MassDEP GHG Reporting Program Summary Report
For Retail Sellers of Electricity
Emissions Year 2022

DECEMBER 2024

The information below summarizes the 2022 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 fourteenth[2] year of emissions reporting by retail sellers of electricity, and the fifth 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 2022.

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 of 104
2020	all 3	60 of 61	all 40	103 of 104
2021	all 3	56 of 59	all 40	99 of 102
2022	all 3	57 of 61[5]	all 40	100 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 2022: 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 2022 in MWh and as a percent of total. The increase in unit-specific generation in 2022 for electric utilities and competitive suppliers seen in Figures 2 and 3 is due to the first year of compliance with MassDEP's CES-E (clean existing generation) requirement.

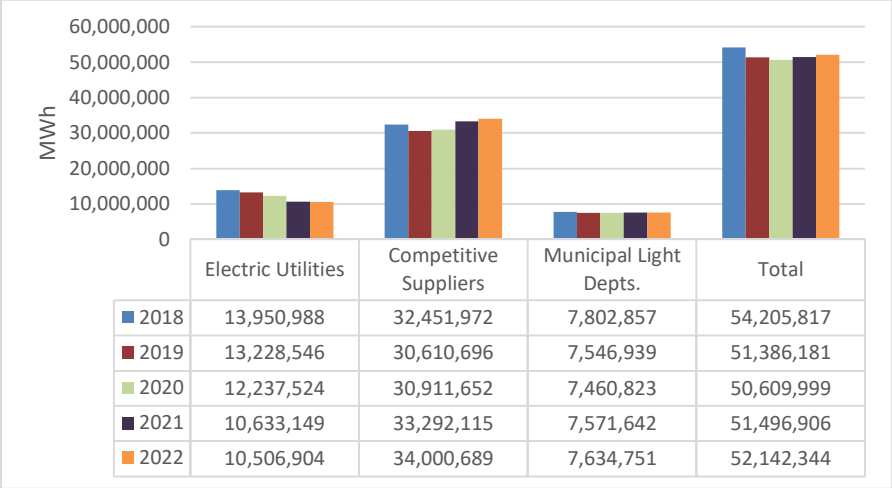
[4] In this document, Municipal Electric Departments and Municipal Light Boards are collectively referred to as municipal electric departments (MEDs).

[5] Sixty-one competitive suppliers sold retail electricity in Massachusetts in 2022. Four competitive suppliers (Agera, Liberty, Mega, and Sunwave) failed to report their 2022 unit-specific generation. It is MassDEP's understanding that these competitive suppliers no longer operate 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.

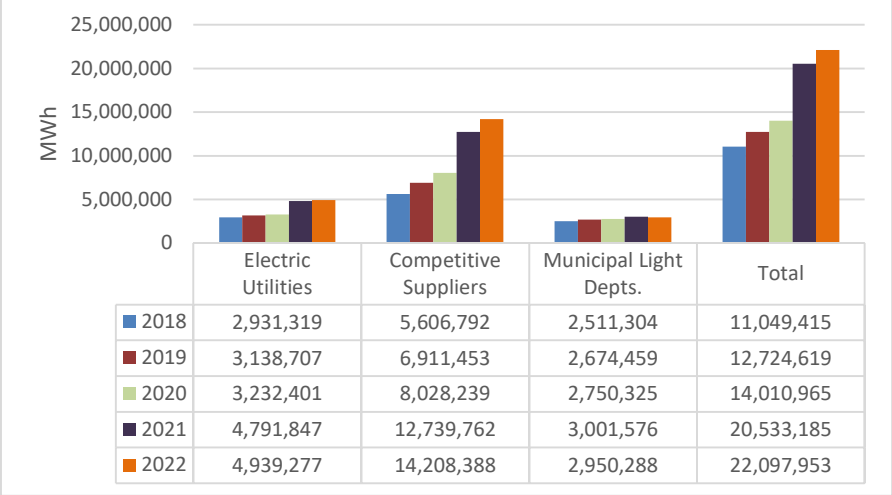
[7] For more details on Step 1 of the GHG reporting process in Massachusetts, see https://www.mass.gov/how-to/aq-31-32-retail-seller-of-electricity-greenhouse-gas-emissions-reporting.

Figure 1. Total MWh of Retail Sales of Electricity



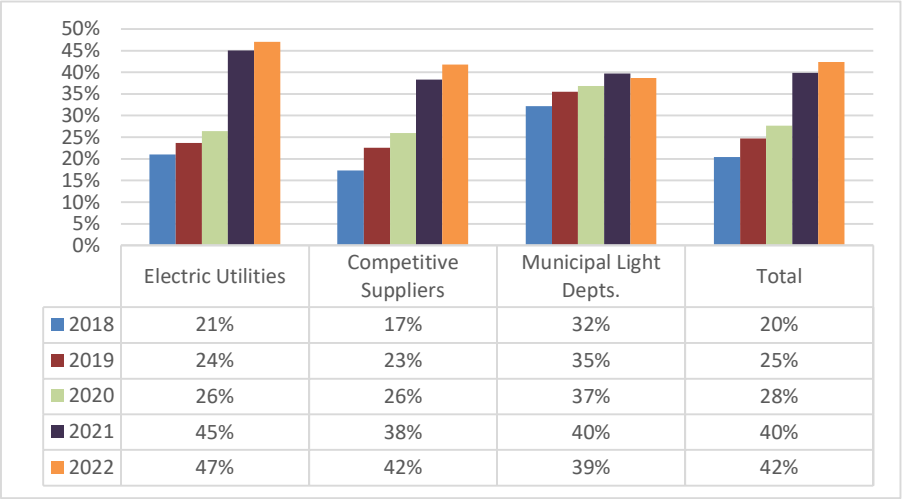
	Electric Utilities	Competitive Suppliers	Municipal Light Depts.	Total
2018	13,950,988	32,451,972	7,802,857	54,205,817
2019	13,228,546	30,610,696	7,546,939	51,386,181
2020	12,237,524	30,911,652	7,460,823	50,609,999
2021	10,633,149	33,292,115	7,571,642	51,496,906
2022	10,506,904	34,000,689	7,634,751	52,142,344

Figure 2. MWh reported from Unit-Specific Generation



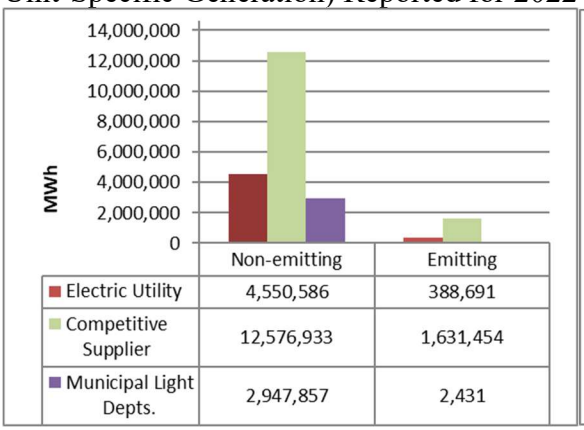
	Electric Utilities	Competitive Suppliers	Municipal Light Depts.	Total
2018	2,931,319	5,606,792	2,511,304	11,049,415
2019	3,138,707	6,911,453	2,674,459	12,724,619
2020	3,232,401	8,028,239	2,750,325	14,010,965
2021	4,791,847	12,739,762	3,001,576	20,533,185
2022	4,939,277	14,208,388	2,950,288	22,097,953

