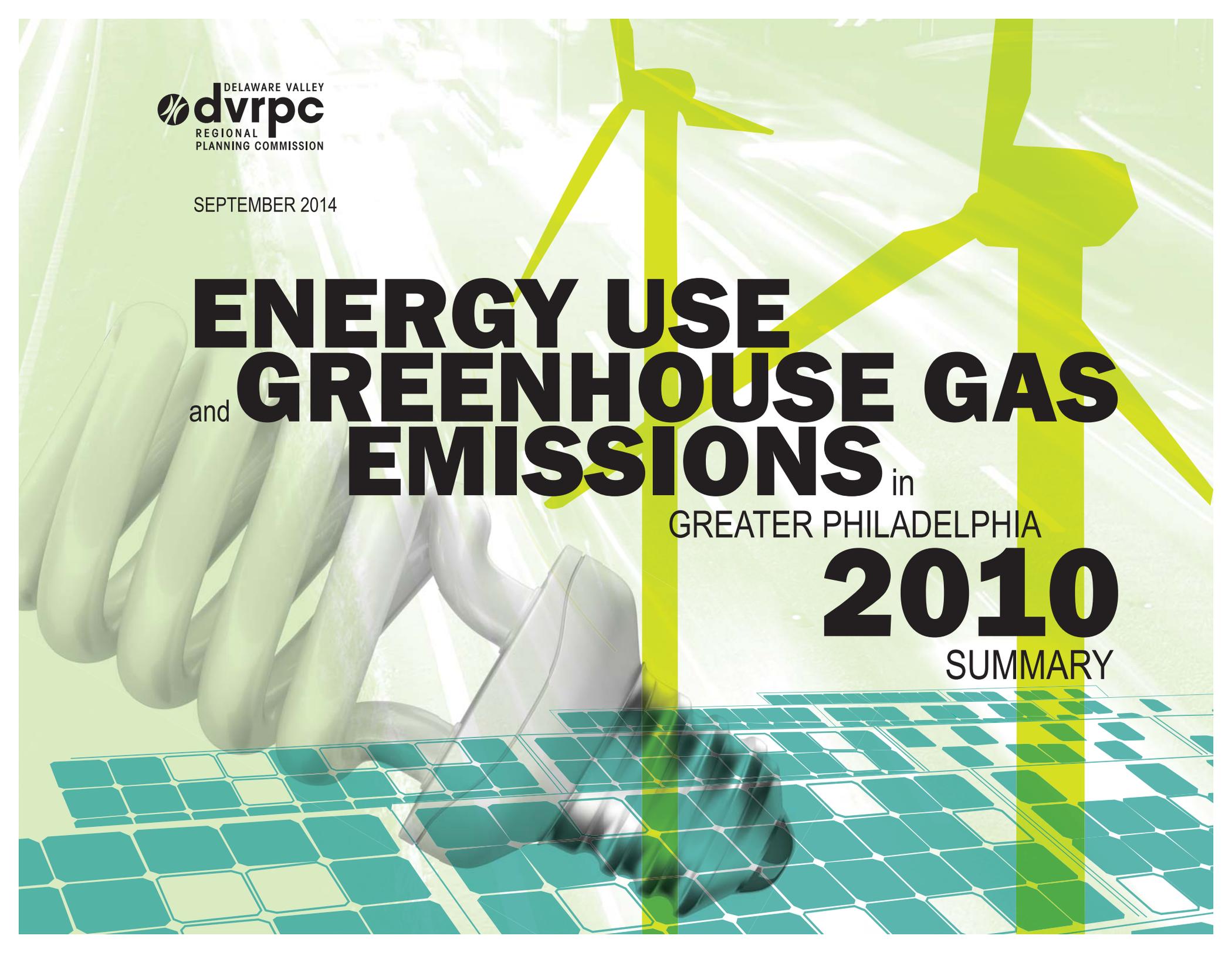


SEPTEMBER 2014



**ENERGY USE**  
and **GREENHOUSE GAS**  
**EMISSIONS** in  
GREATER PHILADELPHIA  
**2010**  
SUMMARY



*The Delaware Valley Regional Planning Commission is dedicated to uniting the region's elected officials, planning professionals, and the public with a common vision of making a great region even greater. Shaping the way we live, work, and play, DVRPC builds consensus on improving transportation, promoting smart growth, protecting the environment, and enhancing the economy. We serve a diverse region of nine counties: Bucks, Chester, Delaware, Montgomery, and Philadelphia in Pennsylvania; and Burlington, Camden, Gloucester, and Mercer in New Jersey. DVRPC is the federally designated Metropolitan Planning Organization for the Greater Philadelphia Region — leading the way to a better future.*



The symbol in our logo is adapted from the official DVRPC seal and is designed as a stylized image of the Delaware Valley. The outer ring symbolizes the region as a whole while the diagonal bar signifies the Delaware River. The two adjoining crescents represent the Commonwealth of Pennsylvania and the State of New Jersey.

DVRPC is funded by a variety of funding sources including federal grants from the U.S. Department of Transportation's Federal Highway Administration (FHWA) and Federal Transit Administration (FTA), the Pennsylvania and New Jersey departments of transportation, as well as by DVRPC's state and local member governments. The authors, however, are solely responsible for the findings and conclusions herein, which may not represent the official views or policies of the funding agencies.

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## Executive Summary

This document provides an overview of energy use and greenhouse gas (GHG) emissions in Greater Philadelphia for calendar year 2010, the most recent year for which complete data are available. DVRPC performs a regional energy use and GHG emissions inventory every five years. Our initial inventory was for 2005. This 2010 inventory is the first update. DVRPC expects to release its 2015 inventory in 2018.

DVRPC's inventory estimates energy use and GHG emissions in the nine-county Greater Philadelphia region (see Figure 1). DVRPC calculated energy use and GHG emissions associated with the residential, commercial, and industrial sectors as well as transportation sectors (on-road transportation, passenger and freight rail, aviation,

**Figure 1:** Nine-County Greater Philadelphia Region



Source: DVRPC 2014

marine transportation, and off-road vehicles). DVRPC also included non-energy GHG emissions resulting from waste management (solid waste and wastewater), agriculture processes (animal and plant related), non-energy-related emissions from industrial processes, and fugitive and process emissions from fuel systems (natural gas systems and petroleum systems). These categories are similar to those used in the U.S. Environmental Protection Agency's *Inventory of U.S. Greenhouse Gas Emissions and Sinks*.

In 2010, activities in the region used energy equivalent to almost 20 times the 2013 net generation output of the Limerick Generating Station in Montgomery County, PA,<sup>1,2</sup> and resulted in the emission of greenhouse gases equivalent to the release of 83 million metric tons of carbon dioxide (MMT<sub>CO<sub>2</sub>e</sub>). When carbon dioxide taken up or released by growth or loss of trees and forests is taken into account, net emissions from the region in 2010 were about 81 MMT<sub>CO<sub>2</sub>e</sub>.

These estimated net annual regional GHG emissions are about 13 percent lower than the 93 MMT<sub>CO<sub>2</sub>e</sub> estimated for 2005.<sup>3</sup> The region's 2010 GHG emissions make up about 1.2 percent of the United States'

<sup>1</sup> 1,290 trillion British thermal units (BTUs). Conversion from Exelon Corporation, *Limerick Generating Station*, Accessed July 2014. Available at: [www.exeloncorp.com/PowerPlants/limerick/Pages/profile.aspx](http://www.exeloncorp.com/PowerPlants/limerick/Pages/profile.aspx).

<sup>2</sup> This accounting of energy use includes all energy contained in fossil fuels consumed directly through combustion as well as the energy contained in fossil fuels, biomass, and uranium used to generate electricity. Due to conversion losses, the energy contained in a fuel does not equate to the energy delivered to the end-user. For instance, it takes about 1.1 pounds of coal containing 9,756 BTUs of energy to generate 1 kWh of electricity, which contains only 3,412 BTUs of energy. Between the generation plant and the point of use, an average six percent of this energy is lost, meaning only 3,213 BTUs are delivered.

<sup>3</sup> Application of more accurate estimation methods used in the 2010 regional energy use and greenhouse gas emissions inventory and applied to 2005 data resulted in an adjustment of net emissions estimated for 2005 from 87.7 MMT<sub>CO<sub>2</sub>e</sub> (previously published) to 93 MMT<sub>CO<sub>2</sub>e</sub>. DVRPC adopted new methods in areas where new data sources became available or where new estimation methods offered a more reliable estimation of energy use and greenhouse gas emissions.

total 2010 GHG emissions. Greater Philadelphia, with roughly 1.8 percent of the nation's population, has a per capita emissions rate of 14.4 metric tons of CO<sub>2</sub>e (MTCO<sub>2</sub>e)—about 35 percent below the national average.<sup>4</sup> Yet, globally, the Greater Philadelphia region's total emissions are comparable to those of Austria, a nation with roughly 1.5 times the population of Greater Philadelphia. For further comparison, China and India, the world's most populous countries, have per capita GHG emissions rates of about eight MTCO<sub>2</sub>e and two MTCO<sub>2</sub>e, respectively.<sup>5</sup>

*Connections 2040: Plan for Greater Philadelphia*, DVRPC's long-range plan for future growth and development, sets a target of reducing 2005 emissions by 50 percent by the year 2035 and calls for a 60 percent drop by 2040 in order to achieve an 80 percent reduction by 2050. A reduction in GHG emissions between 2005 and 2010 helps move the region toward this goal. However, continued reductions will require sustained, concerted, and aggressive action at the household, firm, community, regional, state, national, and global level.

