FINAL DRAFT

CITY OF PASADENA

GREENHOUSE GAS EMISSIONS INVENTORY AND REDUCTION PLAN

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EXECUTIVE SUMMARY

Leading scientists around the world agree that the potential for Global Warming is a reality and that human activities are disrupting the Earth's climate by intensifying the greenhouse effect. Its effects will be felt throughout our communities and while local action alone cannot solve the problem the City of Pasadena (City) is aggressively working to reduce its contribution to climate change by adopting policies, developing strategies, and implementing programs to reduce Greenhouse Gas (GHG) emissions.

Committed to becoming a sustainable community, the City has established policies that incorporate environmental responsibility into its daily management of urban and industrial growth, education, energy and water use, air quality, transportation, waste reduction, economic development, and open space and natural habitats.

To further these efforts, the City has developed a baseline GHG emissions inventory, a methodology for tracking and reporting emissions in the future, and recommendations for GHG reduction strategies. An indicator of the success of these efforts will be a measured reduction in Greenhouse Gas (GHG) emissions using the established protocols provided in this report.

The City of Pasadena has elected to be an environmental advocate. A green and sustainable city is a community of residents, neighbors, workers, and visitors who strive together to balance ecological, economic, and social needs to ensure a clean, healthy and safe environment for all members of society and for generations to come. The City has established policies that incorporate environmental responsibility into its daily management of urban and industrial growth, education, energy and water use, air quality, transportation, waste reduction, economic development, and open space and natural habitats.

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LIST OF ACRONYMS

AB 32	Assembly Bill 32, The California Climate Change Solutions Act of 2006
BAU	Business as usual scenario
BTU	British thermal unit
CARB	California Air Resources Board
CAT	Climate Action Team
CCAR	California Climate Action Registry
CEC	California Energy Commission
CEQA	California Environmental Quality Act
CFC	Chlorofluorocarbons
C2F6	Hexafluoroethane
CF4	Carbon Tetrafluoride
CH4	Methane
CO	Carbon Monoxide
CO2	Carbon Dioxide
CO2e	Equivalent Carbon dioxide
DKM	dekatherm
DPM	Diesel Particulate Matter
EMFAC2007	On-Road Emission Factors published by the CARB in 2007
GCC	Global Climate Change
GHG	Greenhouse Gas
GWhs	Gigawatt Hours
GWP	Global Warming Potential
HFC	Hydrofluorocarbons
HFC-23	Trifluoromethane
HFC-134	Hydrofluorocarbon 134
HFC-152a	Difluoroethane
IPCC	Intergovernmental Panel on Climate Change
ITS	Intelligent Transportation Systems
LEED	Leadership in Energy and Environmental Design
MMBTU	A thousand thousand BTUs
MMT CO2e	Million Metric Tonne Carbon Dioxide Equivalent
MWh/year	Megawatt hours per year
MPO	Metropolitan Planning Organization
MWh	Megawatt hours
N2O	Nitrous Oxide
PFC	Tetrafluoromethane
PWP	Pasadena Water and Power Department
SF6	Sulfur Hexafluoride
Tg CO2 Eq	One teragram of Carbon dioxide equivalent
UEA	Urban Environmental Accords
UNUEA	United Nations Urban Environmental Accords
URBEMIS2007	Urban Emissions Model, version 9.2 published in June 2007

USEPA	United States Environmental Protection Agency
VMT	Vehicle miles traveled

SECTION 1 - INTRODUCTION

Leading scientists around the world agree that global warming is a reality and that human activities are disrupting the Earth's climate by intensifying the greenhouse effect. Its effects will be felt throughout our communities and, while local action alone cannot solve the problem, the City of Pasadena (City) is aggressively working to reduce its contribution to climate change by adopting policies, developing strategies and implementing programs to reduce Greenhouse Gas (GHG) emissions.

This section describes the purpose and goals of the Greenhouse Gas Inventory and Reduction Plan, provides some background information on GHG emissions, the climate change impacts that are expected in Pasadena and a brief summary of the regulatory framework regarding GHG emissions and climate change.

1.1 PURPOSE

The Pasadena Greenhouse Gas Inventory and Reduction Plan (Plan) was designed under the premise that the City is uniquely capable of addressing the many sources of the emissions that contribute to global warming. The City developed this document with the following purposes in mind:

- Create a GHG baseline from which to benchmark GHG reductions;
- Provide a plan that is consistent with and complementary to the GHG emissions reduction efforts being conducted by the State of California through the Global Warming Solutions Act (AB 32), and the Federal Government through the actions of the Environmental Protection Agency, and the global community through the Kyoto Protocol;
- Determine whether (or the extent to which) the GHG emissions resulting from the implementation of the City's recently adopted sustainability initiatives are sufficient to meet the City's GHG emissions reduction goals; and
- Provide a policy document with specific implementation measures meant to be considered as part of the planning process for future development projects.

1.2 GOALS

To fulfill the purposes of the Pasadena Greenhouse Gas Reduction Plan, the City identified the following goals to be achieved:

- Provide a list of specific actions that will aggressively reduce GHG emissions, giving the highest priority to actions that provide the greatest reduction in GHG emissions and benefits to the community at least cost;
- To reduce emissions attributable to the City of Pasadena to levels at or below 1990 GHG emissions by year 2020 consistent with the target reductions of AB 32 and to begin to

further reduce GHG emissions toward the ultimate goal of 80 percent below 1990 GHG emissions by year 2050 consistent with the Kyoto Protocol and Executive Order S-3-05;

- Provide estimated GHG reductions associated with the City's sustainability efforts;
- Integrate the City's sustainability efforts into the specific actions of this plan; and
- Establish thresholds of significance for GHG emissions within the California Environmental Quality Act (CEQA) thereby creating a legally defensible foundation to use with the environmental analysis of future development projects subject to City review.

1.3 BACKGROUND

The Plan achieves the purpose and goals described above by providing: an analysis of GHG emissions and sources attributable to the City of Pasadena; estimates on how those emissions are expected to increase; recommended policies and actions that can reduce GHG emissions to meet State, Federal and International targets; a timeline of implementation; and a defined tracking and reporting mechanism that will measure progress toward the goals.

In order to understand this process, the reader needs to know a few facts about GHG emissions, climate change impacts that are expected within the City of Pasadena, and the international, federal, state, and local regulatory framework designed to address climate change. The following information provides a brief background on these topics. A more complete description of the greenhouse effect, GHG emissions, and general climate change impacts can be found in Appendix A of this document.

1.3.1 Greenhouse Gases

Individual GHGs have varying global warming potentials (GWP) and atmospheric lifetimes. The reference gas for GWPs is carbon dioxide. Carbon dioxide (CO_2) has a GWP of one (1). Compared to methane's GWP of 21, it is clear that methane has a greater global warming effect than CO_2 on a molecule per molecule basis (EPA 2006b). As shown below in Table 1.1 GWPs range from 1 (CO_2) to 23,900 (sulfur hexafluoride).

Atmospheric lifetimes vary from 1.5 (HFC-152a) to 50,000 years (tetrafluoromethane). One teragram (equal to one million metric tons) of carbon dioxide equivalent (Tg CO2 Eq.) is the mass emissions of an individual GHG multiplied by its GWP. The atmospheric lifetime and GWP of selected greenhouse gases are also summarized in Table 1.1.

Table 1.1 Global Warming Potentials and Atmospheric Lifetimes

Gas	Atmospheric Lifetime (years)	Global Warming Potential (100 year time horizon)
Carbon Dioxide	50 - 200	1
Methane	12 ± 3	21
Nitrous Oxide	120	310
HFC-23: Trifluoromethane	264	11,700
HFC-134a:1,1,1,2-Tetrafluoroethane	14.6	1,300
HFC-152a: 1,2-difluoroethane	1.5	140
PFC: Tetrafluoromethane (CF4)	50,000	6,500
PFC: Hexafluoroethane (C2F6)	10,000	9,200
Sulfur Hexafluoride (SF6)	3,200	23,900
Source: U.S. Environmental Protection Agency, 2006.		

The global warming potential of the various GHGs is based upon a comparison with carbon dioxide (CO_2), which is set at one in Table 1.1. GHG emissions for each gas is based upon its global warming potential in carbon dioxide equivalents (CO_2e) by multiplying the amount of each GHG by the global warming potential shown in the right hand side of Table 1.1.

1.4 IMPACTS FROM GREENHOUSE GAS EMISSIONS

1.4.1 Impacts to Pasadena

The increasing atmospheric concentration of GHGs resulting from human activities is changing the climate in ways that pose serious risks to Pasadena's health, economy, and environment. Potential consequences of climate change could include impacts on the City's water resources, public health, air quality, electricity supplies, stormwater management, fire suppression resources, and vegetation. Unlike coastal portions of California, Pasadena will not see a direct impact from rising sea levels associated with climate change.

Pasadena Climate Change Projections:

- **Human Health:** One of the biggest risks to the health of Pasadena residents attributed to climate change is air pollution. Increased heat may increase ozone levels and air

pollution toxicity, which may intensify respiratory cases and death attributed to asthma and pulmonary inflammation. Warmer temperatures could increase the opportunities for tick-borne Lyme disease and mosquito-borne diseases such as West Nile virus. Cases of dehydration, heat stroke/exhaustion, heart attack, stroke and respiratory distress caused by extreme heat may also increase.

- **Ecosystems:** The ecosystems that support Pasadena through water and food supply as well as its economy will endure a variety of stresses associated with climate change. There is some uncertainty about exactly how changes in temperature and precipitation will impact the health of the many ecosystems of the state, and how sensitive their interdependent systems are to any significant level of change.

- **Temperature:** Average global temperatures could increase as much as 10 degrees by 2100 (Luers, 2006). The average daily temperature for Pasadena in 2007 was 68.7°F (20°C). Given a 10 degree increase, the average daily temperature in Pasadena could reach 78.7°F (30°C) by 2100.

- **Water Resources:** Southern California is a semi-arid region and is largely dependent upon imported water supplies. A growing population, climate change, environmental concerns, and other factors in other parts of the State and western United States, make Pasadena highly susceptible to water supply reliability issues. Primary water supplies from snow packs in the Sierra Nevada mountain range and Colorado Mountains could be reduced by as much as 70 to 90 % by 2100. Record-low rainfall in the state during 2006-2007 and a federal court ruling that restricts pumping activities in the Sacramento-San Joaquin Delta have caused the Metropolitan Water District (MWD) to draw from its storage reserves. The water stored in reserve is designated for use during shortages and emergencies. If water levels in regional drought conditions persist and if MWD curtails its allocation to Pasadena due to pumping restrictions, Pasadena Water & Power (PWP) projects that there will be a water shortage in Pasadena. Pasadena relies on imported water from the MWD to meet 65% of the city's water needs. Pasadena's groundwater wells provide the remaining 35% of the City's supply. Pasadena's ground water wells are currently 60 feet below historical norms.

    - Imported water supplies from snow packs in the Sierra Nevada mountain range and Colorado Mountains provide water via the State Water Project and the Colorado River Aqueduct to Pasadena, which could be reduced by as much as 70 to 90 percent by 2100.

- Local groundwater supplies in Pasadena will also be affected by climate change as snow pack in the San Gabriel Mountains that feed the local groundwater basin is reduced by as much as 90 percent by 2100. Because winter storms are predicted to provide most of the precipitation in the local mountains as rain by 2100, more of the natural recharge to the groundwater basin through percolation will need to come from stormwater runoff which currently flows to the ocean rather than recharging the groundwater basin. Providing percolation basins that capture these storm flows will help alleviate a portion of the problem, however, percolation basins cannot provide the same capacity or winter storage and recharge as the natural snowpack in the San Gabriel Mountains. The result is that local groundwater supplies are predicted to continue to decrease.

- **Fire Risk:** The occurrence of wildfires could increase as much as 55%, especially in areas interfacing with natural vegetation including Arroyo Seco and Hahamongna Watershed Park and Eaton Canyon.

- **Increased Frequency of Rolling Blackouts:** The California Energy Commission (CEC) has predicted future worst case scenarios of electrical demand in California resulting from the combined effect of population growth, per capita increase in electricity consumption, and increased air conditioning demand from rising temperatures due to climate change. The Pasadena Department of Water and Power (PWP) has taken the CEC data in predicting the increase in electrical demand in Pasadena due to these factors. Under the worst case scenario electricity demand in Pasadena by 2020 could increase by approximately 193 Gigawatt Hours (GWhs) annually over the 2007 baseline. A blackout refers to the total loss of power to an area. Blackouts come without warning, last for indeterminate periods, and are typically caused by catastrophic equipment failure, severe weather, or excessive power demands. Under the worst case scenario electricity demand in 2020 could increase by approximately 193 GWhs annually over the 2007 baseline. Worst case scenarios include rolling and/or total black outs. The nature, cause, and locality of the blackout determine who is affected. Outages may last from a few hours to a few weeks depending on the nature of the blackout and the configuration of the electrical network. Rolling blackouts are deliberate power cuts which are designed to reduce the load on an electricity generation system and the power grid. Rolling blackouts are a last resort measure used by an electricity provider in order to avoid a total blackout of the power system. They are usually in response to a situation where the demand for electricity exceeds the power supply capability of the network. Rolling blackouts may be localized to a specific part of the electricity network or may be more widespread and affect the entire City. Rolling blackouts typically last only a few hours.

Almost all modern activities depend on electricity. An electricity blackout causes impacts to every aspect of daily life, virtually bringing daily activities to a complete standstill. Electrical loss would affect our daily commute (no traffic signals, no trains), ability to use elevators, office functions (no light, computers, copiers, faxes), cook food (no microwave, refrigerators, appliances, solid state ignition) or have access to vital information (no television, radio.). Emergency services would drastically be affected. As electricity demand increases and sources decrease cost will rise and affect our overall economy. Pasadena's existing local generating station has the ability to supply approximately 60-70 percent of the City's peak electricity demand and the remainder is imported from remote resources. Pasadena is part of the state power grid. Pasadena's contract with the state's Independent System Operator (ISO) requires that Pasadena abide by ISO directives during power shortage emergencies.

1.5 REGULATORY SETTING

In an effort to stabilize GHG emissions and reduce impacts associated with climate change, international agreements, as well as federal and state actions have been implemented beginning as early as 1988. The regulatory setting related to GHG emissions includes the international, federal, state, regional, and local government agencies discussed below. These agencies work jointly, as well as individually, to address GHG emissions through legislation, regulations, planning, policy-making, education, and a variety of programs.

1.5.1 International

In 1988, the United Nations established the Intergovernmental Panel on Climate Change (IPCC) to evaluate the impacts of global warming and to develop strategies that nations could implement to curtail global climate change. In 1992, the United States joined other countries around the world in signing the United Nations' Framework Convention on Climate Change agreement (Kyoto Protocol) with the goal of controlling GHG emissions. As a result, the Climate Change Action Plan was developed to address the reduction of GHG in the United States. The plan consists of more than 50 voluntary programs.

1.5.2 Federal

The United States Environmental Protection Agency (EPA) is responsible for implementing federal policy to address global climate change. The Federal government administers a wide array of public-private partnerships to reduce GHG intensity generated by the United States. These programs focus on energy efficiency, renewable energy, methane, and other non-CO_2 gases, agricultural practices, and implementation of technologies to achieve GHG reductions.

The EPA implements several voluntary programs that substantially contribute to the reduction of GHG emissions.

In February 2002, the United States **government** announced a strategy to reduce the GHG intensity of the American economy by 18 percent over the 10-year period from 2002 to 2012. GHG intensity measures the ratio of GHG emissions to economic output. Meeting this commitment will prevent the release of more than 100 million metric tons of CO_2e emissions to the atmosphere (annually) by 2012 and more than 500 million metric tons (cumulatively) between 2002 and 2012. This policy has three basic objectives: slowing the growth of emissions; strengthening science, technology, and institutions; and enhancing international cooperation.

The EPA is responsible for setting and enforcing the National Ambient Air Quality Standards (NAAQS) for atmospheric pollutants. It regulates emission sources that are under the exclusive authority of the federal government such as aircraft, ships, and certain locomotives.

In Massachusetts v. Environmental Protection Agency (Docket No. 05–1120), argued November 29, 2006 and decided April 2, 2007; the U.S. Supreme Court held that not only did the EPA have authority to regulate greenhouse gases, but the EPA's reasons for not regulating this area did not fit the statutory requirements. As such, the U.S. Supreme Court ruled that the EPA should be required to regulate CO_2 and other greenhouse gases as pollutants under the federal Clean Air Act (CAA). To date, the EPA has not developed a regulatory program for greenhouse gas emissions, nor has it been mandated to do so.

1.5.3 State

The California Air Resources Board (CARB) is responsible for implementing state policy to address global climate change. CARB, which is a part of the California Environmental Protection Agency, is responsible for the coordination and administration of both the federal and State air pollution control programs within California. In this capacity, the CARB conducts research, sets California Ambient Air Quality Standards (CAAQS), compiles emission inventories, develops suggested control measures, provides oversight of local programs, and prepares the State Implementation Plan (SIP). In addition, the CARB establishes emission standards for motor vehicles sold in California, consumer products (e.g. hairspray, aerosol paints, and barbeque lighter fluid), and various types of commercial equipment. It also sets fuel specifications to further reduce vehicular emissions.

California Assembly Bill 1493 enacted on July 22, 2002, required CARB to develop and adopt regulations that reduce GHG emitted by passenger vehicles and light duty trucks. In 2005, the CARB submitted a “waiver” request to the EPA from a portion of the federal Clean Air Act in order to allow the State to set more stringent tailpipe emission standards for CO_2 and other GHG

emissions from passenger vehicles and light duty trucks. In December 2007, EPA initially denied the request for a waiver. However, on June 30, 2009, the EPA reversed its initial denial and announced that it had granted the California Request to Reduce Vehicle Greenhouse Gas Emissions "waiver" request.

In June 2005, California Governor Arnold Schwarzenegger issued Executive Order S-3-05, GHG Emissions, which established the following GHG reduction targets for the State as well as a process to ensure that the targets are met:

- 2010: Reduce greenhouse gas emissions to 2000 levels
- 2020: Reduce greenhouse gas emissions to 1990 levels
- 2050: Reduce greenhouse gas emissions to 80% below 1990 levels.

Executive Order S-3-05 directed the Secretary for the California EPA to report every two years on the State's progress toward meeting the Governor's GHG emission reduction targets. As a result of this executive order, the California Climate Action Team (CAT), led by the Secretary of the California EPA, was formed. The CAT is made up of representatives from a number of State agencies and was formed to implement global warming emission reduction programs and report on the progress made toward meeting State-wide targets established under the Executive Order. State agency members include the Business, Transportation and Housing Agency; Department of Food and Agriculture; Resources Agency; Air Resources Board; California Energy Commission; Public Utilities Commission; and Department of Water Resources. The CAT published its Climate Action Team Report to Governor Schwarzenegger and the Legislature in March 2006, in which it laid out 46 specific emission reduction strategies for reducing GHG emissions and reaching the targets established in the Executive Order.

In 2006, the California State Legislature adopted Assembly Bill 32 (AB 32), the California Global Warming Solutions Act of 2006. AB 32 requires CARB to adopt rules and regulations that would achieve GHG emissions equivalent to State-wide levels of 1990 by 2020 through an enforceable State-wide emission cap which will be phased in starting in the year 2012. Emission reductions shall include carbon sequestration projects (projects that would remove carbon from the atmosphere), and best management practices that are technologically feasible and cost effective.

An additional bill related to AB 32, Senate Bill 97 (SB 97) requires by July 1, 2009, that the California Office of Planning and Research (OPR), prepare, develop, and transmit to the Resources Agency guidelines for the feasible mitigation of GHG emissions or the effects of GHG emissions, as required by the California Environmental Quality Act (CEQA), including but not limited to, effects associated with transportation or energy consumption. The Resources Agency will then be required to certify and adopt the guidelines by January 1, 2010, and to periodically

update the guidelines to incorporate new information or criteria established by CARB pursuant to AB 32.

OPR released the CEQA guideline amendments for GHG emissions to the State Resource Agency on April 14, 2009. The State Resources Agency will certify and adopt the CEQA guideline amendments into law on or before January 2010. OPR does not identify a threshold of significance for GHG emissions, nor has it prescribed assessment methodologies or specific mitigation measures. The amendments encourage lead agencies to consider many factors in performing a CEQA analysis, but preserve the discretion granted by CEQA to lead agencies in making their own determinations based on substantial evidence. The amendments also encourage public agencies to make use of programmatic mitigation plans and programs from which to tier when they perform individual project analyses.

