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Draft 2019 Greenhouse Gas Emission Factors to be used by Retail Sellers of Electricity Reporting under 310 CMR 7.75(9)(c) "Greenhouse Gas Emissions Reporting"

Regulatory Authority:
M.G.L. Chapter 111, Sections 142A through 142E
and Chapter 21N, Section 2(a)

June 2021

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Introduction
This document explains:

- the public comment procedure on the draft initial emission factors (EFs);
- the regulations requiring retail sellers of electricity to report greenhouse gas (GHG) emissions;
- the procedure for reporting GHG emissions;
- the procedure used to determine GHG emissions;
- the draft 2019 EFs;
- the different EF approaches;
- the data sources and methodology used to calculate the draft initial EFs; and
- the information presented in Appendix A spreadsheet.

Public Comment
The posting of this document and the Appendix A spreadsheet on the website of the Massachusetts Department of Environmental Protection (MassDEP) triggers a 30-day public comment period ending at 5 pm on Thursday, July 22, 2021. By that deadline, any person may comment on the methodologies, data sources or calculations used to determine the draft initial EFs.

Comments on these EFs must be sent to Sue Ann Richardson at sue.ann.richardson@mass.gov or MassDEP, One Winter Street, Boston, MA 02108 by the 5 pm Thursday, July 22, 2021 deadline. MassDEP has sent notice of the posting of the draft EFs to the most recent e-mail address it has for each retail seller. If you are a retail seller and you did not receive this information directly from MassDEP, please provide your contact information to Sue Ann Richardson at sue.ann.richardson@mass.gov.

Regulatory Requirements
The Massachusetts Global Warming Solutions Act (GWSA) requires "reporting of greenhouse gas emissions from generation sources producing all electricity consumed, including transmission and distribution line losses from electricity generated within the commonwealth or imported from outside the commonwealth; provided, however, that this requirement shall apply to all retail sellers of electricity, including electric utilities, municipal electric departments and municipal light boards… ."[1]

This requirement is implemented through the chapter 310 Code of Massachusetts Regulations (CMR) 7.75 "Clean Energy Standard" (CES) provisions at 7.75(9)(c) "Greenhouse Gas Emissions Reporting"[2] which require each retail seller of electricity to annually report to MassDEP its megawatt hours (MWh) sold, and associated GHG emissions released in the course of generating that electricity.[3]

The term "retail seller" means a competitive supplier licensed by the Department of Public Utilities (DPU) or, as each is defined in Massachusetts General Law (MGL) chapter 164A §1, an electric utility, municipal electric department (MED) or municipal light board (MLB) that is connected to the regional electric grid. 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).

The regulation, under 310 CMR 7.75(9)(c)4., requires an additional annual submittal from retail sellers subject to 310 CMR 7.75(4). Specifically, electric utilities and competitive suppliers are required to report the number of emitting and non-emitting MWh, by fuel and by state, that they retired in their New England Power Pool Generation Information System (NEPOOL GIS) Massachusetts subaccounts. An

[1] See M.G.L. Chapter 21N, Section 2(a)(5) at http://www.mass.gov/legis/laws/seslaw08/sl080298.htm.
[2] http://www.mass.gov/eea/agencies/massdep/air/regulations/310-cmr-7-00-air-pollution-control-regulation.html
[3] Retail seller reporting requirements were previously in 310 CMR 7.71 "Reporting of Greenhouse Gas Emissions."

optional submittal is also allowed under 310 CMR 7.75(9)(c)5. for MEDs and MLBs to claim specific generation that they own, contract for, or retire in a Massachusetts NEPOOL GIS subaccount.

In order to finalize the annual biogenic and non-biogenic EFs, the regulation at 310 CMR 7.75(9)(c) requires MassDEP to:

i. post draft annual EFs, including methodologies and data sources, on its website for public comment for 30 days and notify retail sellers of the posting and the deadline for submittal of public comment; and,
ii. post final annual EFs, including methodologies and data sources, on its website.[4]

This document and the attached Appendix A spreadsheet have been posted as part of complying with the first part of these requirements. Later sections of this document explain how the draft EFs are calculated.

