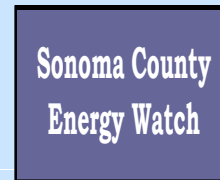
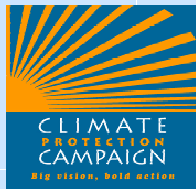
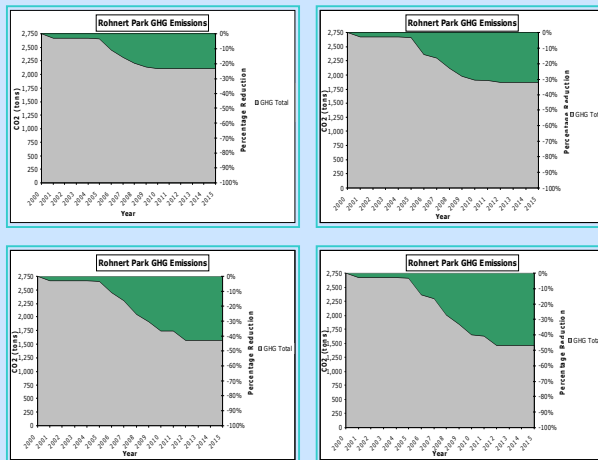


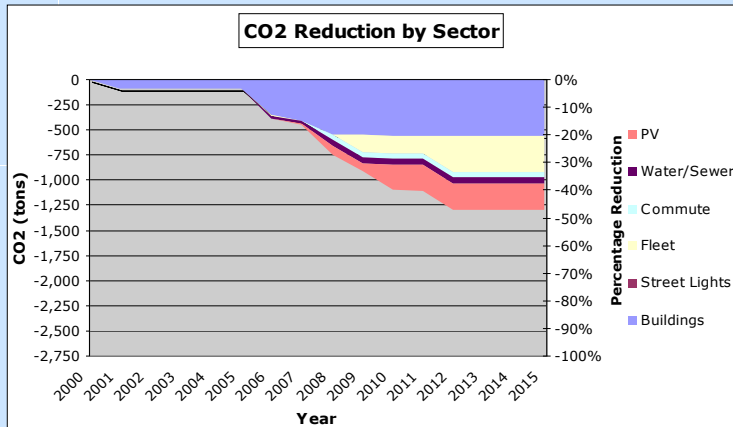
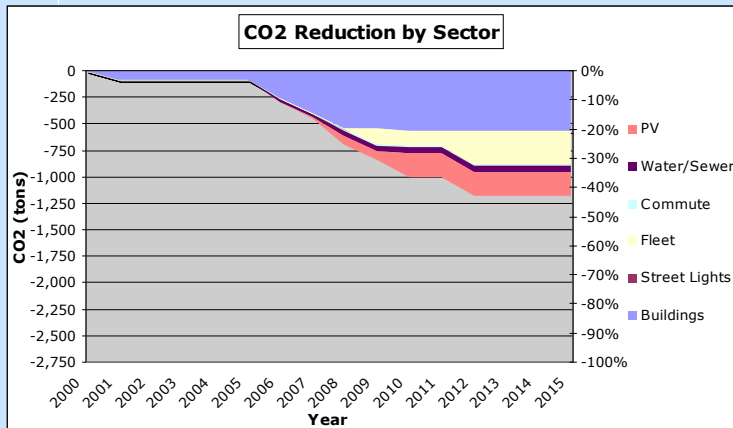
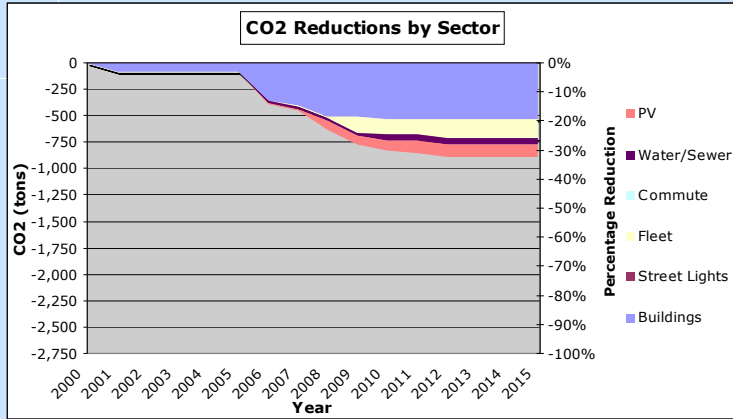
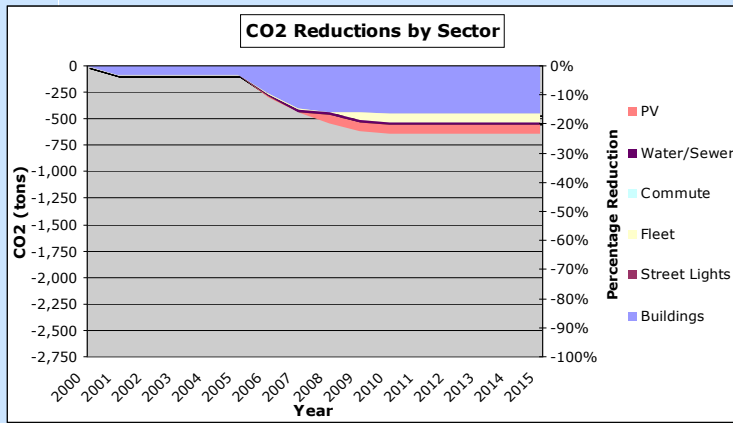
City of Rohnert Park Greenhouse Gas Emissions Reduction Action Plan Analysis Final Report

August 20, 2007

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Senior Engineer
Climate Protection Campaign



Prepared by the Climate Protection Campaign
with funding from the
Sonoma County Energy Watch
and the California Public Utilities Commission



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Disclaimer: The Climate Protection Campaign and its subcontractors do not imply any guarantees. The information contained in this report is intended to support the City in its efforts to understand the greenhouse gas emissions trend and opportunities for city operations and employee commutes. All results are approximations using standard engineering methodologies, based on historical energy usage.

¹ This program is funded by the California utility ratepayers under the auspices of the California Public Utilities Commission (CPUC). Legal Notice: This report was prepared as a result of work sponsored by the California Public Utilities Commission (Commission). It does not necessarily represent the views of the commission, its employees, or the state of California. The commission, the state of California, its employees, implementers, and subimplementers make no warranty, express or implied, and assume no legal liability for the information in the report: nor does any party represent that the use of this information not infringe upon privately owned rights. This report has not been approved or disapproved by the commission nor has the commission passed up on the accuracy or adequacy of the information in this report.

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1.0 Executive Summary

The City of Rohnert Park is implementing the ICLEI program to reduce the greenhouse gas (GHG) emissions from city controlled sources. This program has five steps, referred to as “Milestones.” Milestone 1, creating the GHG inventory, and Milestone 2, setting a reduction target have been completed. The City Council has adopted a reduction target for internal operations of 20% below 2000 levels by 2010. Milestone 3 requires the creation of a plan to meet this target. This report and associated analysis provides the roadmap to satisfy Milestone 3 providing four measure-specific plans to reduce emissions by more than 20%. Furthermore, the framework associated with this material will support the City in meeting the requirements of Milestone 4 (implementation) and Milestone 5 (monitoring and adjustment). The framework facilitates the integration of new and revised information, taking advantage of new opportunities and allowing adjustments to under performing initiatives.

The analysis, and resulting GHG emissions reduction plans, incorporates many opportunities in the various contributing sectors (Building Efficiency, Fleet, Commute, Water/Sewer, Streetlights, and Photovoltaic), as identified by the City Staff as the best available information at the time of research. The results provide an emissions impact estimate for five plans with the corresponding financial analysis.

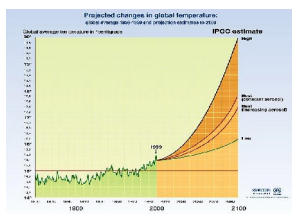
The results for each plan include the GHG emissions reduction expressed in tons CO₂e (equivalent CO₂ emissions)² and as a percentage of the total City GHG emissions. These results are presented along with a number of other important metrics, including the internal rate of return (IRR) and net present value (NPV) of each plan. These are critical in the financial evaluation of the “investment”. Other information includes the budget resources not sent to the utility company and the fuel companies, and the value of the resources redirected to local investments. Plan C, for example, results in over \$5 million in local investment over the 25 year life of the plan.

Five Action Plans are presented. Each plan has advantages and challenges, which are described in the following sections of this report. Action Plan A contains those measures already implemented by City Staff since 2000. Because Plan A represents “no further action”, it does not meet the target reduction of 20% by 2010. However, the other four plans do exceed this target, resulting in reductions from 23% to over 50%.

The intent of this work is to allow the independent plans to be considered on their merits in numerous areas, providing the capability to compare the comprehensive costs and benefits of competing paths, and thereby allow Policy Makers the ability to select the most appropriate path to reducing global warming pollution emissions in the City of Rohnert Park.

² CO₂e: Equivalent CO₂ in lbs or tons. The additional greenhouse gases such as methane are converted into the equivalent amount of CO₂ for analysis and clearer presentation.

1.1 Background



Sonoma County public jurisdictions (cities and counties) have adopted global warming pollution reduction targets and have committed to developing action plans. The first step, creating the inventory of emissions produced by the internal operations has been completed for all cities and the county. The City of Rohnert Park emissions by sector are presented as a percentage of the total emissions in Figure 1 below.

The total emissions for 2000 are 2,749 tons of CO₂e. Solid waste provides a GHG credit as the waste facility utilized by the waste contractor is equipped to gather and utilize the methane produced³. There were no significant new sources of GHG emissions identified since the baseline year of 2000⁴. The analysis assumes that the addition of the new, energy efficient City Hall will be balanced out by the decommissioning of the existing City Hall. This assumption can be modified when energy usage data becomes available for the newly renovated building.

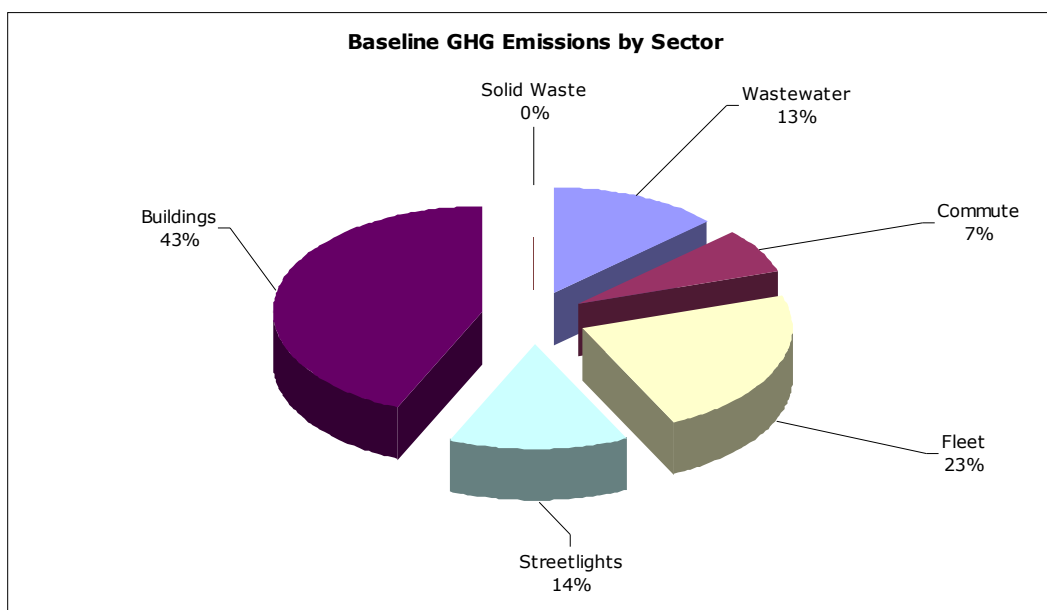


Figure 1: City of Rohnert Park GHG inventory as a percentage of the 2000 total

Many of the measures available to reduce GHG emissions also will reduce the City electricity and natural gas costs. These costs are a significant element of the municipal budget, and the potential volatility of their costs represents a threat beyond the control of City Staff. Figure 2 below provides the trends for the annual cost of utility supplied electricity and natural gas based on four rate escalation scenarios. The electricity and natural gas related measures contained in this analysis will reduce the vulnerability to utility price increases.

³ This approach is consistent with the ICLEI methodology for solid waste.

⁴ The recently completed library is controlled by the County and therefore is not analyzed in this report.