The actions needed to increase energy efficiency and reduce GHG emissions do more than reduce energy costs and our region's contribution to climate change. They also make the transportation network more efficient, improve air quality, bolster public health, and

make the region's communities more livable. An energy-efficient regional economy producing low GHG emissions will not only protect our regional environment but will also be more competitive in a world where climate change is an important concern.

### Strategies to Reduce Greenhouse Gas Emissions

- Use energy more efficiently in buildings and in transportation.
- Produce energy with lower GHG emissions by using lower- and no-carbon fuels to generate electricity and move vehicles.
- Maintain healthy forest lands and plant additional trees and vegetation.
- Reduce the demand for transportation energy by locating jobs, housing, and services closer together and encouraging denser development.

<sup>4</sup> Due to variability in the methods used, economic sectors included, and geographies covered, comparisons between large cities and major metropolitan areas within the United States are difficult to make. However, denser cities, with smaller homes, shorter driving distances, and more extensive public transportation networks, do tend to have lower emissions per capita. In its 2013 *PlaNYC: Inventory of New York City Greenhouse Gas Emissions*, New York City reported a per capita emissions rate of 5.7 MTCO<sub>2</sub>e in 2012, while the City of Baltimore, in its 2007 inventory, reported a per capita emissions rate of 14.9 tons of CO<sub>2</sub>e.

<sup>5</sup> Emissions estimates from the European Commission, Joint Research Centre (JRC)/PBL Netherlands Environmental Assessment Agency. Emission Database for Global Atmospheric Research (EDGAR), release version 4.2, 2011, available at [edgar.jrc.ec.europa.eu](http://edgar.jrc.ec.europa.eu). Country population estimates from U.S. Census Bureau, International Programs, Country Rankings, available at [www.census.gov/population/international/data/countryrank/rank.php](http://www.census.gov/population/international/data/countryrank/rank.php).

## What Is an Energy Use and Greenhouse Gas Emissions Inventory?

An energy use and greenhouse gas (GHG) emissions inventory is an accounting of energy use and greenhouse gases emitted to or removed from the atmosphere over a period of time (e.g., one year) within particular geographic or organizational boundaries. Inventories are performed at regular intervals—starting with a baseline year—to measure progress toward energy use and GHG emissions reduction goals and to help identify the best opportunities to reduce both energy use and GHG emissions. Periodic inventories can reveal long-term trends. Inventories can be performed at multiple scales, from the local to the global. In the United States, some of the most prominent inventories are performed by large cities, states, and the federal government. Organizations, including some corporations, also publish inventories.

Energy use and GHG emissions inventories can be area-based (“in-boundary”), consumption-based, or life-cycle based.

**Area-based inventories** measure all energy use and GHG emissions within a specified area, whether or not that energy use or those emissions result from consumption by that area’s residents. For instance, in an area-based inventory a municipality hosting a regional electricity generation facility would be allocated all the emissions from and energy produced by that facility, even if most of the electricity was consumed by customers outside the municipality.

**Consumption-based inventories** measure energy use and GHG emissions associated with the consumption of resources by a specified population, whether or not that energy use and those emissions occur where that population lives. In a consumption-based inventory, a municipality hosting a regional electricity generation facility would be allocated energy use and emissions based on the electricity consumed by customers in the municipality and based on the generation mix of the electricity grid as a whole.

**Life-cycle based inventories** seek to quantify and add indirect sources of emissions, such as emissions at natural gas drilling sites, to direct emissions, such as combustion of natural gas in homes and businesses.

DVRPC employs a hybrid inventory method, using consumption-based estimates for activities such as electricity generation and automobile travel and area-based estimates for activities such as petrochemical refining and iron and steel manufacturing.

## Why Inventory Energy Use and Greenhouse Gas Emissions?

An energy use and GHG emissions inventory provides the information required to track energy use and GHG emissions trends, develop and prioritize strategies and policies to reduce energy use and GHG emissions, and assess progress toward energy use and GHG emissions reduction goals. An inventory can help policymakers and citizens identify the largest sources of energy use and GHG emissions to help guide actions that will result in the largest decreases.

DVRPC’s *2010 Energy Use and Greenhouse Gas Emissions in Greater Philadelphia* provides regional estimates of energy use and GHG emissions, as well as estimates for each of the counties and municipalities in Greater Philadelphia.<sup>6</sup> DVRPC’s Office of Energy and Climate Change Initiatives works to reduce regional, county, and local energy use and GHG emissions through regional data-sharing, cooperation, and planning and is available to assist counties and municipalities with their own efforts.

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<sup>6</sup> Please see [www.dvrpc.org/webmaps/municipalenergy](http://www.dvrpc.org/webmaps/municipalenergy) for an online tool that provides detailed municipal energy use and GHG emissions estimates.

## DVRPC's Regional Energy Use and Greenhouse Gas Emissions Inventory

DVRPC's *2010 Energy Use and Greenhouse Gas Emissions in Greater Philadelphia* tracks energy use and GHG emissions in three major use and emissions categories and twelve major sectors. These use and emissions categories are:

- Stationary energy use: use of energy in buildings and other stationary applications;
- Mobile energy use: use of energy for propulsion of vehicles and other mobile applications; and
- Other emissions/sequestration sources (not energy use related).

The sectors within each of these categories are shown to the right. These categories and sectors are similar to those used in the U.S. Environmental Protection Agency's *Inventory of U.S. Greenhouse Gas Emissions and Sinks*.

DVRPC's inventory estimates emissions of the three major greenhouse gases: carbon dioxide (CO<sub>2</sub>), methane (CH<sub>4</sub>), and nitrous oxide (N<sub>2</sub>O), as well as hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF<sub>6</sub>). DVRPC uses a blend of "top-down" data (e.g., state fuel consumption estimates), "bottom-up" data (e.g., local consumption data from utilities), and modeling (e.g., DVRPC's regional travel model) to develop estimates of energy use and GHG emissions. The mix of data and other inputs used in this inventory was dictated by availability, existing protocols, and resource limitations. DVRPC's inventory methods and sources are described in detail in *2010 Energy Use and Greenhouse Gas Emissions in Greater Philadelphia: Methods and Sources*.

### GHG Emissions—Categories and Sectors

#### Stationary Energy Use

- Commercial and Industrial
- Residential

#### Mobile Energy Use

- On-road Motor Vehicles
- Rail
- Aviation
- Marine and Port-related
- Off-road Motorized Vehicles and Equipment

#### Other Emissions/Sequestration Sources (not energy use related)

- Fuel Refining, Transmission, and Distribution
- Industrial Processes
- Waste Management
- Agriculture
- Land Use, Land Use Change, and Forestry

## Energy Use and Greenhouse Gas Emissions in Greater Philadelphia

DVRPC estimates that, in 2010, activity in the nine-county Greater Philadelphia region resulted in the use of 1,290 trillion BTUs of energy, costing \$23 billion and equivalent to almost 20 times the 2013 net generation output of the Limerick Generating Station in Montgomery County, PA.<sup>7</sup> This energy use estimate includes energy from fuel consumed within or outside the region to provide electricity to users in Greater Philadelphia, fuels consumed within the region to heat homes and businesses and propel vehicles, and a portion of the energy from fuels consumed outside of the region for motor vehicle trips with an out-of-region origin or destination. About 73 percent of this energy was used by the region's homes, businesses, schools, and other stationary applications. Mobile energy use by motor vehicles, trains, planes,

### BTU

A BTU or British thermal unit is the amount of energy needed to cool or heat one pound of water by one degree Fahrenheit. It is equivalent to about 1055 Joules. A kilowatt hour of electricity contains about 3412 BTUs, and a gallon of gasoline contains about 114,000 BTUs.

ships, and other mobile applications accounted for the remaining 27 percent.

Activity in Greater Philadelphia also resulted in the emission of GHGs equivalent to 83 million metric tons of carbon dioxide (MMTCO<sub>2</sub>e), not including emissions and sequestration from land use, land use change, and forestry. If the net sequestration due to land use change and forestry is considered, emissions decrease to a net total of about 81 MMTCO<sub>2</sub>e.