Reporting Annual GHG Emissions

The regulation requires retail sellers to report biogenic and non-biogenic GHG emissions separately. Biogenic GHG emissions means 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.

Annual GHG reports are submitted to MassDEP by each retail seller on the AQ 32 Form, 'Mandatory Greenhouse Gas Emissions Reporting Form for Retail Sellers of Electricity.' The report includes the AQ 32 Spreadsheet provided by MassDEP showing the calculations required under 310 CMR 7.75(9)(c)3. Since the EFs change annually as the quantity and sources of electricity imported into and generated within Massachusetts change, an updated AQ 32 Spreadsheet is posted each year on the MassDEP website[5] when final EFs have been determined.

All retail sellers must report the total MWh they report for CES compliance (for competitive suppliers and electric utilities) or to DPU (for MEDs and MLBs). Retail sellers must also enter any specific MWh, biogenic, and non-biogenic emissions they have claimed for themselves, as explained in the 'Determining Annual GHG Emissions' section below. MEDs and MLBs who chose not to claim ownership or use of specific generation sources only enter the total MWh. The AQ 32 Spreadsheet calculates each retail seller's biogenic and non-biogenic GHG emissions using both a Massachusetts and a regional approach, as explained in the 'Massachusetts-based and Regional Emission Factors' section below. Retail sellers then enter these emissions into their AQ 32 Form.

Determining Annual GHG Emissions

Retail seller GHG emissions are determined by multiplying:

- Final EFs supplied by MassDEP each year for biogenic and non-biogenic GHG emissions (pounds carbon dioxide equivalents[6] per MWh, or lb CO_2e/MWh), by

[4] Note that beginning with the 2018 GHG reporting year, the deadline under 310 CMR 7.75 is the 15th day of the second September following each calendar year.

[5] The AQ 32 Form and Instructions can be found here: https://www.mass.gov/how-to/aq-31-32-retail-seller-of-electricity-greenhouse-gas-emissions-reporting. The AQ 32 Spreadsheet will also be posted at this link. The AQ 32 report for the 2019 GHG reporting year is due by September 15, 2021.

[6] Not all GHGs have the same heat-trapping capacity. For example, one pound of methane is equivalent to greater than 20 pounds of CO_2 with respect to their heat trapping potentials. To account for these differences, a standard relating the heat trapping potential of each GHG to an equivalent quantity of CO_2 over a given time horizon, has been developed. Emissions shown in this document continue to utilize this standard and are expressed in units of pounds of carbon dioxide equivalent (CO_2e) as updated in the Intergovernmental Panel on Climate Change (IPCC) Fourth Assessment Report (AR4). Retail seller EFs from 2008 through 2013 used the earlier IPCC Second Assessment Report (SAR).

- Annual electricity consumed by customers in a particular calendar year, including the portion of electricity lost during transmission and distribution line losses (MWh).

In implementing the basic approach of reporting GHG emissions based on multiplying EFs by the MWh consumed by a retail seller's customers, the regulation requires that retail sellers rely on existing sources of MWh data. In particular, electric utilities and competitive suppliers are required to use the same MWh for reporting their GHG emissions that they used for their compliance with CES. This information is submitted to the Massachusetts Department of Energy Resources (DOER) and MassDEP by July 1st each year via the 'RPS/APS/CES Annual Compliance Workbook.'

Similarly, Massachusetts MEDs and MLBs are required to report the MWh consumed by their customers in an annual return to the DPU.[7] MassDEP is requiring MEDs and MLPs to use the MWh they report in their annual return on page 57, line 15, minus any MWh they report on page 57, line 18, as sales for resale,[8] to calculate their reported GHG emissions.

Line losses are included in the MWh reported to MassDEP for the CES and to DPU for the annual return. Use of these MWh sources therefore complies with GWSA's requirement that GHG reporting by electricity sellers include transmission and distribution line losses.

A number of adjustments to the basic approach of reporting GHG emissions are allowed in order to account for the ownership and/or use[9] of specific generation sources by retail sellers.