While the OPR has not yet adopted formal significance thresholds, OPR issued a guidance document on June 19, 2008 to provide interim advice to lead agencies regarding the analysis of GHG emissions in environmental documents. The technical advisory suggests three components for CEQA disclosure: quantification of GHG emissions from a project's construction and operation, determination of significance of the project's impact to climate change, and if the project is found to be significant, the identification of suitable alternatives and mitigation measures. The analysis contained herein follows this guidance.

On December 6, 2007, CARB released the calculated 1990 GHG emissions of 427 million metric tons of CO_2e. In 2004, the emissions were estimated at 480 million metric tons of CO_2e. A reduction of 13 percent was needed to reduce 2004 levels to 1990 levels. A series of early actions, tailpipe regulations, and the development of fuels with less carbon in them are estimated to provide reductions totaling 66 million tons of CO_2e. CARB prepared a Scoping Plan to develop programs and measures to address the remaining 107 million tons of CO_2e in order to reach the total of 173 million tons by the year 2020. The Scoping Plan was submitted to CARB in November of 2008 and was approved by CARB on December 11, 2008.

California Energy Commission AB 2021 (Levine, Chapter 743, Statutes of 2006) the intent of the Legislature is that load-serving entities procure all cost-effective energy efficiency measures so that the state can meet the goal of reducing total forecasted electricity consumption by 10 percent over the next 10 years. Local publicly owned electric utilities shall acquire all energy efficiency and demand reduction resources that are cost-effective, reliable, and feasible. Energy savings achieved through the enactment of this act are an essential component of the state's plan to meet the Governor's greenhouse gas reduction targets established in Executive Order S-3-05.

On September 12, 2002 Renewable Portfolio Standard SB 1078 was signed and accelerated in 2006 under Senate Bill 107. The Renewable Portfolio Standard requires electric corporations to increase procurement from eligible renewable energy resources by at least 1% of their retail sales annually, until they reach 20% by 2010.

On August 21, 2006 California Solar Initiative(CSI) SB 1 was signed. Under SB 1 the California Public Utilities Commission (CPUC) and the California Energy Commission (CEC) will implement the CSI program. The California Solar Initiative offers solar incentives to energy users (except new homes) in investor-owned utility territories in California. The CSI Program has a goal to install 1,940 MW of new solar by 2017.

On September 29, 2006, Senate Bill 1368 (Perata, Chapter 598, Statutes of 2006) was signed. This law limits long-term investments in baseload generation by the state's utilities to power plants that meet an emissions performance standard (EPS) which was jointly established by the California Energy Commission and the California Public Utilities Commission. The Energy Commission has designed regulations that establish a standard for baseload generation owned by, or under long-term contract to publicly owned utilities, of 1,100 lbs CO2 per megawatt-hour (MWh). This will encourage the development of power plants that meet California's growing energy needs while minimizing their emissions of greenhouse gases.

The California Air Pollution Control Officers Association (CAPCOA) released a white paper, entitled CEQA and Climate Change, in January, 2008. The white paper contains the disclaimer that it is “intended as a resource, not a guidance document,” and examines various threshold approaches available to air districts and lead agencies for determining whether GHG emissions are significant.

1.5.4 Regional

The South Coast Air Quality Management District (SCAQMD) is the agency principally responsible for comprehensive air pollution control in the Basin. In order to provide GHG emission guidance to the local jurisdictions within the South Coast Air Basin, the SCAQMD has organized a Working Group to develop GHG emission analysis guidance and thresholds.

SCAQMD released a draft guidance document regarding interim CEQA GHG significance thresholds in October 2008. SCAQMD proposed a tiered approach, whereby the level of detail and refinement needed to determine significance increases with a project’s total GHG emissions. The tiered approach defines projects that are exempt under CEQA and projects that are within a GHG Reduction Plan as less than significant.

SECTION 2 - METHODOLOGY

2.1 OVERVIEW

The methodology to prepare the GHG inventories in the Plan incorporates the protocols, methods and emission factors found in the California Climate Action Registry (CCAR) General Reporting Protocol (version 3.1, January 2009), and the Local Government Protocol (version 1, August 2008). The Local Government Protocol (version 1, August 2008) categorizes GHG emissions into three distinct scopes that provide a way of organizing the GHG emissions and reduction plan development.

Definition of Local Government Protocol:

- **Scope 1 Emissions:** includes all "direct" sources of GHG emissions from sources that are owned or controlled by the City including (but not limited to): production of electricity, heat, or steam in owned or controlled boilers, furnaces, etc; transportation (using corporate or fleet vehicles) of materials, products, waste, and community members; and fugitive emissions (from unintentional leaks of GHGs directly into the atmosphere).

- **Scope 2 Emissions:** accounts for "indirect" sources of GHG emissions from the generation of purchased utilities consumed by the City. A purchased utility is defined as one that is bought or otherwise brought into the jurisdictional authority of the local government, but not physically generated in power plants owned and/or operated by the local government. Scope 2 emissions physically occur at locations outside of the jurisdictional boundaries and direct control of the local government and thus are separated from direct emissions reported by the utility company or local government in order to avoid double counting.

- **Scope 3 Emissions:** GHG Protocol Initiative considers this an optional reporting category that allows for the treatment of all other "indirect emissions". Scope 3 emissions are a consequence of the activities of the local government, but occur from sources not owned or controlled by the local government.

Because Scope 3 emissions are indirect emissions that are attributable to emissions sources that are not owned or controlled by the City of Pasadena, they are not considered in this GHG Emissions Inventory and Reduction Plan. Scope 1 emissions are characterized named in this report as "direct emissions." Scope 2 emissions are characterized and named as indirect source emissions." The Scope 1 through 3 emissions classifications are also described in Section 4 of this document and describe the relevance of these classifications to the types of reduction measures available.

The analysis relative to Pasadena's GHG Emission Inventory and Reduction Plan employs both quantitative and qualitative components. The quantitative analysis contains an inventory of the City's GHG emissions, while the qualitative component involves compliance with the emission reduction strategies contained in federal, State, and local legislation.

The analysis is tailored to include all historic, existing, and projected emission sources within the City while providing, to the fullest extent feasible, a comprehensive analysis of GHG impacts and mitigation measures available to reduce impacts. The GHG Emission Reduction Plan estimates carbon reduction for the City for the purpose of determining whether the existing plans, programs and policies within the City are sufficient to reach the City's GHG reduction goal. The Emissions Reduction Plan is oriented to achieving a certain reduction rate of GHG emissions per capita, as estimated by the Department of Finance, and thereby help achieve State reduction targets. The Global Warming Solutions Act of 2006 (AB 32) established a comprehensive program of regulatory and market mechanisms to achieve real, quantifiable, cost-effective reductions of greenhouse gas emissions. The law mandates the reduction of CO_2e emissions in California to 1990 levels by 2020.

2.2 DIRECT AND INDIRECT SOURCES OF GHG'S

Total GHG emissions are the sum of emissions from both direct and indirect sources. Direct sources include mobile sources such as motor vehicles, landscape equipment, and stationary sources such as cooling and heating equipment. Indirect sources are comprised of electrical and potable water use, and the generation of solid waste and waste water.

Direct Source Emissions are determined based on sources as follows:

- Emissions from mobile sources are associated with the types and distances of vehicle trips for each land use in the city as well as emissions associated with the operation of construction equipment.
- Emissions from stationary sources are determined based on the amount of electrical generation by the City of Pasadena; the usage of natural gas for heating/cooling, cooking; and manufacturing as well as flue emissions from fireplaces.
- Area source emissions are associated with landscape equipment and hearth exhaust is quantified in Urbemis model runs.

Indirect Sources Emissions are determined based on source as follows:

- Electrical energy used by the City associated with electricity not generated by the City is reported as annual emissions from electrical generation by others (including transmission of electricity) based on the amount of energy from each source.
- Potable water usage is reported as the annual emissions from electrical demand on pumps and equipment needed for treatment and transport of potable water based on water usage data from Pasadena Water & Power.

- Electricity generated by others and used to pump and treat imported potable water. Electrical consumption and the GHG emissions resulting from this source was based upon data from the CEC (CEC 2008).
- Solid waste is reported as the sum of annual emissions from solid waste disposal, treatment, transportation, and fugitive emissions of methane during the life-cycle of the solid waste facilities based on solid waste tonnage data provided by the Pasadena Department of Public Works.
- Wastewater usage is reported as the annual emissions from electrical demand on pumps and equipment needed for wastewater transport, treatment, and disposal based on data from the CEC (CEC 2008).

2.3 GHG EMISSIONS IN THE CITY OF PASADENA

The first step in developing the GHG Emission Reduction Plan was to establish a baseline inventory of Pasadena's GHG emissions. The purpose of this inventory is to identify and categorize the major sources and quantities of GHG emissions being produced by the City's residents, businesses and municipal operations. The Plan establishes 1990 as the target year, in conformance with the AB 32 target goals. AB 32 mandates the reduction of the State's GHG emissions to 1990 levels by the year 2020 and requires that CARB implement regulations to achieve these reductions. The inventory provides a framework on which to design programs and actions that specifically target reductions by emissions sources. Programs and actions already in place within the City are described in Section 4. The inventory also serves as a reference against which to measure the City's progress towards reducing GHG emissions over time, and documentation for potential emission trading opportunities.

In estimating Pasadena's total greenhouse gas emissions, data sources from city, regional, and State agencies were used. For community energy statistics, the following agencies and city departments were consulted: the Pasadena Planning and Development Department, Planning Division; Pasadena Department of Public Works; Pasadena Water and Power; and the California Energy Commission. Transportation data sources included the Pasadena Department of Transportation; Pasadena Department of Public Works, Building Systems & Fleet Management Division; California Department of Transportation; Metropolitan Transit Authority's (MTA) Metro Rail system; Caltrans; CARB; and the California Department of Motor Vehicles. Solid waste data was gathered from Pasadena Department of Public Works, Street Maintenance & Integrated Waste Management Division.

The City's Departments of Water and Power, Transportation, and Planning and Development provided data on municipal operations. In cases where specific historical or forecast data was not available, estimates were made by extrapolating from existing data. General estimate calculations and assumptions are compiled in Appendix B. All of the contributors to greenhouse gas emissions (kilowatt-hours of electricity generated by fossil fuel combustion in power plants,

natural gas in therms, vehicle travel in gallons of fuel, solid waste in tons) are expressed here in the common unit of tons of "carbon dioxide equivalent" (CO_2e) released into the atmosphere in a given year.

Pasadena's main contribution to GHGs is carbon dioxide. The City will directly generate emissions of CO_2 primarily in the form of vehicle exhaust and in the consumption of natural gas for heating. Pasadena will directly generate emissions of methane (CH_4) primarily from natural gas and petroleum systems and wastewater treatment and Nitrous oxide (N_2O) predominately from motor vehicle use.

Because of the successful global bans on chlorofluorocarbons (primarily used as refrigerants, aerosol propellants and cleaning solvents), Pasadena does not generate significant emissions of these GHGs and therefore, they are not considered any further in this analysis. This also includes other synthesized gases such as HFCs and CF_4 which have been banned and are no longer available on the market. Because of the ban, the City of Pasadena will not generate emissions of these GHGs and therefore, they are not considered any further in this analysis.

Another GHG with a high global warming potential is Sulfur hexafluoride (SF_6), which is mainly used as a gaseous dielectric medium in electric switchgear of high voltage electric transmission lines and medical use in retinal detachment surgery and ultrasound imaging. In both uses, SF_6 is not released to the atmosphere and therefore, it is not considered further in this analysis.

2.4 CALCULATION OF GHGS

The following summarizes the basis of the GHG calculations by emission source. The emissions calculations follow the California Climate Action Registry (CCAR) General Reporting Protocol, version 3.1 (January 2009), Local Government Protocol, version 1 (August 2008), the Urban Forestry Protocol, version 1 (August 2008) and CARB's Mandatory GHG Reporting Regulations. These protocols are consistent with the methodology and emission factors endorsed by SCAQMD, the CARB and US EPA. In cases where the various protocols do not contain specific source emission factors, the AP 42, emission factors published by US EPA were used. AP-42 is a compilation of air pollution emission factors by the U.S. EPA.

Equations used in the calculations of GHG's are included in Appendix B. Calculations of GHG's for 1990, 2007, and 2020 are included in Appendices C through E. When data was not available from the City for 1990, estimations for this data were based on square footage of land use as a percentage of 2007 values. 2020 data was estimated by multiplying the 2007 land use by the estimated growth rate of 1.25% per year. The growth rate was calculated by averaging the California Department of Finance estimates of economic growth rates for the City for the years

2000 to 2008. (The method and calculations used in determining economic growth rates based upon the California Department of Finance can be found in Appendix B).

GHG emissions are typically segregated into direct and indirect sources as discussed above. However, direct and indirect sources are not completely independent of each other and are often combined into other more encompassing categories. For example, although natural gas combustion is a direct source and electricity generation is an indirect source, they both are typically discussed under a heading of "Energy" when policies are put in place to reduce emissions. In this GHG Reduction Plan, Business-As-Usual (BAU) refers to continued operations and development of the city without the inclusion of recently-adopted sustainability initiatives. The BAU scenario describes how emissions would be in year 2020, if the emissions inventory continued to grow strictly based upon the growth projections for the City and the naturally occurring events that might change the character of emissions. Therefore, BAU follows a linear growth pattern of emissions with minor changes associated with the increasing density that is naturally occurring due to the continued urbanization of the City. There is a modest reduction in vehicle miles traveled based upon the continued urbanization, but BAU does not include all of the intentional programs that the City of Pasadena is implementing. In particular, BAU does not include the sustainability indicators and programs described below.

Pasadena has established a number of sustainability indicators and quantifiable measurements following the framework of the United Nations Urban Environmental Accords (UEAs) (detailed in Section 4.2.3) for the purposes of setting and tracking reduction goals for the City. With that in mind, the methodology specific to Pasadena's emissions are organized in such as way as to reflect the categories outlined in the UEAs. Not all of the UEA categories are discussed below because categories such as Environmental Health and Urban Design do not have sources that are unique to their category and therefore programs and actions developed under these categories would reduce emissions from sources that are quantified under other categories.

Energy

Natural Gas Combustion:

Carbon dioxide emissions from natural gas combustion were generated using a US EPA AP-42 emission factor (EPA 1998). The annual natural gas usage for the City in MMBTUs (A thousand thousand BTUs) was multiplied by the respective emissions factors for CO_2, CH_4, and N_2O to determine the emissions from natural gas combustion, typically used for heating. In order to prevent the double counting of emissions, the natural gas consumed during the generation of electricity at the two local natural gas powered generation stations was subtracted from the total annual natural gas usage for the City. Emissions from this use of natural gas are included in the emissions from electricity generation.

Electricity:

The City emits CO_2, CH_4, and N_2O through the generation and use of electricity. Annual electricity usage obtained from the City for the target years, was used in determining emissions from electricity consumption and generation.

The PWP provides electricity from a variety of sources including the Intermountain Power Plant in Delta, Utah; natural gas-fired generating stations in Pasadena and Burbank, California; as well as electricity purchased from the wholesale power market, in September 2008 PWP has signed a solar "purchase power agreement" with SolarMax Technology, Inc.. Each of these sources of electricity emits different levels of GHG emissions. The annual usage in MWh/year (megawatt hours per year) was multiplied by the respective emission factors appropriate to the source of electricity for CO_2, CH_4, and N_2O to determine emissions from these sources.

Solid Waste Management

Waste Reduction/Recycling

GHG emissions from recycling are determined as the sum of emissions generated by transportation from its source to the recycling process facility, and the equipment used to sort the materials into separate commodities.

Emissions from the transportation of recyclable are determined based on the annual lbs/year of recycling generated, the density of the material, the capacity of the hauling trucks, the average number of miles traveled by each truck; and the CO_2, CH_4, and N_2O emissions generated per mile traveled.

Solid Waste:

Emissions from solid waste are determined as the sum of emissions generated by transportation from its source to the landfill, the equipment used in its disposal at the landfill, and the fugitive emissions from decomposition in landfills.

Emissions from the transportation of solid waste is determined based on the annual lbs/year (pounds per year) of total waste disposed in landfills including biosolids waste from wastewater treatment plants, the density of the waste, the capacity of the hauling trucks, the average number of miles traveled by each truck; and the CO_2, CH_4, and N_2O emissions generated per mile traveled.

Emissions from the equipment used at the landfills is calculated by determining the average hours of operation per day, the number of days of operation, and the emission factors for disposal equipment for CO_2, CH_4, and N_2O as determined from SCAQMD off-road mobile source emission factors.

Fugitive emissions of carbon dioxide and methane from the decomposition of solid waste are calculated based on the annual waste generation multiplied by the respective emission factors for waste production for CO_2 and CH_4. Nitrous Oxide is not a bi-product of decomposition and therefore no fugitive emissions of nitrous oxide are anticipated from this source.

Urban Nature

Landscape Equipment:

Emissions of CO_2, CH_4, and N_2O are generated by the use of landscape equipment through the combustion of gasoline. CO_2 emissions are determined directly through URBEMIS2007. URBEMIS2007 is a computer software package that is used for air quality modeling. From the CO_2 emissions, the approximate number of gallons of gasoline consumed through landscape equipment use was calculated. This number was then multiplied by emission factors presented in the California Climate Action Registry (CCAR) to determine both CH_4 and N_2O emissions.

Transportation:

Carbon dioxide emissions from vehicles were calculated utilizing URBEMIS2007 version 9.2.4 EMFAC2007 emission factors. The Emission Factors (EMFAC) model was developed by the Air Resources Board and used to calculate emission rates from on-road motor vehicles from light-duty passenger vehicles to heavy-duty trucks that operate on highways, freeways, and local roads in California. Motor vehicle emissions of CH_4, and N_2O were also calculated using USEPA emission factors for on-road vehicles based on the total annual mileage driven (as obtained from URBEMIS2007) multiplied by USEPA emission factors for CH_4, and N_2O. Vehicle miles are determined through URBEMIS based on the number of dwelling units for residential land use types, or the square footage of commercial and industrial lands use types. Vehicle miles traveled is based on URBEMIS2007 estimates which assume that all vehicles are either gasoline or diesel powered. The estimates therefore do not account for electrical, biodiesel (a blend of diesel and vegetable oil), or hydrogen powered systems. Any 100% electrically powered vehicles will be accounted for in the electrical usage for the City.

Water

Potable Water:

Electricity is needed to move and treat water. Pasadena's groundwater wells provide 40% of the City's supply and the electricity needed to power those wells was accounted for in the electricity

calculations described above. However, to meet the remaining 60% of the City's water needs, Pasadena relies on imported water from the Metropolitan Water District (MWD). Emissions of CO_2, CH_4, and N_2O from potable water supplied by the MWD are calculated by multiplying annual gallons of water purchased by a conversion factor for the amount of MWh of electricity used to treat and transport the water to the City.

Waste Water Treatment:

Emissions from waste water treatment are based on the annual emissions of each of the GHGs from electricity generation used for potable water treatment and transportation multiplied by the ratio between potable water usage and waste water production as provided by the USEPA.

SECTION 3 - GREENHOUSE GAS EMISSIONS INVENTORY

The first step in developing the Green House Gas Reduction Plan was to conduct an inventory of GHG emissions by emission sources for the year 1990 and the current year (2007). The emissions inventory identifies and categorizes the major sources and quantities of GHG emissions currently being produced by City residents, businesses, and municipal operations using the best available data. Using historic emissions and business-as-usual (BAU) practices as a basis, the inventory includes GHG emissions as projected for the year 2020.

The Emissions Inventories are organized to follow the outline of the City's Green City Action Plan which follows the framework of the United Nation's Urban Environmental Accords (UEA) as closely as possible. The UEA is a set of 21 actions for cities across the globe to take in order to become sustainable. The 21 are grouped equally into seven urban thematic areas: energy, waste reduction, urban design, urban nature, environmental health, transportation and water. However, some of the UEA categories (namely environmental health and water) are by their nature incorporated into other categories. For example, water emissions are determined based on the amount of electricity needed to treat and pump potable water, therefore they are included as part of the "energy" emissions.

Urban Design, from an emissions inventory perspective, deals strictly with emissions as related to land use types. Emissions from Urban Design include portions of the emissions generated for each of the other UEA categories. For example, emissions from single family homes include aspects of transportation, waste generation and energy consumption. Therefore Urban Design, as addressed here, strictly provides an alternative breakdown of the net yearly GHG emissions by general land use types. With respect to Urban Design, industrial processes refers to all warehouse, light industrial, and industrial land uses throughout the city; residential incorporates all single and multi family as well as congregate care dwelling units; and commercial encompasses all other land uses within the City. Details on the various land use categories and how emissions were modeled for these categories are included in Appendix B.