### Carbon Dioxide Equivalent (CO<sub>2</sub>e)

GHG emissions are generally reported in carbon dioxide equivalent (CO<sub>2</sub>e)—a measure of a gas's global warming potential (GWP) compared to a unit of CO<sub>2</sub>. The GWP takes into account the fact that many gases are more powerful GHGs than CO<sub>2</sub>, per unit mass. For instance, one metric ton of methane has the same global warming effect as 21 metric tons of carbon dioxide over the course of 100 years. The equivalencies, or global warming potentials, used in this inventory are identical to those used in the U.S. Environmental Protection Agency's *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990–2012*. Table 1 below shows the relative global warming potential—expressed in CO<sub>2</sub>e—for the GHGs included in this inventory.

**Table 1:** Global Warming Potentials of Greenhouse Gases

Greenhouse Gas	Global Warming Potential
<b>Carbon Dioxide (CO<sub>2</sub>)</b>	1
<b>Methane (CH<sub>4</sub>)</b>	21
<b>Nitrous Oxide (N<sub>2</sub>O)</b>	310
<b>Hydrofluorocarbons (HFCs)</b>	140-11,700
<b>Perfluorocarbons (PFCs)</b>	6,500-9,200
<b>Sulfur Hexafluoride (SF<sub>6</sub>)</b>	23,900

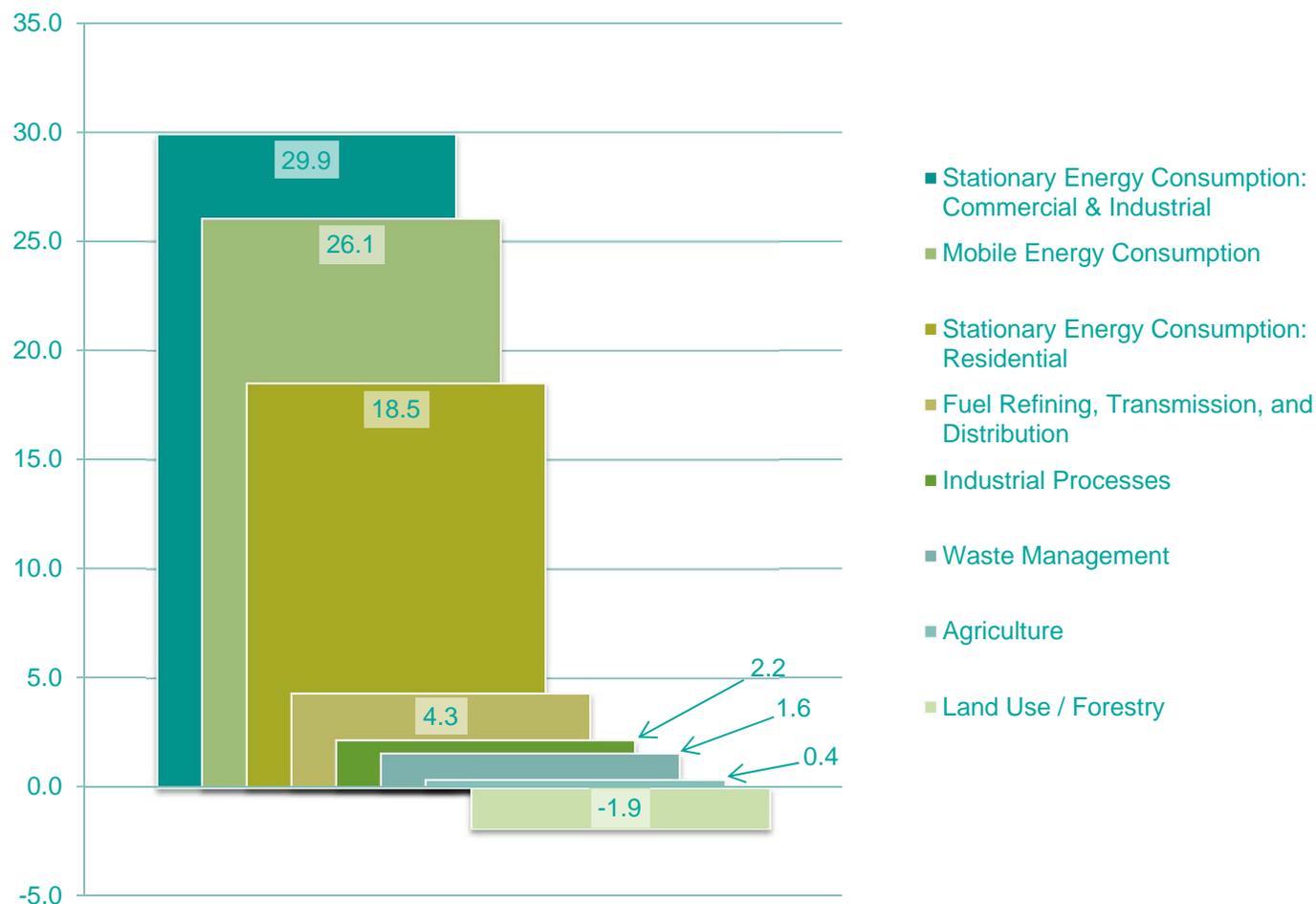
*Source: United States Environmental Protection Agency, Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990–2012, April 15, 2014 and United States Environmental Protection Agency, Climate Change: Overview of Greenhouse Gases, April 17, 2014. Accessed on June 5, 2014 at [www.epa.gov/climatechange/ghgemissions/gases.html](http://www.epa.gov/climatechange/ghgemissions/gases.html)*

<sup>7</sup> Exelon Corporation, *Limerick Generating Station*, Accessed July 2014. Available at: [www.exeloncorp.com/PowerPlants/limerick/Pages/profile.aspx](http://www.exeloncorp.com/PowerPlants/limerick/Pages/profile.aspx).

Of the 83 MMTCO<sub>2</sub>e of GHG emissions, about 90 percent were associated with energy use, comprising stationary energy use by the residential, commercial, and industrial sectors and mobile energy use by the transportation sectors (see Figure 2). Fugitive and process emissions from fuel systems (i.e., leaks from natural gas transmission and distribution infrastructure and leaks and evaporation from

petroleum refining) accounted for 5.2 percent of total emissions. Industrial processes and waste management each accounted for an additional 2.6 percent and 1.9 percent, respectively. Agricultural processes accounted for less than one percent of total emissions. Net sequestration due to land use and forestry reduced overall emissions by about two percent.

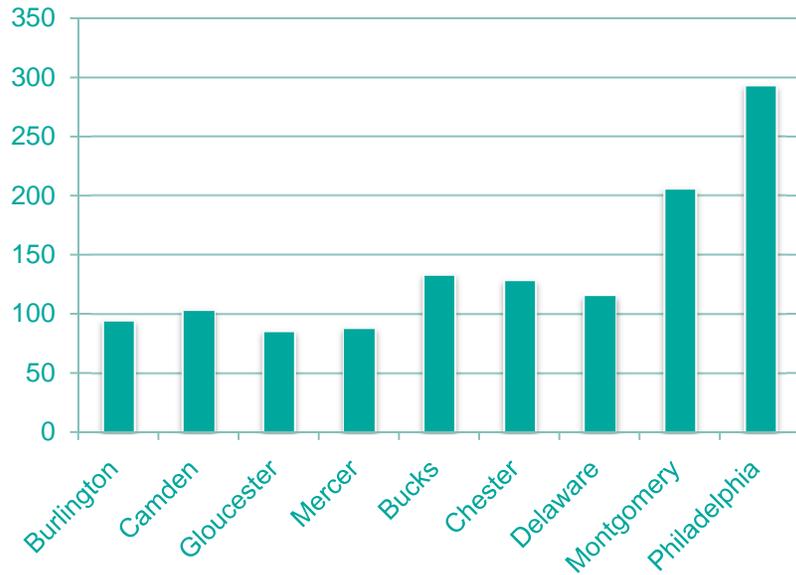
**Figure 2:** Greater Philadelphia's 2010 Greenhouse Gas Emissions (MMTCO<sub>2</sub>e)



Source: DVRPC 2014

Activity in Philadelphia used the most energy, with 293 trillion BTUs (see Figure 3). Activity in Gloucester County used the least energy, with 86 trillion BTUs. However, Philadelphia had the lowest energy use per capita with 130 million BTUs used per person/job,<sup>8</sup> while Gloucester County had the highest energy use per capita at 212 million BTUs per person/job (see Figure 4). Higher per capita energy use in Gloucester County results, in part, from substantial energy use by the county's commercial and industrial sector and a residential population that is lower than other counties in the region. Diffuse development of larger homes, resulting in longer commutes and more driving, also plays a role.

