MassDEP GHG Reporting Program Summary Report
For Retail Sellers of Electricity
Emissions Year 2020

JANUARY 2023

The information below summarizes the 2020 greenhouse gas (GHG) emissions and megawatt hours (MWh) of electricity sales in Massachusetts by the 104 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 twelfth[2] year of emissions reporting by retail sellers of electricity, and the third 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 2008 and 2010-2017.[3] Changes to the regulation and the methodology for calculating emission factors make data from before 2018 not comparable with data since 2018; therefore, this summary only includes data beginning with 2018.

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-.

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).[4] Table 1 shows the number of retail sellers reporting MWh from specific generating units from 2018 through 2020.

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

	Electric Utilities	Competitive Suppliers	Municipal Electric Departments	Total Retail Sellers
2018	all 3	62 of 65	all 40	105 of 108
2019	all 3	56 of 61	all 40	99 0f 104
2020	all 3	60 of 61[5]	all 40	103 of 104

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).[6, 7] Retail sellers are then required to include these MWh and emissions in the mandatory GHG Emissions report. 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 2018 through 2020: 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. Figures 4 and 5 show the amount of emitting and non-emitting unit-specific generation retired by retail seller type for 2020 in MWh and as a percent of total.

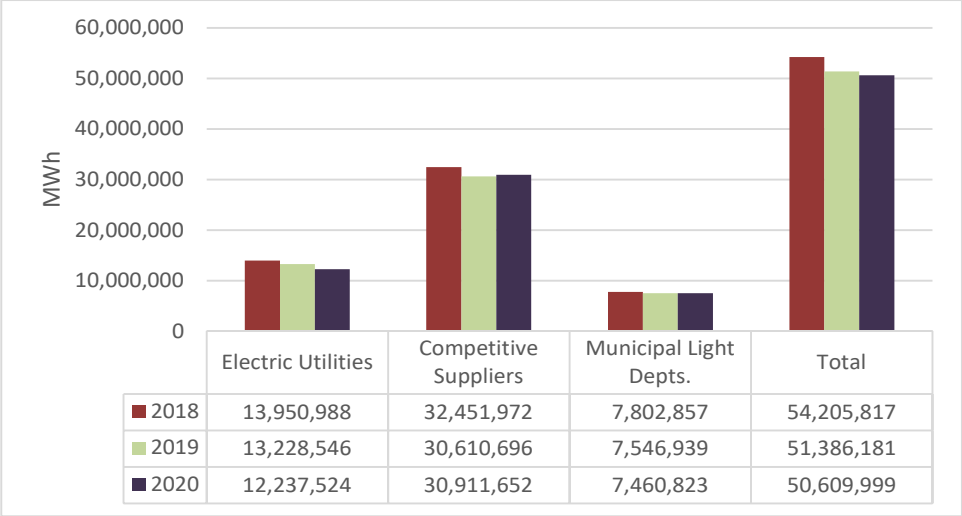
[4] In this document, Municipal Electric Departments and Municipal Light Boards are collectively referred to as municipal electric departments (MEDs).

[5] Sixty-one competitive suppliers sold retail electricity in Massachusetts in 2020. One competitive supplier (Agera) failed to report their 2020 unit-specific generation. It is MassDEP's understanding that this competitive supplier no longer operates in MA.

[6] 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.

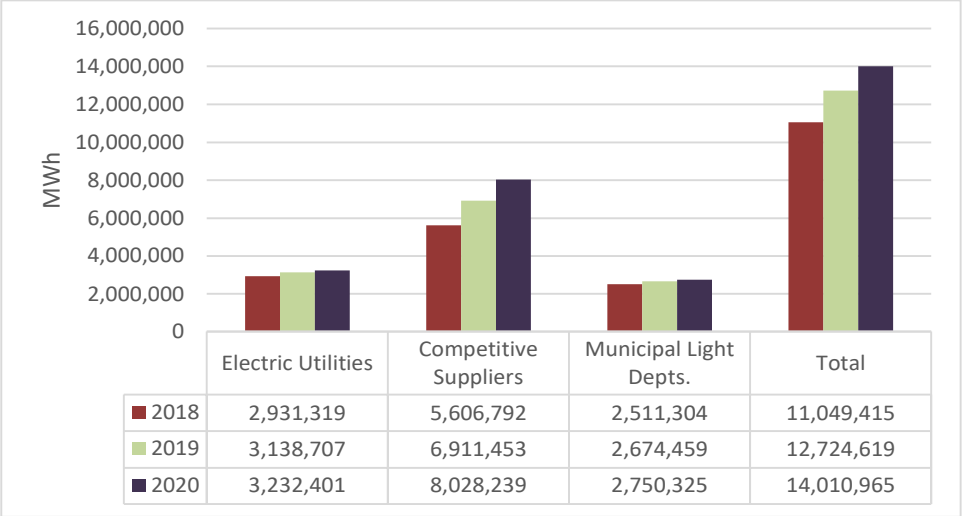
[7] For more details on Step 1 of the GHG reporting process in Massachusetts, see https://www.mass.gov/how-to/aq-31-32-retail-seller-of-electricity-greenhouse-gas-emissions-reporting.

Figure 1. Total MWh of Retail Sales of Electricity



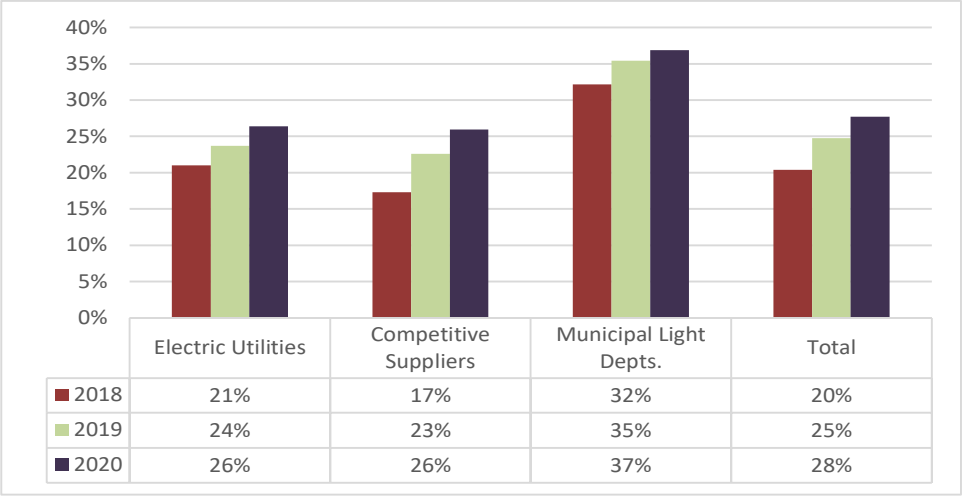
	Electric Utilities	Competitive Suppliers	Municipal Light Depts.	Total
2018	13,950,988	32,451,972	7,802,857	54,205,817
2019	13,228,546	30,610,696	7,546,939	51,386,181
2020	12,237,524	30,911,652	7,460,823	50,609,999

