

Sector

Energy Generation and Distribution

Strategy/Policy

More Stringent Power Plant Rules

Methodology and Data Sources for GHG Emission Reduction Calculation

$$M_n = \sum_{i=2010}^n Z_i$$

If unit(s) or plant(s) shut down in year i, then

$$Z_i = \underbrace{\frac{\overline{E_{2007 \rightarrow 2009}}}{C}}_{\text{GHG emissions from power plant(s) or unit(s) shutting down}} - \underbrace{(\overline{G_{2007 \rightarrow 2009}} \times A)}_{\text{GHG emissions from electricity generation that will occur to supply power, assumed from marginal natural gas power plant(s)}}$$

GHG emissions from power plant(s) or unit(s) shutting down

GHG emissions from electricity generation that will occur to supply power, assumed from marginal natural gas power plant(s)

Otherwise, $Z_i = 0$

where:

Symbol	Value	Unit	Description	Data Source & Assumption
M_n	(calculated)	MMTCO ₂ e	CO ₂ e mitigated in year n	(see below)
Z_i	(depends on year i)	MMTCO ₂ e	CO ₂ e savings for year i from power plant(s) or unit(s) shutting down that year, but accounting for electricity that will be generated by assumed marginal natural gas power plants	(see below)
$\overline{E_{2007 \rightarrow 2009}}$	(depends on power plant(s) or unit(s) shutting down)	short ton CO ₂	three year 2007-2009 average of the reported CO ₂ emissions at the power plant(s) or unit(s) shutting down in year i	Annual CO ₂ emissions data as reported to EPA by power plants. Assumed that the 3-year average would buffer annual differences influenced by maintenance schedule variability, weather patterns, electricity demand, etc.
$\overline{G_{2007 \rightarrow 2009}}$	(depends on power plant(s) or unit(s) shutting down)	MWh	three year 2007-2009 average of the electricity generated at the power plant(s) or unit(s) shutting down in year i	As reported to MassDEP by power plants. Assumed that the 3-year average would buffer annual differences influenced by maintenance schedule variability, weather patterns, electricity demand, etc.
A	0.40435848E-6	MMT	emission rate for natural gas power plants	Based on natural gas emission rate used in the LEAP

Symbol	Value	Unit	Description	Data Source & Assumption
		CO ₂ e/MWh		model in developing the Clean Energy and Climate Plan for 2020.
<i>C</i>	1.10231131092439E6	short ton/MMT	conversion factor to convert short tons of CO ₂ into million metric tons of CO ₂ e (MMTCO ₂ e)	Assumed minimal or no significant emission from other gases, besides carbon dioxide (CO ₂), with global warming potential.

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Strategy/Policy

Expanded Renewable and Alternative Portfolio Standard

Methodology and Data Sources for GHG Emission Reduction Calculation

$$M_n = \underbrace{[R_n - (L_n \times P_n)]}_{\text{Submitted RPS Class 1 RECs beyond the remaining baseline energy load after energy efficiency measures}} \times A \div C$$

Submitted RPS Class 1 RECs beyond the remaining
baseline energy load after energy efficiency measures

where:

Symbol	Value	Unit	Description	Data Source & Assumption
M_n	(calculated)	MMT CO ₂ e	CO ₂ e mitigated in year n	(see below)
R_n	(depends on year n)	MWh	Submitted RPS Class 1 renewable energy credits (RECs) for year n	MA Department of Energy Resources (DOER)
L_n	(depends on year n)	MWh	Expected energy load after energy efficiency measures through year n	Based on baseline calculations for the Clean Energy and Climate Plan for 2020. Assumed that energy savings from the All Cost Effective Energy Efficiency strategy/policy are fully realized. The baseline energy load used 2009 ISO-NE CELT Forecast for MA Net Energy Load projections, less pre-Green Communities Act RPS, 14.8% of load delivered by municipal electric companies, and a 7% loss during distribution.
P_n	(depends on year n)	%	RPS Class 1 standard before the Green Communities Act of 2008: percentage of electricity from renewable sources for year n	Massachusetts Renewable Energy Portfolio Standards (RPS) requirements before the Green Communities Act of 2008.
A	1030	lb CO ₂ /MWh	emission factor for electricity savings	2010 New England Average Avoided CO ₂ Emissions, average for New England, average for winter & summer (AESC 2009 , Exhibit 6-47).
C	2204.62E6	lb/MMT	conversion factor to convert pounds of CO ₂ into million metric ton of CO ₂ e (MMT CO ₂ e)	Assumed minimal or no significant emission from other gases, besides carbon dioxide (CO ₂), with global warming potential.