

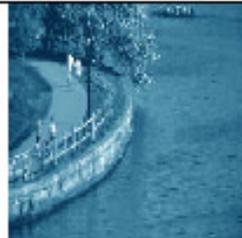
Local Action Plan for Climate Change



City of Philadelphia
April 2007



PREPARED BY CITY OF PHILADELPHIA, SUSTAINABILITY WORKING GROUP





Executive Summary

In response to growing concern about sustainability in general, and global climate change in particular, the City of Philadelphia has joined several national and international initiatives seeking to reduce greenhouse gas (GHG) emissions. These commitments include:

- **Cities for Climate Protection® (CCP) Campaign of ICLEI-Local Governments for Sustainability** – In 1999 the City committed to a goal to reduce Philadelphia greenhouse gases to 10 percent below 1990 levels by 2010.
- **US Mayors' Climate Protection Agreement of the US Conference of Mayors** – In 2005 the City agreed to meet or beat the GHG reduction targets recommended for the US under the Kyoto Protocol (seven percent below 1990 levels), and to urge state and federal governments to enact policies and programs to reinforce local efforts.
- **Large Cities Climate Leadership Group and Clinton Climate Initiative (CCI)** – In 2006 the City joined an international group of major cities committed to reduce urban carbon emissions and adapt to climate change. This initiative is supported by the Clinton Climate Initiative (CCI) of the William J. Clinton Foundation.

This *Local Action Plan* provides specific action steps to reinforce Philadelphia's commitment to these initiatives. The City and its public and private partners will now work together to support the *Local Action Plan* and monitor broader community and City government performance in the reduction of GHG emissions and the adaptation to climate change.

An immediate aim of this *Local Action Plan* is to ensure that the broader community and City government meet or exceed the CCP commitment to reduce GHG emissions by 10 percent by 2010. The *Plan* recommendations include steps to keep the larger community on track to reduce GHG emissions by 11.6 percent as well as additional steps required for City government to meet the CCP goal. Through continued energy efficiency initiatives in municipal buildings and fleets, and through expanded municipal use of renewable energy and cleaner fuels, annual GHG emissions in City operations will be reduced by an additional 17,980 tonnes of carbon dioxide equivalent (tCO₂eq). This will lower GHG emissions from City government by 12.3 percent by 2010.

The longer goal of this initial *Local Action Plan* is to help Philadelphia prepare for the responsibilities and opportunities of GHG reduction and adaptation beyond 2010. Building on local examples of environmental stewardship and innovation, the early steps outlined here will further improve Philadelphia's ability to cost-effectively reduce GHG impacts on the world while enhancing quality of life at home.

The Honorable John F. Street, Mayor
City of Philadelphia

Sustainability Working Group



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Leading by Example

Philadelphia can point to several actions that are already helping to reduce GHG emissions from the broader community and City government operations, including:

Municipal Energy Office - Energy Management Program

The City maintains a successful program to manage energy through best practices in procurement, construction and facility management. Between FY03 and FY06 electricity use for the General Fund accounts fell by 18,000 MWh and natural gas use by 63,000 Mcf. As a result, annual GHG emissions fell by 12,400 tCO₂eq, or tonnes of carbon dioxide equivalent.

Streets Department - LED Traffic Signals

In 1999, Philadelphia became the first large city in the US to replace traffic signal lamps with light emitting diodes, or LEDs. LEDs consume about 80 percent less energy than standard incandescent bulbs. The City replaced 28,000 red lamps resulting in annual energy savings of 8,300 MWh and emissions savings of 4,100 tCO₂eq. The longevity of LEDs also reduces waste and the number of man-hours needed for replacement. The City plans to double these benefits by changing to three-color LEDs.

Philadelphia International Airport - Wind Energy Purchase

As part of its environmental stewardship program, the Philadelphia Division of Aviation began purchasing wind energy at the start of 2006 for Philadelphia International Airport (PHL). Since 2001, the floor area of buildings at PHL has nearly doubled from 1.4 million square feet to 2.4 million square feet. To help offset the increased CO₂ emissions, PHL purchases 12,960 MWh of wind energy annually. This represents approximately eight percent of PHL's overall electricity demand and reduces emissions by 6,500 tCO₂eq.

Philadelphia Water Department - Digester Gas Project

The Northeast Water Pollution Control Plant (NEWPCP) utilizes a waste treatment process that produces substantial quantities of digester gas, which contain primarily methane and carbon dioxide. About 43 percent of the digester gas is currently captured and used, while the rest is flared. Under design is a biomethane purification plant that will treat the entire digester gas stream. Some of the resulting pipeline-quality gas will be used at the NEWPCP, and the rest will be sold to the City. This "renewable" gas will displace about 185,000 Mcf of interstate pipeline gas now purchased by the City and reduce GHG emission by an estimated 10,600 tCO₂eq annually.

Fuel Switching from Coal and Oil to Natural Gas

A large number of residential, commercial and industrial buildings and facilities in Philadelphia have been switched from coal and fuel oil to natural gas heating. This has significantly reduced greenhouse gas emissions attributable to Philadelphia, since coal burning emits 70 percent more carbon dioxide than natural gas. Industrial residual oil (#6 oil) emits 43 percent more CO₂, and home heating oil (#2 oil) emits 34 percent more CO₂, than natural gas.



Introduction

The Need to Act

Global climate change emerged in the past year as the most significant sustainability issue faced by our planet. Environmental, economic, and social concerns about climate change relate to:

- Predictions that global average temperatures will rise by 3.2 to 7.2 degrees Fahrenheit by the end of the century;
- Forecasts for increased episodes of severe weather, such as extreme heat, torrential rain, blizzards, and changes in precipitation rates;
- Potentially severe impacts on ecosystems, sea levels, and human well-being.

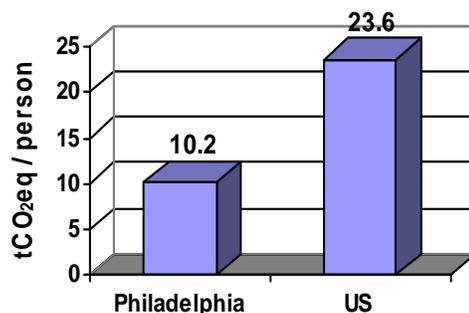
Growing scientific evidence links increased accumulation of carbon dioxide (CO₂) in the Earth's atmosphere to human activity. This has compelled an increasing number of local, regional, national, and international bodies to accelerate actions to reduce carbon emissions. Responsible leaders in both the public and private sectors agree that, while uncertainties persist in our understanding of climate change, the most prudent ways to manage risk associated with climate change are to:

- Take climate change seriously;
- Take steps now to reduce the known contributors to climate change; and
- Take steps to mitigate and adapt to climate change impacts that cannot be avoided.

The Role of Cities

Cities must play a major part in efforts to address climate change. Urbanized areas are responsible for as much as 75 percent of the world's energy consumption and related GHG emissions. (Source: Large Cities Climate Leadership Group.) Yet cities also demonstrate that population density, mixed land use, and reduced dependence on the automobile can contribute to lower GHG emissions on a per capita basis. For example, Figure 1 shows that Philadelphia's per capita GHG emissions are less than half of the per capita GHG emissions for the nation¹ as a whole.

Figure 1: GHG Emissions per Capita¹



¹ City of Philadelphia per capita GHG emissions for 2006 based on 2006 inventory and estimated population of 1.485 million. See Appendix. US per capita GHG emissions based on gross emissions for 2004, the most recent year for which data are available from the US EPA.



