



PHILADELPHIA CITYWIDE GREENHOUSE GAS INVENTORY, 2012

PUBLISHED SPRING 2015



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This document was prepared by the Energy Office and Office of Sustainability at the City of Philadelphia. The offices would like to particularly recognize the efforts of Kate Wessels, former intern at the Office of Sustainability, in producing this inventory. The following agencies provided data and support in ensuring the accuracy of the City's greenhouse gas accounting: Air Management Services (City of Philadelphia), Amtrak, Delaware Valley Regional Planning Commission, PECO, Philadelphia Gas Works, Philadelphia Water, the Streets Department, and Veolia.



METHODOLOGY AND EMISSIONS SCOPE

In 2014, the City moved to a new accounting tool which provides a robust platform for measuring greenhouse gas emissions.

The ClearPath tool provided by ICLEI USA allows users to easily standardize emissions factors and other metrics across multiple reporting years, minimizing year-to-year variation in inventory methodologies.

Emissions are categorized by their scope, which varies based on their source. **SCOPE 1** emissions are those which are directly emitted from sources that are owned or controlled by the entity (the municipal government for the Municipal Inventory and the City of Philadelphia as a whole for the Citywide Inventory), typically through burning fossil fuels on site and through entity-owned or entity-leased vehicle use. **SCOPE 2** emissions are indirect emissions resulting from electricity, heating and cooling, or steam generated off site but purchased by the entity. **SCOPE 3** emissions include indirect emissions from sources that are not owned or controlled by the entity but are related to the entity's activities.

Citywide Inventory

INTRODUCTION

Greenhouse gas inventories provide policymakers with information necessary to assess the existing state of carbon emissions within their jurisdictions and to make decisions on where to focus mitigation efforts. Philadelphia has been tracking greenhouse gas emissions on a regular basis as part of the *Greenworks* commitment to reducing emissions 20 percent by 2015.

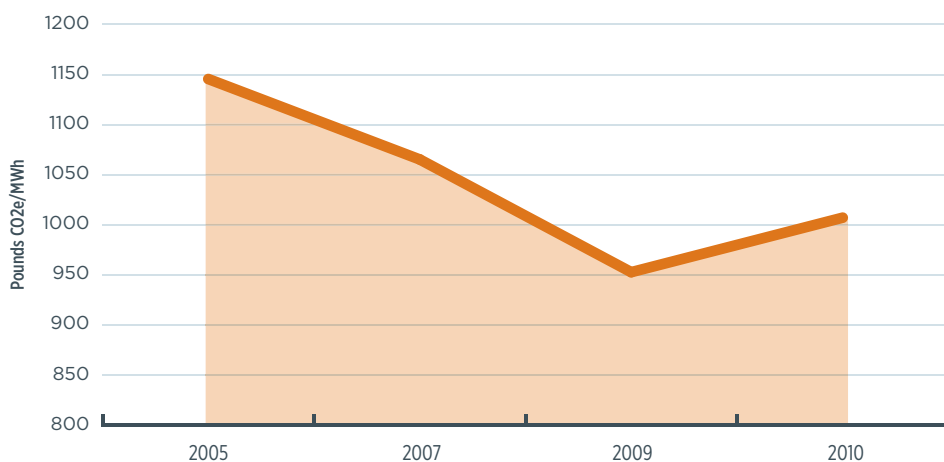
The citywide inventory follows the recommended methodologies described in ICLEI's Community Protocol unless otherwise noted. A detailed methodology and comprehensive list of emissions factors used in this inventory are available online at www.phila.gov/green. This inventory covers emissions from 2012, the most recent year for which all required data is available.

Overall emissions were down nine percent from the 2006 baseline. The majority of this decline can be attributed to a reduction in energy usage in Philadelphia's building stock, which accounts for more than 60 percent of citywide emissions. Variation in weather patterns can influence building energy usage, but efforts by building owners and utilities (as part of the state-mandated Act 129 program) have also played a role in improving the energy performance of Philadelphia's building stock.