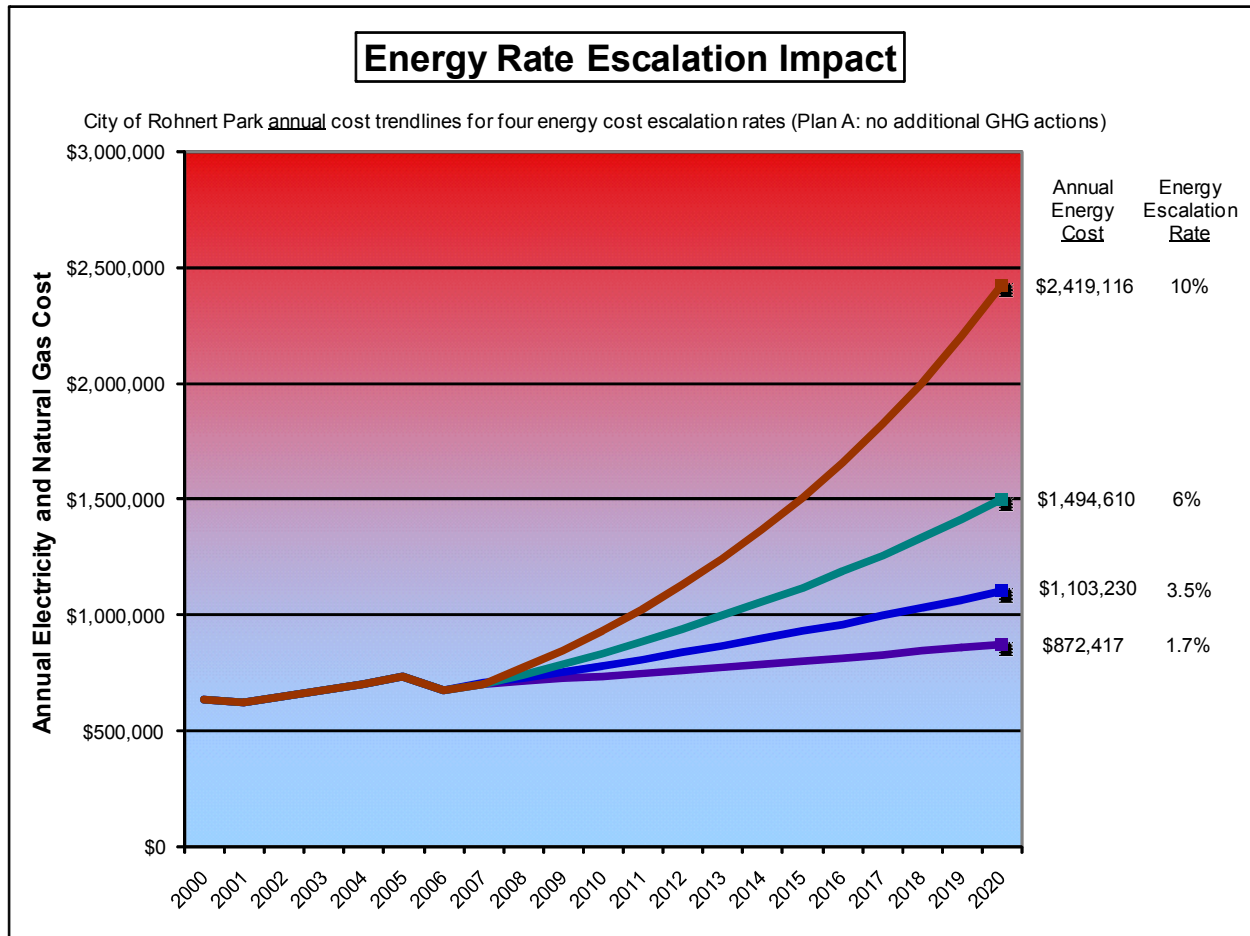


Figure 2: Energy Rate Escalation Scenarios

1.2 Methodology

Plan C	978	Tons CO2 Avoided	35.6%	GHG Reduction
<u>Community Benefit (over 25 year life of plan)</u>		<u>Financial Metrics</u>		
\$\$\$ Avoided Utility Company Payments		\$6,776,259	SPB: 12.4	
\$\$\$ Avoided Fuel Purchases		\$1,473,872	IRR: 15.3%	
\$\$\$ Invested Locally in GHG Projects		\$5,010,979	NPV: \$1,286,650	

The Rohnert Park GHG emissions inventory for 2000 was established in 2003⁵ and provides the baseline for this work. The specific actions and events affecting this baseline that were identified by City Staff were factored into the inventory

and resulted in a trend from 2000 to 2007. These are individually identified and quantified in Action Plan A representing completed projects.

The options for future action by the city, comprised of measures applicable to building and equipment energy efficiency, fuel efficiency, alternative fuel options, and distributed energy generation projects, have been identified and quantified. These have been evaluated and presented as individual measures, and as groups of measures (plans). Each is assigned a status (completed, pending or future) and an implementation date to enable the trending and future results graphs.

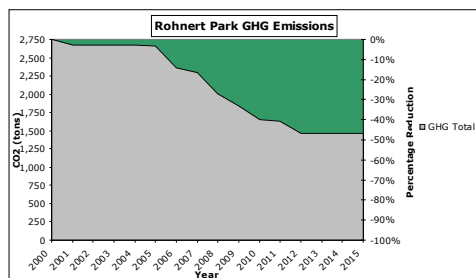
The measures are grouped to create comprehensive GHG emissions reduction plans. Each of the plans is analyzed to provide profiles enabling the evaluation of the plans individually and in comparison to the other plan options. Measure specific data such as capital cost, year of implementation, financing, energy and cost savings were processed to provide the following information for the five action plans:

- Emissions reduction in tons CO₂e avoided and as percentage of target
- CO₂e reduction by sector
- Annual Cash Flow including debt service, replacement cost and incremental O&M costs
- Outstanding principal and debt service by year
- Simple Payback (SPB) for each plan
- Internal Rate of Return (IRR) for each plan
- Net Present Value (NPV) for each plan
- Avoided utility company payments (NPV over life of plan)
- Avoided fuel purchases (NPV over life of plan)
- Value invested locally in emission reduction projects

A measure evaluation matrix was employed to quantify subjective considerations to allow their inclusion in the planning process. The evaluation scoring contributes to the understanding of the opportunities *but is not intended to provide a final ranking of the measures*. The decision to include measures in each plan is dependent on its role in achieving the objective of that plan, and is therefore independent of any fixed criteria or ranking. The results of the evaluation are provided in the Appendices.

⁵ GHG Inventory Report Rohnert Park, Hyun Moon, City of Rohnert Park, September 2003.

1.3 Results



Five plans have been created for consideration by the City of Rohnert Park. These plans consist of numerous measures to reduce GHG emissions, reduce energy costs, address equipment problems, and reduce the uncertainty of the city’s future annual energy costs. Summary financial information is provided in Table 1 below. The results contained in this table should be considered with the Action Plan Evaluations provided in

the Appendices to understand the relative strengths of each combination of measures populating the Action Plans. Detailed information for each measure is provided within the Measure Details section of this report.

Plan Results and Comparison Tables

Table 1 provides important financial information for each plan including the net annual cash flow. The “% Reduction” is the amount of CO₂e reduced as a percentage of the total city emissions. Plan A, completed projects, indicates a reduction of 10.9% below the year 2000 (baseline) emissions. Plan E provides a strategy to reduce the city’s emissions to 50.3% below 2000 emissions.

The financial analysis is provided with each plan. The critical metrics of Internal Rate of Return (IRR), and Net Present Value (NPV) provide important information to evaluate the worthiness of the investment from a cash flow perspective. It is important to note the large negative net cash flows for Plans D and E in year 2022. These are incurred by a substantial reinvestment in a large photovoltaic (PV) system (replacement of the associated inverters after 12 years) and the replacement of the energy efficient fleet after 10 years of service.⁶ Both costs may be considered overstated, and therefore conservative.

The cash flow results below do not include the effects of completed projects. When these are added into the financial analysis, the IRR and NPV are substantially improved due to the substantial financial returns of these earlier energy efficiency investments. These results are presented in the Appendices.

⁶ The assumption is that the cost of inverters will increase at the generally assumed inflation rate of 3%. However likely advances in technology, and improved economies of scale for the industry suggest this is overly conservative. The aggressive fleet measure assumes all vehicles are repurchased in 2022 (after a 10 year life). In practice, the purchases are phased which would improve the net cash flow for 2022 and decrease the cash flows for surrounding years.

GHG Action Plan Summary					
Analysis	Plan A	Plan B	Plan C	Plan D	Plan E
% Reduction	10.9%	23.2%	35.6%	42.9%	50.3%
SPB	2.1	0.9	12.4	16.5	20.1
IRR	76.6%	138.2%	15.3%	9.1%	3.4%
NPV	\$1,758,018	\$1,567,607	\$1,286,650	\$1,029,859	(\$357,822)
Annual Cash Flow	Plan A	Plan B	Plan C	Plan D	Plan E
2000	\$0	\$0	\$0	\$0	\$0
2001	\$0	\$0	\$0	\$0	\$0
2002	\$34,014	\$0	\$0	\$0	\$0
2003	\$35,768	\$0	\$0	\$0	\$0
2004	\$37,583	\$0	\$0	\$0	\$0
2005	\$39,463	\$0	\$0	\$0	\$0
2006	\$24,662	\$0	\$0	\$0	\$0
2007	\$15,744	(\$5,000)	(\$5,000)	(\$5,000)	(\$5,000)
2008	\$21,330	\$18,569	\$4,436	\$14,284	\$4,436
2009	\$43,216	\$20,573	\$15,394	(\$40,623)	(\$141,716)
2010	\$49,196	\$31,237	\$34,717	(\$59,748)	(\$155,695)
2011	\$55,383	\$55,621	(\$23,668)	(\$86,206)	(\$224,810)
2012	\$61,783	\$61,166	(\$142,321)	(\$59,559)	(\$240,249)
2013	\$68,406	\$66,911	(\$49,700)	(\$211,145)	(\$391,277)
2014	\$108,060	\$83,896	(\$30,521)	(\$182,259)	(\$362,801)
2015	\$115,149	\$111,332	\$9,031	(\$159,583)	(\$330,695)
2016	\$122,483	\$117,721	\$17,766	(\$74,901)	(\$213,636)
2017	\$130,071	\$124,341	\$26,809	(\$55,182)	(\$194,351)
2018	\$87,728	\$142,132	\$105,826	\$183,602	\$43,535
2019	\$146,045	\$69,443	\$137,864	(\$63,271)	(\$203,787)
2020	\$154,449	\$126,031	\$94,993	\$249,015	\$108,040
2021	\$163,145	\$186,560	\$218,255	\$324,433	\$242,958
2022	\$269,648	\$194,454	\$58,215	(\$1,710,536)	(\$1,831,577)
2023	\$278,956	\$202,630	\$198,365	\$371,752	\$247,540
2024	\$288,587	\$217,606	\$311,636	\$403,119	\$380,161
2025	\$298,552	\$226,375	\$323,567	\$428,815	\$405,358

Table 1: GHG Action Plan Financial Results

Energy Rate Escalation and Associated Budget Vulnerability

There is considerable discussion about the availability of fossil fuels in the near and middle term future (5 to 20 years). The “Peak Oil” movement suggests that we are at or near the point where our increased global demand for oil cannot be supplied from new petroleum discoveries, while production from existing oil fields is waning. Similar arguments are made for natural gas supply vs. demand. If demand outstrips supply, simple economics indicates that the cost to consumers will escalate rapidly, until the global demand is sufficiently dampened and realigns with available supply. The concern is significant enough to have prompted a US government sponsored study to determine the impacts of demand exceeding supply in the near future.⁷ This issue has important implications for local Sonoma County jurisdictions. Forty percent of PG&E power is generated by natural gas. A spike in the cost of this energy source will result in significant increases in the cost of electrical power, as well as increased volatility in the cost of natural gas used directly by the City.

Energy efficiency projects and photovoltaic energy systems can play a significant role in moderating this vulnerability. Figure 3 below provides potential impact of energy efficiency strategies on the associated vulnerability. For example, under the 3.5% escalation rate scenario, the city would reduce its utility payments by nearly \$400,000 per year (\$1,103,230 - \$703,300) in 2020 by implementing the aggressive Action Plan E. If there were a significant disruption in the supply of energy in California (energy escalation rate = 10% per year) the City would reduce payments by a significantly greater amount.

⁷ Hirsch, Robert. et al. (February 2005) “Peaking of World Oil Production: Impacts, Mitigation, & Risk Management.” SAIC.