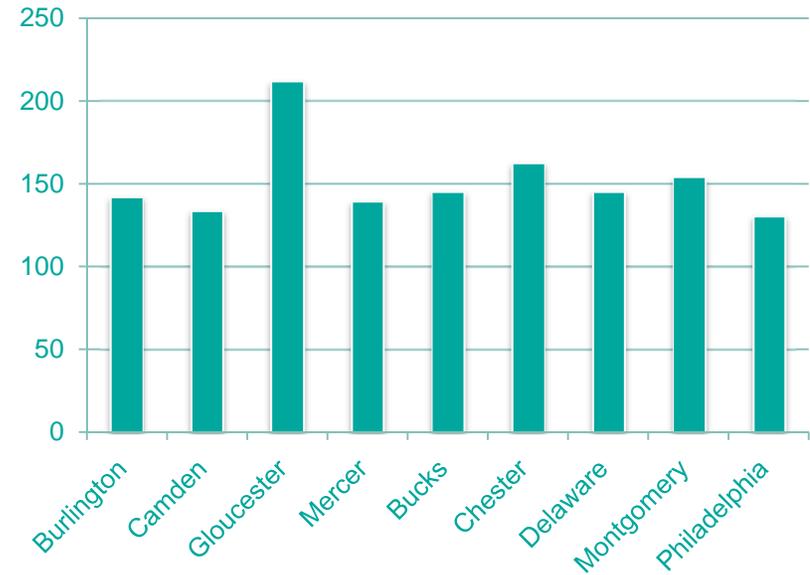
**Figure 3: 2010 Energy Use by County (Trillion BTUs)**



Source: DVRPC 2014

<sup>8</sup> DVRPC combines population and jobs to serve as the basis for a modified per capita calculation that reflects the energy demands of both households and businesses.

**Figure 4: 2010 Energy Use per Capita (Million BTUs per Person/Job)**

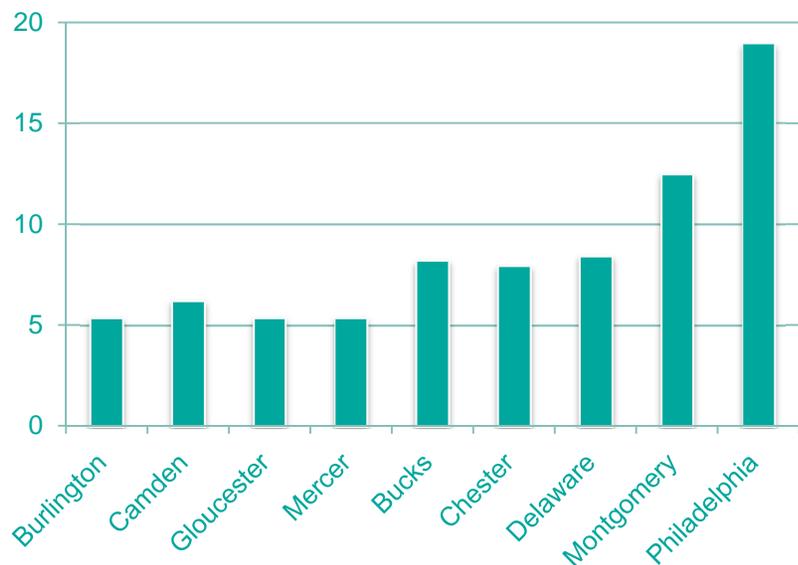


Source: DVRPC 2014

Activity in Philadelphia resulted in the highest GHG emissions,<sup>9</sup> with 19.0 MMTCO<sub>2</sub>e (see Figure 5).<sup>10</sup> Activity in Gloucester and Mercer Counties resulted in the lowest emissions, with 5.38 MMTCO<sub>2</sub>e each. Camden County had the lowest emissions per capita, with 8.2 metric tons of CO<sub>2</sub>e per person/job, while Gloucester County had the highest emissions per capita, with 14.0 metric tons of CO<sub>2</sub>e per person/job (see Figure 6). Again, higher per capita GHG emissions in Gloucester

County result in part from substantial energy use by the county's commercial and industrial sector and emissions resulting from that use, but it is further increased by industrial process and fugitive (non-energy) emissions from petroleum refining facilities located in the county. Diffuse development again also plays a role.

**Figure 5:** 2010 Greenhouse Gas Emissions by County (MMTCO<sub>2</sub>e)

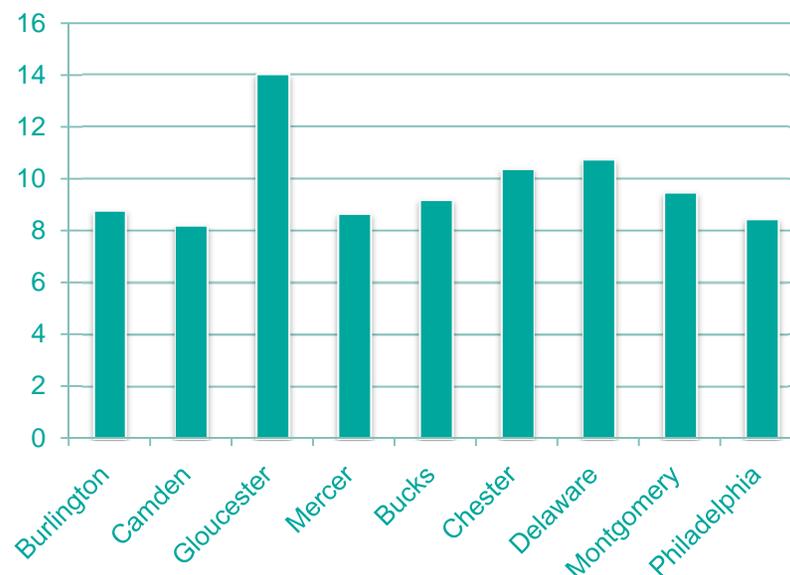


Source: DVRPC 2014

<sup>9</sup> In this section, emissions reported take into account carbon sequestered (stored) in urban and forest trees.

<sup>10</sup> In *Greenworks: 2014 Progress Report*, the City of Philadelphia estimates that activity in the city resulted in the emission of 21.33 tons of CO<sub>2</sub>e in 2010. Differing estimation methods and data availability contribute to this difference. DVRPC uses methods that can be replicated with data available across the region, whereas the City of Philadelphia, in some cases, uses methods and data that are available only in the city.

**Figure 6:** 2010 Greenhouse Gas Emissions per Capita (MTCO<sub>2</sub>e per Person/Job)



Source: DVRPC 2014

## Land Use, Energy Use, and Greenhouse Gas Emissions in Municipalities

The following maps (Figures 8–13), placed on facing pages, compare per acre and per capita<sup>11</sup> energy use and GHG emissions at the municipality level. Communities with walkable, mixed-use neighborhoods; near transit infrastructure; and with smaller houses tend to use less energy and produce lower GHG emissions per capita (see Figures 9, 11, and 13).<sup>12</sup> These communities tend to be in the region’s historic core and in its transit-connected suburbs. *Connections 2040: Plan for Greater Philadelphia* calls for continued investment in these already-established communities or “Centers.” As the region continues to grow, focusing new development in these areas will be essential to achieving energy use and greenhouse gas emissions reduction goals, as well as to building vibrant, walkable communities.

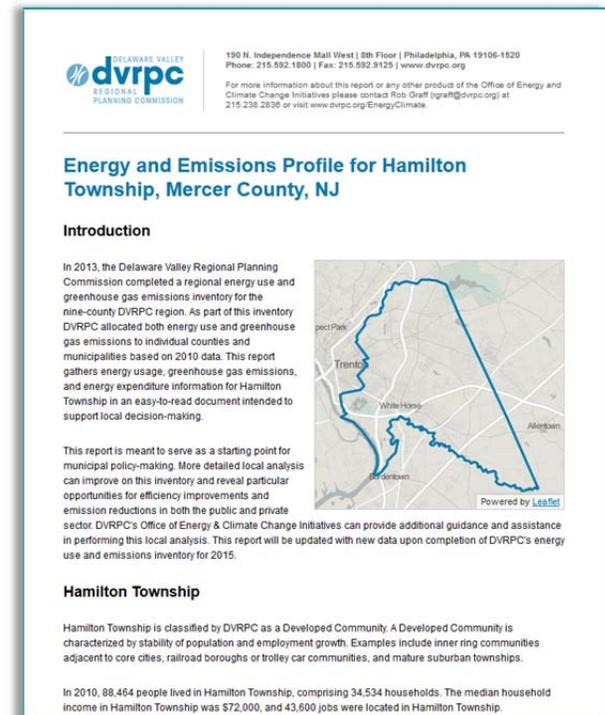
When the sequestration of carbon dioxide by forests is taken into account (see Figures 12 and 13), sparsely populated, heavily forested municipalities also share in lower net per capita GHG emissions, pointing to the importance of conservation of the region’s forests and natural areas as embodied in *Connection 2040*’s Greenspace Network and Conservation Focus Areas.

For the 2010 inventory, DVRPC developed an online tool that provides detailed municipal-level reports of energy use and GHG emissions (see Figure 7). Energy use and GHG emissions in these reports are sometimes based on reported data, but in other cases reflect estimates

based on population, economic data, and other factors. Not all emissions estimated at the regional level have been allocated to the municipal level. Though in some cases more refined analysis could be performed locally, this allocated energy use and emissions data can be useful in prioritizing local strategies to reduce energy use and greenhouse gas emissions.

DVRPC’s tool for creating detailed municipal-level energy use and greenhouse gas emissions profiles is available at [www.dvrpc.org/webmaps/municipalenergy](http://www.dvrpc.org/webmaps/municipalenergy).

