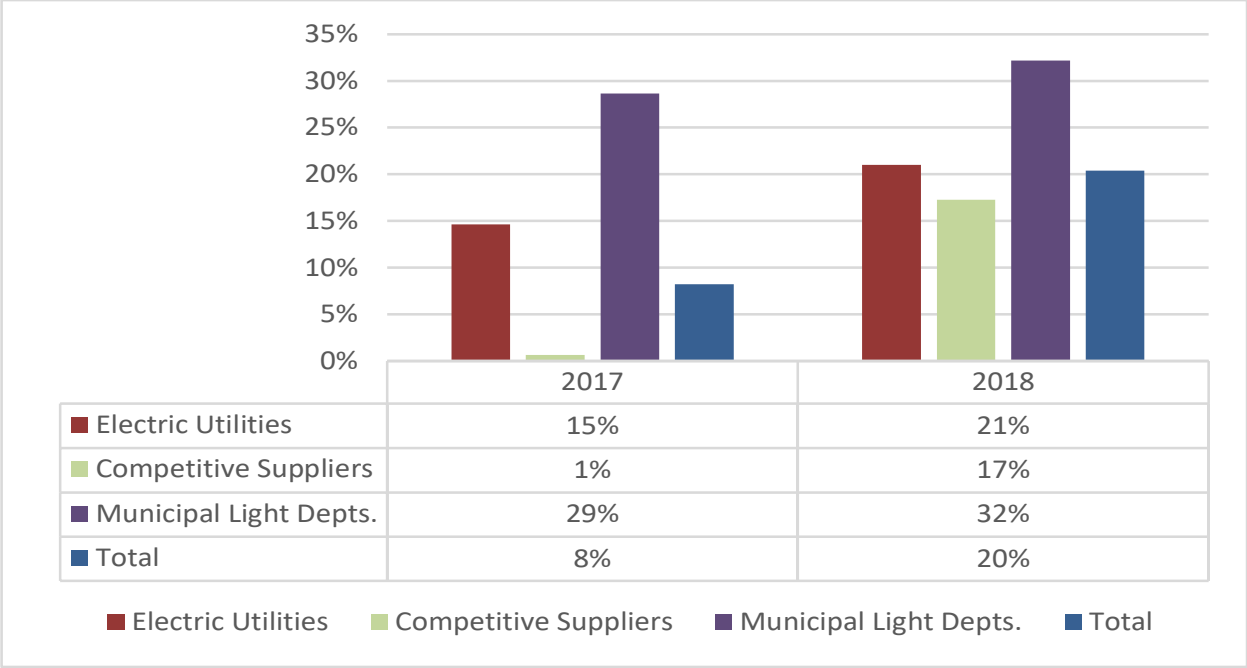
	2017	2018
Electric Utilities	14,485,374	13,950,988
Competitive Suppliers	32,824,790	32,451,972
Municipal Light Depts.	7,614,025	7,802,857
Total	54,924,189	54,205,817

Figure 2. MWh reported from Unit-Specific Generation

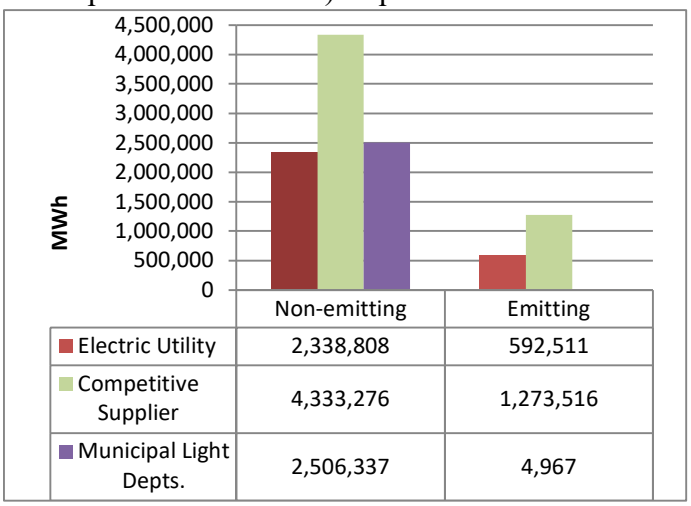


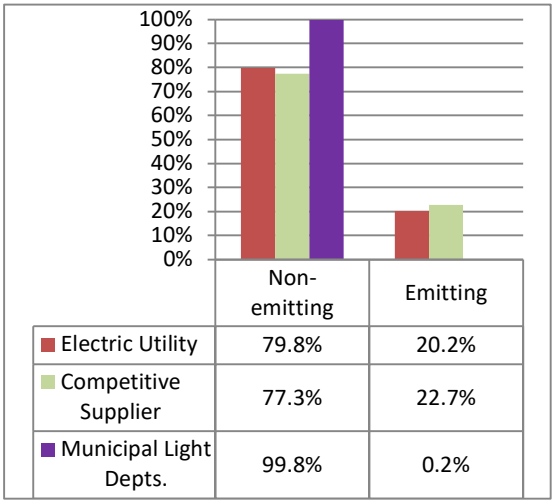
	2017	2018
Electric Utilities	2,121,872	2,931,319
Competitive Suppliers	211,012	5,606,792
Municipal Light Depts.	2,180,359	2,511,304
Total	4,513,243	11,049,415

Figure 3. MWh from Unit-Specific Generation as % of Total Retail Sales



Figures 4 and 5. Unit-Specific Non-emitting and Emitting Generation (as MWh and as Percent of Unit-Specific Generation) Reported for 2018





Because the full accounting of certificates purchased by electric utilities and competitive suppliers for compliance[12] with various programs is already included in the RPS/APS/CES Annual Compliance Reports,[13] by state and fuel type, this information is not repeated in this summary. Details on the MWh reported by MEDs from specific generating units can be found in Appendix 2: *Optional Unit-Specific Generation Reported by MEDs for 2018*.

[12] Retired certificates from units that produce thermal energy are not reported for the purpose of calculating GHG emissions.

[13] These reports can be found at https://www.mass.gov/service-details/annual-compliance-reports.