3.1 1990 EMISSIONS INVENTORY

In 1990, the City of Pasadena's total GHG annual emissions were approximately **7.3 million** tons CO_2e. The following Tables and Figures (Table 3-1, 3-2, Table 3-3, Table 3-4, Table 3-5, and Table 3-6; and Figure 3-1, Figure 3-2, and Figure 3-3), summarize the 1990 emissions by UEA category.

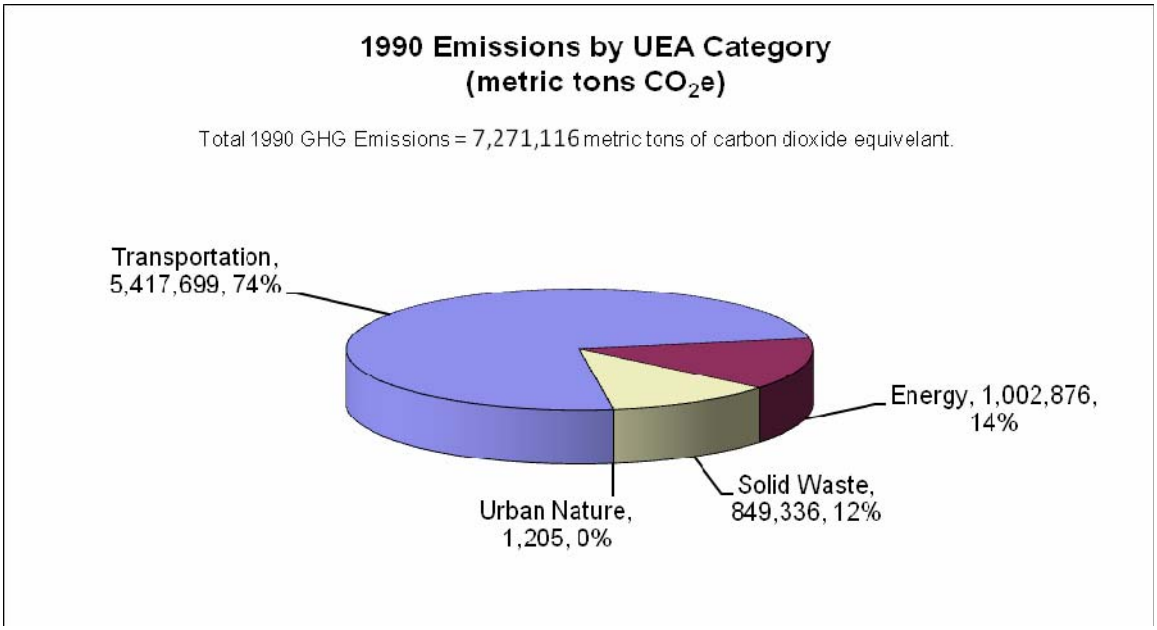
3.1.1 1990 Net Total Emissions

Table 3-1 summarizes the net 1990 City emissions of CO_2e as broken down by category. Each of these categories is further broken down in Tables 3-2 through 3-5 below. Figure 3-1 is a graphical representation of Table 3-1. A detailed breakdown of 1990 emissions by category is available in Appendix C.

Table 3-1: 1990 Net Total Emissions

Net Total Emissions	
UEA Category	**Metric tons of CO_2e**
Energy	1,002,876
Solid Waste	849,336
Urban Nature	1,205
Transportation	5,417,699
Total	**7,271,116**

Figure 3-1: 1990 Emissions by UEA Category (CO_2e)



3.1.2 1990 Energy Emissions

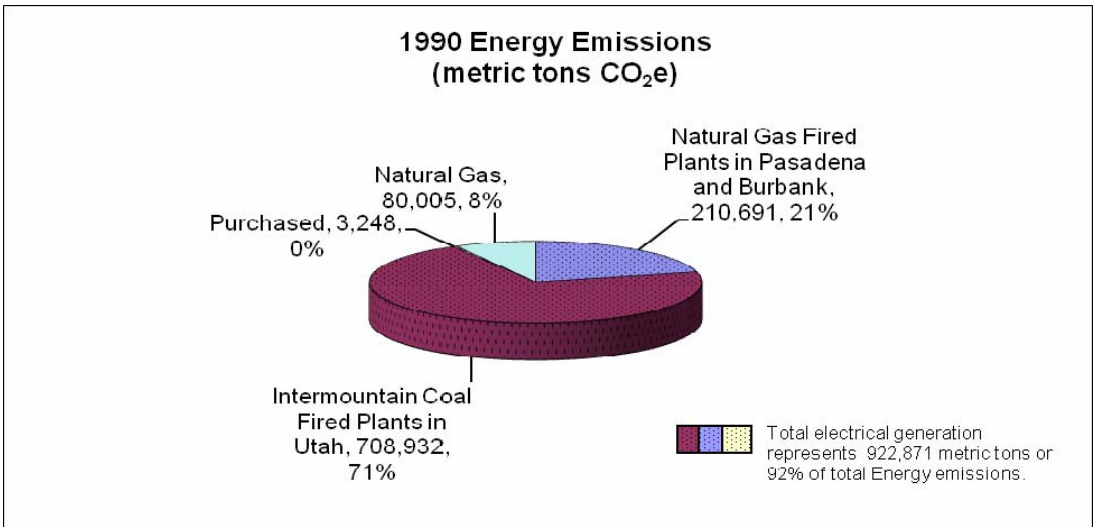
Emissions associated with 1990 energy were based on the emissions data and energy production collected by PWP. Energy accounted for approximately 14 percent of the total emissions produced in 1990. This constitutes the second largest sector of emissions. Because PWP generates its own electricity, it is useful to review the individual sources contributing to the total energy sector emissions in order to review potential reduction strategies associated with PWP-owned and/or operated generating stations. Table 3-2 summarizes the emissions from energy

generation and/or consumption with respect to electricity and natural gas. Electricity generation is determined based on the operation of the natural-gas-fired plants owned by Pasadena, the coal-fired plant contracted by Pasadena, or the electricity purchased by Pasadena from other sources used to meet the electric loads within the City. Natural gas consumption does not include the natural gas used to power the electrical generation stations as that consumption is figured into the emissions from generating electricity. Figure 3-2 is a graphical representation of this table. A detailed breakdown of 1990 energy emissions is available in Appendix C.

Table 3-2: 1990 Energy Emissions

Energy Emissions		
	Sources:	**Metric tons of CO_2e**
1	Electric	
	Natural Gas Fired Plants in Pasadena and Burbank	210,691
	Intermountain Coal Fired Plants in Utah	708,932
	Purchased	3,248
2	Natural Gas	80,005
3	Other Fuels	Data Not Available
	Total	**1,002,876**

Figure 3-2: 1990 Energy Emissions (CO_2e)



3.1.3 1990 Solid Waste Emissions

Table 3-3 summarizes the 1990 City emissions from the transportation, disposal, and decomposition of solid waste generated with the City. The data for green waste and materials recycling in 1990 is not available at this time. Solid-waste-related emissions represent

approximately 12% of the total GHG emissions generated by the City of Pasadena in 1990. A detailed breakdown of 1990 solid waste emissions is available in Appendix C.

Table 3-3: 1990 Solid Waste Emissions

Solid Waste Emissions		
Source		**Metric tons of CO_2e**
1	Solid Waste Disposal	849,336
2	Green Waste Recycling	Data Not Available
3	Materials Recycling	Data Not Available
	Total	**849,336**

3.1.4 1990 Urban Nature Emissions

Table 3-4 summarizes the 1990 City emissions from Urban Nature. At this time this only includes the emissions from landscaping activities. Urban-Nature-related emissions represent less than 1% of the total GHG emissions generated by the City of Pasadena in 1990. Data is not available to determine the 1990 emissions with respect to planting trees or fertilizer use or carbon sink from CO_2 sequestration. A detailed breakdown of 1990 Urban Nature emissions is available in Appendix C.

Table 3-4: 1990 Urban Nature Emissions

Urban Nature Emissions		
Sources:		**Metric tons of CO_2e**
1	Emissions from tree planting	Data Not Available
2	Fugitive emissions from fertilizer	Data Not Available
3	Landscaping	1,205
4	Carbon sink from CO_2 sequestration	Data Not Available
	Total	**1,205**

3.1.5 1990 Transportation Emissions

Table 3-5 summarizes the 1990 City emissions with respect to vehicle miles traveled for all vehicles with trip origins or destinations in the City of Pasadena. Details on the vehicle fleet and emissions calculations can be found in Appendices C and D. Transportation emissions do not

include pass-through traffic on the freeways within the City of Pasadena and only account for vehicle trips related to Pasadena land uses as starting points and destinations. The total vehicle miles traveled (VMT) related to these trips includes the total commute whether or not the entire trip is within City boundaries. Transportation-related emissions represent approximately 74% of the total GHG emissions generated by the City of Pasadena in 1990. A detailed breakdown of 1990 transportation emissions is available in Appendix C.

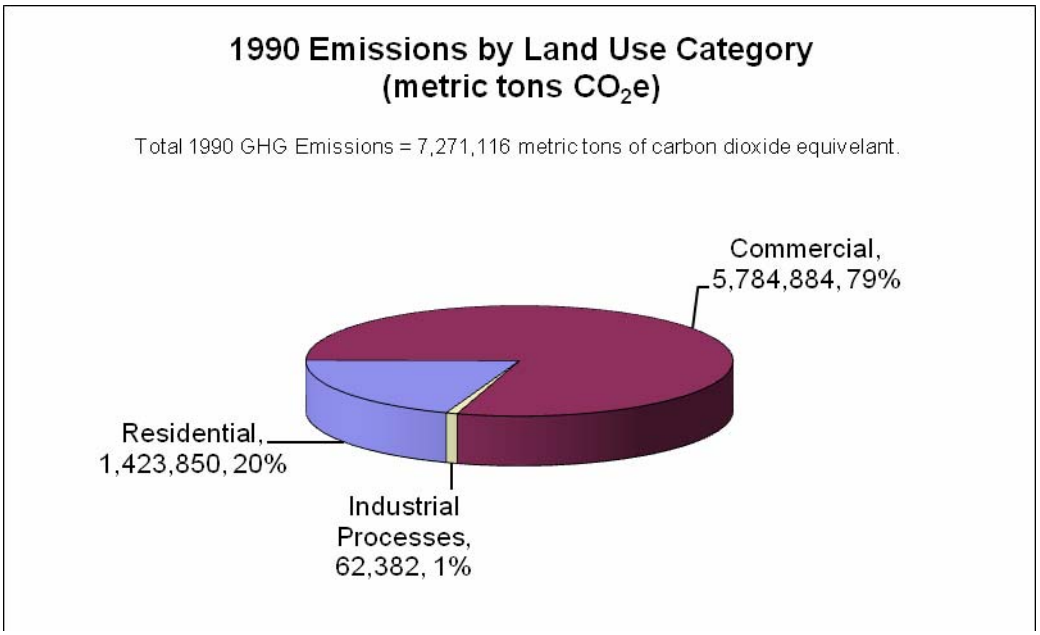
Table 3-5: 1990 Transportation Emissions

Transportation Emissions		
	Source:	**Metric tons of CO_2e**
1	On-Road Vehicles	5,417,699
	Total	**5,417,699**

3.1.6 1990 Urban Design Emissions

Urban Design as addressed here strictly provides a breakdown of the total 1990 GHG emissions for the City of Pasadena by land use categories (residential, commercial and industrial). Figure 3-3 provides a breakdown of emissions by land use categories. A detailed breakdown of 1990 emissions as organized by individual land use type is available in Appendix C.

Figure 3-3: 1990 Emissions by Land Use Category (CO_2e)



3.2 2007 EMISSIONS INVENTORY

The City of Pasadena emitted a total of **8 million** metric tons of CO_2e in 2007, a 7.2% increase over 1990 levels. The following tables and Figures (Table 3-6, Table 3-7, Table 3-8, Table 3-9, and Table 3-10; and Figure 3-4, 3-5, and 3-6) summarize the emissions by UEA category.

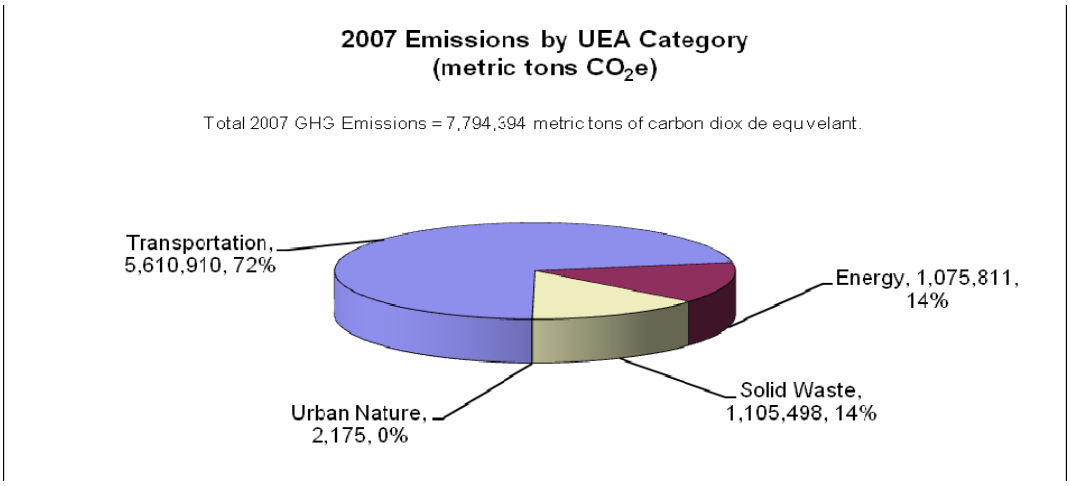
3.2.1 2007 Net Total Emissions

Table 3-6 summarizes the net 2007 City emissions of CO_2e as broken down by UEA category. Each of these categories is further broken down in Tables 3-7 through 3-10 below. Figure 3-4 is a graphical representation of Table 3-6. A detailed breakdown of 2007 emissions by category is available in Appendix D.

Table 3-6: 2007 Net Total Emissions

Net Total Emissions	
UEA Category	**Metric tons of CO_2e**
Energy	1,075,811
Solid Waste	1,105,498
Urban Nature	2,175
Transportation	5,610,910
Total	**7,794,394**

Figure 3-4: 2007 Emissions Generated by UEA Category (CO2e)



3.2.2 2007 Energy Emissions

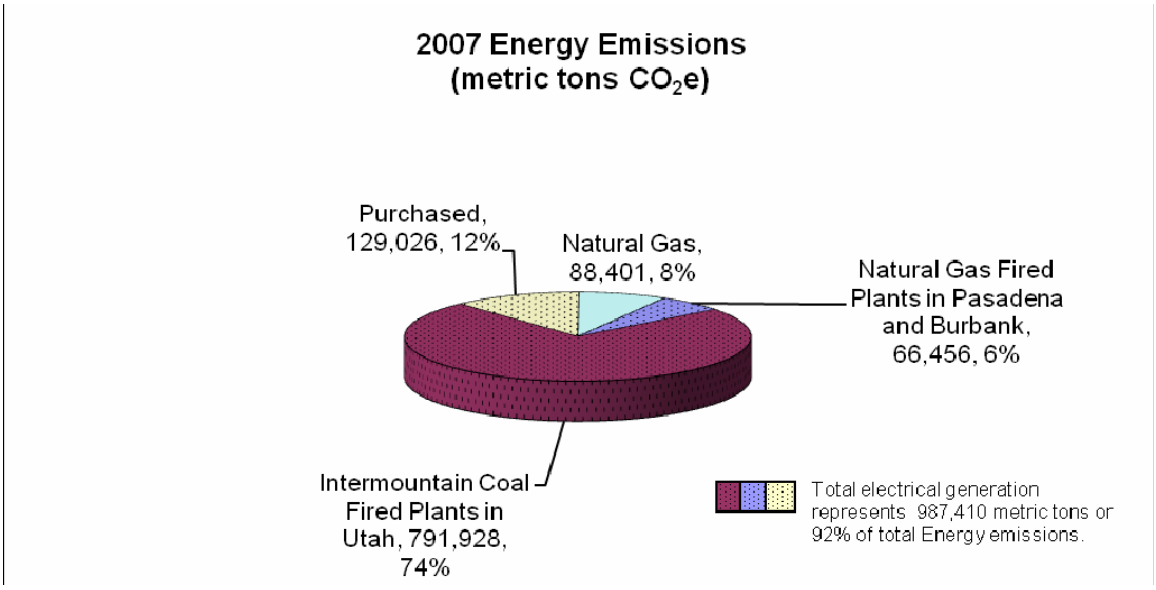
Table 3-7 summarizes the emissions from energy generation and/or consumption with respect to electricity and natural gas. Energy related emissions represent approximately 14% of the total GHG emissions generated by the City of Pasadena in 2007. The largest single source of GHG

emissions in the energy sector is the Intermountain Coal-Fired electrical generating plants in Utah. Figure 3-5 is a graphical representation of this table. A detailed breakdown of 2007 energy emissions is available in Appendix D.

Table 3-7: 2007 Energy Emissions

Energy		
Sources:		**Metric tons of CO_2e**
1	Electric	
	Natural Gas Fired Plants in Pasadena and Burbank	66,456
	Intermountain Coal Fired Plants in Utah	791,928
	Purchased	129,026
2	Natural Gas	88,401
3	Other Fuels	Data Not Available
	Total	**1,075,811**

Figure 3-5: 2007 Energy Emissions (CO_2e)



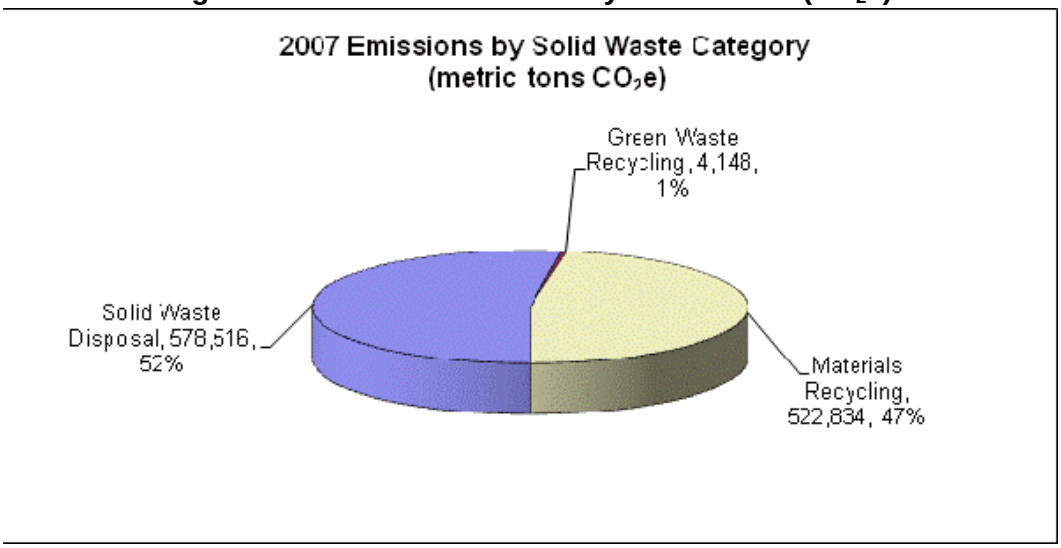
3.2.3 2007 Solid Waste Emissions

Table 3-8 summarizes the 2007 City emissions from the transportation, disposal, and decomposition of solid waste generated within the City. In 2007, the City disposed 225,733 tons of solid waste, recycled 1,559 tons of green waste and recycled 334,047 of mixed materials. Solid-waste-related emissions represent approximately 14% of the total GHG emissions generated by the City of Pasadena in 2007. A detailed breakdown of 2007 solid waste emissions is available in Appendix B.

Table 3-8: 2007 Solid Waste Emissions

Solid Waste		
	Source	**Metric tons of CO_2e**
1	Solid Waste Disposal	578,516
2	Green Waste Recycling	4,148
3	Materials Recycling	522,834
	Total	**1,105,498**

Figure 3-6: 2007 Emissions by Solid Waste (CO_2e)



3.2.4 2007 Urban Nature Emissions

Table 3-9 summarizes the 2007 City emissions from Urban Nature. At this time this only includes the emissions from landscaping activities and the carbon sink from CO_2 sequestration. Urban-Nature-related emissions represent less than 1% of the total GHG emissions generated by the City of Pasadena in 2007. Data is not available to determine the 2007 emissions with respect to planting trees or fertilizer use. A detailed breakdown of 2007 Urban Nature emissions is available in Appendix D.