**Figure 7:** Municipal Energy Use and Greenhouse Gas Emissions Profile Report

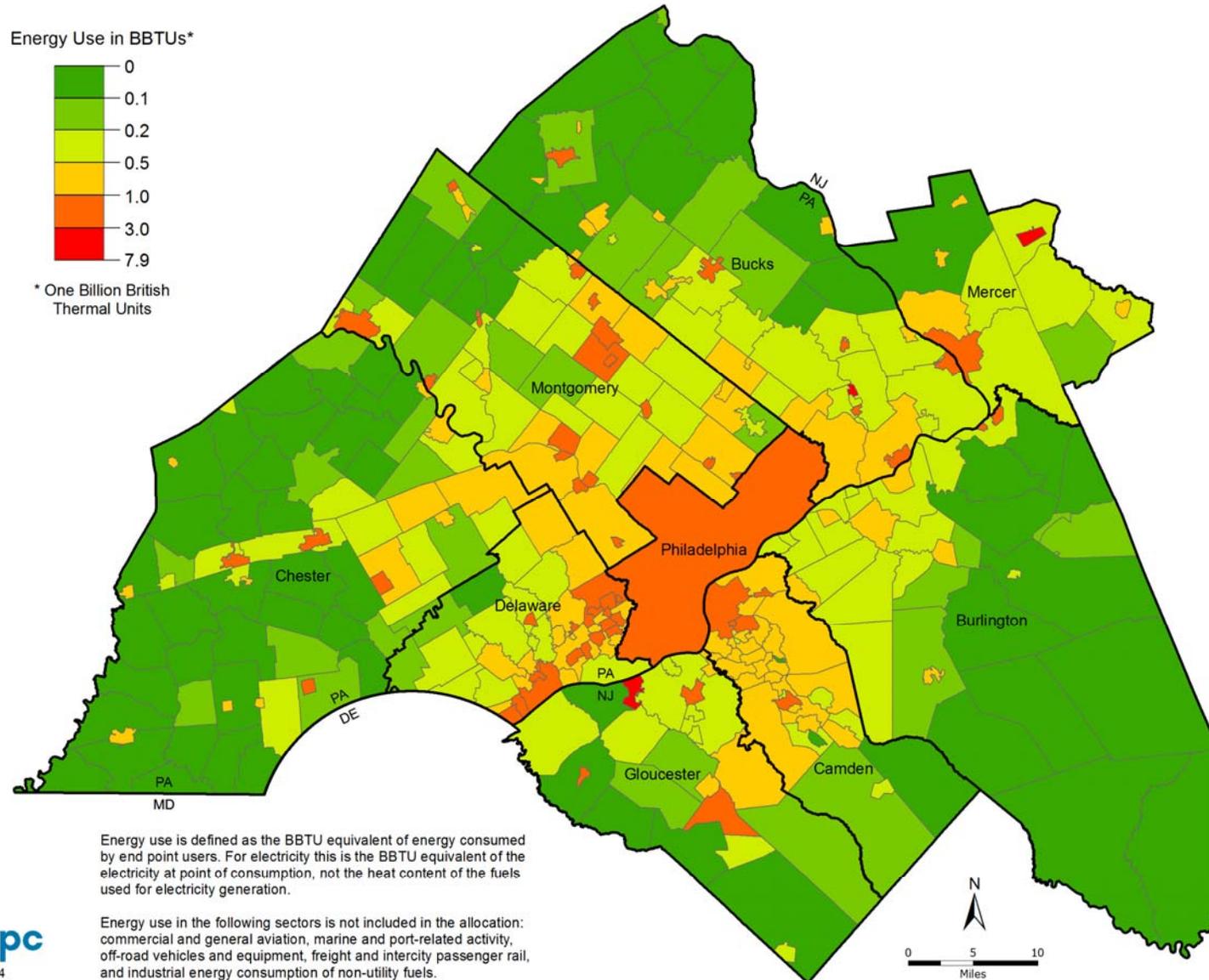


Source: DVRPC

<sup>11</sup> As noted elsewhere, DVRPC combines population and jobs to serve as the basis for a modified per capita calculation that reflects the energy demands of households and businesses in any particular municipality.

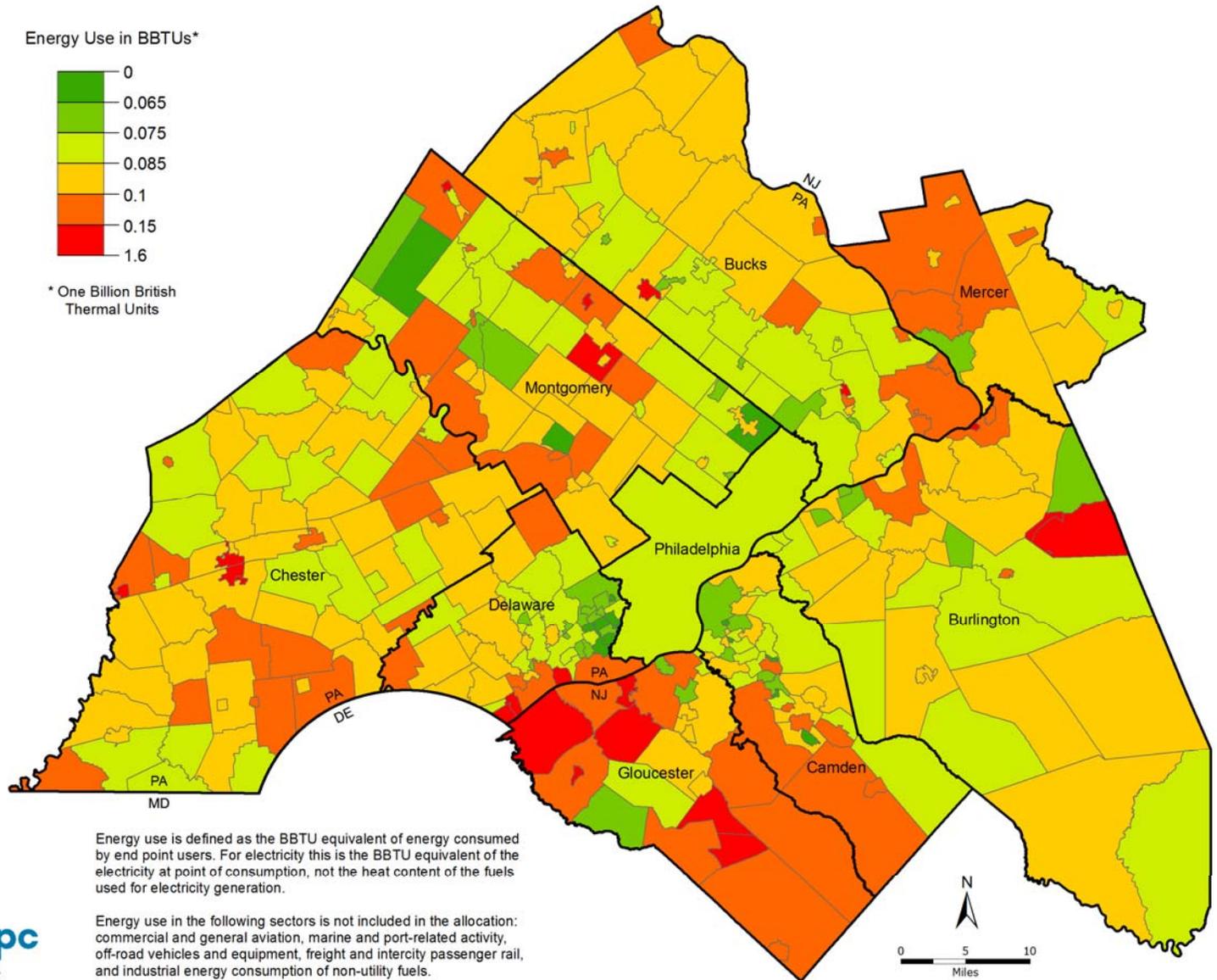
<sup>12</sup> For purposes of municipal reporting, energy use includes all energy contained in fossil fuels consumed directly through combustion as well as the energy delivered to end-users in the form of electricity. It does not include the additional energy contained in fossil fuels, biomass, and uranium used to generate electricity.