Cities also play a significant role as operating, planning, and regulatory enterprises that:

- Produce GHG emissions while providing public services;
- Influence GHG emissions via land use, infrastructure, fiscal, and social policies;
- Help bear the costs of GHG emissions on local populations and facilities, and;
- Share in the direct benefits and co-benefits from the reduction of GHG emissions

For these reasons, cities offer a pragmatic model for implementation of the motto “Think Globally – Act Locally” in addressing the challenges of climate change. Cities have knowledge of local conditions, managers and entrepreneurs capable of finding flexible, cost-effective strategies, and agencies and institutions dedicated to long-term priorities.

Commitments

The cornerstones of Philadelphia’s response to climate change, and of this *Local Action Plan for Climate Change*, are City commitments to three GHG reduction initiatives:

- **Cities for Climate Protection (CCP) Campaign (ICLEI)** – In June of 1999, former Mayor Edward G. Rendell affiliated the City of Philadelphia with the CCP campaign sponsored by ICLEI-Local Governments for Sustainability. CCP provided a framework for various departments and agencies to collaborate on greenhouse gas reductions both within the City government and in the broader community. The City agreed to a voluntary five-step process to reduce greenhouse gases². The first two steps, the development of a GHG inventory and the setting of a goal to reduce GHG 10 percent below 1990 levels, are completed. The third step is the development and adoption of this *Local Action Plan for Climate Change*. The final two steps are to implement the *Plan* and monitor the quantifiable results that are achieved.
- **U.S. Mayors’ Climate Protection Agreement of the U.S. Conference of Mayors** - Mayor John F. Street in June of 2005 endorsed the Climate Protection Agreement sponsored by the USCM. Under this agreement, cities will: strive to meet or beat the targets recommended for the US under the Kyoto Treaty; urge state and federal governments to enact policies and programs to reduce GHG emissions; and urge the US Congress to establish an emission trading system.
- **Large Cities Climate Leadership Group and Clinton Climate Initiative (CCI)** - In August of 2006, Mayor John F. Street accepted an invitation for Philadelphia to join other major international cities that are committed to reduce urban carbon emissions and adapt to climate change. As part of the Large Cities Climate Leadership Group, Philadelphia will work in coming years with member cities and the William J. Clinton Foundation’s Climate Change Initiative (CCI) to identify and implement steps to reduce carbon emissions in urban areas.

² Greenhouse gases (GHG) generally include: carbon dioxide CO₂, methane CH₄, nitrous oxide N₂O, hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride SF₆.



Statement of Targets

The City's most specific current commitment, as part of ICLEI's Cities for Climate Protection (CCP) Campaign, is to reduce greenhouse gas (GHG) emissions by 10 percent below 1990 levels by 2010. This commitment includes the entire public and private community as well as the subset of City government. Led by the Air Management Services (AMS) Division of the Department of Public Health, an inter-agency team within the City government developed the City's emissions inventory back through 1990 and projected forward to 2010. Figures 2 and 3 show the historical pattern and the projections to 2010 for both the broader community and the City government. (See Appendix for additional detail.)

Figure 2: Philadelphia Community GHG Emissions and Target

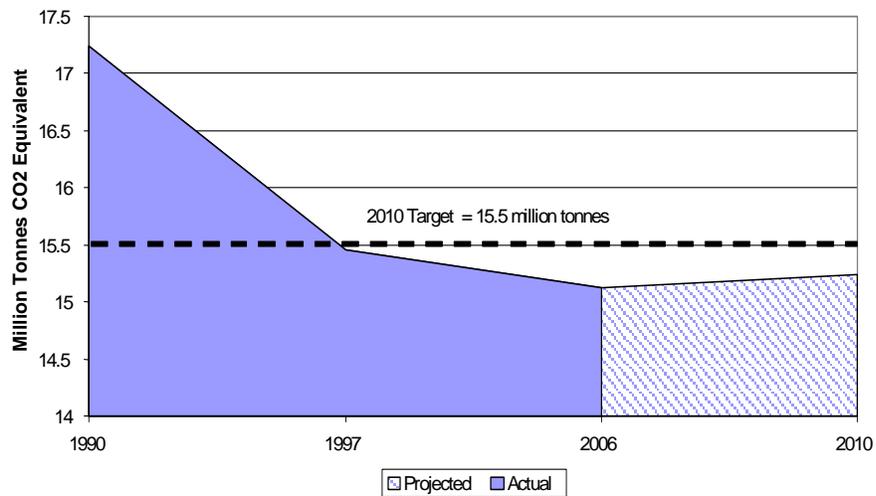
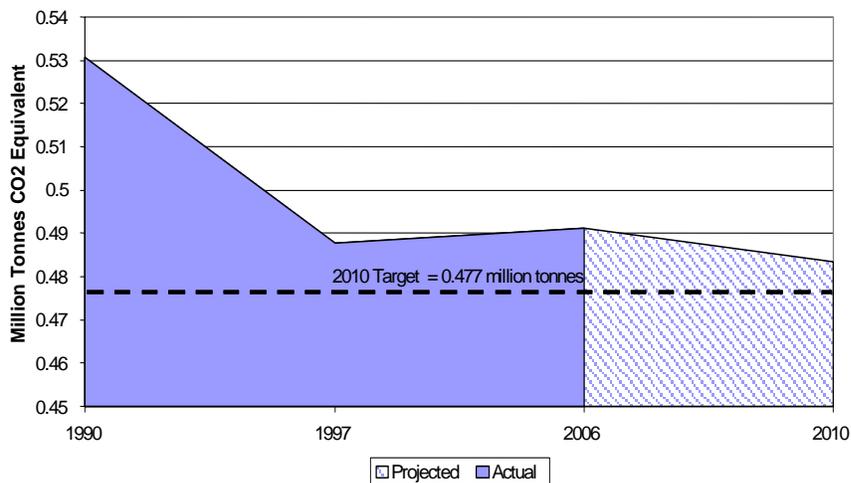


Figure 3: Philadelphia City Government GHG Emissions and Target

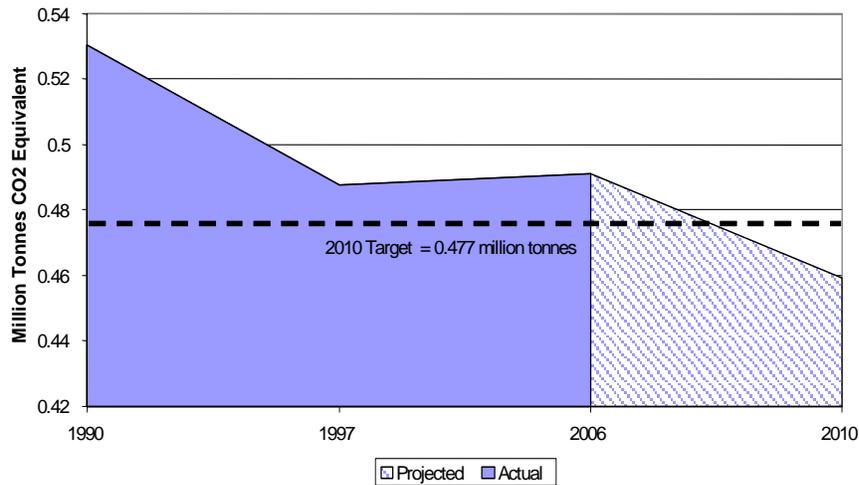




As shown in Figures 2 and 3, Philadelphia is projected to reduce community emissions by 11.6 percent and City government emissions by 8.9 percent by 2010. The recommendations of this *Local Action Plan* include first-priority steps to keep the overall community on track to achieve at least this 11.6 percent GHG reduction, as well as additional steps required to help municipal operations meet or exceed the CCP goal.

