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Response to Comments on the Statewide Greenhouse Gas Emissions Level: 1990 Baseline and 2020 Business as Usual Projection Update

Regulatory Authority:

MGL Chapter 21N, Section 3

July 2016

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I. Introduction

The Massachusetts Global Warming Solutions Act (GWSA)[1] was signed into law in August of 2008. The major requirements of this statute include:

- Adoption of statewide greenhouse gas (GHG) emissions limits for 2020, 2030, and 2040 that will maximize the ability of the Commonwealth to meet the 2050 limit of at least 80% below 1990 emissions,
- Implementation of plans to achieve these statewide GHG emissions limits, and
- Mandatory reporting of GHG emissions by larger GHG emitting sources and retail sellers that sell electricity in the Commonwealth.

GHGs accumulate in the atmosphere and trap heat that would otherwise be radiated back into space. This "greenhouse effect" is the primary cause of global climate change. There are a number of gases that are considered GHGs. The most prevalent GHG is carbon dioxide (CO_2), which is emitted when fuels are burned. Methane (CH_4), nitrous oxide (N_2O) and several other compounds primarily used as refrigerants are also GHGs of concern due to their potential to contribute to climate change.[2]

GWSA established the Climate Protection and Green Economy Act in Massachusetts General Law, which requires the Massachusetts Department of Environmental Protection (MassDEP) to, among other actions "*… triennially publish a state greenhouse gas emissions inventory that includes comprehensive estimates of the quantity of greenhouse gas emissions in the commonwealth for the last 3 years in which the data is available,*" and "*…determine the statewide greenhouse gas emissions level in calendar year 1990 and reasonably project what the emissions lever will be in calendar year 2020 if no measures are imposed to lower emissions other than those formally adopted and implemented as of January 1, 2009.*" [MGL chapter 21N, section 2, subsection (c) and section 3, subsection (a)]

GWSA section 14 further required MassDEP to establish the 1990 Baseline and 2020 Business as Usual (BAU) Projection by July 1, 2009. The 1990 Baseline and 2020 BAU Projection were published July 1, 2009 and presented actual emissions from 1990 through 2008 for most sectors, and projected emissions to 2020 for all sectors.

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[1] See http://www.malegislature.gov/Laws/SessionLaws/Acts/2008/Chapter298

[2] Not all GHGs have the same heat-trapping capacity. For example, one ton of methane is equivalent to greater than 20 tons of CO_2 with respect to their heat trapping potentials. To account for these differences, a standard, known as the global warming potential (GWP), 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 utilize this standard, and are expressed in units of million metric tons of carbon dioxide equivalents ($MMTCO_2e$).

GWSA required the Secretary of the Executive Office of Energy and Environmental Affairs (EEA), in consultation with other state agencies and the public, to establish a statewide limit on GHG emissions of between 10 percent and 25 percent below 1990 levels for 2020 — on the way to at least an 80 percent reduction in emissions in 2050 — along with a plan to achieve the 2020 limit [MGL chapter 21N, section 4, subsections (a-g)]. In December 2010, EEA set the 2020 limit at 25 percent below the 1990 Baseline level. The *Massachusetts Clean Energy and Climate Plan for 2020* (CECP Update), dated December 31, 2015, contains strategies to meet that limit.[3] The 1990 emissions baseline is the emissions level against which Massachusetts' future GHG emissions reductions limits will be planned and measured.

Updating the 1990 Baseline and the 2020 BAU Projection

The *Statewide Greenhouse Gas Emissions Level: 1990 Baseline and 2020 Business as Usual Projection* (July 1, 2009)[4] states: "The Department recognizes that the science and practice of determining GHG emissions is changing rapidly and that Massachusetts, being at the cutting edge of this work, should avail itself of advancements in the science to the extent possible. Therefore, MassDEP will reevaluate the 1990 Baseline as needed (e.g., significant new data becomes available). If amendment is necessary, a full public review process will be used."

Significant new data have become available, including revisions to the Global Warming Potentials (GWPs) of GHGs; therefore, MassDEP drafted a *Statewide Greenhouse Gas Emissions Level: 1990 Baseline and 2020 Business As Usual Projection Update*.

GWSA requires the Secretary of EEA to update the CECP at least once every five years [MGL chapter 21N, section 4, subsection (h)]. This updated final 1990 Baseline inventory supports the first CECP Update, dated December 31, 2015.

