REPORT TO COUNCIL
City of Sacramento

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Staff Report
February 16, 2010

Honorable Mayor and
Members of the City Council

Title: Climate Action Plan, Phase 1 – Internal Operations

Location/Council District: Citywide

Recommendation: Review and comment on Phase 1 of the Climate Action Plan and direct staff to proceed with Phase 2 of the project.

Contact: Erik de Kok, Senior Planner, (916) 808-2022; Tom Pace, Long Range Planning Manager, (916) 808-6848

Presenters: Erik de Kok

Department: Community Development

Division: Planning

Organization No: 21001221

Description/Analysis

Issue: On March 3, 2009, the City Council adopted the 2030 General Plan and directed staff to complete a Climate Action Plan (CAP) for the City of Sacramento by July 2011. The work plan and budget for the CAP was approved by City Council on August 18, 2009. Additional background information is provided in Attachment 1.

Phase 1, the internal operations section of the City of Sacramento Climate Action Plan (Phase 1 CAP) is substantially complete (Attachment 2). The Phase 1 CAP primarily describes strategies and specific actions for reducing greenhouse gas (GHG) emissions 15% below 2005 levels by 2020 for the City's internal operations, and provides an analysis of the GHG emissions reductions, and the estimated costs and cost savings associated with each action.

The focus of the Phase 1 CAP is GHG emissions that City has control over as a result of its internal operations. These include GHG emissions from City's vehicle fleet; the purchased energy that powers the City's buildings and facilities; purchased energy that powers the City's streetlights and traffic signals; and

emissions from solid waste disposal. GHG emissions from the broader community within the city boundary that the City does not have direct control over, but can influence (e.g., automobiles and trucks; heating, cooling and lighting energy used in private residences and businesses; private water usage; and solid waste), will be addressed in the community-wide Phase 2 CAP.

Community Development Department and Department of General Services staff worked across all City departments to identify past, current or proposed programs and projects that will reduce GHG emissions in City operations. The Phase 1 CAP identifies over 30 specific projects and programs that not only address climate change, but could potentially result in significant cost savings to the City due to improved energy and/or operational efficiencies and return on investment.

The Phase 1 CAP also addresses the issue of adaptation to the effects of climate change, however it is anticipated that a more substantial analysis of adaptation strategies will occur during Phase 2 of the project.

Policy Considerations: The preparation of the Phase 1 CAP is consistent with the City's goals and policies as established in 2030 General Plan. The 2030 General Plan includes the goal of reducing greenhouse gas emissions, and an implementation measure to develop and adopt a climate action plan.

Committee/Commission Action: Not applicable.

Environmental Considerations:

California Environmental Quality Act (CEQA): The preparation of the CAP was identified as a mitigation measure in the 2030 General Plan Master Environmental Impact Report (EIR). However, the CAP will undergo CEQA review as part of the CAP work program because the CAP will be amended into the 2030 General Plan upon completion of Phase 2. The specific CEQA document that will be prepared for the CAP will be determined at a later date.

Sustainability Considerations: The Sustainability Master Plan (SMP) includes Climate Protection goals and targets for the City's internal municipal operations, and for the Sacramento region. The Phase 1 CAP is consistent with the specific Climate Protection targets to reduce GHG emission from the City's internal operations as follows:

- 1990 levels by 2020 (AB 32 target),
- 25% below 1990 levels by 2030 (UN Environmental Accords),
- 80% below 1990 levels by 2050 (Governor's Executive Order S-3-05)

Rationale for Recommendation: The CAP will help the City prepare for pending changes to the State and Federal regulatory environment, including the Global Warming Solutions Act of 2006 (AB32), SB375, and related legislation. It will help position the City to compete for energy conservation and air quality grant funding,

and will strategically identify areas in which to direct grant funds.
In addition to providing a strategy for reducing GHG emissions, the CAP will help to provide a framework for:

- Creating and retaining "green collar jobs"
- Saving energy, and keeping energy dollars in the community
- Reinvesting in the community (energy efficiency retrofits for existing buildings)
- Stimulating investment and innovation in renewable energy & related technology
- Creating a roadmap for the longer-term transition to zero-net energy use and carbon-neutrality
- Providing for a more secure energy future
- Adapting to the likely effects of climate change on our community

Financial Considerations: The Phase 1 CAP identifies past, current, or proposed programs and projects that will reduce GHG emissions in City operations. When energy cost savings and the incremental costs of a project or program were both available, simple payback was used to conservatively estimate the return on investment. For many of the projects and programs, however, a more appropriate analysis would be a comprehensive life-cycle cost/benefit study that is beyond to scope of the CAP. In some cases, project cost data is unavailable. Staff will continue to work through these issues as development of the CAP continues during 2010-2011.

The projects and programs indentified in the CAP fall into a range of cost/benefit categories. The first of these is the low-to-no cost category, which includes measures with GHG reduction benefits and cost savings at virtually no upfront cost. Some examples in this category are the Sustainable Operations Policy and the Solid Waste 4/10 Schedule. The moderate cost/benefit category includes programs that have a significant up-front cost, but offer a significant payback in a relatively short number of years. Fleet Telemetrics is an example of a program in the moderate cost/benefit category, with $2.6 million in up-front costs and a short simple payback of three to four years. Finally, there are measures that have significant upfront costs that may not offer a proportionate cost savings, but have been or may be implemented for other reasons. Examples in this category include the green building (LEED) policy for new City buildings, or expansion of the urban forest.

Emerging Small Business Development (ESBD): No goods or services are being purchased as part of this work program at this time.

Respectfully Submitted by: David W. Kwong

David Kwong
Planning Director

Approved by: _____
David Kwong
Acting Director of Community Development

Recommendation Approved:

_____
Ray Kerridge
City Manager

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Attachment 1

Background

Project Description

The purpose of the City of Sacramento Climate Action Plan (CAP) is to provide a comprehensive plan for reducing the City's greenhouse gas emissions and adapting to climate change.

The International Council for Local Environmental Initiatives (ICLEI) has developed a standard process and methodology for setting and meeting climate protection goals. The City will generally follow the ICLEI 5-Step Process for reducing Sacramento's greenhouse gas emissions. The City's process includes a greenhouse gas emissions inventory[1] for the baseline year of 2005, a "business as usual" emissions-forecast for future greenhouse gas emissions, establishing emissions targets for the year 2020, and identifying action strategies to reduce emissions consistent with the targets..

The first phase of the planning process is focused on the City's internal operations and specific actions for reducing greenhouse gas (GHG) emissions that City has control over, such as emissions from the City's fleet; emissions from the fossil fuel energy that runs City's buildings and facilities; the energy used to keep the City's streetlights on, etc.

The second phase will focus on community-wide strategies and specific actions for reducing GHG emissions within City boundaries which the City does not directly control but can influence, such as emissions from private automobiles, heating, cooling and lighting private residences and businesses, etc.

An inventory of GHG emissions for the baseline year of 2005 was completed in June 2009 as part of a County-wide GHG inventory. A summary of the inventory is included in part II of the CAP. A link to the full inventory document can be found on the City's website at: http://www.sacgp.org/climate_action_plan.html

History/Timeline

- August 18, 2009 City Council approved the work program and budget for the Climate Action Plan and directed staff to proceed with the project.

- May 22, 2009, Council adopted Resolution 2009-319 authorizing the application and acceptance of a 2009 Federal Energy Efficiency and Conservation Block Grant (EECBG) with the U.S. Department of Energy in the amount of $4.7 million, which included the allocation of $200,000 for the development of a Climate Action Plan.

- March 3, 2009: City Council adopted the 2030 General Plan and directed staff to complete a Climate Action Plan by July 2011. The General Plan includes key policies and implementation measures, consistent with the Sustainability Master Plan that will help to address climate change and reduce greenhouse gas emissions.

- In early 2008, the County of Sacramento, along with other incorporated cities in the county and the City, formed the Sacramento Area Green Partnership to coordinate the development of a joint study to develop a county-wide greenhouse gas inventory. The inventory provides each jurisdiction within the county with an accurate accounting of its own communitywide greenhouse gas emissions for a common baseline year (2005) using a common standardized approach developed by ICLEI-Local Governments for Sustainability. The Sacramento Area Green Partnership continues to meet monthly to coordinate the development of the inventory and a process for regionally-consistent climate action planning among all the participating jurisdictions.

- In December 2007, the City Council adopted the City's Sustainability Master Plan, including the goal of meeting the intent of the Global Warming Solutions Act (AB32) and subsequent legislation. This goal includes City operations, the community of Sacramento, and collaboration with regional partners in the SACOG region to develop a regional climate action plan and climate adaptation plan. It established a target for the SACOG region to reduce carbon dioxide emissions to 1990 levels by 2020.

- On April 4, 2006, the City Council authorized the Mayor to sign the United Nations Urban Environmental Accords, which identified a reduction target of 25% below 1990 levels by 2030.

- The City of Sacramento joined the California Climate Action Registry (CCAR) as a charter member in October 2002, and has been tracking and registering greenhouse gas emissions from the City's internal operations for over four years.

- The City joined ICLEI-Local Governments for Sustainability in 1998. Staff has used ICLEI as a resource since that time to address sustainability and climate change issues in policy development and planning.

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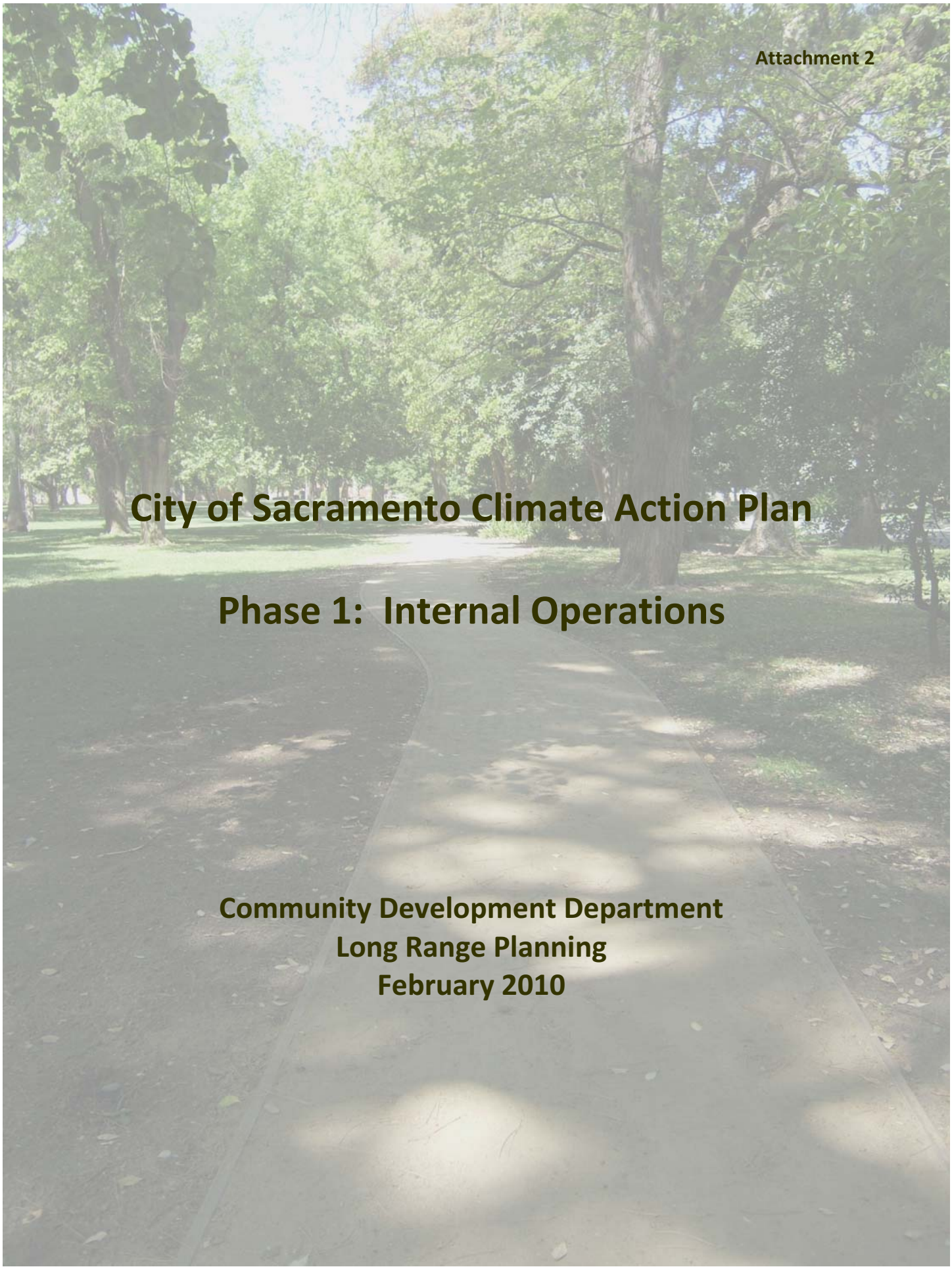

Attachment 2

City of Sacramento Climate Action Plan

Phase 1: Internal Operations

Community Development Department
Long Range Planning
February 2010

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Executive Summary

The City of Sacramento has been a leader in our region in moving towards sustainability and livability. Through the adoption of a Sustainability Master Plan in 2007, the 2030 General Plan in 2009 and by implementing important programs and projects which are already carrying out these plans, the City has demonstrated a clear commitment to sustainability.

Phase 1 of the City of Sacramento's Climate Action Plan (CAP) examines the City's internal government operations and identifies strategies to reduce greenhouse gas (GHG) emissions in a cost effective manner in the City's municipal buildings, vehicle fleet, streetlights and signals, parks maintenance, water and drainage pumping, and other facilities and operations that are within the City's immediate control. Phase 2 of the Climate Action Plan will focus on reducing communitywide GHG emissions within the City limits, as well as strategies to adapt to the effects of climate change.

GHG Emission Inventory and Targets

The City's total annual GHG emissions from internal operations were benchmarked for the year 2005 in a countywide GHG inventory at 78,584 metric tons of carbon dioxide equivalents ($MTCO_2e$). Approximately 45% of these emissions were from electricity and natural gas usage in the City's buildings and facilities, 28% were from fuel used in the City's vehicle fleet, 18% were from waste-in-place at a City-owned landfill, and 8% were from electricity usage in the City's streetlights & signals.

In order to meet the intent of the City's climate change policies and maintain consistency with AB 32, the Phase 1 CAP utilizes a minimum reduction target of 15% below 2005 levels by the year 2020 in accordance with recommended California Air Resources Board guidance to local government agencies. This means that by 2020, total annual GHG emissions need to be reduced by at least 11,788 $MTCO_2e$.

Action Plan

Strategies for reducing GHG emissions from the City's internal operations were identified for each sector in the GHG emissions inventory, along with multi-sector/cross-cutting initiatives and additional measures that achieve multiple sustainability goals. Some of the action strategies were completed after the baseline year (2005) and will continue to be effective through the year 2020. Many of the action strategies are in progress already but have not reached full implementation. Total GHG reductions from City operations by 2020 are estimated to be approximately 10,075 $MTCO_2e$, or 13% below 2005 levels.

The local electric utility also plays an important role in reducing emissions from the City's purchased electricity. The Sacramento Municipal Utility District (SMUD) has committed to improving its renewable energy portfolio gradually over time, consistent with the statewide renewable portfolio standard of 33% renewable energy sources by 2020. As a result, approximately 7,132 MTCO2e will be reduced from the City's electricity usage in internal

operations apart from the City's specific action measures, reducing emissions from the City's 2005 levels by roughly 9%.

Table 1 below summarizes total GHG reductions from both City-initiated action strategies and SMUD's improved renewable energy portfolio through 2020, which are estimated to result in a total reduction of 17,207 MTCO2e, or 22% below 2005 levels. This exceeds the minimum recommended GHG reduction target by over 7%.

Table 1: Summary of Total Combined GHG Reductions (Phase 1 CAP Action Strategies and Renewable Portfolio Standards)

	GHG Emissions MTCO2e	% change
Total Baseline GHG Emissions in 2005	78,584	
SMUD renewable portfolio (33% by 2020)	*(7,132)*	*-9%*
City GHG Reduction Strategies:	*(10,075)*	*-13%*
TOTAL REDUCTIONS by 2020	*(17,207)*	*-22%*
2020 TOTAL NET EMISSIONS	61,377	

A total of 30 specific action strategies for each sector of the City's operations were identified and are summarized below:

- **Buildings and Facilities:** Significant reductions can be achieved by implementing energy efficiency and conservation measures in the City's existing buildings and facilities. **$MTCO_2e$** in emission reductions are identified, resulting in an **11%** reduction from this sector's 2005 levels. Key strategies include:
  - Expand thermostat set-point optimization program (Sustainable Operations Policy)
  - Implement energy conservation education program for City staff (Sustainable Operations Policy)
  - North Area Corporation Yard Lighting Retrofit Project
  - Downtown Plaza Parking Garage Bi-Level LED Lighting Project
  - Convention Center Complex Lighting Retrofit Projects
  - Implement energy efficiency retrofit program for select, high-priority facilities
  - Install Solar PV and Hot Water systems at various locations
  - Continue to implement the City's green building policy for new facilities (min. LEED Silver, 25% efficiency above Title 24)
  - Continue Greenergy and other purchased offsets for select City facilities
  - Implement "Green IT" programs & projects for City's computers, printers, and other devices
  - Pumping efficiency improvements in the City's water, sewer, and drainage systems

- **Streetlights and Signals:** Continuing a long-standing commitment to improve energy efficiency in the City's traffic signal systems, the strategies in the action plan result in about **1,504 MTCO_2e** in GHG reductions, a reduction of **22%** below 2005 levels for this sector. The two key strategies include:
  - Convert remaining traffic signals to light-emitting diode (LED)
  - Implement a streetlight LED pilot program and long-term conversion to LED streetlights citywide

- **Vehicle Fleet and Fuels:** Building upon the City's Sustainable Fleet policies already in effect, continued improvements in fleet vehicle efficiency, alternative fuels and infrastructure, and operational and behavioral changes to reduce fuel usage and vehicle miles travel are identified for this sector, reducing GHG emissions by **4,570 MTCO_2e**, a reduction of over **21%** from the sector's 2005 levels. Key strategies include:
  - Implement Fleet Telemetrics System to manage vehicle performance, reduce idling and vehicle miles traveled (VMT), and improve routing efficiencies (average 10% annual fuel savings)
  - Continue to implement fleet-wide fuel efficiency improvement program (average 3% annual improvement)
  - Continue to expand low-carbon fuel, vehicles, and infrastructure (E85 ethanol, LNG)
  - Implement joint use of the County North Area Recovery Station to decentralize solid waste transfer activities
  - Shift to 4/10 schedule for solid waste and recycling operations
  - Implement containerized green waste collection services citywide

- **Waste/Waste-in-Place:** Key programs and projects were identified to help reduce emissions from both existing waste-in-place and the City's ongoing future operational waste stream. These include:
  - Improve fugitive methane capture and reporting for the closed 28th Street landfill
  - Expand waste reduction and recycling programs for City facilities

- **Multi-Sector or Additional Strategies*:*** The City's commitment to sustainability includes some cross-cutting initiatives that span GHG emission sectors, or in some cases reduce GHG emissions that are outside the scope of the City's emissions inventory. Key strategies in this category include:
  - Implement low maintenance landscaping practices in parks & open spaces
  - Watering Reductions in City parks and open spaces
  - Install centralized and weather-sensitive irrigation controls
  - Apply Interim Water Conservation Plan and Water Efficient Landscaping Ordinance
  - Green Landscaping Equipment Pilot Program
  - Explore Waste-to-Energy Opportunities
  - Expand the Urban Forest by planting additional trees above replacement value in City parks, open spaces, and streetscapes, resulting in increased carbon sequestration
  - Improve in-region disposal options for the City's operational and communitywide waste stream, thereby reducing VMT from private waste haulers to distant landfills

- Sustainable Purchasing Policy to increase purchase of recycled products, energy efficiency equipment or services, and other measures which reduce third-party emissions

Costs, Benefits, and Co-Benefits

When energy cost savings and the incremental costs of a project or program were both available, simple payback was used to conservatively estimate the return on investment. For many of the projects and programs, however, a more appropriate analysis would be a comprehensive life-cycle cost/benefit study that is beyond to scope of the CAP. In some cases, project cost data is unavailable. Staff will continue to work through these issues as Phase 2 of the CAP process continues during 2010-2011.

The projects and programs indentified in the CAP fall into a range of cost/benefit categories. The first of these is the low-to-no cost category, which includes measures with GHG reduction benefits and cost savings at virtually no upfront cost. Some examples in this category are the Sustainable Operations Policy and the Solid Waste 4/10 Schedule. The moderate cost/benefit category includes programs that have a significant up-front cost, but offer a significant payback in a relatively short number of years. Fleet Telemetrics is an example of a program in the moderate cost/benefit category, with $2.6 million in up-front costs and a short simple payback of three to four years based solely on fuel savings. Finally, there are measures that have significant upfront costs that may not offer a proportionate cost savings, but have been or may be implemented for other reasons. Examples in this category include the green building (LEED) policy for new City buildings, or expansion of the urban forest.

While the specific action measures identified in this plan are oriented towards reduction of GHG's, many of them will achieve an important "co-benefit" of also helping to adapt to potential effects of climate change on our community's resources – such as the ongoing availability and reliability of our energy and water supply, air quality, and public health. There are also many cases where taking action now is cost-effective and would lessen the impact, or where the issue is evident even without the added challenge of climate change (for example, water resources are already limited, air quality is already impaired due to a growing population, and energy and fuel prices are increasing and will likely become less reliable over time).

I. Introduction

The City of Sacramento has been a leader both in our region and beyond in moving our community towards sustainability and livability. Through the adoption of a Sustainability Master Plan[1] in 2007, the 2030 General Plan in 2009, and by implementing programs and projects identified in these plans, the City has demonstrated a commitment to operating more sustainably.

Both the Sustainability Master Plan and the 2030 General Plan call for a Climate Action Plan that will outline specific strategies for reducing greenhouse gas (GHG) emissions from both our own local government operations and the broader community. The CAP will also outline steps that our community will need take to adapt to a changing climate. This report represents an initial step in the development of the City's Climate Action Plan. It examines the City's internal government operations and identifies strategies for how we can begin to reduce GHG emissions in a cost effective manner. The Phase 1 CAP includes strategies for our local government's buildings, vehicles, streetlights and signals, parks maintenance, water and drainage pumping, and other facilities and operations that are within the City's immediate control.

Assembly Bill (AB) 32

In 2006, Governor Schwarzenegger signed AB 32, also known as the California Global Warming Solutions Act, which established an overall goal to reduce statewide GHG emissions to 1990 levels by 2020. The year 1990 is an important baseline year identified by the United Nations Intergovernmental Panel on Climate Change (IPCC) as a benchmark year against which global GHG emissions should be reduced (80% below 1990 levels by 2050) in order to stabilize average global temperatures from increasing more than 2 degrees Celsius[2]

AB 32 identified the California Air Resources Board (ARB) as the lead agency for coordination and implementation of AB 32. The ARB drafted a Scoping Plan, adopted in December 2008, to identify the key statewide action strategies for achieving AB 32's 2020 target. Local governments were identified in the Scoping Plan as having an important role in helping to achieve the AB 32 target through local land use and building permitting authority, regulation of water and energy use, economic development and job training, and other locally-based activities.