Through continued energy efficiency initiatives in municipal buildings and fleets, and through the expanded municipal use of renewable energy and cleaner fuels, annual GHG emissions in City operations will be reduced by at least an additional 17,890 metric tons of carbon dioxide equivalent (tCO₂eq). (See Figure 4.) This will reduce GHG emissions from City government by 12.3 percent by 2010.

Figure 4: Philadelphia City Government GHG Emissions and Target Including Priority Actions 1, 3, 4, and 12.



The City recognizes that projected reductions in GHG emissions from 1990 to 2010 reflect a number of causes, including population and employment losses, switching to lower carbon fuels, and energy conservation by households and businesses. However, Philadelphia expects its population and employment to stabilize and grow. This expectation reinforces the necessity to develop, implement, and monitor the GHG reduction strategies included in this inaugural *Local Action Plan*. With this *Plan* ...

Philadelphia is laying the technical and organizational foundation to cost-effectively and steadily reduce per capita emissions of greenhouse gases while accommodating future economic development and population growth.



Plan Elements and Actions

The *Local Action Plan* organizes recommended actions into five elements: Buildings; Transportation; Industry and Waste; Greening and Open Space; and Policy, Education and Outreach. The first three of these elements largely mirror the categories used in the City's GHG inventory. (See Appendix.) Actions are presented on the following pages in a Summary Table of Priority Actions, a Summary Table of All Actions, and in detailed descriptions of Actions by Plan Element.

The *Local Action Plan* aims a significant number of recommendations at the reduction of GHG emissions from buildings. One reason for this emphasis is that more than half of the overall community GHG emissions, and 60 percent of the City government's GHG emissions, appear to be attributable to buildings. (See Appendix.) Another reason is that energy use and associated GHG emissions from buildings are more readily quantified, monitored, and managed than other sectors. For example, data tracked by the City of Philadelphia Municipal Energy Office shows that nearly 80 percent of emissions from City-owned buildings are due to electricity consumption.

A Note on the Costs of Emissions Reduction

Several of the priority actions have a calculable Cost of Emissions Reduction (CER): the implementation cost per tonne of CO₂ equivalent (tCO₂eq) per year. For some items, like purchasing wind energy, the cost to continue achieving the emissions reduction will be ongoing. The City has to continue purchasing wind power to achieve the associated reduction of tCO₂eq. For other items, there is an upfront cost that leads to continued reductions. LEED™ certifiable buildings, for example, consume less energy over their lifespan than conventional buildings. For such items, the CER is amortized over the expected useful life of the reduction.

- Action #1, the eventual purchase of at least 12,800 MWh of wind power annually by 2010, has an associated CER of \$35/tCO₂eq. This will save 6,400 tCO₂eq/year.
- Action #3, requiring LEED certifiable buildings has an associated CER of \$23/tCO₂eq when amortized over 20 years, and annual emissions savings of 580 tCO₂eq.
- Action #4, reducing energy consumption by five percent for General Fund accounts has a CER of \$24/tCO₂eq when amortized over ten years, and annual emissions savings of 7,600 tCO₂eq.
- Action #12, reducing vehicle consumption by five percent for City government vehicles has a CER of \$41/tCO₂eq when amortized over ten years, and annual emissions savings of 3,400 tCO₂eq.

The CER methodology and additional valuation calculations are included in the Appendix.



Summary Table of Priority Actions

The *Local Action Plan* recommends ten priority actions to keep Philadelphia on the path to reach the 2010 goal of a 10 percent reduction of both community and City government emissions from 1990 levels. As shown in Figure 4, implementation of Actions 1, 3, 4, and 12 would achieve an additional GHG reduction of at least 17,980 tCO₂eq, helping the City government to surpass the 2010 goal.

#	Action	Plan Element	Inventory Impact
1	Purchase wind energy to meet at least five percent of the electricity needs of General Fund electricity accounts by 2010.	Buildings	City Government
2	Require the purchase of ENERGY STAR® qualified products for all U.S. EPA listed product categories and NEMA Premium electric motors for all bid solicitations and RFPs for both public-works and SSE (Service Supply and Equipment) contracts issued by the Procurement Department.	Buildings	City Government
3	Require LEED™ certification for General, Aviation, and Water Fund new construction and major renovation projects over 10,000 square feet of gross floor area.	Buildings	City Government
4	Reduce energy use for the General Fund utility accounts by five percent from 2006 levels by 2010.	Buildings	City Government
5	Develop and implement codes and development strategies for “Transit-Oriented Development” and “Green Building”.	Buildings	Community
11	Ensure adequate and predictable funding for transit operations and infrastructure.	Transportation	Community
12	Reduce vehicle fuel consumption by City government vehicles by five percent from 2006 levels by 2010.	Transportation	City Government
18	Increase the City's residential recycling rate from six to ten percent by 2010.	Industry and Waste	Community
23	Maintain the City's 15 percent tree canopy.	Greening and Open Space	Community
25	Establish an Office of Sustainability and Environment.	Policy, Education and Outreach	Community



Summary Table of All Actions

Buildings

#	Description	Inventory Impact
1	Purchase wind energy to meet at least five percent of the electricity needs of General Fund electricity accounts by 2010.	City Government
2	Require the purchase of ENERGY STAR® Qualified Products for all U.S. EPA listed product categories and NEMA Premium electric motors for all bid solicitations and RFPs for both public works and SSE (Service Supply and Equipment) contracts issued by the Procurement Department.	City Government
3	Require LEED™ certification for General, Aviation, and Water Fund new construction and major renovation projects over 10,000 square feet of gross floor area.	City Government
4	Reduce energy use for the General Fund utility accounts by five percent from 2006 levels by 2010.	City Government
5	Develop and implement codes and development strategies for “Transit-Oriented Development” and “Green Building”.	Community
6	Increase assistance for weatherization programs.	Community
7	Evaluate the financial feasibility of installing solar and other non-GHG producing systems at City-owned facilities.	City Government
8	Promote the installation of combined heat and power systems (cogeneration) at City complexes.	City Government
9	Promote the implementation of Demand Side Management (DSM) programs by local utilities.	Community
10	Promote fuel switching to lower carbon content fuels.	Community

Transportation

#	Description	Inventory Impact
11	Ensure adequate and predictable funding for transit operations and infrastructure.	Community
12	Reduce vehicle fuel consumption by City government vehicles by five percent from 2006 levels by 2010.	City Government
13	Reduce vehicle fuel consumption by non-City fleets by five percent from 2006 levels by 2010.	Community
14	Develop and implement updated parking policies and codes.	Community
15	Expand anti-idling measures.	Community
16	Improve citywide bicycle and pedestrian accessibility.	Community
17	Invest in transit and private vehicle infrastructure to increase electrification of the transportation sector.	Community



Summary Table of All Actions (continued)

Industry and Waste

#	Description	Inventory Impact
18	Increase the City's residential recycling rate from six to ten percent by 2010.	Community
19	Expand cost-effective energy recovery strategies in City water treatment and waste treatment facilities.	City Government
20	Implement emission requirements for equipment and vehicles used in the construction of City infrastructure.	Community
21	Incorporate climate change criteria into City requests for proposals (RFPs) and contracts for disposal of Municipal Solid Waste (MSW) and construction and demolition waste (C&D).	Community
22	Strengthen City policies to purchase "green" products and materials for use in City operations.	City Government

Greening and Open Space

#	Description	Inventory Impact
23	Maintain the City's 15 percent tree canopy.	Community
24	Reduce energy demands from buildings through planning, design, and implementation of greening and open space.	Community