- For electric utilities and competitive suppliers, accounting for the ownership and/or use of specific generation is required via the 'GHG' tab in the 'RPS/APS/CES Annual Compliance Workbook' as part of their Annual Compliance Filing required under 310 CMR 7.75(6).
- For MEDs and MLBs, accounting for specific generation may be done via the AQ 31 Form 'Optional Greenhouse Gas Emissions Reporting Form for Municipal Retail Sellers of Electricity' and the corresponding AQ 31 Spreadsheet (together, the AQ 31 report).

These adjustments are explained further in the AQ 32 Form 'Mandatory Greenhouse Gas Emissions Reporting Form for Retail Sellers of Electricity' and its instructions found on MassDEP's website.[10]

Once individual retail sellers claim specific MWh, the initial EFs must be recalculated based on the emissions of the remaining MWh consumed in Massachusetts, to ensure accuracy and avoid double counting. The final EFs to be used by retail sellers for the remaining unclaimed MWh consumed in Massachusetts result from removing the claimed MWh and emissions from the initial EFs. Thus, submittals of specific emitting and non-emitting generation in the GHG tabs and the AQ 31 reports are used for two purposes: to allow an individual retail seller to account for ownership and/or use of specific generation sources, and to modify the annual EFs used by retail sellers to report annual GHG emissions associated with MWh that are not reported through either the GHG tab or the AQ 31 report.

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[7] Annual Returns from municipalities can be found at https://www.mass.gov/service-details/find-an-mlp-annual-return.

[8] The MWh reported on page 57, line 18, as sales for resale should be subtracted from the total MWh reported on line 15, as these MWh are sold again through another retail seller of electricity and should therefore not be counted as part of the first retail seller's load.

[9] For example, if an MED/MLB owns a hydroelectric plant and supplies the MWh from that plant to its customers, it may choose to submit Form AQ 31 'Optional Greenhouse Gas Emissions Reporting Form for Municipal Retail Sellers of Electricity' to take credit for the non-emitting hydroelectric power, rather than multiplying those MWh by the final EFs.

[10] https://www.mass.gov/how-to/aq-31-32-retail-seller-of-electricity-greenhouse-gas-emissions-reporting.

Draft 2019 GHG Emission Factors

Table 1A contains the draft initial EFs on which MassDEP is seeking comment. The spreadsheet in Appendix A contains the data and calculations described below and used to calculate the draft EFs. The calculations for the draft initial EFs are consistent with the methodology used to calculate GHG emissions from electricity imports for the Massachusetts GHG Inventory.[11]

The draft initial EFs are calculated prior to accounting for any retail sellers' ownership and/or use of specific generation sources as submitted with the GHG tabs and AQ 31 reports. The combined EFs shown in Tables 1A and 1C below are provided for information only and are not to be used in the reporting of emissions by retail sellers.

Table 1A. Draft initial Emission Factors for Electricity Consumed in Massachusetts in 2019 prior to accounting for ownership and/or use of specific generation sources from GHG tabs and AQ 31 reports (lb CO_2e/MWh)

	Massachusetts-based approach	**Regional approach**
Non-Biogenic	416	402
Biogenic	62	119
Combined	478	521

The specific generation and associated biogenic and non-biogenic emissions submitted in the GHG tabs and AQ 31 reports are summarized below in Table 1B and also on the 'Emission Factors' tab of Appendix A. This generation represents a subset of the total retail seller load.

Table 1B. Specific 2019 MWh and GHG Emissions claimed by Massachusetts retail sellers through GHG tabs and AQ 31 reports

MWh	12,718,002
Non-Biogenic emissions (lb CO_2e)	2,954,820,613
Biogenic emissions (lb CO_2e)	3,209,361,610

Table 1C contains draft final GHG EFs that are calculated from the draft initial EFs after subtracting the specific generation and emissions in Table 1B. Calculation of the draft final GHG EFs can be found in the summary tables at the top of the 'Emission Factors' tab of Appendix A.