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

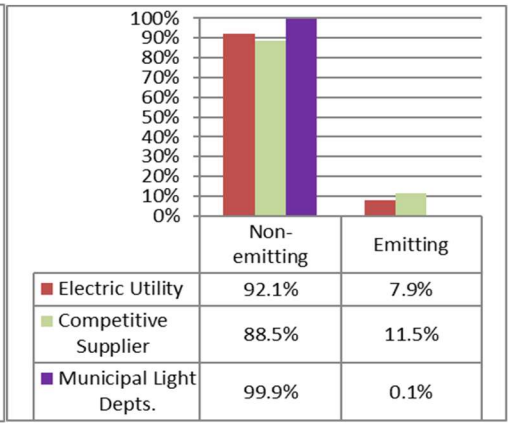


	Electric Utilities	Competitive Suppliers	Municipal Light Depts.	Total
2018	21%	17%	32%	20%
2019	24%	23%	35%	25%
2020	26%	26%	37%	28%
2021	45%	38%	40%	40%
2022	47%	42%	39%	42%

Figures 4 and 5. Unit-Specific Non-emitting and Emitting Generation (as MWh and as Percent of Unit-Specific Generation) Reported for 2022



	Non-emitting	Emitting
Electric Utility	4,550,586	388,691
Competitive Supplier	12,576,933	1,631,454
Municipal Light Depts.	2,947,857	2,431



	Non-emitting	Emitting
Electric Utility	92.1%	7.9%
Competitive Supplier	88.5%	11.5%
Municipal Light Depts.	99.9%	0.1%

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 2022* and Appendix 2B: *Unit-Specific Generation from GIS Certificates*[8] *Reported by Electric Utilities and Competitive Suppliers for 2022.*

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: *2022 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 2022 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 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.

[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-2022-ghg-emission-factors/download

[10] Massachusetts retail sellers retired approximately 96% of the MWh generated in Massachusetts by MSW in 2022.

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
2021	466	71	537	426	126	552
2022	454	55	509	439	99	538
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
2021	634	15	650	478	117	595
2022	637	0	637	499	85	584

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 six competitive suppliers that failed to submit 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	all 40	101 of 104
2021	all 3	54 of 59	all 40	97 of 102
2022	all 3	55 of 61[11]	all 40	98 of 104

Figure 6 shows the total GHG emissions for the three types of retail sellers in 2022. Tables 4 and 5 show the corresponding values for Massachusetts-based and Regional-based non-biogenic and biogenic GHG emissions.

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] Six competitive suppliers (Agera, Astral, Liberty, Mega, Starion and Sunwave) failed to report their 2022 GHG emissions. It is MassDEP's understanding that these competitive suppliers no longer operate in MA.

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

Table 4. GHG Emissions Reported by Retail Seller Type and Year using the Massachusetts-based methodology (Short Tons CO_2e)

	Non-biogenic GHG emissions				Biogenic GHG emissions			
	2019	2020	2021	2022	2019	2020	2021	2022
Electric Utilities	2,818,274	3,140,224	2,247,553	2,157,741	520,238	421,645	425,224	371,765
Competitive Suppliers	6,768,544	8,179,280	7,752,319	7,556,832	1,213,013	1,482,424	1,559,685	1,406,484
Municipal Light Depts.	1,140,160	1,424,945	1,449,539	1,492,009	19,490	8,410	35,258	1,617
Total	10,726,978	12,744,449	11,449,411	11,206,583	1,752,741	1,912,479	2,020,167	1,779,866

Table 5. GHG Emissions Reported by Retail Seller Type and Year using the Regional methodology (Short Tons CO_2e)

	Non-biogenic GHG emissions				Biogenic GHG emissions			
	2019	2020	2021	2022	2019	2020	2021	2022
Electric Utilities	2,581,163	2,356,779	1,789,729	1,773,575	1,004,550	804,363	722,600	608,389
Competitive Suppliers	6,191,248	6,142,781	6,141,486	6,191,164	2,392,169	2,477,265	2,605,989	2,247,656
Municipal Light Depts.	1,025,657	1,015,131	1,091,351	1,168,782	253,369	208,607	267,916	200,707
Total	9,798,068	9,514,691	9,022,566	9,133,520	3,650,089	3,490,235	3,596,505	3,056,752

The GHG emissions for each individual retail seller, and the total GHG emissions for each of the three types of retail seller, can be found in Appendix 1: *2022 Individual Retail Seller GHG Emissions*.

Appendix 1: 2022 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.[12]

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 6. 2022 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)	37,173	6,313	43,486	30,534	10,402	40,936
National Grid (Mass. and Nantucket Electric)	1,201,425	210,507	1,411,932	988,309	341,775	1,330,083
Eversource/NSTAR Electric and Western MA Electric	919,143	154,945	1,074,088	754,732	256,212	1,010,945
Competitive Suppliers						
Actual Energy Inc	10,611	1,606	12,216	8,672	2,800	11,472
Agera Energy LLC*	26	0	26	21	4	24
Alpha Gas & Electric, LLC	2,545	421	2,966	2,088	703	2,791
Ambit Northeast, LLC	29,628	4,845	34,473	24,295	8,130	32,424
American Power & Gas of MA, LLC	222	0	222	174	30	204
Astral Energy, LLC*	34	0	34	27	5	31
Atlantic Energy, LLC	17,905	2,915	20,820	14,679	4,902	19,581
BP Energy Retail Company, LLC	505,658	109,372	615,030	416,295	164,415	580,709
Calpine Energy Solutions, LLC	295,593	45,257	340,850	241,569	78,533	320,101
Catalyst Power & Gas, LLC	17	0	17	13	2	15
Champion Energy Services	49,298	7,620	56,918	40,220	13,211	53,431
CleanChoice Energy, Inc	44,915	7,939	52,854	36,963	12,837	49,800
Clearview Electric, Inc	19,706	3,453	23,159	16,210	5,606	21,816
Constellation NewEnergy, Inc.	2,781,947	470,402	3,252,349	2,276,129	781,956	3,058,085
Devonshire Energy, LLC	10,931	2,349	13,280	9,089	3,484	12,573
Direct Energy Business LLC	1,058,818	260,766	1,319,584	871,089	376,396	1,247,485
Direct Energy Services, LLC	38,375	20,923	59,298	31,563	25,119	56,682
Discount Power, Inc.	10,519	2,343	12,862	8,595	3,528	12,123
Dynegy Energy Services (East), LLC	398,814	61,116	459,929	325,452	106,302	431,754