Figure 2. MWh reported from Unit-Specific Generation



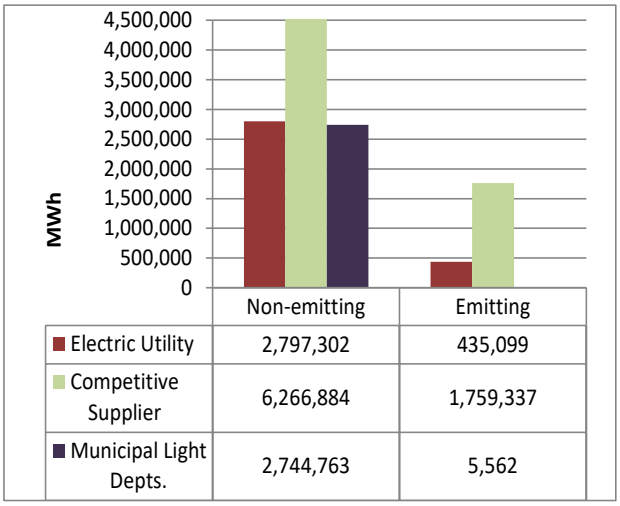
	Electric Utilities	Competitive Suppliers	Municipal Light Depts.	Total
2018	2,931,319	5,606,792	2,511,304	11,049,415
2019	3,138,707	6,911,453	2,674,459	12,724,619
2020	3,232,401	8,028,239	2,750,325	14,010,965

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

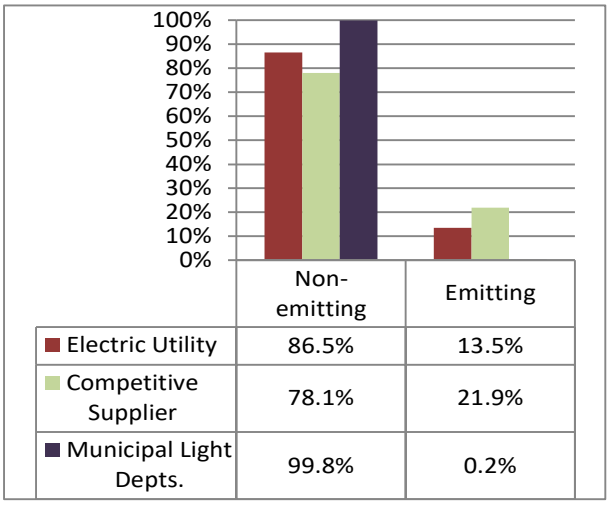


	Electric Utilities	Competitive Suppliers	Municipal Light Depts.	Total
2018	21%	17%	32%	20%
2019	24%	23%	35%	25%
2020	26%	26%	37%	28%

Figures 4 and 5. Unit-Specific Non-emitting and Emitting Generation (as MWh and as Percent of Unit-Specific Generation) Reported for 2020



	Non-emitting	Emitting
Electric Utility	2,797,302	435,099
Competitive Supplier	6,266,884	1,759,337
Municipal Light Depts.	2,744,763	5,562



	Non-emitting	Emitting
Electric Utility	86.5%	13.5%
Competitive Supplier	78.1%	21.9%
Municipal Light Depts.	99.8%	0.2%

Details on the MWh reported by retail sellers from specific generating units can be found in Appendix 2A: *Optional Unit-Specific Generation Reported by MEDs for 2020* and Appendix 2B: *Unit-Specific Generation from GIS Certificates*[8] *Reported by Electric Utilities and Competitive Suppliers for 2020.*

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: *2020 Retail Level Emission Factors for Use by Consumers of Electricity to Report Greenhouse Gas Emissions (Massachusetts-based Emission Factors)* for appropriate values.)

For an explanation of the 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 2020 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."*[9]

The RPS regulation requires electric utilities and competitive suppliers to retire certificates from emitting unit-specific generation, including municipal solid waste (MSW).[10] Therefore, electric utilities and competitive suppliers are required to claim these certificates in their unit-specific

[8] 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/.

[9] https://www.mass.gov/doc/technical-support-document-draft-2020-ghg-emission-factors/download

[10] Massachusetts retail sellers retired approximately 91% of the MWh generated in Massachusetts by MSW in 2020.

generation reports. Because MSW emissions make up the major portion of biogenic emissions, particularly in Massachusetts, the result is a decrease from the initial biogenic emission factors to the final biogenic emission factors that are applied to non-unit-specific generation, as shown in Table 2.

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)						
2018	445	72	517	430	134	564
2019	416	62	478	402	119	521
2020	509	68	577	407	108	515
Final Emission Factors: **after** accounting for unit-specific generation (Step 3)						
2018	486	18	504	445	118	563
2019	468	8	476	421	104	525
2020	605	2	607	431	87	518

Step 4: GHG Emissions Reported by Retail Sellers

Most of the 104 retail sellers submitted their GHG emissions reports as shown in Table 3. This summary report reflects the MWh and GHG emissions data for all retail sellers that submitted their emission reports and includes data for the three competitive suppliers that failed to submit either the unit-specific generation report or the GHG emissions report.

Table 3. Number of Retail Sellers Reporting GHG Emissions

	Electric Utilities	**Competitive Suppliers**	**Municipal Electric Departments**	**Total Retail Sellers**
2018	all 3	58 of 65	all 40	101 of 108
2019	all 3	56 of 61	all 40	99 of 104
2020	all 3	58 of 61[11]	all 40	101 of 104

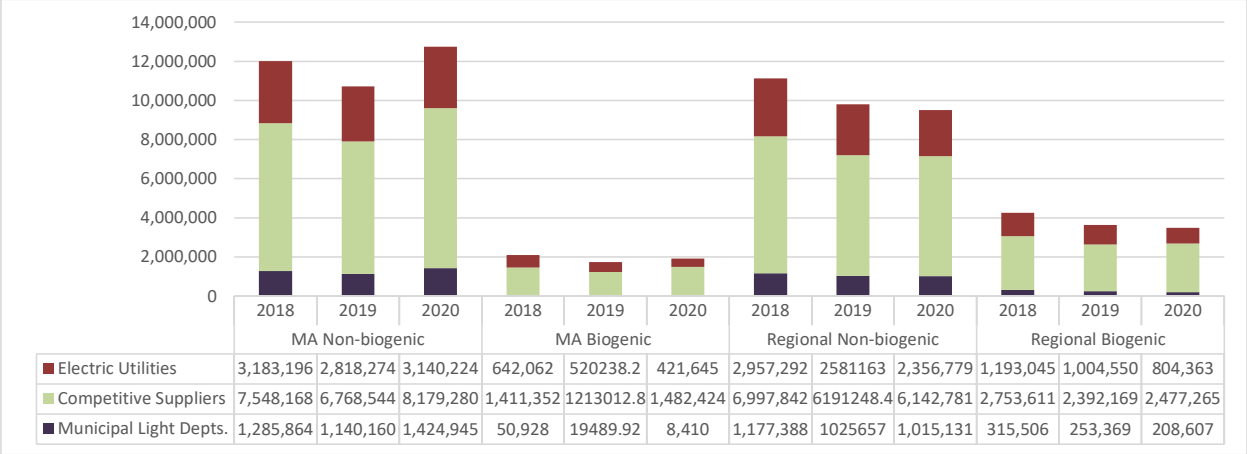
Figure 6 shows the total GHG emissions for the three types of retail sellers in 2020. Massachusetts-based non-biogenic GHG emissions increased from 2019 to 2020 primarily due to the increase in the Massachusetts-based non-biogenic emission factor resulting from the large quantity of nuclear certificates now retired in the state of Connecticut.[12] Regional emission factors and emissions are not affected because the certificates remain in the region (see Table 2).

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.

[11] Three competitive suppliers (Agera, Liberty and Sunwave) failed to report their 2020 GHG emissions. It is MassDEP's understanding that these competitive suppliers no longer operate in MA.

[12] See State of Connecticut June Special Session, Public Act No. 17-3, *An Act Concerning Zero Carbon Solicitation and Procurement* https://cga.ct.gov/2017/ACT/pa/2017PA-00003-R00SB-01501SS1-PA.htm.