**Figure 8: 2010 Energy Use per Acre by Municipality (BBTUs)**



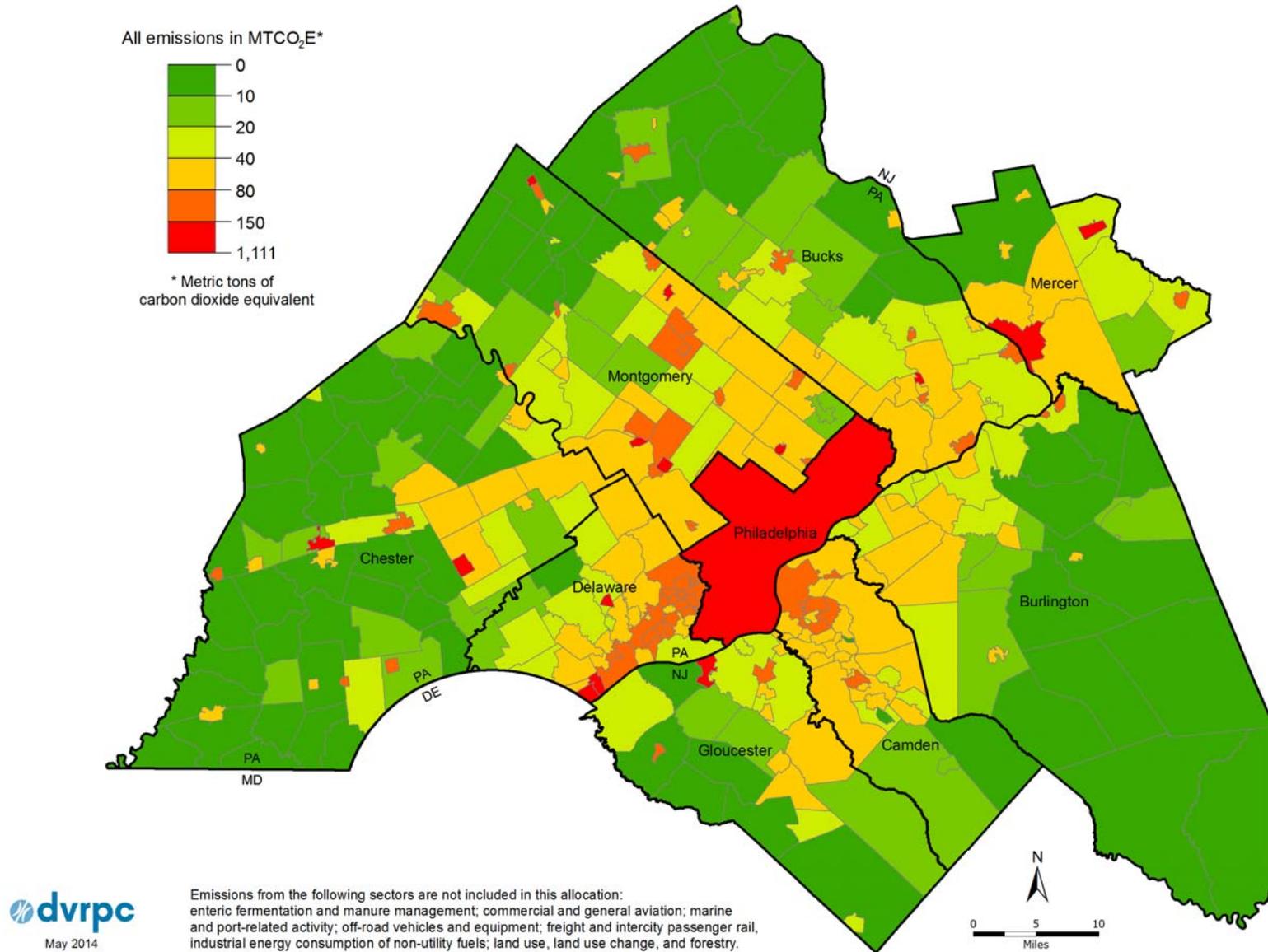
Source: DVRPC 2014

**Figure 9: 2010 Energy Use per Population + Employment by Municipality (BBTUs)**



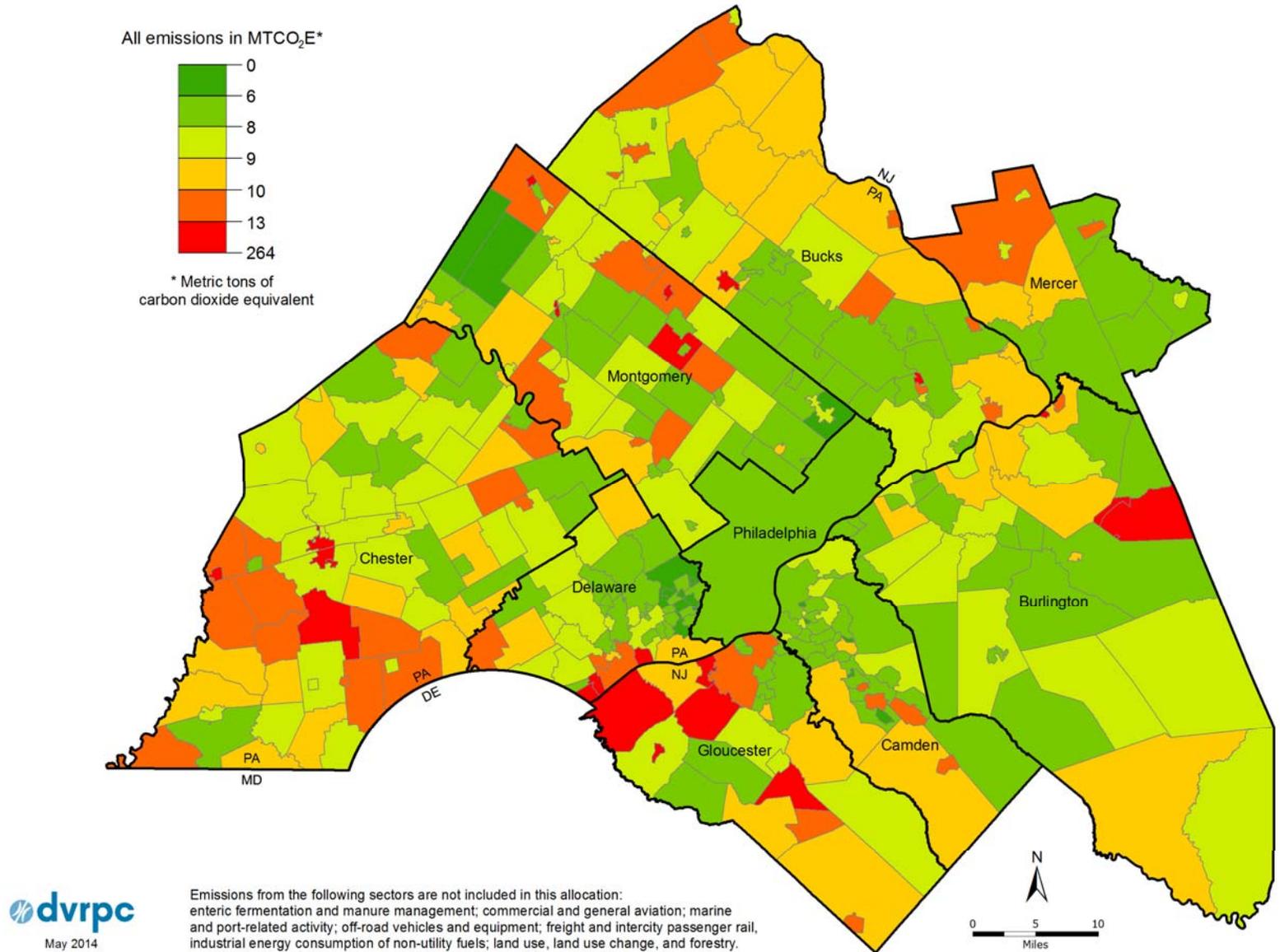
Source: DVRPC 2014

**Figure 10:** 2010 Greenhouse Gas Emissions per Acre by Municipality (MTCO<sub>2</sub>e)



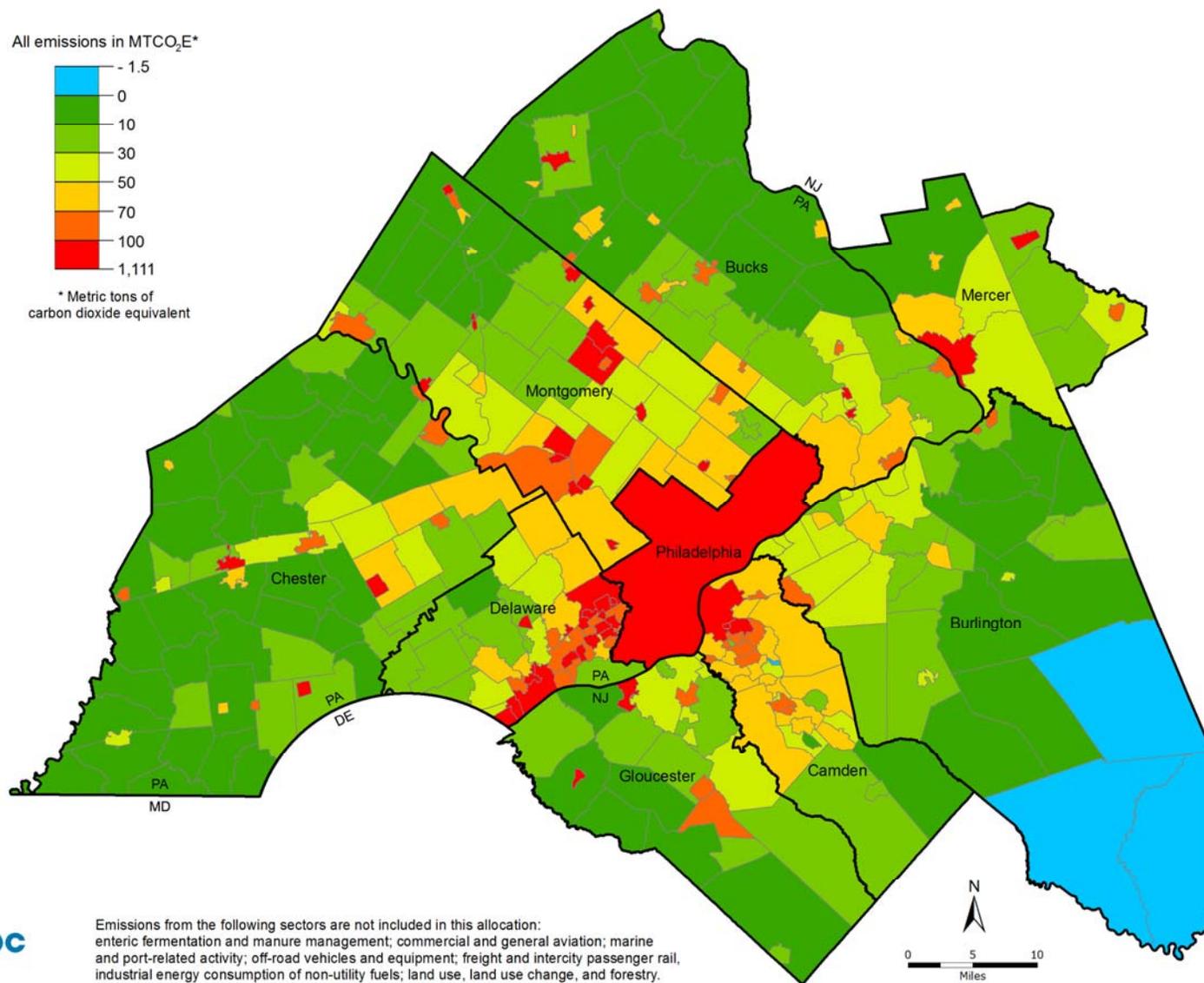
Source: DVRPC 2014

**Figure 11: 2010 Greenhouse Gas Emissions per Population + Employment by Municipality (MTCO<sub>2</sub>e)**



Source: DVRPC 2014

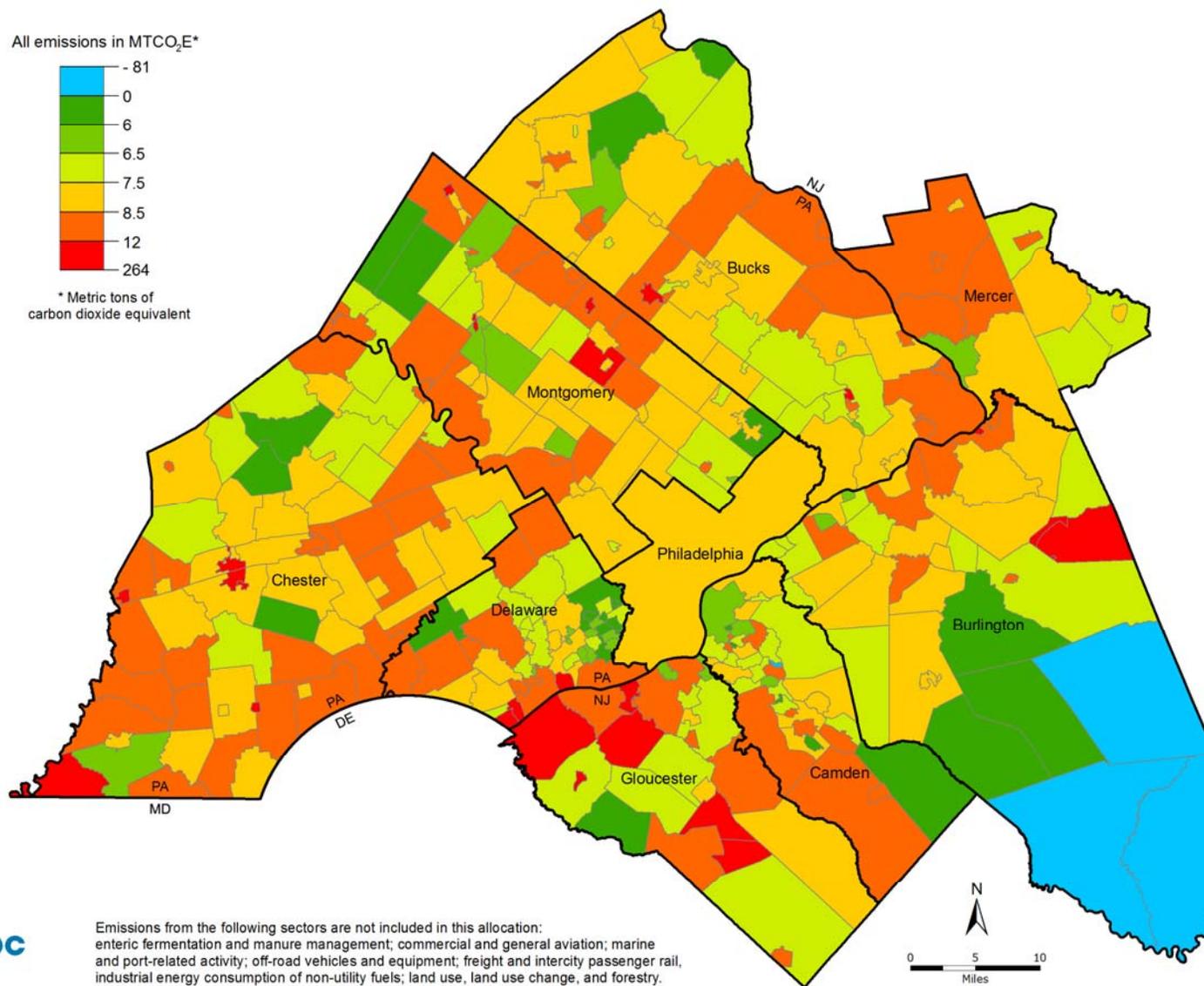
**Figure 12:** 2010 Greenhouse Gas Emissions/Sequestration Including Land Use, Land Use Change, and Forestry per Acre by Municipality (MTCO<sub>2</sub>e)



Emissions from the following sectors are not included in this allocation: enteric fermentation and manure management; commercial and general aviation; marine and port-related activity; off-road vehicles and equipment; freight and intercity passenger rail, industrial energy consumption of non-utility fuels; land use, land use change, and forestry.

Source: DVRPC 2014

**Figure 13:** 2010 Greenhouse Gas Emissions/Sequestration Including Land Use, Land Use Change, and Forestry per Population + Employment by Municipality (MTCO<sub>2</sub>e)



Source: DVRPC 2014