Steps 2 and 3: GHG Emission Factors

Table 2 shows the initial (Step 2) and final (Step 3) emission factors upon which retail seller GHG emissions are based. The combined non-biogenic and biogenic emission factors have been included in this summary report for informational purposes. (Please note that Table 2 presents wholesale emission factors. Consumers of electricity that want to use Massachusetts-specific emission factors to report their GHG emissions from electricity use should see Appendix 3: *2018 Retail Level Emission Factors for Use by Consumers of Electricity to Report Greenhouse Gas Emissions (Massachusetts-based Emission Factors)* for appropriate values.)

As noted above, the methodology for determining the initial emission factors was updated for 2018 and now includes all retired certificates in the ISO-New England control area, aligning retail seller reporting with the Massachusetts GHG Inventory. Table 2 shows the 2017 emission factors for comparison. While most unit-specific generation reported by retail sellers is still from non-emitting fuel sources, most of the emitting generation is from biogenic fuel sources (e.g., landfill gas). Therefore, the most obvious effect of the methodology change occurs with the biogenic emission factors:

- The decrease from 2017 to 2018 in the initial Massachusetts-based biogenic emission factor occurs because a substantial number of certificates generated in Massachusetts from biogenic fuel sources, particularly wood/biomass in 2018, are retired in other New England states. This decreases the initial Massachusetts-based biogenic emission factor (but not the Regional biogenic emission factor since the certificates stay within the region).

For an explanation of the updated methodology used to calculate the initial emission factors, and of the "Massachusetts-based" and "Regional" approaches used to calculate the emission factors in Table 2, see *Draft 2018 Greenhouse Gas (GHG) Emission Factors to be used by Retail Sellers of Electricity Reporting under 310 CMR 7.75(9)(c) "Greenhouse Gas Emissions Reporting."*[14]

The methodology for the calculation of final emission factors from the initial emission factors has not changed. However, instead of the increase seen in previous years from initial to final emission factors, the change in the regulation that now requires (rather than leaving optional) reporting of unit-specific generation by electric utilities and competitive suppliers results in the large decrease from the initial to the final biogenic emission factors in 2018:

- The RPS regulation requires electric utilities and competitive suppliers to retire certificates from emitting unit-specific generation, including municipal solid waste (MSW).[15] Therefore, electric utilities and competitive suppliers are required to claim these certificates in their unit-specific generation reports. Because MSW emissions make up the major portion of biogenic emissions, particularly in Massachusetts, the result is a large decrease in the final biogenic emission factors that are applied to the remaining non-unit-specific generation, as shown in Table 2.[16]

[14] https://www.mass.gov/doc/technical-support-document-draft-2018-ghg-emission-factors/download.

[15] Retail sellers retired approximately 1.6 million of the 1.7 million MWh generated in MA by MSW in 2018.

[16] MSW certificates are separated into biogenic and non-biogenic portions based on data provided by EIA Form 923. While the emissions from both the non-biogenic and biogenic portions of MSW are claimed by electric utilities and competitive suppliers, the non-biogenic emissions from MSW are a much smaller fraction of MA's total non-biogenic emissions than the biogenic emissions are of total biogenic emissions. Thus, the change from optional to

Table 2. GHG Emission Factors for Electricity Consumed in Massachusetts, prior to and after accounting for Unit-Specific Generation (lb CO_2e/MWh)

	Massachusetts-based approach			Regional approach		
	Non-Biogenic	**Biogenic**	**Combined**	**Non-Biogenic**	**Biogenic**	**Combined**
Initial Emission Factors: **prior to** accounting for unit-specific generation (Step 2)						
2017	535	100	636	469	138	607
2018	445	72	517	430	134	564
Final Emission Factors: **after** accounting for unit-specific generation (Step 3)						
2017	580	109	688	486	143	630
2018	486	18	504	445	118	563

Step 4: GHG Emissions Reported by Retail Sellers

As noted above, 2018 was the first year of the new reporting requirements. Most of the 108 retail sellers submitted their GHG emissions reports as shown in Table 3; however, many retail sellers either did not include, or did not include the corrected, MWh and emissions information from their unit-specific generation report. This summary report reflects corrected MWh and GHG emissions data for the 34 retail sellers with errors in their emission reports, including data for the three competitive suppliers that failed to submit the unit-specific generation report.

Table 3. Number of Retail Sellers Reporting GHG Emissions

	Electric Utilities[17]	**Competitive Suppliers**	**Municipal Electric Departments**	**Total Retail Sellers**
2018	all 3	58 of 65[18]	all 40	101 of 108

Figure 6 shows the total GHG emissions for the three types of retail sellers in 2018. Massachusetts-based and Regional non-biogenic and biogenic GHG emissions decreased from 2017 to 2018. This is due to the decrease in emission factors (see Table 2), the decrease in the total load served in Massachusetts (see Figure 1), and the increase in the amounts of unit-specific generation retired by retail sellers (see Figure 2), much of which is from non-emitting generators.

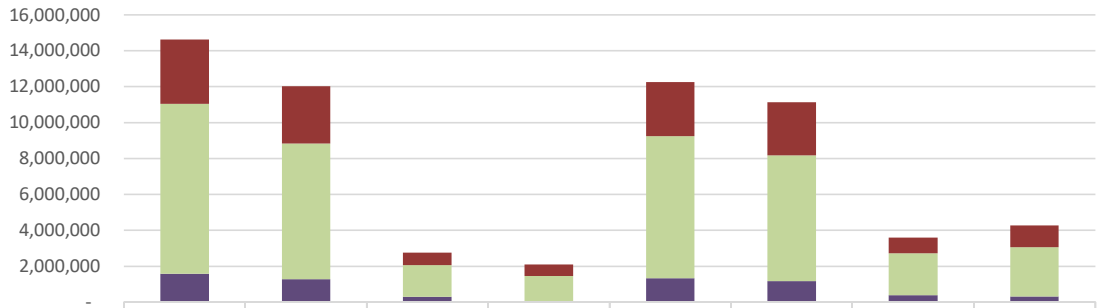
The information provided in Figures 3, 5 and 6 should not be used to draw comparisons between the three types of retail sellers because electric utilities and competitive suppliers are subject to two requirements that MEDs are not: 1. reporting all unit-specific electricity generation and 2. retiring MSW certificates, which causes electric utilities and competitive suppliers to have higher relative emissions than MEDs.

mandatory reporting of retired MSW certificates has a much larger effect on the final biogenic emission factors than on the final non-biogenic emission factors.