[12] 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	10,866	1,923	12,789	8,943	3,107	12,050
Energy Plus Holdings	2,612	944	3,556	2,152	1,227	3,379
Engie Resources, LLC	562,703	90,542	653,245	458,598	154,665	613,262
Everyday Energy, LLC Rewards	143	25	168	118	41	158
First Point Power	279,431	57,085	336,516	228,639	88,370	317,009
Great American Gas & Electric, LLC	1	0	1	1	0	1
Green Mountain Energy Company	2,524	456	2,980	2,080	730	2,809
Grid Power Direct, LLC	2,905	493	3,398	2,386	813	3,198
Hampshire Power Corporation	19	0	19	15	3	18
Harborside Energy of Massachusetts, LLC	4,403	684	5,087	3,602	1,177	4,779
Harvard Dedicated Energy, LTD	35,215	5,927	41,142	28,914	9,808	38,722
Hudson Energy Services	157,622	25,229	182,851	128,595	43,108	171,703
Inspire Energy Holdings, LLC	109,935	18,651	128,586	90,297	30,747	121,044
Interstate Gas Supply, Inc (dba IGS Energy)	48,355	10,045	58,400	39,863	15,276	55,138
Just Energy Mass. Corp.	3,098	1,127	4,225	2,679	1,385	4,064
Liberty Power Holdings*	531	0	531	416	71	487
Major Energy Electric Service, LLC	10,384	1,759	12,143	8,529	2,902	11,431
Massachusetts Gas & Electric Co.	13,459	2,292	15,751	11,057	3,772	14,829
Mega Energy Holdings, LLC*	11,153	0	11,153	8,737	1,488	10,225
MidAmerican Energy Services LLC	15,126	2,836	17,962	12,485	4,463	16,948
MP2 Energy NE LLC	20,184	0	20,184	15,811	2,693	18,504
National Gas & Electric, Inc	8,981	1,569	10,550	7,386	2,551	9,937
NextEra Energy	617,710	115,900	733,610	508,507	183,163	691,670
Nordic Energy Services	5,620	956	6,576	4,616	1,574	6,190
Palmco Power MA, LLC	11,656	1,913	13,569	9,560	3,204	12,764
Provider Power Mass, LLC	33,428	5,403	38,831	27,396	9,118	36,514
Public Power, LLC	12,439	1,902	14,341	10,170	3,299	13,470
Reliant Energy Northeast	83,425	19,573	102,998	68,629	28,687	97,315
Renaissance Power and Gas	1,745	271	2,016	1,427	466	1,894
Residents Energy, LLC	71,877	15,055	86,932	59,101	22,924	82,025
SFE Energy Massachusetts	22,212	3,679	25,891	18,224	6,135	24,359
SmartEnergy Holdings, LLC	17,732	4,030	21,762	14,601	5,958	20,559
Starion Energy, Inc.*	44	0	44	35	6	41
Summer Energy	2,344	0	2,344	1,836	313	2,149
Sunwave Gas & Power Massachusetts, Inc.*	1,100	0	1,100	862	147	1,009
Texas Retail Energy	19,275	2,965	22,240	15,764	5,128	20,891
Think Energy, LLC	13,665	147	13,812	10,738	1,950	12,688

	Massachusetts-based approach			Regional approach		
	Non-Biogenic	Biogenic	Combined	Non-Biogenic	Biogenic	Combined
Titan Gas and Power	16,805	2,599	19,404	13,747	4,483	18,230
Town Square Energy, LLC	7,673	1,330	9,003	6,309	2,170	8,479
Verde Energy USA Massachusetts, LLC	10,993	1,838	12,831	9,023	3,051	12,074
Viridian Energy, LLC	23,309	3,816	27,125	19,114	6,400	25,514
Xoom Energy Massachusetts LLC	8,572	2,193	10,765	7,063	3,123	10,186
Municipal Electric Departments						
Ashburnham Muni. Light Dept.	7,858	0	7,858	6,155	1,049	7,204
Belmont Municipal Light Dept.	25,830	0	25,830	20,234	3,447	23,681
Boylston Municipal Light Dept.	6,955	0	6,955	5,448	928	6,376
Braintree Electric Light Dept.	46,602	0	46,602	36,506	6,218	42,725
Chester Muni. Electric Light Dept.	1,735	0	1,735	1,359	231	1,591
Chicopee Electric Light Dept.	139,348	0	139,348	109,160	18,594	127,754
Concord Municipal Light Plant	2,517	1,617	4,134	1,973	1,952	3,925
Danvers Electric Division	48,458	0	48,458	37,960	6,466	44,426
Georgetown Municipal Light Dept.	9,801	0	9,801	7,677	1,308	8,985
Groton Electric Light Dept.	17,652	0	17,652	13,828	2,355	16,183
Groveland Municipal Light Dept.	10,636	0	10,636	8,332	1,419	9,751
Hingham Municipal Lighting Plant	34,626	0	34,626	27,124	4,620	31,745
Holden Municipal Light Dept.	16,638	0	16,638	13,034	2,220	15,254
Holyoke Gas & Electric Dept.	77,911	0	77,911	61,033	10,396	71,429
Hudson Light & Power Dept.	8,541	0	8,541	6,691	1,140	7,830
Hull Municipal Lighting Plant	7,930	0	7,930	6,212	1,058	7,271
Ipswich Municipal Light Dept.	28,863	0	28,863	22,610	3,851	26,462
Littleton Electric Light & Water	65,661	0	65,661	51,436	8,762	60,198
Mansfield Municipal Electric Dept.	38,247	0	38,247	29,961	5,104	35,065
Marblehead Municipal Light Dept.	21,884	0	21,884	17,143	2,920	20,063
Merrimac Muni. Light & Water	8,009	0	8,009	6,274	1,069	7,343
Middleborough Gas & Elec. Dept.	36,212	0	36,212	28,367	4,832	33,199
Middleton Muni. Electric Dept.	21,284	0	21,284	16,673	2,840	19,513

	Massachusetts-based approach			Regional approach		
	Non-Biogenic	Biogenic	Combined	Non-Biogenic	Biogenic	Combined
North Attleboro Electric Dept.	52,601	0	52,601	41,205	7,019	48,224
Norwood Municipal Light Dept.	74,136	0	74,136	58,075	9,893	67,968
Paxton Municipal Light Dept.	3,629	0	3,629	2,843	484	3,327
Peabody Municipal Light Plant	100,458	0	100,458	78,695	13,405	92,100
Princeton Municipal Light Dept.	4,808	0	4,808	3,766	642	4,408
Reading Municipal Light Dept.	156,547	0	156,547	122,633	20,889	143,522
Rowley Municipal Lighting Plant	14,001	0	14,001	10,968	1,868	12,836
Russell Municipal Light Dept.	1,487	0	1,487	1,165	198	1,363
Shrewsbury Electric & Cable Ops.	59,699	0	59,699	46,766	7,966	54,732
South Hadley Electric Light Dept.	6,028	0	6,028	4,722	804	5,527
Sterling Municipal Light Dept.	13,559	0	13,559	10,621	1,809	12,430
Taunton Municipal Lighting Plant	159,193	0	159,193	124,706	21,242	145,948
Templeton Muni. Light & Water	12,203	0	12,203	9,560	1,628	11,188
Wakefield Muni. Gas & Light	33,158	0	33,158	25,975	4,425	30,399
Wellesley Municipal Light Plant	35,469	0	35,469	27,785	4,733	32,518
West Boylston Muni. Light. Plant	9,543	0	9,543	7,475	1,273	8,749
Westfield Gas & Electric	72,292	0	72,292	56,631	9,647	66,278
2022 Electric Utility Total	**2,157,741**	**371,765**	**2,529,506**	**1,773,575**	**608,389**	**2,381,964**
2022 Competitive Supplier Total	**7,556,832**	**1,406,484**	**8,963,316**	**6,191,164**	**2,247,656**	**8,438,820**
2022 MED Total	**1,492,009**	**1,617**	**1,493,626**	**1,168,782**	**200,707**	**1,369,488**
2022 RETAIL SELLER TOTAL	**11,206,583**	**1,779,866**	**12,986,449**	**9,133,520**	**3,056,752**	**12,190,272**