Policy, Education and Outreach

#	Description	Inventory Impact
25	Establish an Office of Sustainability and Environment.	Community
26	Establish monitoring and annual reporting responsibilities and procedures for performance on sustainability and climate change.	City Government
27	Strengthen community-wide campaigns to increase public awareness and participation in sustainability and GHG reduction efforts.	Community
28	Develop a follow-up "agenda" to guide public and private action on each of the elements of the <i>Local Action Plan</i> .	Community



Plan Element: Buildings

Greenhouse gas (GHG) emissions from the building sector are generated by energy produced for and used within buildings and related infrastructure for heating, air conditioning, lighting (including street), ventilation, refrigeration, appliances, computers, and other equipment. Efforts to reduce GHG emissions from buildings will reduce energy usage within the buildings and increase the share of renewable energy used in buildings. (Inventory Impact: C=Community, CG=City Government)

1. **Purchase wind energy to meet at least five percent of the electricity needs of General Fund electricity accounts by 2010.** (CG) Building upon the commitment to purchase wind-generated electricity made by the Division of Aviation, the City will in FY08 purchase 8,500 MWh of wind power, sufficient to meet the electricity needs of City Hall. The City will by 2010 purchase at least five percent of its General Fund electricity use as wind energy. This will equal about 12,800 MWh annually, resulting in annual GHG emissions of about 6,400 tCO₂eq. *Going forward, the City should plan to purchase or generate at least 15 percent of electricity demand for City buildings from renewable sources by 2015.*
2. **Require the purchase of ENERGY STAR® qualified products for all US EPA listed product categories and NEMA Premium electric motors for all bid solicitations and RFPs for both public works and SSE (Service Supply and Equipment) contracts issued by the Procurement Department.** (CG) Philadelphia already purchases ENERGY STAR®-rated products for many listed product categories, as well as NEMA Premium motors. This practice will be formalized and expanded to include public-works construction projects, including new construction, renovations and equipment replacements for General Fund, Water Department and Aviation projects. ENERGY STAR® products meet strict energy efficiency guidelines set by the US EPA and US Department of Energy, and have undergone detailed cost-benefit analysis. *Going forward, the City should require the use of available ENERGY STAR® products in all City-financed projects and the achievement of ENERGY STAR HOMES® certification in City-supported affordable housing production.*



- 3. Require LEED™ certification for General, Aviation, and Water Fund new construction and major renovation projects over 10,000 square feet of gross floor area.** (CG) Building on the Philadelphia High Performance Building Renovation Guidelines (2004), and current Capital Program Office (CPO) Leadership in Energy and Environmental Design (LEED™) design practices for new construction, require that all new construction and major renovation projects be designed to meet and are certified as meeting at least the LEED™ “Silver” rating. Additionally, require that projects achieve 20 percent reductions in energy use compared with standard practices (as specified in the current building code). Assuming at least 250,000 square feet are LEED™ certifiable by 2010, this would achieve GHG reductions of 580 tCO₂eq³. *Going forward, evaluate whether City projects undertaken after 2010 should be required to achieve LEED™ “Gold” certification.*
- 4. Reduce energy use for the General Fund utility accounts by five percent from 2006 levels by 2010.** (CG) Building on the City’s successful energy-management program, which reduced energy use about eight percent between 2003 and 2006, achieve another five percent reduction by 2010. Estimated GHG reductions will be 7,600 tCO₂eq per year. *Going forward, evaluate adopting similar targets for the Aviation and Water Funds, and increase the energy conservation targets to at least 15 percent below 2006 levels by 2015, for a cumulative reduction from 2003 of 23 percent.*
- 5. Develop and implement codes and development strategies for “Transit-Oriented Development” and “Green Building”.** (C) As a next step in Philadelphia’s environmentally conscious updating of building regulations and incentives, create and adopt new code and investment tools to achieve GHG-reduction through transit-supporting land use around transit nodes and greater citywide use of resource-efficient features in building renovation and construction. Build upon increasing private sector awareness of the GHG reduction benefits and co-benefits of “green” building, and support ongoing public infrastructure reinvestment in commercial corridors (e.g. ReStore Commercial Corridor program) and transit (e.g. reconstruction of Market-Frankford El). *Going forward, complete a comprehensive update of City development regulations and incentives, incorporating state-of-the-art environmental protection provisions into the City’s zoning, subdivision, building code, and incentive programs.*

³ Typical energy intensity of 110,200 Btu/sq.ft. used to determine reduction potential. Source: EIA, AEO 2006, Feb. 2006, <http://buildingsdatabook.eere.energy.gov/docs/1.2.4.pdf>.



6. **Increase assistance for weatherization programs.** (C) Philadelphia has a large number of low-income families that often live in old, energy-inefficient buildings. Current low-income weatherization programs significantly reduce energy use, reduce energy bills, and are an important strategy for reducing GHG emissions in the residential component of the buildings sector. Philadelphia's long-standing programs and networks that provide weatherization services and promote energy conservation should be better funded to enable more households to be served and achieve greater energy savings in each household. An adequate commitment of federal and Commonwealth resources is necessary to provide essential services especially to low-income households. *Going forward, public/private partnerships should help make cost-effective weatherization services more available to a broader range of City households.*
7. **Evaluate the financial feasibility of installing solar and other non-GHG producing systems at City-owned facilities.** (CG) Building on its previous evaluations of solar energy systems, the City will work with other partners, including the Commonwealth through the Governor's proposed Energy Independence Strategy, to identify cost-effective solar energy equipment for installation at City-owned facilities. *Going forward, develop utilization targets for solar and other potential, non-GHG producing energy sources.*
8. **Promote the installation of combined heat and power systems (cogeneration) at City complexes.** (CG) Combined heat and power systems can reduce GHG emissions through their high fuel efficiencies, and these systems may be cost effective at some City-owned facilities and at large private-sector projects. Initially, the City will evaluate the financial feasibility of cogeneration at the Prison System's complex located on State Road. *Going forward, the City will explore approaches to encourage combined heat and power systems at other public and private facilities.*
9. **Promote the implementation of Demand Side Management (DSM) programs by local utilities.** (C) In cooperation with other parties, work with the Public Utility Commission to develop and adopt energy-conservation and demand-response programs for implementation by regulated utilities, particularly those programs that have substantial GHG emissions benefits. Assure funding for such programs through a systems benefit charge. Experiences in California and elsewhere show that DSM programs have the potential to significantly reduce GHG emissions.
10. **Promote switching to lower carbon content fuels for buildings.** (C) Working with the Philadelphia Gas Works (PGW) and other potential providers, develop marketing programs to increase the penetration into the residential and commercial building markets of heating fuels that have lower carbon content. For example, were 40 percent of PGW's non-heating residential customers to switch to natural gas heating, the result could be an annual citywide CO₂ reduction of 30,000 tCO₂eq. Support for the installation of higher-efficiency heating equipment as part of fuel-switching programs will even further reduce GHG emissions.



Plan Element: Transportation

GHG emissions from the transportation sector are generated from the consumption of fuels by transportation vehicles, including automobiles, all forms of material transport, and all forms of public transport. Emissions attributable to transportation are estimated to account for 25 percent of Philadelphia's GHG inventory. Efforts to reduce GHG emissions from transportation will reduce the total vehicle miles traveled by highway vehicles, use less polluting sources and mixes of fuel for transportation, and increase the efficiency of various modes of transportation. This initial *Local Action Plan* does not include emissions from aircraft. (See Appendix for discussion.)