[17] Two electric utilities (NSTAR and WMECO) now report under a single entity as Eversource, reducing the number of electric utilities reporting in MA from 4 to 3.

[18] See footnote 10.

Figure 6. GHG Emissions Reported by Retail Seller Type and Year using the Massachusetts-based and Regional methodologies (Short Tons CO_2e)



	2017	2018	2017	2018	2017	2018	2017	2018
	MA Non-biogenic		MA Biogenic		Region Non-biogenic		Region Biogenic	
Electric Utilities	3,585,416	3,183,196	673,811	642,062	3,004,331	2,957,292	883,990	1,193,045
Competitive Suppliers	9,457,996	7,548,168	1,777,451	1,411,352	7,925,148	6,997,842	2,331,885	2,753,611
Municipal Light Depts.	1,578,000	1,285,864	296,555	50,928	1,322,255	1,177,388	389,059	315,506

The GHG emissions for each retail seller can be found in Appendix 1: *2018 Individual Retail Seller GHG Emissions*.

Appendix 1: 2018 Individual Retail Seller GHG Emissions

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

- the final GHG emission factors,
- MWh reported as retail load to MassDEP for compliance with the Clean Energy Standard by electric utilities and competitive suppliers and to the Department of Public Utilities (DPU) by MEDs, less MWh reported from unit-specific generation, and
- GHG emissions reported from unit-specific generation.[19]

Table 4. 2018 Massachusetts Retail Seller GHG Emissions (Short Tons CO_2e)

	Massachusetts-based approach			Regional approach		
	Non-Biogenic	Biogenic	Combined	Non-Biogenic	Biogenic	Combined
Electric Utilities						
Unitil (Fitchburg Gas & Electric Co.)	39,111	7,059	46,170	36,320	13,865	50,185
National GRID (Mass. and Nantucket Electric)	1,570,460	345,334	1,915,794	1,459,111	616,916	2,076,027
Eversource/NSTAR Electric Co. and Western MA Electric Cos.	1,573,625	289,669	1,863,294	1,461,861	562,264	2,024,125
Competitive Suppliers						
Agera Energy LLC	367,887	13,625	381,513	336,851	89,322	426,174
Ambit Northeast, LLC	63,298	21,664	84,962	58,896	32,400	91,296
Atlantic Energy LLC	12,641	2,452	15,093	11,742	4,646	16,387
Blue Rock Energy LLC	54,714	2,026	56,741	50,099	13,285	63,383
Calpine Energy Solutions LLC	251,747	47,354	299,101	233,694	91,386	325,081
Champion Energy Services	127,036	27,773	154,809	117,949	49,938	167,887
Clean Choice	24,457	4,355	28,813	22,707	8,625	31,332
Clearview Electric, Inc.	19,758	732	20,490	18,091	4,797	22,888
Connecticut Municipal Electric Energy Cooperative	59,783	10,464	70,246	55,488	20,939	76,427
Constellation NewEnergy, Inc.	1,601,849	316,157	1,918,006	1,488,549	592,499	2,081,048
Devonshire Energy, LLC	16,505	3,094	19,600	15,338	5,941	21,279
Direct Energy Business LLC	900,135	195,253	1,095,388	835,599	352,657	1,188,256
Direct Energy Services, LLC	84,652	15,981	100,633	78,676	30,557	109,233
Discount Power, Inc.	7,513	1,336	8,849	6,975	2,648	9,623
Dynegy Energy Services (East), LLC	144,362	26,547	170,908	134,096	51,584	185,680
East Avenue Energy, LLC	159	28	187	147	56	203
EDF Energy Services, LLC/ TransCanada	361,720	70,026	431,747	335,683	133,532	469,215
Eligio Energy MA LLC	18,150	7,633	25,783	16,863	10,773	27,636
Energy Plus Holdings	6,318	1,373	7,691	5,867	2,473	8,340
ENGIE Resources, LLC	591,166	113,531	704,697	548,782	216,907	765,689

[19] Alternative Compliance Payments (ACPs) are not considered as part of Retail Seller GHG Reporting, and certificates previously banked with DOER are accounted for in the year they were generated, and therefore result in no MWh being subtracted and no emissions being added to a retail seller's AQ32 report in Step 4.

	Massachusetts-based approach			Regional approach		
	Non-Biogenic	Biogenic	Combined	Non-Biogenic	Biogenic	Combined
ENGIE Retail, LLC (dba Think Energy)	30,676	5,285	35,961	28,464	10,679	39,143
Everyday Energy LLC	22	5	27	20	8	29
First Point Power	81,826	21,824	103,650	76,027	35,967	111,994
Great Eastern Energy (aka BBPC, LLC)	334,090	12,374	346,463	305,905	81,116	387,022
Green Mountain Energy Company	3,669	671	4,340	3,408	1,307	4,716
Hampshire Council of Governments	11,662	2,162	13,825	10,806	4,252	15,058
Harborside Energy of Massachusetts LLC	1,563	280	1,843	1,451	552	2,004
Harvard Dedicated Energy, Ltd.	32,610	1,208	33,818	29,859	7,918	37,777
Hudson Energy Services	102,849	21,042	123,891	95,445	39,101	134,546
Inspire Energy Holdings, LLC	26,692	7,777	34,469	24,790	12,416	37,206
Interstate Gas Supply, Inc. (dba IGS Energy)	14,803	2,755	17,558	13,754	5,313	19,067
Just Energy Mass. Corp.	33,010	5,396	38,406	30,604	11,265	41,868
Liberty Power Holdings	63,657	12,783	76,440	59,159	23,753	82,912
Linde-Messer Energy Services	3,350	609	3,959	3,111	1,191	4,302
Major Energy Electric Service, LLCs	34,910	6,303	41,214	32,420	12,378	44,798
Massachusetts Gas & Electric Co.	40,662	6,640	47,302	37,688	13,896	51,583
Mega Energy Holdings, LLC	12,072	2,839	14,911	11,200	4,966	16,166
Mint Energy, LLC	34,427	5,951	40,378	31,947	12,000	43,947
National Gas & Electric, Inc.	6,518	3,250	9,767	6,056	4,375	10,431
NextEra Energy	559,890	95,493	655,383	519,402	194,245	713,647
Nordic Energy Services	381	14	395	349	93	441
Oasis Power, LLC	16,161	3,164	19,325	15,007	5,980	20,987
Palmco Power MA, LLC	17,903	8,596	26,499	16,633	11,694	28,327
Perigee Energy, LLC	0	0	0	0	0	0
Provider Power MASS, LLC	171,989	48,256	220,245	159,836	77,895	237,732
Public Power, LLC	579,104	117,880	696,984	537,204	220,074	757,278
Reliant Energy Northeast	97,576	22,839	120,415	90,649	39,734	130,383
Renaissance Power and Gas	482	87	569	448	171	619
Residents Energy, LLC	15,660	4,533	20,192	14,545	7,252	21,797
SFE Energy Massachusetts	117,927	25,026	142,953	109,496	45,588	155,084
SmartEnergy Holdings, LLC	11,965	4,335	16,301	11,124	6,388	17,512
South Jersey Energy	21,883	6,751	28,634	20,290	10,635	30,925
Spark Energy, LLC	25,123	5,851	30,974	23,428	9,985	33,413
Starion Energy, Inc.	63,630	14,881	78,511	59,098	25,935	85,032
Summer Energy	9,912	367	10,279	9,076	2,407	11,482
Sunwave Gas & Power	27,791	5,411	33,201	25,805	10,253	36,059