Table 3-9: 2007 Urban Nature Emissions

Urban Nature Emissions		
Sources:		**Metric tons of CO_2e**
1	Emissions from tree planting	Data Not Available
2	Fugitive emissions from fertilizer	Data Not Available
3	Landscaping	2,192
4	Carbon sink from CO_2 sequestration*	(17)
	Total	**2,175**

* ***See Urban Forestry Program*** *Table 4-5*

3.2.5 2007 Transportation Emissions

Table 3.10 summarizes the 2007 City emissions with respect to vehicle miles traveled. Transportation emissions do not include pass-through traffic on the freeways within the City of Pasadena and only account for vehicle trips related to Pasadena land uses as starting points and destinations. Transportation-related emissions represent approximately 72% of the total GHG indirect sources of emissions generated within the City of Pasadena. Transportation emissions in 2007 represent an 3.57% increase from 1990 levels. A detailed breakdown of 2007 transportation emissions is available in Appendix D.

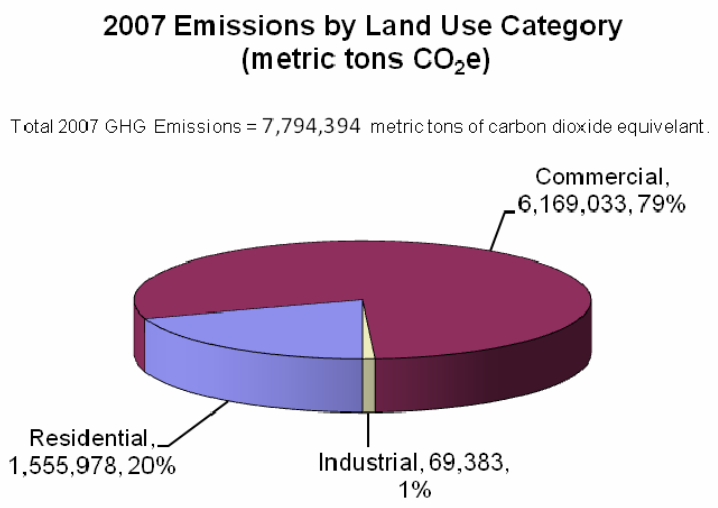
Table 3-10: 2007 Transportation Emissions

Transportation Emissions		
Source:		**Metric tons of CO_2e**
1	On-Road Vehicles	5,610,910
	Total	**5,610,910**

3.2.6 2007 Urban Design Emissions

Urban Design as addressed here strictly provides a breakdown of the total 2007 GHG emissions for the City of Pasadena by the residential, commercial and industrial land use categories (Figure 3-7). A detailed breakdown of 2007 emissions by land use is available in Appendix D.

Figure 3-7: 2007 Emissions by Land Use Category (CO_2e)



3.3 2020 BUSINESS AS USUAL (BAU) EMISSIONS INVENTORY

In 2020, the City of Pasadena is projected to emit a total of **8.7 million** metric tons of CO_2e from business-as-usual standpoint. Business-as-usual refers to continued operations and development of the city according to 2007 policies, without the inclusion of recently-adopted sustainability initiatives described in Chapter 4. The calculations excluded the emissions reductions from these programs because the GHG benefits would not have been realized in 2007. The following Tables and Figures (Table 3-11, Table 3-12, Table 3-13, Table 3-14, and Table 3-15; and Figure 3-7, 3-8, and 3-9) summarize the BAU emissions by UEA category as estimated for 2020 without factoring in implementation of the emission reduction strategies.

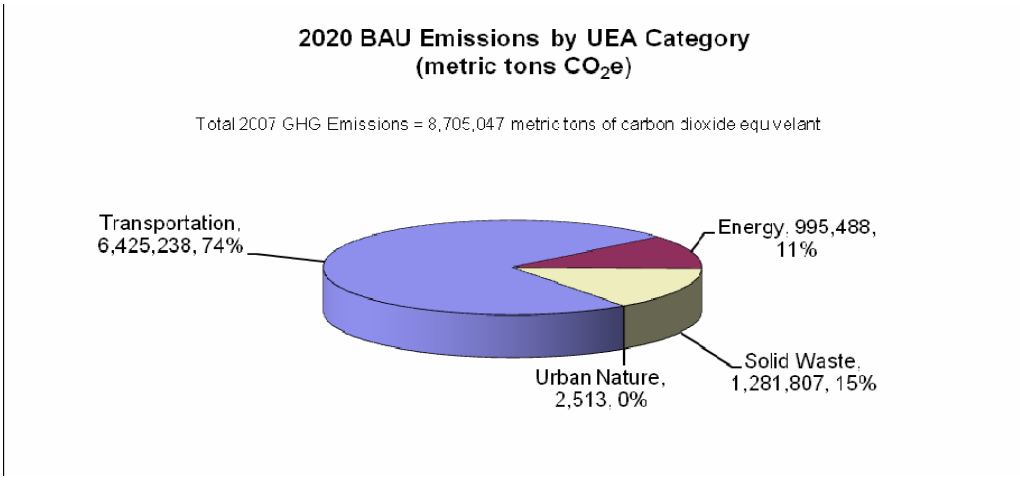
3.3.1 2020 BAU Net Total Emissions

Table 3-11 summarizes the net 2020 City emissions of CO_2e as broken down by UEA category. Each of these categories is further broken down in Tables 3-12 through 3-15 below. Figure 3-8 is a graphical representation of Table 3-11. A detailed breakdown of 2020 emissions by category is available in Appendix E.

Table 3-11: 2020 BAU Net Total Emissions

Net Total Emissions	
UEA Category	**Metric tons of CO_2e**
Energy	995,488
Solid Waste	1,281,807
Urban Nature	2,513
Transportation	6,425,238
Total	**8,705,047**

Figure 3-8: 2020 BAU Emissions Generated by UEA Category (CO_2e)



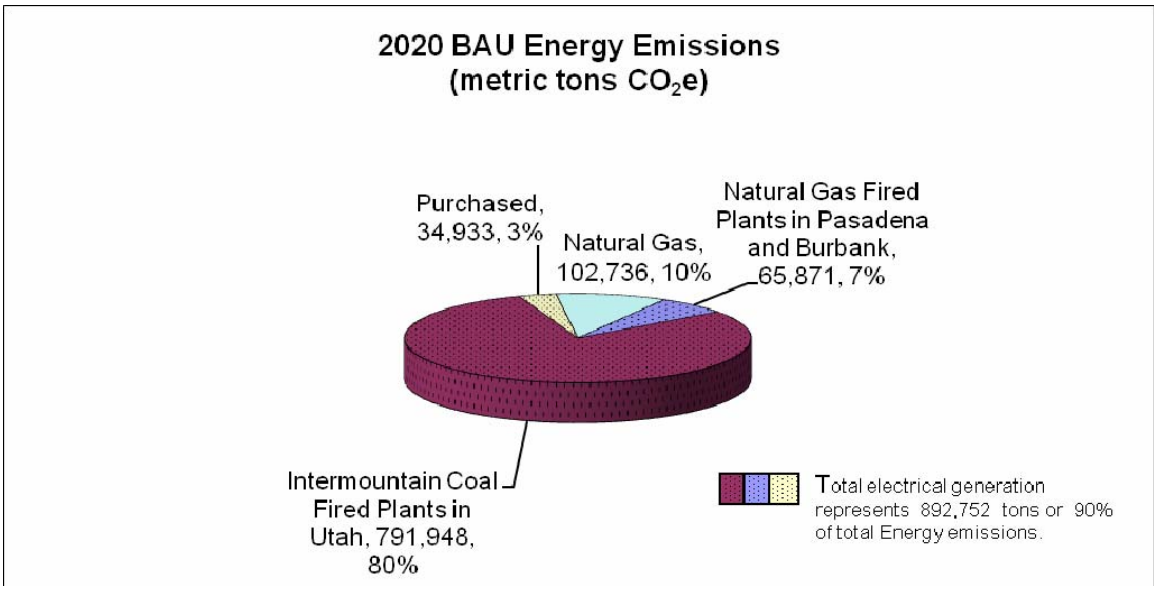
3.3.2 2020 BAU Energy Emissions

Table 3-12 summarizes the emissions from energy generation and/or consumption with respect to electricity and natural gas. The total also includes indirect energy emissions associated with pumping and treating potable water and wastewater. Energy related emissions represent approximately 11% of the total GHG emissions generated by the City of Pasadena in 2020. Figure 3-9 is a graphical representation of this table. A detailed breakdown of 2020 energy emissions is available in Appendix E.

Table 3-12: 2020 BAU Energy Emissions

Energy Emissions		
	Sources:	**Metric tons of CO_2e**
1	Electric	
	Natural Gas Fired Plants in Pasadena and Burbank	65,871
	Intermountain Coal Fired Plants in Utah	791,948
	Purchased	34,933
2	Natural Gas	102,736
3	Other Fuels	Data Not Available
	Total	**995,488**

Figure 3-9: 2020 BAU Energy Emissions (CO_2e)



3.3.3 2020 BAU Solid Waste Emissions

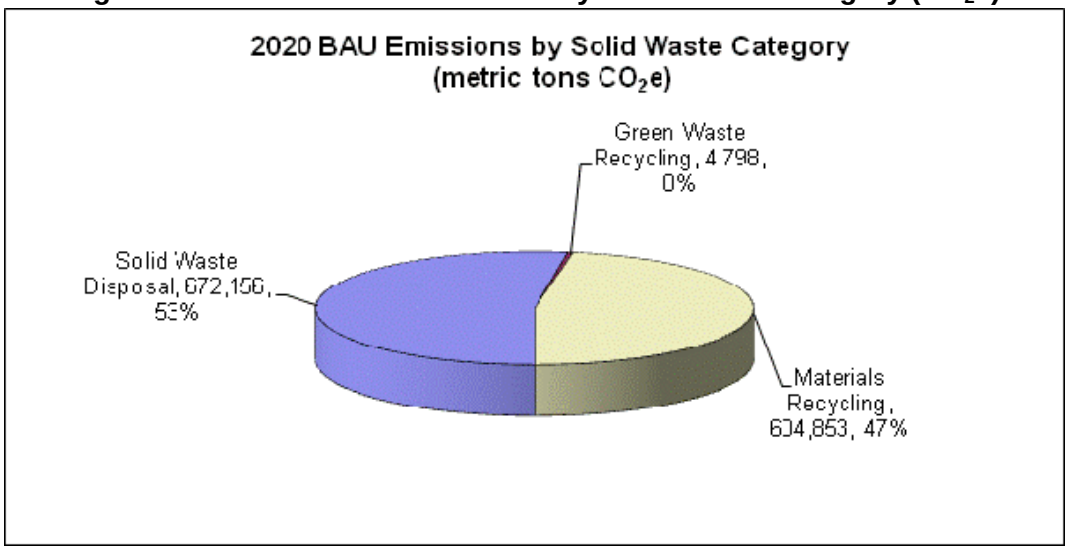
Table 3-13 summarizes the 2020 City emissions from the transportation, disposal, and decomposition of solid waste generated with the City. Solid-waste-related emissions represent approximately 15% of the total GHG emissions generated by the City of Pasadena in 2020.

Figure 3-10 is a breakdown of Business as Usual emissions by Solid Waste Category. A detailed breakdown of 2020 solid waste emissions is available in Appendix E.

Table 3-13: 2020 BAU Solid Waste Emissions

Solid Waste Emissions		
	Source	**Metric tons of CO_2e**
1	Solid Waste Disposal	672,156
2	Green Waste Recycling	4,798
3	Materials Recycling	604,853
	Total	**1,281,807**

Figure 3-10: 2020 BAU Emissions by Solid Waste Category (CO_2e)



3.3.4 2020 BAU Urban Nature Emissions

Table 3-14 summarizes the 2020 City emissions from Urban Nature. At this time this only includes the emissions from landscaping activities and the carbon sink from CO_2 sequestration. Urban-Nature-related emissions represent less than 1% of the total GHG emissions generated by the City of Pasadena in 2020. Data is not available to determine the 2020 emissions with respect to planting trees or fertilizer use. A detailed breakdown of 2020 Urban Nature emissions is available in Appendix E.

Table 3-14: 2020 BAU Urban Nature Emissions

Urban Nature Emissions		
Sources:		**Metric tons of CO_2e**
1	Emissions from tree planting	Data Not Available
2	Fugitive emissions from fertilizer	Data Not Available
3	Landscaping	2,530
4	Carbon sink from CO_2 sequestration	(17)
	Total	**2,513**

3.3.5 2020 BAU Transportation Emissions

Table 3-15 summarizes the 2020 City emissions with respect to vehicle miles traveled. Transportation emissions do not include pass-through traffic on the freeways within the City of Pasadena and only account for vehicle trips related to Pasadena land uses as starting points and destinations. Transportation-related emissions represent approximately 74% of the total GHG emissions generated by the City of Pasadena in 2020. A detailed breakdown of 2020 transportation emissions is available in Appendix E.

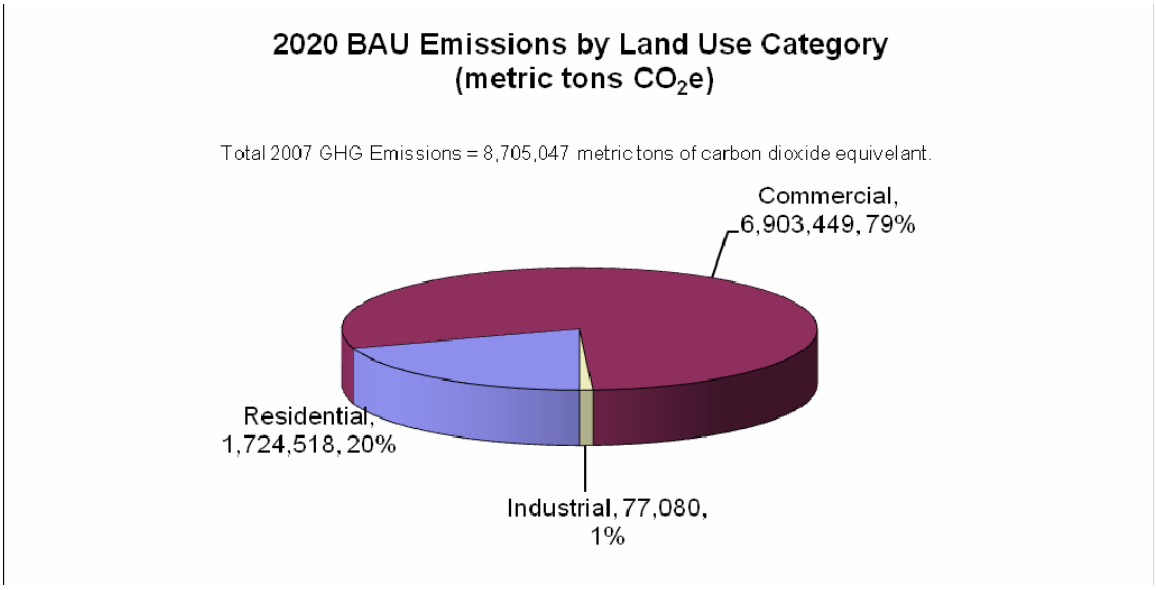
Table 3-15: 2020 BAU Transportation Emissions

Transportation Emissions		
Source:		**Metric tons of CO_2e**
1	On-Road Vehicles	6,425,238
	Total	**6,425,238**

3.3.6 2020 BAU Urban Design Emissions

Urban Design as addressed here strictly provides a breakdown of the total 2020 GHG emissions for the City of Pasadena by the residential, commercial and industrial land use categories (Figure 3-11). A detailed breakdown of 2020 emissions by land use is available in Appendix E.

Figure 3-11: 2020 BAU Emissions by Land Use Category (CO_2e)



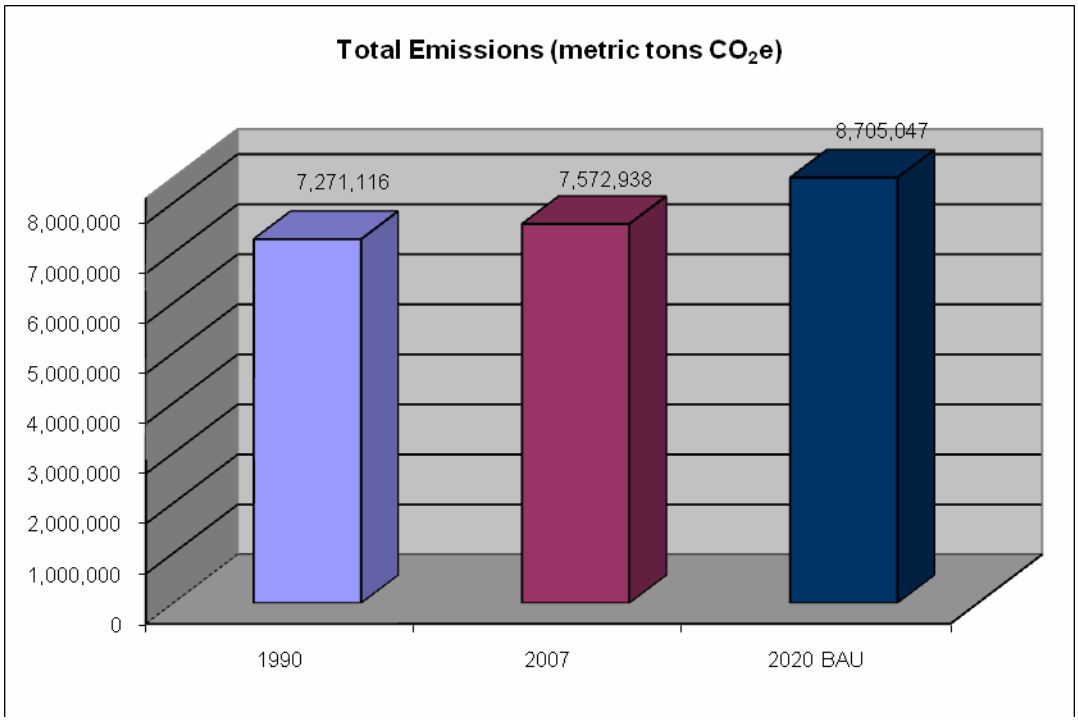
3.3.7 Net Emissions Comparison by Year

The 8.7 million metric tons of CO_2e of GHG emissions for 2020 is an estimated increase of 14.95% above 2007 levels and 19.72% above 1990 levels following business-as-usual projections. This level of increase is lower than the state average. This is primarily due to a combination of factors including a slow growth rate (1.25% annually) and the continued urbanization of Pasadena which results in a modest decrease in vehicle miles traveled per vehicle trip as compared to the average in California. Table 3-16 and Figure 3-12 show a comparison of Net Emission Total for 1990, 2007, and 2020 BAU emissions.

Table 3-16: Net Total Emissions by Year

Net Total Emissions			
	Metric tons of CO_2e		
UEA Category	**1990**	**2007**	**2020**
Energy	1,002,876	854,355	995,488
Solid Waste	849,336	1,105,498	1,281,807
Urban Nature	1,205	2,175	2,513
Transportation	5,417,699	5,610,910	6,425,238
Total	**7,271,116**	**7,572,938**	**8,705,047**
% Reduction from 1990 Levels	-	(4.15)	(19.72)
% Reduction from 2007 Levels	-	-	(14.95)

Figure 3-12: Net Emissions by Year (CO_2e)



SECTION 4 - EXISTING GHG EMISSIONS REDUCTION PROGRAMS AND REGULATIONS

4.1 STATE

The state of California has set specific targets for reducing greenhouse gas emissions from the burning of fossil fuels in both power plants and vehicles by adopting the following legislation:

Senate Bill 1771 Sher, 2000: Requires the California Energy Commission (CEC) to prepare an inventory of the state's greenhouse gas emissions, to study data on global climate change, and to provide government agencies and businesses with information on the costs and methods for reducing greenhouse gases. It also established the California Climate Action Registry to serve as a certifying agency for companies and local governments to quantify and register their greenhouse gas emissions for possible future trading systems.

Senate Bill 1078, Sher, 2002: Established a Renewable Portfolio Standard, requiring electricity providers to increase purchases of renewable energy resources by 1% per year until they have attained a portfolio of 20% renewable resources.

Assembly Bill 1493, Pavley, 2002: Requires the State Air Resources Board to develop and adopt regulations that achieve the maximum feasible reduction of greenhouse gases from vehicles primarily used for non-commercial transportation by January 2005.

California Solar Initiative Program, 2006: Comprehensive $2.8 billion program that provides incentives toward residential and commercial solar development over 11 years.

AB 32 Nuñez & Pavley, 2006: Institutes a mandatory limit on greenhouse gas pollution – reducing emissions in California to 1990 levels by the year 2020, or 25% below forecasted levels. The bill also directs the CARB to establish a mandatory reporting system to track and monitor State emission levels and requires CARB to develop various compliance options and enforcement mechanisms.