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



	2018	2019	2020	2018	2019	2020	2018	2019	2020	2018	2019	2020
	MA Non-biogenic			MA Biogenic			Regional Non-biogenic			Regional Biogenic		
Electric Utilities	3,183,196	2,818,274	3,140,224	642,062	520238.2	421,645	2,957,292	2581163	2,356,779	1,193,045	1,004,550	804,363
Competitive Suppliers	7,548,168	6,768,544	8,179,280	1,411,352	1213012.8	1,482,424	6,997,842	6191248.4	6,142,781	2,753,611	2,392,169	2,477,265
Municipal Light Depts.	1,285,864	1,140,160	1,424,945	50,928	19489.92	8,410	1,177,388	1025657	1,015,131	315,506	253,369	208,607

The GHG emissions for each retail seller can be found in Appendix 1: *2020 Individual Retail Seller GHG Emissions*.

Appendix 1: 2020 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, as adjusted by MassDEP.[13]

Competitive suppliers that failed to submit reports as noted above, or that failed to re-submit corrected reports, are marked with an asterisk. GHG emissions were calculated for these retail sellers.

Table 4. 2020 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.)	41,725	5,571	47,296	31,346	10,641	41,987
National GRID (Mass. and Nantucket Electric)	1,548,119	215,546	1,763,665	1,162,631	403,859	1,566,490
Eversource/NSTAR Electric Co. and Western MA Electric Cos.	1,550,381	200,528	1,750,909	1,162,802	389,363	1,552,664
Competitive Suppliers						
Actual Energy Inc	173	22	195	130	44	173
Agera Energy LLC*	1,215	4	1,219	866	175	1,041
Alpha Gas & Electric, LLC	135	17	152	101	34	135
Ambit Northeast, LLC	47,751	7,553	55,304	35,790	13,396	49,187
American Power & Gas of MA, LLC	29	0	29	20	4	25
Astral Energy, LLC	24	0	24	17	3	20
Atlantic Energy LLC	17,193	2,130	19,323	12,867	4,243	17,110
Calpine Energy Solutions LLC	306,774	52,731	359,505	230,085	90,194	320,279
Champion Energy Services	105,403	16,706	122,109	78,906	29,649	108,556
Clean Choice	50,714	6,554	57,267	38,034	12,748	50,782
Clearview Electric, Inc.	27,623	6,427	34,050	20,731	9,794	30,525
Constellation NewEnergy, Inc.	2,344,829	508,140	2,852,970	1,762,949	792,392	2,555,341
Devonshire Energy, LLC	13,807	2,190	15,997	10,476	3,817	14,293
Direct Energy Business LLC	1,160,284	183,993	1,344,277	874,122	323,785	1,197,907
Direct Energy Services, LLC	221,689	61,325	283,013	166,912	88,083	254,995
Discount Power, Inc.	7,466	523	7,989	5,467	1,499	6,966
Dynegy Energy Services (East), LLC	236,712	45,000	281,712	178,436	73,468	251,904
EDF Energy Services, LLC/ TransCanada	349,739	51,299	401,039	262,736	93,801	356,537

[13] 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 GHG emissions report in Step 4.

	Massachusetts-based approach			Regional approach		
	Non-Biogenic	Biogenic	Combined	Non-Biogenic	Biogenic	Combined
Eligo Energy MA LLC	20,372	2,725	23,097	15,306	5,200	20,506
Energy Plus Holdings	4,787	2,033	6,820	3,575	2,625	6,200
ENGIE Resources, LLC	8,11,161	148,529	959,690	610,525	246,541	857,066
ENGIE Retail, LLC (dba Think Energy)	25,020	4,182	29,201	18,790	7,225	26,015
Everyday Energy LLC	355	48	403	267	91	358
First Point Power	175,198	27,872	203,070	131,814	49,065	180,879
Green Mountain Energy Company	4,265	1,086	5,351	3,194	1,609	4,803
Grid Power Direct, LLC	1,807	239	2,047	1,357	459	1,816
Harborside Energy of Massachusetts LLC	2,954	378	3,332	2,214	739	2,953
Harvard Dedicated Energy, Ltd.	28,926	96	29,022	20,607	4,160	24,767
Hudson Energy Services	199,436	33,750	233,186	150,386	57,760	208,046
Inspire Energy Holdings, LLC	86,760	14,266	101,026	65,037	24,878	89,914
Interstate Gas Supply, Inc. (dba IGS Energy)	54,297	8,896	63,193	40,788	15,495	56,283
Just Energy Mass. Corp.	22,166	4,012	26,177	16,633	6,714	23,348
Liberty Power Holdings*	131,165	434	131,599	93,441	18,862	112,303
Major Energy Electric Service, LLCs	15,750	4,888	20,638	11,867	6,785	18,652
Massachusetts Gas & Electric Co.	24,017	3,346	27,363	18,084	6,244	24,328
Mega Energy Holdings, LLC	16,314	54	16,367	11,622	2,346	13,968
MidAmerican Energy	152	1	152	108	22	130
MP2 Energy NE LLC	807	3	809	575	116	691
National Gas & Electric, Inc.	11,285	1,584	12,869	8,501	2,944	11,445
NextEra Energy	611,574	85,633	697,207	459,245	160,047	619,291
Nordic Energy Services	2,329	320	2,649	1,747	640	2,351
Oasis Power, LLC	0	0	0	0	0	0
Palmco Power MA, LLC	15,050	2,183	17,233	11,291	4,020	15,310
Provider Power MASS, LLC	82,369	22,726	105,095	62,133	32,611	94,744
Public Power, LLC	498,258	88,438	586,696	375,356	148,476	523,832
Reliant Energy Northeast	100,186	20,910	121,095	74,971	33,227	108,198
Renaissance Power and Gas	3,063	634	3,697	2,296	1,008	3,304
Residents Energy, LLC	43,165	6,168	49,333	32,436	11,409	43,846
SFE Energy Massachusetts	55,200	14,891	70,091	41,894	21,391	63,285
SmartEnergy Holdings, LLC	20,129	2,697	22,825	15,125	5,141	20,266
South Jersey Energy	7	0	7	5	1	6
Spark Energy, LLC	4	1	5	3	1	5
Starion Energy, Inc.	40,913	10,743	51,656	30,578	15,791	46,370
Summer Energy	8,572	1,064	9,636	6,415	2,117	8,533
Sunwave Gas & Power Massachusetts, Inc.*	22,912	468	23,380	16,323	3,687	20,010
Texas Retail Energy	19,439	1,997	21,436	13,851	4,727	18,578
Titan Gas and Power	10,063	1,293	11,356	7,545	2,523	10,068
Town Square Energy, LLC	35,278	6,263	41,541	26,500	10,551	37,051