	Massachusetts-based approach			Regional approach		
	Non-Biogenic	Biogenic	Combined	Non-Biogenic	Biogenic	Combined
Massachusetts, Inc.						
Texas Retail Energy	22,735	4,062	26,796	21,109	8,027	29,136
Titan Gas and Power	1	0	1	1	0	1
Town Square Energy, LLC	27,543	6,691	34,234	25,565	11,514	37,079
Union Atlantic Electricity LLC	7,847	291	8,138	7,185	1,905	9,090
Utility Expense Reduction	6,481	240	6,721	5,934	1,574	7,508
Verde Energy USA Massachusetts, LLC	58,599	16,524	75,123	54,418	26,721	81,139
Viridian Energy, LLC	85,917	16,031	101,948	79,612	31,409	111,022
Wattifi, Inc.	5	0	5	4	1	6
Xoom Energy Massachusetts LLC	18,744	3,472	22,216	17,415	6,714	24,129
Municipal Electric Departments						
Ashburnham Muni. Light Dept.	5,737	212	5,949	5,253	1,393	6,645
Belmont Municipal Light Dept.	23,720	879	24,599	21,719	5,759	27,478
Boylston Municipal Light Dept.	5,069	188	5,257	4,642	1,231	5,872
Braintree Electric Light Dept.	68,789	2,548	71,336	62,986	16,702	79,687
Chester Muni. Electric Light Dept.	1,318	49	1,367	1,207	320	1,527
Chicopee Electric Light Dept.	111,496	4,129	115,626	102,090	27,071	129,161
Concord Municipal Light Plant	18,733	3,997	22,730	17,154	7,848	25,002
Danvers Electric Division	40,764	1,510	42,274	37,325	9,897	47,222
Georgetown Municipal Light Dept.	7,012	260	7,271	6,420	1,702	8,122
Groton Electric Light Dept.	14,110	523	14,632	12,919	3,426	16,345
Groveland Municipal Light Dept.	8,172	303	8,475	7,483	1,984	9,467
Hingham Municipal Lighting Plant	28,459	1,054	29,513	26,058	6,910	32,968
Holden Municipal Light Dept.	14,518	538	15,056	13,293	3,525	16,818
Holyoke Gas & Electric Dept.	13,262	491	13,753	12,143	3,220	15,363
Hudson Light & Power Dept.	10,285	381	10,666	9,418	2,497	11,915
Hull Municipal Lighting Plant	5,578	207	5,784	5,107	1,354	6,461
Ipswich Municipal Light Dept.	22,951	850	23,801	21,014	5,572	26,587
Littleton Electric Light & Water	58,717	2,175	60,892	53,764	14,256	68,020
Mansfield Municipal Electric Dept.	26,729	990	27,718	24,474	6,490	30,963

	Massachusetts-based approach			Regional approach		
	Non-Biogenic	**Biogenic**	**Combined**	**Non-Biogenic**	**Biogenic**	**Combined**
Marblehead Municipal Light Dept.	17,722	656	18,378	16,226	4,303	20,529
Merrimac Muni. Light & Water	6,659	247	6,906	6,097	1,617	7,714
Middleborough Gas & Elec. Dept.	49,494	1,833	51,328	45,319	12,017	57,336
Middleton Muni. Electric Dept.	13,076	484	13,561	11,973	3,175	15,148
North Attleboro Electric Dept.	40,141	1,487	41,628	36,755	9,746	46,501
Norwood Municipal Light Dept.	79,861	2,958	82,819	73,124	19,390	92,514
Paxton Municipal Light Dept.	2,789	103	2,892	2,554	677	3,231
Peabody Municipal Light Plant	82,161	3,043	85,204	75,230	19,949	95,179
Princeton Municipal Light Dept.	3,548	131	3,679	3,249	861	4,110
Reading Municipal Light Dept.	136,389	5,051	141,440	124,883	33,115	157,998
Rowley Municipal Lighting Plant	10,485	388	10,874	9,601	2,546	12,147
Russell Municipal Light Dept.	1,144	42	1,186	1,047	278	1,325
Shrewsbury Electric & Cable Ops.	49,739	1,842	51,581	45,543	12,077	57,619
South Hadley Electric Light Dept.	3,918	145	4,063	3,587	951	4,538
Sterling Municipal Light Dept.	8,942	331	9,274	8,188	2,171	10,359
Taunton Municipal Lighting Plant	142,291	5,270	147,561	130,287	34,548	164,835
Templeton Muni. Light & Water	8,138	301	8,439	7,451	1,976	9,427
Wakefield Muni. Gas & Light	28,172	1,043	29,215	25,795	6,840	32,635
Wellesley Municipal Light Plant	57,801	2,141	59,942	52,925	14,034	66,959
West Boylston Muni. Light. Plant	7,187	266	7,453	6,581	1,745	8,326
Westfield Gas & Electric	50,789	1,881	52,670	46,505	12,332	58,836
2018 Electric Utility Total	3,183,196	642,062	3,825,258	2,957,292	1,193,045	4,150,338
2018 Competitive Supplier Total	7,548,168	1,411,352	8,959,520	6,997,842	2,753,611	9,751,452
2018 MED Total	1,285,864	50,928	8,980,228	1,177,388	315,506	9,136,328
2018 RETAIL SELLER TOTAL	**12,017,228**	**2,104,342**	**63,808,116**	**11,132,522**	**4,262,162**	**65,081,230**