II. Public Comment Process

The draft *Statewide Greenhouse Gas Emissions Level: 1990 Baseline and 2020 Business As Usual Projection Update* was posted for public comment on the MassDEP public notice webpage on November 23, 2015. An email announcement was also sent to GHG stakeholders on that date. The 30-day public comment period closed on December 23, 2015.

MassDEP sought comment on the methodologies and data described in the draft Update that were used to estimate Massachusetts' 1990 GHG emissions. A summary of public

[3] http://www.mass.gov/eea/docs/eea/energy/cecp-for-2020.pdf
[4] http://www.mass.gov/eea/agencies/massdep/climate-energy/climate/ghg/greenhouse-gas-ghg-emissions-in-massachusetts.html#2

comments received and responses to those comments are presented here and a final Update and Appendices are posted on the MassDEP website.

III. Comments and Responses

List of Commenters

Eversource, Catherine Finneran [EVR]

Gleason, Terry [TG]

Home Energy Efficiency Team, Audrey Schulman [HEET]

National Grid, Alexander G. Taft [NGrid]

Northeast Gas Association, Steve Leahy [NGA]

Office of Representative Frank I. Smizik [RS]

Saxon, Keith [KS]

The Nature Conservancy, Stephen Long [TNC]

Waste Management, Steve Poggi & Garrett Trierweiler [WM]

West Boylston Municipal Lighting Plant, Jonathan Fitch [WBMLP]

General

Comments: Several commenters were in support of an updated 1990 Baseline inventory using the most current data and methodologies consistent with other inventories that exist at various government levels. [TNC, NGrid, NGA] Several commenters expressed their desire to see more frequent updates to the inventory in order to more accurately measure progress. [WBMLP, TG]

Response: MassDEP thanks the commenters for their support. MassDEP typically publishes updates to the GHG Inventory twice per year when major new data are released (by the U.S. Energy Information Administration (EIA) for energy consumption in mid-summer and by the U.S. Environmental Protection Agency (EPA) for the remaining Inventory sectors early in each calendar year).

Global Warming Potentials

Comments: Several commenters were in support of using updated Global Warming Potentials (GWPs) in the updated 1990 Baseline and annual inventories. [NGA, EVR, NGrid] Several commenters specifically supported the use of the GWPs from the Intergovernmental Panel on Climate Change (IPCC) Fourth Assessment Report (AR4) in lieu of the IPCC Fifth Assessment Report (AR5) as a way to continue to measure emissions consistently with national inventories and various federal, state and regional GHG

programs, reducing the potential for confusion and error. [KS, WM] One commenter preferred the IPCC AR5 Report, asserting that Massachusetts as a world leader in climate policy, clean energy, and environmental protection should adhere to the latest scientific data and consensus, continuing to lead in these areas, but recognized that consistency with other states and nations would be a justifiable argument for choosing AR4 GWPs for this update. [RS]

Response: MassDEP has chosen the AR4 GWPs for the updated 1990 Baseline and annual inventories, consistent with GHG inventories and reporting programs of other jurisdictions. This ensures that Massachusetts can compare its efforts to other jurisdictions and learn from the endeavors and good ideas of parties striving, like Massachusetts, to address the challenge of climate change. As the science and reporting conventions evolve, Massachusetts will track progress and new information, and update its inventory as necessary.

Electricity Generation and Imports

Comment: One commenter appreciated the difficulty of accurately determining the origin of electricity used in Massachusetts, and the updates made to account for the success of the Massachusetts Renewable Portfolio Standard (RPS) in increasing the percentage of electricity that comes from renewable sources. [TNC]

Response: MassDEP agrees with the commenter.

Comment: One commenter requested that more recent data, particularly within the electric sector, be posted, including the 2013, 2014, and 2015 GHG emission data for the energy generation and distribution sector. The data from this sector is generally available within 1-3 months at the end of each year. [WBMLP]

Response: Some energy and generation data, such as CO_2 emissions from the larger Massachusetts generating facilities subject to the Regional Greenhouse Gas Initiative (RGGI), is available within 1 to 3 months of the end of each year. These data are published on the RGGI[5] and EPA websites.[6] However, complete emissions data from all electric generating sources not subject to RGGI in New England, Canada, and New York, are not. Therefore it is not currently possible for MassDEP to publish more frequent complete GHG emissions data from the electric sector.