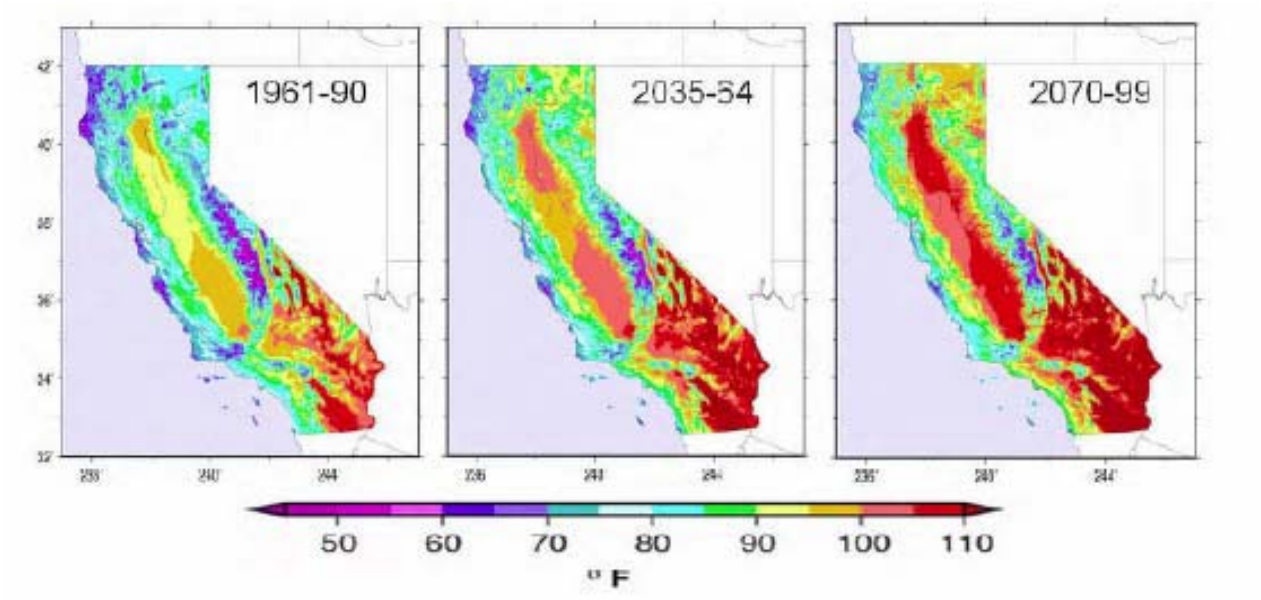
[1] Sustainability Master Plan, (http://www.cityofsacramento.org/generalservices/sustainability/)
[2] http://www.ipcc.ch

Global Climate Change and Potential Threats to Sacramento

Global climate change is a complex issue of growing importance that could have substantial environmental, economic and social consequences if no action is taken. Warming average global temperatures could result in a variety of environmental effects locally and around the world. Some potential problems for the Sacramento region could include:

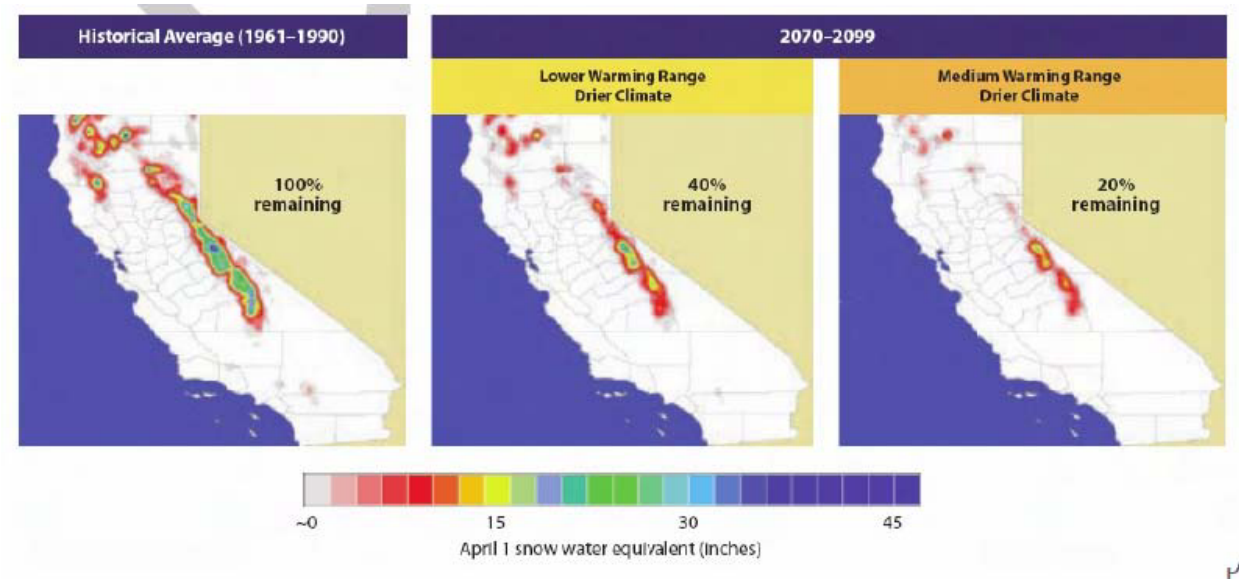
- More frequent and intense heat waves, and hotter average summer temperatures (see Figure 1 below);
- More frequent and persistent droughts due to decreasing snow pack in the Sierra Nevada mountains (see Figure 2 below);
- Significant increases in sustained peak electrical power demand and greater stress placed on local utilities and emergency responders;
- Changing and unpredictable flooding patterns due to less winter snow pack and more runoff in rivers and streams during the wet season; and
- Higher sea levels and associated changes in the Sacramento-San Joaquin Delta region and potential increases in saltwater intrusion in the Sacramento River.

Figure 1: CA Historical and Projected July Temperature Increase (1961-2099)[3]



[3] CA Natural Resources Agency, "2009 California Climate Adaptation Strategy," Introduction (http://www.climatechange.ca.gov/adaptation/)

Figure 2: CA Historical and Projected Decrease in Sierra Nevada Snowpack, (1961-2099)[4]



While the level of severity or types of impacts are still not fully understood, there is growing consensus that the impacts will be adverse and impose significant costs to our economy and public services and operations. A study conducted in 2008 by UC Berkeley and Next10 estimated that potential statewide direct costs due to climate change-induced damage, if no action is taken, could exceed tens of billions of dollars annually, with even higher direct costs and the placement of trillions of dollars of real estate at risk.[5] If even a fraction of these impacts were to occur in the Sacramento region, inaction could deliver a price tag of hundreds of millions of dollars annually in Sacramento to deal with the direct impacts of climate change.

Taking Action and "Leading by Example"

The potential effects of climate change and the magnitude of costs to deal with these changes require immediate action. Taking action to address climate change involves:

- GHG Mitigation: Reducing our local GHG emissions, which are part of the overall cumulative global carbon footprint contributing to climate change; and

- Adaptation: Preparing for how we can respond and adapt to changes that are likely already occurring and will likely continue to occur here in Sacramento.

By initially "leading by example" and addressing the City's municipal operations, the City is framing the discussion regarding GHG emission reduction and adaptation strategies

[4] *Ibid*, p. 80.
[5] David Roland-Holst and Fredrich Kahrl, "**California Climate Risk and Response,"** UC Berkeley, November 2008 http://www.next10.org/next10/publications/research_ccrr.html

for the broader community that will be addressed in a future phase of work on the Climate Action Plan, which will encompass all sources of GHG emissions in the City limits, including homes and businesses, cars and trucks, solid waste, residential and commercial water use, and other sources.

Moving Towards Sustainability

The action strategies outlined in this document not only address climate change and make our city more "green" environmentally, but also result in significant cost savings to the City due to greater efficiencies and return on investment. Actions to increase energy efficiency, generate renewable energy, reduce fossil fuel use and implement cleaner, more efficient technology can result in both short and long-term cost savings that in many cases more than pay for the cost of implementing the programs or projects themselves. Thus, the process of climate action planning is not just a regulatory compliance activity, but an opportunity to reduce operating costs and therefore make more efficient use of resources and move our organization towards true sustainability. In a time where revenues for public services are declining, going "green" makes sense for both the environment and our organization's (and ultimately the broader community's) long-term benefit.

Overview of the Climate Action Planning Process

The City of Sacramento is a member of the International Council for Local Environmental Initiatives (ICLEI). ICLEI is a membership association of local governments committed to advancing climate protection and sustainable development. ICLEI's Cities for Climate Protection™ (CCP) Campaign assists cities to adopt policies and implement quantifiable measures to reduce local GHG emissions, improve air quality, and enhance urban livability and sustainability.

The CCP program is modeled on a "Five Milestone" process[6] for climate action planning, which is summarized as follows:

- **Milestone 1.** ***Conduct a baseline emissions inventory and forecast.*** Based on energy consumption and waste generation, the city calculates GHG emissions for a base year (e.g. 2000) and for a forecast year (e.g. 2015). The inventory and forecast provide a benchmark against which the city can measure progress.

- **Milestone 2.** ***Adopt an emissions reduction target for the forecast year.*** The city establishes an emission reduction target for the city. The target both fosters political will and creates a framework to guide the planning and implementation of measures.

[6] http://www.icleiusa.org/action-center/getting-started/iclei2019s-five-milestones-for-climate-protection

- **Milestone 3.** ***Develop a Local Action Plan.*** Through a multi-stakeholder process, the city develops a Local Action Plan that describes the policies and measures the local government will take to reduce GHG emissions and achieve its emissions reduction target. Most plans include a timeline, a description of financing mechanisms, and an assignment of responsibility to departments and staff. In addition to direct GHG reduction measures, most plans also incorporate public awareness and education efforts.

- **Milestone 4.** ***Implement policies and measures.*** The city implements the policies and measures contained in their Local Action Plan. Typical policies and measures implemented by CCP participants include energy efficiency improvements to municipal buildings and water treatment facilities, streetlight retrofits, public transit improvements, installation of renewable power applications, and methane recovery from waste management.

- **Milestone 5.** ***Monitor and verify results.*** Monitoring and verifying progress on the implementation of measures to reduce or avoid greenhouse gas emissions is an ongoing process. Monitoring begins once measures are implemented and continues for the life of the measures, providing important feedback that can be used to improve the measures over time.

The City's Climate Action Planning process will generally follow Milestones 1 through 3. Milestones 4 and 5 would occur on an ongoing basis after the plan is adopted.

II. GHG Inventory and Reduction Targets

Most local government jurisdictions are not able to quantify 1990 GHG emission levels due to limited availability and reliability of energy and waste data for 1990. ICLEI and other experts recommend setting a reasonable baseline year for which data is readily available and considered reliable, and identifying an ambitious but achievable reduction target below the baseline year.

The AB 32 Scoping Plan did not identify exact 1990 levels or suggest a methodology for doing so at the local government level. The ARB Scoping Plan did provide guidance to local government for the purposes of action planning that GHG emissions for internal operations be reduced by at least 15% below current levels (2005) by the year 2020.[7] ARB also recommended utilizing this minimum target as a starting point for communitywide climate action planning as well.

Sacramento's Greenhouse Gas Emissions Inventory

Both the County and City of Sacramento, in partnership with the six additional incorporated cities located in the county, completed an integrated countywide greenhouse gas (GHG) emissions inventory for the baseline year of 2005.[8] The inventory was conducted in 2008 and 2009 utilizing ICLEI's Clean Air Climate Protection (CACP 2003) modeling software, which is based on standard General Reporting Protocols for GHG emissions developed by ARB and ICLEI.

The countywide inventory included a comprehensive GHG baseline for the entire County, as well as a specific inventory for each individual jurisdiction within the county. For each jurisdiction, a specific breakdown of GHG emissions by sector was provided for communitywide emissions, along with internal operations emissions for each jurisdiction as a subset of each communitywide emissions profile.

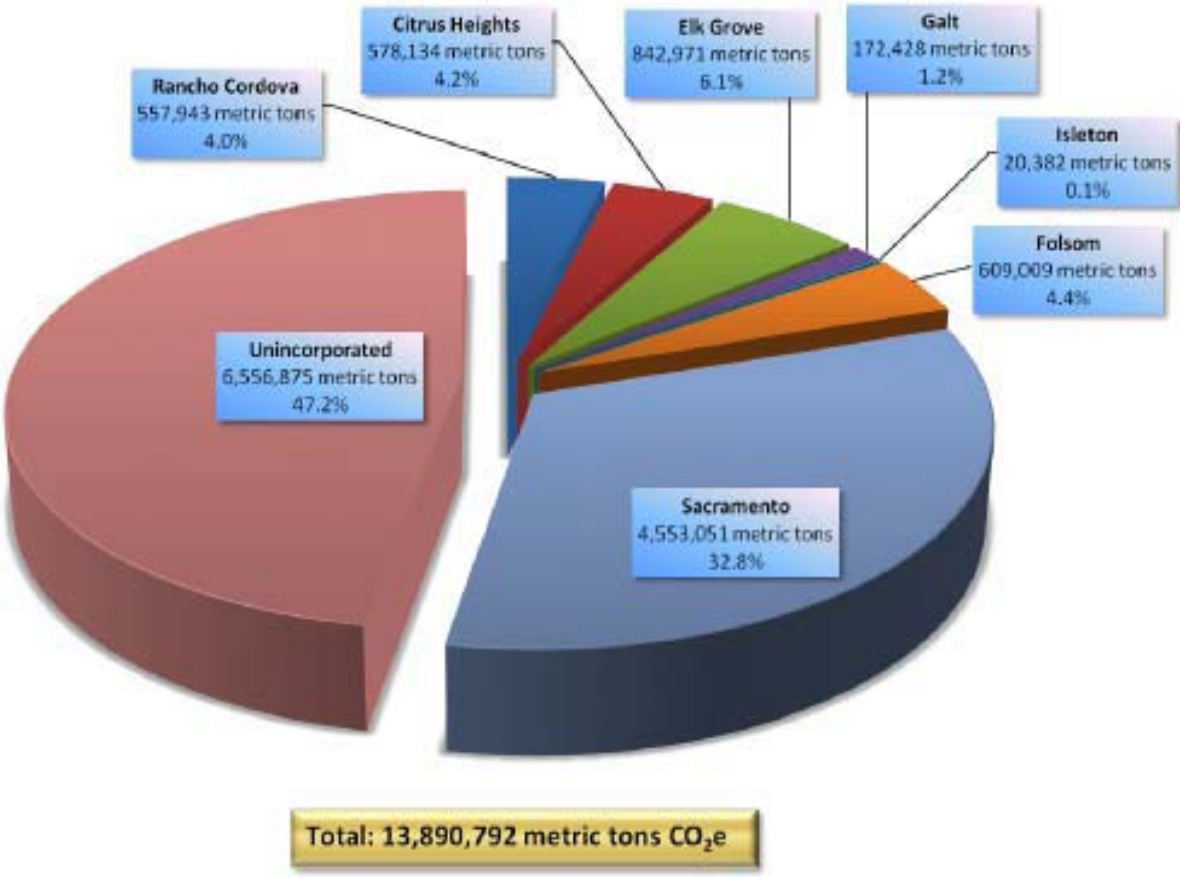
Carbon dioxide (CO_2) is the most prevalent GHG and largest contributor to climate change, however AB 32 lists five other primary GHG's that are of concern and should be addressed in order to meet the AB 32 target: methane (CH_4), nitrous oxide (N_2O), sulfur hexafluoride (SF_6), hydrofluorocarbons (HFCs), and perfluorocarbons (PFCs). Carbon dioxide equivalent (CO_2e) is a unit of measurement used to normalize all greenhouse gases so that they can measured equally in terms of global warming potential. Typically, under the General Reporting Protocol, GHG emissions are measured by weight in terms of *metric tons of carbon dioxide equivalent (*$MTCO_2e$*)*. This report uses $MTCO_2e$ as the

[7] California Air Resources Board, "Climate Change Scoping Plan: A Framework for Change," December 2008, p. 27 (http://www.arb.ca.gov/cc/scopingplan/document/scopingplandocument.htm)
[8] ICF Jones &and Stokes, "Greenhouse Gas Emissions Inventory for Sacramento County," June 2009 (http://www.climatechange.saccounty.net/ReportsPublications/default.htm).

standard unit of measurement for both the GHG inventory and quantification of GHG reduction measures to be included in the plan.[9]

Figure 3 below depicts the results of the 2005 countywide inventory, broken down by jurisdiction. Countywide, GHG emissions for all jurisdictions totaled 13,890,792 MTCO2e. GHG emissions in the unincorporated County of Sacramento area were 47.2% of total, while the City of Sacramento's GHG emission were approximately 32.8% of total. Collectively, the County and City's GHG emissions represent about 80% of the countywide inventory, while the remaining six incorporated cities represent approximately 20%.

Figure 3: Total 2005 GHG Emissions for Sacramento County, by Jurisdiction (Communitywide)



[9] A metric ton (tonne) is equal to 1,000 kilograms (kg) or 2,204.62 pounds (lb).

Figure 4 below also summarizes the total countywide emissions inventory by emissions source. The largest share of the countywide GHG emissions is vehicular fuel combustion in transportation, with on-road sources (48.3%) and off-road vehicles (4.2%) combining for a total of 52.5%. The second largest category of sources is from electricity and natural gas used in buildings, with residential (17.5%) and commercial and industrial (16.0%) combining for a total of 43.5%.

Figure 4: Total 2005 GHG Emissions for Sacramento County, by Source (All Jurisdictions, Communitywide)

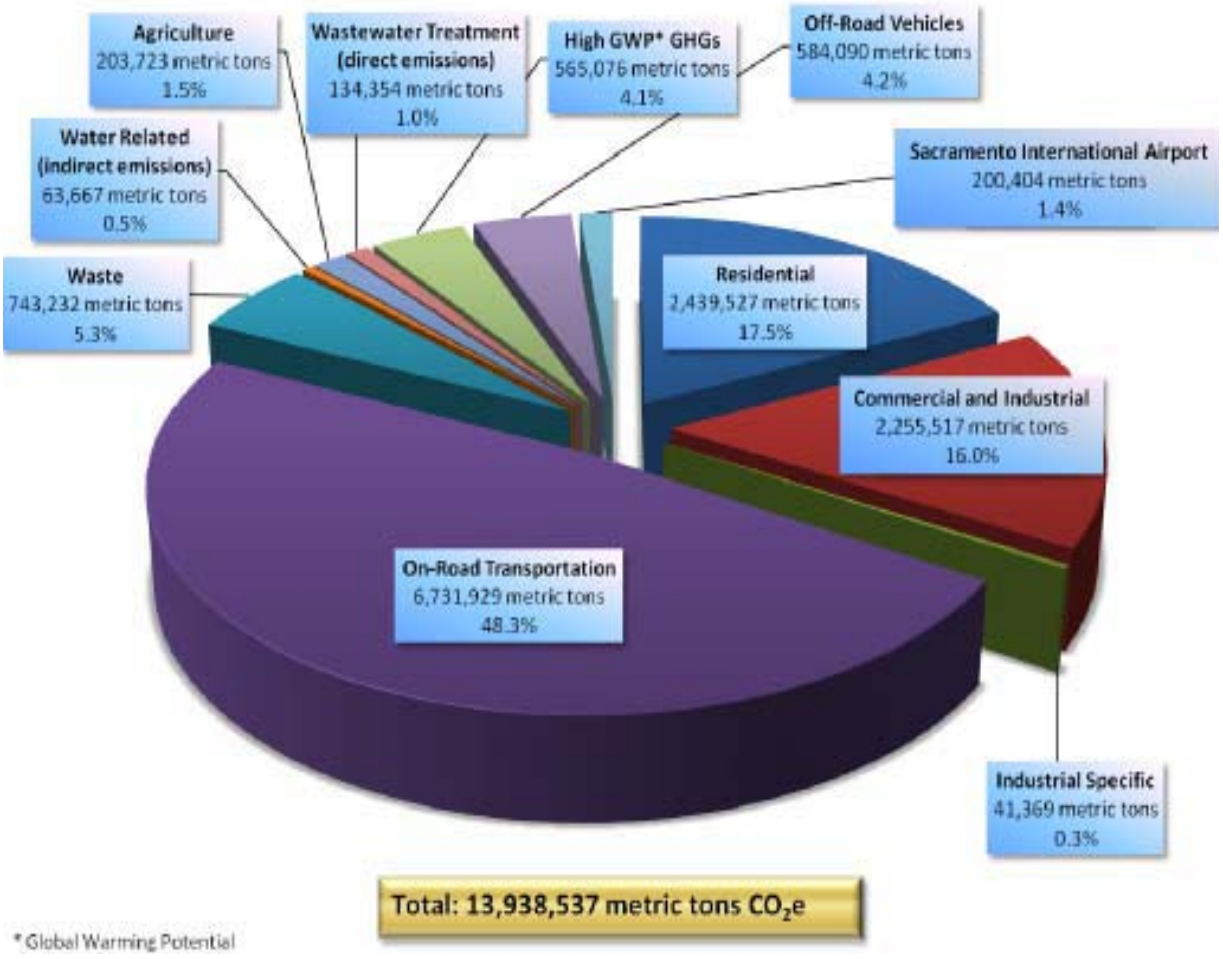


Figure 5 and Table 2 below show the City of Sacramento's 2005 inventory at the **communitywide** level by emissions sector. The City's total communitywide emissions in 2005 were 4,553,051 $MTCO_2e$. The largest sector was vehicular fuel combustion in transportation, with on-road sources (42.7%) and off-road vehicles (4.2%) combining for a total of 46.9%. The second largest sector was electricity and natural gas used in buildings, with residential (16.5%) and commercial and industrial (21.5%) combining for a total of 38%. Waste accounted for 8.8%, while high global-warming-potential (GWP) emissions (primarily refrigerants) came in at 4%. Water-related emissions (electricity from pumping and treatment) and wastewater treatment each represent 1% or less of the communitywide total.

Figure 5: Total 2005 GHG Emissions for the City of Sacramento (Communitywide)

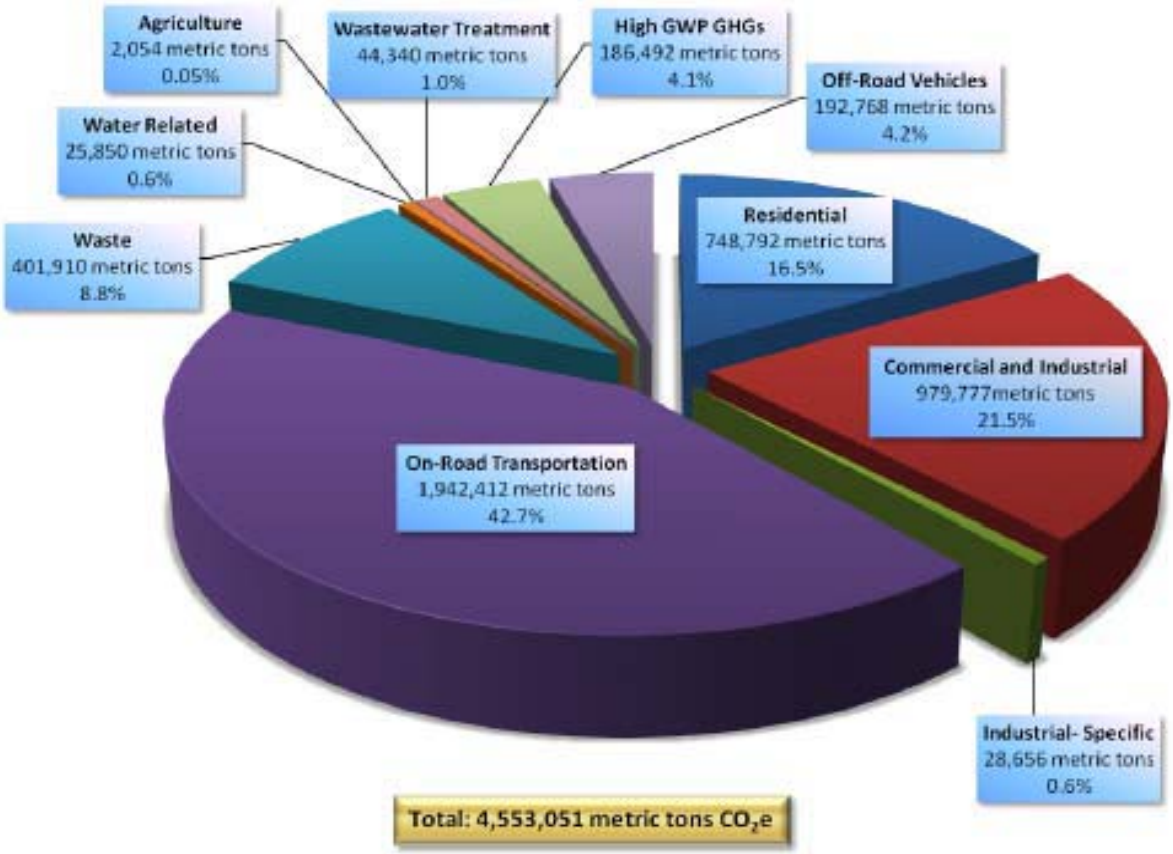


Table 2: 2005 City of Sacramento Communitywide GHG Inventory - by sector

Sector	Description	MTCO2e	% of Total
On-Road Vehicles	Fuel combustion by cars, light trucks, heavy trucks, buses, etc.	1,942,412	43%
Off-Road Vehicle Use	Fuel combustion use by construction equipment, boats, all-terrain and recreational vehicles, lawnmowers and landscaping equipment, etc.	192,768	4%
Commercial and Industrial Buildings	Electricity, natural gas consumption by commercial and industrial buildings[a]	979,777	22%
Residential Buildings	Electricity, natural gas	748,792	16%
Waste	Methane generated from waste disposed in landfills during 2005, as well as from waste-in-place in existing landfills[b]	401,910	9%
Wastewater Treatment	Methane and nitrous oxide from treatment of City-generated sewage at Sacramento Regional Wastewater Treatment Plant	44,340	1%
Water Related	Electricity for pumping related to intake, treatment and pumping of water; and stormwater/drainage pumping	25,850	1%
High Global Warming Potential GHGs	Chlorofluorocarbons (CFCs) and hydrofluorocarbons (HFCs) used as substitutes for ozone-depleting substances; primarily coolants, refrigerants, etc.	186,492	4%
Industrial Specific	Consumption of electricity and natural gas by industrial buildings.[a]	28,656	1%
Agriculture	Enteric fermentation and manure management for cattle and swine, use of fertilizers, and emissions from dairy operations were considered	2,054	0%
2005 TOTAL		**4,553,051**	**100%**

[a] Companies that fall within the industrial sector may, by law, choose not to disclose energy use. In that case, energy consumed by the industrial sector is included in the combined Commercial/Industrial sector to maintain confidentiality. The Industrial-Specific sector includes those emissions where industrial energy use was disclosed and documented.

[b] Transportation-related emissions from waste collection and hauling is included in on-road transportation for all trips within the City limits. Emissions from hauling of municipal waste outside the County to landfills in Nevada were not included in this inventory. See discussion under GHG reduction strategies for Waste for further discussion.

Finally, Figure 6 and Table 3 below show the City of Sacramento's inventory for **internal operations** in 2005, by type of emissions source. The internal operations inventory is essentially a subset of the City's communitywide inventory, but the sector categories differ from the communitywide inventory since this aspect of the inventory was conducted consistent with Local Government Reporting Protocols.

City Buildings represent the largest sector of operational emissions, at 45.5%. It is important to note here that the "Buildings" emissions category includes emissions from energy use in many types of facilities along with typical buildings. The largest user of electricity in City operations, for example, is pumping activities in the City's water, sewer and drainage facilities. Vehicle fleet operations represent the second largest sector at 27.9%. Waste-in-Place emissions (primarily methane) from the former City landfill at Sutter's Landing amounts to approximately 17.8% of total. Streetlights and traffic signals represent the fourth largest sector at 8.7%.