	Massachusetts-based approach			Regional approach		
	Non-Biogenic	Biogenic	Combined	Non-Biogenic	Biogenic	Combined
Verde Energy USA Massachusetts, LLC	23,314	4,052	27,366	17,587	6,849	24,436
Viridian Energy, LLC	44,732	6,233	50,965	33,683	11,631	45,314
Xoom Energy Massachusetts LLC	13,265	2,675	15,940	9,911	4,313	14,224
Municipal Electric Departments						
Ashburnham Muni. Light Dept.	7,068	23	7,092	5,035	1,016	6,052
Belmont Municipal Light Dept.	26,816	89	26,905	19,104	3,856	22,960
Boylston Municipal Light Dept.	6,440	21	6,461	4,588	926	5,514
Braintree Electric Light Dept.	54,819	181	55,000	39,053	7,883	46,936
Chester Muni. Electric Light Dept.	1,556	5	1,561	1,109	224	1,332
Chicopee Electric Light Dept.	129,109	427	129,536	91,977	18,566	110,543
Concord Municipal Light Plant	25,978	3,786	29,764	18,512	7,433	25,945
Danvers Electric Division	46,000	152	46,152	32,770	6,615	39,385
Georgetown Municipal Light Dept.	9,537	32	9,568	6,794	1,371	8,165
Groton Electric Light Dept.	16,698	55	16,753	11,895	2,401	14,297
Groveland Municipal Light Dept.	9,278	31	9,308	6,609	1,334	7,944
Hingham Municipal Lighting Plant	28,584	94	28,678	20,363	4,110	24,473
Holden Municipal Light Dept.	16,412	54	16,466	11,692	2,360	14,052
Holyoke Gas & Electric Dept.	21,792	72	21,864	15,525	3,134	18,658
Hudson Light & Power Dept.	16,276	54	16,330	11,595	2,341	13,935
Hull Municipal Lighting Plant	8,574	28	8,603	6,108	1,233	7,341
Ipswich Municipal Light Dept.	24,598	81	24,680	17,524	3,537	21,061
Littleton Electric Light & Water	65,123	215	65,339	46,394	9,365	55,759
Mansfield Municipal Electric Dept.	32,725	108	32,833	23,313	4,706	28,019
Marblehead Municipal Light Dept.	20,859	69	20,928	14,860	3,000	17,860
Merrimac Muni. Light & Water	8,651	29	8,679	6,163	1,244	7,407
Middleborough Gas & Elec. Dept.	30,256	100	30,356	21,554	4,351	25,905
Middleton Muni. Electric Dept.	15,862	52	15,915	11,300	2,281	13,581
North Attleboro Electric Dept.	45,803	151	45,955	32,630	6,587	39,217

	Massachusetts-based approach			Regional approach		
	Non-Biogenic	Biogenic	Combined	Non-Biogenic	Biogenic	Combined
Norwood Municipal Light Dept.	86,544	286	86,830	61,653	12,445	74,099
Paxton Municipal Light Dept.	3,462	11	3,474	2,467	498	2,965
Peabody Municipal Light Plant	93,308	308	93,617	66,472	13,418	79,890
Princeton Municipal Light Dept.	4,516	15	4,531	3,217	649	3,866
Reading Municipal Light Dept.	163,799	541	164,340	116,690	23,555	140,244
Rowley Municipal Lighting Plant	11,446	38	11,484	8,154	1,646	9,800
Russell Municipal Light Dept.	1,347	4	1,351	960	194	1,153
Shrewsbury Electric & Cable Ops.	57,846	191	58,038	41,210	8,318	49,528
South Hadley Electric Light Dept.	5,052	17	5,069	3,599	727	4,326
Sterling Municipal Light Dept.	12,504	41	12,545	8,908	1,798	10,706
Taunton Municipal Lighting Plant	165,014	546	165,560	117,555	23,729	141,285
Templeton Muni. Light & Water	11,025	36	11,061	7,854	1,585	9,439
Wakefield Muni. Gas & Light	31,358	104	31,461	22,339	4,509	26,848
Wellesley Municipal Light Plant	36,574	121	36,695	26,055	5,259	31,314
West Boylston Muni. Light. Plant	8,987	30	9,017	6,402	1,292	7,695
Westfield Gas & Electric	63,348	209	63,557	45,129	9,110	54,238
2020 Electric Utility Total	3,140,224	421,645	3,561,870	2,356,779	804,363	3,161,142
2020 Competitive Supplier Total	8,179,280	1,482,424	9,661,704	6,142,781	2,477,265	8,620,046
2020 MED Total	1,424,945	8,410	1,433,355	1,015,131	208,607	1,223,738
2020 RETAIL SELLER TOTAL	12,744,449	1,912,479	14,656,929	9,514,691	3,490,235	13,004,926

Appendix 2A: Optional Unit-Specific Generation Reported by MEDs for 2020

Below is a summary of the 2020 data that MEDs chose to submit from unit-specific generation. All unit-specific generation submitted by MEDs in 2020 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 Figures 7 and 8. Table 6 shows the individual MED lb CO_2e/MWh emission rates (GHG emissions divided by retail load).

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

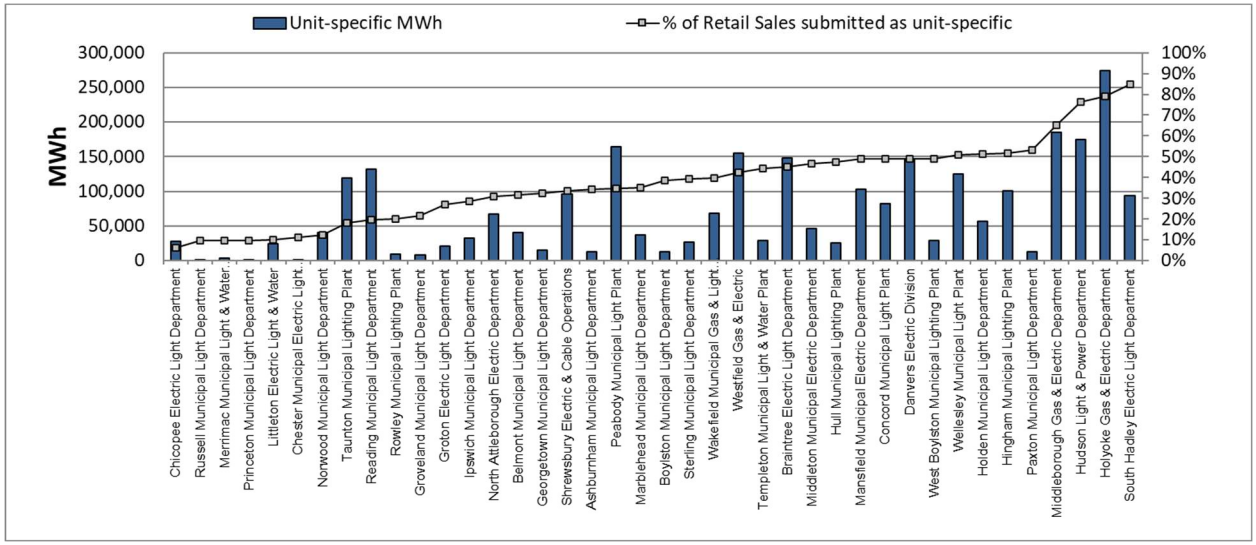


Figure 8. Electricity Sales by MED: Unit-Specific MWh vs. Total Retail Sales MWh

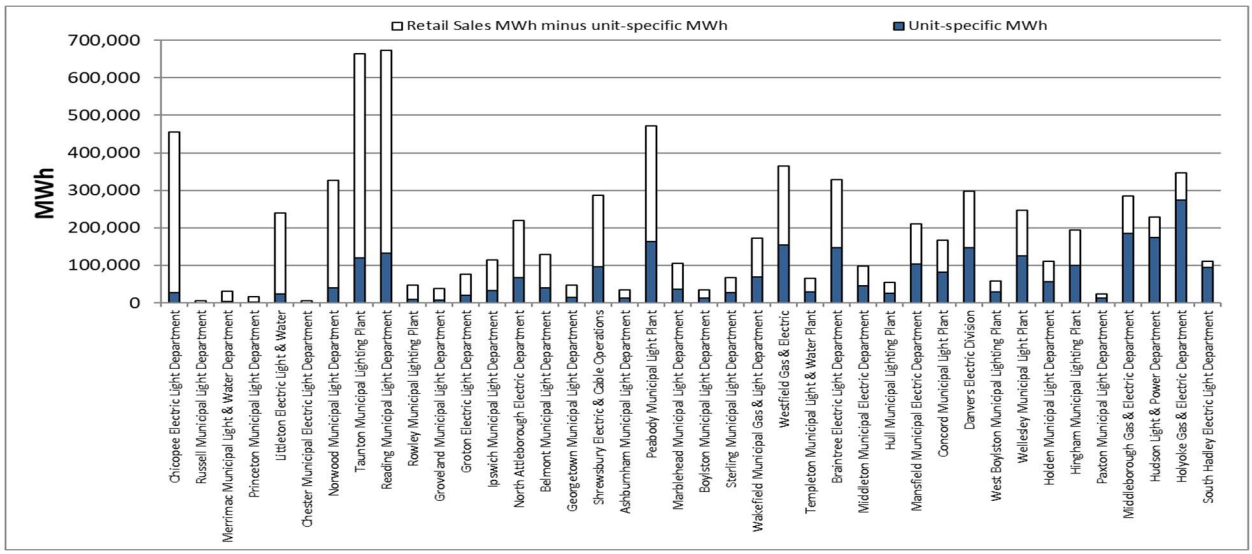


Table 5. Individual 2020 MED Percent of Sales Claimed as Unit-Specific Generation