(Inventory Impact: C=Community, CG=City Government)

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11. **Ensure adequate and predictable funding for transit operations and infrastructure.** (C) Preserve and enhance transit service to help reduce automobile trips, auto fuel usage, air pollution, and road congestion. Support the work of the Commonwealth to address transit funding and service as part of an overall transportation system that supports sustainable land use and economic development. Service by SEPTA, NJ Transit, PATCO, AMTRAK and others must be frequent, reliable, safe, clean, and comfortable. *Going forward, long-term funding should enable transit providers to plan and invest in service enhancements and fuel-efficient equipment that help to reduce Philadelphia's GHG emissions and average daily vehicle miles traveled per capita.*
 12. **Reduce vehicle fuel consumption by City Government vehicles by five percent from 2006 levels by 2010.** (CG) Continue the efforts of the Office of Fleet Management to improve the fuel economy, improve the emission performance, and reduce the size of municipal fleets. Build on the Managing Directors Office's support for car sharing and pre-tax benefits to employees for transit use. Seek financial assistance from other governments and organizations to accelerate the replacement of older vehicles with reliable, task-appropriate vehicles that are more fuel-efficient and less polluting. Encourage expanded use by City employees of fuel-efficient shared vehicles, transit, bicycling, and walking. Steadily increase the share of City vehicles powered by hybrid systems or alternative fuels. *Going forward, the City should by 2015 reduce overall vehicle fuel consumption by at least 15 percent and increase to 15 percent the share of hybrid or alternative-fuel-powered vehicles in City fleets.*
 13. **Reduce vehicle fuel consumption by non-City fleets by five percent from 2006 levels by 2010.** (C) Parallel to City efforts, the operators of public and private non-City fleets should also use management techniques and upgraded vehicles to improve the overall fuel economy and emission performance of fleet vehicles. Identify programs and resources to help SEPTA, the School District, utilities, taxi companies, car rental companies, and other fleet owners to replace older vehicles with more efficient models. *Going forward, the owners of non-City fleets should by 2015 reduce overall vehicle fuel consumption by at least 15 percent and increase to 15 percent the share of hybrid or alternative-fuel powered vehicles in non-City fleets.*



- 14. Develop and implement updated parking policies and codes.** (C) As a next step in Philadelphia's environmentally conscious updating of codes and development regulations, work with public and private stakeholders to propose and adopt updated parking policies and regulations that fairly yet directly address the external impact of automobile use in an urban environment. Build on recent Planning Commission, Parking Authority, and Department of Licenses & Inspections efforts to make the City's approach to parking more consistent with 'best practices' in sustainable planning and development. Use pricing, marketing and information systems, regulations for parking location and design, and other parking management strategies to encourage travelers to use transit. *Going forward, integrate updated parking policies and codes into a comprehensive update of City development regulations and incentives.*
- 15. Expand anti-idling measures.** (C) Continue and expand enforcement of anti-idling regulations by Air Management Services and the Philadelphia Parking Authority to reduce emissions from trucks and buses. *Going forward, incorporate anti-idling measures into the design of all major new facilities, and encourage plug-in infrastructure and driver comfort stations so that truck and bus engines can be turned off during layovers.*
- 16. Improve citywide bicycle and pedestrian accessibility.** (C) Boost public/private resources for the design and implementation of bicycle and pedestrian networks and facilities. Reinforce the inherent advantages of many City neighborhoods as walkable and bike-able communities. Enable Planning Commission and Streets Department staff to fully support the Bicycle/Pedestrian Advisory Task Force and to develop citywide and district plans for bicycling and pedestrians. *Going forward, adopt a "complete streets" policy to ensure that walking and bicycling receive adequate attention in all transportation planning and operations.*
- 17. Invest in transit and private vehicle infrastructure to increase electrification of the transportation sector.** (C) Support the enhancement of existing infrastructure for electric-powered vehicles. Decrease the number and proportion of vehicles operating on carbon-based fuels. Where local electrical power remains less dependent on traditional coal, oil, and gas generation, as it is in Philadelphia, the environmental performance per mile of electric trains, trolleys, buses, trucks and cars is superior. *Going forward, assess the needs for infrastructure necessary to support additional electrification of transit services and private vehicles.*



Plan Element: Industry and Waste

GHG emissions from industry and waste result from industrial processes (including energy production) and from the management of municipal solid waste, sewage, hazardous waste, and construction and demolition waste.

(Inventory Impact: C=Community, CG=City Government)

Industry

Industrial processes include the conversion of fuels, the use of heavy equipment, water treatment, and pollution control. Efforts to reduce GHG emissions from industry will reduce polluting sources/mixes of fuel, and increase the efficiency of the equipment or processes in use.

Waste

Waste minimization and recycling reduce climate change impacts by reducing the amount of waste to be managed and by recovering more energy from the waste that remains to be managed. Waste products typically end up in landfills that produce methane as products decompose, and incinerators that produce GHG emissions through combustion.

18. Increase the City's residential recycling rate from six to ten percent by 2010.

(C) Build on efforts by the City Streets Department and Recycling Office to expand residential single-stream recycling. Facilitate higher residential recycling levels by obtaining additional public and private resources to increase by 50 percent the capacity of the City to collect recyclable materials and recycle in a consumer-friendly, single-stream process. A four percent increase in the residential recycling rate could reduce GHG emissions attributable to the overall community by 65,000 tCO₂eq per year. *Going forward, continue to refine and increase both residential and commercial recycling as an important part of reducing overall energy use and greenhouse gas emissions throughout all stages of product life cycles.*

19. Expand cost-effective energy recovery strategies in City water treatment and waste treatment facilities.

(CG) Building on the Philadelphia Water Department's plan to construct a digester gas treatment facility at its Northeast Water Pollution Control Plant (NEWPCP), the City will evaluate a similar project at its Southwest treatment plant if the digester gas at that facility is not needed for a proposed sludge drying project.

20. Implement emission requirements for equipment and vehicles used in the construction of City infrastructure.

(C) Building on ongoing efforts by Air Management Services and the Procurement Department, the City will establish percentage-based requirements in all public-works construction contracts to increase the use of low-emission diesel vehicles or alternative fuels. All City contractors subject to this provision will be required to minimize vehicle idling to the maximum extent possible.



21. **Incorporate climate change criteria into City requests for proposals (RFPs) and contracts for disposal of Municipal Solid Waste (MSW) and construction and demolition waste (C&D).** (C) Identify criteria that accurately reflect energy use and emissions related to solid waste disposal, and incorporate these criteria in the selection process for waste transfer, hauling, and disposal contracts. Include fuel use by City and contractor trucks, facility siting and design, operations, and market strategies for resource recovery and reuse of collected materials. *Going forward, develop MSW and C&D facilities and practices that reflect world-class standards for GHG reduction as well as positive community and economic impacts.*

22. **Strengthen City policies to purchase “green” products and materials for use in City operations.** (CG) Building on the current practice of the City Procurement Department to purchase products with recycled content and ENERGY STAR ratings, evaluate the establishment of an “environmentally preferred purchasing” program for goods and materials used in City operations. All else equal, give preference to items that have credible third-party certifications as being energy-efficient in their production, use, and eventual reuse or disposal. *Going forward, consider the potential of an environmentally preferred purchasing program to help reinforce local economic development efforts.*



Plan Element: Greening and Open Space

Well-maintained trees, shrubs, grasses, and parks generally improve neighborhood values and quality of life. Greening and open space also reduce GHG emissions through the capacity of plants to absorb CO₂, while the shade from trees reduces GHG emissions by helping to lower energy demands for cooling. Effectively managed, greening and open space can play an important role in helping the City adapt to the predicted climate change impact of warming temperatures.