Over the past several years, the region's electric grid has reduced its reliance on carbon-intensive energy sources. Between 2005 and 2010 (the most recent PJM grid data available), CO₂-equivalent emissions¹ declined by more than 100 pounds per megawatt hour, an improvement of nearly 14 percent (see Figure 1).

The second-largest source of carbon emissions in Philadelphia is transportation. While vehicle miles travelled (VMT) have declined considerably over the past few years, overall transportation emissions went up slightly between 2010 and 2012, with only a slight decline from the 2006 baseline. Analysis of the VMT data shows that much of this increase is due to heavy-truck traffic through Philadelphia; as the economy has improved following the Great Recession, goods movement up and down the Northeast Corridor has increased transportation-related emissions occurring within city limits.

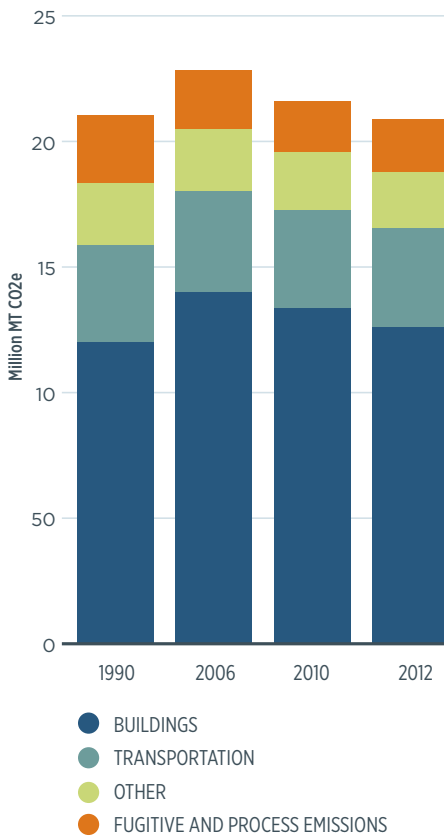
FIGURE 1 CO₂-EQUIVALENT EMISSIONS FROM PJM GRID, 2005-2010



▲ The PJM grid's CO₂-equivalent per capita emissions decreased between 2005 and 2010, reflecting the transition of the region's grid to less carbon-intensive energy sources.

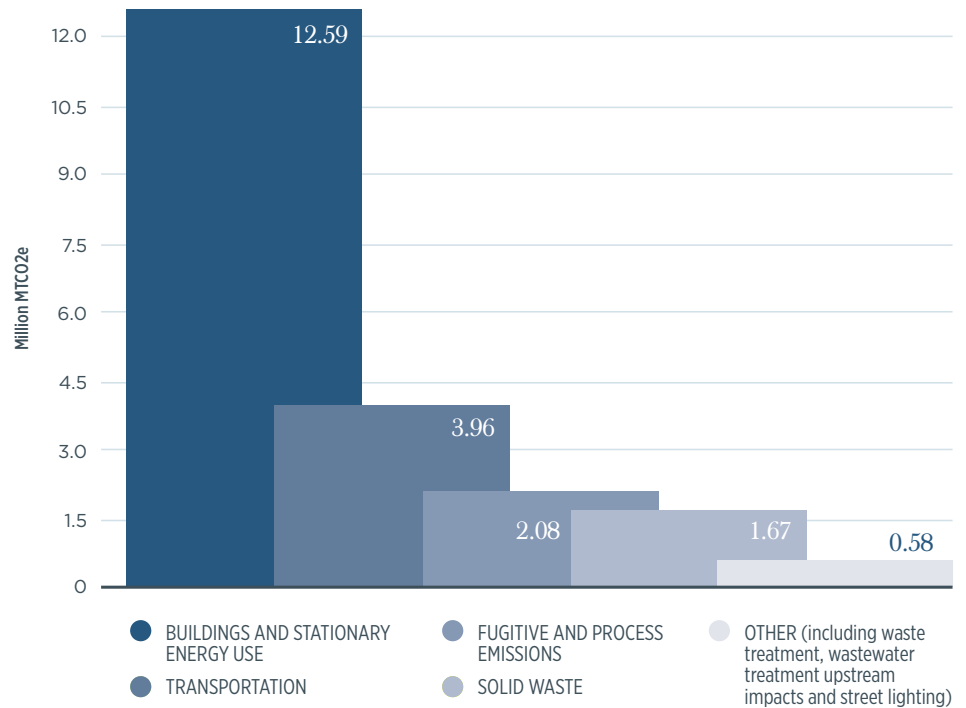
¹ Greenhouse gas emissions from grid operation include carbon dioxide (CO₂), methane (CH₄), and nitrous oxide (N₂O). CO₂-equivalent emissions is a measure that normalizes the intensity of each of these gases to produce a single metric that reflects the carbon output from the electric grid.