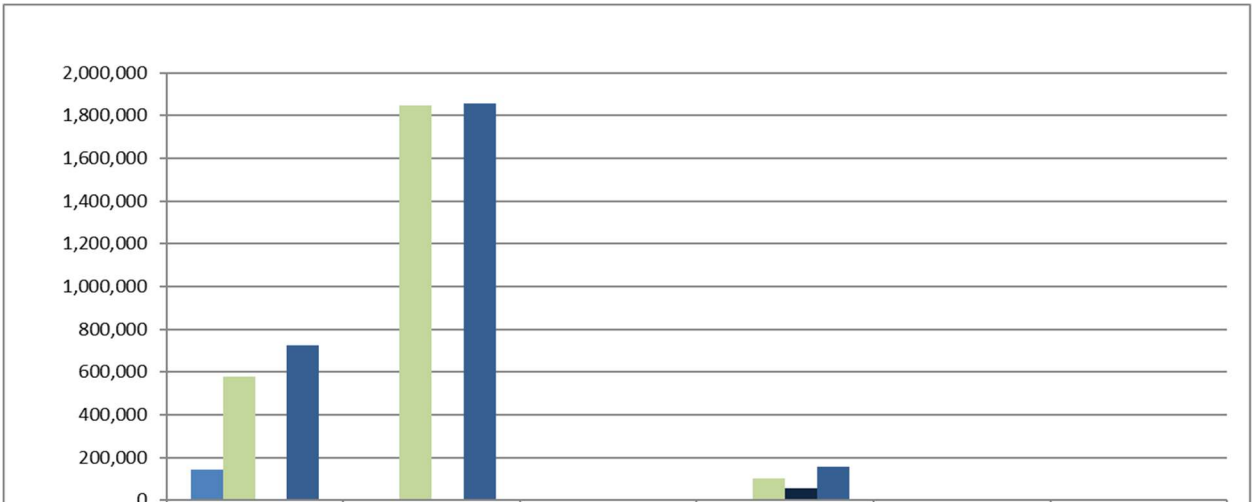
	MWh reported as retail sales	MWh claimed as unit-specific generation		% of sales claimed as unit-specific generation
		non-emitting	emitting	
Ashburnham Muni. Light Dept.	35,679	12,313	0	34.5%
Belmont Municipal Light Department	129,650	41,001	0	31.6%
Boylston Municipal Light Dept.	34,609	13,320	0	38.5%
Braintree Electric Light Dept.	329,322	148,103	0	45.0%
Chester Municipal Electric Light Dept.	5,782	638	0	11.0%
Chicopee Electric Light Dept.	454,825	28,018	0	6.2%
Concord Municipal Light Plant	168,000	76,623	5,562	48.9%
Danvers Electric Division	298,520	146,454	0	49.1%
Georgetown Municipal Light Department	46,706	15,179	0	32.5%
Groton Electric Light Dept.	75,787	20,588	0	27.2%
Groveland Municipal Light Dept.	39,078	8,408	0	21.5%
Hingham Municipal Lighting Plant	195,086	100,594	0	51.6%
Holden Municipal Light Dept.	111,314	57,060	0	51.3%
Holyoke Gas & Electric Dept.	346,130	274,090	0	79.2%
Hudson Light & Power Dept.	228,576	174,771	0	76.5%
Hull Municipal Lighting Plant	53,923	25,578	0	47.4%
Ipswich Municipal Light Department	113,692	32,375	0	28.5%
Littleton Electric Light & Water	239,043	23,759	0	9.9%
Mansfield Municipal Electric Dept.	211,319	103,138	0	48.8%
Marblehead Municipal Light Dept.	106,372	37,415	0	35.2%
Merrimac Municipal Light & Water Dept.	31,670	3,073	0	9.7%
Middleborough Gas & Electric Dept.	285,676	185,657	0	65.0%
Middleton Municipal Electric Dept.	98,504	46,066	0	46.8%
North Attleboro Electric Dept.	219,042	67,626	0	30.9%
Norwood Municipal Light Dept.	326,597	40,502	0	12.4%
Paxton Municipal Light Dept.	24,443	12,997	0	53.2%
Peabody Municipal Light Plant	472,279	163,822	0	34.7%
Princeton Municipal Light Dept.	16,544	1,616	0	9.8%
Reading Municipal Light Dept.	673,526	132,043	0	19.6%
Rowley Municipal Lighting Plant	47,362	9,525	0	20.1%
Russell Municipal Light Department	4,921	468	0	9.5%
Shrewsbury Electric & Cable Ops.	286,964	95,736	0	33.4%
South Hadley Electric Light Dept.	110,597	93,895	0	84.9%
Sterling Municipal Light Dept.	68,213	26,877	0	39.4%
Taunton Municipal Lighting Plant	664,866	119,365	0	18.0%
Templeton Municipal Light & Water	65,342	28,897	0	44.2%
Wakefield Municipal Gas & Light Dept.	172,474	68,812	0	39.9%
Wellesley Municipal Light Plant	246,083	125,178	0	50.9%
West Boylston Municipal Lighting Plant	58,323	28,614	0	49.1%
Westfield Gas & Electric	363,984	154,569	0	42.5%
MED Total	**7,460,823**	**2,744,763**	**5,562**	**36.9%**

Table 6. Individual 2020 MED Emission Factors (lb CO_2e/MWh)

	Massachusetts-based approach		Regional approach	
	Non-Biogenic	**Biogenic**	**Non-Biogenic**	**Biogenic**
Final 2020 Retail Seller Emission Factors from Table 2 (applied only to non-unit-specific generation - shown for comparison)	**605**	**2**	**431**	**87**
Ashburnham Muni. Light Dept.	396	1	282	57
Belmont Municipal Light Department	414	1	295	59
Boylston Municipal Light Dept.	372	1	265	54
Braintree Electric Light Dept.	333	1	237	48
Chester Municipal Electric Light Dept.	538	2	383	77
Chicopee Electric Light Dept.	568	2	404	82
Concord Municipal Light Plant	309	45	220	88
Danvers Electric Division	308	1	220	44
Georgetown Municipal Light Department	408	1	291	59
Groton Electric Light Dept.	441	1	314	63
Groveland Municipal Light Dept.	475	2	338	68
Hingham Municipal Lighting Plant	293	1	209	42
Holden Municipal Light Dept.	295	1	210	42
Holyoke Gas & Electric Dept.	126	0	90	18
Hudson Light & Power Dept.	142	0	101	20
Hull Municipal Lighting Plant	318	1	227	46
Ipswich Municipal Light Department	433	1	308	62
Littleton Electric Light & Water	545	2	388	78
Mansfield Municipal Electric Dept.	310	1	221	45
Marblehead Municipal Light Dept.	392	1	279	56
Merrimac Municipal Light & Water Dept.	546	2	389	79
Middleborough Gas & Electric Dept.	212	1	151	30
Middleton Municipal Electric Dept.	322	1	229	46
North Attleboro Electric Dept.	418	1	298	60
Norwood Municipal Light Dept.	530	2	378	76
Paxton Municipal Light Dept.	283	1	202	41
Peabody Municipal Light Plant	395	1	281	57
Princeton Municipal Light Dept.	546	2	389	79
Reading Municipal Light Dept.	486	2	347	70
Rowley Municipal Lighting Plant	483	2	344	70
Russell Municipal Light Department	547	2	390	79
Shrewsbury Electric & Cable Ops.	403	1	287	58
South Hadley Electric Light Dept.	91	0	65	13
Sterling Municipal Light Dept.	367	1	261	53
Taunton Municipal Lighting Plant	496	2	354	71
Templeton Municipal Light & Water	337	1	240	49
Wakefield Municipal Gas & Light Dept.	364	1	259	52
Wellesley Municipal Light Plant	297	1	212	43
West Boylston Municipal Lighting Plant	308	1	220	44
Westfield Gas & Electric	348	1	248	50
Average MED Emission Factors	**382**	**2**	**272**	**56**