(Inventory Impact: C=Community, CG=City Government)

23. Maintain the City's 15 percent tree canopy. (C) With guidance from the collaborative, agenda-setting process of GreenPlan Philadelphia – the City's blueprint for sustainable open space - reverse the loss of tree canopy in the City and stabilize the tree canopy at a level of 15 percent of the City's land area. Key supporters of GreenPlan Philadelphia include the Pennsylvania Horticultural Society, Fairmount Park, and PA DCNR's TreeVitalize program. Trees perform valuable work by absorbing carbon dioxide, cleaning the air of other pollutants, and reducing air-conditioning needs in the summer. Coordinate the management of the City's two million trees with City strategies for climate change. Identify consistent methodologies and responsibility for monitoring the coverage of trees and other vegetative landscapes. Marshal the public and private resources necessary to reduce annual tree mortality and increase the annual number of new trees planted. *Going forward, establish policies and project review processes to ensure no net loss of trees and effective tree canopy within the City.*

24. Reduce energy demands from buildings through planning, design, and implementation of greening and open space. (C) Furthering the implementation of GreenPlan Philadelphia, develop guidelines and programs to encourage designers, builders, and property owners to employ greening and open space to help reduce energy use. Programs should include strategic use of open space corridors and trees to mitigate urban heat islands – the summer build up of high temperatures around buildings and paved surfaces. *Going forward, strengthen greening and open space requirements as part of a comprehensive update of development regulations and incentives, incorporating state of the art environmental protection provisions into the City's codes and incentive programs.*



Plan Element: Policy, Education, and Outreach

Policy, education, and outreach are necessary complements to the other elements of the *Plan*. GHG reductions are difficult to measure for policy and education actions, yet these actions are needed to achieve and sustain overall reductions in GHG emissions.

(Inventory Impact: C=Community, CG=City Government)

25. **Establish an Office of Sustainability and Environment.** (C) Building on collaborations underway among many City government and community partners, the City will establish an Office of Sustainability and Environment to strengthen coordination of planning, monitoring, and implementation initiatives related to urban sustainability and environmental stewardship, including climate change. This office will work with regional partners and City agencies to develop a policy framework and action plan for sustainability that supports sharing of information and civic engagement, leverages financial and technical resources, and develops innovative financing and training programs. *This Office will ensure that Philadelphia is prepared to work with and benefit from emerging sustainability and environmental initiatives at the regional, Commonwealth, national, and international levels.*
26. **Establish monitoring and annual reporting responsibilities and procedures for performance on sustainability and climate change.** (CG) Building upon existing reporting procedures, an Office of Sustainability and Environment will work with the Budget Office and relevant departments to establish appropriate departmental objectives for measuring performance toward goals for sustainability, including climate change. By FY09, formally incorporate annual reporting on sustainability into departmental reviews, the Mayor's Report on City Services, and the City of Philadelphia Five-Year Financial Plan. *Going forward, update the City's GHG inventory and Local Action Plan on a regular basis, and improve the quality of GHG data to facilitate City participation in GHG trading.*
27. **Strengthen community-wide campaigns to increase public awareness and participation in sustainability and GHG reduction efforts.** (C) Build on efforts by the media, public agencies, utilities, transit providers, advocacy organizations, and others to improve public understanding and adoption of cost-effective steps to reduce energy use and GHG emissions. Identify and implement effective improvements to important existing campaigns, especially those that address the needs of vulnerable households. *Going forward, identify and implement additional public awareness efforts that may be needed to promote action across all plan elements.*
28. **Develop a follow-up "agenda" to guide public and private action on each of the elements of the *Local Action Plan*.** (C) Building on the foundation set by this inaugural 2007 *Local Action Plan*, engage a broader group of stakeholders to develop a more in-depth action "agenda" for each of the *Plan* elements. *GreenPlan Philadelphia* already serves as the agenda-setting process for the element of Greening and Open Space. Additional efforts need to be confirmed or developed for Buildings, Transportation, and Industry and Waste. The "agenda" for each *Plan* element should: provide additional technical support on criteria and measurement; help build consensus around issues, market opportunities, and implementation steps; and inform the next, even more ambitious *Local Action Plan*.



Acknowledgements and Resources

City of Philadelphia

The Honorable John F. Street, Mayor

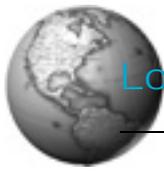
Sustainability Working Group

The Sustainability Working Group (SWG) is an inter-agency effort to promote, coordinate, and monitor City government and community initiatives to improve performance across a range of sustainability measurements. The first tasks of the Sustainability Working Group have been to support the update of the City's greenhouse gas inventory and to complete Philadelphia's initial *Local Action Plan for Climate Change*. The SWG was convened by:

Managing Director's Office	Pedro Ramos, Esq., Managing Director James Donaghy, Deputy Managing Director
Philadelphia City Planning Comm.	Janice Woodcock, AIA, AICP, Executive Director Gary Jastrzab, Deputy Executive Director
Law Department	Romulo L. Diaz, Jr., City Solicitor J. Barry Davis, Chief Deputy City Solicitor
Commerce Department	Stephanie Naidoff, Director Duane Bumb, Senior Deputy Director

Sustainability Working Group – Participating Philadelphia City Agencies

- Air Management Services, Department of Public Health
- Philadelphia Airport System, Commerce Department
- Office of Budget and Program Evaluation, Finance Department
- Capital Program Office
- Philadelphia City Planning Commission
- Commerce Department
- Fairmount Park Commission
- Office of Fleet Management
- Philadelphia Gas Works
- Office of Housing and Community Development
- Philadelphia Industrial Development Corporation
- Law Department
- Department of Licenses and Inspections
- Managing Director's Office
- Municipal Energy Office
- Mayor's Office of Neighborhood Transformation
- Procurement Department
- Department of Public Health
- Department of Public Property
- Recreation Department
- Department of Streets
- Philadelphia Water Department



Sustainability Working Group - GHG Inventory and Local Action Plan Team

The Philadelphia agencies on the preceding page, and other partnering organizations, contributed to the development of the greenhouse gas inventory and *Local Action Plan for Climate Change*. The principal team included:

Air Management Services, DPH	Morris Fine (retired) Thomas A. Weir III Hallie Weiss Kassahun Sellassie, PhD
Commerce Department	Jon Edelstein
Law Department	J. Barry Davis Patrick K. O'Neill
Managing Director's Office	Darlene Messina
Municipal Energy Office	Kent Miller
Philadelphia City Planning Commission	Alan Urek, AICP John Haak, AICP
Philadelphia Water Department	John Hadalski (retired)
PWI Energy, consultants	P. Richard Heimann, CEP Joann Garbin

For comments, suggestions, and additional information:

Darlene Messina, Managing Director's Office darlene.messina@phila.gov
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John Haak, AICP, Philadelphia City Planning Commission john.haak@phila.gov
Senior Planner, SWG Coordinator (215.683.4653)

Additional Resources

The following organizations are among the many groups that are contributing ideas and leadership to climate change efforts in Philadelphia:

Clean Air Council	www.cleanair.org
Clinton Climate Initiative	www.clintonfoundation.org
Delaware Valley Green Building Council	www.dvgbc.org
Delaware Valley Regional Planning Commission	www.dvrpc.org
Energy Coordinating Agency	www.ecasavesenergy.org
ICLEI-Local Governments for Sustainability	www.ICLEI.org
PA Dept. of Environmental Protection	www.depweb.state.pa.us
PA Dept. of Conservation and Natural Resources	www.dcnr.state.pa.us
Pennsylvania Environmental Council	www.pecpa.org
Pennsylvania Horticultural Society	www.pennsylvaniahorticulturalsociety.org
Urban Sustainability Forum	www.sustainablephiladelphia.com
US Environmental Protection Agency	www.epa.gov



Appendix

Key Terms

Adaptation: An adjustment in natural or human systems, in response to actual or expected climatic stimuli or effects, to reduce harm or exploit beneficial opportunities.