Appendix 2A: Optional Unit-Specific Generation Reported by MEDs for 2022

Below is a summary of the 2022 data that MEDs chose to submit from unit-specific generation. Most unit-specific generation submitted by MEDs in 2022 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 7 for individual MED values used in Figures 7 and 8. Table 8 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)

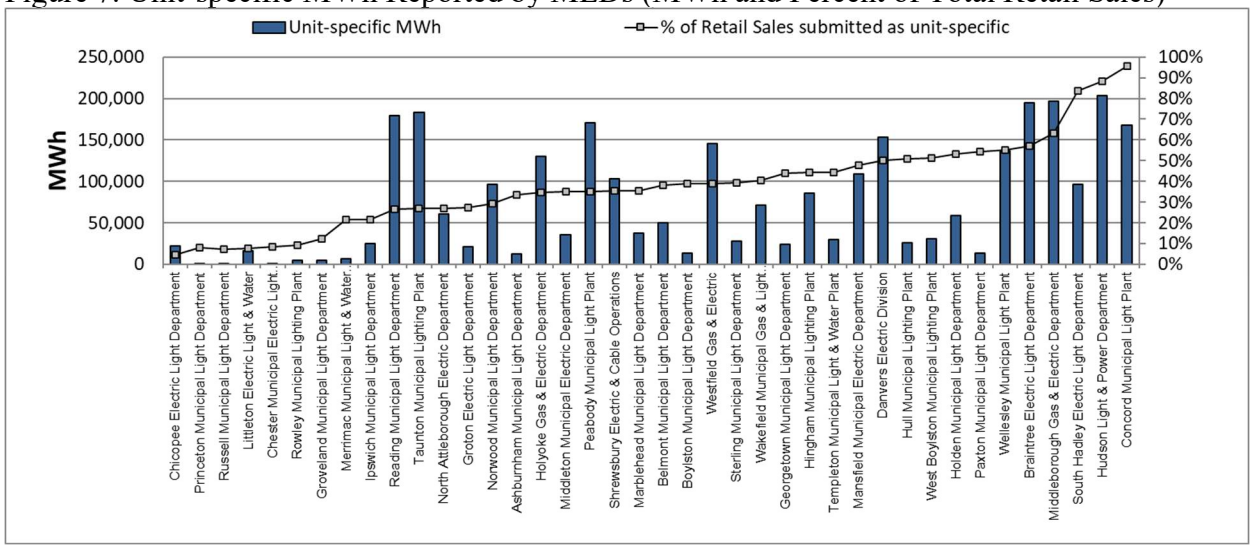


Figure 8. Electricity Sales by MED: Unit-Specific MWh vs. Total Retail Sales MWh

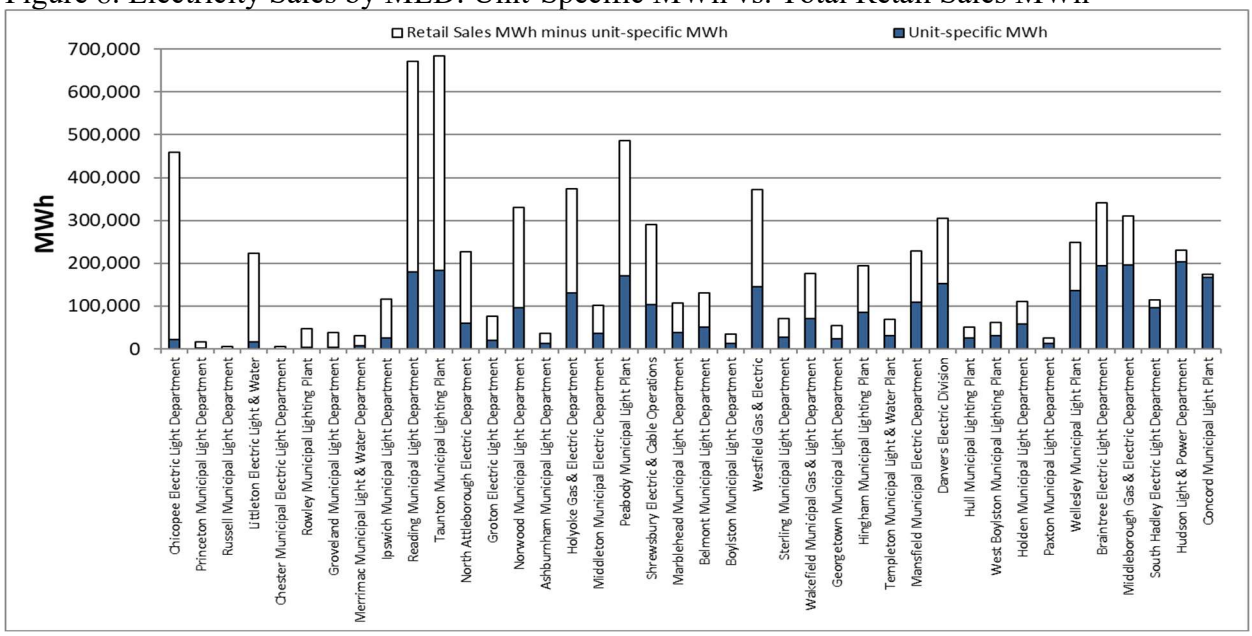


Table 7. Individual 2022 MED Percent of Sales Claimed as Unit-Specific Generation