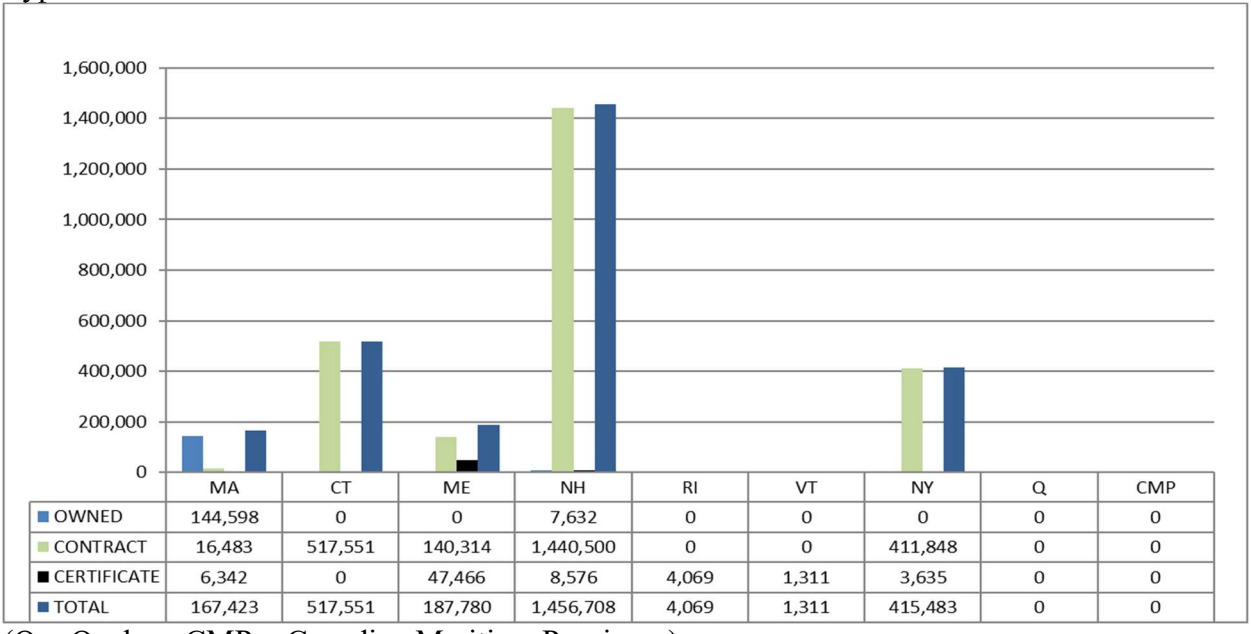
Figures 9 and 10 show the MWh reported by MEDs from unit-specific generation by fuel and reporting type and by location and reporting type. Figures 11, 12 and 13 show the unit-specific generation reported by MEDs as a percent by fuel, by location and by reporting type. Information on GHG emissions of each MED can be found in Appendix 1: *2020 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	143,394	7,632	1,204	0	0	0
CONTRACT	576,355	1,849,068	0	101,273	0	0
CERTIFICATE	3,794	0	7,093	54,950	2,686	2,876
TOTAL	723,543	1,856,700	8,297	156,223	2,686	2,876

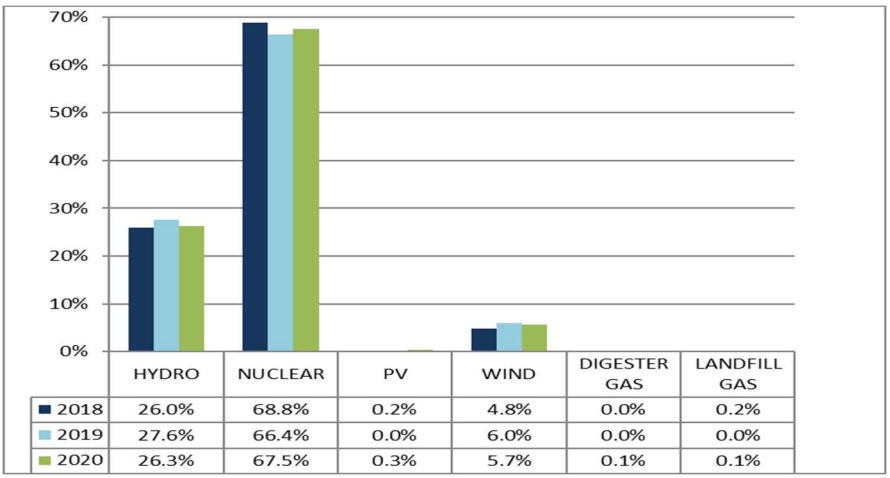
Figure 10. MWh reported by MEDs from unit-specific generation by Location and Reporting Type



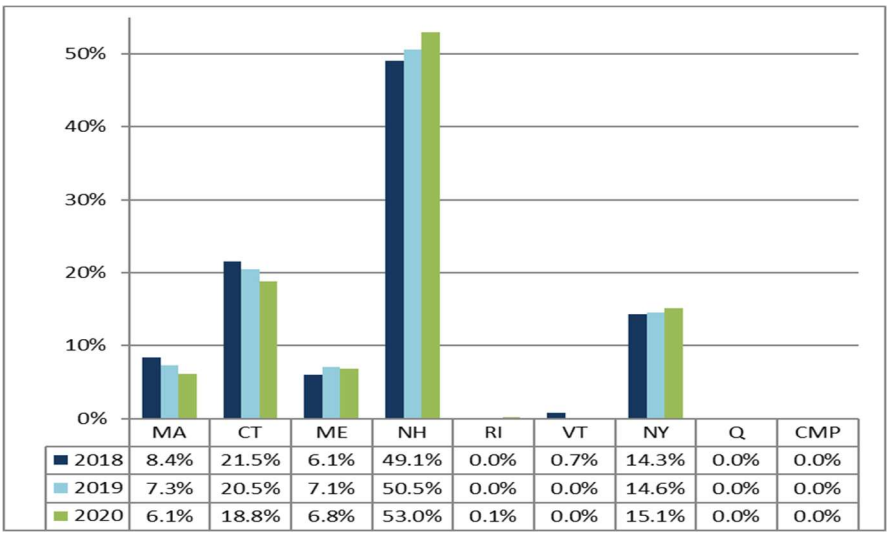
	MA	CT	ME	NH	RI	VT	NY	Q	CMP
OWNED	144,598	0	0	7,632	0	0	0	0	0
CONTRACT	16,483	517,551	140,314	1,440,500	0	0	411,848	0	0
CERTIFICATE	6,342	0	47,466	8,576	4,069	1,311	3,635	0	0
TOTAL	167,423	517,551	187,780	1,456,708	4,069	1,311	415,483	0	0