FIGURE 2**PHILADELPHIA'S CITYWIDE EMISSIONS OVER TIME**

▲ Philadelphia citywide carbon emissions have decreased by nearly ten percent since 2006, with the largest reduction in the building sector.

One of the biggest declines from 2006 to 2012 is in fugitive emissions, which include leaks from natural gas pipelines and waste from industrial refining. This improvement may reflect a slowing of industrial processes or a tightening of gas infrastructure. As more businesses and residents switch from fuel oil to natural gas for heat, limiting leaks in pipelines—which currently account for around 15 percent of total natural gas emissions citywide—becomes even more critical.

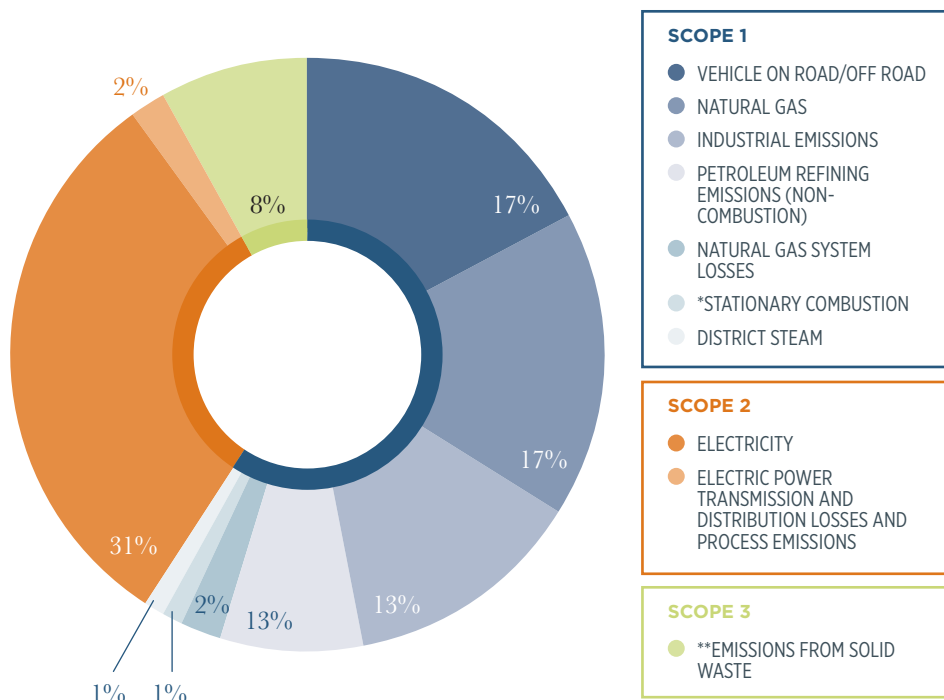
FIGURE 3 PHILADELPHIA'S CITYWIDE EMISSIONS, 2012

▲ The main source of Philadelphia's carbon emissions are buildings and stationary energy use (60 percent of total inventory).