Table 1C. Draft final GHG Emission Factors for Electricity Consumed in Massachusetts in 2019 after accounting for ownership and/or use of specific generation sources from GHG tabs and AQ 31 reports (lb CO_2e/MWh)

	Massachusetts-based approach	**Regional approach**
Non-Biogenic	468	421
Biogenic	8	104
Combined	476	525

Once final, the EFs in Table 1C will be the EFs that retail sellers will use for their 2019 GHG emissions reporting.

Massachusetts-based and Regional Emission Factor Approaches

[11] See "*Appendix U: 2018 Emissions from Electricity Consumed in Massachusetts"* at https://www.mass.gov/lists/massdep-emissions-inventories#greenhouse-gas-baseline,-inventory-&-projection- for the most recent methodology.

There are a variety of methods that can be used to estimate the emissions due to Massachusetts' consumption of electricity, including emissions associated with electricity generated out-of-state. MassDEP believes it is appropriate to consider GHG emissions associated with electricity consumption in both state-specific and regional contexts, since, due to the linked, regional nature of the New England electricity grid, electricity generated in a state is not necessarily consumed in that state, even if that state is a net importer of electricity. Therefore, Tables 1A and 1C, and the Appendix A spreadsheet present two sets of draft biogenic and non-biogenic EFs to account for emissions associated with electricity consumed in Massachusetts.

The first Massachusetts-based set of EFs assumes that all electricity generated in Massachusetts is used in Massachusetts. As required by statute,[12] MassDEP requires reporting that reflects all the GHG emissions associated with generation of the electricity consumed in the state. Since Massachusetts consumes more electricity than it generates,[13] the GHG emissions from generation located in Massachusetts do not represent the total GHG emissions associated with consumption of electricity in Massachusetts. Massachusetts-based EFs are based on the portion of emissions from Massachusetts generation that remains in the state, plus a portion of emissions from generation in the other New England states that generate more electricity than they use in a given year. In years that New England receives net imports of electricity from the adjacent control areas (New York, New Brunswick, Quebec), a portion of the emissions from generation in those control areas is also included in the Massachusetts-based EFs.

Under this Massachusetts-based approach, the generation and emissions of each New England state are adjusted by accounting for power from specific generating units that is transferred between the states or brought into the region, as explained in the following section. Emissions due to Massachusetts' consumption of imported electricity are then determined by apportioning to Massachusetts a share[14] of any excess generation (and associated emissions) from each New England state that generates more electricity than it uses. Thus, the Massachusetts-based draft EFs include a share of the emissions associated with each electricity-exporting state's exported electricity. Similarly, the approach apportions to Massachusetts a percentage of the MWh of losses (and associated emissions) due to pumped hydro[15] and of the net annual imports into the ISO New England grid from the adjacent control area grids.

The second regional set of EFs is based on the fraction of New England electricity (in MWh) that is consumed in Massachusetts. Massachusetts is then assumed to be responsible for that same fraction of the GHGs emitted while generating that electricity. Thus, the Regional EFs are based on the total of New

[12] From GWSA, ""Statewide greenhouse gas emissions", the total annual emissions of greenhouse gases in the commonwealth, including all emissions of greenhouse gases from the generation of electricity delivered to and consumed in the commonwealth, accounting for transmission and distribution line losses, whether the electricity is generated in the commonwealth or imported; provided, however, that statewide greenhouse gas emissions shall be expressed in tons of carbon dioxide equivalents."

[13] In 2019, the amount of electricity generated inside of Massachusetts was approximately 43 % of the amount of electricity consumed in Massachusetts, as reported by NE-ISO in its "Annual Generation and Load Data for ISO NE and the Six New England States" report. The remaining 57 % was generated outside of Massachusetts and imported from other states and Canada.

[14] Generally, the emissions associated with electricity from exporting states are assigned proportionately to importing states. For example, in 2019, MA, ME, RI, and VT all generated less electricity than they used, while CT and NH generated more electricity than they used (and New York, New Brunswick and Quebec sent electricity to New England). Massachusetts' MWh needs were 81% of the sum of MWh needed by MA, ME, RI, and VT. Therefore, 81% of the excess generation (and associated emissions) from CT, NH, New York, New Brunswick and Quebec were apportioned to MA.