Appendix 2: Optional Unit-Specific Generation Reported by MEDs for 2018

Below is a summary of the 2018 data that MEDs chose to submit from unit-specific generation. Most unit-specific generation submitted by MEDs in 2018 was non-emitting. Figures 7 and 8 show the unit-specific MWh reported by each MED and the ratio of their unit-specific MWh to their retail sales. MEDs are presented in order of increasing percentage of unit-specific generation reported. Figure 7 compares the unit-specific MWh reported as a percentage of total retail sales. Figure 8 shows the variation in total MWh sales. See Table 5 for individual MED values used in these figures and Table 6 for individual MED emission rates.

Figure 7. Unit-specific MWh Reported by MEDs (MWh and Percent of Total Retail Sales)

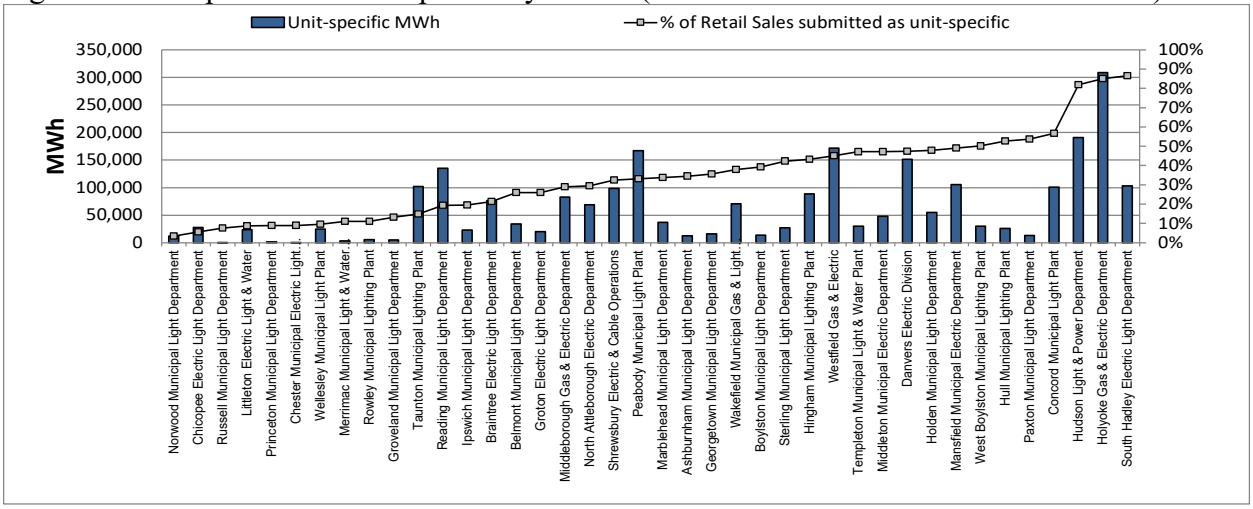


Figure 8. Electricity Sales by MED: Unit-Specific MWh vs. Total Retail Sales MWh

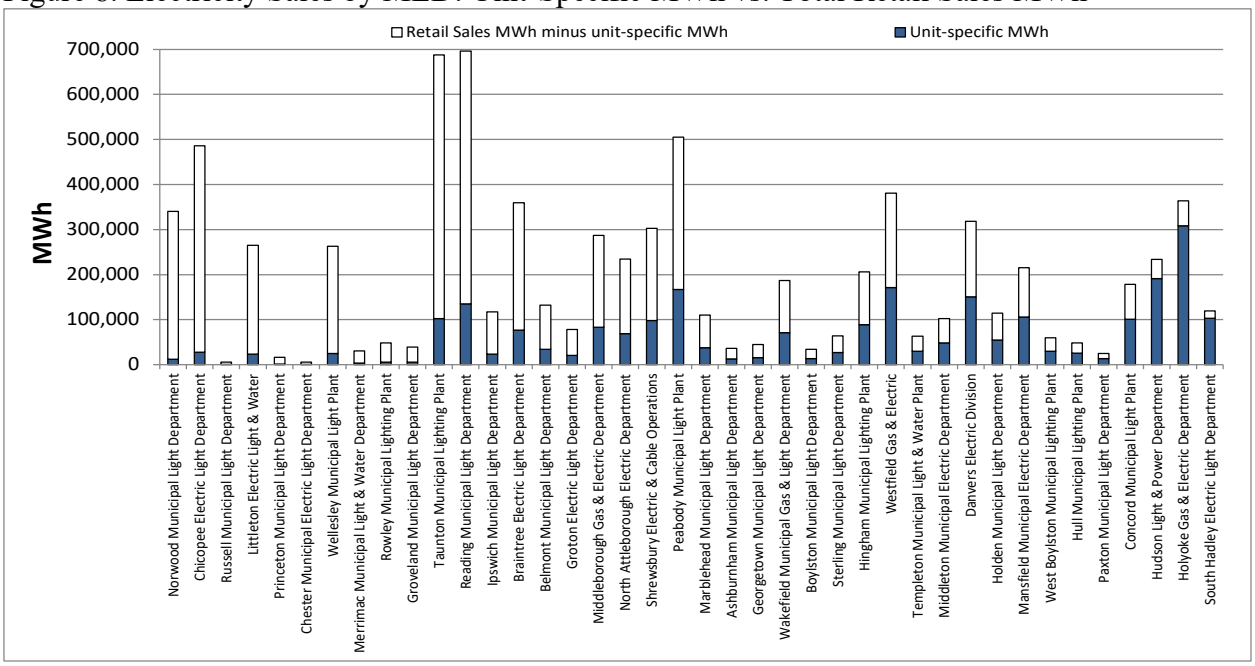


Table 5. Individual 2018 MED Percent of Sales Claimed as Unit-Specific Generation