(Q = Quebec; CMP = Canadian Maritime Provinces)

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

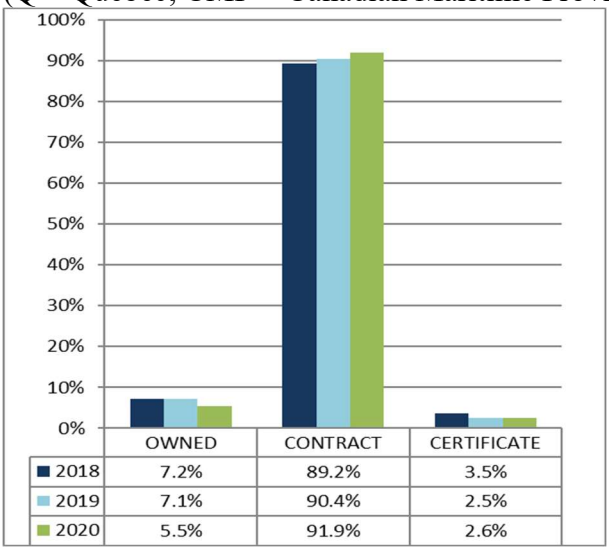


	HYDRO	NUCLEAR	PV	WIND	DIGESTER GAS	LANDFILL GAS
2018	26.0%	68.8%	0.2%	4.8%	0.0%	0.2%
2019	27.6%	66.4%	0.0%	6.0%	0.0%	0.0%
2020	26.3%	67.5%	0.3%	5.7%	0.1%	0.1%



	MA	CT	ME	NH	RI	VT	NY	Q	CMP
2018	8.4%	21.5%	6.1%	49.1%	0.0%	0.7%	14.3%	0.0%	0.0%
2019	7.3%	20.5%	7.1%	50.5%	0.0%	0.0%	14.6%	0.0%	0.0%
2020	6.1%	18.8%	6.8%	53.0%	0.1%	0.0%	15.1%	0.0%	0.0%

(Q = Quebec; CMP = Canadian Maritime Provinces)



	OWNED	CONTRACT	CERTIFICATE
2018	7.2%	89.2%	3.5%
2019	7.1%	90.4%	2.5%
2020	5.5%	91.9%	2.6%

Appendix 2B: Unit-Specific Generation from GIS Certificates Reported by Electric Utilities and Competitive Suppliers for 2020

Below is a summary of the 2020 data reported by electric utilities and competitive suppliers from unit-specific generation. Because the certificates, by state and fuel type, purchased by electric utilities and competitive suppliers for compliance[14] with various programs are already included in the RPS/APS/CES Annual Compliance Reports,[15] that information is not repeated in this summary. The use of banked certificates or payments[16] by electric utilities and competitive suppliers to meet their compliance requirements with these programs are not reflected in this summary.

"N/A" appears in the unit-specific generation columns for competitive suppliers that did not submit any unit-specific information. Competitive suppliers that failed to submit, or to correct, a unit specific or GHG emissions report are marked with an asterisk. The percent of sales claimed as unit-specific generation were calculated for those retail sellers, where possible.

Table 7: Individual 2020 Electric Utility and Competitive Supplier 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	
Electric Utilities				
Unitil (Fitchburg Gas & Electric Co.)	165,683	40,688	5,700	28.0%
National GRID (Mass. and Nantucket Electric)	6,013,404	1,358,108	224,399	26.3%
Eversource/NSTAR Electric Co. and Western MA Electric Cos.	6,058,437	1,398,506	205,000	26.5%
Competitive Suppliers				
Actual Energy Inc	650	131	23	23.7%
Agera Energy LLC*	4,018	N/A	N/A	0%
Alpha Gas & Electric, LLC	521	116	18	25.7%
Ambit Northeast, LLC	185,559	39,695	8,387	25.9%
American Power & Gas of MA, LLC	95	0	0	0%
Astral Energy, LLC	99	21	0	21.2%
Atlantic Energy LLC	64,795	12,893	2,175	23.3%
Calpine Energy Solutions LLC	1,182,262	240,596	60,186	25.4%
Champion Energy Services	396,588	73,241	18,788	23.2%
Clean Choice	186,541	34,100	6,700	21.9%
Clearview Electric, Inc.	105,956	18,810	7,929	25.2%
Constellation NewEnergy, Inc.	8,916,459	1,588,498	639,685	25.0%
Devonshire Energy, LLC	57,836	14,300	2,250	28.6%
Direct Energy Business LLC	4,457,082	944,583	223,286	26.2%
Direct Energy Services, LLC	862,504	155,399	77,486	27.0%
Discount Power, Inc.	30,323	6,829	523	24.3%
Dynegy Energy Services (East), LLC	938,109	216,698	51,577	28.6%

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

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

[16] See footnote 13.

	MWh reported as retail sales	MWh claimed as unit-specific generation		% of sales claimed as unit-specific generation
		non-emitting	emitting	
EDF Energy Services, LLC/ TransCanada	1,356,882	302,126	54,718	26.3%
Eligo Energy MA LLC	76,022	15,006	2,788	23.4%
Energy Plus Holdings	18,380	1,665	2,785	24.2%
ENGIE Resources, LLC	3,129,699	653,903	169,635	26.3%
ENGIE Retail, LLC (dba Think Energy)	96,875	20,572	4,694	26.1%
Everyday Energy LLC	1,387	324	49	26.9%
First Point Power	665,970	136,922	30,379	25.1%
Green Mountain Energy Company	16,839	3,153	1,376	26.9%
Grid Power Direct, LLC	6,800	1,380	245	23.9%
Harborside Energy of Massachusetts LLC	11,714	2,825	386	27.4%
Harvard Dedicated Energy, Ltd.	129,535	33,911	0	26.2%
Hudson Energy Services	790,581	188,371	37,265	28.5%
Inspire Energy Holdings, LLC	325,504	59,753	16,059	23.3%
Interstate Gas Supply, Inc. (dba IGS Energy)	209,232	44,064	9,900	25.8%
Just Energy Mass. Corp.	85,201	16,967	4,641	25.4%
Liberty Power Holdings*	433,603	0	0	0%
Major Energy Electric Service, LLCs	61,510	10,586	6,291	27.4%
Massachusetts Gas & Electric Co.	93,257	21,643	3,427	26.9%
Mega Energy Holdings, LLC	60,806	6,877	0	11.3%
MidAmerican Energy	502	0	0	0%
MP2 Energy NE LLC	2,667	0	0	0%
National Gas & Electric, Inc.	44,156	10,534	1,623	27.5%
NextEra Energy	2,360,084	519,459	89,713	25.8%
Nordic Energy Services	8,705	1,700	321	23.2%
Oasis Power, LLC	2	2	0	100.0%
Palmco Power MA, LLC	56,534	10,982	2,342	23.6%
Provider Power MASS, LLC	328,791	67,665	28,523	29.3%
Public Power, LLC	1,948,642	436,509	99,468	27.5%
Reliant Energy Northeast	396,898	81,593	25,478	27.0%
Renaissance Power and Gas	11,874	2,296	764	25.8%
Residents Energy, LLC	171,011	41,203	6,493	27.9%
SFE Energy Massachusetts	208,088	37,202	17,948	26.5%
SmartEnergy Holdings, LLC	78,127	17,848	2,759	26.4%
South Jersey Energy	22	0	0	0%
Spark Energy, LLC	15	4	1	33.3%
Starion Energy, Inc.	163,983	31,809	13,383	27.6%
Summer Energy	31,026	5,154	1,086	20.1%
Sunwave Gas & Power Massachusetts, Inc.*	87,005	10,679	589	13.0%
Texas Retail Energy	83,377	16,245	2,905	23.0%
Titan Gas and Power	37,817	7,552	1,322	23.5%
Town Square Energy, LLC	138,264	30,204	7,161	27.0%
Verde Energy USA Massachusetts, LLC	93,613	23,301	4,488	29.7%
Viridian Energy, LLC	173,697	40,310	6,384	26.9%
Xoom Energy Massachusetts LLC	52,184	10,372	3,256	26.1%
Electric Utility Total	**12,237,524**	**2,797,302**	**435,099**	**26.4%**
Competitive Supplier Total	**30,911,652**	**6,268,581**	**1,759,658**	**25.9%**