[15] The MWh of losses associated with pumped hydro are obtained from ISO-NE. The MWh of losses associated with pumped hydro are apportioned to each New England state according to that state's fraction of total New England load.

England GHG emissions from electricity generation plus GHG emissions associated with electricity imported from the adjacent control areas in years that New England receives net imports of electricity from those control areas; this total is multiplied by the ratio of Massachusetts to New England electricity consumption.

Methodology and Data Sources for the calculation of the draft initial GHG EFs
Retail seller EFs are calculated by dividing GHG emissions by the number of MWh. This requires the determination of:

- MWh of electricity generated and consumed in each New England state, and imported from each of the adjacent control areas that send power to New England; and
- electric-generating sector GHG emissions data in each New England state, and imported from each of the adjacent control areas that send power to New England.

The steps that are followed to calculate the draft initial EFs in Table 1A are presented below. The determination of MWh of electricity is found in steps 1 and 2, and the determination of electric-generating sector GHG emissions are explained in steps 4 through 6. The Massachusetts-based EFs also require the additional calculation of MWh and GHG emissions imported into Massachusetts from other New England states as explained in steps 3 and 7.

1. *Determining electricity generated and consumed in New England states*.
The MWh of electricity generated and consumed in each New England state, and imported from adjacent control areas, is available from the region's independent system operator, ISO New England, which manages the New England electricity grid.[16] Pumped hydro MWh data is also obtained from ISO New England and is apportioned to the New England states.

2. *Determining imports of specific generation into the ISO New England region.*
Consistent with the methodology for calculating GHG emissions from imported electricity in the Massachusetts GHG Inventory,[17] the retail seller EF methodology also takes into account specific generation transferred from one state (or province) into another by retail sellers and other account holders through the NEPOOL GIS. The 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."[18] Each GIS certificate represents one MWh. The GIS certificate MWh are subtracted from the generation of the generating state (or province) and added to the generation of the state in which the certificates were retired. GIS certificates often represent power from distributed and behind-the-meter generation that is usually not accounted for through ISO New England's system. Therefore, any MWh from distributed and behind-the-meter generation are added to the generating state's load.

3. *Determining electricity imported into Massachusetts from other New England states*.
Each state's net exported MWh or needed import MWh is determined by subtracting load from generation. This allows the amount of power imported into MA from the exporting states and provinces to be calculated.

4. *Determining emissions from generation in New England and New York.*

[16] Electric sector GHG emissions determined as described in step 4 include the entire state of Maine, while ISO New England load for Maine in the Appendix A spreadsheet does not include the part of Maine supplied by the Northern Maine Independent System Administrator (NMISA). Northern Maine load and generation data are obtained from NMISA to estimate the ISO New England and NMISA fractions of Maine's total generation, to pro-rate Maine's electric sector GHG emissions.
[17] https://www.mass.gov/lists/massdep-emissions-inventories#greenhouse-gas-baseline,-inventory-&-projection-
[18] Information on NEPOOL GIS can be found at: https://www.nepoolgis.com.

For certain units that reported CO_2 emissions under federal regulation 40 Code of Federal Regulations (CFR) Part 75, these Part 75 CO_2 emissions are used. Part 75 does not require separate reporting of CO_2 emissions by type of energy produced (steam vs. electricity) or fuel used (biogenic vs. non-biogenic). Therefore, CO_2 emissions reported under Part 75 by units co-generating steam and electricity or firing biogenic and non-biogenic fuels could not be used for this effort to determine electricity EFs for biogenic and non-biogenic fuels.

State level emissions of CO_2 for units for which Part 75 is unavailable or not usable, and emissions of CH_4 and N_2O from all units, are determined by multiplying fuel-specific heat input by fuel- and pollutant-specific EFs (note that these fuel- and pollutant-specific EFs are distinct from the EFs in Tables 1A and 1C). Heat input (in millions of British thermal units per year, or mmBtu) is obtained from the United States Department of Energy's Energy Information Administration's (EIA's) "Power Plant Operations" Form 923[19] on which certain facilities report the heat input used to make electricity.