Figure 6: 2005 GHG Emissions for City of Sacramento Internal Operations, by sector

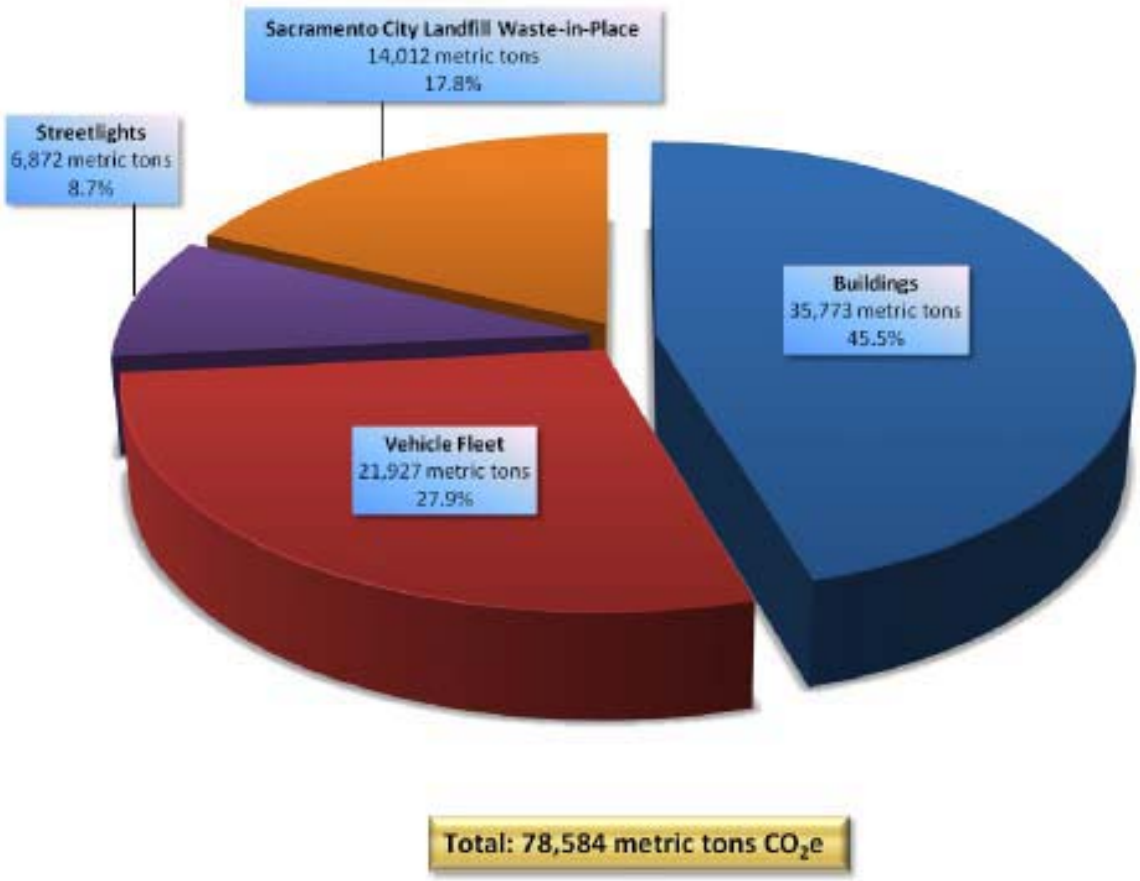


Table 3: 2005 City of Sacramento Internal Operations GHG Inventory - by sector

Sector	Description	MTCO2e	Percent
Buildings and Facilities	Electricity and Natural Gas used by City buildings and facilities	35,773	45.5%
Vehicle Fleet	Gasoline, diesel, LNG, and other fuels used in City vehicles and other motorized equipment	21,927	27.9%
Landfill Waste-in-Place	Methane generated from waste disposed in prior years in the 28th Street City landfill at Sutter's Landing (closed in 1997).	14,012	17.8%
Traffic Signals and Streetlights	Electricity used by streetlights and signals in public right of way or adjacent to City facilities	6,872	8.7%
2005 Total		**78,584**	**100%**

As noted earlier, the internal operations emissions data noted above are a subset of the communitywide inventory, so no "double-counting" is occurring between communitywide and internal operations. However, because emissions sector categories differ slightly between the City's municipal operations vs. communitywide inventory data sets, the following clarifications are needed:

- The Buildings and Facilities sector includes all City-owned buildings and facilities. The City owns over 450 individual buildings at various locations throughout the City, each of which requires electricity and natural gas for heating, cooling, lighting, computers, and other equipment. Included in this category are all facilities that use electricity to pump water, sewer and drainage. The communitywide inventory on previous pages noted that GHG emissions generated in the "Water-Related" category were approximately 25,850 $MTCO_2e$. Some of these "Water-Related" communitywide emissions are also included in the City's Buildings and Facilities internal operations sectors so there is an overlap of emissions. However since some of the "Water-Related" emissions are due to pumping by other water purveyors through wheeling agreements with the City, there is not an exact 100% overlap between communitywide vs. internal operations with respect to water-related emissions.

- The vehicle fleet sector includes emissions from all motorized vehicles. This includes heavy trucks to collect and transport solid waste, recycling, and green waste from residential and commercial homes to transfer facilities and ultimately to landfills or other processing facilities. Thus, waste collection by the City's Solid Waste division in the Department of Utilities is reflected in the Vehicle Fleet sector, and not in Landfill/Waste-in-Place sector.

- Motor vehicle GHG emissions from privately-owned trucks hauling the City's municipal solid waste to landfills outside the region (e.g. Lockwood, NV) are NOT included in the City's vehicle fleet category. These GHG emissions are considered

"Scope 3 emissions" according to Local Government Reporting Protocol and are not included in the inventory. They will be addressed, however, under the "Additional Measures" section of the action plan discussion below.

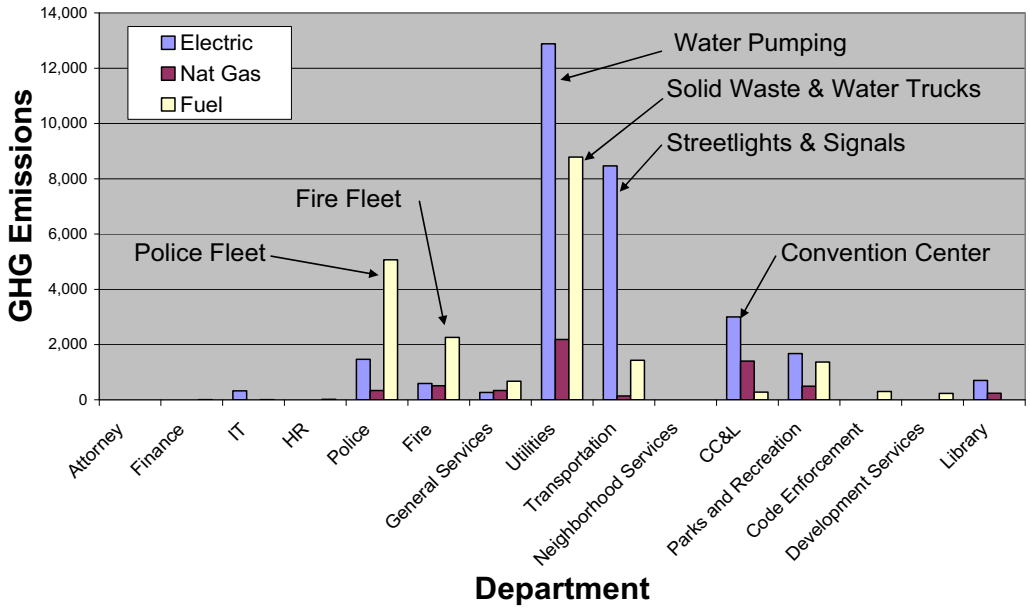
- The Landfill/Waste-in-Place sector for internal operations includes only GHG emissions generated "in place" from waste at the former 28th Street landfill located at Sutter's Landing in the city limits. No data was available for solid waste generated by the City's operations, therefore solid waste from the City's internal operations is assumed to be included in the communitywide emissions inventory dataset. Any GHG emissions associated with waste collected in the broader community will be accounted for under the communitywide emissions inventory and will be addressed in a future phase of the climate action planning process.

Overview of the City's Energy Usage, by Department and Commodity

The 2005 GHG Inventory for the City's internal operations was based on standard emissions reporting protocol, and includes both energy usage, as well as waste-in-place emissions. Since the majority of the City's GHG emissions come from electricity, natural gas, and vehicle fuels, it is helpful to understand specifically how energy usage and GHG emissions are generated across City Departments and by type of energy used.

Figure 7 below depicts energy use for all City Departments, by type of energy used in the year 2007. The labels within the chart indicate the major operational activities that generate demand for a specific energy commodity (e.g., the Convention Center utilizes the majority of electricity in all facilities operated by the Convention Culture and Leisure Dept).

Figure 7: GHG Emissions from Energy Usage – By City Department and Fuel Commodity



While the 2007 data presented in this figure may vary slightly from the 2005 baseline inventory data, it illustrates some key points:

- The Department with the most GHG emissions is Utilities (44%), with water pumping making its electricity use the highest in the City's operations, as well as the largest amount of fuel used by heavy trucks in the DOU's Solid Waste and Water divisions.
- The Department of Transportation (DOT) uses a significant amount of electricity for streetlights and signals, much more than any of the other departments but still far less than that used for water pumping. DOT represented about 18% of the total GHG emissions in 2005.
- The City's public safety departments (Police and Fire) use significant amounts of fuel for their share of the fleet category.
- The Sacramento Convention Center (managed by the Convention Culture and Leisure Dept) is the largest single user of electricity among the 450+ buildings in the City's operations.

GHG Reduction Targets

In 2007, the City of Sacramento adopted the Sustainability Master Plan (SMP)[10], which contains goals and targets for 9 key sustainability focus areas, including Climate Protection. The Climate Protection section identifies the following policy-level GHG reduction goals for City operations:

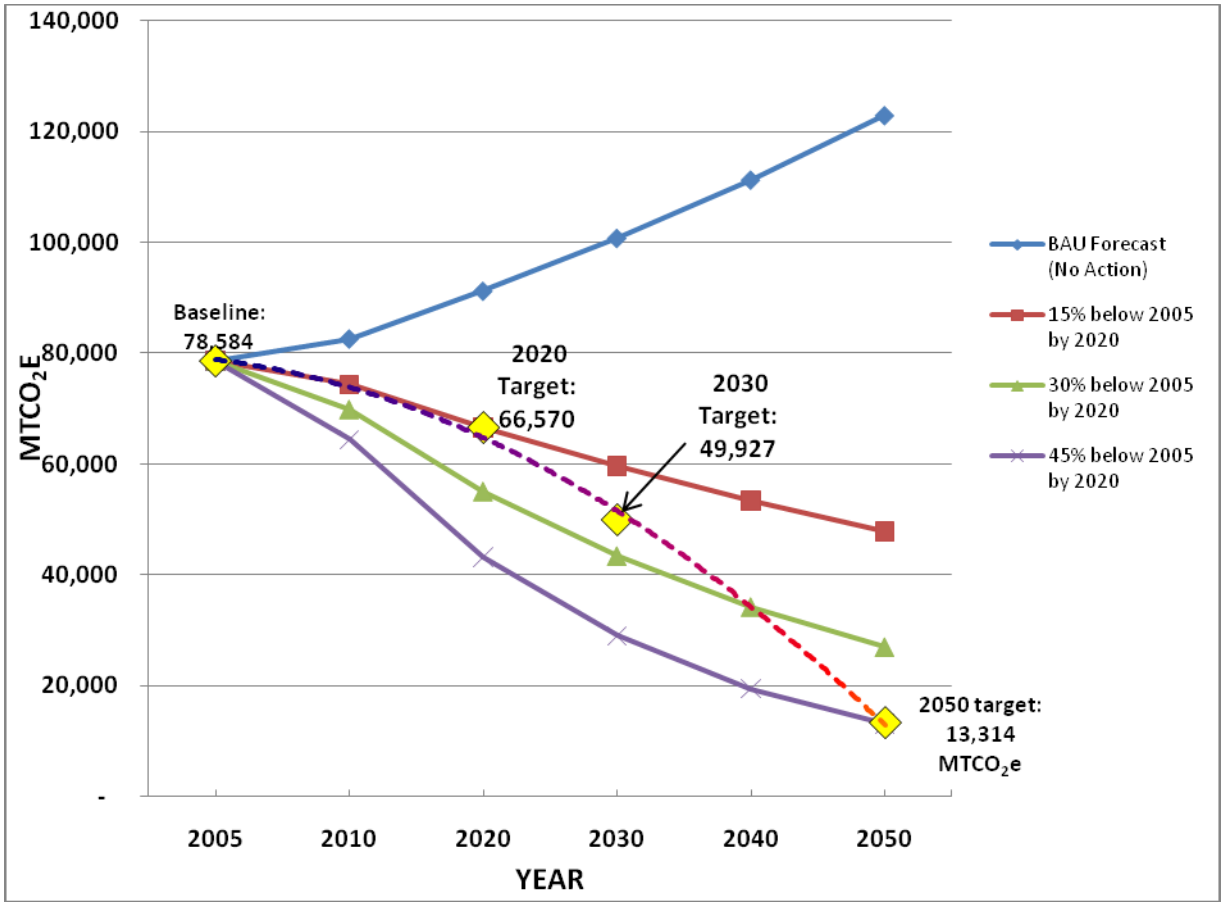
- 1990 levels by 2020 (AB 32 target),
- 25% below 1990 levels by 2030 (UN Environmental Accords),
- 80% below 1990 levels by 2050 (Governor's Executive Order S-3-05)

The SMP set a specific 2020 reduction target of 54,000 $MTCO_2e$, which was based on a preliminary staff estimate of the City's operational GHG levels in 1990. However, the 1990 estimate was not based on a formal inventory using Local Government Operations Protocol and was included in the SMP prior to the completion of the 2005 inventory described earlier.

For the purposes of this internal operations analysis, it was assumed that the preliminary SMP target for internal operations would need to be updated per guidance issued by ARB in the AB 32 Scoping Plan, which set a minimum target of **15% below 2005 levels by 2020** for local government operations. Using this minimum target would mean that the City would need to reduce its annual GHG emissions from 78,584 MTCO2e in 2005, to 66,795 MTCO2e in 2020, **a reduction of approximately 11,788 MTCO2e** (see Figure 8 below).

[10] http://www.cityofsacramento.org/generalservices/sustainability/

Figure 8: Forecast and GHG Reduction Scenarios, City Internal Operations, 2005-2050



GHG Emissions Forecast

The City's internal operations have been growing steadily in recent years, commensurate with increases in population and the gradual expansion of the service area within the City limits. The City's population experienced steady growth at an average annual rate of 2% between 2000 and 2009, increasing from 407,018 to 481,097 for a net increase of 18% during the nine-year period. Similarly, between FY2002-2003 and FY2008-2009, City staff full-time equivalent (FTE) positions increased from 4,659 to 5,300, an average increase of 2% per year and a net increase of 14% during the six-year period.

The current economic recession, however, slowed the rate of growth and has led to cuts in City staff and services due to severely reduced revenues. City full-time equivalent (FTE) positions dropped from 5,300 FTE in FY2008-2009 to 4,548 FTE in FY2009-2010. This was a decrease of 14 percent, resulting in a staffing level below FY2002-2003 levels. Similar reductions in City services and staffing levels could continue in the near term. Therefore, it is not expected that the City's internal operations will grow at similar rates in the near future.

While economic recovery and growth are expected to resume sometime in 2011 or later, it remains uncertain as to when the City's operations will match or exceed 2005 levels to service existing service obligations. However, several key areas of growth in the City have been approved for a number of significant infill and greenfield development areas. The exact timing and demand for new services, in light of the current fiscal constraints on the City, are unknown. Approved plans for the Downtown Railyards, the Delta Shores area in South Sacramento, the Greenbriar and Panhandle areas in North Natomas, and other newly-developing areas within or adjacent to the City's edge will likely trigger the need to increase services by 2020.

For the purposes of the Climate Action Plan, it is assumed that any resumed growth in City operations would be close to an average of 1% annually between 2005 and 2020, taking into account a period of significant expansion in City operations that occurred between 2005 and 2008, a current period of reductions in staffing and services in 2009-2011, and conservative to modest growth between 2012 and 2020. The "business-as-usual" forecast indicated in Figure 8 therefore, assumes no action and growth in GHG emissions from City operations in accordance with these growth rates.

Figure 8 also depicts three potential GHG emission reduction scenarios based on variations in reductions from 2005 levels by 2020. The scenarios are intended to compare the relative trends associated with meeting the SMP targets noted above for 2020 through 2050. As shown, simply complying with the minimum 15% reduction target and maintaining that trend over time (approximately 1.1% annual reductions through 2050) would not put the City on track to reduce its internal operations GHG emissions to 80% below 1990 levels by 2050. Similarly, even a 30% reduction below 2005 levels by 2020 would not put the City on course to meet the 2050 goal. Increasing levels of emission reductions will need to be phased in over time, as the dashed trend line indicates, and/or the City may also choose to cut emissions more aggressively in the future.

To provide a sense of scale of what a 15% reduction from 2005 levels by 2020 could look like, the following comparisons are helpful:

- **Reducing GHG emissions by 1 $MTCO_2e$** is roughly equivalent to doing any one of the following:
    - Saving 112 gallons of gasoline
    - Saving 3,600 kilowatt hours of electricity
    - Saving 190 therms of natural gas
    - Planting 46 trees

- **Reducing 11,788 $MTCO_2e$** of GHG emission by 2020 would therefore be roughly equivalent to doing any one of the following:
    - Saving 1,320,256 gallons of gasoline
    - Saving 42,436,800 kilowatt hours of electricity
    - Saving 2,239,720 therms of natural gas
    - Planting 542,248 trees

Since it would be impossible to rely solely on any one of the broadly-stated actions noted above independently of the others, staff has outlined a climate action strategy for internal operations in the following chapters that identifies feasible, cost-effective programs and projects to collectively meet the GHG reduction target and move the City towards meeting its sustainability goals, minimize fiscal impact, and in some cases even generate a return on investment in the long term.

III. Action Plan - GHG Reduction Strategies

City Actions

The action plan for reducing GHGs from internal operations is centered on 30 key action strategies focused on the City's Buildings and Facilities, Vehicle Fleet, Streetlights and Signals, Waste and Waste-in-Place, along with multi-sector/cross-cutting initiatives and additional measures that achieve multiple sustainability goals. Additional actions by SMUD are also included in the action plan and will be discussed later in this chapter.

The following summarizes GHG reductions achieved in each of the 5 strategic areas:

- **Buildings and Facilities:** Significant reductions can be achieved by implementing energy efficiency and conservation measures in the City's existing buildings and facilities. **4,001 MTCO$_2$e** in reductions are identified, resulting in an **11%** reduction from this sector's 2005 levels.

- **Streetlights and Signals:** Continuing a long-standing commitment to improve energy efficiency in the City's traffic signal systems, and expanding this commitment to City streetlights, these strategies result in about **1,504 MTCO$_2$e** in GHG reductions, a reduction of **22%** below 2005 levels for this sector.

- **Vehicle Fleet and Fuels:** Building upon the City's Sustainable Fleet policies already in effect, continued improvements in fleet vehicle efficiency, alternative fuels and infrastructure, and operational and behavioral changes to reduce fuel usage and vehicle miles traveled are identified for this sector, reducing GHG emissions by **4,570 MTCO$_2$e**, a reduction of over **20%** from the sector's 2005 levels.

- **Waste/Waste-in-Place:** Key programs and projects were identified to help reduce emissions from both existing waste-in-place and the City's ongoing future operational waste stream. While no specific reduction estimates are currently available, additional strategies will be addressed and quantified in Phase 2.

- **Multi-Sector or Additional Strategies*:*** The City's commitment to sustainability includes some cross-cutting initiatives that span GHG emission sectors, or in some cases reduce GHG emissions that are outside the scope of the City's emissions inventory. Of those that were quantified and applicable to the City's inventory (Scope 1 and Scope 2 emissions), reductions are estimated to be approximately 149 MTCO$_2$e.[11] Scope 3 emission reductions of nearly 2,000 MTCO2e were identified but

[11] To date, all of the Multi-Sector GHG action strategies that have been quantified would reduce emissions primarily in the Buildings & Facilities sector. Thus, the 149 MTCO2e identified was added to the 3,852 MTCO2e identified for the Buildings & Facilities sector, for a total of 4,001 MTCO2e.

are not counted towards meeting the City's GHG reduction target, since Scope 3 emissions were not included in the GHG baseline inventory.

Table 4 and Figure 9 summarize and depict total GHG emission reductions by operational sector. A comprehensive list of specific GHG reduction measures (programs and projects) for each of the 5 strategic areas, along with estimated GHG and energy cost savings and projected cost estimates, are also included below in summary Table 5.

Table 4*: GHG Reductions from City Action Strategies: 2005 to 2020, by Emissions Sector

	2005 Baseline GHG		Annual Reductions by 2020	2020 Emissions	%
Sectors:	MTCO2e	% of total	MTCO2e	MTCO2e	change
Buildings & Facilities	35,773	46%	4,001	31,772	-11%
Vehicle Fleet	21,927	28%	4,570	17,357	-21%
Streetlights & Signals	6,872	9%	1,504	5,368	-22%
Waste-in-Place	14,012	18%	TBD	14,012	-
Total	78,584		10,075	68,509	-13%

**Table 3 note: Multi-Sectoral Strategies reductions of 149 MTCO2e were included with Buildings & Facilities for a total of 4,001 MTCO2e in Buildings & Facilities. The only substantial quantified GHG emissions reductions in the Multi-Sectoral/Additional strategies category were applicable to the Buildings & Facilities sector.*

Figure 9: GHG Reductions from City Action Strategies: 2005 to 2020, by Emissions Sector

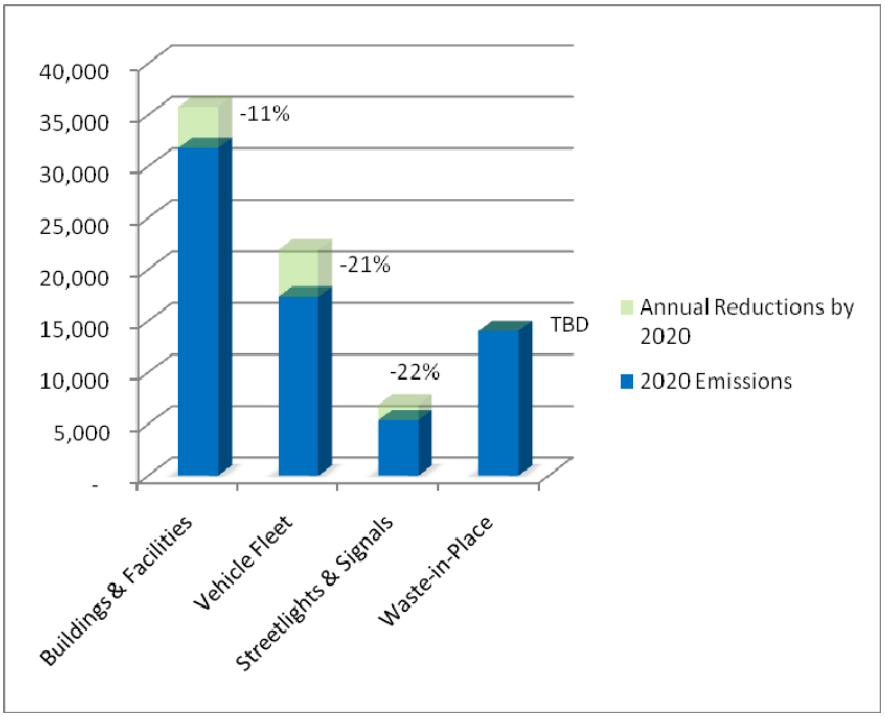


Table 5: Summary of GHG Reduction Measures for City Internal Operations, 2005-2020

GHG SECTOR	Action Strategy ID	General Description of Project or Program	Year Completed	Annual GHG Reduced (MTCO2e)	Annual Energy Cost Savings	Project / Program Cost (incl incentives)	Funded?
Buildings & Facilities	1	Thermostat Set-Point Optimization Policy (API #57)	2010-2020	450	$143,390	No cost	n/a
Buildings & Facilities	2	Energy Savers Campaign - "Lights & Equip Off" Policy (API #57)	2010-2020	unknown	unknown	unknown/low	n/a
Buildings & Facilities	3	North Area Corp Yard - Lighting Reduction Project	2009	28	$16,320	$12,500	yes
Buildings & Facilities	4	Downtown Plaza Parking Garage - LED Pilot Project	2009	5	$2,977	$24,244	yes
Buildings & Facilities	5	Convention Center Complex - Lighting Retrofit Projects	2007-2010	50	$29,478	$492,548	yes
Buildings & Facilities	6	Energy Efficiency Retrofits on existing City facilities	2010-2020	1,263	$535,163	$4,695,781	partial
Buildings & Facilities	7	Solar PV and Thermal Hot Water on City Facilities	2009-2020	1,049	varies	varies	n/a
Buildings & Facilities	8	Green Building Policy for New City Buildings	2010	77	$46,817	n/a	varies
Buildings & Facilities	9	Greenergy and other purchased offsets	2009	262	n/a	$4,380	yes
Buildings & Facilities	10	"Green IT" Programs & Projects	2009	611	$345,345	$50,000	partial
Buildings & Facilities	11	Pumping efficiency & system optimization (water, sewage, drainage)	TBD	56	$29,400	$1,135,000	partial
SUBTOTAL:	***Buildings & Facilities***			***3,852***			
Streetlights & Signals	12	Streetlight LED pilot project and citywide replacement program	TBD	1,127	$648,000	$21,000,000	partial
Streetlights & Signals	13	Traffic Signals LED Replacement Program	2015	377	$500,000	$3,000,000	yes
SUBTOTAL:	***Streetlights & Signals***			***1,504***			
Vehicle Fleet	14	Fleet Telemetrics (Zonar) Implementation on all City vehicles	2014	2,104	$800,000	$2,600,000	yes
Vehicle Fleet	17	Fleet Efficiency (3% annual improvement through 2020)	2020	576	unknown	unknown	partial
Vehicle Fleet	18	Alternative Fuels: Low Carbon Fuel Program (vehicles & infrastructure)	2010-2020	654	varies	$1,000,000	partial
Vehicle Fleet	15	Solid Waste 4/10 Schedule	2009	539	$41,598	No cost	n/a
Vehicle Fleet	16	Joint use of County North Area Recovery Station (Solid Waste VMT reductions)	2010	268	$34,587	n/a	partial
Vehicle Fleet	19	Green Waste Containers citywide (Solid waste VMT & fuel reductions)	2020	429	$129,961	n/a	yes
SUBTOTAL:	***VEHICLE FLEET & FUELS***			***4,570***			
Waste	20	Expand waste reduction and recycling programs for City facilities (API #57))	TBD	n/a	n/a	n/a	n/a
Waste	21	Fugitive methane reductions at 28th Street Landfill.	TBD	n/a	n/a	n/a	n/a
SUBTOTAL:	***Waste***						
Multi/ Other	22	Low-Maintenance Landscaping	2010-2020	64	varies	varies	no
Multi/ Other	23	Watering Reductions in City Parks	TBD	n/a	n/a	$0	n/a
Multi/ Other	24	Centralized, Weather-Sensitive Irrigation Systems	2010-2020	79	$45,348	$14,730,114	partial
Multi/ Other	25	Interim Water Conservation Plan and Water Efficient Landscaping Ordinance	TBD	unknown	unknown	TBD	n/a
Multi/ Other	26	Green Landscaping Equipment Pilot Program	TBD	n/a	n/a	n/a	n/a
Multi/ Other	27	Explore Waste-to-Energy Opportunities	TBD	unknown	unknown	unknown	n/a
Multi/ Other	28	Expanding the Urban Forest	2010-2020	6	unknown	unknown	n/a
Multi/ Other	29	In-region waste disposal (reduce private commercial hauling out-of-region)	TBD	n/a	n/a	n/a	n/a
Multi/ Other	30	Sustainable Purchasing Policy (reduced Scope 3 emissions)	2010-2020	n/a	n/a	n/a	n/a
SUBTOTAL:	***Multi-Sector/Additional Measures***			**149**			
TOTAL GHG REDUCTIONS - ALL SECTORS				**10,075**			

Actions under Implementation of Renewable Portfolio Standards

In addition to actions that the City takes, local utilities that generate and distribute electrical power also play an important role in reducing GHG emissions in the Sacramento region. The Sacramento Municipal Utility District (SMUD) provides service to Sacramento County, while Pacific Gas & Electric Company (PG&E) provides service to much of the remaining territory outside Sacramento County. The State of California has mandated that the share of renewable energy used to generate power (commonly referred to as a utility's "renewable portfolio") for all investor-owned utilities be increased to 33% of total electricity generation by 2020. As a publicly-owned utility, SMUD has committed to meet the same renewable portfolio standard as the investor-owned utilities. GHG Emission factors for electrical power are therefore expected to decrease over time for both SMUD and PG&E.