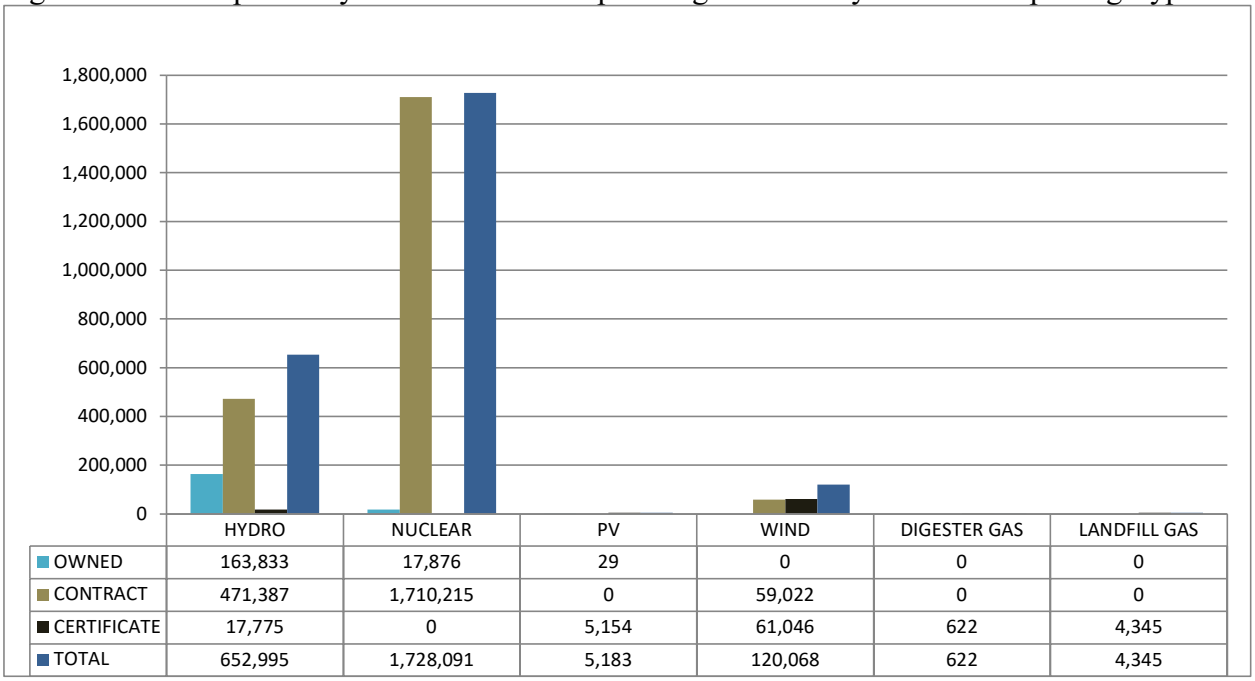
	MWh reported as retail sales	MWh claimed as unit-specific generation		% of sales claimed as unit-specific generation
		non-emitting	emitting	
Ashburnham Muni. Light Dept.	36,045	12,438		34.5%
Belmont Municipal Light Department	131,754	34,140		25.9%
Boylston Municipal Light Dept.	34,326	13,465		39.2%
Braintree Electric Light Dept.	359,858	76,777		21.3%
Chester Municipal Electric Light Dept.	5958	535		9.0%
Chicopee Electric Light Dept.	486,236	27,404		5.6%
Concord Municipal Light Plant	177,937	95,950	4,967	56.7%
Danvers Electric Division	318,781	151,029		47.4%
Georgetown Municipal Light Department	44,769	15,915		35.5%
Groton Electric Light Dept.	78,394	20,329		25.9%
Groveland Municipal Light Dept.	38,751	5,121		13.2%
Hingham Municipal Lighting Plant	206,014	88,898		43.2%
Holden Municipal Light Dept.	114,616	54,870		47.9%
Holyoke Gas & Electric Dept.	363,283	308,707		85.0%
Hudson Light & Power Dept.	233,292	190,965		81.9%
Hull Municipal Lighting Plant	48,558	25,605		52.7%
Ipswich Municipal Light Department	117465	23,018		19.6%
Littleton Electric Light & Water	265,006	23,371		8.8%
Mansfield Municipal Electric Dept.	215,396	105,402		48.9%
Marblehead Municipal Light Dept.	110,237	37,309		33.8%
Merrimac Municipal Light & Water Dept.	30,798	3,395		11.0%
Middleborough Gas & Electric Dept.	286,789	83,108		29.0%
Middleton Municipal Electric Dept.	101,885	48,073		47.2%
North Attleboro Electric Dept.	234,057	68,868		29.4%
Norwood Municipal Light Dept.	340,331	11,685		3.4%
Paxton Municipal Light Dept.	24,806	13,329		53.7%
Peabody Municipal Light Plant	505,201	167,088		33.1%
Princeton Municipal Light Dept.	16,017	1,416		8.8%
Reading Municipal Light Dept.	696,131	134,861		19.4%
Rowley Municipal Lighting Plant	48,515	5,365		11.1%
Russell Municipal Light Department	5,095	389		7.6%
Shrewsbury Electric & Cable Ops.	302,898	98,211		32.4%
South Hadley Electric Light Dept.	119,100	102,978		86.5%
Sterling Municipal Light Dept.	63,848	27,048		42.4%
Taunton Municipal Lighting Plant	687,784	102,224		14.9%
Templeton Municipal Light & Water	63,391	29,902		47.2%
Wakefield Municipal Gas & Light Dept.	186,886	70,952		38.0%
Wellesley Municipal Light Plant	262,885	25,019		9.5%
West Boylston Municipal Lighting Plant	59,303	29,726		50.1%
Westfield Gas & Electric	380,461	171,452		45.1%
MED Combined Total	**7,802,857**	**2,506,337**	**4,967**	**32.2%**