► Indego, Philadelphia's first bike-sharing system, provides residents and visitors with an emissions-free way to get around Philadelphia.



FIGURE 4 CITYWIDE EMISSIONS BY SOURCE AND SCOPE, 2012

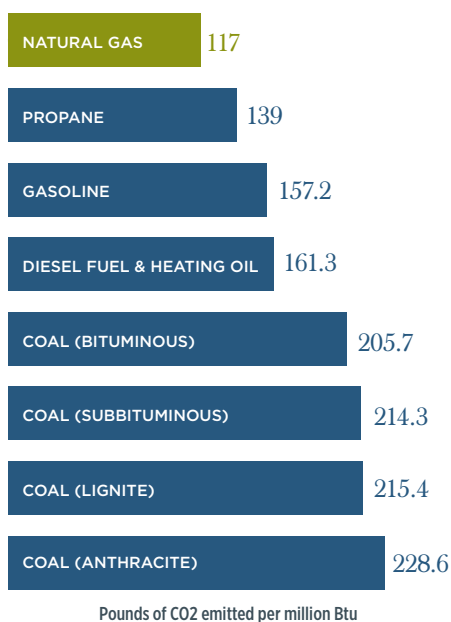


*Other Combustibles include kerosene, LPG, fuel oil, and propane

**Solid Waste landfilling and incineration takes place outside of City boundaries

FIGURE 5

CARBON EMISSIONS BY FUEL TYPE



▲ Natural gas is the least-carbon intense fossil fuel for home heating (Source: Energy Information Agency)

BUILDINGS AND STATIONARY ENERGY USE

There are more than 600,000 buildings in Philadelphia, including homes, schools, office buildings, and factories. Not all of these buildings emit carbon equally, or even on the same scale. Commercial and industrial buildings account for more than twice as many emissions as residential buildings despite representing just a fraction of the building stock, making a focus on these buildings a priority for any carbon mitigation strategy.

Philadelphia's energy benchmarking program is designed to target the largest of these buildings (more than 50,000 ft²), which together account for 14 percent of total emissions citywide. Benchmarking helps building owners measure their facilities' energy performance against themselves and their peers over time, providing the baseline necessary to begin considering energy efficiency investments. In 2014, the Mayor's Office of Sustainability released Year Two benchmarking results for individual buildings, which are available online at www.phila.gov/benchmarking.

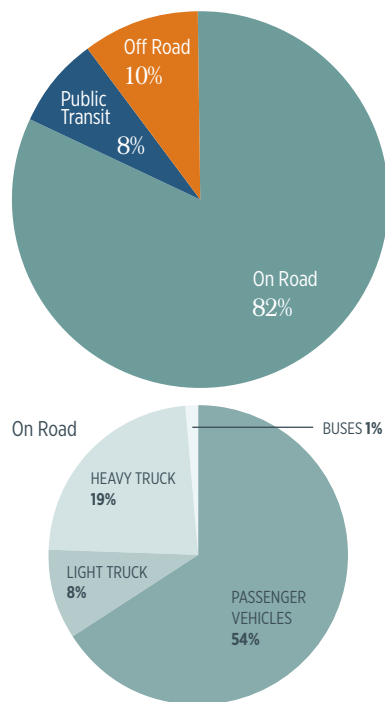
The City and its partners also continue to make progress on improving the energy efficiency of Philadelphians' homes. More than eleven thousand houses were retrofitted as part of the EnergyWorks Residential program and through incentives available by PECO and PGW, and thousands more have been upgraded through the private market. Home energy retrofits will not only improve Philadelphia's carbon footprint but also improve comfort and safety for residents.