GHG emissions from purchased electricity were approximately 28,139 MTCO2e, or 36% of the City's total GHG emissions, for internal operations in 2005. When adjusted for SMUD's projected lower emission factors in the future, the City's baseline electricity usage would be approximately 21,007 MTCO2e by 2020 (assuming the level of electrical power usage would be held constant absent any actions), resulting in a net GHG reduction of 7,132 MTCO2e. Full details of this analysis are included in Appendix B.

Table 6 below summarizes the combined effect of both City and SMUD actions by 2020. **Total GHG emissions from City operations would be reduced by 17,207 MTCO2e below 2005 levels by 2020, a reduction of approximately 22%**, or 7% below than the minimum target of 15% below 2005 levels by 2020.

TABLE 6: Summary of Total Combined GHG Reductions (Phase 1 CAP Action Strategies and Renewable Portfolio Standards)

	GHG Emissions MTCO2e	% change
Total Baseline GHG Emissions in 2005	78,584	
SMUD renewable portfolio (33% by 2020)	*(7,132)*	*-9%*
City GHG Reduction Strategies:	*(10,075)*	*-13%*
TOTAL REDUCTIONS by 2020	*(17,207)*	*-22%*
2020 TOTAL NET EMISSIONS	61,377	

Analysis of Costs, Savings, and Return on Investment

The relative costs and benefits of reducing greenhouse gas emissions vary considerably, depending on the type of activity, the incremental investment required, current or projected costs of energy, and ongoing operations and maintenance costs. The action strategies in Phase 1 of the CAP are primarily those that can be implemented at a reasonable cost, either now or in the future, and which help to achieve the City's key policy objectives to create a more sustainable and livable city.

When energy cost savings and the incremental costs of a project or program were both available, simple payback was used to conservatively estimate return on investment. For many of the projects and programs, however, a more appropriate analysis would be a comprehensive life-cycle cost/benefit study that is beyond the scope of the CAP. In some cases, project cost data is currently unavailable and thus complete information is not available as to the overall costs and benefits of each strategy. Staff will continue to work through these issues as Phase 2 of the CAP process continues during 2010-2011.

Some of the action strategies require that an initial pilot program be conducted prior to full implementation (e.g. streetlight LED program), and therefore the estimated costs and expected savings are very preliminary and likely to change as more information becomes available in several years.

The action strategies can generally be included in one of the three categories as follows:

1.) Low or No-Cost Strategies:

Many of the proposed actions can be implemented at virtually little or no incremental cost to the City, as they require simple changes in behavior or minor changes in procurement or operating or procedures and will result in direct efficiency and cost savings.

Examples in this category are actions associated with the City's Sustainable Operations Policy (thermostat optimization and staff education/training for energy efficiency & conservation); the Solid Waste 4/10 schedule; and Green IT measures such as EnergyStar replacement program as part of the new Sustainable Purchasing Policy.

2.) Moderate Cost Strategies:

The moderate cost category includes programs that have some up-front, incremental costs, but offer a significant payback in a reasonable amount of time. In many cases, information about reduced operating and maintenance costs are unavailable, so the data shown in Table 3 for these action strategies is based solely on incremental implementation costs offset by energy savings.

Examples in this category include the Fleet Telemetrics System, with $2.6 million in up-front costs and a short simple payback of three to four years based solely on fuel savings; and the City Facilities Energy Efficiency Retrofits program, which will require over $4 million to implement with paybacks from a period of only a few months to several years, depending on the facility and type of improvements identified.

3.) Higher-Cost Strategies:

A few of the action strategies require a modest to significant investment but do not necessarily generate a beneficial financial return for the City based on current energy prices and implementation costs. In most cases, the City has already committed as a matter of policy to implement these programs or projects to achieve multiple sustainability objectives (e.g. help to create new "green" jobs in the clean energy/green technology sector). Longer-term increases in energy prices, and/or reduced incremental capital costs of infrastructure or certain technologies, due to broader market acceptance and pricing, could result in some of these strategies becoming revenue neutral or even generate some return on investment for the City.

Examples in this category include installation of Solar PV and Solar Thermal; exploration of additional renewable energy technologies such as biomass, gasification, or other emerging waste-to-energy technologies; and the Alternative Fuels and Fleet Efficiency Improvement programs for the City's Fleet.

Co-Benefits

Many of the action strategies identified in the CAP to reduce GHG emissions will also help achieve a number of important co-benefits" by helping to adapt in moving the City and the broader community towards sustainability. Some examples include:

- Energy efficiency and conservation strategies in City buildings and facilities will assist in adapting to longer-term effects of climate change, which could include increased and extended peak demand periods due to hotter average summer temperatures and more severe heat waves.
- Switching to cleaner fuels and achieving fuel reductions through reduced idling and vehicle miles traveled will help to improve the region's air quality and improve public health, and also improve the City's resiliency in the event of disruptions in fuel supply or significant fluctuations in fuel prices.
- Conserving water and switching to lower-maintenance landscaping will assist in adapting to one of the longer-term effects of climate change, which could include more severe and extended periods of drought due to reduced snow-pack in the Sierra Nevada and reduced precipitation levels in the Sacramento Valley.

- Planting additional trees and expanding the urban forest will serve to both enhance the City's existing reputation for being a "tree city," and also help in adapting to potentially hotter average summer temperature and extended heat waves in the future.

The external costs imposed on the public due to the longer-term impacts of climate change are still not fully understood. Projected statewide impacts to public agencies estimated to be in the billions of dollars annually, and trillions of dollars worth of real estate are estimated to be at risk under some of the climate impact scenarios.[12] The long-term costs of inaction are likely to be far greater than the relatively modest costs of taking action now to minimize these potential future risks.

[12] David Roland-Holst and Fredrich Kahrl, "**California Climate Risk and Response,"** UC Berkeley, November 2008 http://www.next10.org/next10/publications/research_ccrr.html

IV. Detailed Analysis of Strategies to Reduce Internal Operations GHGs

Community Development and General Service's staff worked with all City departments to identify past, current or proposed programs and projects that will reduce GHG in all City operations within the four main sectors identified in the 2005 inventory (Buildings, Vehicle Fleet, Streetlights and Signals, and Waste/Waste-in-Place). Additional measures that reduce GHG emissions not included in the inventory are also addressed.

Past Accomplishments that Reduced GHGs (1990-2005)

Identifying past or existing emissions reductions is not typically considered part of the five-milestone process of climate action planning, yet it is important to understand how these efforts have been successful in helping to move the City towards sustainability. Some programs or projects that occurred prior to 2005 are described in this section because they illustrate past achievements or provide context for implementing ongoing or improved efforts. However it is important to note that these are not credited towards meeting the reduction target if they were operational prior to the 2005 baseline inventory. Some programs or projects that involve gradual phasing over time (e.g., traffic signal LED replacements) are described as an ongoing project and credited for increased reductions post-2005.

Recent or Planned Actions to Reduce GHG Emissions (2005-2020)

Since 2005, the City has continued to implement programs and projects that save energy and reduce GHG emissions, building upon past successes. These are noted in each sector where appropriate and are counted towards meeting the 2020 target.

The City also continues to plan and integrate new ideas and approaches from 2010-2020 to reduce energy and GHG emissions both for its own operations and for the broader community. At the planning level, new policies and targets were approved recently as part of the 2007 Sustainability Master Plan, along with the annual Sustainability Implementation Plan which contains more specific actions related to its goals and targets and is tracked and revised annually. Similarly, the 2030 General Plan (adopted in March 2009) identified key policies and implementation programs to help mitigate GHG emissions that were anticipated as the result of full plan build-out. Some of these policies and programs are included in this Climate Action Plan, where appropriate, while others will be addressed in Phase 2.

METHODOLOGY AND KEY ASSUMPTIONS

- **CAPPA, EnergyStar, and other tools:** Several tools were used to quantify estimated GHG reductions from the CAP programs and projects. The Climate and Air Pollution Planning Assistant (CAPPA) as well as various web-based energy savings calculators available from the US EPA's EnergyStar program were used to quantify expected reductions and cost savings. CAPPA is a software tool designed by ICLEI and the US EPA to assist local governments in identifying emissions reduction projects and strategies to meet their own climate and air pollution reduction goals. CAPPA and EnergyStar calculator default settings were adjusted where appropriate to take into account assumptions regarding local GHG emission factors, the City's current and expected future operational characteristics, etc.

- **Annual Reductions by 2020:** For each program or project, estimated average annual reductions in GHG emissions in MTCO2e are identified, assuming sustained implementation through 2020. It is important to note that some programs or projects result in relatively consistent, immediate, and predictable annualized reductions (e.g. lighting retrofit), while others involve gradual phasing in over time (e.g. EnergyStar replacement policy). Still others are subject to considerable annual variations due to variables such as weather, variable energy or supply costs, behavioral response, etc. In the case where a steady increase over time is expected due to phasing, the expected 2020 annual GHG reduction is reported for the program or project, to demonstrate its ultimate effectiveness in meeting the target.

- **GHG Emission Factors**: GHG emission factors are not expected to be static over time, but fluctuate based on many external factors out of the City's control. Purchased electricity from SMUD varies from year to year based on climatological conditions in the Sierra Nevada, which affect the amount of renewable hydro-power that SMUD can rely upon. SMUD is also in the process of increasing its renewable energy portfolio, thereby decreasing the carbon intensity of its power mix over time. Actions associated with SMUD's renewable portfolio goal (33% renewables by 2020) are expected to play a significant role in reducing GHG emissions in the region. In analyzing specific GHG reductions strategies involving conservation of purchased electricity through 2020, a reduced GHG emissions factor of 460 lb/MWh was applied to produce estimated annual GHG emissions in 2020. This reduced emissions factor is significantly lower than the 616 lb/MWh emissions factor used to calculate electricity usage in the City's 2005 emissions baseline. See Appendix B for more information on expected change in SMUD emission factors over time.

  As noted in Chapter III, SMUD's actions even without the Climate Action Plan would reduce GHG emissions associated with electricity usage by over 7,000 MTCO2e. However, SMUD's actions alone would not enable the City to meet its GHG reduction target. Additional strategies for energy efficiency and conservation outlined in this Phase 1 CAP are foundational in order for the City to meet its targets.

- **Quantitative vs. Qualitative:** Many of the measures were quantified in terms of their expected effectiveness in reducing GHG emissions; however for a number of actions there was insufficient data to reasonably estimate the effectiveness of a particular program or project. In some cases, a general strategy is described but due to the complexity of the program and/or because insufficient data exists by which to measure ongoing effectiveness of the program or specific components of the program, the only feasible way to measure success will be ongoing monitoring & implementation. Staff will continue to explore this issue as Phase 2 of the Climate Action Plan continues during 2010-2011.

- **Cost/Benefit Analysis:** A strong attempt was made to obtain information regarding not only actual energy and GHG savings, but also potential energy cost savings along with incremental costs required beyond business as usual to implement the action measures. Simple payback was used for some of the action measures to conservatively estimate return on investment; however, for many of the action measures, a more appropriate analysis would be a more comprehensive life-cycle cost/benefit study, which take into account additional factors such as long term operations and maintenance savings, increases in energy prices, and other factors typically not assumed as part of simple payback. In many cases, project cost data is unavailable or difficult to obtain to conduct this level of analysis. Staff will continue to work through these issues as development of the Climate Action Plan continues during 2010-2011.

- **Double-Counting:** A concerted effort was made to avoid double-counting GHG emission reductions wherever possible. However, there may be instances where double-counting cannot be avoided. Some action strategies were calculated independent of other actions, while others were modeled against one another. Taken together, however, some action strategies in some sectors may not ultimately reduce total GHG emissions as reported. Staff will continue to work through these issues as development of Phase 2 of the Climate Action Plan continues during 2010-2011.

BUILDINGS AND FACILITIES

The City has a long standing commitment to substantially reduce energy use and associated GHG emissions from buildings and facilities. Between 1992 and 2002, the City partnered with SMUD to implement a major series of energy efficiency and conservation projects for City buildings and facilities (including early phases of the traffic signal LED replacement program discussed later in this chapter). These efforts resulted in over 11 million kilowatt hours of annual electricity savings. [13] In addition, annual cost savings of over $700,000 per year have since more than paid for capital costs for the improvements. GHG emission reductions attributed to these electricity savings are approximately 4,300 $MTCO_2e$, however as noted earlier, these reductions cannot be counted towards meeting the 2020 target because they occurred prior to 2005 and are already reflected in the baseline.

The Sustainability Master Plan target of **reducing energy use in City operations 25% below 2005 levels by 2030** is ambitious, but will help the City both move towards energy independence and meet GHG reduction targets. The action measures described below for Buildings and Facilities focus on low/no-cost energy conservation methods including:

- Making existing buildings and facilities more efficient through upgrades to heating and cooling, lighting, water and drainage pumping, etc;
- Ensuring that all future new buildings and facilities are as energy efficient as possible;
- Installing solar PV on City property to generate renewable energy;
- Consolidation and "greening" of the City's information technology (IT) infrastructure; and
- Making sure publicly-owned landscaping on City streets and parks are sustainably designed and maintained.

1. Thermostat Set Point Optimization - "2 Up/2 Down" Policy (Sustainability API #57)

Overview

The City Manager approved an Administrative Policy Instruction (API) for Sustainable Operations in January 2009 (API #57), which included a variety of low or no-cost operational changes that will help achieve sustainability and climate protection goals and result in cost savings. Included in API #57 was a requirement for Optimization of Facility Temperature Settings in which the summer and winter set points would be established at 78 degrees and 68 degrees, respectively. However, if the set points are not currently maintained, the API instructs City staff to work towards these set points by

[13] City Council staff report, "Governor Gray Davis Energy Pledge / City of Sacramento Energy Policy," October 23, 2001.

increasing the set points 2 degrees in the summer, and reducing them by 2 degrees in the winter ("two up/two down"). The API also provides for a number of exceptions for special circumstances.

GHG Reduction Analysis

Heating and cooling typically accounts for 35% to 40% of a building's energy usage. By changing the temperature one degree Fahrenheit in a 100,000 square foot building, energy savings associated with this change are equal to about 5% and can reduce GHG's approximately 45,000 pounds of CO2e (roughly 20 $MTCO_2e$). A two-degree shift (two up/two down) on an annual basis could therefore result in 90,000 lbs of CO2e (40 $MTCO_2e$) for a typical 100,000 square foot facility.

Given that there are over 2.5 million square feet of total space in current City facilities, the potential for savings is significant. However, some City facilities, such as the Convention Center or the Crocker Art Museum, are exempt from the Temperature Optimization policy due to the need to maintain specific set points to protect the assets held by the facility or maximize comfort and functionality during events held at the facility. Adjusting for these types of facilities, and assuming that not all City facilities will be in full compliance or will not be able to achieve these levels of energy savings, approximately **450 $MTCO_2e$ of GHG emissions can be reduced** by implementing API #57 Set Points or the "Two Up/Two Down" targets across roughly 1.1 million square feet of building space.

Feasibility and Implementation

Compliance with API #57 Temperature Optimization Settings is a no-cost action that can be implemented immediately for almost all City facilities, therefore it is considered highly feasible. Many City Departments are already in compliance with this administrative policy and the City is likely to achieve some reductions in the forthcoming year.

The Department of General Services has primary responsibility for deployment of establishing the summer and winter set points at certain buildings and facilities. However, resident City departments within various facilities also must play a role in complying with the "Two Up/Two Down" rule where the set points cannot be immediately achieved. Both actions are already being implemented, and can be deployed immediately at facilities not currently in compliance with this policy. No funding is required to implement this strategy.

Direct energy cost savings associated with these reductions is expected to be approximately $143,390 annually by 2020, assuming the level of compliance noted in the analysis above (1.1 million square feet). This assumes static energy costs; if SMUD and PG&E rates increase over time, annual cost savings would be even greater.

2. Energy Savers Campaign - "Lights and Equipment Off" Policy (API #57)

Overview

API #57 also included a policy directing City staff to turn off all lights and computers when not in use. Lighting and computer use typically accounts for 40% to 50% of a building's energy consumption. Many lights and computers in City buildings are left on overnight. By simply turning off lights, computers, fax machines, printers, copiers, or other office equipment at the close of business, significant energy and GHG savings could be achieved at no cost. *(Note: The US EPA's EnergyStar programs, which address energy efficiency and GHG reduction through equipment purchasing standards for all new computers, monitors, printers and copiers, are described later in this chapter.)*

To effectively implement this policy, an organization-wide campaign should be implemented to encourage staff in all Departments to be conscious of energy waste and empower them to take action and shut off lights and other plugged-in office or power equipment that is not currently in use, where appropriate.

A similar campaign was used for all City staff during the 2001 energy crisis. Flyers, labels on light switches, and other promotional/educational materials were developed encouraging staff to ask the question "Watts Up" and to "Kill a Watt." The City's intranet (Citynet), email reminders, and other e-communication techniques could also be employed to remind and encourage staff to take action.

Another idea is to have occupants of each City facility engage in an "Energy Savers" or "Energy Stars" competition to reduce year-over-year energy use in their respective buildings or facilities, with a regular rewards/incentives program, similar to what the Sacramento Transportation Management Association uses to incentivize better commuting options. This competition could also be used to benchmark progress in implementing thermostat set-point optimization requirements of API #57 (see GHG action measure #1, described above).

GHG Reduction Analysis

While there is specific information available about energy use in the City's buildings and facilities, it is difficult to estimate the potential success of behavioral changes over time related to a variety of different types of lighting and equipment. Some facilities are already equipped with timers and/or occupancy sensors to optimize lighting performance, while others are manually controlled. Similarly, different Departments have differing needs with respect to hours of operations. Nevertheless, the fact that just under half of a typical building's energy use comes from lighting and office equipment underscores the potential for significant energy savings.

If this program is implemented, actual changes in energy usage for specific buildings should be monitored over time (monthly, annual) to gauge the effectiveness of any educational campaign and to weight them against other environmental or operational changes (e.g. weather, changes in building occupancy or hours of operation, etc).

(Note: a more specific analysis of power management techniques for computers, monitors, printers and copiers are addressed later in this chapter under Green IT programs.)

Feasibility and Implementation

This action measure is a low-cost educational and awareness-building program that would require some staff time and resources to implement. Participation rates amongst City staff are not expected to be significant during the initial phase of the program; however, over time and with persistent outreach, possibly combined with a friendly "Energy Stars" competition to raise awareness and incentivize action, significant savings could be achieved with very little additional operational costs.

The Department of General Services will be the lead staff for this program, working in cooperation with the Sustainability Steering Committee (a working committee consisting of City staff assigned to implement the SMP) and leadership through the Office of the City Manager and City Department Heads. Additional staff resources could be required to design and implement the outreach program, and a small amount of funding would be needed to provide award incentives to the selected winners of the competitive portion of the program.

3. North Area Corporation Yard - Lighting Reduction Project

GHG Reduction Analysis

The City's North Area Corporation Yard (NACY) is located at a former trucking facility in North Natomas which was determined to be "over-lit" for the City's current use. Approximately 25% of the lights at the facility were disconnected in 2009, which will result in an estimated 136,000 kWh saved per year, or **approximately 28 $MTCO_2e$ in annual GHG reductions**.

Feasibility and Implementation

This measure was completed by the Department of General Services in 2009, and is an example of a low-cost approach to "right-sizing" a facility to conserve energy that also results in GHG emission reductions. Annual energy cost savings associated with this

project are estimated to be around $16,320 through 2020. Costs to implement the project were approximately $12,500, resulting in a simple payback of less than 1 year.

4. Downtown Plaza Parking Garage - LED Pilot Project (completed in 2009)

Overview

In 2009, the City partnered with SMUD to implement a Light-Emitting Diode (LED) pilot project at the Downtown Central Parking Garage's lower level. The project involved replacement of twenty-five High-Intensity Discharge (HID) fixtures with twenty-five bi-level LED fixtures. Each fixture has an occupancy sensor. When the area around the fixture is unoccupied, the fixture operates in the low mode. When the occupancy sensor is triggered, the fixture goes into the high mode. *(Note: See the Streetlight and Traffic Signal LED Replacement Programs later in this chapter for additional measures to save energy through the use of LED technology.)*

GHG Reduction Analysis

The LED fixture identified for the pilot project uses about 40 watts in the low mode and 119 watts in the high mode. Compared to 213 watts for the HID, and assuming 80% in low mode and 20% in high mode, the LED pilot project is estimated to save about 24,810 kWh per year, a GHG reduction of approximately **5 $MTCO_2e$** annually.

Feasibility and Implementation

The LED pilot project was completed in 2009 by the Department of General Services, working in partnership with City DOT, SMUD, and the California Lighting Technology Center. Annual energy cost savings associated with the project, compared to prior HID lighting energy usage, are estimated to be $2,977. Project implementation costs were estimated to be approximately $24,244, resulting in a payback period of approximately 8 years.

While the GHG reductions for the project are small relative to the overall target, and the initial costs of the LED pilot project would have been high without project subsidies, the pilot project demonstrates that there can be significant cost savings achieved. If similar technology was deployed for a much larger set of parking garages or other facilities, there is potential for significant savings assuming per unit costs decrease as project size increases. *(See the Streetlight and Traffic Signal LED Replacement*

Programs later in this chapter for additional measures to save energy through the use of LED lighting.)

5. Convention Center Complex - Lighting Retrofit Projects

Overview

The Sacramento Convention Center complex is a full-service convention and special events facility operated by the City's Convention, Culture and Leisure Department. The complex hosts over 600 events annually. The Convention Center opened in 1974 and underwent a major expansion in 1996 that tripled its size to approximately 134,000 square feet of exhibit space. Major components of the complex also include 31 meeting rooms, including a 24,000 square foot ballroom; the 2,452-seat Community Center Theater; and the historic 3,849-seat Memorial Auditorium.

Recently, the City's Convention Culture and Leisure Dept has been undergoing a process of "greening" these facilities' operations and has undertaken a number of projects that result in energy savings. *(Note: additional measures to be completed in the future for the Convention Center complex is included below under the Energy Efficiency Retrofits program).*

GHG Reduction Analysis

Several projects were completed in the complex that involved replacement of older, inefficient interior lighting between 2007 and 2009. Annual energy savings from the lighting retrofits were approximately 77,160 kWh, resulting in approximately 16 $MTCO_2e$ in annual GHG reductions**.**

CC&L recently issued an RFP for the retrofit of the marquis sign on J Street, from incandescent to energy efficient LED. Preliminary estimates indicate that the retrofit will save 164,466 kWh per year, which would result in 34 $MTCO_2e$ in annual GHG emission reductions.

Total annual GHG emission reductions for completed Convention Center lighting retrofit projects and planned retrofits to the J Street marquis sign are approximately **50 $MTCO_2e$.**

Feasibility and Implementation

The interior lighting retrofit projects were completed in 2007-2009 and do not need additional funding. It is estimated that the renovation of the J Street marquis electric sign will cost $450,000. The total cost to implement all of the projects is approximately $492,548 with annual energy savings of approximately $29,478. Annual energy savings associated with the upgrades will recoup the cost of the interior lighting projects by

2014. It is estimated that the cost of renovating the J Street marquis sign will be recouped about 22 years after installation is complete.

6. Energy Efficiency Retrofits Program for Existing Facilities

Overview

The City's Energy Efficiency Retrofits program for City facilities is designed to provide better facility systems performance with higher efficiencies, resulting in reduced energy costs and maximizing return on investment. The current and future program builds on past success and partnerships with SMUD in greening the City's facilities. By identifying cost-effective improvements to existing facilities in heating/cooling, lighting, pumping systems, and other facility components, the City can both reduce energy usage & GHG in a cost-effective manner.