Senate Bill 375, 2008: Requires the Air Resources Board to develop regional greenhouse gas emission reduction targets to be achieved from the automobile and light truck sectors for 2020 and 2035. The 18 Metropolitan Planning Organizations (MPOs) in California will prepare a "sustainable communities strategy" to reduce the amount of VMT in their respective regions and demonstrate the ability for the region to attain ARB's targets.

California Code of Regulations (CCR), Title 24 includes The California Green Building Standards Code, effective August 1, 2009: The purpose of this code is to improve public health, safety and general welfare by enhancing the design and construction of buildings through the use of building concepts that have a positive environmental impact and encourage sustainable construction practices in the following categories: planning and design, energy efficiency, water efficiency and conservation, material conservation and resource efficiency, and environmental air quality

California Water Reduction Goals (20% by 2020), March 2008: The 20% by 2020 Plan sets forth a statewide road map to maximize the state's urban water efficiency and conservation opportunities. It aims to set in motion a range of activities designed to achieve the 20 percent per capita reduction in urban water demand by 2020. The 20% by 2020 Plan addresses only urban water use and conservation.

4.2 LOCAL GOVERNMENT PROTOCOL SCOPE AND REDUCTION MEASURES

4.2.1 Scope and Reduction Measures

The Local Government Protocol (version 1, August 2008) categorizes GHG emissions into three distinct scopes that provide a way of organizing the GHG reduction plan development. Below is a definition of type of Scope and Reduction Measure Classification. Although these scopes were used to develop the GHG inventory, the emissions inventories as presented in Section 3 were organized to follow the City of Pasadena Urban Environmental Accords.

Definition of Local Government Protocol:

- **Scope 1 Emissions:** includes all "direct" sources of GHG emissions from sources that are owned or controlled by the City including (but not limited to): production of electricity, heat, or steam in owned or controlled boilers, furnaces, etc; transportation (using corporate or fleet vehicles) of materials, products, waste, and community members; and fugitive emissions (from unintentional leaks of GHGs directly into the atmosphere).

- **Scope 2 Emissions:** accounts for "indirect" sources of GHG emissions from the generation of purchased utilities consumed by the City. A purchased utility is defined as one that is bought or otherwise brought into the jurisdictional authority of the local government, but not physically generated in power plants owned and/or operated by the local government. Scope 2 emissions physically occur at locations outside of the jurisdictional boundaries and direct control of the local government and thus are separated from direct emissions reported by the utility company or local government in order to avoid double counting.

- **Scope 3 Emissions:** GHG Protocol Initiative considers this an optional reporting category that allows for the treatment of all other "indirect emissions". Scope 3 emissions are a consequence of the activities of the local government, but occur from sources not owned or controlled by the local government. Some examples of scope 3 activities are extraction and production of purchased materials; transportation of purchased fuels; and use of sold products and services. Pasadena's GHG inventory did not consider Scope 3 emissions. However, some of the existing state and city programs will reduce these types of emissions. In those cases, they are called out as scope 3 reduction measures and not quantified. Another type of scope 3 reduction measures are those that cannot be quantified such as education programs.

4.2.2 Reduction Measure Classifications

- **Reduction Measures for Classification 1 (M1):** includes all adopted, implemented, and proposed national, state, and regional measures that do not require additional City action. The M1 measures are not included in the Pasadena GHG Reduction Strategy because all of the City measures exceed the minimum reduction requirements for every one of the state mandated measures. These measures may require City action, but that action is limited and compulsory.

- **Reduction Measures for Classification 2 (M2):** includes all measures currently implemented or in the process of implementation by the City of Pasadena, as well as any additional quantifiable measures that require independent City action and could further reduce the GHG emissions.

- **Reduction Measures for Classification 3 (M3):** includes all additional measures that are a part of the City's GHG Reduction Plan but were not individually quantified as part of the proposed City 2020 emissions target. These measures either lack available data, lack developed protocols and/or emission factors required for quantification, lack certainty regarding the City's jurisdictional control over areas of the inventory, or are individual components of an overall strategy that was already quantified in that strategy. As an example, the City of Pasadena has the objective to reduce peak energy load demand by 10 percent, which was quantified. An M3 measure that supports that goal is an educational program to provide the public with ways of reducing peak demand. The educational program is classified as an M3 measure because there is both a lack of available data to quantify this particular measure and the measure supports a strategy—to reduce peak energy load demand by 10 percent—which was quantified.

A detailed list of each of the reduction strategies categorized into M2 and M3 measures are provided in Appendix F.

4.2.3 City of Pasadena Green City Action Plan

Pasadena set ambitious goals in becoming a sustainable community. Notably, the City's Green City Action Plan, adopted in 2006, is modeled after the United Nations Urban Environmental Accords (UEA) of 2005. The UEA acknowledge the environmental challenges and opportunities facing urban areas across the globe. The Urban Environmental Accords (UEA) categories as adopted by the City of Pasadena are as follows:

UEA-1. Energy
UEA-2. Waste Reduction
UEA-3. Urban Design
UEA-4. Urban Nature
UEA-5. Transportation
UEA-6. Environmental Health
UEA-7. Water

Pasadena has developed the Green City Indicator (GCI) system to measure the City's progress towards achieving specific targets identified in the action plan. Listed below are the 21 UEA goals the City has endorsed. It should be noted that in some instances, the City has adopted more stringent goals than those established in the UEA.

Urban Environmental Accord Actions:

Energy

ACTION 1: Increase the use of renewable energy to meet 10% of the City's peak electric load within seven years.

ACTION 2: Reduce the City's peak electric load by 10% within seven years through energy efficiency, shifting the timing of energy demands and conservation measures.

ACTION 3: Reduce GHG emissions by 25% by 2030, and include a system for accounting and auditing these emissions.

WASTE REDUCTION

ACTION 4: Achieve zero waste to landfills and incinerators by 2040.

ACTION 5: Reduce the use of disposable, toxic, or nonrenewable products by at least 50% in seven years.

ACTION 6: Implement "user-friendly" recycling and composting programs, with the goal of reducing by 25% per capita solid waste disposal to landfill and incineration in seven years.

URBAN DESIGN

ACTION 7: Mandate a green building rating system standard that applies to all new municipal buildings.

ACTION 8: Advance higher density, mixed use, walkable, bikeable and disabled accessible neighborhoods which coordinate land use and transportation with open space systems for recreation and ecological restoration.

ACTION 9: Create environmentally beneficial jobs in low-income neighborhoods.

URBAN NATURE

ACTION 10: Ensure that there is an accessible public park or recreational open space within 1/2 kilometer of all residents by 2015.

ACTION 11: Conduct an inventory of existing canopy coverage in the City; and, then establish a goal to plant and maintain canopy coverage in not less than 50% of all available sidewalk planting sites.

ACTION 12: Protect critical habitat corridors and other key habitat characteristics from unsustainable development.

TRANSPORTATION

ACTION 13: Expand affordable public transportation coverage to within 1/2 kilometer of all City residents in ten years.

ACTION 14: Phase down sulfur levels in diesel and gasoline fuels, use advanced emission controls on all public fleets to reduce particulate matter and smog-forming emissions from those fleets by 50% in seven years.

ACTION 15: Implement a policy to reduce the percentage of commute trips by single occupancy vehicles by 10% in seven years.

ENVIRONMENTAL HEALTH

ACTION 16: Every year, identify one product, chemical or compound that is used within the City that represents the greatest risk to human health and reduce or eliminate its use by the municipal government.

ACTION 17: Support the public health and environmental benefits of locally grown organic foods. Ensure that 20% of all City facilities (including schools) serve locally grown and organic food within seven years.

ACTION 18: Establish an Air Quality Index (AQI) to measure the level of air pollution and set the goal of reducing by 10% in seven years the number of days categorized in the AQI range as “unhealthy” or “hazardous.”

WATER

ACTION 19: Develop policies to increase adequate access to safe drinking water, aiming at access for all by 2015. For cities, such as Pasadena with potable water consumptions greater than 100 liters per capita per day, UNUEA requires adoption and implementation of policies to reduce consumption by a minimum of 10% by 2015.

ACTION 20: Protect the ecological integrity of the City’s primary drinking water sources (i.e., aquifers, rivers, lakes, wetlands and associated ecosystems).

ACTION 21: Adopt municipal wastewater management guidelines and reduce the volume of untreated wastewater discharges by 10% in seven years through the expanded use of recycled water and the implementation of a sustainable urban watershed planning process that includes participants of all affected communities and is based on sound economic, social and environmental principles.

4.2.4 Pasadena’s Environmental Charter

In 2006, the City of Pasadena formally adopted an Environmental Charter that has been part of an administrative practice. The charter states that the city has elected to be an environmental advocate. A green and sustainable city is a community of residents, neighbors, workers, and visitors who strive together to balance ecological, economic, and social needs to ensure a clean, healthy and safe environment for all members of society and for generations to come. Cities looking for sustainable inspiration need look no further than the City of Pasadena. Pasadena is a leader in environmental compliance and protection. The City cultivates superior environmental standards that provide for sustainable municipal development.

Pasadena focuses on the practical challenges and opportunities the City will face in order to tackle rising greenhouse gas emissions, energy consumption and congestion. The City recognizes that growth and opportunity cannot be conducted at the expense of environmental protection and enhancement, and that growth and environmental stewardship are intimately related.

The City believes that the implementation of environmental ethic need not interfere with economic development, and that practicing environmental ethic can ultimately be expected to enhance economic affairs and provide for responsible, farsighted development. The City has established policies that incorporate environmental responsibility into its daily management of growth,

education, energy and water use, air quality, transportation, waste reduction, economic development, and open space and natural habitats.

Pasadena has implemented significant programs to become a green city. The following sections are a discussion of these programs.

Energy

Pasadena is increasing the use of environmentally friendly energy sources and promoting energy conservation Citywide. Pasadena continues to advance toward a future of clean, efficient and reliable energy. Pasadena's efforts include new programs, groundbreaking partnerships and a community-wide effort to adopt a new 20-year power supply plan with the long-term goal of converting 40 percent of electrical generation to renewable energy sources. The long-term benefits of renewable energy will reduce greenhouse gas emissions, a leading contributor to climate change. Pasadena has made a commitment to conserve energy and increase use of renewable energy (solar, wind, geothermal, and hydroelectric) in order to provide a sustainable power supply for the City. Table 4-1 lists the energy programs that have been developed by Pasadena Water and Power.

Table 4-1: Energy Programs

Program	Description
Integrated Resource Plan (IRP) ***M2 Measure***	In its 2009 Integrated Resource Plan (2009 IRP), Pasadena PWP identifies its Preferred Resource Plan for satisfying its electric power requirements, consisting of energy efficiency, demand-side management resources, renewable resources and other supply-side resources over the next twenty years. This Preferred Resource Plan best meets the multiple objectives PWP's long term electricity needs in a reliable, cost competitive, flexible, and environmentally conscious manner under a wide variety of market, regulatory, and economic conditions. The Preferred Resource Plan therefore improves PWP's ability to attain a position of environmental leadership, consistent with the City's broader environmental goals and commitments. The IRP takes into account future energy demand, advances in renewable energy resources, energy efficiency and conservation, forecast changes in regulatory requirements and more.
Integrated Resource Plan - Energy (Strategy) ***M2 Measure***	The Integrated Resource Plan is a strategy that sets goals for reducing dependency on fossil fuel generated electricity, improves energy efficiency, and increases the City's renewable energy portfolio. Major plan goals include: ▪ reducing coal power purchases from the Utah plant by at least 35 MW by 2016; ▪ retrofitting the local plant on Glenarm Street with a more efficient and reliable natural gas combined cycle

Program	Description
	combustion turbines; ▪ Implementing aggressive energy-efficiency and load-reduction programs; ▪ Increasing the proportion of green power in PWP's mix to 40 percent by 2020; ▪ Purchasing 10 MW of renewable power from "feed-in" sources within Pasadena (e.g. private solar installations); and ▪ Cutting carbon dioxide emissions by 40 percent by 2020.
Pasadena Solar Initiative (PSI) ***M2 Measure***	PWP is committed to helping its customers install a total of 14,000 kilowatts of solar power by 2017. PWP's solar power rebate program applies to both residents and business. This initiative will save thousands, even hundreds of thousands of dollars on installation costs and Pasadena's consumer energy bill, depending on the size of the system
Renewable Energy Wind ***M2Measure***	PWP recently signed a long-term agreement to buy a six megawatt share in the High Winds generation facility in Solano County in Northern California. In addition to the High Winds contract, PWP buys renewable energy from hydroelectric facilities in Azusa and at Hoover Dam.
Energy Efficiency Partnering Program (EEP): ***M3 Measure***	Under the EEP program, any permanently installed energy-saving retrofit project may qualify for a rebate incentive. The more cost-effective and energy-saving the project is, the higher the rebate. Pasadena was presented with the CMUA Community Service Award for this program. This program is defined as an M3 measure because it cannot be individually quantified and supports the IRP energy strategy.
LED Traffic Signal Lamps Replacement Program **M3** ***Measure***	The City has installed LED (light emitting diodes) on all traffic signals. (Currently all red indications have been replaced with LED. Pasadena expects to complete yellow & green indications in a year) The program has been estimated to save the City 85% in the energy costs related to traffic signals. While this program is quantifiable, it is defined as an M3 measure because it was already quantified in the IRP energy strategy listed above.
Efficient Cooling Home Incentive Program ***M3 Measure***	PWP is providing rebates to its residential electric customers for the purchase and installation of energy efficient items to cool their homes. This program is defined as an M3 measure because it cannot be individually quantified and supports the IRP energy strategy.

Program	Description
Energy Saving Light Bulbs ***M3 Measure***	In 2008, PWP first offered a kit equipped with two free CFLs, a recycling pouch for safe disposal of CFLs, plus an order form for $75 worth of free CFLs. Pasadena's goal is for all 53,000 Pasadena households to switch to at least 10 energy-saving bulbs and thereby eliminate over 10,000 tons of CO_2 emissions every year. This program is defined as an M3 measure because it cannot be individually quantified and was determined to support the IRP energy strategy because it encourages the continued use of CFLs by providing a convenient and safe way of disposing of CFL bulbs after they have expired.
All-Electric Household Rebate Program ***M3 Measure***	PWP is offering residential electric customers who live in all-electric homes rebates on certain energy efficient products. All-electric households use electricity, rather than natural gas, for heating (Pasadena, 2008k). This program is defined as an M3 measure because it will help support emissions reduction provided the City meets its 40 percent renewable energy goal in the IRP energy strategy.
PWP's Energy Star® Rebate Program ***M3 Measure***	PWP offers residential electric customers rebates on certain Energy Star® products. The Energy Star label certifies that the product exceeds federal energy-efficiency standards. This program is defined as an M3 measure because it cannot be individually quantified and supports the IRP energy strategy.
Refrigerator Recycling Program ***M3 Measure***	PWP provides rebates for recycling of old refrigerators and freezers, and a coupon redeemable for three compact fluorescent light bulbs to its residential customers. Refrigerators sold today are at least 25% more efficient than models sold just four years ago. This program is defined as an M3 measure because it cannot be individually quantified and supports the IRP energy strategy.
Refrigerator Replacement Program for Low-Income ***M3 Measure***	Pasadena will recycle and replace the old refrigerators of qualified low income residence with new efficient refrigerators. This program is defined as an M3 measure because it cannot be individually quantified and supports the IRP energy strategy.
Cool Trees Program ***M3 Measure***	PWP offers residential electric customers a rebate for planting any one of 37 species of shade trees. Estimates are that well-placed trees around a home can reduce cooling costs by as much as 20 percent. This program is defined as an M3 measure because it cannot be individually quantified, but indirectly supports the IRP energy strategy by providing increased shade which reduces the need for cooling and the energy consumption associated with cooling.

Waste Reduction

The City is committed to reducing waste, reducing the use of disposable and toxic products, and implementing user-friendly recycling and composting programs. Efficient refuse and recycling collection programs ensure that the City is aesthetically pleasing, protects the community's health, and reduces the City's waste stream.

Table 4-2 lists the waste reduction programs that have been developed by Pasadena Public Works Department.

Table 4-2: Waste Reduction Programs

Program	Description
Waste Reduction Goals and Program (WRGP) ***M2 Measure***	The City of Pasadena has set a waste reduction goal of diverting 75% of the solid waste from landfills and incinerators by implementing "user-friendly" recycling and composting programs by 2020 with the ultimate goal of zero waste to landfills and incinerators by 2040Other near-term goals include reducing the use of disposable, toxic, or nonrenewable products within the City by 50% within 7 years, and implementing "user friendly" recycling and composting programs, that reduce solid waste disposal by 25% per capita within 7 years.
City Recycle Purchase Program (A) ***M3 Measure***	The City has implemented a program to purchase 100% post-consumer recycled paper for municipal operations. This program is defined as an M3 measure because it cannot be individually quantified but supports the WRGP waste reduction strategy.
City Recycle Purchase Program (B) ***M3 Measure***	The City has implemented a program to prohibit the purchase of bottled water for municipal operations and government-sponsored events. This program is defined as an M3 measure because it cannot be individually quantified but supports the WRGP waste reduction strategy.
PWP Recycled Oil Filter Program ***M3 Measure***	The City has implemented a program to purchase oil filter equipment which recycles 175,000 gallons of oil per year for PWP transformers, recovering approximately 98% of the transformer oil purchased. This program is defined as an M3 measure because it cannot be individually quantified but supports the WRGP waste reduction strategy.
Recycling Programs (Rosebowl Recycling Program) ***M3 Measure***	Pasadena expanded the recycling programs at special events and at the Rose Bowl, collecting over half a million beverage containers. This program is defined as an M3 measure because it was already quantified in the WRGP waste reduction strategy.
Household Hazardous Waste (HHW) & E-Waste Roundup and collection Program.	Pasadena and L.A. County host a collective Residential Special Materials and Electronic Waste Roundups. The annual event provides the residents of Pasadena a legal and cost free way to dispose of unwanted household chemicals that cannot be disposed of in the regular trash. As part of this program Pasadena implemented a battery recycling program. This program is defined

Program	Description
M3 Measure	as an M3 measure because it cannot be individually quantified but supports the WRGP waste reduction strategy.
Green Waste Recycled ***M3 Measure***	In 2007, The City Recycled 85% of all green waste accumulated by City crews, converting waste into mulch for ground cover in the City's natural areas, parkways and frontage roads. This program is defined as an M3 measure because it was already quantified in the WRGP waste reduction strategy.
Construction Debris and Waste Haulers: ***M3 Measure***	Pasadena limits the number of waste haulers which can operate in the City to reduce air pollution, road damage, noise pollution, and congestion. In 2007, the City recycled 40 million pounds of debris materials from construction projects in Pasadena. The City is examining the feasibility of increasing the recycling requirement for construction and demolition debris projects. This program is defined as an M3 measure because it cannot be individually quantified but supports the WRGP waste reduction strategy.
City Office Space Recycling Program: ***M3 Measure***	City office spaces provide blue desk-side recycling containers to each employee to capture all paper, plastic, aluminum, glass, and cardboard products. This program is defined as an M3 measure because it cannot be individually quantified but supports the WRGP waste reduction strategy.
City Leased Office Space Recycling Program ***M3 Measure***	PWP expanded its recycling program to its leased City office spaces, providing blue desk-side recycling containers to each employee to capture all paper, plastic, aluminum, glass, and cardboard products. This program is defined as an M3 measure because it cannot be individually quantified but supports the WRGP waste reduction strategy.
Library Overdue E-Mail Notification Program: ***M3 Measure***	Pasadena's Libraries overdue notifications are being sent via email, saving postcards and postage. This program is defined as an M3 measure because it cannot be individually quantified but indirectly supports the WRGP waste reduction strategy by reducing the number of paper notices that might otherwise become solid waste.
Food Waste Recycling Program ***M3 Measure***	The City will implement a pilot food waste recycling program with area restaurants. This program is defined as an M3 measure because the level of detail to individually quantify the reduction is not available but supports the WRGP waste reduction strategy.
Single Family Residence Recycling - Pay As You Throw Program ***M3 Measure***	Under this program the cost for collection is based upon how much waste is recycled and how much the family throws away. The more recycled, the less cost to the resident. This program is defined as an M3 measure because the level of detail to individually quantify the reduction is not available but supports the WRGP waste reduction strategy.

Urban Design- Land Use

The Green Building Program: As part of this program, initiated in 2006, the City adopted a green building practices ordinance. Green buildings reduce energy consumption and improve occupant health. Summaries of the accomplishments and benefits of the program are as follows (Table 4-3).