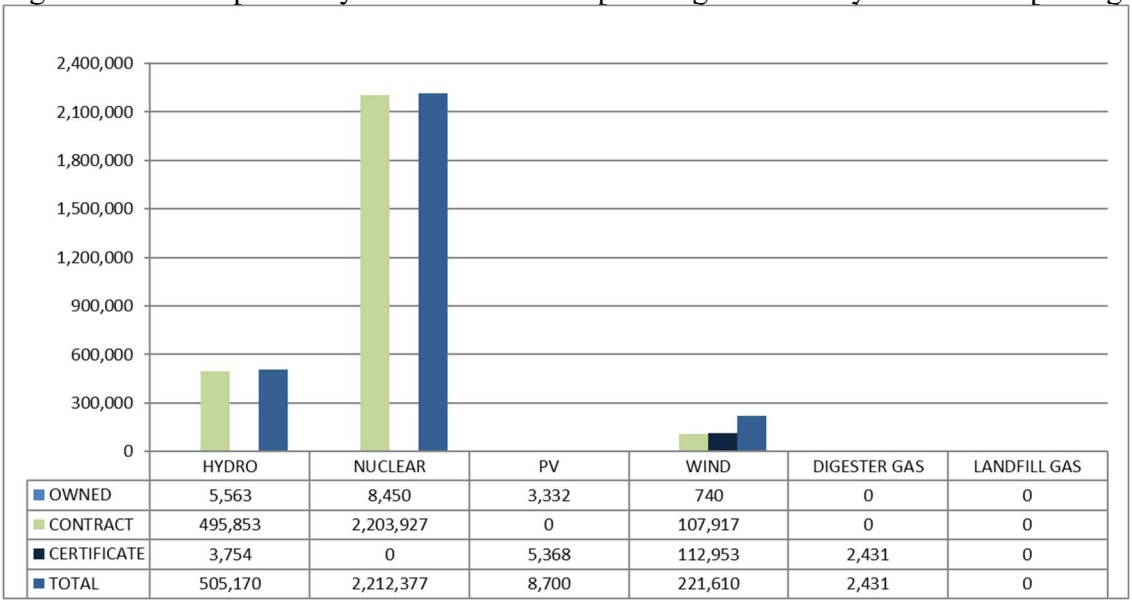
	MWh reported as retail sales	MWh claimed as unit-specific generation		% of sales claimed as unit-specific generation
		non-emitting	emitting	
Ashburnham Muni. Light Dept.	37,125	12,454	0	33.5%
Belmont Municipal Light Department	131,553	50,453	0	38.4%
Boylston Municipal Light Dept.	35,660	13,823	0	38.8%
Braintree Electric Light Dept.	340,616	194,299	0	57.0%
Chester Municipal Electric Light Dept.	5,958	511	0	8.6%
Chicopee Electric Light Dept.	459,248	21,734	0	4.7%
Concord Municipal Light Plant	175,229	164,922	2,431	95.5%
Danvers Electric Division	305,210	153,066	0	50.2%
Georgetown Municipal Light Department	54,962	24,191	0	44.0%
Groton Electric Light Dept.	76,309	20,887	0	27.4%
Groveland Municipal Light Dept.	38,143	4,749	0	12.5%
Hingham Municipal Lighting Plant	194,726	86,011	0	44.2%
Holden Municipal Light Dept.	111,207	58,967	0	53.0%
Holyoke Gas & Electric Dept.	374,683	130,063	0	34.7%
Hudson Light & Power Dept.	230,399	203,583	0	88.4%
Hull Municipal Lighting Plant	50,809	25,910	0	51.0%
Ipswich Municipal Light Department	115,869	25,246	0	21.8%
Littleton Electric Light & Water	222,973	16,815	0	7.5%
Mansfield Municipal Electric Dept.	229,501	109,417	0	47.7%
Marblehead Municipal Light Dept.	106,606	37,896	0	35.5%
Merrimac Municipal Light & Water Dept.	32,002	6,856	0	21.4%
Middleborough Gas & Electric Dept.	310,756	197,061	0	63.4%
Middleton Municipal Electric Dept.	102,691	35,865	0	34.9%
North Attleboro Electric Dept.	226,111	60,959	0	27.0%
Norwood Municipal Light Dept.	329,443	96,676	0	29.3%
Paxton Municipal Light Dept.	24,887	13,494	0	54.2%
Peabody Municipal Light Plant	486,422	171,012	0	35.2%
Princeton Municipal Light Dept.	16,411	1,316	0	8.0%
Reading Municipal Light Dept.	670,790	179,276	0	26.7%
Rowley Municipal Lighting Plant	48,363	4,405	0	9.1%
Russell Municipal Light Department	5,046	377	0	7.5%
Shrewsbury Electric & Cable Ops.	290,275	102,838	0	35.4%
South Hadley Electric Light Dept.	114,984	96,057	0	83.5%
Sterling Municipal Light Dept.	70,295	27,725	0	39.4%
Taunton Municipal Lighting Plant	683,325	183,503	0	26.9%
Templeton Municipal Light & Water	68,689	30,374	0	44.2%
Wakefield Municipal Gas & Light Dept.	175,449	71,342	0	40.7%
Wellesley Municipal Light Plant	248,547	137,184	0	55.2%
West Boylston Municipal Lighting Plant	61,306	31,345	0	51.1%
Westfield Gas & Electric	372,173	145,195	0	39.0%
MED Total	**7,634,751**	2,947,857	2,431	**38.6%**

Table 8. Individual 2022 MED Emission Factors (lb CO_2e/MWh)

	Massachusetts-based approach		Regional approach	
	Non-Biogenic	**Biogenic**	**Non-Biogenic**	**Biogenic**
Final 2022 Retail Seller Emission Factors from Table 2 (applied only to non-unit-specific generation - shown for comparison)	**637**	**0**	**499**	**85**
Ashburnham Muni. Light Dept.	423	0	332	56
Belmont Municipal Light Department	393	0	308	52
Boylston Municipal Light Dept.	390	0	306	52
Braintree Electric Light Dept.	274	0	214	37
Chester Municipal Electric Light Dept.	582	0	456	78
Chicopee Electric Light Dept.	607	0	475	81
Concord Municipal Light Plant	29	18	23	22
Danvers Electric Division	318	0	249	42
Georgetown Municipal Light Department	357	0	279	48
Groton Electric Light Dept.	463	0	362	62
Groveland Municipal Light Dept.	558	0	437	74
Hingham Municipal Lighting Plant	356	0	279	47
Holden Municipal Light Dept.	299	0	234	40
Holyoke Gas & Electric Dept.	416	0	326	55
Hudson Light & Power Dept.	74	0	58	10
Hull Municipal Lighting Plant	312	0	245	42
Ipswich Municipal Light Department	498	0	390	66
Littleton Electric Light & Water	589	0	461	79
Mansfield Municipal Electric Dept.	333	0	261	44
Marblehead Municipal Light Dept.	411	0	322	55
Merrimac Municipal Light & Water Dept.	501	0	392	67
Middleborough Gas & Electric Dept.	233	0	183	31
Middleton Municipal Electric Dept.	415	0	325	55
North Attleboro Electric Dept.	465	0	364	62
Norwood Municipal Light Dept.	450	0	353	60
Paxton Municipal Light Dept.	292	0	228	39
Peabody Municipal Light Plant	413	0	324	55
Princeton Municipal Light Dept.	586	0	459	78
Reading Municipal Light Dept.	467	0	366	62
Rowley Municipal Lighting Plant	579	0	454	77
Russell Municipal Light Department	589	0	462	79
Shrewsbury Electric & Cable Ops.	411	0	322	55
South Hadley Electric Light Dept.	105	0	82	14
Sterling Municipal Light Dept.	386	0	302	51
Taunton Municipal Lighting Plant	466	0	365	62
Templeton Municipal Light & Water	355	0	278	47
Wakefield Municipal Gas & Light Dept.	378	0	296	50
Wellesley Municipal Light Plant	285	0	224	38
West Boylston Municipal Lighting Plant	311	0	244	42
Westfield Gas & Electric	388	0	304	52
Average MED Emission Factors	**391**	**0**	**306**	**53**