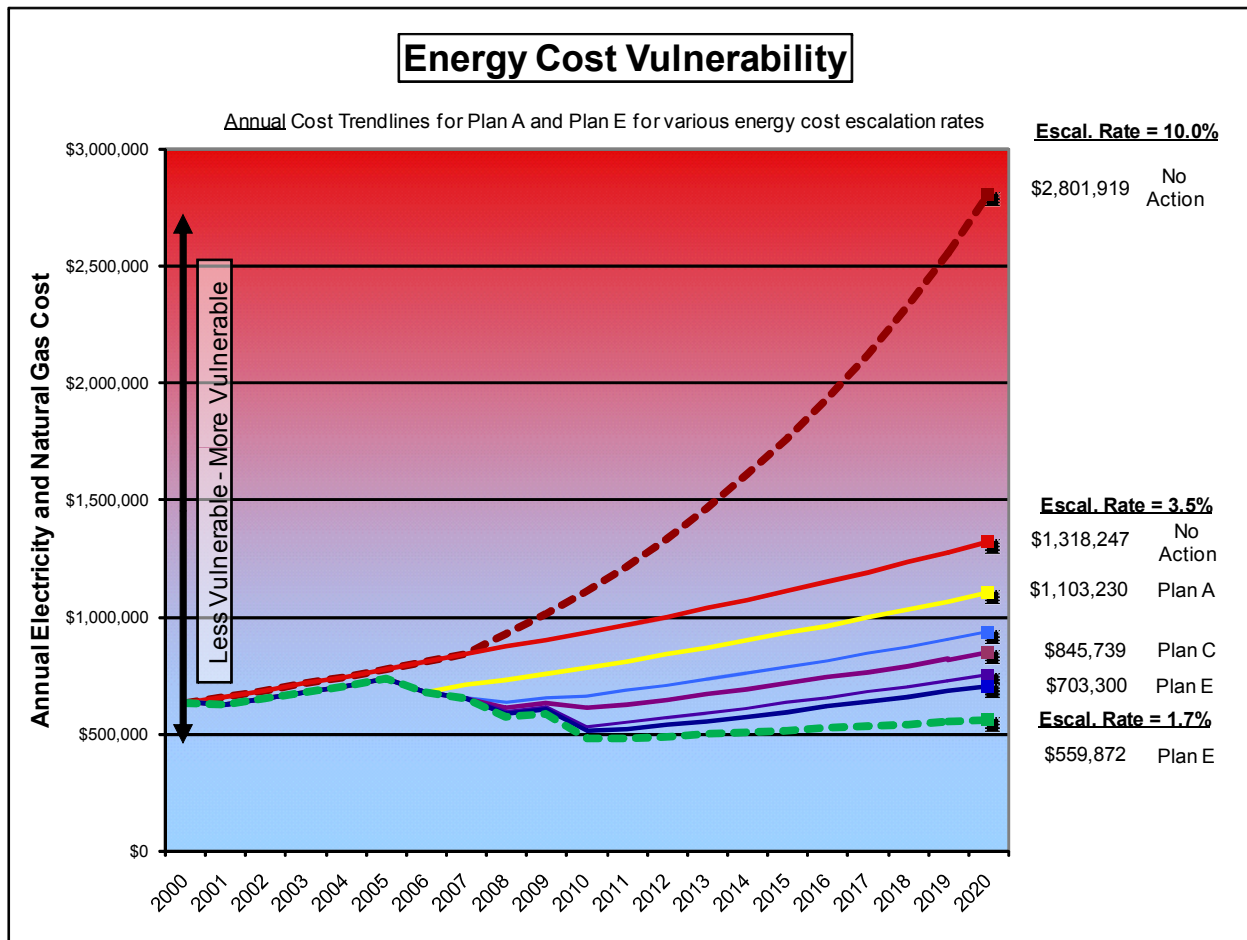


Figure 3: Annual Cost of Energy*

*Note: Data labels for Plan B and Plan D are omitted for clarity.

Action Plan Details

The measures used in this analysis are provided in Table 2 below. The first five columns indicate which measure is included in each Action Plan. More information on the measures is available in the Measure Details section of the report. The material that follows provides the results for each Action Plan. It is important to note that some measures are mutually exclusive. Measures 27 and 28, for example, apply to the same set of equipment, the city pumps. Measure 27 is more aggressive, setting a lower threshold of annual savings as the criteria for inclusion. Therefore, a plan would select either Measure 27 or Measure 28 but not both. The fleet measures incorporate similar considerations.

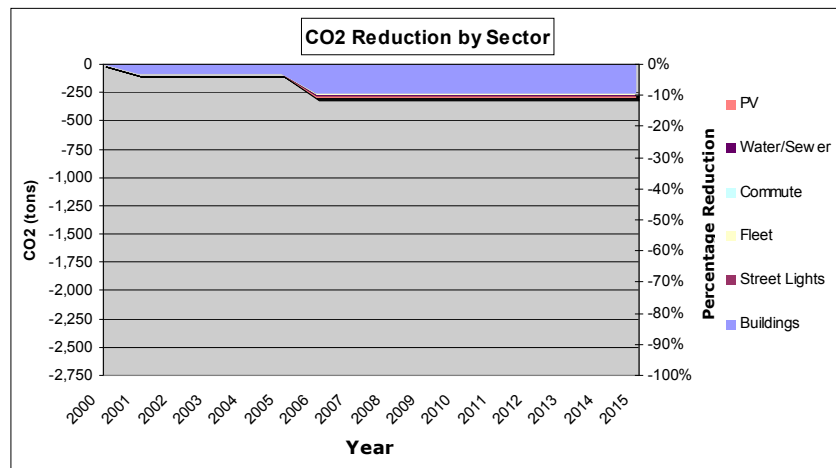
Action Plan					Measure Summary	Description	Status
A	B	C	D	E			
y	y	y	y	y	Measure 1	APS Measures	Completed
y	y	y	y	y	Measure 2	Lighting Retrofit (multi-bldg)	Completed
n	y	y	y	y	Measure 3	Building HVAC	Future
n	n	y	y	y	Measure 4	Computer Network Controls	Future
n	y	y	y	y	Measure 5	Addtl Lighting	Future
y	y	y	y	y	Measure 6	Pool Covers	Completed
n	y	y	y	y	Measure 7	Decommission Fountain	Future
n	y	n	y	y	Measure 8	Boiler Replcmnt Sports Center	Future
n	n	y	y	y	Measure 9	Lift Station #1	Future
n	n	y	y	y	Measure 10	H-Pool Solar Wtr	Future
n	y	y	y	y	Measure 11	Pool Pump Measures	Future
n	n	n	y	y	Measure 12	City Fleet New 2	Future
n	y	y	y	y	Measure 13	PV-New City Hall	Future
n	n	n	y	y	Measure 14	PV Supplying 100% Wtr &Wste Energy Cost	Future
y	y	y	y	y	Measure 15	PV APS	Completed
n	n	y	n	y	Measure 16	PV4	Future
n	n	y	n	y	Measure 17	PV5	Future
n	y	y	y	y	Measure 18	PV6 -CREBS	Future
n	n	n	y	y	Measure 19	Commute	Future
y	y	y	y	y	Measure 20	Fleet 2000-2006	Completed
n	y	n	n	n	Measure 21	Biodiesel B20	Future
n	n	n	y	y	Measure 22	Fleet Natural Gas Conversions	Future
n	y	y	n	n	Measure 23	City Fleet New 1	Future
n	n	y	y	y	Measure 24	Biodiesel B100	Future
n	n	y	n	n	Measure 25	Ethanol E85	Future
y	y	y	y	y	Measure 26	Pump Measures (4 implemented)	completed
n	n	n	y	y	Measure 27	Pump Measures (Savings criteria \$800)	Future
n	y	y	n	n	Measure 28	Pump Measures (Savings criteria \$1500)	Future
n	y	y	y	y	Measure 29	Staff Coordinator	future
n	y	y	y	y	Measure 30	APS Public Safety Central DDC	Future
6	18	23	24	26			

Table 2: Measure List

Plan A	299	Tons CO2 Avoided	10.9%	GHG Reduction
<u>Community Benefit (over 25 year life of plan)</u>			<u>Financial Metrics</u>	
\$\$\$ Avoided Utility Company Payments	\$3,008,849		SPB: 2.1	
\$\$\$ Avoided Fuel Purchases	\$75,610		IRR: 76.6%	
\$\$\$ Invested Locally in GHG Projects	\$1,377,574		NPV: \$1,758,018	

Action Plan A: This plan includes only the completed projects. These measures (See Plan Details) include building and water pump efficiency improvements, and a photovoltaic project. The cash flow reflects the City’s investment in two significant efficiency projects implemented in 2001 (lighting retrofit) and 2006 (building HVAC, LED traffic signals, and PV). The resulting annual cash flow is the net income to the city (energy cost savings minus project debt service, replacement costs and associated O&M).

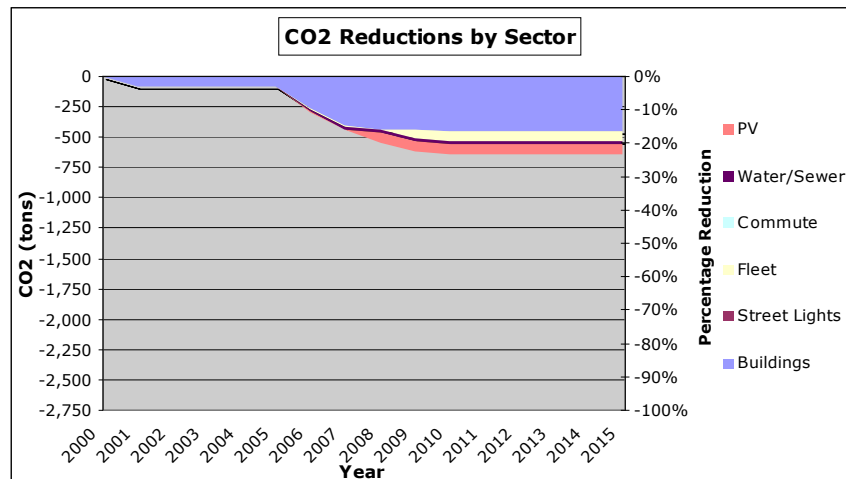
Annual Cash Flow	Plan A
2000	\$0
2001	\$0
2002	\$34,014
2003	\$35,768
2004	\$37,583
2005	\$39,463
2006	\$24,662
2007	\$15,744
2008	\$21,330
2009	\$43,216
2010	\$49,196
2011	\$55,383
2012	\$61,783
2013	\$68,406
2014	\$108,060
2015	\$115,149
2016	\$122,483
2017	\$130,071
2018	\$87,728
2019	\$146,045
2020	\$154,449
2021	\$163,145
2022	\$269,648
2023	\$278,956
2024	\$288,587
2025	\$298,552



Plan B	639	Tons CO2 Avoided	23.2%	GHG Reduction
<u>Community Benefit (over 25 year life of plan)</u>			<u>Financial Metrics</u>	
\$\$\$ Avoided Utility Company Payments	\$5,175,611		SPB: 0.9	
\$\$\$ Avoided Fuel Purchases	\$767,924		IRR: 138.2%	
\$\$\$ Invested Locally in GHG Projects	\$3,009,917		NPV: \$1,567,607	

Action Plan B: This plan includes all completed projects, and an additional 12 measures (see Plan Details). The new measures include a wide range of projects, from building air conditioning to a photovoltaic project. This plan allows the City to exceed the target of 20% GHG emissions reduction by 2010. The projected reduction of 23.8% provides a margin of flexibility for changing conditions and unforeseen difficulties in implementing the plan. The resulting annual cash flow is the net income to the city (energy cost savings minus project debt service, replacement costs and associated O&M), and represents a net gain for the city in each year after 2007.