Table 4-3: The Green Building Program

Program	Description
Green Building Practices Ordinance ***M2 Measure***	Green buildings minimize waste of natural resources; use of recycled materials; reduce the amount of debris in local landfills; incorporate water and energy conservation; decrease pollution; and offer healthier air and lighting for occupants. The ordinance applies to municipal buildings of 5,000 square feet or more of new construction; non-residential buildings with 25,000 square feet or more of new construction; tenant improvements of 25,000 square feet or more; and mixed use and multi-family residential of 4 stories or more. Effective May 16, 2008, the City Council adopted amendments requiring municipal renovations over 15,000 square feet and commercial buildings over 50,000 square feet to achieve LEED silver-equivalent certifications. As part of the requirement all projects subject to this ordinance must achieve LEED credit 3.1 (Exceed baseline water projection by 20%)

On April 15, 2006, the City Council approved a set of progressive green building regulations for public and private sector buildings, Pasadena Municipal Code Chapter 14.90. Pasadena's ordinance adopts by reference the US Green Building Council LEED Leadership in Energy and Environmental Design green building rating system. As 2008, 14 buildings totaling 1,178.746 square feet have been reviewed for conformance with the ordinance requirements and have received final plan sign-off. In addition, Table 4-4 provides a list of currently completed LEED certified buildings in the city (although formal LEED certification by the USGBC is not a requirement except for City owned buildings). These projects voluntarily elected to seek LEED certification. LEED awards points to buildings based on five main categories:

- Sustainable site planning;
- Safeguarding water and water efficiency;
- Energy efficiency and renewable energy;
- Conservation of materials and resources; and
- Indoor environmental quality.

Table 4-4: USGBC Certified LEED Projects in Pasadena

Completed LEED Projects					
Project Name	**Address**	**LEED Ranking**	**LEED Rating**	**Year**	**Sq. Feet**
Tricom Building	2812 East Walnut St.	Silver	LEED NC 2.0	2004	23,343
Art Center College of Design South Campus	950 South Raymond Ave.	Certified	LEED NC 2.1	2005	116,753
Northwest Innovation Center	45 Eureka St.	Gold	LEED NC 2.1	2006	29,078
Earthlink	2947 Bradley Dr.	Gold	LEED CI 2.0	2007	55,000
Pasadena City Hall	175 N. Garfield	Gold	LEED NC 2.1	2008	132,500
Mother's Club	980 N. Fair Oaks Ave.	Gold	LEED NC v2.2	2008	10,600
Corporate Center Pasadena	251 S. Lake Ave	Gold	LEED EB	2009	630,000

Urban Nature

Pasadena's Urban Nature programs preserve areas within the City that naturally sequester carbon (GHGs) reducing the GHG emissions increase that would normally occur as the area continues to urbanize replacing natural habitat that sequesters GHG emissions with buildings and activities that generate GHG emissions. Pasadena's Urban Nature programs also enhance the sequestration of GHG emissions within the City by increasing the number of trees that form Pasadena's urban forest (4,200 acres of tree canopy covering 28.6% of the city). Pasadena has twenty-three parks totaling more than one thousand acres of parkland.

The Arroyo Seco is the City's largest natural open space, linking the San Gabriel Mountains to the Los Angeles River. Six native plant communities exist in the Arroyo Seco, providing habitat and wildlife corridors for hundreds of species of birds, insects and other wildlife. The commitment to protect this valuable resource is detailed in the Arroyo Seco Master Plans, a set of four separate planning documents, which portray a community vision for the Arroyo.

The National Arbor Foundation has named Pasadena a Tree City USA City for five consecutive years due to its continued efforts to preserve and enhance the community's urban forest.

Pasadena continues to make great strides in restoring our City's natural areas. Listed in Table 4-5 are the City's Urban Nature Programs and the benefits of each.

Table 4-5: Urban Nature Programs

Program	Description
Tree Canopy Goals and Program ***M2 Measure***	Pasadena is a "built-out" city, meaning that Pasadena must look to creative means of providing an urban forest. The City goal is to plant and maintain canopy coverage in all available sidewalk planting sites throughout the City, which requires an additional 2,837 trees.
City Trees and Tree Protection Ordinance (PMC Chapter 8.52) ***M3Measure***	Pasadena recognized the importance of trees by adopting an ordinance that protects trees on private and public property. The ordinance protects various categories of trees including public, landmark, specimen, and native trees. This program is defined as an M3 measure because the level of detail to individually quantify the reduction is not available but supports and enhances the City's Tree Canopy Goals.
Open Space & Natural Habitat ***M3 Measure***	Pasadena's Open Space Element (1976) provides for continued improvement in the quality of the City's' urban environment as established in the quality and quantity of its open spaces. Goals established by this program are as follows: ▪ Public parkland shall be protected from non-recreational uses: any loss of parkland through governmental action shall be replaced in-kind. ▪ The development of new park facilities should be undertaken only after a thorough study justifying needs and potential usage. ▪ Park planning will take into consideration all related recreational factors. ▪ Citizen participation shall play a major role in all phases of recreational open space planning from site selection to program development. ▪ Provides unique opportunities to acquire additional land at minimal costs, lending to the pursuit of additional recreational possibilities. This program is defined as an M3 measure because the level of detail to individually quantify the reduction is not available but supports the Urban Nature strategy.
Urban Forestry Program ***M3 Measure***	Pasadena has approximately 61,000 street trees, 25,000 park trees and over 118,000 trees on private property. These trees provide shade to cool homes, sequester carbon, and turn CO_2 into oxygen. 28.6% or (4,200 acres) of the City is covered in tree canopy. The Urban Forestry program is responsible for maintaining and enhancing the City's Urban forest. This program is defined as an M3 measure because the level of detail to individually quantify the reduction is not available but supports the Urban Nature strategy.
Native Habitat and	Pasadena has renovated 2,132 feet of trails, restored two acres of habitat, and repaired over 500 linear feet of rock walls using

Program	Description
Restoration Program : ***M3 Measure***	on-site Arroyo stone. This program is defined as an M3 measure because the level of detail to individually quantify the reduction is not available, however, these improvements, along with other enhancements to trails, banks and native habitats supports the Urban Nature strategy.

Transportation

Pasadena is committed to making affordable and accessible public transportation available to City residents; to the use of cleaner-burning fuels; to expanding alternative-fuel vehicles for the City's fleet; and to drastically reducing single-driver commutes to lessen traffic congestion. Pasadena has implemented the following adopted plans and programs in Table 4-6 to illustrate the City's commitment to enhancing and promoting alternative transportation.

Table 4-6: Transportation Programs

Program	Description
Traffic Congestion Reduction Strategy ***M2 Measure***	Pasadena has committed to implementing policies to reduce the emissions due to commuter traffic. The goal of these policies is to reduce single occupancy vehicle trips by 10% of existing levels by 2012. This strategy also includes a 25% reduction in the number of vehicle trips taken on Pasadena streets during the evening rush hour.
Intelligent Transportation System (ITS) Communication Master Plan Expansion ***M3 Measure***	This program will expand the Traffic Management Center's (TMC) capabilities thus reducing GHG emissions by reducing undue delay. The TMC manages 300 traffic signals, 10 traffic surveillance closed circuit television cameras and 9 variable message signs within the City. This program is defined as an M3 measure because it cannot be directly quantified.
Trip Reduction Ordinance (A) ***M3 Measure***	The ordinance reduces the demand for vehicle commute trips by ensuring that the design of major nonresidential, mixed-use, & multi-family residential development projects accommodate facilities for alternative modes of transportation. Ordinance 10.64.010 and 10.64.020 provides regulation of nonresidential projects, and the nonresidential portion of mixed-use projects, which are between 25,000 square feet and 75,000 square feet of gross floor area. These projects require carpool and vanpool preferential parking; bicycle parking; commuter car pool matching services, to be provided for all employees on an annual basis, and for all new employees upon hiring; and the posting of transportation information displays on site and situated so as to be

Program	Description
	seen by the greatest number of employees. This program is defined as an M3 measure because it is already quantified in the Traffic Congestion Reduction Strategy plan.
Public Transportation Strategy ***M2 Measure***	The City goal of the Public Transportation Strategy is to expand affordable public transportation coverage to within ½ kilometer of all City residents by 2015. This public transportation goal reduces vehicle trips by providing easily accessible and affordable transit throughout the city. This is an M2 measure because SCAQMD and the URBEMIS2007 program can quantify trip reduction based upon transit proximity to vehicle trip origins and destinations.
Pasadena Area Rapid Transit System (ARTS) ***M3 Measure***	In addition to regional bus and rail service provided to Pasadena through METRO and Foothill Transit, the City operates the Pasadena Area Rapid Transit System consisting of nine bus routes throughout the City. Many ARTS buses run on clean "green" fuel. Twelve buses use diesel (planned for installation of particulate traps); five buses are hybrid – running on electric current and gas; and two buses use CNG. This program is defined as an M3 measure because it supports and is quantified in the public transportation strategy.
Prideshare Program "Try Transit" Program ***M3 Measure***	This program encourages employees to use transit to get to and from work. Through this program the City contributes money to City employees toward the purchase of transit passes (and deducts the same amount of money from people who do not use transit). Program Participants include Art Center College of Design, One Colorado, Huntington Hospital, Macy's, Fidelity, Avery Dennison, and EarthLink. . This program is defined as an M3 measure because it cannot be quantified but supports the public transportation strategy.
Trip Reduction Ordinance (B) ***M3 Measure***	The City of Pasadena requires transportation displays on all major corridors providing information on transit and other alternative modes of transportation. The transportation displays shall include, without limitation, current maps, routes, and schedules for public transit serving the development; the telephone number and web sites of referrals for transportation information including the numbers and web sites for the regional ridesharing agency and local transit operators; ridesharing promotional materials; bicycle routes and facility information; a listing of facilities available for bicyclist, carpoolers, pedestrian, transit riders, and vanpoolers at the development; and contact information for responsible party at the site. This program is defined as an M3 measure because it cannot be quantified but supports the Public Transportation Strategy.
Clean Vehicles Strategy	The City goal of the Clean Vehicles Strategy is to phase out sulfur levels in diesel and gasoline fuels and use advance emission

Program	Description
M3 Measure	controls on all public fleets to reduce particulate matter as well as smog-forming emissions from those fleets by 50% by 2012 without increasing levels of GHG emissions. The clean vehicle strategy is considered an M3 measure because it does not reduce GHG emissions; but rather, prevents increases in GHG emissions during efforts to reduce air pollution. However, specific programs designed to implement the clean vehicle strategy, such as conversion of diesel-fueled engines to particular alternative fuels such as compressed natural gas (CNG) modestly reduce GHG emissions and can be quantified. In those particular instances, the programs are designated as M2 measures and quantified.
Pasadena's Diesel Fleet Modification Program: ***M3 Measure***	In 2007, the City modified its diesel fleet by installing particulate traps to reduce the release of particulate material into the atmosphere by 95%. Pasadena has committed to the use of cleaner-burning fuels; expanding alternative-fuel vehicles for the City's fleet.
Pasadena's Diesel Fleet Modification Program – Conversion of Refuse-Collection Trucks ***M2 Measure***	In 2007, the City converted six refuse-collection trucks to dual fuel, utilizing compressed natural gas (CNG) and diesel in order to reduce diesel exhaust. This program is defined as an M2 measure because it can be quantified.
Pasadena's Diesel Fleet Modification Program - Preferred Purchasing Practices: ***M3 Measure***	Pasadena implemented environmentally-preferred purchasing practices for City vehicle purchases. Preference is given to environmentally-friendly and fuel-efficient vehicles. This program has expanded the City's green fleet to 45 vehicles as of 2009. This program is defined as an M3 measure because it cannot be quantified.
Pasadena's Diesel Fleet Modification Program - CNG Fueling Stations: ***M3 Measure***	Pasadena began the construction of a CNG fueling station at the City's yards. The system will utilize natural gas to fuel the City's CNG fleet. Natural gas is less polluting than standard gas. This program is defined as an M3 measure because it cannot be quantified but supports the use alternative fuels by the municipal fleet.
Green Fleet Program ***M3 Measure***	The City's has implemented a strategy for replacing fossil-fuel vehicles with alternative fuel vehicles. The City has already made significant progress in reducing fossil fuel vehicles and adding alternative energy vehicles to its fleet. This program is defined as an M3 measure because it cannot be quantified but supports the Green Transportation strategy.

Transportation – Bicycling

Bicycling In Pasadena: On November 6, 2000 the City adopted the Bicycle Master Plan, "Century of Bikes". The Pasadena General Plan Mobility Element promotes a livable community

where people can circulate without cars. Non-auto travel modes are emphasized in this Element in order to recognize their role in improving the City's environment and quality of life.

Pasadena's Mobility Element includes:

- Adoption and implementation of the Bicycle Master Plan;
- Establishment of street and alley-way guidelines to encourage walking;
- Expansion of the "Suggested Safe Routes to School" program; and
- Installation of pedestrian-friendly traffic-signal equipment in commercial areas.

Currently Pasadena has Class II and Class III bike lanes. Class II bike lanes are lanes on the outside edge of roadways reserved for the exclusive use of bicycles. The lanes are designated with special signing and pavement markings. Class III bike routes are bike routes where roadways are recommended for bicycle use and often connect to bike lanes and bike paths. Routes are designated with signs only and may not include additional pavement width. Pasadena has enhanced these routes to include 4" white edge line and "Share the Road" signage. Summaries of the bicycling program are included in Table 4-7.

Table 4-7: Bicycling Programs

Program	Description
Bicycling In Pasadena: ***M2 Measure***	The Bicycling in Pasadena program and associated Bicycle Master Plan are an important component to promoting vehicle trip reduction with the co-benefit of a more livable community. GHG emissions reductions associated with the Bicycle Master Plan are quantified using the trip reduction calculations found in the URBEMIS2007 model. The URBEMIS2007 model calculates trip reductions based upon the amount of bicycle paths and bicycle infrastructure that is in close proximity to potential vehicle trip origins and destinations.
Bicycling Roadways and Implementation: ***M3 Measure***	Over 60 miles of collector and arterial roadways in Pasadena have bikeways. Pasadena offers parking for over 1,000 bicycles in the form of bicycle racks at bus stops, City-owned parking lots, churches, private office garages, retail stores and apartment buildings. This is an M3 measure because it supports and was already quantified in the Bicycling in Pasadena program.
Annual Bike Week Pasadena ***M3 Measure***	The Annual Bike Week Pasadena is sponsored by the City, local business districts and community groups. The city-wide event promotes and encourages bicycling to everyone. Marketing first time bicyclists/commuters from surrounding communities and counties to promote bicycling as a healthy, recreational alternative mode of transportation to shop, and play. Pasadena advocates increased bicycle use, access, safety, and education by promoting the bicycle as means of transportation and recreation. This is an M3 measure because it cannot be quantified but supports the Bicycling in Pasadena program.

Program	Description
Annual Bike to Work Day ***M3 Measure***	Every year on the annual bike to work day, employees of the City of Pasadena bicycle to work to promote healthy living and an environmentally friendly commute. Pasadena advocates increased bicycle use, access, safety, and education, by promoting the bicycle as means of transportation and recreation. This is an M3 measure because it cannot be quantified but supports the Bicycling in Pasadena program.

Water

Pasadena relies on imported water from the Metropolitan Water District to meet 60% of the City's water needs. Pasadena's groundwater wells provide the other 40% of the City's supply. Pasadena's ground water wells are currently 60 feet below historical norms.

In 1991 PWP signed a Memorandum of Understanding (MOU) with the State of California, Department of Water Resources. The MOU states that Pasadena agrees to implement the BMPs identified in and comply with the MOU. Based on the requirements of the MOU, Pasadena is required to submit a bi-annual progress report to the California Urban Water Conservation Council.

On April 13, 2009 Pasadena adopted a "Comprehensive Water Conservation Plan" (CWC Plan). The CWC Plan includes information and recommendations related to managing short-term water supply shortages, as well as estimated financial impacts of 10%, 20%, and 30% water sale reductions. As a follow-up, the City will develop Water Integrated Resource Plan taking action on a number of specific programs such as adopting a landscape irrigation efficiency ordinance, establishing gray water and rainwater use information, and developing a fixture replacement program.

The CWC Plan includes six water conservation approaches that will be pursued simultaneously to meet the City's water conservation targets:

- Implement water conservation rate designs;
- Adopt sustainable water supply ordinances;
- Provide incentives for use of water efficient technology and practices;
- Provide direct installation and distribution of efficient technologies;
- Provide water use audits; and
- Provide water use information, education, and outreach.

Due to the significance of water issues to the Pasadena community, PWP will provide ongoing reports regarding supply conditions and program results. Pasadena has developed a website dedicated to water conservation and efficiency, www.PasadenaSavesWater.com.

The City of Pasadena's general welfare requires that the water resources available to the City be put to the maximum beneficial use such that:, the waste, unreasonable use, or unreasonable method of the use of water be prevented, and the conservation of such waters is to be exercised. The City provides water shortage procedures with voluntary and mandatory provisions to minimize the effect of a water shortage to City customers. The provisions will significantly reduce the consumption of water over an extended period of time thereby extending the available water for the City while reducing the hardship of the City and the general public to the greatest extent possible. Prior to implementation of a water shortage plan the City Council shall hold a public hearing for the purposes of determining whether a water shortage exists and the water shortage plan or plans which may be appropriate to address the water shortage. The following sections of Municipal Code 13.10.010 include Water Shortage Plans I, II and III.

Pasadena Municipal Code 13.10.040 addresses Water Shortage Plan I. This plan has nine water conservation measures. The plan directs that all persons and customers of the department shall, on a voluntary basis, reduce water usage by taking the following water conservation measures (Ord. 6289 § 1 (part), 1988: Ord. 6275 § 1 (part), 1988):

A. Refrain from hosing or washing sidewalks, walkways, driveways, parking areas or other paved surfaces;

B. Refrain from cleaning, filling, or maintaining levels in decorative fountains, ponds, lakes, and similar structures unless such structure is equipped with a water recycling system;

C. Refrain from serving drinking water, unless at the express request of a customer, in all restaurants, hotels, cafes, cafeterias, or other public places where food is sold, served or offered for sale;

D. Promptly repair all leaks from indoor and outdoor plumbing fixtures, including but not limited to sprinkler systems;

E. Refrain from allowing water to run off landscape areas into adjoining streets, sidewalks, parking lots or alleys:

F. While washing vehicles, refrain from allowing water to run off into adjoining streets, sidewalks, parking lots or alleys;

G. Refrain from landscape watering more often than once every 3 days;

H. Refrain from landscape watering between the hours of 10:00 a.m. and 5:00 p.m.

I. Refrain from filling or refilling a swimming pool.

Pasadena Municipal Code 13.10.045 Water shortage plan II (Ord. 6289 § 1 (part), 1988)::

A. No customer of the department shall use or allow the use of water from the department to hose or wash sidewalks, walkways, driveways, parking areas or other paved surfaces.

B. No customer of the department shall use or allow the use of water from the department to fill or maintain levels in decorative fountains, ponds, lakes, and similar structures unless such structure is equipped with a water recycling system.

C. No restaurant, hotel, cafe, cafeteria, or other public place where food is sold, served, or offered for sale shall serve drinking water from the department unless at the express request of its customer.

D. No customer of the department shall allow water from the department to leak from any facility on his premises or on premises under his control or fail to effect a timely repair of any such leak.

E. No customer of the department shall cause or allow the use of water from the department to run off landscape areas into adjoining streets, sidewalks, parking lots or alleys due to incorrectly directed or maintained sprinklers or excessive watering.

F. No customer of the department shall use or allow the use of water from the department for landscape watering more often than once every 3 days.

G. No customer of the department shall use or allow the use of water for landscape watering between the hours of 10:00 a.m. and 5:00 p.m.

H. No customer of the department shall use or allow the use of water from the department to refill a swimming pool emptied after the commencement of a water shortage period.

Pasadena Municipal Code 13.10.050 Water shortage plan III (Ord. 6425 § 2, 1991; Ord. 6289 § 1 (part), 1988: Ord. 6275 § 1 (part), 1988):

A. Phase 1. No customer shall use or allow the use of water from the department for any purpose in an amount in excess of 85% of that customer's base, except that process water may be used to the extent of 95% of that customer's base.

B. Phase 2. No customer shall use or allow the use of water from the department for any purpose in an amount in excess of eighty 80%of that customer's base, except that process water may be used to the extent of 90% of that customer's base.

C. Phase 3. No customer shall use or allow the use of water from the department for any purpose in an amount in excess of 75% of that customer's base, except that process water may be used to the extent of 85% of that customer's base.

D. Phase 4. No customer shall use or allow the use of water from the department for any purpose in an amount in excess of 65% of that customer's base.

E. Phase 5. No customer shall use or allow the use of water from the department for any purpose in an amount in excess of 50% of that customer's base.

F. Nothing contained in this section shall be deemed to require any customer of the department to reduce his consumption of water provided by the department to an amount less than 20 billing units, bi-monthly, at each meter during any billing period.