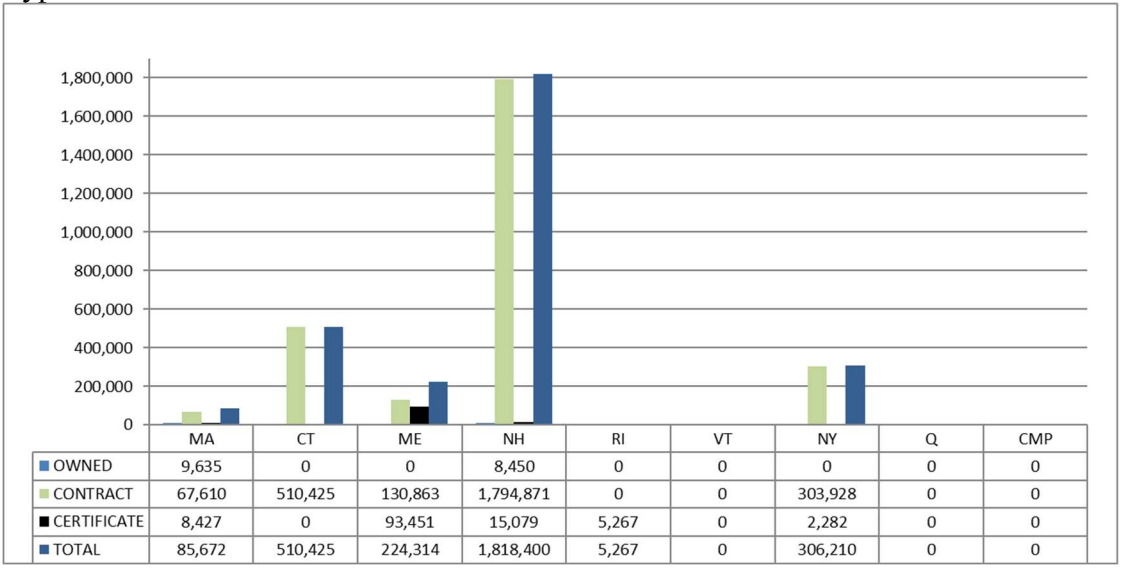
Figures 9 and 10 show the MWh reported by MEDs from unit-specific generation by fuel and reporting type and by location and reporting type. Figures 11, 12 and 13 show the unit-specific generation reported by MEDs as a percent by fuel, by location and by reporting type. Information on GHG emissions of each MED can be found in Appendix 1: *2022 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	5,563	8,450	3,332	740	0	0
CONTRACT	495,853	2,203,927	0	107,917	0	0
CERTIFICATE	3,754	0	5,368	112,953	2,431	0
TOTAL	505,170	2,212,377	8,700	221,610	2,431	0

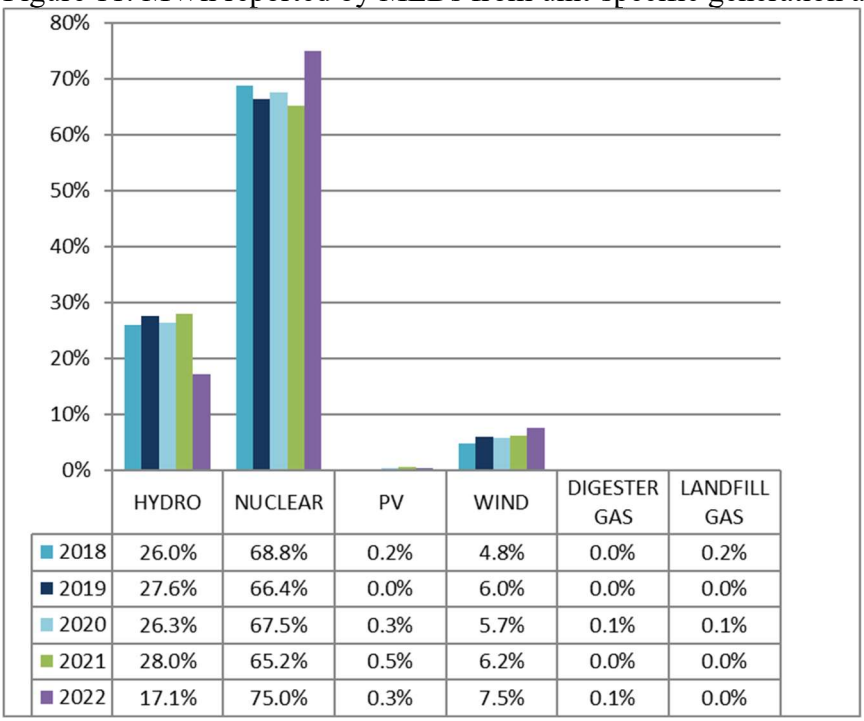
Figure 10. MWh reported by MEDs from unit-specific generation by Location and Reporting Type



	MA	CT	ME	NH	RI	VT	NY	Q	CMP
OWNED	9,635	0	0	8,450	0	0	0	0	0
CONTRACT	67,610	510,425	130,863	1,794,871	0	0	303,928	0	0
CERTIFICATE	8,427	0	93,451	15,079	5,267	0	2,282	0	0
TOTAL	85,672	510,425	224,314	1,818,400	5,267	0	306,210	0	0

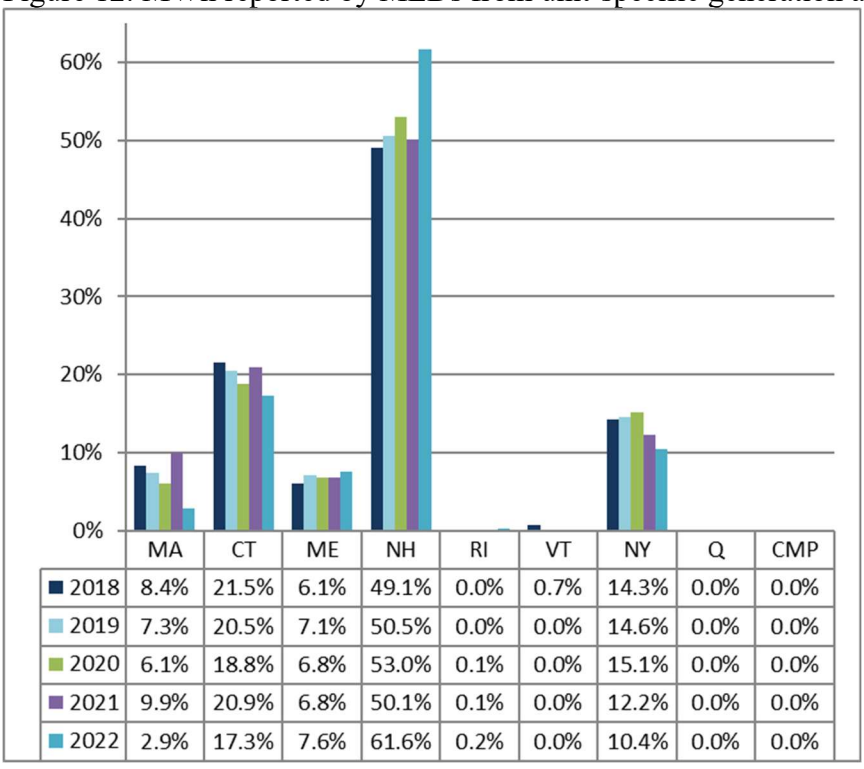
(Q = Quebec; CMP = Canadian Maritime Provinces)

Figure 11. MWh reported by MEDs from unit-specific generation as Percent by Fuel 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%
2021	28.0%	65.2%	0.5%	6.2%	0.0%	0.0%
2022	17.1%	75.0%	0.3%	7.5%	0.1%	0.0%