Since 2006, citywide carbon emissions from buildings have decreased by more than 11 percent. This is due in large part to fuel switching: emissions from fuel oil have declined by half, as more and more building owners in Philadelphia convert their homes and businesses to natural gas. Though natural gas burns more efficiently than fuel oil (see Figure 5), the environmental impact of gas extraction and transportation is not included in this analysis.



FIGURE 6

TRANSPORTATION EMISSIONS BY VEHICLE TYPE



▲ The majority of the transportation emissions come from on-road passenger vehicles, trucks, and buses.



▲ In 2014 SEPTA added new 40-foot and 60-foot hybrid-electric buses to its fleet to replace aging diesel buses. By the end of 2016, more than half of SEPTA's bus fleet will be hybrid-electric.

TRANSPORTATION

Automobiles are one of the most visible symbols of carbon pollution in America today, and while they are a secondary source of emissions in Philadelphia, the transportation sector still provides an opportunity to mitigate climate change locally. Yet while vehicles miles travelled declined between 2006 and 2012, overall emissions increased two percent during the same period. This is primarily due to a 2012 reclassification of truck traffic within Pennsylvania Department of Transportation traffic models, which more accurately reflect the differentiation between vehicle traffic passing through Philadelphia and short-haul trucks making stops within city limits.

Despite the increase in transportation emissions, the relative contribution of driving to carbon emissions is diminishing. In 2007, the Michigan Eco-Driving Index began tracking the average fuel economy of new vehicles sold, and has found that in the past seven years the average miles-per-gallon of purchased vehicles improved by nearly 25 percent.³ This figure is likely to increase in the coming years, as new federal Corporate Average Fuel Economy (CAFE) standards for vehicle efficiency are implemented for personal cars and trucks.

Locally, SEPTA and Amtrak travel account for less than ten percent of emissions within the transportation sector, and less than two percent citywide (see Figure 6). Trips on public transit have significantly lower climate impacts than automobile and truck traffic (see page 11, "Existing Assets Mitigating Philadelphia's Greenhouse Gas Emissions"), helping to reduce Philadelphia's overall carbon footprint. Similarly, the continued rise in commuting by biking and walking (workers walking and biking to work increased by more than six percent between 2009 and 2012) underscore the value these non-emitting transportation modes have in both improving quality of life and reducing city-wide greenhouse gas emissions.

FUGITIVE AND PROCESS EMISSIONS

Encompassing nearly ten percent of total greenhouse gas emissions in Philadelphia, fugitive and process emissions are a little-known but significant sector within the inventory. Process emissions are often a necessary part of industrial activity, generating goods (and energy) used locally and nationally. In Philadelphia, the biggest source of process emissions is the refinery operated by Philadelphia Energy Solutions. In contrast, fugitive emissions are almost entirely waste, making them a key opportunity for reducing Philadelphia's overall carbon footprint.

Fugitive emissions frequently take the form of losses from the distribution of energy, and Philadelphia's utilities have taken action to reduce these losses. Philadelphia Gas Works (PGW) is responsible for administering natural gas infrastructure that is decades—and in some cases over a century—old, making the responsible repair and replacement of transmission systems challenging. Nonetheless, in recent years PGW has accelerated the rate of gas pipeline repair, helping reduce total fugitive emissions more than 12 percent between 2006 and 2012.

PECO has also played a role in this reduction, particularly through their work in the reduction of sulfur hexafluoride (SF₆), an extraordinarily potent greenhouse gas nearly 25 *thousand* times as damaging as carbon dioxide. PECO estimates that their work in replacing circuit-breakers leaking SF₆ has helped reduce their overall carbon footprint by more than half since 2001.⁴

OTHER EMISSIONS

While buildings, transportation, and fugitive and process emissions encompass the vast majority of Philadelphia's carbon footprint, tracking other, less significant sources of emissions, where there are also opportunities for reductions, is important. These sources include solid waste, water and wastewater treatment, and streetlights and traffic signals. Information on each of these sources is included in the appendix to this report, and also covered in more detail in the 2013 Philadelphia Municipal Greenhouse Gas Inventory, which is available online at www.phila.gov/green.