In 2008, the City conducted a preliminary assessment of a broad range of energy efficiency projects for City facilities. Facility lists and associated utility consumption were reviewed, and a sample of these facilities was selected as being likely representatives of the majority of those found throughout the City. These buildings included two community centers, two libraries including the Central Library, the Convention Center, the Sacramento River Water Treatment Plant, and representative samples of parking garages, street lighting and a fire station. Based on the 2008 assessment, staff developed a list of short-term and mid-term priorities for implementing the energy efficiency retrofits program. In addition to the 2008 assessment, the Department of Parks & Recreation is in the process of retrofitting all pumps at the City's public pools with variable frequency drives (VFD's).

Additional assessments in future phases of the program could reveal additional facilities or projects in which to expand energy efficiency and further improve energy & GHG reductions and cost savings.

GHG Reduction Analysis

Based on information provided in the 2008 preliminary assessment and additional information provided by the Parks & Recreation Department, specific energy efficiency retrofit projects within four facilities were identified as feasible and cost effective and are the mostly likely to move forward in the near term within the next 2 years based on funding available, while the others are anticipated to occur over the longer-term in future phases of the program due to partial funding or funding yet to be identified. Table 7 below summarizes energy savings, costs and simple payback for all projects identified through 2020. When taken together, all currently-identified projects in this program would reduce energy usage by 4,738,566 kWh of electricity and 52,029 therms

of natural gas annually by 2020 resulting in approximately **1,263 MTCO2e in GHG reductions**.

Feasibility

The energy efficiency retrofits program is based on a proven method of identifying feasible, cost effective strategies which achieve acceptable levels of operational efficiencies. As noted in Table 7 below, total costs to implement specific retrofit projects would be close to $5 million. Annual energy savings would be over $500,000 annually, resulting in a simple payback (including utility incentives) of just under 9 years. Based on the short-term energy efficiency projects alone, the City could achieve a very attractive return on investment by implementing improvements that would achieve net savings in a relatively shorter period of time. The projected energy cost savings are very conservative and do not reflect additional increases in SMUD and PG&E rates. Also, some of the projects would also likely reduce other operations & maintenance costs that are difficult to quantify, resulting in additional cost savings to the City.

Implementation and Funding

The Department of General Services, working in partnership with other City Departments, is currently initiating the next phase of the project to implement the short-term priorities noted below in Table 7. The City Council allocated $1.8 million from the City's Energy Efficiency and Conservation Block Grant (EECBG) for this first phase. Approximately, $1 million will be used to create a revolving loan program whereby the energy savings from the improvements will be used to pay back the cost of the improvements. The Department of General Services will set up the revolving loan to be able to continue to have a sustained source of funds to continue this type of work for the City. The remaining $800,000 will be used for staff administration costs, replacing old energy management controls, and software needed for monitoring and verifying energy savings.

Full capital improvement funding for all of the projects identified is estimated at nearly $5 million. Since only $1 million of the capital costs will be funded initially through the EECBG program, staff is exploring other financing options. As part of the State Energy Program, the California Energy Commission (CEC) is supplementing its existing energy-efficiency loan program with $25 million in American Recovery and Reinvestment Act (ARRA) funding to assist public entities in improving energy efficiency in their facilities. In addition, CEC will be offering one-percent interest loans to local government agencies with the ARRA funding.

Table 7: Facility Energy Efficiency Retrofit Program: Summary of Project Energy Savings and Costs

Project Title	Savings (kWh)	Savings (Therms)	Project Cost	Energy Cost Savings Estimate	Simple Payback (yrs)	Utility Incentives	Simple Payback with Incentive (yrs)
Short-Term Energy Efficiency Retrofit Projects for City Facilities (2010-2012)							
Pannell Center- DDC Controls Optimization	19,830	531	$ 9,964	$ 2,525	3.9	$ 531	3.7
Pannell Center - Boiler retrofit		2,547	$ 43,200	$ 2,598	16.6	$ 2,547	15.6
Pannell Center - Replace fan inlet vanes w/VFDs AHU 1-7	71,977		$ 129,730	$ 7,198	18.0	$ 5,758	17.2
Pannell Community Center - Lighting Retrofit	91,205		$ 96,304	$ 9,121	10.6	$ 7,650	9.7
Clunie Community Center - Lighting Retrofit	17,704		$ 23,733	$ 1,770	13.4	$ 1,641	12.5
Central Library - Heating Hot Water System Optimization	12,061	2,593	$ 83,703	$ 3,851	21.7	$ 3,558	20.8
Central Library - Chilled Water Pumping Optimization	48,062		$ 30,544	$ 4,806	6.4	$ 3,845	5.6
Central Library - Condenser Water System Optimization	22,421		$ 38,514	$ 2,242	17.2	$ 1,794	16.4
Central Library - Demand Control Ventilation AHU-4	28,050	1,235	$ 31,343	$ 4,065	7.7	$ 4,021	6.7
Central Library- Lighting Retrofit	222,109		$ 157,908	$ 22,211	7.1	$ 18,615	6.3
Central Library - Verdiem PC Energy Management System	44,944		$ 4,037	$ 4,944	0.8	$ 3,596	0.1
Plaza Parking Garage - Lighting Retrofit	907,470		$ 444,465	$ 90,747	4.9	$ 47,015	4.4
Subtotal (Short-Term Projects)	*1,485,833*	*6,906*	*$ 1,093,443*	*$ 156,078*	*7.0*	*100,571*	*6.4*
Mid- or Long-Term Energy Efficiency Retrofit Projects for City Facilities (2012-2020)							
Solar Pool Water Heater (Pannell Center)	-	6,404	$ 99,400	$ 6,532	15.2	$ 6,404	14.2
Central Library - Electronic DDC retrofit Zone VAV boxes	32,523	1,450	$ 494,342	$ 4,731	104.5	$ 4,052	103.6
Convention Center - Chilled Water Central Plant Upgrade	495,153	-	$ 655,330	$ 49,515	13.2	$ 44,037	12.3
Convention Center - HHW Plant Optimization	73,520	11,754	$ 965,856	$ 19,341	49.9	$ 17,636	49.0
Convention Center - Air Handler Fan to match occupancy	1,685,061	25,514	$ 1,042,933	$ 194,531	5.4	$ 171,241	4.5
Convention Center - Lighting Retrofit	422,156	-	$ 452,786	$ 42,216	10.7	$ 36,979	9.8
Pool Pump VFDs at 13 locations	544,320	-	$ 228,303	$ 62,220	3.7	49,776	2.9
Subtotal (Mid- or Long-Term Projects)	*3,252,733*	*45,122*	*$ 3,938,950*	*$ 379,086*	*10.4*	*$ 330,125*	*9.5*
TOTALS (All Retrofit Projects through 2020)	***4,738,566***	***52,028***	***$ 5,032,393***	***$ 535,164***	***9***	***$ 430,696***	***8.6***

7. Solar Photovoltaic (PV) and Solar Thermal Hot Water on City Facilities

Overview

The City is committed to the development of renewable energy resources in our community and within our own municipal operations. The Sustainability Master Plan includes specific goals and targets to establish Energy Independence by decreasing reliance on fossil fuels, improving the availability of locally and regionally produced renewable energy, avoiding energy price volatility, and encouraging and recruiting green technology firms to locate in our city. Specific sustainability targets related to renewable energy goals are as follows:

- Work to maximize local and regional renewable energy production with the goal that fifty percent of the energy (electricity, natural gas, motor fuels) consumed within the SACOG region be produced within the SACOG region.
- By 2020, city operations will be substantially fossil free (electricity, motor fuels).
- By 2030, peak electrical demand of City facilities as measured by annual load factor (energy consumed divided by peak summer electrical demand) will be 75%.
- By 2015, the SACOG region will have added 20,000 new jobs to the renewable/ clean energy sector.

An additional target applicable to renewable energy in the Sacramento region was established by CA SB1, which requires SMUD to install 125 MW of solar in the region by 2017. Finally, in 2008, the City became the recipient of a Solar America Cities grant to further the development of solar energy in Sacramento and overcome barriers to expanding its deployment in the region.

A number of proposed solar photovoltaic (solar PV) projects, as well as solar hot water projects, have been initiated by the City and are summarized here as part of the City's GHG reduction strategy for its buildings and facilities (see also Table 6 below):

- In October 2009, the Department of General Services issued a Request for Qualifications (RFQ) for a Solar Power Purchase Agreement (SPPA) to nearly triple the amount of solar power generated within the City by adding solar PV on City-owned facilities at 11 sites. Current estimates for total sizes of these 11 systems would be approximately 3,740 kWh (3.74 MW).

- In October 2009, the Department of Utilities also issued an RFQ to explore the feasibility of placing a solar PV array on the closed 28th Street Landfill at Sutter's Landing Regional Park. The landfill has been closed since 1994, is currently capped, and is undergoing methane removal per regulatory requirements through 2027 *(note: see action strategies described later in this chapter to address the landfill's emissions)*. The proposed project would allow a third-party to install a solar PV

"farm" on the site for a ten-year period, subject to feasibility study, approval by the City and appropriate regulatory agencies. As of late 2009, no estimated system sizes or types were available.

- The Department of Utilities is currently designing a 100 kW rooftop mounted PV system for its 35th Avenue Engineering building. The project is expected to be completed in summer 2010.

- The new Valley Hi Library, opened in 2009, includes a solar hot water heating unit as part of the project's LEED Gold design.

GHG Reduction Analysis

The solar PV and thermal hot water projects, along with their energy generation potential and associated GHG emission offsets, are included in Table 8. Based on these estimates, GHG reductions of approximately **1,049 MTCO2e** could be achieved annually if all of the projects are fully implemented, based on renewable energy generated and/or avoided energy usage (in the case of thermal hot water).

TABLE 8: Solar PV and Thermal Hot Water Projects

Project	Year Completed	Estimated annual kWh generated*	Estimated annual natural gas savings (therms)	Estimated annual GHG reduced (MTCO2e)
3,740 kW total PV systems at 11 sites (PPA)	2011	4,900,000	n/a	1,022
100 kW PV at 35th Ave Engineering Bldg	2010	98,269	n/a	21
PV array at 28th Street Landfill/Sutter's Landing	TBD	TBD	n/a	TBD
Thermal Hot Water at Valley Hi Library	2009	n/a	1,102	6
TOTALS		**4,998,269**	**1,102**	**1,049**

* Annual solar PV energy generation estimates are preliminary in all cases and will be further adjusted once design and implementation of the projects have been completed.

Feasibility and Implementation

The pursuit of a Power Purchase Agreement (PPA) makes sense because the current cost of solar PV systems makes it difficult for City Departments to justify the purchase of solar PV systems when compared to the avoided cost of electricity purchased under the otherwise applicable utility tariffs. Also, the federal tax credits and accelerated

depreciation schedules, established by the federal government through legislation, such as the Federal Energy Policy Act of 2005, are not available to City Departments. These incentives help reduce the net cost of installing and operating solar PV systems. The rationale for pursuing third party owned solar PV systems is to allow private sector companies to take advantage of these incentives, and then pass on the savings to the City host facility through lower solar power costs on a cents per kWh basis. Because the PPA project is still in the pre-design stages, it will be difficult to say exactly what the full costs and benefits will be. The Department of General Services will begin implementation of the PPA projects sometime in 2010-2011.

The 100 kW PV system at the 35th Avenue Engineering building is estimated to cost approximately $800,000. The project is funded as a Capital Improvement Project (CIP). SMUD will provide a rebate of approximately $320,000, reducing the total project cost to approximately $480,000. The energy generation potential of the system will be approximately 98,269 kWh per year, resulting in $11,792 in renewable energy credited to the City annually (assuming $0.12/kWh given SMUD's current phased rate increase approved in September 2009). While the simple payback exceeds 40 years for this project, it demonstrates the City's commitment to reduce GHG emissions and increase the deployment of solar in our region to meet SMUD's renewable energy goals. The Department of Utilities expects the 35th Avenue solar installation to be completed by summer 2010.

No detailed information is currently available on the proposed solar PV array at Sutter's Landing Park. As DOU moves forward with an RFP process in 2010 and additional information becomes available, this section will be updated prior to final adoption of the CAP.

8. Green Building Policy for New City Buildings

Overview

"Green buildings" are designed, constructed and operated according to a whole-systems approach to achieve efficient use of energy, water and raw materials, avoid or reduce waste, and other techniques that improve overall sustainability of the built environment. The concept of Green Building represents a growing paradigm shift in the design and construction industry in the movement towards sustainability. Through the efforts of the U.S. Green Building Council,[14] Build It Green,[15] and other organizations, efforts are underway to standardize green building techniques through the adoption of certification standards such as the Leadership in Energy and Environmental Design

[14] More information about USGBC and LEED can be found at http://www.usgbc.org/
[15] More information about Build It Green can be found at http://www.builditgreen.org/

(LEED) rating system for new and existing commercial and institutional buildings, and Build It Green's GreenPoint Rating system for new and existing residential homes.

In 2004, the City Council adopted a "Green Building" construction policy related to City facilities:

> *The City will design and operate facilities to achieve the highest level Leadership in Energy and Environmental Design (LEED) rating and energy efficiency possible for that type of building. In analyzing the LEED and energy efficiency levels, life cycle costing will be utilized to determine the best selection of features and components. For appropriate buildings, 5,000 square feet and larger, a minimum level of LEED Silver shall be the goal.*[16]

The 2007 Sustainability Master Plan also included a target requiring LEED Silver certification or an equivalent certification for all new City owned buildings. In addition, the City Council also adopted LEED and GreenPoint Rated as the City's preferred voluntary green building standards as part of its emerging Green Building program in the Community Development Department.

Since the City's Green Building policy was adopted, several new City-owned facilities are either under construction or were recently completed and all are on track to be at least LEED Silver Certified for new construction, including the North Natomas Library, Valley Hi Library, Robbie Waters Pocket Greenhaven Library, Oak Park Community Center Expansion, and George Sim Community Center Expansion. Other new facilities currently in the design or construction process include the new Crocker Art Museum expansion, and the new North Natomas Fire Station 43.

GHG Reduction Analysis

As noted in Table 9 below, the City has designed and constructed 5 new facilities that will consume significantly less energy than minimum Title 24 requirements. Two additional facilities (Crocker Expansion and Fire Station 43) are in the design or construction stages, but since no data is available for these projects as of the writing of this report, they are not included in the table. A comparison of the buildings' estimated reduced annual energy usage below Title 24 requirements for the type and size of facility was completed. This comparison was then used to estimate net energy savings and calculate avoided GHG emissions of approximately **77 $MTCO_2e$ of GHG annually** as a result of the higher energy efficiency standards under the green building policy for 5 new City facilities. Other than the projects referenced above, no additional is available at this time for new City facilities to be constructed by 2020.

It should be noted that these energy savings are building energy savings, and do not take into account other "green" features which might also reduce GHG, such as

[16] Resolution 2004-751

improved water efficiency, waste reduction, etc. Also, for one of the facilities (Valley Hi Library), solar hot water energy savings are calculated separately and are included above under the GHG reduction program for Solar PV and Thermal Hot Water on City Facilities.

Table 9: Summary of Energy and GHG Savings in New Facilities

New City Facilities planned, in design, under construction, or completed since 2005 that meet or exceed minimum LEED Silver

Facility Name	LEED standard achieved	Year Completed	Size (sq ft)	Energy Efficiency above min Title 24 reqs	Annual Energy Savings by Design (kWh)	Annual Energy Savings by Design (therms)	Annual GHG reduction (metric tons CO2e)	Annual Energy Cost Savings	Incremental Cost of Energy Efficiency Measures	Utility Incentives	Years to Simple Payback (with incentives)
LEED for New Construction											
North Natomas Library	Silver	2009	22,645	22%	103,370	(3,908)	1	$ 14,566	TBD	TBD	TBD
Valley Hi Library	Gold *	2009	20,505	34%	58,080	819	16	$ 4,898	$ 306,400	$ 23,278	58
George Sim Community Center Expansion	Silver	2009	15,400	23%	99,097	-	25	$ 11,367	$ 67,943	$ 12,136	5
George Sim Event Center	Silver	2009	15,781	23%	24,802	(132)	4	$ 3,063	$ 49,780	$ 9,869	13
Oak Park Community Center Expansion	Gold	2009	7,000	29%	60,158	(284)	11	$ 6,608	TBD	TBD	TBD
Robbie Waters Pocket Library	Silver	2010	15,387	25%	52,628	1,526	19	$ 6,315	TBD	$ 17,506	TBD

Feasibility and Implementation

As noted in Table 9 above, new facilities constructed to meet "green" standards can produce significant energy and GHG savings. Incremental costs to implement the energy efficiency measures can be recaptured through energy cost savings as well as rebates provided through SMUD. In some cases, the investment in the energy efficiency design features can be easily recaptured in a period of several years. In other cases, the incremental costs are significant and are not recoverable within the lifespan of the improvements, at least on the basis of simple payback.

All of the energy efficiency improvements, however, result in absolute GHG reductions that reduce the City's carbon footprint and further the commitment to sustainability. As noted earlier, most of the cost estimates associated with "green buildings" do not take into account other co-benefits such as improved air quality, public health, and other benefits that are not easily quantified yet are important to the health and safety of future users of these facilities.

The City's Department of General Services is the lead implementing Department for this action strategy. The new facilities described in this action measure were funded through the City's Capital Improvement Program, the City's Community Reinvestment Capital Improvement Program (CRCIP), and/or development impact fees. Most of the projects were completed in 2009 or are anticipated to be completed sometime in 2010.

9. SMUD Greenergy Program for City Facilities

Overview

A carbon credit or offset is a financial instrument that provides a market-based mechanism for reducing carbon emissions either by physical reduction, destruction or prevention of emissions. Carbon Credits are purchased and used to "offset" GHG emissions which organizations and individuals cannot feasibly reduce themselves to meet their own carbon emission reduction objectives or compliance. One carbon offset or carbon credit is equivalent to the reduction of one metric ton of carbon dioxide, or its equivalent in GHG emissions.

The Sacramento Zoo purchases carbon credits to offset emissions from air travel and zoo vehicles from Terrapass. Funding for the purchase is raised by the Zoo Green Team.

SMUD's Greenergy program allows both residential and commercial customers to pay a surcharge on top of their current rate in exchange for SMUD matching a customer's electricity needs with purchases from renewable resources for use on the SMUD power grid. The City of Sacramento is currently participating in the Greenergy program for a number of its facilities, thereby further reducing the GHG emissions from some of its operations, while also leveraging SMUD's commitment to

matching 40% of Commercial Greenergy Program revenue with additional investments in new sources of renewable generation.

GHG Reduction Analysis

Table 10 on the following page summarizes the four City facilities currently enrolled in the Greenergy program, as well as other carbon offsets purchased by the Zoo. Approximately 789,589 kWh will be offset annually from Greenergy, and when combined with the Zoo's additional purchased offsets, result in a total of **262 MTCO2e in GHG reductions**. Additional City facilities are under consideration for enrollment in the Greenergy program, but no estimates are available as of late 2009. Ongoing discussions between the City and SMUD are expected to occur as the City's sustainability efforts continue to move forward.

Table 10: Summary of Greenergy Purchases for City Facilities

Facility Name	Annual Greenergy blocks purchased (kWh)	Annual GHG reduced (MTCO2e)	Annual Costs	Cost/MTCO2e
Convention Center	234,000	65	$ 2,340	$ 36
Valley Hi Library	267,376	75	$ 960	$ 13
North Natomas Library	288,213	81	$ 1,080	$ 13
Sacramento Zoo (SMUD offsets)	**TBD**	**19**	**NA**	**NA**
Sacramento Zoo (Terrapass)	**NA**	**22**	**NA**	**NA**
TOTAL	**789,589**	**262**	**$ 4,380**	**$ 20**

Feasibility and Implementation

Greenergy program purchases for City facilities do not result in any direct cost savings to the City; however, as shown in the table above, they are a low cost method of achieving simple GHG reductions through this program. Furthermore, they help to leverage SMUD's commitment to match 40% of the Commercial Greenergy program fees and continue expansion of its renewable energy portfolio, a key component of the statewide strategy to meet the goals of AB 32.

In addition, both the Valley Hi Library and North Natomas Library are new facilities which utilized the Greenergy program to help achieve a higher score on each of the projects' LEED certification checklists. The Greenergy program blocks are not included or "double-counted" in the calculations for these facilities under the Green Building Policy for New Buildings program mentioned previously.

As noted in the table above, various City facilities are included in this program. For each facility, the managing City Department is typically responsible negotiating individual agreements for each facility. It is important to note that these Greenergy program offsets are assumed to be continuous through 2020 for the purposes of this CAP. However, the City only has contracts in place for these projects through 2012. Ongoing monitoring and updates will be required in subsequent years to verify their continuation in future updates to the City's CAP.

10. "Green IT" Information Technology Projects and Programs

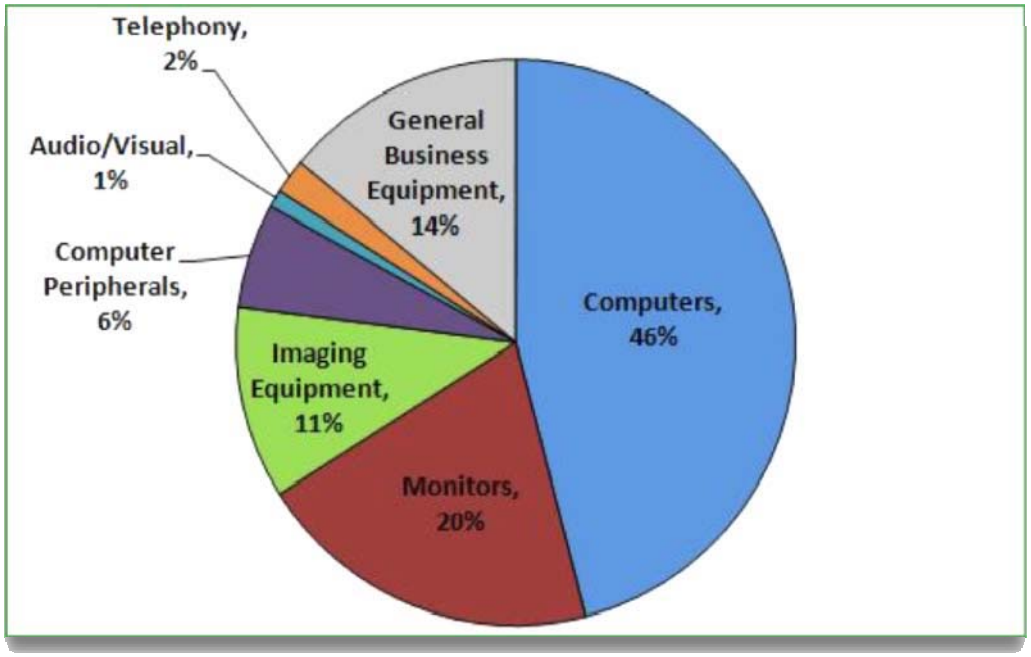
Overview

The City's information technology (IT) services, infrastructure and equipment are critical to support the City's operations in the 21st century where electronic communication, "e-governance" and web-based services are becoming the standard. The IT Department operates a centralized support service for Enterprise Systems to all City Departments, while many Departments maintain their own IT support services for business specific applications.

The City maintains an inventory of over 3,000 personal computers and monitor displays. Of these, approximately 2,800 are in active use. Each Department also utilizes a significant number of additional electronic devices to support day-to-day operation, including approximately 1,150 printers and plotters, 200 copiers, 150 fax machines. All of these machines contribute significantly to the "plug load" energy used in many City facilities. A recent study conducted for the CA Energy Commission estimated that this "plug load" contributes up to 30% of total building energy usage in California office buildings.[17] A breakdown of typical commercial office building plug load energy usage from the above-referenced study is shown in Figure 10.

[17] http://www.efficientproducts.org/product.php?productID=11

Figure 10: Typical Office Building Plug-Load Usage



Recently, the City began a series of programs and projects that will help to "green" the City's IT infrastructure and office equipment and will result in significant energy cost savings over time, along with GHG reductions. These Green IT measures are summarized below (see table 11 and GHG analysis on the following pages for specific energy and GHG savings estimates).

- ***Data Center Energy Efficiency Projects***: The IT Department recently completed a series of upgrades and operational changes to the City's data center that will achieve energy savings, including increasing the temperature by 4 degrees in the data center (from 68 to 72), raising floor venting to allow better air-flow and cooling, decommissioning a very large and inefficient mainframe server, and installing new cooling units that are more energy efficient.

- ***Server Virtualization and Consolidation Project:*** In 2008, the IT Department began a program to virtualize and consolidate servers, enabling a significant reduction in equipment and improving energy efficiency. As a result of this program, over 100 servers will be consolidated into approximately 7 virtual servers. Additionally, as a result of this program, approximately 12 sever rooms in various buildings throughout the City used to house servers will no longer be needed, resulting in additional energy, cost and GHG savings due to reduced power and cooling needs.

- ***Storage Management Project:*** The IT Department is actively exploring ways to improve data storage management options that will result in the ability to avoid

adding new storage devices, and possibly replace existing storage units with more energy efficient units.

- ***Power Management Project:*** A recent evening walk-through survey of various City facilities conducted by the IT Department revealed that close to 80% of computers and printers are left on overnight, resulting in a significant amount of energy waste. The IT Department is actively exploring options to deploy a centralized power management software program that would ensure that these power management settings would be turned on for most workstations currently on the City's network. EnergyStar Power Management features — standard in Windows and Macintosh operating systems — place monitors and computers (CPU, hard drive, etc.) into a low-power "sleep" or "hibernation" mode after a period of inactivity. Simply touching the mouse or keyboard "wakes" the computer and monitor in seconds, with no loss in data or programs.