Table 8 shows the individual electric utility and competitive supplier lb CO_2e/MWh emission rates (GHG emissions divided by retail load). The emission factors for individual electric utilities

and competitive suppliers in Table 8 should not be compared to the emission factors calculated for MEDs in Table 6 in Appendix 2A: *Optional Unit-Specific Generation Reported by MEDs for 2020*, because the requirement to retire MSW certificates[17] causes electric utilities and competitive suppliers to have higher emission factors than MEDs.

Competitive suppliers that failed to submit, or to correct, a unit specific or GHG emissions report are marked with an asterisk. Individual emission factors were calculated for those retail sellers.

Table 8: Individual 2020 Emission Factors for Electric Utilities and Competitive Suppliers (lb CO_2e/MWh)

	Massachusetts-based approach		**Regional approach**	
	Non-Biogenic	**Biogenic**	**Non-Biogenic**	**Biogenic**
Final 2019 Retail Seller Emission Factors from Table 2 (applied only to non-unit-specific generation - shown for comparison)	**605**	**2**	**431**	**87**
Electric Utilities				
Unitil (Fitchburg Gas & Electric Co.)	504	67	378	128
National GRID (Mass. and Nantucket Electric)	515	72	387	134
Eversource/NSTAR Electric Co. and Western MA Electric Cos.	512	66	384	129
Competitive Suppliers				
Actual Energy Inc	532	69	399	134
Agera Energy LLC*	605	2	431	87
Alpha Gas & Electric, LLC	518	67	389	130
Ambit Northeast, LLC	515	81	386	144
American Power & Gas of MA, LLC	605	2	431	87
Astral Energy, LLC	477	2	340	69
Atlantic Energy LLC	531	66	397	131
Calpine Energy Solutions LLC	519	89	389	153
Champion Energy Services	532	84	398	150
Clean Choice	544	70	408	137
Clearview Electric, Inc.	521	121	391	185
Constellation NewEnergy, Inc.	526	114	395	178
Devonshire Energy, LLC	509	76	385	137
Direct Energy Business LLC	521	83	392	145
Direct Energy Services, LLC	514	142	387	204
Discount Power, Inc.	492	34	361	99
Dynegy Energy Services (East), LLC	505	96	380	157
EDF Energy Services, LLC/ TransCanada	516	76	387	138
Eligo Energy MA LLC	536	72	403	137
Energy Plus Holdings	512	221	389	286
ENGIE Resources, LLC	518	95	390	158
ENGIE Retail, LLC (dba Think Energy)	517	86	388	149
Everyday Energy LLC	512	69	384	131
First Point Power	526	84	396	147
Green Mountain Energy Company	507	129	379	191
Grid Power Direct, LLC	532	70	399	135
Harborside Energy of Massachusetts LLC	504	64	378	126

[17] See footnote 10.

	Massachusetts-based approach		Regional approach	
	Non-Biogenic	**Biogenic**	**Non-Biogenic**	**Biogenic**
Harvard Dedicated Energy, Ltd.	447	1	318	64
Hudson Energy Services	505	85	380	146
Inspire Energy Holdings, LLC	533	88	400	153
Interstate Gas Supply, Inc. (dba IGS Energy)	519	85	390	148
Just Energy Mass. Corp.	520	94	390	158
Liberty Power Holdings*	605	2	431	87
Major Energy Electric Service, LLCs	512	159	386	221
Massachusetts Gas & Electric Co.	515	72	388	134
Mega Energy Holdings, LLC	537	2	382	77
MidAmerican Energy	605	2	431	87
MP2 Energy NE LLC	605	2	431	87
National Gas & Electric, Inc.	511	72	385	133
NextEra Energy	518	73	389	136
Nordic Energy Services	535	73	401	139
Oasis Power, LLC	0	0	0	0
Palmco Power MA, LLC	532	77	399	142
Provider Power MASS, LLC	501	138	378	198
Public Power, LLC	511	91	385	152
Reliant Energy Northeast	505	105	378	198
Renaissance Power and Gas	516	107	387	170
Residents Energy, LLC	505	72	379	133
SFE Energy Massachusetts	531	143	403	206
SmartEnergy Holdings, LLC	515	69	387	132
South Jersey Energy	605	2	431	87
Spark Energy, LLC	537	135	421	191
Starion Energy, Inc.	499	131	373	193
Summer Energy	553	69	414	136
Sunwave Gas & Power Massachusetts, Inc.*	527	11	375	85
Texas Retail Energy	466	48	332	113
Titan Gas and Power	532	68	399	133
Town Square Energy, LLC	510	91	383	153
Verde Energy USA Massachusetts, LLC	498	87	376	146
Viridian Energy, LLC	515	72	388	134
Xoom Energy Massachusetts LLC	508	103	380	165
Average Electric Utility Emission Factors	513	69	385	131
Average Competitive Supplier Emission Factors	528	96	396	160

Appendix 3: 2020 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 2020 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.

2020 RS Wholesale Non-Biogenic MA-based EF	509 lb	Non-Biogenic CO_2e/Wholesale MWh
+ 2020 RS Wholesale Biogenic MA-based EF	+ 68 lb	Biogenic CO_2e/Wholesale MWh
2020 RS Wholesale Combined MA-based EF	577 lb	Combined CO_2e/Wholesale MWh

Wholesale v. Retail EFs (line losses): Power lines lose 6%[18] (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, 6% 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 – 6% of MWh due to line losses) = Retail Combined EF

Specifically: 577 lb CO_2e/Wholesale MWh / (1 - 0.06) = 614 lb CO_2e/Retail MWh

Table 9. 2020 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	509	541
Biogenic	68	72
Combined	577	614

[18] This value was updated to align with the line loss value used in the Interim 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 2020 retail level Combined EF, this results in 610 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 2020 by MassDEP are: 1 for CO_2, 25 for CH_4, and 298 for N_2O.[19]

lb CO_2e/MWh = ((lb CO_2 *1) + (lb CH_4 * 25) + (lb N_2O * 298)) / MWh. *Specifically*,
1.2 lb CO_2e from CH_4 / 25 = 0.046 lb CH_4 *and* 1.8 lb CO_2e from N_2O / 298 = 0.006 lb N_2O;
therefore,
614 lb CO_2e/Retail MWh = (610 lb CO_2 + (0.046 lb CH_4 * 25) + (0.006 lb N_2O * 298))/Retail MWh

The breakdown of the 614 lb CO_2e/Retail MWh value from Table 9 into individual gases, at various scales of electricity, is shown in Table 10.

Table 10. 2020 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	0.610	0.000046	0.000006
lb/Retail MWh	610	0.046	0.006
lb/Retail GWh	610,000	46	6

The lb/Retail kWh values in the upper row of Table 10 may be the values most likely to be used by electricity consumers since most electric bills show kWh use.

The breakdown of the 610 lb CO_2/Retail MWh value from Table 10 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 11. 2020 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	0.538	0.072
lb/Retail MWh	538	72
lb/Retail GWh	538,000	72,000

[19] 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.