³ <http://www.umich.edu/~umtriswt/ecodriving.html>

⁴ See <https://www.peco.com/Environment/OurInitiatives/Pages/GreenPractices.aspx>



CLIMATE ADAPTATION PLANNING

In 2011, Philadelphia initiated a climate adaptation planning process focused initially on City-owned assets and services. Climate scientists prepared down-scaled climate projections for Philadelphia through 2100, demonstrating not only that our city will face a hotter and wetter future over the next century but also providing detailed information on climate trends and extremes, including heat waves, heavy-precipitation events, and sea level rise. These projections are available online as *Useful Climate Information for Philadelphia*, at www.phila.gov/green/resources.html

The Mayor's Office of Sustainability will continue climate adaptation planning in 2015 with department-focused work to integrate this science into key decision-making areas through the City of Philadelphia's operations.

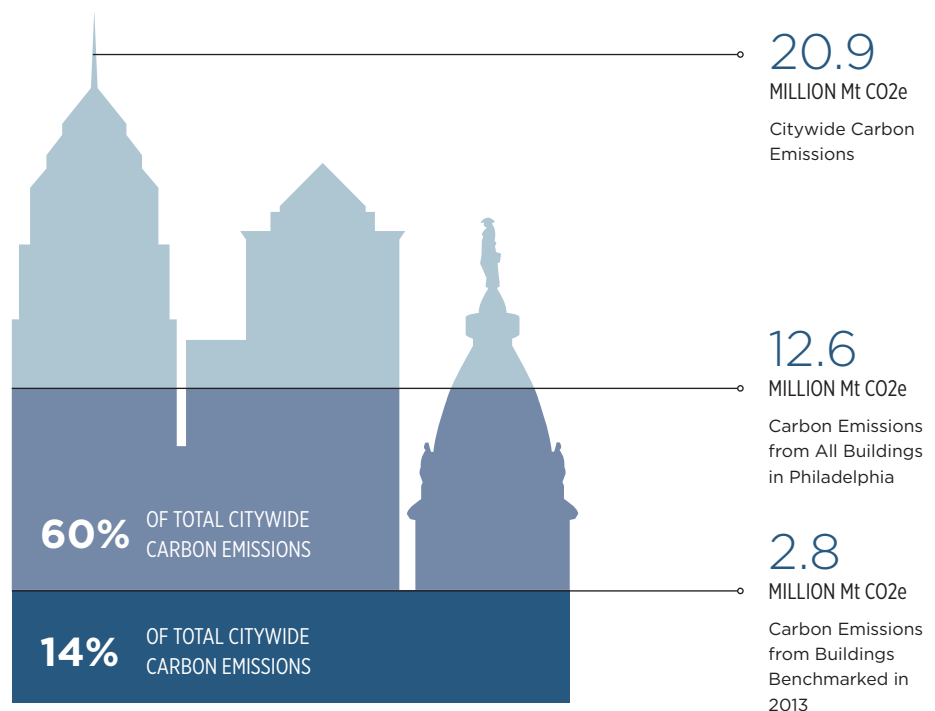
NEXT STEPS

The City of Philadelphia is committed to continued tracking of greenhouse gas emissions. Municipal inventories will be updated on an annual basis, while updates to citywide inventories (which rely on outside information more difficult to obtain on a regular schedule) will come every other year. The City's transition to the ICLEI ClearPath platform will allow for more consistent tracking of greenhouse gas trends in future years.