- ***EnergyStar Computing and Office Equipment Replacement Program****:* The City is in the process of adopting a Sustainable Purchasing Policy (SPP) that will require, among other things, all new computers, office equipment, and other machines purchased by the City to meet EnergyStar standards, where feasible. A typical computer, for example, has a lifespan from 4 to 5 years in a public agency, whereas a typical printer or copier lifespan is 5 to 7 years, so it is highly likely that between 2010 and 2020, the City's entire inventory of office equipment will be replaced by more energy efficient units. By applying this policy to computer and monitors, copiers, printers, and other office equipment, significant energy, GHG and cost savings can be achieved with no incremental cost if applied within the City's normal replacement purchasing schedule over the next 10 years.

GHG Reduction Analysis

As shown in Table 11 below, the Green IT measures described above could result in significant energy and GHG reductions if fully implemented by 2020. Over 2.9 million kWh could be reduced, resulting in **611 $MTCO_2e$ in GHG reductions**.

Table 11: Summary of Energy, GHG and Cost Savings from Green IT Measures

Green IT Measure	Annual kWh Savings	Annual GHG Reduction	Annual Cost Savings	Incremental Cost
EnergyStar Computers (2,500)	364,645	76	$ 44,487	$ -
EnergyStar Monitors (2,500)	639,251	133	$ 77,989	$ -
EnergyStar Printers (1,154)	163,508	34	$ 19,948	$ -
EnergyStar Copiers (196)	177,714	37	$ 21,681	$ -
EnergyStar Fax Machines (151)	24,945	5	$ 3,043	$ -
Power Management Software	1,182,375	247	$ 144,250	$ 50,000
Server Virtualization Project	276,816	58	$ 24,913	$ -
Data Center Energy Efficiency Retrofits	100,375	21	$ 9,034	$ -
Storage Management Upgrades	*TBD*	*TBD*	*TBD*	*TBD*
TOTAL	**2,929,629**	**611**	**$ 345,345**	**$ 50,000**

[a]Assumes full project/program implementation by 2020
[b]Cost saving estimates based $0.12/kWH (assumed avg rate based on SMUD's rate increases for 2009-2011).

Feasibility and Implementation

As noted above, some of the projects are already in progress and will achieve significant cost savings with some upfront implementation costs to be recovered in the near term. The End Point Power Management Project would require some upfront investment for software and administration purposes (approximately $50,000); however the annual payback in energy savings would quickly recoup the investment in less than 1 year. Finally, a highly favorable program is the EnergyStar replacement program for various types of computing and office equipment. If implemented as part of the normal replacement schedule, EnergyStar replacement requires no incremental cost to implement.

The IT Department is the lead on most of these projects, although support and participation is required from other City Departments as well. Specifically, the City's Procurement Services team will play a leading role in verifying compliance with the EnergyStar purchasing requirements.

11. Water, Sewer and Drainage Pumping Efficiency and System Optimization

Overview

The City's Department of Utilities (DOU) took significant steps toward demand side energy management in the late 1990's and early 2000's to implement efficiency testing and upgrade to various aspects of DOU facilities. During that time, over a dozen water wells were upgraded to efficient motors, resulting in close to $20,000 annual savings in 2001 dollars.

Upgrades related to the department's *supervisory control and data acquisition* (SCADA) software allow remote monitoring and reporting of various aspects of plant operation characteristics. This has allowed the Plant Services Division to reduce vehicle trips to more than 200 sites from five days per week to once or twice per month. SCADA software and the restructuring of routes have saved roughly 21,000 gallons of fuel annually. In addition, the installation of numerous pumps with variable frequency drives (VFD's) has improved pumping efficiency at numerous pumping facilities and resulted in electricity savings

Since 2005, the City has continued to improve the energy efficiency and operational efficiency its water, sewer and wastewater systems. DOU has made incremental improvements to numerous storm drainage and sewer facilities, as well as improvements to the City's two water treatment facilities on the Sacramento and American Rivers

GHG Reduction Analysis

It is estimated that the installation of VFD driven pumps save approximately 268,000 kWh annually. This estimate is based on an extrapolation from field energy measurements recently conducted for one VFD driven pump at City Facility Sump 119 that was applied to other pumps with VFD's system-wide. It is estimated that electricity savings from all VFD driven pumps installed to date since 2005 will result in an **annual GHG reduction of 56 MTCO2e,** as shown in Table 12 below.

Table 12: Summary of Energy, GHG and Cost Savings from VFD Driven Pumps

Use Category of VFD Pump	Average Annual KWh Saved	GHG Emissions Reduction	Annual Cost of Electricity @ $0.11/kWh (2005-2008)	Annual Cost Savings (2005-2008)	Percent Energy Savings from VFD Pumps	Total Cost to Complete Improvements	Simple Payback (Years)
Storm Drainage	100,000	21	$2,128,000	$4,469	0.21%	**$520,000**	100+
Water Facilities *	161,000	34	$3,436,000	$24,052	0.70%	**$225,000**	9
Sewer Sumps	7,000	1	$147,000	$882	0.60%	**$390,000**	100+
Total	**268,000**	**56**	**$5,711,000**	**$29,403**		**$1,135,000**	

*Includes VFD's at SRWTP and SAFWTP

Feasibility and Implementation

The efficiency improvements described above are feasible because they have already been implemented and will continue to provide annual energy savings and GHG reductions through 2020. The feasibility of additional future improvements that reduce the energy requirements of the City's water, sewer, and drainage systems are not known as this time.

Although the cost savings from energy efficiency alone is not sufficient justify the total project costs for the improvements described above, when all of the operational costs are considered, there is a net cost savings to the City that justifies the improvements that were made.

STREETLIGHTS AND TRAFFIC SIGNALS

The City of Sacramento Department of Transportation (DOT) operates and maintains the City's streetlights and traffic signals in the public right-of-way. In 2005, there were approximately 39,000 streetlights and 562 signalized intersections, which used approximately 20,031,485 kWh and 3,673,698 kWh, respectively, resulting in 6,872 MTCO2e of GHG emissions.

12. Streetlight LED Pilot Project and Replacement Program

Overview

The City of Sacramento currently has in excess of 40,000 street lights in its inventory. There are three main types of lights that make up a large majority of what is utilized throughout the city:

- Ornamental ("acorn") - architectural post with a distinct globe that looks similar to an acorn.
- Mast-arm ("cobra head") – typical standard found throughout the city
- Post Top - found predominantly in the residential areas

Currently, City DOT is developing a pilot program to test feasibility and performance of light-emitting diode (LED) technology on streetlights within certain areas of the City. The goal of the pilot project is to demonstrate that LED lighting is more cost-effective and energy efficient, and the City is also hoping to work with SMUD to monitor performance of the pilot project and ultimately motivate the LED industry to develop LED products compatible with existing historic/ornamental streetlights. If the pilot project is successful, it will put the City on track to replace as many as 30,000 streetlights with LED lamps over the next several years. The pilot project would include ornamental and mast-arm types with energy-efficient light-emitting diode (LED) lamps, which reduce energy use by 50 watts per light during a typical 10-hour period. Total annual energy savings per light could be 180 kWh per year. Post-Top lighting is currently not considered feasible for LED conversion.

GHG Reduction Analysis

If all of the 30,000 streetlights considered feasible were converted to LED, based on the anticipated LED pilot project results of 180 kWh reduced per light per year, up to 5.4 million kWh could be saved annually, resulting in **1,127 $MTCO_2e$** in annual GHG reductions upon full implementation.

Feasibility and Implementation

The City of Los Angeles recently implemented a major LED streetlight retrofit program that is expected to convert over 140,000 cobra-head type fixtures over 5 years, reducing their energy usage by 40%, and saving the City of LA $10 million annually after an initial 7 year payback period.

The City of Sacramento's pilot project will be implemented to determine ultimate feasibility and performance of certain LED product types. Ongoing performance monitoring by the City and SMUD during the pilot project will ultimately determine which LED products and standards should be targeted for citywide program deployment.

Total cost savings estimated from replacing 30,000 streetlights with LED due to both increased energy efficiency and reduced operations and maintenance costs could be up to $625,000 annually. Full LED conversion project costs are currently estimated at approximately $22 million based on current per-unit LED costs and projected design and installation costs; however since the pilot program has not yet been completed, this is a very preliminary estimate. LED product costs have been declining steadily as deployment of this technology becomes more widespread. A more complete analysis of capital costs & debt service, energy savings, operations and maintenance savings, and other considerations for ultimate citywide program deployment will be determined at a later date.

City DOT staff estimates that the pilot project will enter the design phase in early 2010, with installation and monitoring beginning sometime in summer 2010. The pilot program will be operational a period of two years for performance monitoring.

The initial cost of the pilot project will be funded by a $100,000 program allocation through the City's Energy Efficiency & Conservation Block Grant (EECBG). SMUD will also be partnering with the City on the pilot project to provide in-kind technical assistance of approximately $20,000 on energy performance monitoring.

13. Traffic Signal LED Replacement Program

Overview

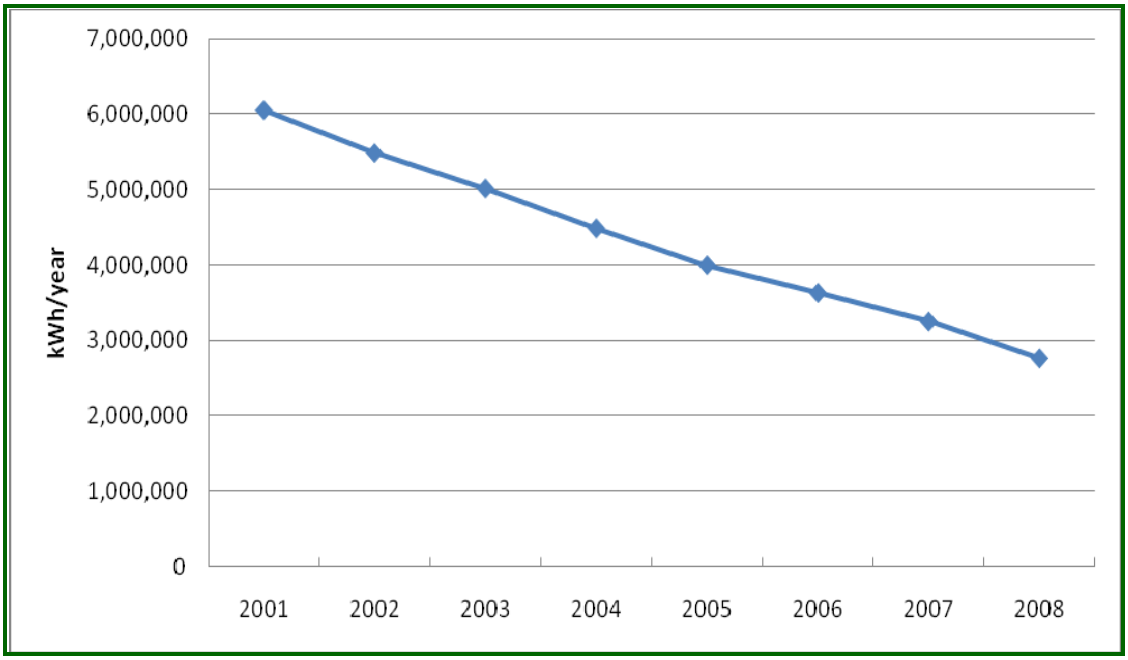
Since 1996, the City has been replacing incandescent traffic signal fixtures with Light-Emitting Diode (LED) fixtures. Each LED fixture is approximately 50% more efficient than incandescent and has an average lifespan of approximately 7 years compared to 2 years for incandescent, which reduces signal maintenance & replacement costs.

As of late 2009, approximately 85% of traffic signals were already converted to LED. Annual traffic signal energy usage between 2001 and 2008 decreased by 3,285,086 kWh, a cumulative reduction of approximately 54% (see Figure 11 below), despite the fact that the number of traffic signals increased by 20%.

GHG Reduction Analysis

As shown in Figure 11 below, annual traffic signal energy usage decreased by over 3 million kWh between 2001 and 2008 due to implementation of the LED replacement program. Between 2005 and 2008, annual traffic signal energy usage decreased by 1,232,933 kWh, generating a net GHG emissions reduction of 257 $MTCO_2e$**.** Staff projects that the conversion of the remaining 15% of incandescent signals to LEDs will result in an additional 574,542 kWh between 2009 and 2015, resulting in a total savings of 1,807,475 kWh annually between 2005 and 2015. These total annual energy savings will result in a permanent reduction of **377 $MTCO_2e$ annually through 2020**.

Figure 11- Traffic Signals – Annual Energy Usage, 2001-2008



Feasibility and Implementation

LED replacements in traffic signals have proven to be highly cost-effective and achieved significant energy savings. DOT will continue to implement the traffic signal LED replacement program for the remaining 15% of incandescent traffic signals by 2015. Completion of the LED replacement program is estimated to cost around $500,000. Major funding sources for the LED replacement program include gas tax, major streets fund, and SMUD's LED rebate program.

Total costs to implement the LED replacement program are estimated at approximately $3 million between initiation of the program in 2001 and estimated completion in 2015.

Incremental costs to deliver the program have largely been offset by energy savings and reduced maintenance costs. Total annual energy savings upon full implementation by 2015 are expected to be over $450,000 compared to 2001 levels.

VEHICLE FLEET

The City's fleet includes nearly two-thousand fuel powered vehicles. Most of these vehicles are used to provide direct services to the community, such as waste and recycling pick up, police, fire, animal control services, etc. A small proportion of the fleet is used to run the City's internal business operations.

Figure 12: Composition of the Vehicle Fleet, by Fuel Type

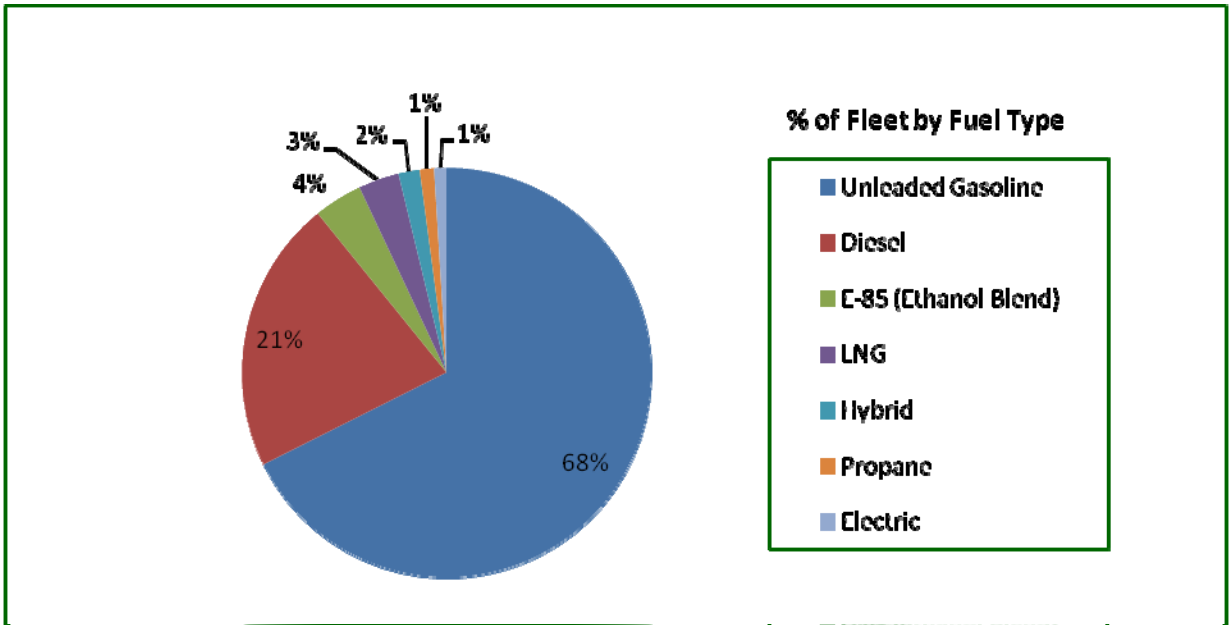


Figure 12 shows the composition of the vehicle fleet by the fuel type that the vehicles burn. Currently, sixty eight percent of the fleet consists of conventional vehicles that burn unleaded gasoline. Twenty one percent utilize diesel, and four percent are flex-fuel vehicles that can burn either unleaded gasoline or an ethanol gasoline blend (E-85). Three percent utilize liquefied natural gas (LNG), a low-carbon alternative to diesel, and one percent burn propane. The City operates thirty three gas-electric hybrids that burn unleaded gasoline, roughly two percent of the fleet. Finally, about 1% of the vehicles are battery-electric. These are small utility vehicles known as "GEMS" (Global Electric Motorcar).

The City's vehicle fleet emitted 21,927 MTCO2e in 2005 (baseline year), which was 27.9% of the total GHG emissions from government operations listed in the 2005 Inventory. The bulk of these emissions came from heavy duty diesel trucks (mostly solid waste and water trucks) and from the Police and Fire Department fleets.

Since the 2005 baseline year, there has been a net decrease overall in fuel use in the City's fleet that has resulted in a GHG emissions reduction of 330 $MTCO_2e$. This was largely due to improvements identified in the Sustainable Fleet section of the City's Sustainable Operations Policy/ API #57, which includes specific requirements for all City

Departments pertaining to low-emission vehicle acquisition, reductions in fuel consumption, and vehicle operations. Some of these fuel reductions are still ongoing and will continue to reduce GHG emissions, however to avoid double-counting they are not included in the action plan. Several action strategies discussed later in this section quantify more specific actions that have contributed in part to this overall net decrease.

Figure 13 and Table 13 below show total gallons of fuel consumed annually, by fuel type, since 2005, as reported by DGS-Fleet. The blue line shows the total gallons consumed, which has declined since 2005 even as the fleet grew in size.

The reduction in fuel use was achieved even as the total number of miles traveled annually by the City's fleet grew from 18,124,738 miles to 19,303,754 miles (a 6.11% increase) between FY2005/06 and FY2007/08.

Figure 13: Annual Fuel Consumption by City Fleet, 2005-2009

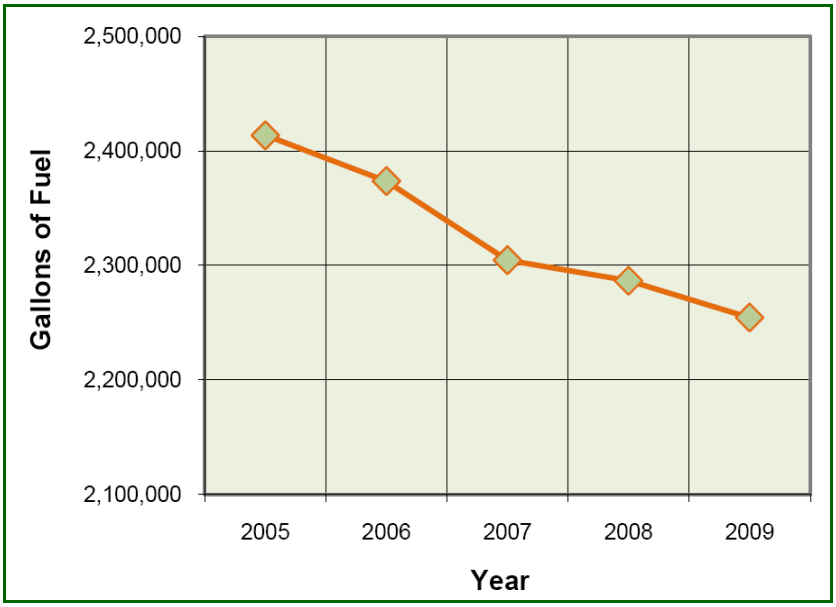


Table 13 – Fuel Consumption by Type and GHG Emissions Reduced from 2005-2009

Fuel Type	2005 Gal.	2006 Gal.	2007 Gal.	2008 Gal.	2009 Gal.	$C0_2$ Emission Factor (kg CO_2/gal)	Average Annual GHG Reduced (MT $C0_2e$)
Diesel	940,992	906,961	959,140	984,812	824,693	10.15	**295**
Unleaded Gasoline	1,204,314	1,215,277	1,135,165	1,149,039	1,186,760	8.81	**39**
LNG	240,102	233,063	202,888	147,410	181,551	4.46	**65**
E-85	0	0	0	0	47,202	6.05	**-71**
Purinox	12,461	0	0	0	0	unknown	
Propane	15,707	18,308	7,264	5,181	14,114	5.74	**2**
TOTAL	2,413,576	2,373,609	2,304,457	2,286,442	2,254,320		**330**

The net reduction in fuel consumption since 2005 has saved the City $72,894. The total cost of alternative fuel projects, however, was $3,230,000 (total fleet improvements since FY2000/01).[18] When only project and fuel costs are taken into account, the time to recoup the investment due to energy savings would be 44 years; however, there are additional benefits that are difficult to quantify which also help to reduce operations and maintenance costs. The City was able to implement new vehicle and fuel technologies because they were subsidized by approximately $3.3 million in air quality grants.[19] With grant funding, even though budget augmentations from user departments were also required, the bottom-line was a $1.7 million savings for the City during over a seven year period.[20]

OVERVIEW OF FLEET ACTION STRATEGIES

There are basically three ways to reduce GHG emissions from transportation-related sources:

1. Vehicle Technology: Improving the average fuel efficiency of the fleet (purchasing vehicles with a higher MPG, or new technology, such as gas/electric hybrids or all-electric plug-in vehicles).

[18] Council Report, Fleet Sustainability Policies, January 27, 2009.
[19] Council Report, Fleet Sustainability Policies, January 27, 2009.
[20] Council Report, Fleet Sustainability Policies, October 23, 2007.

2. Operational Efficiency: Reducing the number of miles that fleet vehicles travel annually and reducing the time that vehicles spend idling. This includes making behavioral changes and changes to vehicle routes.

3. Low Carbon Fuels: Replacing existing fuels with fuels have lower carbon intensity than standard fossil fuels (e.g. ethanol, compressed natural gas or liquid natural gas, etc). This usually requires new vehicle technology and infrastructure in addition to purchasing the alternative fuel.

These strategies are best used in concert with each other, as lack of attention to all three can result in one canceling out the other two. For example, growth in the number of miles traveled can cancel out the gains made by greater fuel efficiency and low-carbon fuels.

Table 14 below shows how six specific action measures used in the City's vehicle fleet add up to a reduction of **4,570 MT CO2e** in annual GHG emission reductions, which is **21 %** of total 2005 baseline emissions. The calculations are based on assumptions about future trends in the City's fleet management and an ongoing commitment to sustainability. Some of the key action measures are new, and there is limited data available regarding how new technology will perform, or how much funding will be available to cover the incremental costs of purchasing alternative fuels, fueling infrastructure, gas-electric hybrids, and the electric vehicles (plug-ins) of the future. Additional details are included in the text following the table under each specific action measure.

Table 14: Summary of Fleet GHG Reduction Measures (2005-2020)

GHG Reduction Measure	Annual Reduction, MT CO_2e	Total Cost of Measures**	Annual Fuel Cost Implications	Simple Payback
Fleet Telemetrics System	2,104	$2,600,000	-$800,000	3.3 years
Solid Waste Operational Efficiency Changes - 4/10 Schedule	539	NA	$41,598	NA
Solid Waste Operational Efficiency Changes – Decentralized/Joint-Use Transfer Facilities	268	TBD	$115,292	NA
Expand Green Waste Container program community-wide	429	TBD	$129,961	NA
Fuel Efficiency Improvement for Fleet, Annual 3% Improvement	576	Unknown	Unknown	
Conversion to Low Carbon Fuels	654	$1,000,000	Varies***	NA
Total Fleet GHG Emissions Reduction	**4,570**			
Fleet Baseline Emissions (2005)	21,927			
Percent Reduction	**21%**			

**Note that a significant portion of actions taken from 2005-2009, including the conversion to low carbon fuels were funded by grants.
***Fleet staff estimates that in the next three years, 75 police cars will be replaced with flex-fuel vehicles. Using today's fuel prices, this would cost the City an additional $24,000/year for E-85 fuel. However, if future fuel prices (projected by the Energy Information Administration) are used, the City could save nearly $4,000 annually instead because unleaded prices are projected to increase more that E-85 prices in the long-term.

14. Fleet Telemetrics

Overview

Through the use of Global Positioning Systems (GPS) technology and integrated software management and reporting, the application of fleet telemetrics to management of the City's fleet has the greatest potential to reduce fleet GHG emissions in the short term. When used with vehicle identification boxes (VIBS), comprehensive fleet telemetrics systems can be used to provide more efficient driving routes, reduce

trip distances, track idling time, and identify engine problems, resulting in overall improvement in vehicle performance and reductions in fuel usage.

GHG Reduction Analysis

Fleet Management anticipates an estimated 10% annual fuel savings from Telemetrics due to routing efficiencies and idling reduction. With the information that is currently available, it is estimated that a comprehensive fleet telemetrics system would achieve an annual **reduction of 2,104 MTCO2e**, based on a 10% reduction in 2009 annual fuel usage. Total 2009 annual fuel usage is included in Table 13. Propane fuel was excluded from the 10% reduction estimate as the Fleet Teletrics system would not apply to vehicles using this fuel type.

Feasibility and Implementation

During FY2007/2008, a pilot fleet telemetrics implementation project on eleven vehicles in the Animal Care Services division resulted in a 20% reduction in fuel consumption. Fleet staff has estimated that if implemented citywide, Fleet Telemetrics will result in a 10% reduction in fuel use fleet-wide. Actual reductions could be higher and will be monitored in future years in accordance with deployment of the telemetrics program over time.

Implementation costs to deploy the program across the fleet were estimated to be around $2.6 million. With approximately $800,000 in annual cost savings from reductions in fuel and improved vehicle monitoring and performance, the project costs could be easily recovered in 3-4years.

The City entered into a contract with Zonar Systems Inc. for the purchase of fleet telemetrics equipment and related services, to outfit approximately 200-275 vehicles per year over the next five years, beginning in FY2009/10 and concluding in FY2013/14. Funding for this project will be provided through the City's Fleet operating budget.