Natural Gas Systems

Comment: One commenter noted that the statewide greenhouse gas inventory needs to take into account emissions from natural gas leaks and cited a 2015 Harvard

[5] https://rggi-coats.org/eats/rggi/
[6] http://ampd.epa.gov/ampd/

University/Boston University study regarding gas leaks in Greater Boston which indicated that 2.7% of all the natural gas being sent to our homes and businesses is leaked into the atmosphere. [HEET]

Response: The updated 1990 Baseline inventory published in November 2015 includes an extensively improved and revised estimate of emissions from natural gas distribution systems across Massachusetts, not just greater Boston. Please refer to the discussion in the Methodology Updates section in Appendix A of the *Statewide Greenhouse Gas Emissions Level: 1990 Baseline and 2020 Business As Usual Projection Update* (November 2015) and the data on the Natural Gas Systems tab of Appendix C. The calculations take into account data from recent studies including revised emission factors and recent data on pipeline miles and services, customer meters, and metering and regulating stations from local distribution companies. The final 1990 Baseline update and annual inventories use the same methodology.

Comment: Several commenters noted the April 2015 Washington State University (Lamb/WSU) study of emission factors for the natural gas distribution system, and the December 2015 release of the EPA document entitled "Inventory of U.S. Greenhouse Gas Emissions and Sinks: Revisions under Consideration for Natural Gas Distribution Emissions." [EVR, NGrid, NGA]

Response: MassDEP used data from the Lamb/WSU study "Direct Measurements Show Decreasing Methane Emissions from Natural Gas Local Distribution Systems in the United States" (published April 2015 at http://pubs.acs.org/doi/abs/10.1021/es505116p) in the updated 1990 Baseline and annual inventories. MassDEP will review the results of EPA's efforts to see if further improvements to estimating this sector's emissions can be made in the future.

Solid Waste Landfills

Comment: One commenter supported the use of Municipal Solid Waste (MSW) landfill data from the EPA's Greenhouse Gas Reporting Program (GHGRP). In particular, they supported EPA's GHGRP methodology for reporting landfill gas, collection efficiency, and the 2013 updates to the methodology for reporting methane oxidation in landfill cover. [WM]

Response: MassDEP plans to continue to include EPA's GHGRP data for MSW landfills (available beginning with 2010), so any change made to the EPA methodology will therefore be incorporated into the data in the Massachusetts GHG inventory. Further review of landfills in Massachusetts revealed only one active industrial (limestone) mineral waste landfill and several active ash landfills. Since neither of these materials decompose, these landfills are not producing methane emissions. Therefore, the 2016 SGIT Solid Waste

module was run with the percentage of methane from industrial landfills set to zero for 1990 to 2009 (and post-2009 solid waste emissions are obtained from EPA's GHGRP).

Comment: One commenter asked that emissions from the "approximately 924 retired landfills in Massachusetts" be included in the statewide methane emission estimate. [EVR]

Response: According to EPA's April 2015 *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2013* (U.S. GHG Inventory) report "methane production typically begins within the first year after the waste is disposed of in a landfill and will continue for 10 to 60 years or longer as the degradable waste decomposes over time" (page 7-4) so the majority of older, closed, and inactive landfills, are very unlikely to be a significant source of methane. No change in the inventory has been made from the proposal.

Comment: One commenter suggested the Massachusetts inventory recognize the role of landfills in storing carbon since the IPCC guidelines for landfill emissions estimation recognizes that organic matter (such as wood products, food scraps and yard trimmings) disposed of in landfills and that does not decompose is permanently stored in the landfill. The commenter notes that the U.S. GHG Inventory reports MSW landfill methane emissions of 114.6 [MMT]CO2e and carbon storage from undecomposed food and yard waste and harvested wood products of 74.9 [MMT]CO2e so that "in the mass balancing of MSW landfill emissions, carbon sequestration offset of over 65 percent of landfill methane emissions." [WM]

Response: Although undecomposed organic matter can sequester carbon in landfills, the commenter's suggestion that this carbon be used towards a mass balancing of MSW landfill emissions does not fit with U.S. EPA or IPCC practices. The U.S. GHG Inventory, organized in accordance with the IPCC guidelines, shows:

- -62.3 MMTCO_2e of stored carbon from harvested wood products in solid waste disposal sites in Table 6-8: "Estimated Net Annual Changes in C Stocks (MMT CO_2/yr) in Forest and Harvested Wood Pools" and
- -12.6 MMTCO_2e as the net emissions of greenhouse gases to the atmosphere (accounting for both the emissions of CO_2 to and the removals of CO_2 from the atmosphere) for landfilled yard trimmings and food scraps in Table 6-1: "Emissions and Removals (Flux) from Land Use, Land-Use Change, and Forestry by Land-Use Change Category."