Table 6. Individual 2018 MED Emission Factors

	Massachusetts-based approach		Regional approach	
	Non-Biogenic	**Biogenic**	**Non-Biogenic**	**Biogenic**
Final 2018 Retail Seller Emission Factors	**486**	**18**	**445**	**118**
Ashburnham Muni. Light Dept.	318	12	291	77
Belmont Municipal Light Department	360	13	330	87
Boylston Municipal Light Dept.	295	11	270	72
Braintree Electric Light Dept.	382	14	350	93
Chester Municipal Electric Light Dept.	442	16	405	107
Chicopee Electric Light Dept.	459	17	420	111
Concord Municipal Light Plant	211	45	193	88
Danvers Electric Division	256	9	234	62
Georgetown Municipal Light Department	313	12	287	76
Groton Electric Light Dept.	360	13	330	87
Groveland Municipal Light Dept.	422	16	386	102
Hingham Municipal Lighting Plant	276	10	253	67
Holden Municipal Light Dept.	253	9	232	62
Holyoke Gas & Electric Dept.	73	3	67	18
Hudson Light & Power Dept.	88	3	81	21
Hull Municipal Lighting Plant	230	9	210	56
Ipswich Municipal Light Department	391	14	358	95
Littleton Electric Light & Water	443	16	406	108
Mansfield Municipal Electric Dept.	248	9	227	60
Marblehead Municipal Light Dept.	322	12	294	78
Merrimac Municipal Light & Water Dept.	432	16	396	105
Middleborough Gas & Electric Dept.	345	13	316	84
Middleton Municipal Electric Dept.	257	10	235	62
North Attleboro Electric Dept.	343	13	314	83
Norwood Municipal Light Dept.	469	17	430	114
Paxton Municipal Light Dept.	225	8	206	55
Peabody Municipal Light Plant	325	12	298	79
Princeton Municipal Light Dept.	443	16	406	108
Reading Municipal Light Dept.	392	15	359	95
Rowley Municipal Lighting Plant	432	16	396	105
Russell Municipal Light Department	449	17	411	109
Shrewsbury Electric & Cable Ops.	328	12	301	80
South Hadley Electric Light Dept.	66	2	60	16
Sterling Municipal Light Dept.	280	10	256	68
Taunton Municipal Lighting Plant	414	15	379	100
Templeton Municipal Light & Water	257	10	235	62
Wakefield Municipal Gas & Light Dept.	301	11	276	73
Wellesley Municipal Light Plant	440	16	403	107
West Boylston Municipal Lighting Plant	242	9	222	59
Westfield Gas & Electric	267	10	244	65
Average MED Emission Factors	**330**	**13**	**302**	**81**

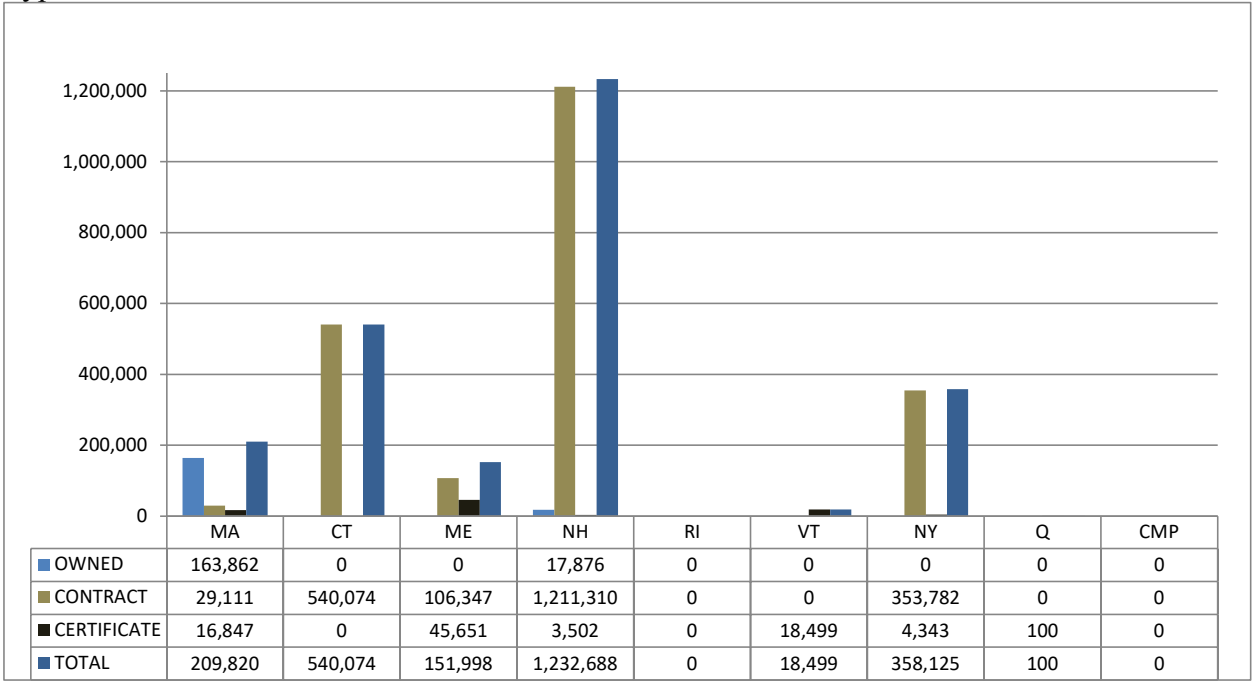
Figures 9 and 10 show the MWh reported by MEDs from unit-specific generation by fuel and reporting type and by location and reporting type. Figures 11, 12 and 13 show the unit-specific generation reported by MEDs as a percent by fuel, by location and by reporting type. Information on GHG emissions of each MED can be found in Appendix 1: *2018 Individual Retail Seller GHG Emissions*.