Table 4-8 provides a list of programs initiated by and ongoing within the Pasadena Water Department:

Table 4-8: Water Programs

Program	Description
Comprehensive Water Conservation (CWC) Plan ***M2 Measure***	The City of Pasadena's CWC Plan includes information and recommendations related to managing water supply shortages. The long-term goals of the city are to provide water conservation measures to reduce per capita water consumption by 10% by 2015, 20% by 2020.
Drought Tolerant Landscape and Irrigation Upgrade Program ***M3 Measure***	This program utilizes drought tolerant landscape and irrigation for parks, medians, City facilities and buildings. This is an M3 measure because it was already quantified for the CWC plan.

Program	Description
"Social Water $mart" ***M3 Measure:***	Pasadena Water and Power has joined MWD in offering a new regional incentive program for water efficient devices. Rebates include High-Efficiency (HEW) Clothes Washer rebate, High Efficiency Toilet (HET) new construction Rebate, HET Upgrade, Zero water Urinals, High Efficiency Urinals, High Efficiency Urinals -Upgrade from 1.0 gpf or New Construction, HEW Commercial Clothes Washers , Pre-Rinse Kitchen Sprayers (Automatic Faucet Shut-Off Valves), Water-Pressurized Broom, Cooling Tower Conductivity Controllers, pH Cooling Tower Conductivity Controllers, Air Cooled Ice Machines, Dry Vacuum Pumps, Steam Sterilizer Retrofits, Weather Based Irrigation Controller Rebate, Rotating Sprinkler Nozzle Rebate, and Synthetic Turf. This is an M3 measure because it was already quantified for the CWC plan
Report Water Waste ***M3 Measure***	Pasadena has implemented on-line reporting of water waste. PWP will send a conservation reminder to the address where water waste is thought to have occurred. The goal of these reminders is to give all persons and businesses the opportunity to: correct the problem; become better informed about the importance of water conservation; and change their water use habits (Pasadena, 2008m). This is an M3 measure because it cannot be quantified but supports the CWC plan.
Efficient Irrigation Workshop ***M3 Measure***	Pasadena has designed programs for both residential and commercial customers who are interested in learning how to maintain a beautiful landscape without wasting water. This educational program is an M3 measure because it cannot be quantified, but does support the CWC plan.

SECTION 5 - TOTAL ESTIMATED REDUCTIONS

In 2020, the City of Pasadena is projected to emit a total of 8.9 million metric tons of CO_2e without the incorporation of reduction measures. With the incorporation of the existing plans and policies described in Chapter 4 of this report, the City emissions for 2020 are estimated to be reduced to **5.3 million** metric tons of CO_2e. Emission reductions estimated for year 2020 were based on the accomplishments both achieved and likely to be achieved as indicated in the programs detailed in Section 4. A detailed description of the reduction calculations is included as Appendix E.

The following Tables and Figures (Table 5-1, Table 5-2, Table 5-3, Table 5-4, and Table 5-5, and Figure 5-1, 5-2, and 5-3) summarize the reduced emissions by UEA category as estimated for 2020 including the percent reduction from 1990 levels.

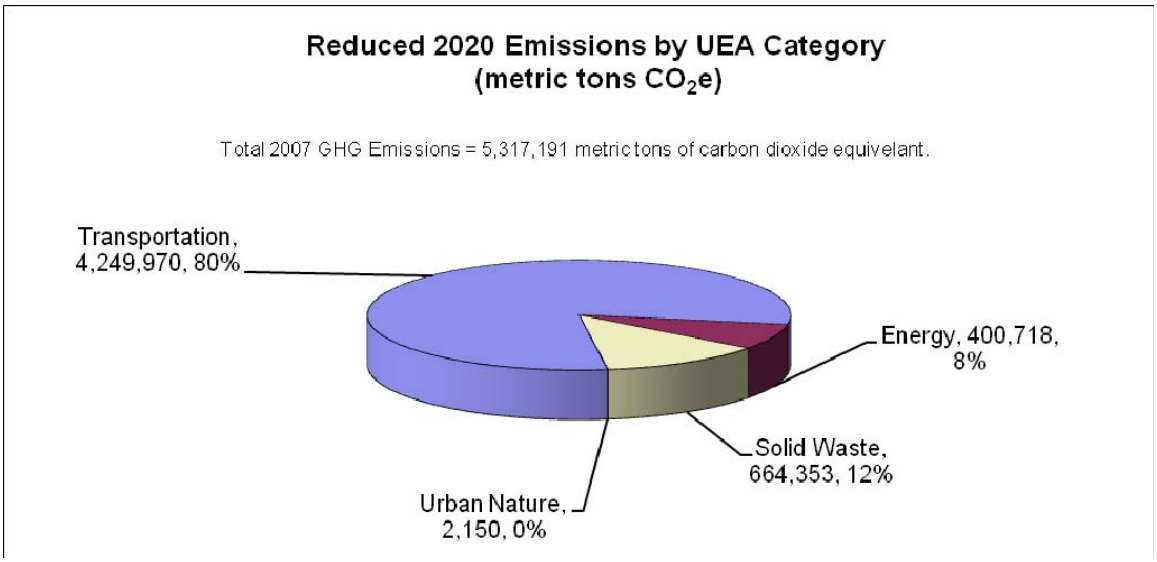
5.1 REDUCED 2020 NET TOTAL EMISSIONS

Table 5-1 summarizes the net reduced 2020 City emissions of CO_2e as broken down by UEA category. Each of these categories is further broken down in Tables 3-2 through 3-5. Figure 5-1 is a graphical representation of Table 5-1. A detailed breakdown of reduced 2020 emissions by category is available in Appendix E.

Table 5-1: Reduced 2020 Net Total Emissions

Reduced Net Total Emissions		
UEA Category	**Metric tons of CO_2e**	**% Reduction From 1990 levels**
Energy	400,718	60.04
Solid Waste	664,353	21.78
Urban Nature	2,150	(78.46)
Transportation	4,249,970	21.55
Total	**5,317,191**	**26.87**

Figure 5-1: Reduced 2020 Emissions by UEA Category (CO_2e)



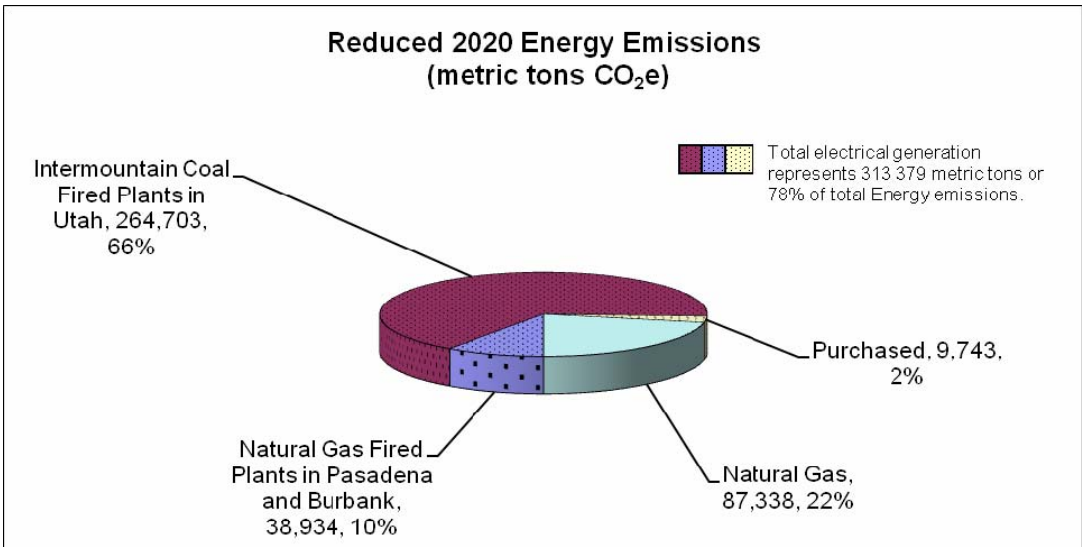
5.2 REDUCED 2020 ENERGY EMISSIONS

Table 5-2 summarizes the emissions from energy generation and/or consumption with respect to the reduced quantities of electricity and natural gas estimated for the City in 2020. Reduced 2020 energy-related emissions represent approximately 8% of the total GHG emissions generated by the City of Pasadena. Figure 2-2 is a graphical representation of this table. A detailed breakdown of reduced 2020 energy emissions is available in Appendix E.

Table 5-2: Reduced 2020 Energy Emissions

Reduced Energy Emissions		
Source:	**Metric tons of CO_2e**	**% Reduction From 1990 levels**
1 Electric		
Natural Gas Fired Plants in Pasadena and Burbank	38,934	81.52
Intermountain Coal Fired Plants in Utah	264,703	62.66
Purchased	9,743	(199.98)
2 Natural Gas	87,338	(9.17)
3 Other Fuels	Data Not Available	-
Total	**400,718**	60.04

Figure 5-2: Reduced 2020 Energy Emissions (CO_2e)



5.3 REDUCED 2020 SOLID WASTE EMISSIONS

Table 5-3 summarizes the reduced 2020 City emissions from the transportation, disposal, and decomposition of solid waste generated with the City. The data for green waste and materials recycling in 1990 is not available at this time. Solid-waste-related emissions represent approximately 12% of the total reduced GHG emissions generated by the City in 2020. A detailed breakdown of these emissions is available in Appendix E.

Table 5-3: Reduced 2020 Solid Waste Emissions

Reduced Solid Waste Emissions		
Source:	**Metric tons of CO_2e**	**% Reduction From 1990 levels**
1 Solid Waste Disposal	242,634	71.42
2 Green Waste Recycling	1594	N/A
3 Materials Recycling	420,126	N/A
Total	**664,353**	**21.78**

5.4 REDUCED 2020 URBAN NATURE EMISSIONS

Table 5-4 summarizes the reduced 2020 City emissions from Urban Nature. At this time this only includes the emissions from landscaping activities and the carbon sink from CO_2 sequestration.

Urban-Nature-related emissions represent less than 1% of the total reduced GHG emissions generated by the City of Pasadena in 2020. Data is not available to determine the 2020 emissions with respect to planting trees or fertilizer use. A detailed breakdown of 2020 Urban Nature emissions is available in Appendix E.

Table 5-4: Reduced 2020 Urban Nature Emissions

Reduced Urban Nature Emissions		
Source:	**Metric tons of CO2e**	**% Reduction From 1990 levels**
1 Emissions from tree planting	Data Not Available	-
2 Fugitive emissions from fertilizer	Data Not Available	-
3 Landscaping	2,169	(80.04)
4 Carbon sink from CO2 sequestration	(19)	-
Total	**2,150**	**(43.96)**

5.5 Reduced 2020 Transportation Emissions

Table 5-5 summarizes the reduced 2020 City emissions with respect to vehicle miles traveled. Transportation emissions do not include pass-through traffic on the freeways within the City of Pasadena and only account for vehicle trips related to Pasadena land uses as starting points and destinations. Transportation-related emissions represent approximately 80% of the total GHG emissions generated by the City in 2020. A detailed breakdown of 2020 transportation emissions is available in Appendix E.

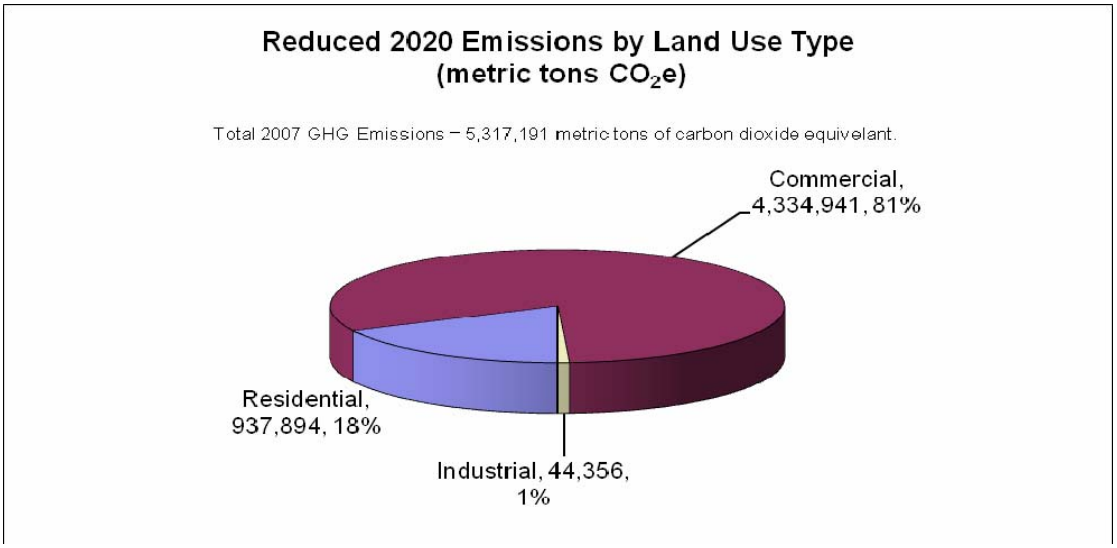
Table 5-5: Reduced 2020 Transportation Emissions

Reduced Transportation Emissions		
Source:	**Metric tons of CO_2e**	**% Reduction From 1990 levels**
1 On-Road Vehicles	4,249,970	21.55
Total	**4,249,970**	**21.55**

5.6 REDUCED 2020 URBAN DESIGN EMISSIONS

Urban Design as addressed here strictly provides a breakdown of the total reduced 2020 GHG emissions for the City of Pasadena by the residential, commercial and industrial land use categories (Figure 5-3). A detailed breakdown of 2020 emissions by land use is available in Appendix E.

Figure 5-3: Reduced 2020 Emissions by Land Use Category (CO_2e)



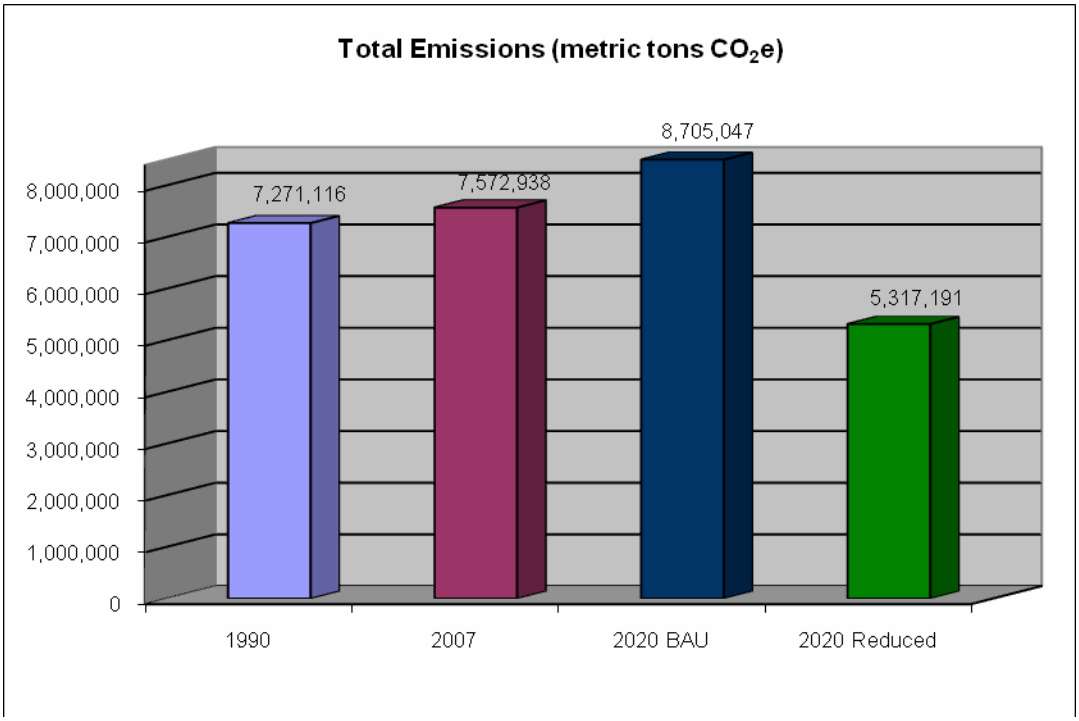
5.7 NET EMISSIONS COMPARISON BY YEAR

The 5.3 million metric tons of CO_2e of Reduced GHG emissions for 2020 is an estimated decrease of 38.92% from 2020 BAU, 29.79% from 2007, and 26.87% from 1990 levels. Table 5-6 and Figure 5-4 show a comparison between the 1990, 2007, and 2020 levels, including what the 2020 BAU emissions would have been without the implementation of, and what they are anticipated to be with the inclusion of these measures.

Table 5-6: Net Total Emissions by Year

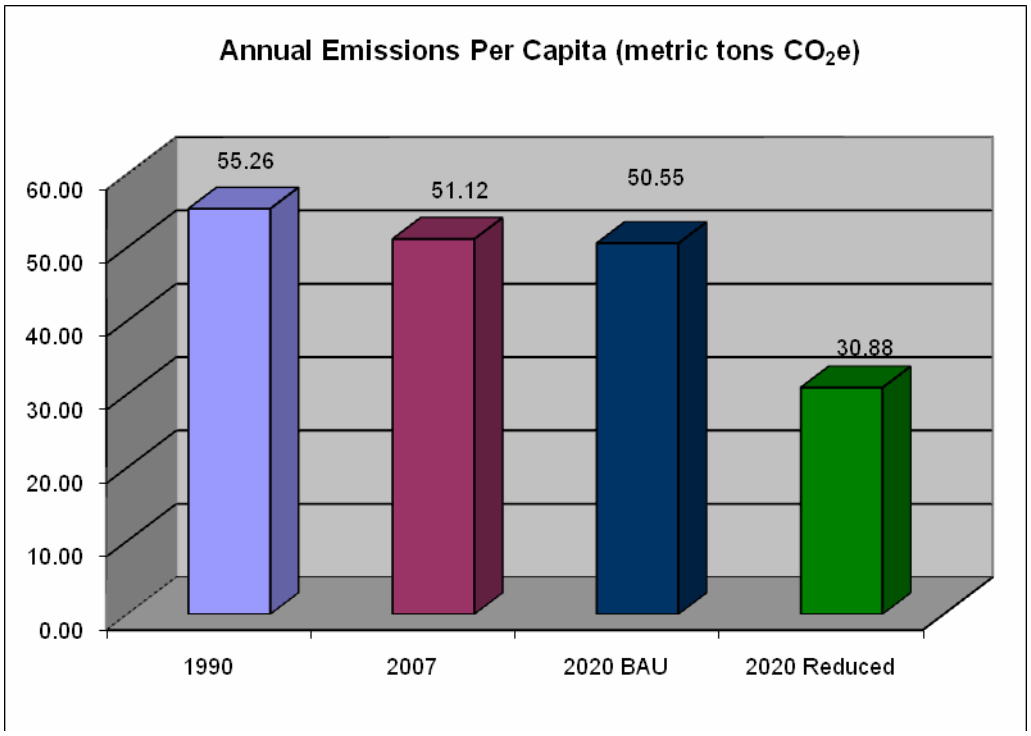
Net Total Emissions				
	Metric tons of CO_2e			
UEA Category	**1990**	**2007**	**2020**	**2020 Reduced**
Energy	1,002,876	854,355	995,488	400,718
Solid Waste	849,336	1,105,498	1,281,807	664,353
Urban Nature	1,205	2,175	2,513	2,150
Transportation	5,417,699	5,610,910	6,425,238	4,249,970
Total	**7,271,116**	**7,572,938**	**8,705,047**	**5,317,191**
% Reduction from 1990 Levels	-	(4.15)	(19.72)	26.87
% Reduction from 2007 Levels	-	-	(14.95)	29.79
% Reduction from 2020 Levels	-	-	-	38.92

Figure 5-4: Net Emissions by Year (CO_2e)



Even with the potential growth in population (from 131,591 in 1990 to as much as 172,196 in 2020 based on estimates from the Department of Finance), the slow growth rate, modernization of vehicle fleets, and urbanization of Pasadena combined with the implementation City programs and policies will reduce GHG emissions by approximately 44.12% per capita (Figure 5-5).

Figure 5-5: Annual Emissions Per Capita (CO_2e)



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SECTION 6 - FURTHER REDUCTION MEASURES

In evaluating the GHG emissions reductions resulting from the enforcement of existing City ordinances and the implementation of existing City programs in combination with established state reduction programs, the City has demonstrated that it will readily exceed the 2020 reduction target (1990 levels) established in AB32. As previously shown, in 2020 Pasadena will be 26.87% below 1990 levels, and will be well on its way to meeting the 2050 goal (80% below 1990 levels).