These values are included in discussions on changes in carbon stocks from forests and land use: they are not combined towards a 62.3 + 12.6 = 74.9 MMTCO2e or 74.9/114.6 = 65% reduction of MSW methane emissions from landfills.

In any case, it should be noted that Massachusetts has waste bans in place such that much degradable organic carbon (e.g., leaves and yard waste, treated and untreated wood and wood waste, and, more recently, commercial food waste) is now prohibited from disposal in Massachusetts landfills. Therefore, undegraded organic carbon in landfills will become a decreasing source for carbon storage. The 2016 draft U.S. GHG Inventory notes that a decrease in generation and an increase in composting has resulted in "a 57% decrease in the quantity of yard trimmings disposed of in landfills since 1990" nationwide. (Page 6-74)

Comment: One commenter supported the separate reporting of biogenic CO_2 obtained from the Massachusetts GHG Reporting Program but noted that it is inconsistent with EPA's GHGRP protocol in that Massachusetts requires reporting of biogenic CO_2 from flaring landfill gas and from oxidation of methane in landfill cover. [WM]

Response: Yes, MassDEP agrees with this comment. The updated 1990 Baseline inventory includes more complete data than EPA GHGRP, for example the biogenic CO_2 emissions from the combustion of landfill gas and the oxidation of methane in landfill cover that are obtained from the Massachusetts GHG Reporting Program.

Biomass Biogenic CO_2 Emissions, Forest Sequestration and Land Use Change Emissions

Comment: One commenter supported MassDEP's decision to continue to account for biogenic CO_2 emissions noting that the recent Paris agreement on climate change re-iterated the importance of forests and other lands as tools to reduce greenhouse gas emissions. [TNC] One commenter supported keeping the reporting of biogenic CO_2 separate from the non-biogenic emissions, in accordance with protocols adopted by The Climate Registry and World Resources Institute. [WM]

Response: MassDEP will continue to develop its accounting for biogenic CO_2. This inventory Update continues to report biogenic emissions separate from non-biogenic emissions.

Comment: One commenter noted that although the data for biogenic carbon sources and sinks may be less available on an annual basis than data for some other sectors, in many cases biogenic data can be checked for accuracy with satellite imaging and increasingly sophisticated national forest carbon datasets (e.g., the Woods Hole National Biomass and Carbon Dataset), complementing verification on the ground. [TNC]

Response: MassDEP and EEA will continue to work towards incorporating biogenic data sets into the Massachusetts GHG inventory.

Issues for Future GHG Inventories

Comment: One commenter disagreed with the decision to leave biosequestration in wetlands and other coastal systems (blue carbon) and carbon sequestration in agricultural and forest soils out of the inventory, in spite of the challenges of adding them to this update. They noted the Massachusetts Division of Ecological Restoration (MassDER) is developing a methodology for quantifying blue carbon in its restoration projects and felt that the inclusion of soil carbon and blue carbon storage estimates in the next GHG inventory update could act to increase the ability of these tools to contribute to the GWSA emissions reduction goals. [TNC]

Response: The CECP Update discusses a 'first edition' Blue Carbon Calculator to determine sequestration and emissions from various MassDER projects. MassDEP will consult with MassDER and EEA on blue carbon and biogenic emissions as methodologies are further developed to estimate state-wide emissions and sequestration from wetlands, coastal systems, forests, and agricultural and forest soils and as appropriate incorporate findings into future GHG inventory updates.

Comment: One commenter would like to better understand the methodology being used in the calculation of SF_6 emissions noted on page 27 of the draft *Statewide Greenhouse Gas Emissions Level: 1990 Baseline and 2020 Business As Usual Projection Update,* published in November 2015. [NGrid]

Response: This reference is to a new Massachusetts regulation, 310 CMR 7.72, regarding the reporting of SF_6. The first data to be reported under this regulation is due in April 2016; therefore, such data has not yet been used in the Massachusetts GHG inventory, and it has not yet been determined if this data will be used in future inventories.