Fuel-specific EFs (in pounds of CO_2, CH_4 and N_2O emitted per mmBtu combusted, or lb/mmBtu) come from a variety of sources. Best practice is to use the most geographically specific emissions or fuel-specific EFs available. Thus, unit-specific CO_2 emissions are used where available, national fuel-specific EFs obtained from the EIA[20] and from EPA[21] are used where unit-specific emissions are not available, and international fuel-specific EFs are used where unit-specific emissions or national EFs are not available. International EFs are obtained from the Intergovernmental Panel on Climate Change (IPCC).[22] The attached Appendix A spreadsheet documents the source and values of unit-specific, national or international CO_2, CH_4 and N_2O emissions and EFs for each fuel for each state.

Multiplying heat inputs by fuel-specific EFs results in total non-Part 75 CO_2 and total CH_4 and N_2O emissions released while generating electricity, per fuel and per state. The CO_2 emissions released from the combustion of biogenic fuels are summed per state, for use in calculating the biogenic EFs. Separately, the CO_2 emissions released from the combustion of non-biogenic fuel, plus the CH_4 and N_2O emissions released from the combustion of any fuel, plus the Part 75 non-biogenic CO_2 emissions available for certain units, are summed per state, for use in calculating the non-biogenic EFs.

5. *Determining emissions from imports into New England from New Brunswick and Quebec.*
Canadian non-biogenic GHG emissions released during the generation of electricity are obtained for each province from an Environment and Climate Change Canada report.[23] Canadian biogenic CO_2 emissions

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[19] Form available at http://www.eia.gov/survey/#eia-923. Final 2019 heat input data released on September 22, 2020. EIA 923 data can be found at https://www.eia.gov/electricity/data/eia923/.
[20] *Electric Power Annual 2019*, U.S. Energy Information Administration, released: October 2020 and corrected on February 21, 2021. See Table A3 "Carbon Dioxide Uncontrolled Emission Factors" at http://www.eia.gov/electricity/annual/html/epa_a_03.html.
[21] Fuel specific EFs from EPA's GHG Reporting Program (40 CFR Part 98 Subpart C Tables C-1 and C-2) are used in instances where no EIA EF is available. Table C-1: https://www.govinfo.gov/content/pkg/CFR-2019-title40-vol23/pdf/CFR-2019-title40-vol23-part98-subpartC-appC.pdf. Table C-2: https://www.govinfo.gov/content/pkg/CFR-2019-title40-vol23/pdf/CFR-2019-title40-vol23-part98-subpartC-appC-id728.pdf.
[22] *2006 IPCC Guidelines for National Greenhouse Gas Inventories Volume 2: Energy* at http://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/2_Volume2/V2_2_Ch2_Stationary_Combustion.pdf. See Chapter 2: *Stationary Combustion*, Table 2.2 "Default emission factors for stationary combustion in the energy industries (kg of greenhouse gas per TJ on a net calorific basis)."
[23] *National Inventory Report 1990–2019: Greenhouse Gas Sources and Sinks in Canada,* Environment and Climate Change Canada, April 12, 2021 at https://unfccc.int/ghg-inventories-annex-i-parties/2021. See Table A13-5 "Electricity Generation and GHG Emission Details for New Brunswick" and Table A13-6 "Electricity Generation and GHG Emission Details for Quebec."

released during the generation of electricity are calculated from the MWh of electricity generated from wood combustion obtained from Statistics Canada.[24] MWh from wood are first converted to mmBtu using an average wood heat rate[25] and then multiplied by the same fuel-specific EFs in step 4 above.

6. Determining emissions from imports of specific generation into the New England ISO region.
While many GIS certificates represent non-emitting power, some represent power from emitting fuel sources. As explained in detail in the Appendix A spreadsheet, the MWh from certificates are first converted to fuel-specific mmBtu using a heat rate for each fuel type that is calculated from EIA 923 data. Emissions from certificates are then determined using a procedure similar to the calculation of generation emissions in step 4 above. As with MWh, emissions from certificates in the NEPOOL-GIS system are subtracted from the state (or province) in which they were generated and added to the state in which they were retired.