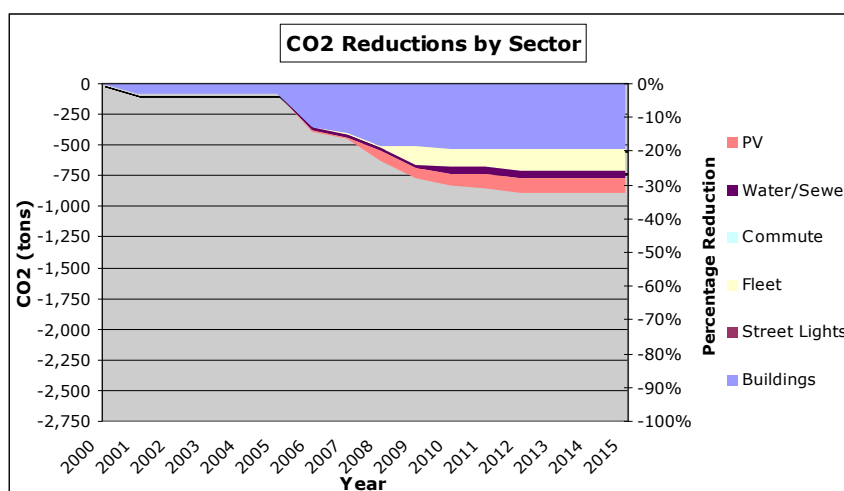
Annual Cash Flow	Plan B
2000	\$0
2001	\$0
2002	\$0
2003	\$0
2004	\$0
2005	\$0
2006	\$0
2007	(\$5,000)
2008	\$8,720
2009	\$10,725
2010	\$26,389
2011	\$45,773
2012	\$51,317
2013	\$57,063
2014	\$74,047
2015	\$111,332
2016	\$117,721
2017	\$124,341
2018	\$142,132
2019	\$69,443
2020	\$126,031
2021	\$186,560
2022	\$194,454
2023	\$202,630
2024	\$217,606
2025	\$226,375



Plan C	978	Tons CO2 Avoided	35.6%	GHG Reduction
Community Benefit (over 25 year life of plan)			Financial Metrics	
\$\$\$ Avoided Utility Company Payments	\$6,776,259		SPB:	12.4
\$\$\$ Avoided Fuel Purchases	\$1,473,872		IRR:	15.3%
\$\$\$ Invested Locally in GHG Projects	\$5,010,979		NPV:	\$1,286,650

Action Plan C: This plan includes all completed projects, and another 17 measures. In addition to many of the measures of Plan B, Plan C includes a wide range of projects from building air conditioning to fleet measures. This plan includes additional photovoltaic projects, biodiesel fuel (100%), and ethanol fuel (85%). Plan C significantly exceeds the City target of 20% GHG emissions reduction by 2010, yet maintains very attractive financial metrics. The Internal Rate of Return is over 15% and the Net Present Value exceeds \$1,000,000 over the term of the analysis (25 years). The annual net cash flow (energy cost savings minus project debt service, replacement costs and associated O&M) is negative for several years. However, the magnitude appears quite reasonable given the IRR and NPV results.

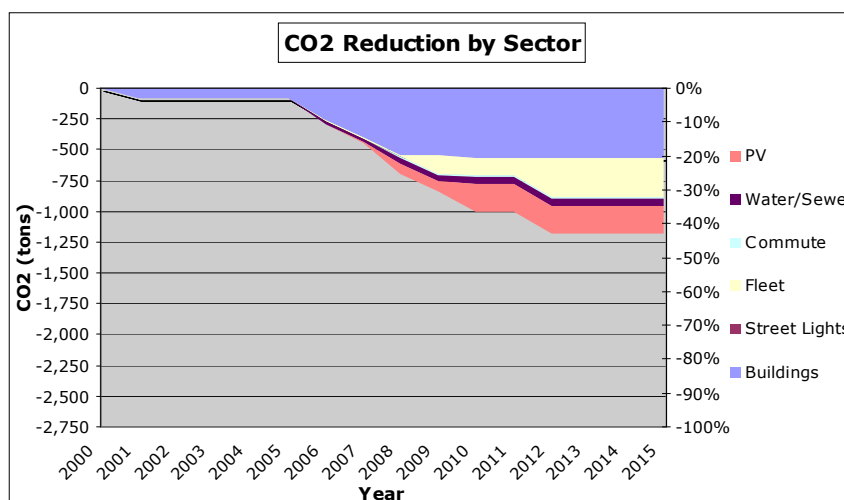
Annual Cash Flow	Plan C
2000	\$0
2001	\$0
2002	\$0
2003	\$0
2004	\$0
2005	\$0
2006	\$0
2007	(\$5,000)
2008	\$4,436
2009	\$15,394
2010	\$34,717
2011	(\$23,668)
2012	(\$142,321)
2013	(\$49,700)
2014	(\$30,521)
2015	\$9,031
2016	\$17,766
2017	\$26,809
2018	\$105,826
2019	\$137,864
2020	\$94,993
2021	\$218,255
2022	\$58,215
2023	\$198,365
2024	\$311,636
2025	\$323,567



Plan D	1,179	Tons CO2 Avoided	42.9%	GHG Reduction
Community Benefit (over 25 year life of plan)			% Reduction	
\$\$\$ Avoided Utility Company Payments	\$8,018,672		SPB: 16.5	
\$\$\$ Avoided Fuel Purchases	\$2,614,190		IRR: 9.1%	
\$\$\$ Invested Locally in GHG Projects	\$7,544,220		NPV: \$1,029,859	

Action Plan D: This plan includes all completed projects, and another 18 measures (several are different than Plan C). In addition to many of the measures Plan B and C, Plan D includes a wide range of projects, from building air conditioning to fleet fuel measures. This plan is less aggressive with PV projects and more aggressive with the fleet purchases and pump efficiency measures, resulting in a doubling of GHG emissions reduction as compared to the City target of 20%. However, these impressive results are not without additional costs, resulting in an IRR under 10%. The NPV remains near \$1,000,000. The annual net cash flow is significantly more challenging than the previous plans. The large negative cash flow in 2012 is due to the replacement of the PV inverters, and the group replacement of vehicles. These expenses would be spread out over several years in practice.

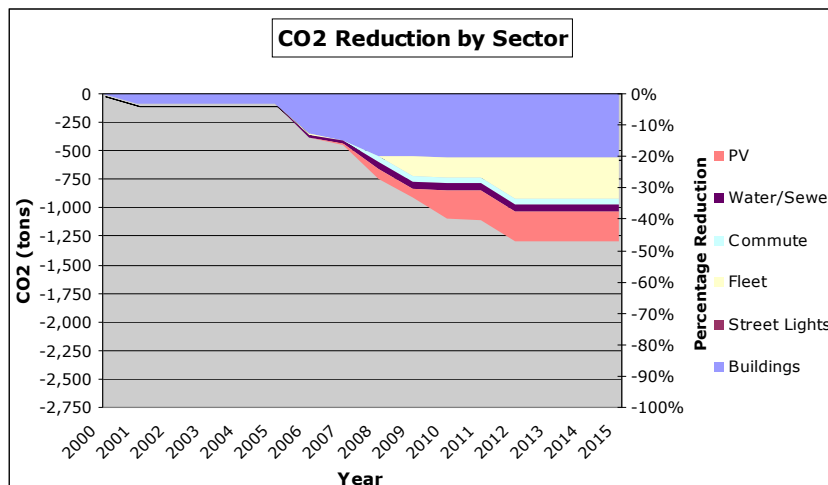
Annual Cash Flow	Plan D
2000	\$0
2001	\$0
2002	\$0
2003	\$0
2004	\$0
2005	\$0
2006	\$0
2007	(\$5,000)
2008	\$4,436
2009	(\$50,471)
2010	(\$64,597)
2011	(\$96,055)
2012	(\$69,407)
2013	(\$220,994)
2014	(\$192,108)
2015	(\$159,583)
2016	(\$74,901)
2017	(\$55,182)
2018	\$183,602
2019	(\$63,271)
2020	\$249,015
2021	\$324,433
2022	(\$1,710,536)
2023	\$371,752
2024	\$403,119
2025	\$428,815



Plan E	1,384	Tons CO2 Avoided	50.3%	GHG Reduction
<u>Community Benefit (over 25 year life of plan)</u>			<u>Financial Metrics</u>	
\$\$\$ Avoided Utility Company Payments	\$8,983,255		SPB: 20.1	
\$\$\$ Avoided Fuel Purchases	\$2,927,243		IRR: 3.4%	
\$\$\$ Invested Locally in GHG Projects	\$8,980,626		NPV: (\$357,822)	

Action Plan E: This plan includes all completed projects, and another 22 measures. All measures are implemented to their maximum potential. Two PV projects (measures 16 and 17) are doubled in size, to 60 kWac. The resulting reduction in GHG emissions exceeds 50%. Yet, this strategy yields in a challenging cash flow and a low IRR of 3.4%. The NPV is negative, in large part to the poor economics of the two PV projects mentioned above. The implementation date of 2011 of these projects is after the CPUC⁸ incentives are projected to expire. However, this plan provides the greatest security against energy cost escalations as detailed in Figure 6.

Annual Cash Flow	Plan E
2000	\$0
2001	\$0
2002	\$0
2003	\$0
2004	\$0
2005	\$0
2006	\$0
2007	(\$5,000)
2008	\$4,436
2009	(\$141,716)
2010	(\$155,695)
2011	(\$224,810)
2012	(\$240,249)
2013	(\$391,277)
2014	(\$362,801)
2015	(\$330,695)
2016	(\$213,636)
2017	(\$194,351)
2018	\$43,535
2019	(\$203,787)
2020	\$108,040
2021	\$242,958
2022	(\$1,831,577)
2023	\$247,540
2024	\$380,161
2025	\$405,358



⁸ California Public Utilities Commission

1.4 Summary

The GHG emissions reduction of 20% by 2010 can be achieved by a number of paths documented in this report. Each path, or Action Plan, is comprised of up to 26 individual measures, each is evaluated for the financial costs and benefits they contribute to the overall strategy. The analysis model underpinning these results will be available for incorporating new information and technologies as they come available, as well as truing the analysis with monitored data. The comprehensive approach to addressing this goal allows the City to meet a number of related goals, including improving the long term financial health of Rohnert Park, addressing the existing maintenance demands of aging equipment, and providing the public demonstration of commitment and progress in the highly visible challenge of greenhouse gas emissions reduction.

2.0 Introduction

Public jurisdictions (cities and counties) have adopted global warming pollution reduction targets and have committed to developing action plans. These detailed plans are required to provide a roadmap to meet the goals and a framework to track and verify the progress toward the goal over the life of the plan.

The Climate Protection Campaign provides these capabilities by using an analysis method developed for the City of Sebastopol. This method incorporates all measures across the various sectors (Building Efficiency, Fleet, Commute, Water/Sewer, Streetlights, and Photovoltaic), and provides an accurate emissions impact estimate and a comprehensive financial analysis. Furthermore, this analysis allows independent plans to be analyzed, providing the capability to compare the cost / benefits of competing paths to global warming pollution emissions reduction.

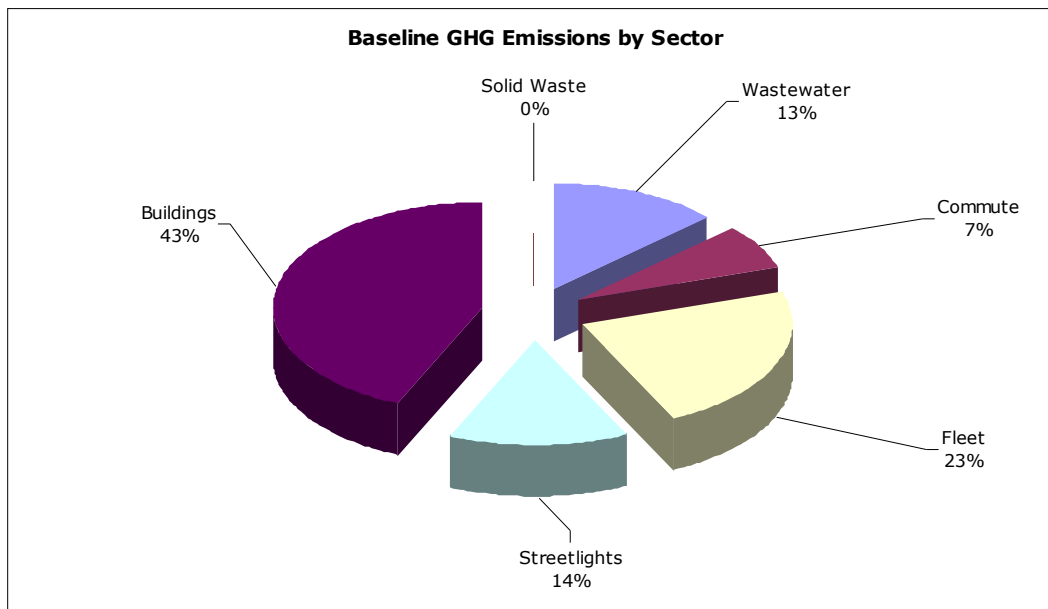


Figure 4: Baseline GHG emissions by sector as a percentage of the total

3.0 Methodology

3.1 Context

The Rohnert Park GHG emissions inventory for 2000, established in September 2003, provides the baseline for this work.⁹ The specific actions and events affecting this baseline were identified by City Staff and factored into the inventory to establish the trend from 2000 to 2007. These measures are individually identified and quantified in Action Plan A, which is comprised of completed projects.