Figure 9. MWh reported by MEDs from unit-specific generation by Fuel and Reporting Type



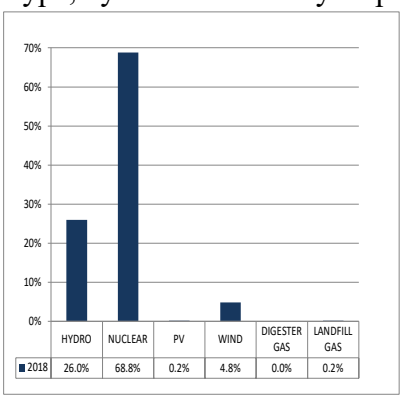
	HYDRO	NUCLEAR	PV	WIND	DIGESTER GAS	LANDFILL GAS
OWNED	163,833	17,876	29	0	0	0
CONTRACT	471,387	1,710,215	0	59,022	0	0
CERTIFICATE	17,775	0	5,154	61,046	622	4,345
TOTAL	652,995	1,728,091	5,183	120,068	622	4,345

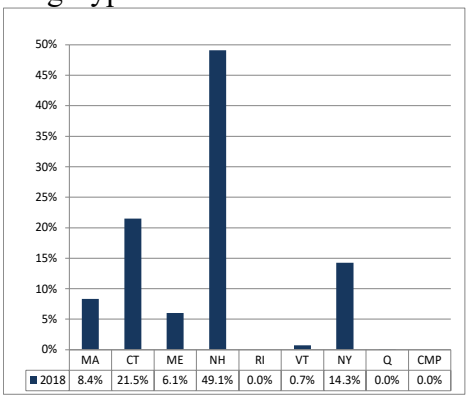
Figure 10. MWh reported by MEDs from unit-specific generation by Location and Reporting Type

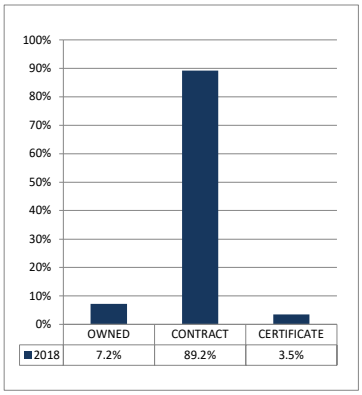


	MA	CT	ME	NH	RI	VT	NY	Q	CMP
OWNED	163,862	0	0	17,876	0	0	0	0	0
CONTRACT	29,111	540,074	106,347	1,211,310	0	0	353,782	0	0
CERTIFICATE	16,847	0	45,651	3,502	0	18,499	4,343	100	0
TOTAL	209,820	540,074	151,998	1,232,688	0	18,499	358,125	100	0

Figures 11, 12 and 13. MWh reported by MEDs from unit-specific generation as Percent by Fuel Type, by Location and by Reporting Type







Appendix 3: 2018 Retail Level Emission Factors for Use by Consumers of Electricity to Report Greenhouse Gas Emissions (Massachusetts-based Emission Factors)

Some electricity consumers have expressed interest in using Massachusetts-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 2018 EFs that consumers of electricity would use to report their GHG emissions at a retail electricity level.

Combined, Biogenic and Non-Biogenic EFs: Progress on achieving the GHG reduction limits in the Global Warming Solutions Act is determined using Massachusetts-based emission calculations. Thus, it is Massachusetts-based EFs that consumers of electricity should use to determine GHG emissions. The Massachusetts-based EFs include 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.

2018 RS Wholesale Non-Biogenic MA-based EF	445 lb	Non-Biogenic CO_2e/Wholesale MWh
+ 2018 RS Wholesale Biogenic MA-based EF	+ 72 lb	Biogenic CO_2e/Wholesale MWh
2018 RS Wholesale Combined MA-based EF	517 lb	Combined CO_2e/Wholesale MWh

Wholesale v. Retail EFs (line losses): Power lines lose 6%[20] (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, 5.7% 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 – 5.7% of MWh due to line losses) = Retail Combined EF

Specifically: 517 lb CO_2e/Wholesale MWh / (1 - 0.057) = 548 lb CO_2e/Retail MWh

Table 6. 2018 Massachusetts-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	445	472
Biogenic	72	76
Combined	517	548

[20] This value was updated to align with the line loss value used in the draft Massachusetts Clean Energy and Climate Plan for 2030, dated December 2020.

Individual CO_2, CH_4, and N_2O EFs: If a consumer wants to use 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 https://www.mass.gov/lists/massachusetts-greenhouse-gas-ghg-reporting-program-data#massdep-emission-factor-calculations-. For the 2018 retail level Combined EF, this results in 545 lb of CO_2e from CO_2, 1 lb of 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 through 2018 by MassDEP are: 1 for CO_2, 25 for CH_4, and 298 for N_2O.[21]

lb CO_2e/MWh = ((lb CO_2 *1) + (lb CH_4 * 25) + (lb N_2O * 298)) / MWh. *Specifically*,
1.1 lb CO_2e from CH_4 / 25 = 0.045 lb CH_4 *and* 1.7 lb CO_2e from N_2O / 298 = 0.006 lb N_2O;
therefore,
548 lb CO_2e/Retail MWh=(545 lb CO_2+(0.045 lb CH_4 * 25)+(0.006 lb N_2O * 298))/Retail MWh

The breakdown of the 548 lb CO_2e/Retail MWh value from Table 6 into individual gases, at various scales of electricity, is shown in Table 7.

Table 7. 2018 Electricity Consumers Retail-level Massachusetts-based CO_2e GHG Emission Factors by Individual Gas

	CO_2e		
	CO_2	**CH_4**	**N_2O**
lb/Retail kWh	0.545	0.000045	0.000006
lb/Retail MWh	545	0.045	0.006
lb/Retail GWh	545,000	45	6

The lb/Retail kWh values in the upper row of Table 7 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 7 are used by MassDEP when voluntarily reporting emissions from its operations to The Climate Registry.

The breakdown of the 545 lb CO_2/Retail MWh value from Table 7 into its non-biogenic and biogenic components is shown in Table 8. All CH_4 and N_2O emissions are considered non-biogenic and thus cannot be further broken down.

Table 8. 2018 Electricity Consumers Retail-level Massachusetts-based Non-Biogenic and Biogenic CO_2 Emission Factors

	CO_2	
	Non-Biogenic CO_2	**Biogenic CO_2**
lb/Retail kWh	0.469	0.076
lb/Retail MWh	469	76
lb/Retail GWh	469,000	76,000

[21] Beginning with the 2014 EFs, MassDEP updated the global warming potentials (GWPs) it uses based on the Intergovernmental Panel on Climate Change's (IPCC's) Fourth Assessment Report (AR4), published in 2007, similar to most other reporting programs. The global GWPs used with earlier EFs were from IPCC's Second Assessment Report (SAR) published in 1996.