## Where Have We Been? Where Are We Going?

*Connections 2040: Plan for Greater Philadelphia* sets a target of reducing regional GHG emissions to 50 percent below their 2005 levels by the year 2035 and calls for a 60 percent drop by 2040 in order to achieve an 80 percent reduction by 2050. DVRPC estimates that net emissions decreased by about 13 percent, from 93 MMTCO<sub>2</sub>e to 81 MMTCO<sub>2</sub>e, between 2005 and 2010 (see Table 2). This overall decrease reflects decreases in all major use sectors, with the largest decreases in GHG emissions associated with stationary energy use by the residential, commercial, and industrial sectors.

**Table 2:** Regional Greenhouse Gas Emissions in 2005 and 2010 (MMTCO<sub>2</sub>e)

	Greenhouse Gas Emissions (MMTCO <sub>2</sub> e)	
	2005	2010
<b>Stationary Energy Use: Commercial and Industrial</b>	33.6	29.9
<b>Mobile Energy Use</b>	27.3	26.1
<b>Stationary Energy Use: Residential</b>	21.2	18.5
<b>Fuel Refining, Transmission, and Distribution</b>	6.5	4.3
<b>Industrial Processes</b>	3.2	2.2
<b>Waste Management</b>	2.2	1.6
<b>Agriculture</b>	0.5	0.4
<b>Total Emissions (Gross)</b>	<b>94.5</b>	<b>83.0</b>
<b>Land Use, Land Use Change, and Forestry</b>	-1.3	-1.9
<b>Total Emissions (Net)</b>	<b>93.2</b>	<b>81.1</b>

Source: DVRPC 2014

Regional energy use decreased approximately four percent, from 1,340 trillion BTUs to 1,290 trillion BTUs (see Table 3). Energy use decreased by five percent in the residential sector and almost 11 percent in the mobile use category, while increasing by over one percent in the combined commercial and industrial sector. While overall energy use decreased, overall electricity demand increased by about one percent (569 gigawatt hours) (see Table 4).