In order to aid in reaching the 2050 goal, this Greenhouse Gas Reduction Plan includes additional programs that the City can incorporate to further reduce emissions (Table 6-1). As technology improves and new resources become available, Pasadena will, under this Greenhouse Gas Reduction Plan, have the ability to revise and update existing programs and develop and implement new programs to best serve the City while further reducing GHG emissions.

Table 6-1: Proposed Further Reduction Measures

Program	Description
Energy	
Renewable Energy Implementation Projects ***M3 measure***	The Integrated Resource Energy strategy listed in Table 4-1 has the ambitious goal of providing 40 percent of the City's energy needs supplied by renewable energy sources. The following set of recommended implementation projects listed below are designed to keep the city on track toward that ambitious goal. These are M3 measures because they were already quantified in Table 4-1, but provide additional support toward the 40 percent renewable goal.
Photovoltaic Solar Projects ***M3 Measure***	Install photovoltaic solar panels on the Windsor Reservoir, city parking garages, and the Glenarm power plant to generate a total of 19 MW of locally-owned solar photovoltaic power by year 2020.
Photovoltaic Solar Incentive Program ***M3 Measure***	Provide incentives for new development to install photovoltaic solar panels that to the extent feasible supply all of the energy needs for the development.
Low Income housing Photovoltaic Solar Retrofit Program ***M3 Measure***	For new development that wishes to participate in the photovoltaic solar incentive program but cannot provide all of its power needs with photovoltaic due to restricted roof area, tree shade or other constraints, provide a fund that the applicant can pay into that will finance the retrofit of existing low income housing with photovoltaic power equal to the power needs of the proposed new development project.

Program	Description
Coal Reduction ***M3 Measure***	By 2016 reduce the demand for coal power purchased from the Intermountain Utah plant by an additional 35 MW and replace it with renewable energy sources through the programs described above.
Energy Efficiency Implementation Projects ***M3 Measure***	UEA 2 has the ambitious goal of reducing the City's annual electricity consumption by an average of 1.33% per year through year 2020 and beyond. UEA 3 has the ambitious goal of reducing existing levels of GHG emissions by 25% in year 2030. These goals will exceed the State's 2020 reduction targets and provide progress toward the ultimate reduction target of 80% below 1990 emission levels by year 2050. The following energy efficiency implementation projects are recommended in order for the City to meet these goals.
Tiered Electric Rates ***M3 Measure***	Provide a tiered electric rate that encourages energy conservation with the goal of reducing the City's annual electricity consumption by an average of 1.33% per year through year 2020 and beyond.
Energy Audit Program ***M3 Measure***	Provide energy audits to residential and commercial electric customers and provide energy efficiency recommendations with the goal of helping them keep within the lowest tiered electric rate described above.
Commercial and Industrial Energy Efficiency Programs ***M3 Measure***	Expand the existing energy efficiency program to include commercial and industrial land uses.
Waste Reduction	
Additional Implementation Measures of the Waste Reduction Goals and Program (WRGP) ***M3 Measure***	The City of Pasadena has set an ambitious waste-reduction goal of zero waste to landfills and incinerators by 2040. Tracking of waste diversion reveals the solid waste disposal at landfills increased during the period of 2007-2008. In order to keep the City's waste diversion programs on track toward achieving the 2040 zero waste to landfills goal, the following waste diversion projects are recommended.
Zero Waste Strategic Plan ***M3 Measures***	Implement analyzing existing programs, new programs and weighing the benefits and resources so as to prioritize projects that move the city towards its goal
Composting for Green Waste ***M2 Measure***	Support development of a composting facility near the City that is capable of composting green waste currently used as cover at landfills and food waste from restaurant/commercial businesses with the goal of diverting 100 percent of the green waste and food waste materials to the composting facility by 2040.

Program	Description
Multi-Family and Commercial Recycling ***M3 Measure***	Create an Ordinance applicable to licensed waste haulers in the city servicing commercial/multi-family units that requires 100 percent of the green waste to be diverted to composting, by 2040.
Reduce Construction and Demolition Debris ***M3 Measure***	Enhance the existing construction & demolition debris recycling program- by increasing the requirements for recycling construction debris to 75 percent by 2012 and 100 percent by 2040.
E-Waste Recycling Program ***M3 Measure***	Host quarterly E-Waste recycling programs.
Plastic Bag to Green Bag ***M3 Measure***	Eliminate single-use disposable bags within the City by 2020. Implement Green Bag program to City's retail stores.
AC and Refrigeration Units HGWP ***M2 Measure***	Refrigerants contribute to global warming since they have a very High Global Warming Potential (HGWP). Implement mandatory regular inspections of AC/HVAC systems to monitor for leakages. City will phase out the use of Hydrochlorofluorocarbons (HCFCs) as technology improves.
Reduce methane from Green Waste ***M3 Measure***	Provide inventory to show emissions reductions if green waste were diverted from landfills to a local composting facility. Reductions are primarily from transportation.
Urban Design/Land Use	
Land Use Strategies	The following land use strategies reduce vehicle trips and VMT and increase energy efficiency to further reduce GHG emissions.
Provide Incentives for Higher Density Development ***M3 Measure,***	High-density land uses require less infrastructure in established communities, are more energy efficient, and result in vehicle trip reduction when located near transit and other amenities. Vehicle trip reduction is accomplished because high density development can support closer amenities, which encourages walking, biking, reduced vehicle trip lengths and the use of public transportation. High-density planning also helps to control the spread of urban suburbs into open lands, improves efficiency in urban infrastructure and services, and results in environmental improvements that support a higher quality of life in cities. The City should provide incentives, such as reduced permitting Fees, expedited processing of plans, to new development that increases the density within the urban core of the city, especially within walking distance of transit facilities.

Program	Description
Provide Incentives for Mixed Use Development ***M3 Measure***	Implementing incentives, such as reduced permitting Fees, expedited processing of plans, for mixed-use infill developments ▪ Activates urban areas during more hours of the day; ▪ Increases housing options for diverse household types. ▪ Reduces auto dependence; ▪ Increases travel options; and ▪ Creates a local sense of place.
Eco Industrial Parks ***M3 Measure***	An Eco-Industrial Park is a commercial/industrial/mixed-use development where the waste stream of one company becomes the feedstock for another within the complex. The development of Eco-Industrial Parks provides benefits for all public and private stakeholders. ▪ Business derives cost savings and new revenues; shared services; reduced regulatory burden; and increased competitiveness. ▪ The community enjoys a cleaner, healthier environment; business and job development; an attraction for recruitment; and an end to conflict between the economy and the environment. ▪ City receives increased tax revenues; reduced enforcement burden; reduced costs of environmental and health damage; and reduced demand on municipal infrastructure. ▪ For the environment there is reduced demand on finite resources; decreased local and global pollution; increased use of renewable energy and materials; and an overall renewal of natural systems.
Transit Oriented Districts (TOD) ***M3 Measure***	Implement incentives for the creation of compact, walkable communities centered on Metro train systems. Possible incentives include, reduced permitting fees and/or expedited processing of plans for the developer and free or discounted transit passes, parking permits to allow cars to be parked at various lots at no charge for the residents. By creating dense, walkable communities with access to a train line or bus route, there is a reduction in the need for driving and consumption of fossil fuels. Pasadena currently has several TOD's in place however Pasadena has a tremendous opportunity for expanding TODs with infill projects. Pasadena ARTS and MTA provide transportation to adjacent Cities for work and entertainment.
Urban Nature	
Hahamongna Watershed ***M3 Measure***	Implement a restoration project for the Hahamonga Watershed including enhancement of water resources, flood management, and habitat restoration in this area.
Water	

Program	Description
Additional Water Conservation Projects ***M2 Measure***	The City of Pasadena's CWC Plan includes the long term goal to reduce per capita water consumption by 10% by 2015. The following water conservation measures are meant to increase water conservation with the additional goal of reducing per capita water consumption by 25% by 2020.
Purple Pipe Program ***M3 Measure***	**Water reclamation for irrigation:** New building construction should include infrastructure for water reclamation for irrigation to be available as City infrastructure is implemented. The purple pipes can be expanded to supply water for purposes such as laundry washing, and toilet flushing in addition to irrigation. Install a joint trenching effort between the City and all Utilities so that when upgrades to existing utilities are conducted, infrastructure for "purple pipe" can be expanded.
Reclaimed wastewater ***M3 Measure***	Utilize reclaimed waste water for watering golf courses and landscaping alongside public roads and City facilities.
Alternative Landscape Design ***M3 Measure***	Provide new development landscape standards to achieve Xeriscaping and eliminate artificial irrigation of landscape.
Landscape retrofit Program ***M3 Measure***	Provide property owners incentives to retrofit their landscaping to Xeriscape to the greatest extent feasible without removing existing trees that provide the City's urban forest and shade canopy.
Transportation	
Vehicle Fuel Efficiency ***M3 Measure***	Encourage the use of clean fuel vehicles. Retire old and under-used municipal vehicles, Purchase fuel efficient (e.g., hybrid) and/or smaller fleet vehicles. Promote community purchases of compact and hybrid vehicles.
Zero Emissions and Ultra Low Emission Vehicles ***M3 Measure***	Promote the purchase and use of Zero Emission Vehicles (ZEV) and ultra low emission vehicles as defined by EPA. ZEVs are defined by EPA as all electric vehicles and hydrogen fuel celled vehicles. Ultra low emission vehicles are defined as natural gas fueled vehicles and extremely efficient gasoline fueled hybrid vehicles. Promotion of the purchase and use of ZEVs and Ultra low emission vehicles can be accomplished by providing buyer incentives or local sales tax exemptions for car dealerships that sell these types of vehicles in the City of Pasadena. Other incentives include preferred parking spaces for these types of vehicles, free parking, and dedicated lanes for discrete roadway segments within the City. This is considered an M3 measure because the number of ZEV and ultra low emission vehicles resulting from this program cannot be quantified.

Program	Description
ARB Certified Diesel Construction Equipment ***M3 Measure***	Promote the use ARB-certified diesel construction equipment. Developers should use California Air Resources Board (CARB) certified alternative fueled engines in construction equipment and/or buses where practicable. Alternative fueled equipment may be powered by Compressed Natural Gas (CNG), Propane (LPG), electric motors, or other CARB certified off-road technologies.
Alternative Fuel Recharging Area ***M3 Measure***	Encourage residents to consider the cost/benefits of alternative fuel vehicles. Provide Charging Stations at high volume areas for electric powered vehicles. Added incentive of lower energy rate charged.
Traffic Management ***M3 Measure***	Apply creative traffic management approaches to address congestion in areas with unique problems, particularly on roadways and intersections in the vicinity of schools in the morning and afternoon peak hours, and near churches, parks and community centers.
Regional Development Patterns ***M3 Measure***	Work with adjacent jurisdictions to address the impacts of regional development patterns (e.g. residential development in surrounding communities, regional universities, employment centers, and commercial developments) on the circulation system.

SECTION 7 - CONCLUSIONS

Climate change is an issue that the City of Pasadena is taking seriously and has shown significant leadership in addressing. This Greenhouse Gas Emissions Inventory and Reduction Plan serves as a guide to help the City pursue work plans with the objectives of conserving resources and further abating global warming. This document is also serves as a technical resource for the preparation of the City's update to the Land Use and Mobility Elements of the General Plan and other land use related documents that may require evaluation and documentation of GHG emissions.

Figures 7-1 and 7-2 show a comparison between Reduced 2020 emissions and the 1990, 2007, and 2020 BAU levels. As shown, the 2020 BAU levels for the City of Pasadena are below both the current (2007) and 1990 emission levels. This is primarily due to a combination of factors including a slow growth rate compared to Los Angeles County as a whole (1.25% annually), the modernization of the on road vehicle fleet as older cars come off the roads, and the urbanization of Pasadena.

Figure 7-1: Net Total Emissions (CO_2e)

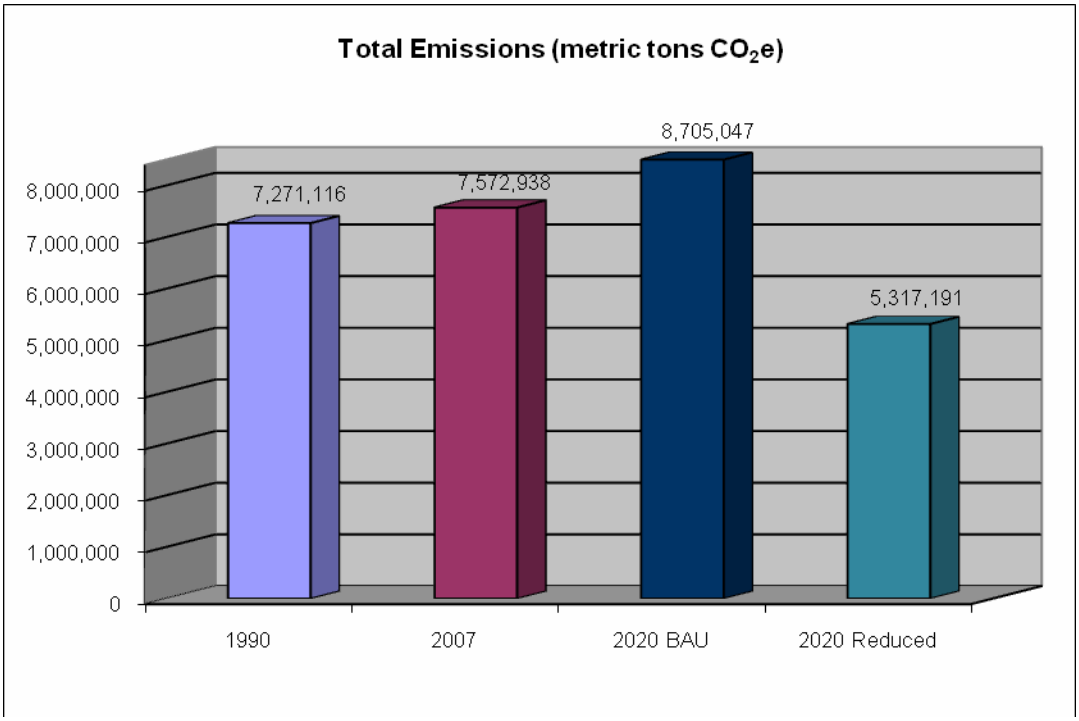
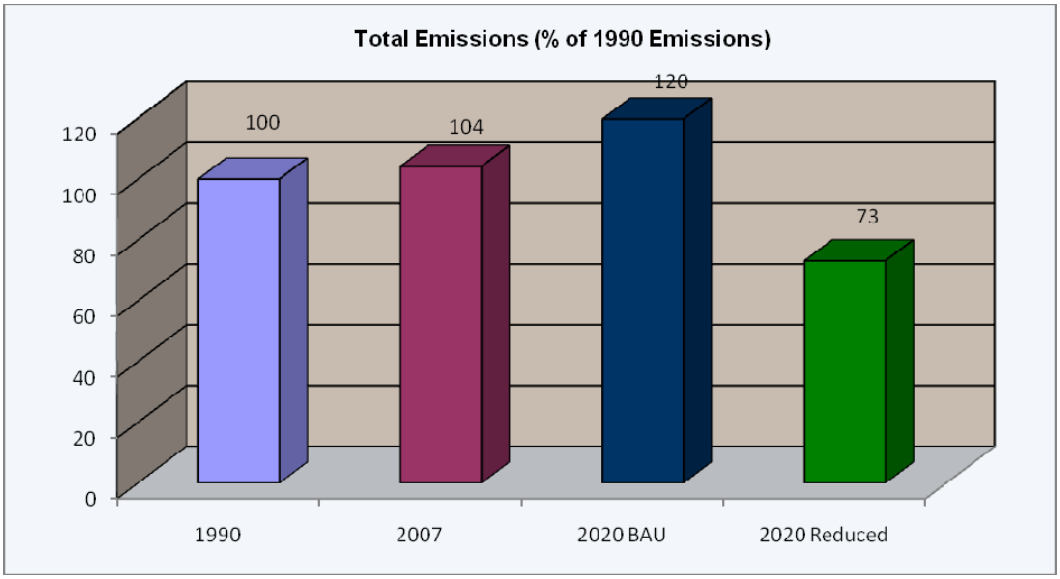
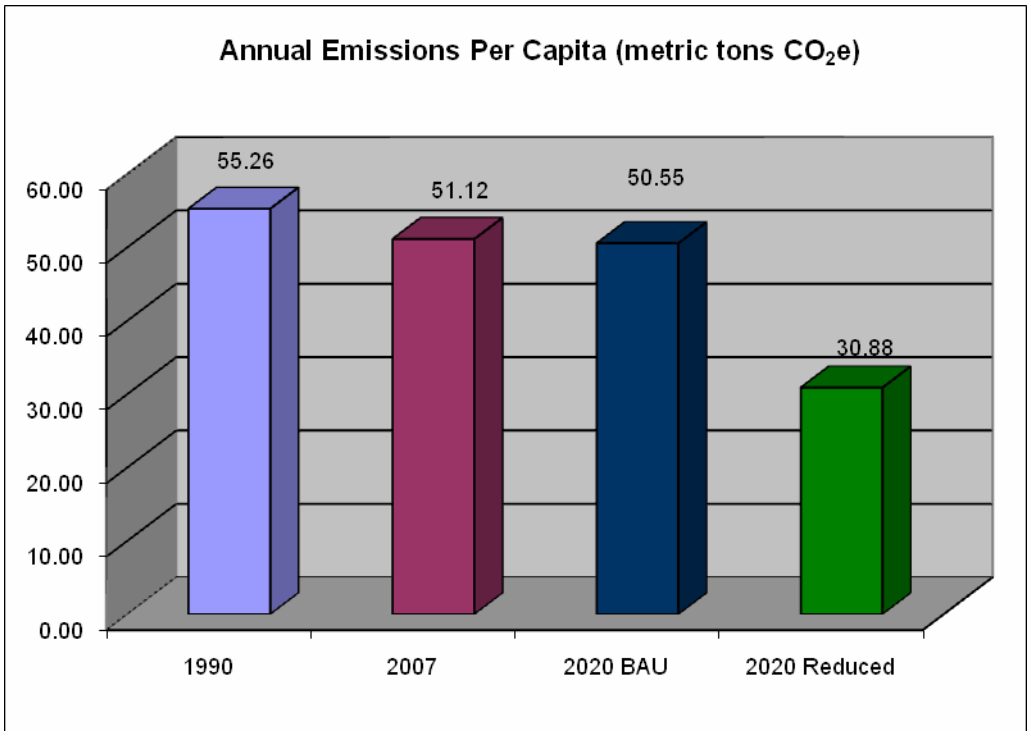


Figure 7-2: Total Emissions as a Percentage of 1990 Emissions



Programs and policies are already underway to help Pasadena exceed the AB 32 target GHG reductions of meeting 1990 levels by 2020 and achieving a level of 80% 1990 emissions by 2050. Such programs include the City's energy efficiency programs, solar rebates, conservation programs, green business support and green building program, incentives and ordinances and Cool Trees programs. Even with the anticipated growth in population (from 131,591 in 1990 to as high as 172,196 in 2020), the slow growth rate, modernization of vehicle fleets, and the urbanization of the City, combined with the continued implementation of the programs already has in place, will reduce GHG emissions by approximately 44.12% per capita (Figure 7-3).

Figure 7-3: Annual Emissions Per Capita (CO_2e)



In some cases, implementation will require the cooperation of other agencies, private businesses, and residents. And, although some of the initiatives in this document are already being implemented by City departments, others will require additional resources. The success of these measures will be tracked using indicators and targets such as those described in this plan. A target has been set to reduce GHG emission emissions to 1990 levels by the year 2020 City wide consistent with the State reduction goals in AB 32. The CARB Scoping Plan provides the State with reduction strategies designed to meet the reduction goal of AB 32 and recommends that local jurisdictions reduce their existing emissions by 15% by 2020. The City has a reduction strategy as described in sections 4 through 6 that is predicted to exceed these State reduction goals.

The ultimate reduction goal, as indicated by Executive Order S-3-05, is to reach 80% below 1990 levels by 2050. As shown in Figure 7-2, with incorporation of all the reduction strategies discussed in Sections 4 and 6 of this GHG Reduction Plan in 2020, Pasadena's GHG emissions will be 26.87% below 1990 levels, well on the way to meeting the 2050 goal. This Greenhouse Gas Reduction Plan includes additional programs that the City can incorporate to further reduce emissions. In addition, it is likely that some measures will evolve and new opportunities will emerge in the period between the Plan implementation and both the 2020 and 2050 goal years.

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Appendix A: The Greenhouse Effect, Greenhouse Gases, and Climate Change Impacts

Appendix B: Assumptions and General Formulas

Appendix C: 1990 URBEMIS Output and GHG Calculations

Appendix D: 2007 URBEMIS Output and GHG Calculations

Appendix E: 2020 URBEMIS Output and GHG Calculations