15. <u>Fleet Fuel Efficiency Improvements</u>

Overview

As part of the City's Sustainable Fleet Policy (API# 57), the City continues to improve fleet vehicle efficiency as part of the City's ongoing replacement program. Vehicle purchases are based upon established vehicle standards that emphasize the greatest fuel economy and lowest emissions each vehicle's respective class. The vehicle classification is assigned based on the actual type of use and need of a particular position. This analysis assumes that an annual rate of conversion typical of the City's replacement program would result in annual increases in fuel efficiency of 3%, from 2010 through 2020.

GHG Reduction Analysis

This analysis assumes the fuel efficiency of the fleet will improve by 3% annually between 2010 and 2020. The calculation has been adjusted to avoid double-counting with the 10% Fleet Telemetrics fuel savings. An annual efficiency improvement of 3% would result in a reduction of **576 MTCO_2e** per year.

Feasibility and Implementation

New technology can dramatically reduce fuel consumption – at a cost. For example, according to a 2005 report to City Council, the replacement of ten standard fleet models with hybrid units could reduce fuel consumption by over 2,300 gallons per year, but the added cost is about $96,000.

Until technological advances are proven and become cost effective, it is not known what advances will be practical. Fleet management will determine which technology mix (hybrid, battery-electric, or other) is most cost effective and best meets vehicle standards as technology develops.

According to SMUD, battery electric vehicles (BEVs) have a carbon footprint that is 60% lower than conventional gasoline-powered vehicles. The cost effectiveness of BEVs will be determined by future energy prices and the availability of future grant funding. As fuel prices rise in the future, and as new technology becomes more affordable, BEV's, hybrids, and perhaps fuel cells may prove to be the most cost effective and efficient solutions. If this turns out to be the case, the purchase of BEVs may begin slowly within the next few years and accelerate between 2015 and 2020. Other technology may also become viable, such a hydraulic hybrids (heavy duty vehicles that convert brake energy to forward momentum).

Starting in 2011, Fleet staff will conduct a pilot program using 12 electric vehicles and charging stations (to be provided at no cost by SMUD, initially). If the pilot program is successful, Fleet management anticipates an average purchase of 10 electric vehicles per year, starting between 2013 and 2015 and continuing through 2020.

16. <u>Low Carbon Fuel, Vehicles and Infrastructure</u>

Overview

Since 2005, the City has replaced a significant portion of its fleet with vehicles that can utilize low carbon fuels such as liquefied natural gas (LNG), propane, and E-85 (85 percent ethanol, 15% unleaded gasoline). The City has also installed alternative fueling infrastructure (fuel pumps, etc.) at key City facilities. Air quality grants have helped to fund much of the incremental costs of this conversion so far, but these fuels also have a

reduced carbon footprint when compared to conventional fuels such as diesel and unleaded gasoline.

GHG Reduction Analysis

Most of the City's heavy duty refuse trucks have already been converted from diesel to LNG. Over the next three and a half years, the remaining 40 heavy duty diesel refuse trucks left in Solid Waste refuse truck fleet will be replaced. This will reduce the quantity of diesel, and increase the quantity of LNG, a lower carbon fuel. The GHG reduction associated with converting to LNG is 559 MT CO_2e annually**,** and is expected to be phased in over the next three and a half years.

In addition, fleet management estimates that in the next three years, approximately 75 flex-fuel vehicles per year will be purchased to replace existing vehicles at no additional incremental cost. By 2020, at least 50% of the remaining police cars will be replaced with flex fuel vehicles. The new flex-fuel vehicles will have the capability to burn both unleaded gasoline and E-85. This will reduce the quantity of unleaded gasoline, and increase the quantity of E-85, reducing GHG by 95 MT CO_2e**.** The total GHG emissions reduction associated with the City's ongoing low carbon fuel program is **654 MT CO_2e.**

Feasibility and Implementation

Flex fuel vehicles can burn both unleaded gasoline and E-85. However, in order to achieve real GHG reductions from E-85, gas tanks will actually need to be filled with E-85. In order for E-85 to be convenient, fueling infrastructure must be installed to make the fuel more readily available. Some fueling stations have already been installed, and additional stations are planned to be installed in the future, such as the Kinney Police station in the north area.

City vehicles typically need replacement as they wear out. This occurs on different schedules, depending on annual mileage of the vehicle. For example, police cars typically turn over every 7-8 years, yet most non-police passenger vehicle turn over on 12-13 year cycles because their annual mileage is relatively low. Fire trucks typically last about 15 years. It is logical to assume, therefore, that by 2020, a significant portion of the City's entire fleet will have been replaced.

In the 2015-2020 timeframe, the manufacturer of the "Crown Victoria" (typical model used for police cars) will stop producing this vehicle. It is likely that the Crown Victoria will be replaced by a flex fuel vehicle.

A conservative estimate has been used for this analysis that is consistent with replacement rates from previous years. Much of the past conversion to LNG and flex fuel has been funded by air quality grants to offset the higher cost of alternative fuels and technology. It is assumed that grant funding will continue in future years. Obviously, the degree of implementation of alternative fuels/technology in the future

depends on future price factors, technological advancements, and availability of grant funding.

17. Solid Waste - 4/10 Schedule

Overview

The City's Solid Waste Division in the Department of Utilities (DOU) is in the process of making operational changes to reduce the number of trips and length of routes. The first operational change is the "4/10" schedule. By shifting the work schedules of employees from 5 days per week and 8 hours per day to 4 days a week and 10 hours per day ("4/10"), vehicle-miles traveled can be reduced by improving the efficiency of the routes to accommodate less time. While the work day and miles traveled per day are extended, the routes themselves are more efficient because they involve less travel to and from waste transfer locations, thereby reducing overall vehicle miles traveled.

GHG Reduction Analysis

The 4/10 schedule saved approximately 65,418 gallons of fuel in 2009, for a **GHG reduction of 539 MTCO2e** as shown in Table 15 below. Because this operational change is expected to continue on a permanent basis through 2020, this analysis assumes that the GHG reduction will reoccur annually through 2020.

Table 15: Implementation of 4/10 Schedule for Refuse Collection

Fuel Type	Average Fuel Costs (2005-2009)	Annual Gallons Saved	Emissions Factor	Annual GHG Emissions Reduction MT CO_2e	Annual Fuel Cost Savings
Diesel	$2.55	43,508	10.15	441.6	$110,946
LNG	$1.09	21,910	4.46	97.7	$23,882
Total		**65,418**		**539**	**$134,828**

Feasibility and Implementation

This program has already been implemented. There were no real costs associated implementing the 4/10 schedule beyond some overtime costs during the first month, and significant ongoing overtime reduction after the first month. As shown in Table 15 above, there is an annual fuel savings of approximately $135,000 per year.

18. Solid Waste – Decentralizing Waste Transfer Facilities

Overview

Another change that second Solid Waste plans to make in order to improve the efficiency of its operations is the decentralization of waste transfer stations to reduce vehicle miles traveled (VMT) of the City's solid waste fleet. Currently, a significant amount of waste collected by the City, including garbage, recyclables and some green waste, is transported from northern area communities, such as Natomas, Robla, North Sacramento and Del Paso Heights, to the City's primary transfer station, located on Fruitridge Road in south Sacramento. This operational change would involve using a transfer facility in the north area of the City known as the Sacramento County North Area Recovery Station (NARS).

GHG Reduction Analysis

Using a facility such as the Sacramento County North Area Recovery Station instead of the facility on Fruitridge Road will save approximately 170,000 VMT annually. As shown in Table 16 below, this would result in the reduction of over 8,500 gallons of fuel saved, reducing GHG emissions by approximately **268 MTCO_2e** annually.

Table 16: Fuel and GHG Savings from Decentralization of Refuse Transfer Activities

Fuel Type	Gallons of Fuel	GHG Emissions Factors kg CO_2/gal.	Annual GHG Emissions Reduction, MT CO_2e	Annual Fuel Cost Savings
Diesel	7,422	10.15	75.3	$32,722
LNG	1,109	4.46	4.9	$1,866
		TOTAL	**80**	**$34,587**

Feasibility and Implementation

The City is currently working out the details of increasing joint use of the North Area Recovery Station (NARS) with Sacramento County. More information is expected to become available sometime in 2010. As noted in Table 16 above, fuel costs savings of $34,587 could be achieved due to increased use of the NARS facility.

19. Green Waste Container Program – Expand Communitywide

Overview

Since 2004, the Department of Utilities' Solid Waste Division has offered containerized green waste collection to select areas of the City on a voluntary basis. Containerizing

green waste reduces fuel usage due to more efficient collection operations, thereby achieving potentially significant GHG emission reductions over the long term. Loose-in-the-street collection requires the operation of two heavy-duty vehicles (a front-loader with a "claw", along with a refuse truck), whereas containerized collection requires only a refuse truck to handle both collection and transport, resulting in reduced fuel usage and lower operation & maintenance costs.

Containerized green waste collection service also includes additional co-benefits that help to create a more sustainable and livable city, including:

- Timely, more predictable weekly collection year-round
- Green waste collection on the same day as garbage and recycling
- Improved appearance of City streets and neighborhoods
- Reduction in residual green waste and debris in gutters and storm drains
- Reduction of potential vector and mosquito control issues by reducing standing water in curbs and gutters; and
- Provision of a clean and safe path of travel for bicyclists

Under the initial phase of the program, residential property owners in the City who qualified for the program switched to containerized garden refuse collection service from standard "loose-in-the-street" green waste collection. However, recently DOU began offering containers on a more widespread basis due to growing demand for the program.

As of late 2009, approximately 85,000 of the City's 115,000 customers (75%) were active participants in the voluntary program. DOU projected that by the end of FY 09/10, an additional 30,000 customers will be offered the service, bringing total voluntary customer participation close to 100% within the next year. By 2020, it is expected that all regular green waste collection will be via containerized collection as opposed to loose-in-the street, with loose-in-the-street collection service capability retained for peak leaf season and for special on-demand requests.

GHG Reduction Analysis

Table 17 below shows a comparison of fuel usage data associated with green waste collection services for the years 2005 and 2009. Since the City has been phasing out loose-in-the-street collection service over time as more and more customers have been opting for containerized green waste collection (85% as of late 2009), fuel usage to operate green waste collection services declined by 32% between 2005 and 2009, resulting in approximately **429 MTCO_2e** in GHG emission reductions to date.

Table 17: Energy Usage of "Loose-in-the-Street" vs. Containerized Green Waste Collection Services

	Diesel gallons	LNG gallons	Unleaded gallons	TOTAL gallons
LITS/"Loose-in-the-Street" (2005)	151,174	55,560	1,351	211,471
Containerized with some LITS (2009)	111,600	31,265	341	143,206
Net Change (2005-2009)	(39,574)	(24,294)	(1,010)	(68,265)
% Change	-26%	-44%	-75%	-32%
GHG reductions (MTCO2e)	-402	-18	-8.97	-429
Fuel Cost Savings	$ (100,914)	$ (26,481)	$ (2,566)	$ (129,961)

Some of the reductions in fuel usage may have been the result of changes in the location of transfer of green waste from collection vehicles, and deployment of the 4/10 schedule in mid-2009 may have also resulted in some additional operational efficiencies that contributed to the reductions. However, most of the reductions are due to gradual phasing out of loose-in-the-street in targeted geographic areas.

While more customers are likely to opt to switch to containers in the future, it is difficult to predict what actual fuel reductions might be achieved as the result of 100% participation in the program. In addition, weekly loose-in-the-street collection services are still currently offered and will continue to be offered periodically throughout each calendar year (currently 8 weeks out of every calendar year, or roughly 15% of the year) during peak-leaf season etc.

As staff monitors and assesses the effect on fuel usage in the Solid Waste division due to continued expansion of the voluntary green waste container program, estimates of GHG emission reductions will likely increase in the future.

Feasibility and Implementation

Direct fuel savings associated with changes in green waste collection are noted above in Table 17 to be approximately $129,961 annually, based on average 2005-2009 prices for each respective fuel type. Information about other operational cost savings was not available as of the writing of this report.

For the City's customers, the transition to containerized green waste collection is an opportunity to cut costs as well. Presently, containerized green waste participants currently pay $9.37 per month for a single-family home, which is 25% cheaper than the current monthly rate of $12.41 for single-family loose-in-the-street collection. The disparity in cost between containerized and loose-in-the-street collection has been increasing significantly and is expected to continue increasing due to individual loose-in-the-street green waste piles becoming increasingly scattered throughout the City as more and more customers are switching to containers, thereby resulting in inefficient operations and increasing the costs to collect each pile.

As noted earlier, since 2004 the voluntary containerized green waste collection program has grown significantly and is expected to reach over 90% participation by the close of FY 09/10, with 100% participation within the next few years. Funding for the green waste container program is provided through existing ratepayer utility fees for the green waste collection program.

WASTE GENERATION AND LANDFILLS

The City generates solid waste as the result of its own internal operations. Waste generation data specific to City of Sacramento government facilities is not currently available. However, all waste deposited in landfills by the City of Sacramento's Solid Waste division, including waste generation from the City's facilities, is included in the communitywide breakdown of the 2005 GHG Inventory. There are several GHG reduction measures, however, that apply to the City's operations that are included in this analysis.

20. Expand Waste Reduction and Recycling Programs for City Facilities

The City is taking active steps to operate more sustainably with respect to waste. As outlined in the City's Sustainable Operations Policy (API #57), City employees are required to follow certain procedures to reduce, reuse, and recycle as follows:

Printing, Copying, Storing and Disseminating Documents

Overview

As of early 2009, the City used over 50,000 reams of paper annually. By changing the way employees print, copy, store, and disseminate files and information, paper costs and associated energy and GHG emissions associated with paper production can be reduced by up to 50%. API #57 requires the following, where feasible and applicable:

- Double-sided printing
- Double-sided copying
- Printing in draft mode to reduce toner
- Electronic storage of files, in accordance with the City's Records Retention Policy and Electronic Document Management Policy
- Electronic Dissemination of Document through Email, Website, or other means

GHG Reduction Analysis

If the City were to reduce its paper usage by 50% by 2020, the following benefits could be achieved:

- 1,300 fewer trees harvested annually to produce the paper (*GHG reduction of 9.1 $MTCO_2e$*)
- 440,000 fewer gallons of water used annually to produce the paper
- 250,000 kWh less electricity used to produce the paper (*GHG reduction of 99.68 MTCO2e*)

Because the avoided energy and potential GHG emission reductions associated with these savings occur in the manufacturing process used to produce the paper and are not within the City's operational control, they are considered "Scope 3" emission reductions under the Local Government Reporting Protocol and are not credited towards the City's reduction target.

Feasibility and Implementation

The Department of Utilities - Solid Waste will implement a new program to improve employee awareness and compliance with API #57.

Recycling in City Operations

Overview

Currently, the State requires the City to recycle 50% of the waste collected within its jurisdiction. The City Council established a higher goal to have 70% of all waste recycled by the year 2012. As of 2007, the City recycled approximately 57% of the waste generated in the City. By encouraging and incentivizing recycling communitywide, as well as within its own municipal operations, the City avoids the cost of landfill waste disposal. In 2008, the disposal cost for one ton of waste was approximately $39.

The City has been recycling in its operations for many years. API #57 clarified that employees are required to recycle waste generated from various aspects of City operations, including:

- paper and cardboard,
- plastics,
- glass,
- aluminum/steel/tin cans,
- printer and toner cartridges,

- hazardous waste, such as bleach, paints, insecticides, solvents, oil, grease, batteries, or common e-waste items such as used electronic equipment, batteries.

In addition to API #57, the City recently passed a Construction and Demolition Waste Ordinance that applies to all construction projects in the City, including City facilities.

A good example of a successful program that promotes waste reduction in City operations is the Sacramento Zoo's "Green Team", which is staffed by volunteers. The Zoo's Green Team has promoted green awareness since 2003, by using positive reinforcement to encourage practices such as:

- Recycling paper and many other materials
- Using re-usable materials whenever practical, rather than disposables
- Using 100% post-consumer recycled paper products
- Energy conservation – turning lights and computers off at night

GHG Reduction Analysis

Most of the Green Teams efforts have not been quantified. One exception is how it has changed the way that the City communicates with its Zoo Membership. It is estimated that the Zoo Green Team has reduced GHG emissions by 3 MTCO2e since 2006 by converting existing Zoo Members to "Green" Members who only receive Zoo news and renewals through email. This avoids paper consumption and has saved the City approximately $24,000 in printing and postage costs.

Other than the above, the GHG emission reduction from recycling in City facilities could not be calculated because the Solid Waste Division does not track the level of recycling by City employees.

Feasibility and Implementation

The Solid Waste Division will implement a new program to improve employee awareness and compliance with API #57. Tracking the level of recycling by City employees or the success of new program is not currently feasible because as the materials are picked up, they co-mingled with materials from outside of City operations.

As discussed above, the Zoo's Green Team provides an example of how such an employee awareness program could work.

Bottled Water Purchasing Restriction

Overview

Bottled water consumption contributes to a significant amount of waste and energy consumption. According to the Container Recycling Institute, the national demand for plastic water bottles in the U.S. for one year consumes over 47 million gallons of oil in the plastic bottle manufacturing process, resulting in about a billion pounds of CO2 annually. In addition, the bottling process consumes an additional 1.5 million barrels of oil and 75 billion gallons of water. Transport of bottled water to the U.S. requires additional transportation energy and GHG emissions, and finally over 75 percent of bottles consumed are discarded, resulting in over 2 billion pounds of plastic annually in landfills around the country.

Cities and counties, funded by ratepayers and state and federal governments, are spending billions of dollars annually to provide safe, clean drinking water from the tap. The City of Sacramento's municipal water system recently gained recognition from the Environmental Working Group as having the safest drinking water among the major California cities over 250,000 in population, and was ranked 18th nationally among all large cities in the EWG's survey.[21] Unfortunately, the migration from tap to bottled water fosters a perception that tap water is not safe or necessary. In truth, tap water quality standards are much more stringent than those for bottled water. The cost of bottled water ranges from 240 to over 10,000 times more expensive than tap water, depending on the brand of bottled water.

API #57 prohibits City staff from using public funds to purchase bottled water in all forms (single-serve or 5 gallon), with some exceptions based on certain circumstances such as for outdoor events where tap water is not readily available, emergencies, and other limited situations.

GHG Reduction Analysis

It is not currently known how much bottled water was purchased annually prior to the adoption of API #57, or how much associated waste reduction and Scope 3 emissions would be achieved under this policy.

[21] http://www.ewg.org/tap-water/rating-big-city-water

Feasibility and Implementation

The Department of Utilities - Solid Waste will implement a new program to improve employee awareness and compliance with API #57.

WASTE-IN-PLACE EMISSIONS

Waste-in-place emissions are calculated based on decomposition of accumulated waste in a landfill over the landfill's lifetime, as opposed to current or future years' generation of waste. There is only one major landfill within the City's operational control, the former Sacramento City Landfill located at the northern terminus of 28th Street in the area known as Sutter's Landing, which was used to dispose of solid waste generated within the City between 1968 and 1994.

Since the 28th Street landfill's permanent closure in 1994 a methane gas recovery system was installed and operated by a third-party contractor that collects and disposes of much of the gas that is generated from the closed landfill. Some of the landfill gas is sold to Blue Diamond Almonds to be used as fuel in their industrial operations. Not all of the methane captured is used, however, so some of the gas has been flared to reduce fugitive methane emissions from the landfill. Current contracts and diminishing quantities of landfill gas also make it difficult to effectively use the currently flared gas for a more beneficial use. In addition, some fugitive GHG emissions occur due to the fact that not all of the methane can be captured or flared through the recovery system. According to the 2005 GHG inventory, waste-in-place at this landfill resulted in annual GHG emissions of approximately 14,012 $MTCO_2e$ in 2005.

21. Landfill Fugitive Methane Emissions Control

Overview

The California Air Resources Board (ARB) is currently developing a new regulatory control measure that will require enhanced control, monitoring and reporting of methane emissions from municipal solid waste (MSW) landfills as part of the early actions to be implemented under AB32. The control measure will reduce methane emissions from municipal solid waste landfills by requiring gas collection and control systems on landfills where these systems are not currently required, and will establish statewide performance standards to maximize methane capture efficiencies. Additionally, as part of this process, the State will explore opportunities to increase energy recovery from landfill methane gas.

GHG Reduction Analysis

As mentioned in the previous section, the 28th Street Landfill is closed, capped, and already has a gas recovery system that provides energy that is sold to Blue Diamond. Until the specific language of the regulation is finalized and adopted, it is not known

whether this system will meet the performance requirement of the new regulation or not. Furthermore, the additional quantity of landfill gas that will be captured will be variable.

Feasibility and Implementation

It is not known if modifications will be required to improve the capture of fugitive landfill gas emissions. If modifications are required by the new regulation, it is likely that this will be at an additional cost to the City.

MULTI-SECTOR STRATEGIES AND ADDITIONAL MEASURES

The City's commitment to sustainability includes some cross-cutting initiatives that span GHG emission sectors, including Sustainable Municipal and Public Landscaping Practices. Additionally, some actions can reduce GHG emissions that are outside the scope of the City's emissions inventory through implementation of a Sustainable Purchasing Policy and other efforts.

Municipal and Public Landscapes

The City of Sacramento owns and maintains nearly 4,000 acres of open space, including parks, golf courses, trails, marinas, a historic cemetery, and undeveloped open space. In addition the Department of Transportation maintains 264 acres of landscaped area along City streets, and the Department of General Services maintains a variety of other miscellaneous landscaped areas associated with the City's remaining facilities. Much of this acreage is conventionally landscaped, predominantly in turf. Although turf is aesthetically pleasing and offers a great deal of flexibility and utility, turf is generally water and energy intensive.

GHG emissions related to landscape essentially have four sources:

- Lawn and garden equipment;
- Water-related electricity use (pumps, etc.);
- Decomposition of plant material; and,
- Transportation emissions related to vehicular travel of maintenance crews.

A significant portion of these emissions can be avoided by designing the landscape more sustainably in the first place, as shown in Table 18 below.

Table 18: Examples of Sustainable Landscaping Benefits

Sustainable Landscaping Levels of Implementation	Benefits
Replace conventional turf landscape with sustainable landscaping	Reduces water consumption by 40-60%. Up to 50% reduction in maintenance requirements resulting in reduced fuel usage in vehicles and lawn/garden equipment.
Replace existing turf with more drought tolerant grass species	Replacing hybrid Bermuda with a drought tolerant variety of Buffalo Grass can reduce water requirements by up to 25%.
Install new weather-based irrigation controller or rain sensor	Water savings of 15-26%.

22. Sustainable Landscaping

Overview

Sustainable alternatives to conventional landscapes include holistic techniques commonly known as "low-maintenance landscaping," "xeriscape", "river friendly landscaping", and "native gardens". They all share common principles and benefits when compared to conventional turf-based landscapes: they conserve water and energy, reduce air pollution, and reduce GHG emissions.

City departments are exploring the degree to which sustainable landscapes can be incorporated into their operations. Some examples of past, current or planned measures to incorporate Sustainable Landscaping include the following:

- The Convention, Culture and Leisure Department (CC&L) eliminated almost 4 acres of turf in the Old City Cemetery in the past 2 years, and replaced it with an expanded native plant demonstration garden.
- The Department of Utilities (DOU) is currently making plans to build a water-efficient demonstration garden/landscape. The purpose is to provide an example to the public that incorporates water conservation and River Friendly Landscape Guidelines, and that is consistent with the requirements of the City's

Outdoor Water Conservation Ordinance and the State Model Water Efficient Landscape Ordinance.[22]

- The Department of Parks and Recreation (DPR) plans to incrementally reduce the acreage that is currently planted with turf and replace it with low water use plants, drought tolerant turf grass or artificial turf, at an average rate of 25 acres per year. Focusing efforts on long and narrow or small, odd shaped turf areas that are difficult to mow and water will conserve water and energy, and will reduce maintenance.
- DPR has committed all future designs for new parks to include a greater emphasis on drought tolerant plants, natives, and plants that are well adapted to local conditions. DPR estimates that from 2010-2020, approximately 200 acres of new parks would be developed. About 15% of this (3 acres annually) would be low water use landscape.

GHG Reduction Analysis

Table 18 below summarizes the range of potential GHG reductions from the landscape conversions listed above. It was necessary to bracket a range of water savings (from 40%-60%) for the analysis, since the information received from departments was not specific. It also includes the GHG reduction from reduced yard waste and powered equipment. The table also includes the water savings from two new artificial sports fields.

Feasibility and Implementation

City departments are just beginning to explore ways to reduce water, energy, and GHG emissions in City landscapes. DPR's estimated conversion rate to sustainable landscaping is conservative because replacing landscape is relatively expensive, and it is not currently known how well these alternative landscapes will be accepted by the public, or how durable they will be. The actual acreage of sustainable landscape that is installed as a part of new park development is dependent on the pace of new development. Table 19 below shows that there are considerable project costs per acre that are difficult to recoup solely from water and energy cost savings. A more comprehensive analysis that includes labor and equipment related costs should be

[22] For more information see:
http://www.water.ca.gov/wateruseefficiency/landscapeordinance/
http://www.qcode.us/codes/sacramento/

considered before making final conclusions about the costs and benefits of sustainable landscaping.

Table 19: Energy and GHG Savings from Low Maintenance Landscaping

Climate Action Measure	Annual Acres Converted	Total Acres to Convert by 2020	Total GHG Reduction (MTCO2e)	Approximate Incremental Cost Per Acre*	Cost Savings per Acre (Water + Electricity)**
DPR: Convert existing park turf to low water use landscapes	25	250	4.76-7.14	$90,000-$313,000	$217-$325
DPR: Convert portion of new parks to low water use landscapes	3	30	26	$41,703	$217-$325
CC&L: Convert Old City Cemetery turf to natives	4	4	33-34	NA	$217-$325
DPR: 2 artificial sports fields	N/A	N/A	4.9	$544,000	$543
TOTAL	**32**		**64-72**		

* Approximate cost per acre based on previous projects, including design, engineering, installation and construction administration. Each project is unique so actual costs will vary. The Native Garden in Old City Cemetery was planted by volunteers.
**Does not include potential labor cost savings.