**Commercial and industrial sector:** GHG emissions resulting from stationary energy use by the combined commercial and industrial sector decreased by 11 percent (3.7 MMTCO<sub>2</sub>e). GHG emissions associated with direct fossil fuel consumption decreased by

**Table 3:** Regional Energy Use in 2005 and 2010 (Trillion BTUs)

	Energy Use (Trillion BTUs)	
	2005	2010
<b>Commercial and Industrial</b>	573	582
<b>Residential</b>	384	363
<b>Mobile</b>	384	342
<b>Total Energy Use</b>	<b>1,340</b>	<b>1,290</b>

Source: DVRPC 2014 (items do not add to totals due to rounding)

**Table 4:** Regional Electricity Use in 2005 and 2010 (Gigawatt Hours)

	Electricity Use (Gigawatt Hours)	
	2005	2010
<b>Commercial and Industrial</b>	34,276	34,330
<b>Residential</b>	20,081	20,601
<b>Mobile</b>	552	548
<b>Total Electricity Use</b>	<b>54,910</b>	<b>55,479</b>

Source: DVRPC 2014 (items do not add to totals due to rounding)

nine percent (1.3 MMTCO<sub>2</sub>e). This was due to both a reduction in BTUs of fossil fuels consumed and an overall shift to natural gas from other fossil fuels with higher carbon content. A less carbon-intensive electricity generation mix (less coal and oil; more natural gas) and a decrease in the grid loss factor (the amount of electricity lost during transmission and distribution) were responsible for the remaining 2.4 MMTCO<sub>2</sub>e decrease in GHG emissions by this sector. A relatively small increase in electricity consumption of only 0.2 percent (54 GWh) offset these effects only slightly.

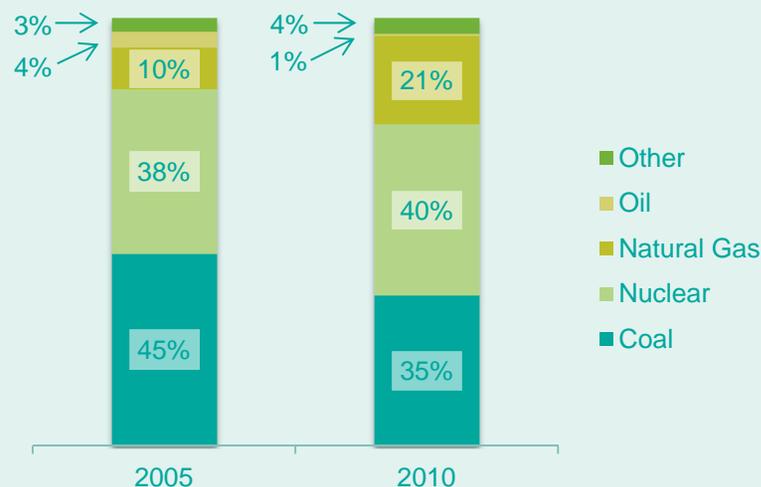
**Residential sector:** GHG emissions resulting from stationary energy use by the residential sector decreased about 13 percent (2.7 MMTCO<sub>2</sub>e). A decrease in natural gas consumption contributed approximately 0.7 MMTCO<sub>2</sub>e to this decrease, while a decrease in consumption of other fossil fuels, primarily heating oil, contributed another 0.7 MMTCO<sub>2</sub>e. A less carbon-intensive electricity generation mix and decrease in the grid loss factor resulted in a 10 percent (1.2 MMTCO<sub>2</sub>e) decrease in emissions attributable to electricity consumption by this sector, despite a three percent (520 GWh) increase in electricity consumption.

**Mobile energy use:** GHG emissions from mobile energy use decreased by about four percent (1.2 MMTCO<sub>2</sub>e). GHG emissions from motor vehicles, which in 2005 and 2010 accounted for over 80 percent of all emissions from mobile sources, decreased about one percent (0.3 MMTCO<sub>2</sub>e). Emissions from aviation decreased 30 percent (0.9 MMTCO<sub>2</sub>e). Marine and port-related mobile emissions decreased by 28 percent (0.1 MMTCO<sub>2</sub>e), while emissions from off-road vehicles increased by 13 percent (0.2 MMTCO<sub>2</sub>e).

## Electricity Generation and Emissions

The mix of fuels used to generate electricity plays a significant role in regional GHG emissions. If the region had met its 2010 electricity demand with its 2005 electricity generation mix, GHG emissions from electricity generation would have increased by about 0.3 MMTCO<sub>2</sub>e (about one percent). Instead, a less carbon-intensive generation mix (see Figure 14) and a reduced grid loss factor together contributed to a 3.6 MMTCO<sub>2</sub>e (about 12 percent) decrease in GHG emissions from electricity generation despite an increase of about one percent in demand for electricity.

**Figure 14:** DVRPC Electricity Generation Mix in 2005 and 2010



Source: United States Environmental Protection Agency (U.S. EPA), Emissions & Generation Resource Integrated Database (eGRID), "Year 2010 Summary Tables" (released February 2014) and "Year 2005 Summary Tables" (released September 2008). DVRPC falls within the RFC East subregion used by the U.S. EPA to classify emission rates and generation mixes. RFC East is the eastern part of the ReliabilityFirst Corporation's territory and contains much of Pennsylvania and New Jersey, and several other Mid-Atlantic states.

**Non-energy sources:** Overall GHG emissions from non-energy sources (e.g., industrial processes, agriculture) decreased by 32 percent (4.0 MMTCO<sub>2</sub>e). This use category includes a large estimated drop, 2.2 MMTCO<sub>2</sub>e or 33 percent, in process and fugitive emissions from fuel refining, transmission, and distribution—a result of decreased petroleum refining activity in the region. Smaller numerical decreases occurred in other industrial processes (1.1 MMTCO<sub>2</sub>e or 33 percent), waste management (0.7 MMTCO<sub>2</sub>e or 29 percent), and agriculture (0.1 MMTCO<sub>2</sub>e or 16 percent).

Without more information, it is difficult to determine which of these decreases resulted from changes in practices and efficiencies between 2005 and 2010 and which merely resulted from reduced production in a slowed economy or from variation in the source data. For some sectors and some fuels, such as heating oil and propane, data is sparse and of limited reliability, resulting in additional uncertainty.

## Conclusion: Reducing Energy Use and Greenhouse Gas Emissions in Greater Philadelphia

A reduction in GHG emissions between 2005 and 2010 helps move the region toward the *Connections 2040* targets of reducing GHG emissions by 50 percent by the year 2035 (in comparison to 2005), 60 percent by 2040, and 80 percent by 2050. Further reductions will require sustained, concerted, and aggressive action at the household, firm, community, regional, state, national, and global level.

The actions needed to increase energy efficiency and reduce GHG emissions do more than reduce energy costs and our region's contribution to climate change. They also make the transportation network more efficient, improve air quality, bolster public health, and

make the region's communities more livable. An energy-efficient regional economy producing low GHG emissions will not only protect our regional environment, but it will also be more competitive in a world where climate change is an important concern.

DVRPC is committed to fostering sustainability, equity, and innovation in Greater Philadelphia. Increasing energy efficiency and decreasing the region's GHG emissions is a goal that motivates activities at DVRPC as varied as planning for transit-accessible, compact, mixed-use communities to administering the RideECO transit benefit program. For more information on DVRPC's activities, please visit our website at [www.dvrpc.org](http://www.dvrpc.org).

DVRPC's Office of Energy and Climate Change Initiatives leads the agency's energy efficiency, energy use and GHG emission, and climate change resiliency efforts. For more information or for assistance with local energy use and GHG emission reduction initiatives, please visit [www.dvrpc.org/EnergyClimate](http://www.dvrpc.org/EnergyClimate).

## Methods and Sources

Please refer to *2010 Energy Use and Greenhouse Gas Emissions in Greater Philadelphia: Methods and Sources* for detailed descriptions of the methods used to calculate and estimate energy use and emissions in Greater Philadelphia as well as a complete list of sources.

## Acknowledgments

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# 2010 Energy Use and Greenhouse Gas Emissions in Greater Philadelphia

## Summary

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**Geographic Area Covered:**

Nine-County Greater Philadelphia region, comprised of Bucks, Chester, Delaware, Montgomery, and Philadelphia counties in Pennsylvania, and Burlington, Camden, Gloucester, and Mercer counties in New Jersey.

**Key Words:**

Energy, Greenhouse Gas, Emissions, Climate Change, Inventory

**Abstract:**

In this regional energy use and greenhouse gas emission inventory, DVRPC estimates energy use and greenhouse gas emissions in the nine-county Greater Philadelphia region in 2010. This inventory is the first since DVRPC's initial inventory of 2005 greenhouse gas emissions. *2010 Energy Use and Greenhouse Gas Emissions in Greater Philadelphia: Summary* describes the scope and findings of the inventory of 2010 energy use and greenhouse gas emissions. In addition to this summary, more information can be found at:  
[www.dvrpc.org/EnergyClimate/Inventory.htm](http://www.dvrpc.org/EnergyClimate/Inventory.htm).

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