Some GIS certificates represent 'system mix' power that is generated in a state or province outside the New England ISO area and retired in specific New England states. Emissions from system mix certificates are calculated by multiplying the number of system mix certificates by a system mix emission rate specific to each generating state or province. These emissions are added to the states in which these certificates were retired.

7. *Determining emissions from imports into Massachusetts from other New England states.*
To determine the Massachusetts-based EFs, the amount of emissions that each exporting New England state sends to the region is calculated using state-specific export emission factors. State-specific export emission factors are calculated using the remaining MWh and emissions from each state's ISO New England generating units (distributed and behind-the-meter generation are not included since this power is presumably used within the state). Each state's exported GHG emissions are then calculated by multiplying the state's net exported MWh by its export emission factor, and, finally, Massachusetts's share of the exported emissions is determined.

[24] Table 25-10-0019-01 – *Electricity from fuels, annual generation by electric utility thermal plants* (formerly *Table 127-0006 - Electricity generated from fuels, by electric utility thermal plants, annual (megawatt hour)),* Statistics Canada, CANSIM (database), http://www5.statcan.gc.ca/cansim/a26?lang=eng&id=1270006&p2=17 (accessed on April 5, 2021).
[25] In the absence of province-specific heat rates, the average heat rate of wood-fired New England and New York electric generating units (as determined from EIA Form 923 data) is used.

Appendix A Guide

Table 2 below summarizes the information found on each tab of the spreadsheet in Appendix A used to calculate draft EFs.

Table 2. Information presented on each tab of the Appendix A spreadsheet to calculate Emission Factors

Tab	Contents
1 Emission Factors	Calculation of draft initial and draft final Massachusetts-based and regional biogenic and non-biogenic EFs, and a table of specific MWh and emissions submitted by retail sellers.
2 State & Province Summary	Summary of emissions and generation data from Tabs 3, 4 and 7 into three tables: Emissions, Generation and NEPOOL GIS Certificates, and Emission Rates (for system mix and state export emissions).
3 Generation Load Imports	Generation, load, import, and pumping MWh data from ISO New England and generation data from other states and provinces, which are summarized on Tab 2 and used to calculate the draft EFs on Tab 1.
4 Generation CO2e	Calculation of CO_2e emissions from CO_2, CH_4 and N_2O by state and Canadian province, which are summarized on Tab 2 and used to calculate the draft EFs on Tab 1.
5 EIA Form 923	Heat input by unit and fuel from EIA Form 923 totaled by state and fuel type and used to calculate CO_2e emissions on Tab 4.
6 EPA Part 75	CO_2 emissions data from EPA for Part 75 units (used in place of calculating CO_2 from EIA fuel data on Tab 1) included on Tab 4.
7 GIS CO2e	Calculation of CO_2e emissions from GIS certificates from: 1) all generating units that transfer between states and provinces, and 2) all ISO New England generating units that retire a) inside the generating state, and b) outside of the generating state. These CO_2e emissions are summarized on Tab 2.
8 GIS Heat Input	Summary of mmBtu data from Tab 9 for the calculation of CO_2e emissions from GIS certificates on Tab 7.
9 GIS	Calculation of mmBtu from settled and reserved GIS certificates for emitting fuel types multiplied by heat rates from 923 data on Tab 5.
10 GWPs & Fuel EFs	Global warming potentials (GWPs) and fuel EFs used to calculate emissions on Tabs 4 and 7 including: EIA's CO_2 EFs by fuel type used where available to calculate CO_2 emissions, EPA's GHG EFs by fuel type used to calculate CO_2 emissions where EIA data is not available and to calculate CH_4 and N_2O emissions, IPCC GHG EFs by fuel type used to calculate GHG emissions where EIA and EPA factors are not available, and the GWPs of each gas from IPCC's Fourth Assessment Report (AR4).

Appendix A: Draft 2019 Data and Calculations spreadsheet.