Community: All net GHG emissions from energy use, waste disposal, and greening attributable to Philadelphia, incl. public & private buildings, transportation, and industry.

City Government: The subset of net GHG emissions attributable to City of Philadelphia municipal operations, including GHG emissions from buildings, vehicles, and operations.

Climate Change: A change of climate that is attributable directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability over comparable time periods.

Co-Benefits: Benefits of policies or actions that are carried out for various reasons at the same time. Most measures designed to address GHG mitigation also have other valuable rationales pertaining to environmental, economic, and social objectives.

General Fund: Includes all City departments that operate with general City revenues. Exceptions are the Water Department (Water Fund) and City airports (Aviation Fund).

Greenhouse Gases (GHG): Carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O), hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride (SF₆).

Inventory Impact: Actions are characterized as having a main GHG reduction impact on the GHG emissions of either the broader community or the subset of City government.

Mcf: One thousand cubic feet. This is a measure of natural gas usage.

Mitigation: An action taken to permanently eliminate or reduce the long-term risk from hazards to human life, property and function.

MWh: Megawatt-hour, a measure of electricity usage equal to 1,000 kilowatt-hours.

Tonne of CO₂ Equivalent (tCO₂eq): GHG emissions are expressed either in tons (British) or tonnes (metric) of CO₂ equivalent. One tonne equals 1,000 kg (or 2,205 lbs), and CO₂eq includes all six GHGs based upon the amount of carbon dioxide that would have the same global warming potential (GWP). (e.g. methane has a GWP of 21, so one tonne of methane equals 21 tonnes of CO₂ or 21 tCO₂eq.)

Sustainable Development: "Development that meets the needs of the present without compromising the ability of future generations to meet their own needs." (United Nations)



Summary of Greenhouse Gas Inventory Methodology

The quantitative foundation for Philadelphia’s initial *Local Action Plan for Climate Change* is an inventory of greenhouse gas (GHG) emissions compiled and updated by the Philadelphia Department of Public Health, Division of Air Management Services (AMS). Staff at AMS currently uses Clean Air and Climate Protection (CACP) software, Version 1.1, June 2005. This version is produced by the National Association of Clean Air Agencies (NACAA), ICLEI-Local Governments for Sustainability, and Torrie Smith Associates. Numerous other City and regional agencies also contribute data and analysis to the inventory.

AMS utilizes the CACP software to estimate the amount of GHG emissions and criteria air pollutants that are produced by energy consumption and solid waste generation within the City of Philadelphia. The CACP software is also capable of quantifying changes in emissions and pollutants resulting from actions to increase energy efficiency, use cleaner fuels, and reduce waste.

The CACP software aggregates the greenhouse gases of carbon dioxide (CO₂), methane (CH₄), and nitrous oxide (N₂O) into carbon dioxide equivalents (CO₂eq), a unit that reflects the differing impact of each gas on the earth’s climate. These impacts are weighted as shown in Figure A:

Figure A: CO₂ Emission Equivalents

Pollutant	One pound is equivalent to X pounds of CO₂
CO ₂	1
CH ₄	21
N ₂ O	310

The CACP software employs emission factors (coefficients) to estimate the amount of particular pollutants produced by specific amounts and types of fuel consumption or waste generation. For example: 3,596 million kwh of residential electricity consumption (1990 est.) times an emission factor for CO₂ of 490.9 tonnes/million kwh (grid average) would equal 1,765,276 tonnes of CO₂. Emissions in the inventory are expressed as equivalent metric tonnes of carbon dioxide (tCO₂eq) to be most consistent with international practices. (One metric tonne is equal to 2,200 pounds.)

Inventory data for Philadelphia are shown for the base year of 1990, the interim years of 1997 and 2006 for verification, and the forecast year of 2010.



To help understand emission sources, trends, and potential reduction strategies, the CACP software analyzes emissions from the whole community and from the subset of activities attributable specifically to the corporate, municipal operations of City government. Where the CACP software calls for demographic and economic inputs to estimate community and City government emissions, the data and assumptions shown in Figure B are used:

Figure B: Population, Households, and Employment

Software Inputs	Base Year 1990	Interim Year 1997	Interim Year 2006	Forecast Year 2010
Population	1,585,577	1,537,958	1,485,000	1,485,000
# Households*	603,075	593,972	585,000	586,500
Persons per household	2.56	2.50	2.44	2.42
# Employees in commercial sector	663,100	610,700	612,500	630,000
# Employees in industrial sector	83,700	56,800	43,300	45,000
# City government jobs	34,000	25,200	25,000	25,000

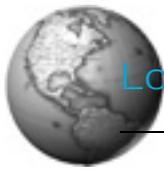
* does not include population in group quarters

The City of Philadelphia, for purposes of the GHG inventory, groups the emission-generating activities captured by the current CACP software into three main categories: Buildings, Transportation, and Industry and Waste. These categories subsequently serve as the first three Plan Elements of the *Local Action Plan*.

Estimates of net emissions from the fourth Plan Element, Greening and Open Space, are not yet included in the CACP software. The overall net GHG impact of greening and open space at the municipal level is likely to be relatively small compared to the GHG impacts of buildings, transportation, and industry and waste. However, GHG benefits and co-benefits from greening and open space are expected to be positive, and updated data and software will support the addition of emission estimates for this element in future refinements of the GHG inventory.

The "City of Philadelphia Greenhouse Gas Inventory" is available in more detail from the Philadelphia Department of Public Health, Air Management Services. The full inventory also includes documentation of data sources including "Notes on the Action Plan Data Sources," prepared by the Municipal Energy Office.

Contact Hallie Weiss, hallie.weiss@phila.gov (215.685.9436)



Analysis of Community GHG Emissions

The community analysis of GHG emissions represents the most inclusive assessment of emission generating and absorbing activity within the boundaries⁴ of Philadelphia. Figure C shows that the reduction in CO₂ equivalent emissions between 1990 and 2010 equals 11.6 percent at the community level. Total 1990 emissions of 17,240,022 tCO₂eq are forecast to drop to 15,238,702 tCO₂eq by 2010. This exceeds the City's goal of a 10 percent reduction in greenhouse gas emissions for the community sector. Figure C also indicates that roughly 50 percent of GHG emissions at the community level are attributable to buildings. Transportation, and industry and waste, each account for approximately 25 percent of GHG emissions. By detailed source of emission, Figure D shows that 39.2 percent of community GHG emissions in 2006 are due to the use of electricity, 25.4 percent to natural gas, and 24.5 percent to gasoline and diesel fuel.