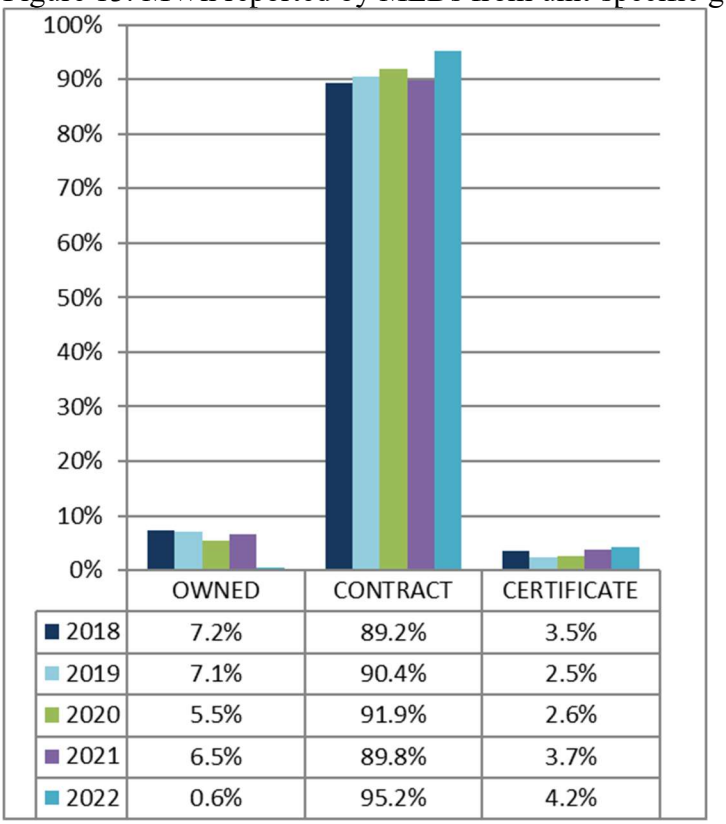
Figure 12. MWh reported by MEDs from unit-specific generation as Percent by Location



	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%
2021	9.9%	20.9%	6.8%	50.1%	0.1%	0.0%	12.2%	0.0%	0.0%
2022	2.9%	17.3%	7.6%	61.6%	0.2%	0.0%	10.4%	0.0%	0.0%

(Q = Quebec; CMP = Canadian Maritime Provinces)

Figure 13. MWh reported by MEDs from unit-specific generation as Percent by Reporting Type



	OWNED	CONTRACT	CERTIFICATE
2018	7.2%	89.2%	3.5%
2019	7.1%	90.4%	2.5%
2020	5.5%	91.9%	2.6%
2021	6.5%	89.8%	3.7%
2022	0.6%	95.2%	4.2%

Appendix 2B: Unit-Specific Generation from GIS Certificates Reported by Electric Utilities and Competitive Suppliers for 2022

Below is a summary of the 2022 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[13] with various programs are already included in the RPS/APS/CES Annual Compliance Reports,[14] that information is not repeated in this summary. The use of banked certificates or payments[15] by electric utilities and competitive suppliers to meet their compliance requirements with these programs is 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 9: Individual 2022 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.)	178,816	75,999	6,600	46.2%
National Grid (Mass. and Nantucket Electric)	5,931,375	2,622,636	220,091	47.9%
Eversource/NSTAR Electric Co. and Western MA Electric Cos.	4,396,713	1,851,951	162,000	45.8%
Competitive Suppliers				
Actual Energy Inc	45,375	15,596	1,679	38.1%
Agera Energy LLC*	83	N/A	N/A	0.0%
Alpha Gas & Electric, LLC	11,826	4,760	440	44.0%
Ambit Northeast, LLC	145,515	63,160	5,066	46.9%
American Power & Gas of MA, LLC	697	0	0	0.0%
Astral Energy, LLC*	107	N/A	N/A	0.0%
Atlantic Energy, LLC	82,384	32,587	3,048	43.3%
BP Energy Retail Company, LLC	2,421,790	1,003,441	123,223	46.5%
Calpine Energy Solutions, LLC	1,252,888	416,919	53,016	37.5%
Catalyst Power & Gas, LLC	61	9	0	14.8%
Champion Energy Services	213,781	74,047	8,181	38.5%
CleanChoice Energy, Inc	220,557	97,012	8,300	47.8%
Clearview Electric, Inc	96,938	42,670	3,610	47.7%
Constellation NewEnergy, Inc.	12,473,491	4,612,504	530,300	41.2%
Devonshire Energy, LLC	51,819	22,669	2,456	48.5%
Direct Energy Business LLC	4,795,734	1,742,301	332,727	43.3%
Direct Energy Services, LLC	185,576	58,426	28,418	46.8%

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

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

[15] See footnote 12.

	MWh reported as retail sales	MWh claimed as unit-specific generation		% of sales claimed as unit-specific generation
		non-emitting	emitting	
Discount Power, Inc.	44,690	14,000	2,800	37.6%
Dynegy Energy Services (East), LLC	1,750,176	621,850	65,118	39.3%
Eligo Energy MA, LLC	53,278	23,397	2,011	47.7%
Energy Plus Holdings	12,688	4,823	1,203	47.5%
Engie Resources, LLC	2,278,378	670,557	99,049	33.8%
Everyday Energy, LLC Rewards	699	305	26	47.4%
First Point Power	1,237,129	435,409	65,605	40.5%
Great American Gas & Electric, LLC	3	0	0	0.0%
Green Mountain Energy Company	12,272	5,352	477	47.5%
Grid Power Direct, LLC	13,647	5,610	515	44.9%
Hampshire Power Corporation	77	16	0	20.8%
Harborside Energy of Massachusetts, LLC	19,237	6,918	715	39.7%
Harvard Dedicated Energy, LTD	161,639	64,120	6,197	43.5%
Hudson Energy Services	640,172	192,018	27,470	34.3%
Inspire Energy Holdings, LLC	520,360	216,251	19,500	45.3%
Interstate Gas Supply, Inc (dba IGS Energy)	246,738	112,611	11,050	50.1%
Just Energy Mass. Corp.	32,225	24,978	1,178	81.2%
Liberty Power Holdings*	1,668	N/A	N/A	0.0%
Major Energy Electric Service, LLC	47,346	18,614	1,839	43.2%
Massachusetts Gas & Electric Co.	65,982	28,769	2,396	47.2%
Mega Energy Holdings, LLC*	35,017	N/A	N/A	0.0%
MidAmerican Energy Services LLC	75,014	33,765	2,965	49.0%
MP2 Energy NE LLC	110,203	46,832	0	42.5%
National Gas & Electric, Inc	42,650	17,906	1,640	45.8%
NextEra Energy	2,904,923	1,178,902	143,375	45.5%
Nordic Energy Services	27,221	11,682	1,000	46.6%
Palmco Power MA, LLC	52,761	20,374	2,000	42.4%
Provider Power Mass, LLC	153,715	60,654	5,649	43.1%
Public Power, LLC	61,377	26,509	1,989	46.4%
Reliant Energy Northeast	403,920	166,740	22,740	46.9%
Renaissance Power and Gas	7,494	2,612	283	38.6%
Residents Energy, LLC	353,786	151,710	16,925	47.7%
SFE Energy Massachusetts	98,979	37,338	3,846	41.6%
SmartEnergy Holdings, LLC	80,767	29,825	5,568	43.8%
Starion Energy, Inc.*	139	N/A	N/A	0.0%
Summer Energy	7,358	0	0	0.0%
Sunwave Gas & Power Massachusetts, Inc.*	3,454	N/A	N/A	0.0%
Texas Retail Energy	81,852	27,860	3,100	37.8%
Think Energy, LLC	46,668	4,086	154	9.1%
Titan Gas and Power	73,411	26,366	2,717	39.6%
Town Square Energy, LLC	37,112	15,947	1,391	46.7%
Verde Energy USA Massachusetts, LLC	49,463	18,995	1,922	42.3%
Viridian Energy, LLC	114,721	49,936	3,990	47.0%
Xoom Energy Massachusetts LLC	41,658	17,195	2,588	47.5%
Electric Utility Total	10,506,904	4,550,586	388,691	47.0%
Competitive Supplier Total	34,000,689	12,576,933	1,631,455	41.8%
Combined Total	44,507,593	17,127,519	2,020,146	43.0%

