

## **Citywide Greenhouse Gas (GHG) Emissions Inventory, 2012**

### **GHG Community Inventory Methodology**

The Community inventory follows the recommended methodologies described in ICLEI's Community Protocol unless otherwise noted. As advised in the protocol, IPCC's 2<sup>nd</sup> Assessment GWPs are used in this inventory. When putting together this inventory, the City received assistance from several organizations with regard to data collection and calculations.

Data on electricity consumption was provided by PECO. EPA's eGRID RFC east region emissions factors for the given year were used. Emissions from T&D losses were calculated using the given year's eGRID loss factor. In the years for which emissions and loss factors were not released, the most recently released factors from years prior are used. In the case of Buildings and Stationary Energy Use, PECO information was sorted by rate codes to determine the best fit between Residential and Commercial/Industrial. Commercial and Industrial emissions are combined, as PECO does not differentiate the two within their tariffs. Data related to public transit electric trains and trolleys comes from SEPTA and Amtrack. The electricity consumption data in Water and Wastewater Treatment was gathered from the City's utility bills and recorded separately. The Water and Wastewater consumption was then subtracted from PECO's Commercial/Industrial consumption to avoid double counting.

PECO provides the Street Lighting and Traffic Signal electricity consumption data. Water and Wastewater Treatment electricity data was gathered separately from the City's utility bills. To avoid double counting, these consumption values were subtracted out from PECO consumption data for the Commercial/Industrial sector.

Natural gas consumption information was provided by PGW and sorted by rate codes to determine the best fit between Residential and Commercial/Industrial. The Commercial and Industrial natural gas consumption totals were combined and recorded as one in order to be consistent with the electricity consumption recording. The natural gas consumption data in Water and Wastewater Treatment was gathered from the City's utility bills. These values were subtracted from PGW's Commercial/Industrial consumption, again to avoid double counting. EPA emissions factors were used along with PGW's energy conversion factor. For a comprehensive list of emissions factors used in this inventory, refer to Appendix C.

Water and Wastewater Treatment fuel oil consumption data comes from utility bills, and EPA emissions factors are employed.

Additional Onsite Combustion calculations were made using data from various sources. First, Residential Stationary Combustion calculations were made. Data from the US Census Bureau and the ACS was used to estimate the number of households using various fuel types both in Pennsylvania and in Philadelphia. Residential consumption data by fuel type for Philadelphia was derived by apportioning the given year's statewide consumption data from the EIA by the household data. Emissions factors from the EPA were used for each particular fuel.

An alternative inventory methodology was employed for Commercial Stationary Combustion in 2012. Fuel consumption data was taken from the City's 2013 energy benchmarking report, and the data was normalized by square footage in order to determine total consumption quantities across the city. EPA emissions factors were again used to calculate the emissions associated with each fuel. This is the preferred methodology that will be used moving forward, as the City will continue to collect energy benchmarking data every year.

The City, however, does not have access to energy benchmarking data that would allow a reasonable approximation for calculating 2006 or 2010 Commercial Stationary Combustion. Instead, an alternative methodology is employed, utilizing a couple significant approximations. Statewide commercial consumption data by fuel type, provided by the EIA, was apportioned to Philadelphia using household heating and employment data. As Philadelphia commercial heating data was unavailable, a household-to-employment adjustment factor, calculated from the Philadelphia to Pennsylvania household heating and employment ratios, was the best available approximation. Ultimately, EPA emissions factors were used to calculate emissions due to the consumption of each fuel type.

The additional unaccounted-for emissions from industrial stationary combustion are calculated in a couple steps. First, total industrial emissions outputs are taken from the EPA's SIT Fossil Fuel Combustion Module and are apportioned to Philadelphia by employment. To avoid double counting, the industrial natural gas emissions from PGW, recorded separately as detailed above, and the steam loop emissions, also recorded separately as detailed below, were subtracted from the total Philadelphia industrial emissions.

Emissions from district steam heating comes from facility-level emissions data from the EPA's GHGRP tool. Emissions data was taken from the appropriate steam production facilities, excluding those going toward electricity production since this is accounted for in electricity usage.

Emissions from Industrial Processes were taken from the EPA's GHGRP tool.

Raw emissions data for Natural Gas Distribution Losses comes from the PHMSA 2012 Distribution Annuals data set. The SIT Natural Gas Module was then used to calculate emissions from distribution losses.

Mobile transportation emissions were calculated with EPA's MOVES model; the outputs from the unallocated model were provided by DVRPC. Off Road emissions were calculated from EPA's NONROAD Emissions Model, core model version 2008a. The required input data was provided by DVRPC.

Emissions from Solid Waste were calculated according to the Community Protocol and with the help of the SIT Solid Waste Module. The following data for the city of Philadelphia was gathered from the Streets Department: total waste landfilled, total MSW combusted, LFGTE emissions reductions, and MSW composition percentages. This data was used along with Philadelphia's population in order to

calculate the emissions corresponding to waste sent to landfills and waste combustion. 2010 LFGTE reductions and MSW composition percentages were used in the 2012 inventory, as 2012 data was not available.

Wastewater Treatment process emissions data was provided by PWD. Equations 10.1, 10.8, and 10.9 from the LGOP were used, respectively, to calculate the CH<sub>4</sub> process emissions from incomplete combustion of digester gas, N<sub>2</sub>O process emissions from wastewater treatment without nitrification, and N<sub>2</sub>O process emissions from effluent discharge.