The options for future action by the city, comprised of measures applicable to building and equipment energy efficiency, fuel efficiency, alternative fuel options, and distributed energy generation projects, have been identified and quantified. These have been evaluated and presented as individual measures, and as groups of measures (plans). Each is assigned a status (completed, pending or future) to enable the trending and future results graphs.

The measures are grouped to create comprehensive GHG emissions reduction plans. Each of the plans is analyzed to provide profiles enabling the evaluation of the plans individually and in comparison to the other plan options.

Measure specific data such as capital cost, year of implementation, financing, energy and cost savings were processed to provide the following information for five action plans:

- Emissions reduction in tons CO₂ avoided and as percentage of target
- CO₂ reduction by sector
- Annual cash flow including debt service and incremental O&M costs
- Outstanding principal and debt service by year
- Simple Payback for each plan
- Internal Rate of Return (IRR) for each plan
- Net Present Value (NPV) for each plan
- Avoided utility company payments (NPV over life of plan)
- Avoided fuel purchases (NPV over life of plan)
- Value invested locally in emission reduction projects
- Value of non-efficiency related capital expenses satisfied by each plan

Each measure included in this analysis has a set of inputs and assumptions. These are documented in the Appendices, and have been reviewed by staff. The details of each measure are provided, such as the vehicle and pump lists in the Appendices. The generally applied assumptions, such as the discount rate, interest rate, escalation rate for the cost of utility supplied power and fuel, and the CO₂e conversion factors for energy and fuel have also been reviewed and adjusted by City Staff. The values are provided in Table 3. These general values can be overridden at the measure level if necessary. For example, the term of financing is set to 7 years as a default value. However, CEC loans are based on generating a net cash flow close to zero over the life of the loan with a maximum value of 10 times the annual cost savings. Therefore, the term of the loan is adjusted at the measure level based on the annual savings for that measure.

⁹ GHG Inventory Report Rohnert Park, Hyun Moon, City of Rohnert Park, September 2003,

3.2 Measure Identification

The list of measures has been generated from document reviews, past experience of other jurisdictions and a review of the Rohnert Park facilities funded by the ABAG EW efficiency program. All measures included in this analysis have been reviewed and approved for inclusion by City Staff. The following sources contributed to the information in this report.

- *City of Rohnert Park Technical Energy Audit Report*, APS Energy Services, May 13, 2005
- *City of Rohnert Park Lighting Retrofit Project*, Chevron Energy Services, (no date)
- *Five Year Capital Improvement Program Budget 2006-07, 2007-08, 2008-09, 2009-2010, 2010-11*, Adopted by Rohnert Park City Council, June 27, 2006
- *Draft Plan: City of Rohnert Park Building Energy Efficiency and Greenhouse Gas Emission Reduction*, Climate Protection Campaign, August 2006
- *Non Residential New Construction Program Final Report for City Hall New Construction and Gut Rehab Project*, Green Building Studio, February 7, 2007
- Pump Test Reports, City of Rohnert Park 12-26-05, Pumping Efficiency Testing Services, 12.26.05
- Building data supplied by the City of Rohnert Park
- Facility on-site reviews conducted on 2.12.07
- Follow up meeting with Richard Behrends, Maintenance Director

3.3 Measure Assumptions: General Variables

This report is based on a set of general inputs for the financial analysis. Each measure utilizes these general inputs unless they are overridden at the measure level. The general inputs are provided in Table 3 below. The values used for each measure are provide in the Appendices. These inputs include the following:

- Term of Analysis
- Term of Finance
- Discount Rate
- Energy Inflation Rate
- Energy Cost
- Interest Rate
- Inflation Rate

The conversions in the table below are based on the best available information. The CO₂/kWh value is from PG&E based on their “fuel mix”.¹⁰ The values for natural gas, gasoline, diesel and biodiesel are consistent with the ICLEI values.¹¹ The value for ethanol is calculated using data

¹⁰ PG&E Power Content: Eligible Renewables: 13%, Coal: 2%, Large Hydro: 17%, Natural Gas 44%, Nuclear: 23%, Other; 1%, California Energy Commission, www.energy.ca.gov/consumer, May 2007.

¹¹ STAPPA/ALAPCO and ICLEI Clean Air and Climate Protection Software, State and Territorial Air Pollution Administrators and Association of Local Air Pollution Control Officials, International Council for Local Environmental Initiatives, released May 2003.

from research published by Argonne Labs.¹² The value used for CO2/kWh is different than the value used in the inventory completed in 2003, which used a more general number from ICLEI.¹³ This analysis has modified the baseline results by using the current value to ensure an appropriate comparison.

Metric	Standard Default Values	Revised Values	Default Values Used in Analysis	Notes
Term of Analysis (yrs)	25		25	
Term of Financing (yrs)	15	7	7	
Discount Rate	5.00%		5.00%	
Energy Inflation Rate	3.50%		3.50%	
Energy Cost (\$/kWh)	\$0.145		\$ 0.145	
Energy Cost (\$/Therm)	\$1.000		\$ 1.000	
Interest Rate	3.95%		3.95%	
Inflation Rate	3.00%		3.00%	
Exclude "Completed" from \$\$\$ cost&benefit			yes	
Conversions				
CO2/kWh (lbs.)	0.489		0.489	
CO2/Therm (#/Therm)	12.34		12.34	
CO2e Gasoline	22.0		22.0	lbs/gal
CO2e Diesel	22.0		22.0	lbs/gal
BioDiesel	0		0	lbs/gal
Ethanol	17.73		17.73	lb/gal for 100% ethanol
Costs				
\$/gal Gasoline	\$3.30		\$3.30	
\$/gal Diesel	\$3.30		\$3.30	
\$/gal Biodiesel	\$3.05		\$3.05	
\$/gal Ethanol	\$4.00		\$4.00	
CNG equivalent \$/gal	\$2.48		\$2.48	
CNG conversion cost	\$5,000		\$5,000	
CNG Equipment	\$150,000		\$150,000	
Electric Vehicle Mileage	0.3		0.3	mid size
Electric Vehicle Mileage	0.2		0.2	subcompact
Target (% of 2000)	20.0%		20.0%	
TOU Factor	1		1	Used of PV financial analysis
Hybrid increased eff	30%		30%	Likely to be revised at measure level

Table 3: General Inputs

¹² Effects of Fuel Ethanol Use on Fuel-Cycle Energy and Greenhouse Gas Emissions; M. Wang, C. Saricks, and D. D. Santini; Argonne Labs; January 1999.

¹³ GHG Inventory Report Rohnert Park, Hyun Moon, City of Rohnert Park, September 2003.

3.4 Measure Specific Variables

The general inputs can be adjusted for each individual measure as appropriate. The other key individual inputs are listed below. The values for each measure are provided in the Appendices.

- Category (Building, Fleet, Commute, PV, Water/Sewer)
- Status (Completed, Pending, and Future). Pending measures are defined as those provided by City Staff with identified funding.
- Financing: The cash flow is heavily dependent on whether or not the measures are financed. This funding decision is defined for each measure independently.
- Project Implementation Date
- Net Capital Cost
- Incremental Capital Cost associated with the cost premium associated with the improved efficiency. For Example: a hybrid compact vehicle is assigned a cost premium of \$4000 over an equivalent standard vehicle.
- Rebates and incentives
- Annual O&M cost associated with the efficiency measure
- Incremental Replacement Cost
- Component Life
- Time of Use factor (Photovoltaic systems)

3.5 Financial Analysis Results

The analysis provides the financial information required for investment decisions. This includes the following:

- Non efficiency related capital costs satisfied by plans¹⁴
- Net Cash Flow for each year of the plans
- Debt load for each year of each plan
- Simple Payback for each plan
- Internal Rate of Return
- Net Present Value
- CO2e reduction for each plan

Financial Definitions¹⁵

Net Present Value (NPV):

NPV is the difference between the present value of cash inflows and the present value of cash outflows. NPV is used in capital budgeting to analyze the profitability of an investment or project. NPV analysis is sensitive to the reliability of future cash inflows that an investment or project will yield.

¹⁴ Example: a 30 year old Air Conditioner needs to be replaced. The entire cost can be funded through energy efficiency resources (rebates and loans), but only a portion of the cost (30%) is a result of the efficiency enhancement.

¹⁵ <http://www.investopedia.com/terms>, <http://www.visitask.com>

$$NPV = \sum_{t=1}^n \frac{C_t}{(1+r)^t} - C_0$$

Where

t - the time of the cash flow

n - the total time of the project

r - the discount rate

C_t - the net cash flow (the amount of cash) at time t .

C_0 - the capital outlay at the beginning of the investment time ($t = 0$)

Internal Rate of Return (IRR):

The Internal Rate of Return (IRR) is the discount rate that generates a zero net present value for a series of future cash flows. This essentially means that IRR is the rate of return that makes the sum of present value of future cash flows and the final market value of a project (or an investment) equal its current market value.

Generally speaking, the higher a project's internal rate of return, the more desirable it is to undertake the project. As such, IRR can be used to rank several prospective projects under consideration. Assuming all other factors are equal among the various projects, the project with the highest IRR would probably be considered the best and undertaken first.

The IRR is based on the total investment and energy cost savings over the life of the investment, independent of the financing strategy for the investment.

3.6 Community Benefit

The investments in the specific measures have positive local consequences. The community benefits are quantified and presented in the following outcomes:

- 1) **\$\$\$ Avoided Utility Company Payments:** This is the net present value (NPV) of all the avoided electricity and natural gas payments over the 25 year period of the analysis.
- 2) **\$\$\$ Avoided Fuel Payments:** The NPV of the avoided gasoline and diesel fuel payments over the 25 year life of the analysis.
- 3) **\$\$\$ Invested Locally in GHG Projects:** This is the total capital cost of the measures specified for the plan. This analysis does not attempt to separate labor, material, overhead or profit to more accurately identify the percentage of these investments likely to remain local. The inherent overstatement of this result is balanced to a significant degree by discounting the well-documented economic multiplier effect of local investment (no multiplier is used). Bio-diesel purchase is considered 100% local. In practice, this will depend on the supplier. Ethanol is not considered to be a local purchase.

3.7 Measure Evaluation

The decision to include a measure in the action plan is based on a comprehensive appraisal of that measure and its impact on the overall cost/benefits of the Action Plan. To aid in the selection process, each measure has been evaluated and scored for seven metrics listed below. While informative, the scoring of the measures is not binding on the selection process. The results of the Measure Evaluation are presented in the Appendices.

- 1) Cost: The measure is scored by the magnitude of the net capital cost, independent of other considerations.
- 2) Financial Metrics: The measure is scored by the internal rate of return (IRR) and Net Present Value (NPV). IRR and NPV are determined from the investment required for the measure (Net Capital Cost), the annual cost savings and the resulting annual cash flow.
- 3) Resolution of Existing Problems: This metric evaluates how the measure solves existing problems, such as a failing air conditioning system. The replacement of old mechanical units will save maintenance staff time and associated costs (maintenance savings are not calculated in the cash flows).
- 4) Public Visibility: Some measures provide an additional benefit by demonstrating to the general public the actions of the jurisdiction to address global warming. Measures such as Photovoltaic systems are scored high for Public Visibility.
- 5) Employee Impact: The additional burden or inconvenience imposed on city staff is a consideration for any measure under consideration. This metric evaluates this impact. A photovoltaic system has no impact and receives a neutral score of 3. New fleet vehicles will require a change from “business as usual” and results in a lower score. The Commute measure creates transportation options for the City Staff and receives a higher score.
- 6) Energy Cost Stabilization: Energy cost variability is a concern for all jurisdictions. The price volatility of natural gas, and the spike in cost for electricity in 2000-2001 give reason to address this vulnerability. This metric evaluates the impact by measure on the city’s long term energy cost volatility. The highest value is assigned to energy efficiency measures. Energy saved by efficiency has an effective cost of \$0 into the future, as long as the efficiency measure is in place.

4.0 Results

Five plans have been created for consideration by the City of Rohnert Park. These plans consist of numerous measures to reduce GHG emissions, reduce energy costs, address equipment problems, and reduce the volatility of the city's annual energy costs. Summary information is provided below. The Action Plan Evaluation provided in the Appendices provides an analysis of the relative strengths of each combination of measures. Similar information for each measure is also provided.