To translate the information contained in these inventories into action, the City and its partners continue to develop and execute policies intended to help mitigate greenhouse gas emissions. The City completed a guaranteed energy savings project in its largest downtown office buildings (including City Hall) and the energy benchmarking and disclosure program for commercial buildings will help building owners, operators, and tenants better understand the opportunity to save energy and reduce carbon emissions in their facilities. Philadelphia's IndeGo bikeshare program will launch in Spring 2015, providing residents a new emissions-free option for traveling around the city, while new funding through the Act 89 transportation bill will allow SEPTA to invest in existing and expanded transit infrastructure.

These policies can have a significant impact on Philadelphia's carbon footprint, but deeper reductions will be necessary to reach aggressive targets. The City of Philadelphia is currently working with Drexel University to develop a framework for reducing greenhouse gas emissions 80 percent from a current baseline by 2050. Several cities nationally and worldwide have made similar commitments, and the Drexel study will be the first step toward establishing a next target for Philadelphia.

FIGURE 7 PHILADELPHIA'S BENCHMARKED BUILDING'S CARBON EMISSIONS



▲ The 1,900 largest non-residential buildings in Philadelphia account for nearly 15 percent of total emissions, and the City is committed to helping them save energy through its benchmarking and disclosure program.



EXISTING ASSETS MITIGATING PHILADELPHIA'S GREENHOUSE GAS EMISSIONS

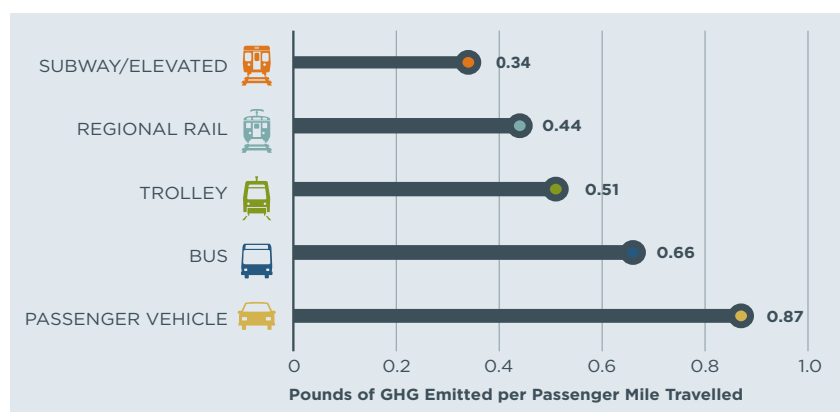
Measuring existing greenhouse gas emissions is an essential part of planning policies for their mitigation, but leaves out an important element when considering the overall carbon footprint of cities: infrastructure *already* in place that helps reduce the carbon footprints of our businesses and residents.

Among the most visible of these is Philadelphia's extensive transit network. SEPTA reaches nearly every part of the city through its subways, trolleys, buses, and trains, and ridership is at highs not seen in decades. The agency maintains its own greenhouse gas accounting, which has shown that the emissions per passenger mile for SEPTA riders can be nearly three times less intense than a private automobile.

A less well known but still impactful asset is Philadelphia's district steam loop, currently managed by Veolia. The steam loop heats hundreds of buildings in Center City and West Philadelphia, and recently converted its fuel source from oil to natural gas, reducing annual carbon emissions by 70,000 metrics tons.⁵

While not explicitly captured in Philadelphia's greenhouse gas inventories, the city's extensive park system is a valuable asset in reducing carbon emissions. In addition to providing quality-of-life benefits, plants naturally sequester carbon, absorbing significant amounts of carbon each year. Recent studies have indicated that older-growth forests (like those found throughout the Fairmount Park system) are particularly effective at sequestration.

EACH SEPTA MODE EMITS LESS GHG PER PASSENGER MILE THAN SINGLE OCCUPANCY VEHICLES



▲ Regardless of mode, riding SEPTA riders emit less carbon per mile than single-occupancy vehicles. (Source: SEPTAinable Annual Report, 2014).

⁵ http://articles.philly.com/2013-01-14/business/36314458_1_veolia-environnement-natural-gas-steam



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