Issues Beyond the Scope of the GHG Inventory

Comment: Several commenters expressed their desire to see more frequent updates to the Massachusetts GWSA 5-Year Progress Report and GWSA Dashboard to demonstrate the effectiveness of existing policies and regulations on reducing GHG emissions. [WBMLP, TG]

Response: EEA regularly updates the GWSA Dashboard. Now that the 2020 CECP Update has been issued, the GWSA Dashboard will be updated with the most recent information and GHG Inventory data. The next 5-Year Progress Report is due January 1, 2018. Note also the response on page 5 above, indicating that the Massachusetts GHG Inventory is updated twice per year.

Comment: One commenter hoped that decisions regarding new and existing energy facilities in Massachusetts will more finely account for the climate change costs and benefits, and avoid making blanket assumptions about carbon balance. The commenter

noted that renewable energy facilities can have different carbon balances based on siting and operation, and provided the following examples: solar arrays sited on land that was cleared of trees versus land that was already cleared; hydropower dams that flood new land versus run-of-the-river or other facilities that don't require a new impoundment; and, efficient wood heat or combined heat and power facilities versus larger-scale less efficient wood electricity facilities. [TNC]

Response: Lifecycle (or embodied) carbon emissions are not included in this inventory, as noted in the draft *Statewide Greenhouse Gas Emissions Level: 1990 Baseline and 2020 Business As Usual Projection Update* (November 2015), due to the continued difficulty in quantifying these emissions and due to GWSA specifying that the inventory is to only include in-state emissions (except for imported electricity). The CECP Update contains information on the Commonwealth's energy strategies in the coming years.

Comment: One commenter noted that the electricity sector in Massachusetts has already made a significant (49%) reduction in GHG emissions from 1990 through 2012 and the electricity ratepayers in Massachusetts "pay a significantly higher price for their leadership and commitment to a clean and diverse power supply." The commenter sought support from the Commonwealth for: 1) developing new technologies to replace old, high emitting, generating plants with new, low emitting, firm generation; and improve the reliability and dependability of new renewable generation; 2) increasing funding from RGGI and RPS proceeds for this new technology; 3) communicating to the federal government that states with high emission rates and low electricity prices should demonstrate effort equal to Massachusetts; and 4) reconciling the GWSA and CECP to show one clear set of goals for each sector. [WBMLP]

Response: As noted in the CECP Update, dated December 31, 2015, the transportation and heating sectors are expected to electrify in coming years while the electric sector is simultaneously decarbonized and electricity use is made more efficient. The CECP Update contains information on the Commonwealth's energy strategies in the coming years.

Comment: One commenter thought that the inventory Update should alert readers to the 2008 recession and any significant impact that may have had on GHG emissions. [TG]

Response: The U.S. Energy Information Administration has a webpage (http://www.eia.gov/environment/emissions/carbon/) that explains economic, weather, and other influences on energy-related emissions each year.

IV. Summary of Changes

The updated 1990 Baseline/2020 BAU Projection has been finalized to reflect the choice of IPCC AR4 as the source of GWPs to be used to determine GHG emissions.

Corrections and Updates: Appendix C, the AR4 spreadsheet of the updated 1990 Baseline inventory, has been revised and republished with the following corrections and updates:

- The May 2016 SGIT Solid Waste module and the April 2016 SGIT release for all other modules are now the source of data for the sectors in the updated 1990 Baseline inventory that still use SGIT modules to calculate GHG emissions.
- The April 2016 SGIT CO2FFC module release corrects the 2012 transportation CO_2 emissions value by removing ethanol from the motor gasoline quantity, consistent with motor gas values in other years.
- The SGIT CO2FFC and Stationary Combustion modules have been updated with fuel data from EIA's June 29, 2016 SEDS release.
- CH_4 emissions and oxidation values from Industrial Landfills as generated by the EPA SGIT Solid Waste module are no longer added into the Inventory.
- CO_2 and N_2O emissions from the application of lime, urea and fertilizer to agricultural and settlement soils, as calculated by the SGIT Land Use, Land Use Change and Forestry (LULUCF) module have been added as part of the Agriculture & Land Use sector.
- Preliminary 2014 data has been added to Appendix C, where available.
- Biogenic data is now complete through 2014.