4.1 GHG Impacts and Plan Financial Results

Table 4 below provides a comparison of each plan. The “% Reduction” is the amount of CO₂e reduced as a percentage of the total city emissions. Plan A, completed projects, indicates a reduction of 10.9% below the year 2000 (baseline) emissions. Plan E provides the measures necessary to reduce the city's emissions by more than 50% below year 2000 emissions. The financial analysis is provided with each plan. The IRR and NPV results are based on the 25 year term of the analysis, from 2007 to 2032.

GHG Action Plan Summary					
Analysis	Plan A	Plan B	Plan C	Plan D	Plan E
% Reduction	10.9%	23.2%	35.6%	42.9%	50.3%
SPB	2.1	0.9	12.4	16.5	20.1
IRR	76.6%	138.2%	15.3%	9.1%	3.4%
NPV	\$1,758,018	\$1,567,607	\$1,286,650	\$1,029,859	(\$357,822)
Annual Cash Flow	Plan A	Plan B	Plan C	Plan D	Plan E
2000	\$0	\$0	\$0	\$0	\$0
2001	\$0	\$0	\$0	\$0	\$0
2002	\$34,014	\$0	\$0	\$0	\$0
2003	\$35,768	\$0	\$0	\$0	\$0
2004	\$37,583	\$0	\$0	\$0	\$0
2005	\$39,463	\$0	\$0	\$0	\$0
2006	\$24,662	\$0	\$0	\$0	\$0
2007	\$15,744	(\$5,000)	(\$5,000)	(\$5,000)	(\$5,000)
2008	\$21,330	\$18,569	\$4,436	\$14,284	\$4,436
2009	\$43,216	\$20,573	\$15,394	(\$40,623)	(\$141,716)
2010	\$49,196	\$31,237	\$34,717	(\$59,748)	(\$155,695)
2011	\$55,383	\$55,621	(\$23,668)	(\$86,206)	(\$224,810)
2012	\$61,783	\$61,166	(\$142,321)	(\$59,559)	(\$240,249)
2013	\$68,406	\$66,911	(\$49,700)	(\$211,145)	(\$391,277)
2014	\$108,060	\$83,896	(\$30,521)	(\$182,259)	(\$362,801)
2015	\$115,149	\$111,332	\$9,031	(\$159,583)	(\$330,695)
2016	\$122,483	\$117,721	\$17,766	(\$74,901)	(\$213,636)
2017	\$130,071	\$124,341	\$26,809	(\$55,182)	(\$194,351)
2018	\$87,728	\$142,132	\$105,826	\$183,602	\$43,535
2019	\$146,045	\$69,443	\$137,864	(\$63,271)	(\$203,787)
2020	\$154,449	\$126,031	\$94,993	\$249,015	\$108,040
2021	\$163,145	\$186,560	\$218,255	\$324,433	\$242,958
2022	\$269,648	\$194,454	\$58,215	(\$1,710,536)	(\$1,831,577)
2023	\$278,956	\$202,630	\$198,365	\$371,752	\$247,540
2024	\$288,587	\$217,606	\$311,636	\$403,119	\$380,161
2025	\$298,552	\$226,375	\$323,567	\$428,815	\$405,358

Table 4: Action Plan Financial Results

The financial analysis is provided with each plan. The critical metrics of Internal Rate of Return (IRR), and Net Present Value (NPV) provide important information to evaluate the worthiness of the investment from a cash flow perspective. It is important to note the large negative net cash flows for Plans D and E in year 2022. These are incurred by a substantial reinvestment in a large photovoltaic (PV) system (replacement of the associated inverters after 12 years), and the replacement of the energy efficient fleet after 10 years of service. The assumption is that the cost of inverters will increase at the generally assumed inflation rate of 3%. However likely advances in technology, and improved economies of scale for the industry suggest this is overly conservative. The aggressive fleet measure assumes all vehicles are repurchased in 2022 (after a 10 year life). In practice, the purchases are phased which would improve the net cash flow for 2022 and decrease the cash flows for surrounding years.

Finally, the actual net cash flow is also provided for each plan in Table 4. Plan A is unique, as it is comprised of only completed projects. Therefore the cashflow includes the cost (debt service) and income (energy cost savings) for the completed measures. However, the cash flow in Table 4 for Plans B through E excludes the financial costs and benefits of completed projects. This allows a clear understanding of the impacts of a “financial decision” in 2007, independent of prior financial decisions.

When the net cash flow associated with the completed projects are added into the financial analysis, the IRR and NPV are improved due to the substantial financial returns of these earlier energy efficiency investments. These results are presented in the Appendices.

4.2 Action Plan Evaluations

The GHG Emission Reduction Action Plans involve more than CO₂e reduction and cash flow. There are critical concerns that should be factored into the decision making process. These include the financial metrics of internal rate of return (IRR) and net present value (NPV) to evaluate the worthiness of the investment; the cost of implementing the measure, some measures come with a large price tag which will challenge liquidity; the degree to which the plan resolves existing problems, such as old, high maintenance air conditioning units; the visibility of the measures to the public, for example the photovoltaic systems are a physical example of actions taken the city and communicate action and commitment to the community. Other key considerations include the employee impacts of new equipment or procedures, which may generate internal opposition; and the impact on the variability of future energy costs and the associated budgetary vulnerability.

Each measure, and the plans as a whole are evaluated by the following considerations:

- Net Capital Cost
- Financial Metrics (IRR and NPV)
- Resolution of Existing Problems
- GHG Impact
- Public Visibility
- Employee Impact
- Energy Cost Stabilization

The results of the evaluation are provided in the Appendices. The individual scores for each category (cost, financial metrics, etc) are aggregated to provide an overall score for that measure. While the results provide important information to be considered when selecting measures, the scores are advisory only. A relatively low score does not preclude a measure, nor should a high score guarantee inclusion of the measure in the Action Plans. There will always be additional considerations that are not reflected in the evaluation process.

4.3 Energy Rate Escalation and Associated Budget Vulnerability

There is considerable discussion about the availability of fossil fuels in the near and middle term future (5 to 20 years). The “Peak Oil” movement suggests that we are at or near the point where our increased global demand for oil cannot be supplied from new petroleum discoveries while production from existing oil fields is waning. Similar arguments are made for natural gas supply vs. demand. If demand outstrips supply, simple economics indicate that the cost to consumers will escalate rapidly, until the global demand is sufficiently dampened and realigns with available supply. The concern is significant enough to have prompted a US government sponsored study to determine the impacts of demand exceeding supply in the near future.¹⁶ This issue has important implications for local Sonoma County jurisdictions. Forty percent of PG&E power is generated by natural gas.¹⁷ A spike in the cost of this energy source will result in significant increases in the cost of electrical power, as well as increased volatility in the cost of natural gas used directly by the City.

Many of the measures available to reduce GHG emissions also will reduce the City electricity and natural gas costs. These costs are a significant element of the municipal budget, and the potential volatility of their costs represents a threat beyond the control of City Staff. Figure 5 below provides the trends for the annual cost of utility supplied electricity and natural gas based on four rate escalation scenarios. The electricity and natural gas related measures contained in this analysis will reduce the vulnerability to utility price increases. These trend lines assume that the City takes no further action to reduce or increase its reliance on utility supplied electricity and natural gas, represented as Plan A in the analysis.

¹⁶ Hirsch, Robert. et al. (February 2005) “Peaking of World Oil Production: Impacts, Mitigation, & Risk Management.” SAIC.

¹⁷ PG&E Power Content: Eligible Renewables: 13%, Coal: 2%, Large Hydro: 17%, Natural Gas 44%, Nuclear: 23%, Other; 1%, California Energy Commission, www.energy.ca.gov/consumer, May 2007.

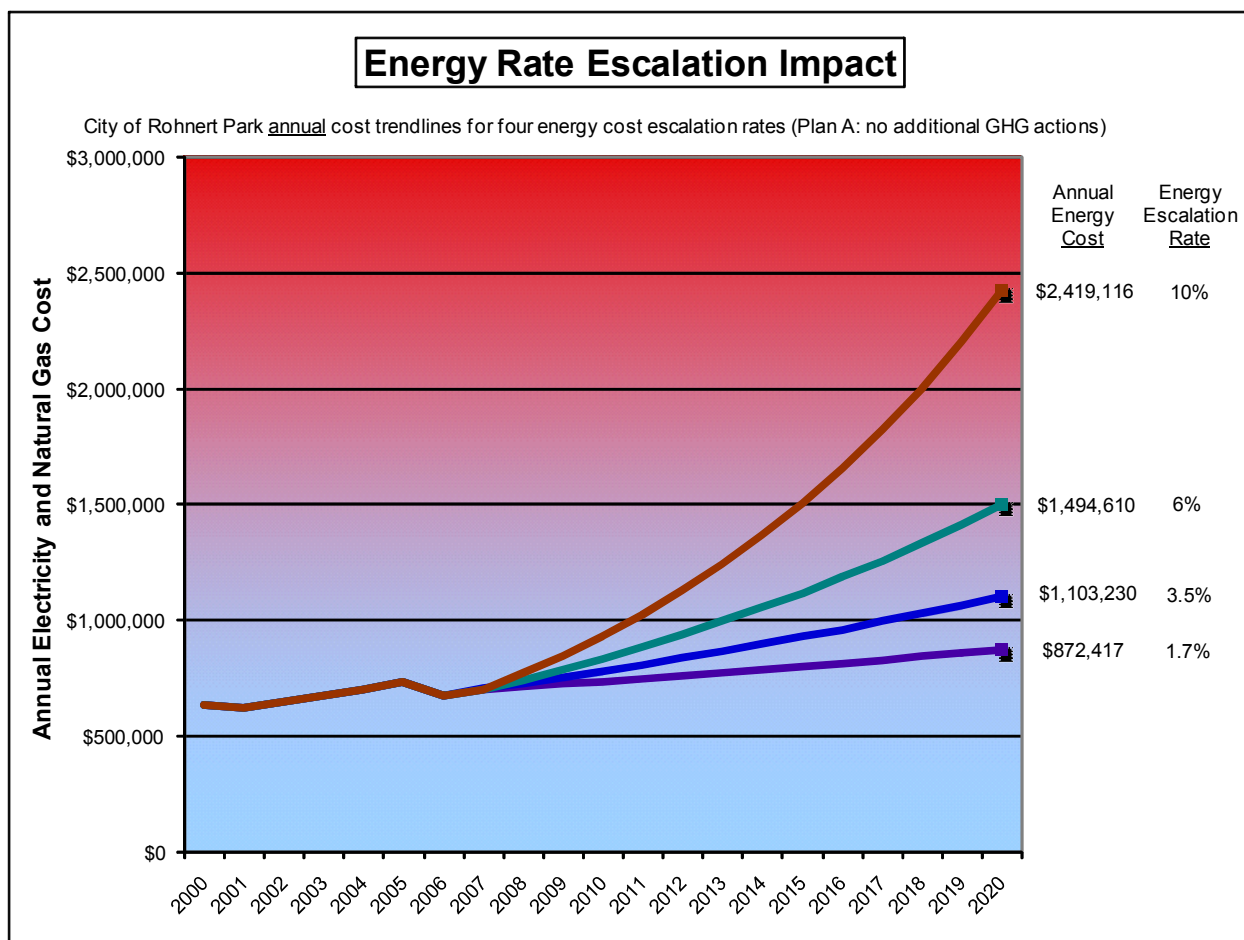


Figure 5: Energy Rate Escalation Scenarios

Energy efficiency projects and photovoltaic energy systems can play a significant role in moderating this vulnerability. Figure 6 below provides potential impact of energy efficiency strategies on the associated vulnerability. For example, under the 3.5% escalation rate scenario, the city would reduce its utility payments by nearly \$400,000 per year (\$1,103,230 - \$703,300) in 2020 by implementing the aggressive Action Plan E. If there were a significant disruption in the supply of energy in California (represented as an energy escalation rate = 10% per year) the City would reduce payments by a significantly greater amount.