Table 10 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 10 should not be compared to the emission factors calculated for MEDs in Table 8 in Appendix 2A: *Optional Unit-Specific Generation Reported by MEDs for 2022*, because the requirement to retire MSW certificates[16] 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 10: Individual 2022 Emission Factors for Electric Utilities and Competitive Suppliers (lb CO_2e/MWh)

	Massachusetts-based approach		**Regional approach**	
	Non-Biogenic	**Biogenic**	**Non-Biogenic**	**Biogenic**
Final 2022 Retail Seller Emission Factors from Table 2 (applied only to non-unit-specific generation - shown for comparison)	637	0	499	85
Electric Utilities				
Unitil (Fitchburg Gas & Electric Co.)	416	71	342	116
National GRID (Mass. and Nantucket Electric)	405	71	333	115
Eversource/NSTAR Electric Co. and Western MA Electric Cos.	418	70	343	117
Competitive Suppliers				
Actual Energy Inc	468	71	382	123
Agera Energy LLC*	637	0	499	85
Alpha Gas & Electric, LLC	430	71	353	119
Ambit Northeast, LLC	407	67	334	112
American Power & Gas of MA, LLC	637	0	499	85
Astral Energy, LLC*	637	0	499	85
Atlantic Energy, LLC	435	71	356	119
BP Energy Retail Company, LLC	418	90	344	136
Calpine Energy Solutions, LLC	472	72	386	125
Catalyst Power & Gas, LLC	543	0	425	72
Champion Energy Services	461	71	376	124
CleanChoice Energy, Inc	407	72	335	116
Clearview Electric, Inc	407	71	334	116
Constellation NewEnergy, Inc.	446	75	365	125
Devonshire Energy, LLC	422	91	351	134
Direct Energy Business LLC	442	109	363	157
Direct Energy Services, LLC	414	225	340	271
Discount Power, Inc.	471	105	385	158
Dynegy Energy Services (East), LLC	456	70	372	121
Eligo Energy MA, LLC	408	72	336	117
Energy Plus Holdings	412	149	339	193
Engie Resources, LLC	494	79	403	136
Everyday Energy, LLC Rewards	410	72	337	116
First Point Power	452	92	370	143
Great American Gas & Electric, LLC	637	0	499	85

[16] See footnote 10.

	Massachusetts-based approach		Regional approach	
	Non-Biogenic	**Biogenic**	**Non-Biogenic**	**Biogenic**
Green Mountain Energy Company	411	74	339	119
Grid Power Direct, LLC	426	72	350	119
Hampshire Power Corporation	505	0	395	67
Harborside Energy of Massachusetts, LLC	458	71	375	122
Harvard Dedicated Energy, LTD	436	73	358	121
Hudson Energy Services	492	79	402	135
Inspire Energy Holdings, LLC	423	72	347	118
Interstate Gas Supply, Inc (dba IGS Energy)	392	81	323	124
Just Energy Mass. Corp.	192	70	166	86
Liberty Power Holdings*	637	0	499	85
Major Energy Electric Service, LLC	439	74	360	123
Massachusetts Gas & Electric Co.	408	69	335	114
Mega Energy Holdings, LLC*	637	0	499	85
MidAmerican Energy Services LLC	403	76	333	119
MP2 Energy NE LLC	366	0	287	49
National Gas & Electric, Inc	421	74	346	120
NextEra Energy	425	80	350	126
Nordic Energy Services	413	70	339	116
Palmco Power MA, LLC	442	73	362	121
Provider Power Mass, LLC	435	70	356	119
Public Power, LLC	405	62	331	108
Reliant Energy Northeast	413	97	340	142
Renaissance Power and Gas	466	72	381	124
Residents Energy, LLC	406	85	334	130
SFE Energy Massachusetts	449	74	368	124
SmartEnergy Holdings, LLC	439	100	362	148
Starion Energy, Inc.*	637	0	499	85
Summer Energy	637	0	499	85
Sunwave Gas & Power Massachusetts, Inc.*	637	0	499	85
Texas Retail Energy	471	72	385	125
Think Energy, LLC	586	6	460	84
Titan Gas and Power	458	71	375	122
Town Square Energy, LLC	414	72	340	117
Verde Energy USA Massachusetts, LLC	444	74	365	123
Viridian Energy, LLC	406	67	333	112
Xoom Energy Massachusetts LLC	412	105	339	150
Average Electric Utility Emission Factors	**411**	**71**	**338**	**116**
Average Competitive Supplier Emission Factors	**445**	**83**	**364**	**132**

Appendix 3: 2022 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 2022 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 non-biogenic EFs include all CO_2, CH_4 and N_2O emissions from non-biogenic (fossil) and CH_4 and N_2O emissions from biogenic (non-fossil) fuels combusted to generate the electricity sold by retail sellers of electricity in Massachusetts. The Massachusetts-based biogenic EFs include only the CO_2 from biogenic fuel combustion. The Combined EF adds the Non-Biogenic and Biogenic EFs together.

2022 RS Wholesale Non-Biogenic MA-based EF	454 lb	Non-Biogenic CO_2e/Wholesale MWh
+ 2022 RS Wholesale Biogenic MA-based EF	+ 55 lb	Biogenic CO_2e/Wholesale MWh
2022 RS Wholesale Combined MA-based EF	509 lb	Combined CO_2e/Wholesale MWh

Wholesale v. Retail EFs (line losses): Power lines lose 6%[17] (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: 509 lb CO_2e/Wholesale MWh / (1 - 0.06) = 541 lb CO_2e/Retail MWh

Table 11. 2022 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	454	483
Biogenic	55	59
Combined	509	541

[17] 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' and the 'GIS CO2e' tabs 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 2022 retail level Combined EF, this results in 540 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 2022 by MassDEP are: 1 for CO_2, 25 for CH_4, and 298 for N_2O.[18]

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 = 0.043 lb CH_4 *and* 1.6 lb CO_2e from N_2O / 298 = 0.006 lb N_2O;
therefore,
541 lb CO_2e/Retail MWh = (540 lb CO_2 + (0.043 lb CH_4 * 25) + (0.006 lb N_2O * 298))/Retail MWh

The breakdown of the 541 lb CO_2e/Retail MWh value from Table 11 into individual gases, at various scales of electricity, is shown in Table 12.

Table 12. 2022 Electricity Consumers Retail-level Massachusetts-based GHG Emission Factors by Individual Gas

	CO_2	**CH_4**	**N_2O**
lb/Retail kWh	0.540	0.000043	0.000006
lb/Retail MWh	540	0.043	0.006
lb/Retail GWh	540,000	43	6

The lb/Retail kWh values in the upper row of Table 12 may be the values most likely to be used by electricity consumers since most electric bills show kWh use.

The breakdown of the 540 lb CO_2/Retail MWh value from Table 12 into its non-biogenic and biogenic components is shown in Table 13. All CH_4 and N_2O emissions are considered non-biogenic and thus cannot be further broken down.

Table 13. 2022 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	0.481	0.059
lb/Retail MWh	481	59
lb/Retail GWh	481,000	59,000

[18] 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.