**Figure C: City of Philadelphia Greenhouse Gas Emissions Inventory Summary
Community Analysis (tCO₂eq), 1990 to 2010 Forecast**

Plan Element	1990	1997	2006	2010
Buildings	8,091,421	8,186,934	7,688,612	7,978,419
Transportation	4,112,905	3,711,138	3,709,597	3,638,124
Industry & Waste	5,035,696	3,560,694	3,725,301	3,622,159
Total	17,240,022	15,458,766	15,123,510	15,238,702
Change from 1990	-	-10.3%	-12.3%	-11.6%

**Figure D: City of Philadelphia Greenhouse Gas Emissions Inventory Summary
Side-by-Side Community/City Government Comparison, 2006
Inventory Breakdown by Detailed Source (tCO₂eq)**

Source	Community		City Government	
	tCO ₂ eq	% of Total	tCO ₂ eq	% of Total
Coal	20,480	0.1%		
Diesel	777,636	5.1%	27,076	5.5%
Electricity ⁵	5,924,422	39.2%	351,274	71.5%
Food Waste	46,114	0.3%	491	0.1%
Fuel Wood(Air Dry)	199	0.0%		
Gasoline	2,931,961	19.4%	40,679	8.3%
Heavy Fuel Oil	341,435	2.3%		
Light Fuel Oil	1,030,656	6.8%	10,650	2.2%
Natural Gas	3,840,584	25.4%	60,120	12.2%
Paper Products	85,071	0.6%	854	0.2%
Plant Debris	-704	0.0%	-41	0.0%
Wood/Textiles	-2,320	0.0%	-57	0.0%
All Other Waste	127,979	0.8%		
Total	15,123,513	100.0%	491,046	100.0%

⁴ Includes portions of Philadelphia International Airport (PHL) in Delaware County, Pennsylvania.

⁵ Energy factors for average grid electricity in the Mid-Atlantic Area Council were used for this estimate.



Analysis of City Government GHG Emissions

The analysis of City government GHG emissions is limited to municipal operations in City-owned buildings, vehicles, and industrial and waste facilities. This represents a subset within the broader community analysis.

Figure E indicates that without additional actions the forecast reduction in CO₂ equivalent emissions is 8.9 percent for the City government between 1990 and 2010. Total 1990 emissions of 530,549 tCO₂eq are forecast to decrease to 483,319 tCO₂eq by 2010. City agencies and departments would need to achieve an additional 1.1 percent reduction to meet the City's goal of a 10 percent decrease in greenhouse gas emissions from City government. With implementation of the *Local Action Plan*, City government would achieve an additional emission reduction of roughly 3.4 percent and would lower GHG emissions from City government by 12.3 percent by 2010.

**Figure E: City of Philadelphia Greenhouse Gas Emissions Inventory Summary
City Government Analysis (tCO₂eq), 1990 to 2010 Forecast**

Plan Element	1990	1997	2006	2010
Buildings (incl. streetlights)	275,997	260,893	293,517	287,519
Transportation	68,012	68,027	67,755	67,735
Industry and Waste (incl. water and sewer pumping)	186,540	158,695	129,774	128,065
Total	530,549	487,615	491,046	483,319
Change from 1990	-	-8.1%	-7.5%	-8.9%

Figure E shows that about 60 percent of City government GHG emissions are attributable to buildings, with Industry and Waste producing 26 percent and transportation contributing 14 percent. Considering the detailed sources of emission, Figure D indicates that 71.5 percent of City government's 2006 GHG emissions result from the consumption of electricity, 13.8 percent from gasoline and diesel fuel, and 12.2 percent from natural gas.



Per Capita GHG Emissions

The emission of GHG on a per capita basis, tCO₂eq/person, can reflect a jurisdiction’s effectiveness in managing GHG regardless of population growth or decline. Factors such as population density, relatively small housing units, and high utilization of mass transit, walking, and biking contribute to a low level of per capita GHG emissions in Philadelphia. The tCO₂eq/person for Philadelphia is projected to decrease over the period 1990-2010, although Figure F indicates that this decrease might not be consistent.

Philadelphia’s per capita emissions appear comparable to estimates from several other cities: Boston, 15 (1998); Seattle, 12 (1990); Portland/Multnomah County, 14 (2004); San Francisco, 12.5 (2000).

Figure F: Annual Per Capita GHG Emissions in the Community Sector

Year	tCO ₂ eq/Person ⁶	% Change from 1990
1990	10.9	-
1997	10.1	-7.6%
2006	10.2	-6.3%
2010	10.3	-5.6%

GHG Emissions from Aircraft

GHG emissions from aircraft idling, taking off, or landing at Philadelphia International Airport (PHL) or Philadelphia Northeast Airport (PNE) are not included in this inventory. It is expected that aircraft emissions could be included in future inventories, as the U.S. Department of Transportation’s Center for Climate Change and Environmental Forecasting is working with other international aviation agencies to develop analytical tools and protocols for fairly assessing and assigning local and global GHG.

⁶ Total Population includes population in households and population in group quarters.
1990 - 1,585,577 (decennial US Census); 1997 - 1,537,958 (straight line estimate between figures from 1990 and 2000 Census)
2006 and 2010 - 1,485,000 (Philadelphia City Planning Commission, based on DVRPC 2030 forecast)



Cost of Emissions Reduction Methodology

In the context of the City of Philadelphia Local Action Plan for Climate Change, the stated *Cost of Emissions Reduction* (CER) is the amount spent to save 1 metric ton of CO₂ equivalent. This is calculated for an action by dividing the total implementation cost by the total emissions saved over the anticipated life of the project. As shown in the example in Figure G for Action 4, reducing energy consumption in General Fund utility accounts by 5 percent has a calculated cost of emissions reduction equal to \$24 per tCO₂eq. This assumes an overall financial payback of 2 years, i.e. implementation cost equals annual cost savings times 2, an average cost per MWh of 85, an average tCO₂eq per MWh of .3621, and an expected lifespan of 10 years.

Figure G: Example of Cost of Emission Reduction Calculation: Action 4 - Reduce energy use for General Fund utility accounts by 5% from 2006 by 2010

if save	10,693	MWh/yr	5% savings in General Fund accounts
then save	908,880	\$/yr	average 85 \$/MWh
and save	7,600	tCO ₂ eq/yr	5% savings in General Fund accounts
implementation cost	1,817,759	\$	assuming 2 year payback
cost of emissions reductions	\$24	\$/tCO ₂ eq	assuming 10 year lifespan

For actions that require an initial investment and result in on-going savings, another valuation is the *Value of the Emissions Reduction* (VER). This is defined as the *Net Present Value* (NPV), or the total cash flow over the life of the project in “today’s” dollars, divided by the total emissions reductions over the life of the project. Calculating NPV takes into consideration a *discount rate*, or interest rate used to determine the present value of future cash flows (7.5 percent), and inflation (2.5 percent). For the example above, the NPV was calculated to be \$5.2 million which gives a VER equal to 70 \$/tCO₂.⁷ This means that for every ton of CO₂ saved in relation to this action, \$70 is also saved.

VERs were also calculated for Actions 1, 3, and 12 as shown in Figure H. Item 1, purchasing wind energy, does not have a return on investment (there are no dollar savings) so the NPV and VER are negative (equal to the cost of the wind purchase and the emissions reduction divided by the cost, respectively, where cost is a negative cash flow). The values shown are for five years of wind purchases.

⁷ Values calculated using ROI Emissions Tool provided by PWI Energy. Values are in tCO₂ instead of tCO₂eq. The difference for calculation purposes is negligible.



Figure H. Valuations of Items 1, 3, 4 and 12.

Action	Description	AER* (tCO ₂ eq/yr)	CER (\$/tCO ₂ eq)	NPV (\$ million)	VER (\$/tCO ₂)
1	Purchase 12,800 MWh of wind power annually by 2010 for General Fund utility accounts.	6,400	35	-1.2	-38
3	Require that City-funded building projects over 10,000 square feet of gross floor area, whether new construction or major renovation, be designed and documented as certified under the appropriate LEED™ rating system.	580	23	1.4	124
4	Reduce energy use for General Fund utility accounts by five percent from 2006 by 2010.	7,600	24	5.2	70
12	Reduce vehicle fuel consumption by City government vehicles by five percent from 2006 levels by 2010.	3,400	41	4.2	123
	Total	17,980			

*Annual Emissions Reduction



Notes