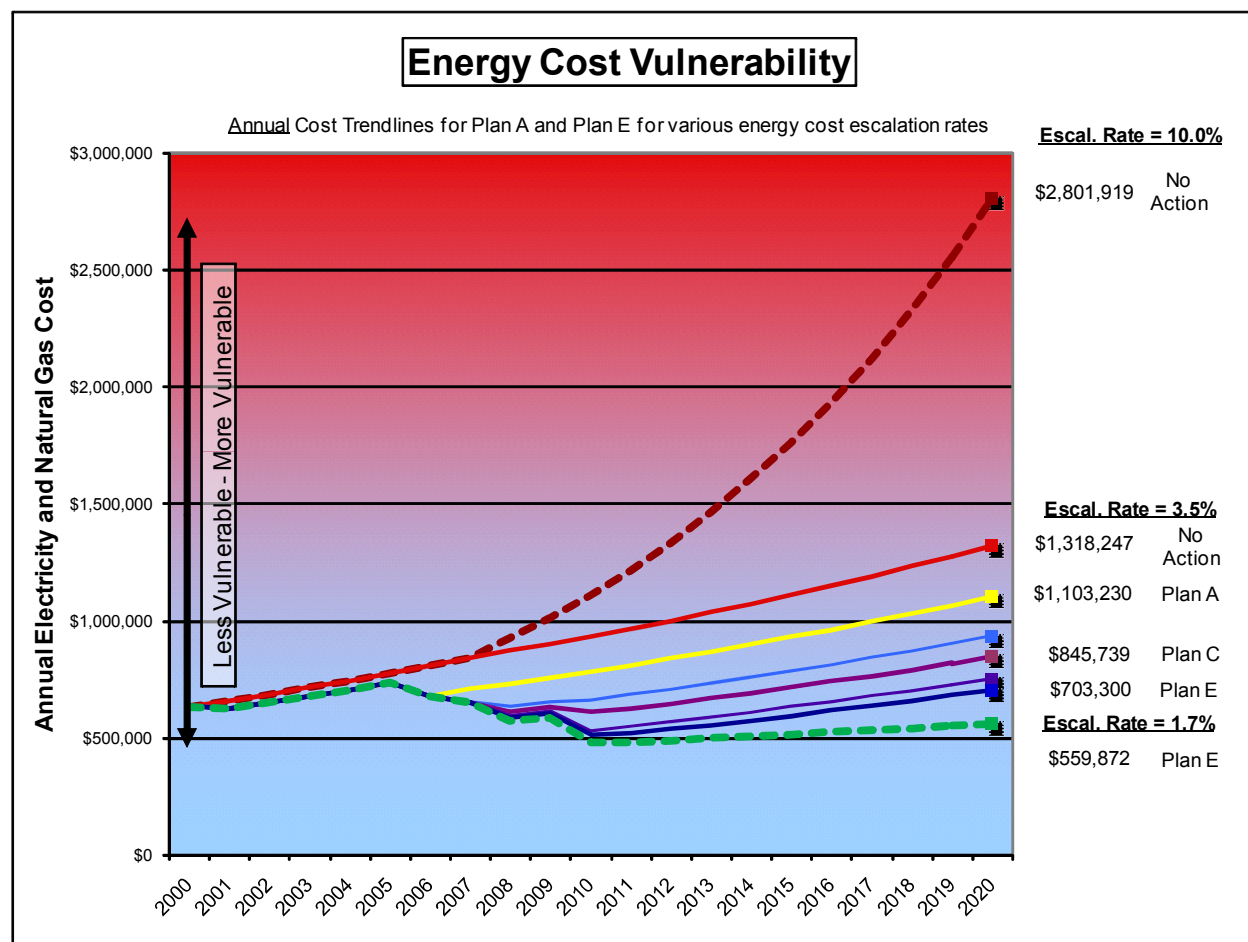


Figure 6: Annual Cost of Energy*

*Note: Labels for Plan B and Plan D are omitted for clarity.

The trend lines compare the outcomes for different approaches to energy savings with a 3.5% annual escalation of energy rates:

- No Action, at an energy escalation rate of 10% (\$2,801,919 annual energy cost in 2020) is represented by the dotted line indicating the annual cost to the city if the city had not pursued any energy saving projects from 2000 to present, and takes no action in the future.
- No Action, at an energy escalation rate of 3.5% (\$1,318,247 annual energy cost in 2020) indicating the escalating energy costs if the city had not pursued any energy savings projects from 2000 to present, and takes no action in the future.
- Plan A, at an energy escalation rate of 3.5% (\$1,103,230) is the annual energy cost including the energy savings achieved by the city staff actions from 2000 to present.
- Plan E (\$703,300) is the same escalation scenario as above, but includes the energy efficiency and photovoltaic measures included in Plan E. This is a reduction of over \$400,000 in energy budgeting uncertainty between Plan A and Plan E at an annual escalation rate of 3.5%.

In summary, an aggressive energy strategy could significantly reduce the city's exposure to the rapidly escalating costs. The investments in energy efficiency and PV energy generation will reduce the uncertainty in future energy cost, which is important when developing long term budget projections.

4.4 Non Efficiency Related Capital Cost Satisfied by Plans

Many of the opportunities to reduce energy consumption, and thereby reduce greenhouse gas emissions, involve the replacement of old, poorly performing equipment. In many cases this equipment is at the end of its useful life and is scheduled to be replaced independently of this analysis. In these situations replacement costs are typically budgeted in the city's Capital Improvement Plan as an expenditure in future years.

However, the energy efficiency packages identified in these plans can be financed using California Energy Commission energy efficiency loans. These loan packages are typically structured to have a net zero cash flow (energy savings = loan payment). The tables below provide the estimated capital investment satisfied by each plan. For example, Plan B specifies the replacement of HVAC equipment which is 25+ years old. The estimated cost to replace this equipment with standard efficiency units is \$112,718. By including this cost in the low interest energy efficiency loan the budgeted capital resources are released for other uses.

Plan A			Plan B			Plan C		
Pending Capital Expense	Total Pending Capital Expenses		Pending Capital Expense	Total Pending Capital Expenses		Pending Capital Expense	Total Pending Capital Expenses	
2000	\$0	Buildings \$0	2000	\$0	Buildings \$112,718	2000	\$0	Buildings \$59,220
2001	\$0		2001	\$0		2001	\$0	
2002	\$0	Fleet \$0	2002	\$0	Fleet \$0	2002	\$0	Fleet \$0
2003	\$0		2003	\$0		2003	\$0	
2004	\$0	Water and \$0	2004	\$0	Water and \$0	2004	\$0	Water and \$0
2005	\$0		2005	\$0		2005	\$0	
2006	\$0	Commute \$0	2006	\$0	Commute \$0	2006	\$0	Commute \$0
2007	\$0		2007	\$59,220		2007	\$59,220	
2008	\$0	PV \$0	2008	\$53,498	PV \$0	2008	\$0	PV \$0
2009	\$0		2009	\$0		2009	\$0	
2010	\$0	Streetlights \$0	2010	\$0	Streetlights \$0	2010	\$0	Streetlights \$0
2011	\$0		2011	\$0		2011	\$0	
2012	\$0		2012	\$0		2012	\$0	
2013	\$0		2013	\$0		2013	\$0	
2014	\$0		2014	\$0		2014	\$0	
2015	\$0		2015	\$0		2015	\$0	

Plan D			Plan E		
Pending Capital	Total Pending		Pending Capital	Total Pending	
2000	\$0	Buildings \$112,718	2000	\$0	Buildings \$112,718
2001	\$0		2001	\$0	
2002	\$0	Fleet \$0	2002	\$0	Fleet \$0
2003	\$0		2003	\$0	
2004	\$0	Water and \$0	2004	\$0	Water and \$0
2005	\$0		2005	\$0	
2006	\$0	Commute \$0	2006	\$0	Commute \$0
2007	\$59,220		2007	\$59,220	
2008	\$53,498	PV \$0	2008	\$53,498	PV \$0
2009	\$0		2009	\$0	
2010	\$0	Streetlights \$0	2010	\$0	Streetlights \$0
2011	\$0		2011	\$0	
2012	\$0		2012	\$0	
2013	\$0		2013	\$0	
2014	\$0		2014	\$0	
2015	\$0		2015	\$0	

Table 5: Capital Expenses Satisfied by Plans

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4.5 Plan Details

Plan A	299	Tons CO2 Avoided	10.9%	GHG Reduction
<u>Community Benefit (over 25 year life of plan)</u>			<u>Financial Metrics</u>	
\$\$\$ Avoided Utility Company Payments	\$3,008,849		SPB: 2.1	
\$\$\$ Avoided Fuel Purchases	\$75,610		IRR: 76.6%	
\$\$\$ Invested Locally in GHG Projects	\$1,377,574		NPV: \$1,758,018	

Plan A: This plan includes all completed projects. There are six measures in the plan, which include building and water pump efficiency improvements, and a photovoltaic project. The cash flow reflects the City’s investment in two significant efficiency projects implemented in 2001 (lighting retrofit) and 2006 (building HVAC, LED traffic signals, and PV). The resulting annual cash flow is the net income to the city (energy cost savings minus project debt service, replacement costs and associated O&M).

The graphics below provides a comprehensive picture of Plan A, including the GHG impacts, the financial metrics, the net cash flow, the GHG emission trend associated with the measures, and the sectors contributing to the reduction.

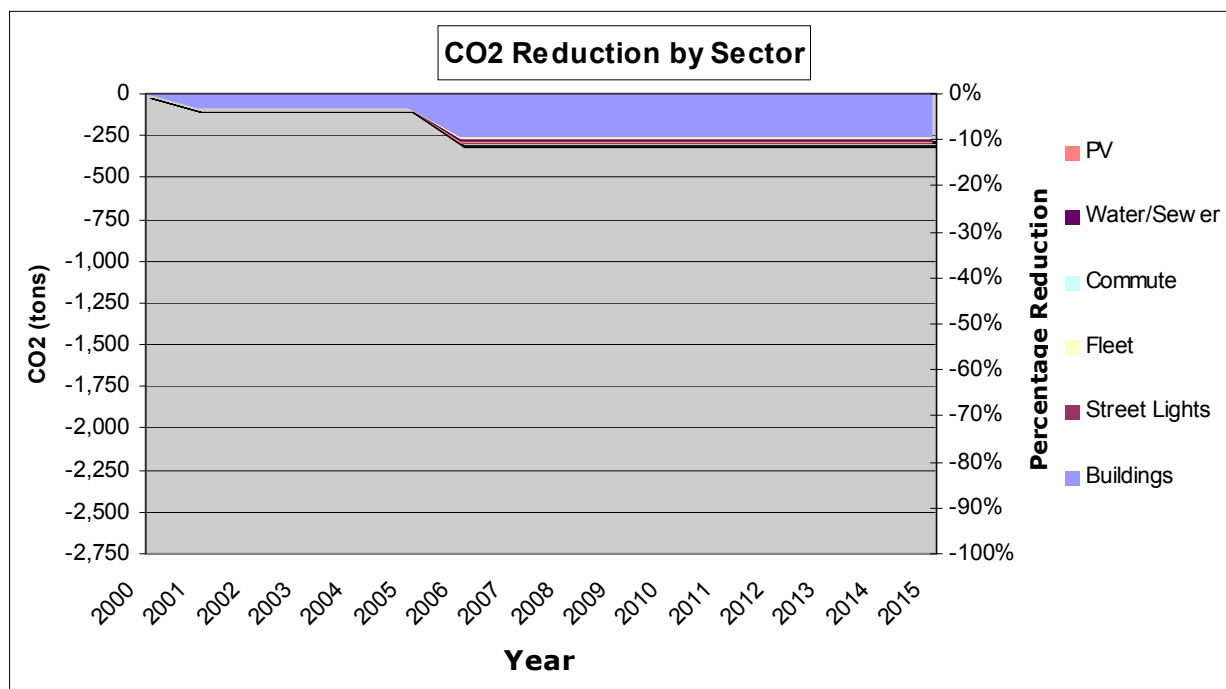


Figure 7: Plan A GHG Emissions Reduction by Sector

The tables below lists the measures included in Plan A, along with the measure status and the net cash flow.