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23. Watering Reductions in City Parks

Overview

DPR has installed water meters in most City parks, and has implemented a number of operational measures to conserve water. For example, DPR has reduced its watering schedule from 5 days per week to 3 days, and now irrigates between 9 p.m. and 5 p.m. to reduce evaporation. In addition, Park maintenance staff monitors meter readings for consistency with pre-established water budgets.

GHG Reduction Analysis

Preliminary data shows that DPR used 28% less irrigation water in 2009 than in 2008. It is not known how much of this reduction came from operational measures, but this reduction in irrigation water translates to a GHG reduction of 207 metric tons in 2009. This number has not been added to the summary table (Table 5) because it is not yet known if this is a one-time reduction or a reduction that can be made permanent.

Feasibility and Implementation

The feasibility of a permanent 28% reduction in water use by the operational changes listed above is uncertain because these changes were made in response to the combination of reduced budget and the current drought. The actual quantity of water savings achievable through operational changes will require additional study by DPR. Given that water rates that DOU charges DPR will increase significantly in the future, DPR will have a strong incentive to continue to conserve water. There may also be an opportunity to combine this approach with the Sustainable Landscape strategy described earlier in this section (#22).

24. Centralized, Weather-Sensitive Irrigation Systems

Overview

A significant portion of the City's municipal and public landscapes are irrigated with outdated systems that have multiple controllers, manual valves and/or manual sprinklers. Converting these to centralized irrigation control saves water and labor costs, and is a necessary prerequisite to state of the art technology such as weather-based control systems. Recent or proposed changes to irrigation systems include the following:

- Since 2005, DPR has converted 500 acres at 55 city parks to new, water-conserving central irrigation systems with weather station or sensor-based irrigation control technology.

- Based on an analysis of previous years, DPR anticipates that it will have funding to replace outdated irrigation systems on 20 acres annually to achieve 200 acres total by 2020. In addition, 100% of new park acres will have a central irrigation system with weather or sensor-based controllers. It is estimated that this will average approximately 20 acres annually, and reach 200 acres by 2020. By 2020,

DPR estimates that it will have a total of 900 acres on central weather-based control.

- CC&L plans to upgrade the irrigation systems for all 204 irrigated acres in *Arcade Creek* and *Bing Maloney* golf courses beginning in 2011. The upgrade would include a central weather-based control system.

GHG Reduction Analysis

It is estimated that implementing centralized irrigation weather-based control systems would generally improve water savings by 15%, which would translate into electricity savings of over 377,899 kWh and a GHG reduction of **79 metric tons CO_2e** as shown in Table 20 below.

Table 20: Energy and GHG Reductions from Centralized Irrigation System Improvements

Facility	Acres	Water Saved (Gal.)	Annual Electricity Saved (kWh)	Total Cost Savings from Water & Electricity	GHG Emissions Reduced MT CO2e	Estimated Project Cost	Simple Payback (Years)
CC&L: Golf Courses	204	19,951,200	69,829	$8,380	15	$5,000,000	100+
DPR: Parks & Open Space	900	88,020,000	308,070	$73,224	64	$9,730,114	100+
TOTAL	**1,104**	**107,971,200**	**377,899**	**$81,604**	**79**	**$14,730,114**	

* There is no water cost savings for golf courses because they are irrigated with well water.

Feasibility and Implementation

DPR staff has estimated that it costs approximately $61,000 per park to retrofit an existing irrigation system with weather-based controls. Estimated savings includes energy and water savings for parks, and energy only for golf courses. Potential labor cost savings for weather-based irrigation system improvements are not included in this analysis, but are likely to be significant.

The retrofit of irrigation systems in existing parks assumes new funding is identified by the prioritization of projects in future Parks & Recreation Programming Guides (PRPGs) and Capital Improvement Programs, and from grants. All new parks will have weather-based control starting in 2010. The pace of residential development primarily drives the rate of new acres acquired and developed over time, making it difficult to predict how many new facilities will benefit from this technology. Funding for the retrofit of *Arcade Creek* and *Bing Maloney* golf courses has already been identified.

25. Interim Water Conservation Plan and Water Efficient Landscaping Ordinance

Overview

The City is a member of the California Urban Water Conservation Council (CUWCC), which was created to increase efficient water use statewide through partnerships among urban water agencies, public interests, organizations, and private entities. The City is also a signatory of the Water Forum Agreement (WFA), and the Memorandum of Understanding Regarding Water Conservation in California (MOU-CUWCC), which sets forth water specific water conservation practices and processes, with the goal of integrating urban water conservation Best Management Practices (BMPs) into the planning and management of California's water resources.

The City's Water Conservation Office, Department of Utilities, is preparing a Water Conservation Plan to communicate the City's approach to implementing water conservation strategies, thereby fulfilling the commitments the City has made to its customers, the Water Forum and the CUWCC.

The Water Conservation Plan will be based on the outcome of an evaluation of each BMP as listed in the MOU-CUWCC. The Plan will also quantify the number of conservation targets the City needs to implement, the cost of implementing the targets and the expected savings. The level of implementation required for programmatic BMPs will depend on whether they are locally cost effective.

The City's Water Conservation Ordinance and Water Efficient Landscape Ordinance[23] are a challenge for some City facilities. The Water Conservation Ordinance provides guidelines for outdoor water use that applies to all City properties in addition to private

[23] Article XI of Chapter 13.04; and Chapter 15.92.010 of the City of Sacramento Municipal Code, which can be viewed online at http://www.qcode.us/codes/sacramento/

property. Pursuant to the Water Conservation and Landscaping Act of 2006, the City is required to adopt a water efficient landscape ordinance by January 1, 2010, or the State's model water efficient landscape ordinance would apply by default. The City Council adopted the ordinance in December 2009. The ordinance amends Chapter 15.92 of the City Code, and will be applicable to new and rehabilitated landscapes for industrial, commercial, office and institutional developments; to parks and other public recreational areas; to multi-family (four or more units) residential and PUD common areas; to model home complexes with three or more model homes; and, to city road medians and corridors.

GHG Reduction Analysis

The strategy for implementing the Water Conservation Plan focuses on obtaining the highest performance per dollar spent. For City landscapes, this will include performing water audits on 120 City parks. During FY2009-10, water conservation specialists will perform 120 park water audits (62 audits are already completed). These audits will provide specific information on best management practices that can be implemented at each park, specific improvements that need to be made, and training for staff. The Water Conservation Team has set a target of saving a total of 100 acre-feet for the park audit program. If the Parks and Recreation Department fully implements the recommendations of the audit and the actions are not redundant with implementation measures previously listed for parks, saving an additional 100 acre feet of water would provide a GHG reduction of 32 MT CO2e. This has not been added to Table 5 because it would likely result in double-counting.

Feasibility and Implementation

The ordinances outlined above pose significant challenges to certain City facilities, which are related the lack of funds to upgrade outdated irrigation systems, the loss of maintenance staff due to budget cuts, and the need for flexibility to accommodate special events that prevent irrigation at otherwise prescribed times. However, per the measures described earlier under Sustainable Landscaping (#22), Operational Changes in Parks to Reduce Water Consumption), and Centralized Irrigation Systems (#24), the City is already taking steps to water and landscape more efficiently. To this end, the Water Conservation Team continues to pursue outside funding for water conservation programs, including the installation of drought tolerant landscaping and efficient irrigation systems.

Achieving water savings from weather-based irrigation controller requires a centralized irrigation system. Many of the City's landscapes have multiple controllers, manual valves and/or manual sprinklers. Thus, major irrigation infrastructure improvements are needed as a prerequisite to installing weather-based control.

Although DPR has committed to achieve this technology in 100% of new park acres starting in 2010, the number of acres of new parks that will be developed through 2020 is an estimate that depends on the pace of new development. The development of new parks and conversion projects in existing parks assumes new funding is identified. Funding for water conservation and climate action projects depends on their relative priority in future Parks & Recreation Programming Guides (PRPGs), Capital Improvement Programs, and funding from grants.

26. Landscaping Equipment

Overview

DPR will conduct a pilot study to explore the feasibility of converting landscape equipment to more fuel efficient or lower-carbon fueled equipment, to reduce GHG emissions and improve air quality. The pilot study would involve the following process:

- The selection of at least two parks to participate in the pilot program. Participating parks should exemplify both high maintenance and low maintenance landscape design.
- Establish a tracking system to measure the fuel consumption of each fuel that is used to power landscape maintenance equipment.
- Track the fuel use at pilot parks for a year to provide a baseline.
- For each pilot park, assess the potential to use mulch to reduce weed growth and/or use hand tools in certain situations.
- Research availability of more efficient landscaping equipment or equipment that can utilize lower carbon fuels (including electric).
- Conduct GHG analysis of potential options and determine GHG reduction strategies.
- Implement changes and track success in reducing GHG emissions for a year.
- Determine if the pilot was successful and whether the changes should be implemented citywide.

GHG Reduction Analysis

An analysis of GHG emissions will be conducted at three stages in the pilot program:

- After one year, to provide a baseline for fuel usage and GHG emissions.
- Prior to determining GHG reduction strategies.
- One year after changes have been implemented, to determine if the pilot was successful.

Feasibility and Implementation

A citywide program would be implemented after the completion of the pilot study, if the program is determined feasible by the Parks Operations Manager.

27. Explore the Feasibility of Waste-to-Energy Options

Overview

Waste-to-Energy (WTE) is the process of creating (or recovering) energy in the form electricity or heat from the incineration of a waste source. WTE processes produce electricity directly through combustion, or produce a combustible fuel commodity, such as methane, methanol, ethanol or synthetic fuels.

The City of Sacramento is currently partnering with SMUD, the County of Sacramento, and others, to explore the feasibility of various programs and projects in the Sacramento region that include a variety of different WTE applications, including fermentation, gasification, and anaerobic digestion. While no specific WTE projects have been developed and implemented to date, ongoing efforts are expected to continue in the near future.

Further exploration of the City's operational role in potential WTE projects in the context of the communitywide waste stream will be addressed in Phase 2 of the Climate Action Plan.

GHG Reduction Analysis

WTE technology could play an important role in reducing overall GHG emissions from landfills. While most WTE technologies still result in some GHG emissions in the form of CO_2, these emissions have been reported by some studies to be roughly half of what typical methane CO_2 equivalent emissions anaerobic composition would have been in a landfill on a per ton basis.[24]

[24] http://en.wikipedia.org/wiki/Waste-to-energy

No definitive conclusions can be drawn about the GHG reduction potential from various WTE technologies to the City of Sacramento's operations until specific WTE technologies and local applications have been identified and studied. As noted above, further exploration of the feasibility of WTE projects and their effectiveness in reducing GHG emissions will be addressed in Phase 2 of the City's Climate Action Plan.

Feasibility & Implementation

While no specific WTE projects have been developed and implemented to date, ongoing efforts to study their feasibility are expected to continue in the near future.

28. Expanding the Urban Forest

Overview

Trees take carbon dioxide out of the air and transform it into wood, leaves, bark, and other tissue. Over the lifetime of a tree, several tons of carbon dioxide can be taken up (McPherson and Simpson 1999). By reducing ambient air temperature, they reduce the energy needed to cool buildings resulting in GHG emissions reduction at the power plant.

While trees are a relatively expensive way to reduce greenhouse gas emissions, they provide multiple benefits including that make them worthwhile investments including:

- Reduce the impact of global warming and the urban heat island effect by providing shade and transpiring water vapor
- Improve air quality by removing toxic air contaminants
- Increase groundwater supplies by storing rainwater in their root zones
- Protect water quality from "pollutant washout" during storms and decrease soil erosion
- Provide visual benefits that improve quality of life and raise property values

GHG Reduction Analysis

It is estimated that the City's combined tree planting efforts will sequester an average of **6 $MTCO_2e$** annually by 2020, as shown in Table 21 below:

Table 21: GHG Reductions from GHG Sequestration by Trees

Trees Planted Annually	Total Trees Planted by 2020	Annual Sequestration Rate (lbs./yr)*	MTC02e
200	2,200	70.6	**6**

*See Appendix C for information on how this annual sequestration rate was derived.

Feasibility and Implementation

DOT-Urban Forest Services has resources to plant, water, and provide care for approximately 1,000 trees annually, depending on funding priorities. The number of trees planted beyond replacement depends on how many trees are lost to storms and other factors in a given year, leaving a balance of approximately 200 trees planted annually (beyond typical replacement value). Increasing the volume of the urban forest would require additional funding for tree maintenance. DOT-Urban Forest Services is currently preparing a "Stratum Analysis" that will provide an assessment of the costs and benefits of the City's urban forest. It is anticipated that the report will be completed in the spring of 2010.

DPR will collaborate with DOT-Urban Forest Services and the Sacramento Tree Foundation to add a minimum of 1,100 new trees (beyond typical replacement levels) in City parks by 2020. It will seek new funding as well as support from Sacramento Tree Foundation volunteers. CC&L has planted 18 trees in the Old City Cemetery since 2005 (beyond replacement). DOT-Urban Forest Services will plant approximately 1,100 more trees (beyond replacement) along City streets. If additional funding is obtained, the level of trees planted annually beyond replacement may be increased until equilibrium is reached between the number of new trees planted and the number of tree planting sites that are available.

There may be potential to implement tree planting programs as part of our CAP that can be marketed to potential investors for GHG offset credits, such as SMAQMD's proposed local carbon exchange program[25]. Any City urban forestry projects that would involve carbon credits for tree planting would need to follow CARB's Urban Forest GHG Protocols.[26]

[25] SMAQMD: http://www.airquality.org/notices/Rules2009/20091208Rules250and350Workshop.shtml
[26] CARB's Urban Forest Protocols: http://www.arb.ca.gov/cc/protocols/urbanforest/urbanforest.htm

ADDITIONAL STRATEGIES

29. Explore In-Region Solid Waste Disposal Options to Reduce Long-Haul Trucking Emissions

Overview

All solid waste collected by the City (both internal operations and communitywide) is transported to landfills in various locations by 3rd party waste haulers. The Lockwood Landfill in Sparks, Nevada is owned and operated by Waste Management, Inc. and is the primary location for the disposal of waste by the City of Sacramento. The landfill accepts municipal waste, industrial waste and special waste. Most of the municipal waste disposed of at the landfill is imported from outside of the county in which it is located. Approximately 75,000 tons of the City's municipal solid waste per year is currently deposited at Lockwood.

Private haulers of solid waste within the City can deliver the waste to a variety of landfills. The Kiefer Landfill is the primary municipal solid waste disposal facility in Sacramento County and is the only landfill facility in Sacramento County permitted to accept household waste from the public. The landfill facility sits on 1,084 acres, but currently uses only 250 acres as landfill. As of 2005, it contained approximately 31 million cubic yards of waste, but has a permitted capacity of over 117 million cubic yards and should be able to serve the area for many years to come.

By more effectively managing the City's waste stream and increasing options for in-region disposal, long-haul trucking could be considerably reduced, thereby achieving significant reductions in fuel consumption and GHG emissions. These are Scope 3 emission, however, since they are produced from a 3rd party waste hauler and are not accounted for in the 2005 GHG inventory.

GHG Reduction Analysis

The City's contracted long-haul waste disposal requires approximately 10 trucks per day transporting approximately 30 tons per truck a distance of roughly 150 miles to the Lockwood Landfill (or 300 miles round trip). Assuming operations take place approximately 200 days per year, an average of 6 mpg per truck and 10.15 kg/gallon of diesel, annual GHG emissions from trucking to Lockwood are approximately 2,030 $MTCO_2e$.

If the same tonnages were to be disposed at an in-region facility such as the Kiefer Landfill (roughly 25 miles round trip from transfer station), using similar waste transfer trucks, the decreased mileage and associated fuel reductions would reduce annual GHG emissions to approximately 176 MTCO2e, a savings of over 1,854 $MTCO_2e$.

Feasibility and Implementation

The City's Solid Waste Division in the Department of Utilities is currently exploring the feasibility of this strategy. No estimates are currently available as to what total costs or savings would be.

30. Sustainable Purchasing Policy

Overview

The City Manager's office is in the process of adopting a Sustainable Purchasing Policy (SPP) which will require City staff to procure products and services for the City's operations in a manner that integrates fiscal responsibility, social awareness and community and environmental stewardship.

The SPP requires acquisitions that accomplish the following objectives:

- Conserve natural resources
- Reduce the use of water and energy
- Minimize environmental impacts such as pollution and use of water and energy
- Eliminate or reduce toxics that create hazards to workers and our community
- Support strong recycling efforts and utilize products where a high likelihood of recycling exists (e.g. steel and paper products)
- Reduce materials that are placed in landfills
- Increase the use and availability of sustainable products that protect the environment
- Encourage vendors to reduce environmental impacts in their production and distribution systems
- All buyers shall consider short-term and long term cost in comparing product alternatives when feasible. This includes evaluation of total cost expected during the time a product is owned, extended warranties, operation, supplies, maintenance, disposal cost and expected lifetime compared to other alternatives.

When determining whether a product is sustainable, SPP includes the following standards for consideration:

- Biobased
- Biodegradable
- Carcinogen-free
- Chlorofluorocarbon (CFC)-free
- Heavy material free (i.e. no lead, mercury, cadmium)
- Low volatile organic compound (VOC) content
- Made from renewable materials
- Compostable
- Low toxicity
- Recycled content

- Rechargeable batteries
- Reusable or refurbished
- Reduced packaging
- Reduced greenhouse gas emissions
- Energy, resource and water efficient

Specific procurement guidance is provided for the following activities (including those activities already consistent with the City's existing Sustainable Operations Policy (API#57) :

- Exclusive purchases of 100% recycled paper for all City departments, with exceptions granted only for equipment related issues, backed by written justification of the manufacturer
- Purchase of postconsumer recycled content cardboard and paper (minimum 20% post-consumer recycled content) office supplies such as envelopes, file folders, planners, boxes, etc.
- Business cards shall be printed on recycled card stock and shall display the recycling symbol
- Restrictions on the purchasing of bottled water
- Purchase of non-toxic/sustainable cleaning and janitorial products, including 100% post consumer recycled paper products
- Exclusive purchases of 100% remanufactured laser toner cartridges
- Purchases of appliances and electronics for which EnergyStar certification is available when practicable (*note: the Green IT action strategy described earlier contains specific estimates of energy & GHG reductions from EnergyStar for certain types of equipment*)
- Energy efficient lighting, including CFL's and other energy saving bulbs and high efficiency heating and cooling (HVAC) systems and equipment
- Purchase of water saving products, including low flow faucets and toilets and efficient irrigation systems
- Vehicle purchases utilizing the Fleet Low Emission Vehicle Acquisition policy
- Sustainable landscaping services employing best management practices, including integrated pest management, grass-cycling, drip irrigation, composting and use of mulch and compost,

GHG Reduction Analysis

As noted earlier in this document, the SPP reinforces specific actions that the City can take to reduce its own emissions when use of equipment or services directly in City operations will result in direct energy savings (e.g. EnergyStar specifications for all new IT and office equipment). However, GHG emission reductions from an agency's purchased goods and services where the manufacture of a product or performance of a service occurs outside the City's immediate operational control, are considered Scope 3 emissions and are not included in the City's Local Government Operations Inventory. No information is readily available on the City's full Scope 3 emissions. Many of the changes in the City's procurement associated with the SPP are likely to reduce these Scope 3 emissions; however they are not credited towards meeting the City internal operations reduction target under the CAP.

Feasibility and Implementation

The Procurement Services Division in the Department of General Services, and those with delegated procurement authority, are responsible meeting the objectives of the SPP. This includes establishing appropriate standards for SPP purchasing requirements, assessing cost effectiveness and making recommendations related to acquisition strategies and issuing reports related to the City's progress in environmental purchasing.

APPENDICES

Appendix A

General Assumptions and Conversion Factors

Energy:

- SMUD projected emissions factor for 2020 (renewable portfolio standard)= 460 lbs CO_2/MWh
- SMUD electricity rate (assuming full adopted rate increase by 2011) = $0.12/kWh
- Energy required to pump one gallon of water = 0.0035 kWh (Source: CAPPA*)
- Natural gas: 52.78 kg CO_2/MMBtu (from eGRID Subregion Emissions – CAMX; available at www.epa.gov/egrid)

Urban Forest Carbon Sequestration:

- Average annual net reduction in CO_2 = 70.6 lbs per tree per year (Source: E. Gregory McPherson - *Atmospheric Carbon Dioxide Reduction by Sacramento's Urban Forest*. Journal of Arboriculture 24(4): July 1988)

Fleet Emission Factors: (Source: Local Government Operations Protocol for the quantification of GHG emissions, Version 1.0, Sept. 2008)

- Diesel fuel – 10.15 kg CO_2 per gallon
- Unleaded gasoline – 8.81 kg CO_2 per gallon
- E-85 – 6.05 kg CO_2 per gallon
- LNG – 4.46 kg CO_2 per gallon
- Propane – 5.74 kg CO_2 per gallon

Landscape:

- Annual water required to irrigate an acre of turf = 652,000 gallons (Source: CAPPA*)
- Annual landfill emissions from an acre of turf = 5.2 tons (Source: Derived from Table 1 (page 7) of 2009 EPA Climate Showcase Communities Grant Application for expanding "River Friendly Landscaping".)
- Annual emissions from hauling grass clippings from an acre of turf = 2.5 tons (Source: Derived from Table 1 (page 7) of 2009 EPA Climate Showcase Communities Grant Application for expanding "River Friendly Landscaping".)
- Annual emissions from landscaping equipment to maintain an acre of predominantly turf landscape = 315 lbs. (Source: Derived from Table 1 (page 7) of 2009 EPA Climate Showcase Communities Grant Application for expanding "River Friendly Landscaping".)

*CAPPA , Climate and Air Pollution Planning Assistant is a tool provided by ICLEI.

Appendix B

City of Sacramento Internal Operations
GHG Emissions from Purchased Electricity
2005 and Projected 2020 GHG Emissions (based on SMUD/PG&E Renewable Energy Portfolio)

	Baseline		No CAP		With CAP		GHG Reductions		
							SMUD RPS Actions	*City CAP Actions*	*TOTAL SMUD+city*
	2005 Electricity kWH	2005 GHG MTCO2e	2020 Electricty kWh	2020 GHG MTCO2e	2020 Electricity kWH (w/ CAP)	2020 GHG MTCO2e	Baseline vs 2020 No CAP (MTCO2e)	2020 No CAP vs 2020 w CAP (MTCO2e)	Baseline vs 2020 with CAP (MTCO2e)
SMUD	96,525,817	26,974	96,525,817	20,140					
PG&E	193,000	43	193,000	29					
Leased	4,017,890	1,123	4,017,890	838					
TOTAL	**100,736,707**	**28,139**	**100,736,707**	**21,007**	**76,684,177**	**16,000**	**(7,132)**	**(5,007)**	**(12,139)**

GHG Emission Factors:

	2005	2020	
SMUD	616.07	460.0	lbs/MWh
PG&E	489.20	*326.30*	lbs/MWh

(note: PG&E emission factor for 2020 was projected from 2005, assumed to be 33% lower by 2020, per RPS standard)

Conversion factor

2204.62 lbs/metric ton

Appendix C

Atmospheric CO_2 Reduction Factor for Sacramento's Urban Forest:

There are a number of factors to consider when determining an average number to use for calculating GHG emissions reductions from trees.

The quantity of atmospheric carbon that is reduced by a tree can vary widely, depending on the following factors[27]:

1) Where the tree is planted on the site: A tree planted in a strategic location next to a building will reduce demand for electricity for air conditioning. A tree on the west side of a building will reduce demand more than a tree on the east side. A single tree that is planted in an open area will not have a significant demand reduction effect. For the purpose of this analysis, we will assume that most trees planted by the City in parks do not provide this benefit of avoided emissions.
2) The size of the tree. In general, a larger tree will provide more shade, and sequester more carbon than a smaller tree.
3) The species of the tree: In general, fast growing trees sequester CO_2 at a higher rate than slow growing trees; however, fast-growing trees often have shorter life spans and as a result, die and release carbon back into the atmosphere sooner than a longer-lived species.
4) The climate and location: A large strategically planted tree will have more impact in a hot climate than in a climate that isn't as extreme. Also, in an area where the electricity has a higher emission rate than SMUD, the tree will have more impact.
5) There may be GHG emissions that result from tree care and maintenance will have an effect on the net CO_2 reduction.

In 1998, E. Gregory McPherson published a paper in the Journal of Arboriculture on the "Atmospheric Carbon Effect of Carbon Dioxide Reduction by Sacramento's Urban Forest". The study concluded that Sacramento County's 6 million trees store 8 million tons of CO_2, and annually sequester 238,000 tons of CO_2. McPherson also estimated that Sacramento's urban forest was responsible for avoided emissions of 75,600 tons annually, but 9,400 tons of CO_2 were emitted to provide care and maintenance for the urban forest. He concluded that the net removal was 304,000 tons annually, equivalent to offsetting 1.8% of the CO_2 emitted as a byproduct of human activities in Sacramento.

The following table summarizes McPherson's findings on the average net annual CO_2 reduction per tree in Sacramento, which was variable depending on location sector:

[27] E. Gregory McPherson - Atmospheric Carbon Dioxide Reduction by Sacramento's Urban Forest. Journal of Arboriculture 24(4): July 1988.

Average Annual CO_2 Reduction per Tree (Sacramento, CA)

	City (kg/tree)	Suburban (kg/tree)	Rural (kg/tree)
Sequestration	-43	-35	-22
Avoided CO2 Emissions (reduced load on HVAC etc.)	-19	-15	-4
Released (care and maintenance)	2.3	1.6	NA
Net CO2 Reduced per Tree (Ave)	-59.7	-48.4	26

Conclusion: For the purpose of this analysis, we will assume that the average tree planted by the City in either city parks or as city street trees will reduce atmospheric CO_2 by 33 kg (70.6 lbs) per year. Note that this number does not include avoided emissions assuming that a significant number of trees are not close enough to buildings to provide shade for avoided emissions.