Plan A Cash Flow Analysis				
Year	Cash Flow (gross)	Annual Debt Service Payments	Net Cash Flow	Outstanding Principal
2000	\$0	\$0	\$0	\$0
2001	\$0	\$0	\$0	\$96,850
2002	\$50,120	(\$16,106)	\$34,014	\$84,569
2003	\$51,874	(\$16,106)	\$35,768	\$71,803
2004	\$53,690	(\$16,106)	\$37,583	\$58,533
2005	\$55,569	(\$16,106)	\$39,463	\$44,739
2006	\$40,768	(\$16,106)	\$24,662	\$1,284,354
2007	\$162,159	(\$146,415)	\$15,744	\$1,193,088
2008	\$167,746	(\$146,415)	\$21,330	\$1,098,003
2009	\$173,525	(\$130,309)	\$43,216	\$1,015,046
2010	\$179,505	(\$130,309)	\$49,196	\$928,578
2011	\$185,691	(\$130,309)	\$55,383	\$838,453
2012	\$192,092	(\$130,309)	\$61,783	\$744,513
2013	\$198,714	(\$130,309)	\$68,406	\$646,597
2014	\$205,566	(\$97,506)	\$108,060	\$577,338
2015	\$212,655	(\$97,506)	\$115,149	\$505,055
2016	\$219,989	(\$97,506)	\$122,483	\$429,615
2017	\$227,577	(\$97,506)	\$130,071	\$350,879
2018	\$185,234	(\$97,506)	\$87,728	\$268,703
2019	\$243,551	(\$97,506)	\$146,045	\$182,937
2020	\$251,956	(\$97,506)	\$154,449	\$93,424
2021	\$260,651	(\$97,506)	\$163,145	\$0
2022	\$269,648	\$0	\$269,648	\$0
2023	\$278,956	\$0	\$278,956	\$0
2024	\$288,587	\$0	\$288,587	\$0
2025	\$298,552	\$0	\$298,552	\$0

Measure	Description	Status
Measure 01	APS Measures	Completed
Measure 02	Lighting Retrofit (multi-bldg)	Completed
Measure 06	Pool Covers	Completed
Measure 15	PV APS	Completed
Measure 20	Fleet 2000-2006	Completed
Measure 26	Pump Measures (4 implemented)	Completed

Plan B	639	Tons CO2 Avoided	23.2%	GHG Reduction
<u>Community Benefit (over 25 year life of plan)</u>			<u>Financial Metrics</u>	
\$\$\$ Avoided Utility Company Payments	\$5,175,611		SPB: 1.3	
\$\$\$ Avoided Fuel Purchases	\$767,924		IRR: 108.4%	
\$\$\$ Invested Locally in GHG Projects	\$3,009,917		NPV: \$1,513,334	

Plan B: This plan includes all completed projects, and another 12 measures. The measures include a wide range of projects from building air conditioning to a photovoltaic project. This plan allows the City to meet the target of 20% GHG emissions reduction by 2010. The projected reduction of 23.8% provides flexibility for changing conditions and unforeseen difficulties. The resulting annual cash flow is the net income to the city and represents a net gain for the city in each year after 2007. It is important to note that the addition of any new city facilities would generally be considered GHG producers. The addition of facilities, even those with high efficiency, could jeopardize the ability of Plan B to meet the 20% target reduction.

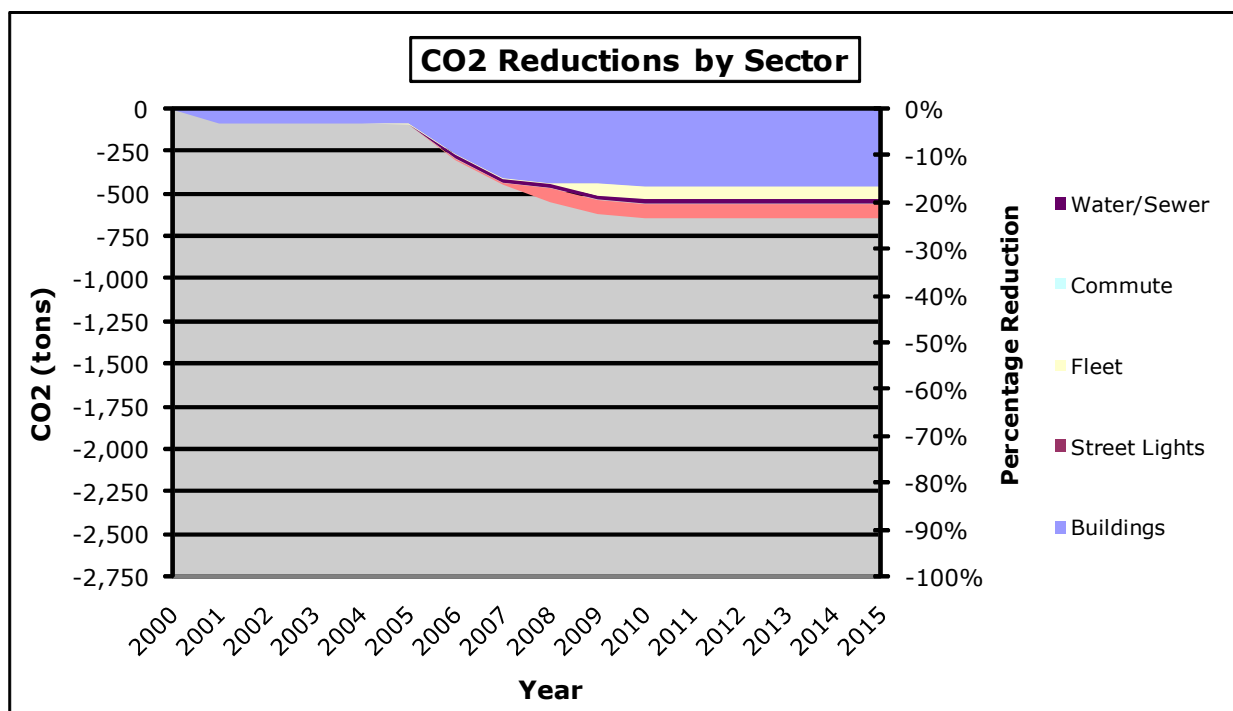


Figure 8: Plan B GHG Emissions Reduction by Sector

The tables below lists the measures included in Plan B, along with the measure status and the net cash flow.

Plan B Cash Flow Analysis				
Year	Cash Flow (gross)	Annual Debt Service Payments	Net Cash Flow	Outstanding Principal
2000	\$0	\$0	\$0	\$0
2001	\$0	\$0	\$0	\$0
2002	\$0	\$0	\$0	\$0
2003	\$0	\$0	\$0	\$0
2004	\$0	\$0	\$0	\$0
2005	\$0	\$0	\$0	\$0
2006	\$0	\$0	\$0	\$0
2007	(\$5,000)	\$0	(\$5,000)	\$116,445
2008	\$51,380	(\$32,811)	\$18,569	\$342,522
2009	\$82,236	(\$61,662)	\$20,573	\$370,389
2010	\$92,389	(\$61,152)	\$31,237	\$389,617
2011	\$127,707	(\$72,086)	\$55,621	\$332,921
2012	\$133,252	(\$72,086)	\$61,166	\$273,985
2013	\$138,997	(\$72,086)	\$66,911	\$212,721
2014	\$144,950	(\$61,054)	\$83,896	\$160,069
2015	\$151,117	(\$39,786)	\$111,332	\$126,607
2016	\$157,507	(\$39,786)	\$117,721	\$91,822
2017	\$164,127	(\$39,786)	\$124,341	\$55,663
2018	\$170,984	(\$28,852)	\$142,132	\$29,010
2019	\$75,950	(\$6,507)	\$69,443	\$23,649
2020	\$132,538	(\$6,507)	\$126,031	\$18,076
2021	\$193,067	(\$6,507)	\$186,560	\$12,282
2022	\$200,962	(\$6,507)	\$194,454	\$6,260
2023	\$209,138	(\$6,507)	\$202,630	\$0
2024	\$217,606	\$0	\$217,606	\$0
2025	\$226,375	\$0	\$226,375	\$0

Measure	Description	Status
Measure 01	APS Measures	Completed
Measure 02	Lighting Retrofit (multi-bldg)	Completed
Measure 03	Building HVAC	Future
Measure 05	Addtl Lighting	Future
Measure 06	Pool Covers	Completed
Measure 07	Decommission Fountain	Future
Measure 08	Boiler Replcmnt Sports Center	Future
Measure 11	Pool Pump Measures	Future
Measure 13	PV-New City Hall	Future
Measure 15	PV APS	Completed
Measure 18	PV6 -CREBS	Future
Measure 20	Fleet 2000-2006	Completed
Measure 21	Biodiesel B20	Future
Measure 23	City Fleet New 1	Future
Measure 26	Pump Measures (4 implemented)	Completed
Measure 28	Pump Measures (Savings criteria \$1500)	Future
Measure 29	Staff Coordinator	Future
Measure 30	APS Public Safety Central DDC	Future

Plan C	978	Tons CO2 Avoided	35.6%	GHG Reduction
<u>Community Benefit (over 25 year life of plan)</u>			<u>Financial Metrics</u>	
\$\$\$ Avoided Utility Company Payments	\$6,776,259		SPB:	12.4
\$\$\$ Avoided Fuel Purchases	\$1,473,872		IRR:	15.3%
\$\$\$ Invested Locally in GHG Projects	\$5,010,979		NPV:	\$1,286,650

Plan C: This plan includes all completed projects and another 17 measures. In addition to many of the measures of Plan B, a wide range of projects are included from building air conditioning to fleet measures. This plan includes additional photovoltaic projects, biodiesel fuel (100%), and ethanol fuel (85%). This plan significantly exceeds the City target of 20% GHG emissions reduction by 2010, yet maintains very attractive financial metrics. The Internal Rate of Return is over 15% and the Net Present Value exceeds \$1,000,000. The annual net cash flow is negative for several years. However, the magnitude appears quite reasonable given the IRR and NPV results.

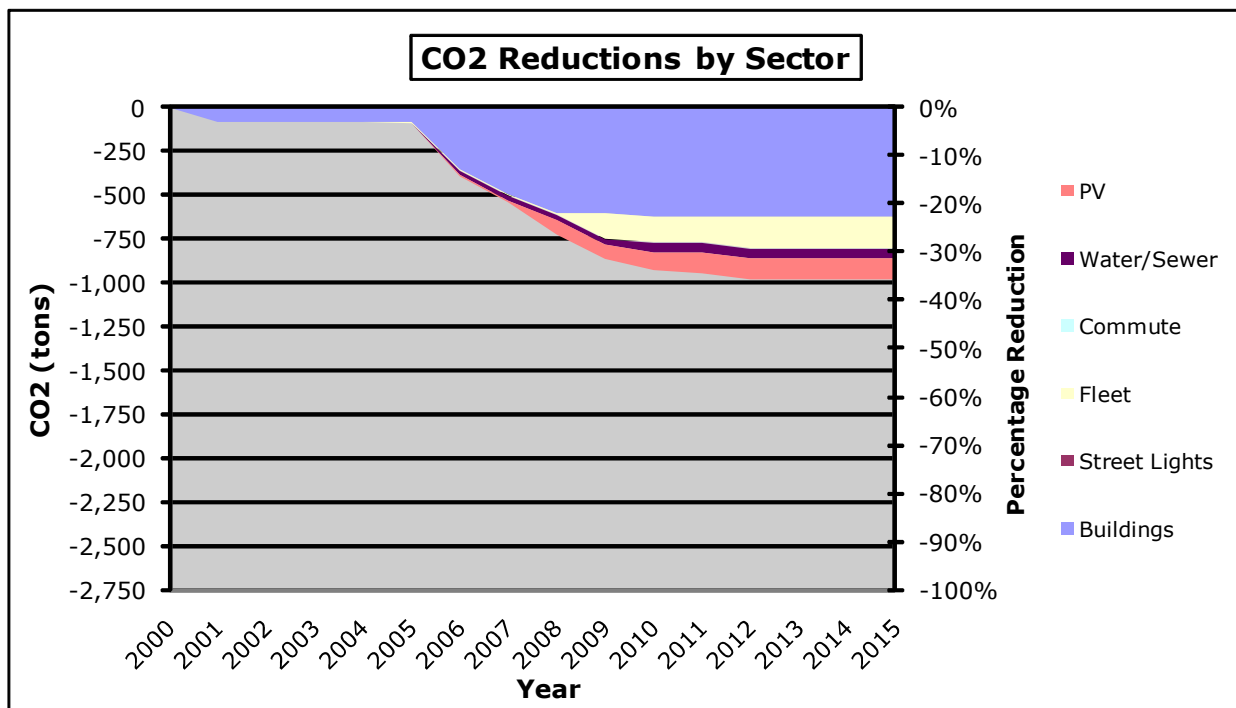


Figure 9: Plan C GHG Emissions Reduction by Sector

The tables below lists the measures included in Plan C, along with the measure status and the net cash flow.

Plan C Cash Flow Analysis				
Year	Cash Flow (gross)	Annual Debt Service Payments	Net Cash Flow	Outstanding Principal
2000	\$0	\$0	\$0	\$0
2001	\$0	\$0	\$0	\$0
2002	\$0	\$0	\$0	\$0
2003	\$0	\$0	\$0	\$0
2004	\$0	\$0	\$0	\$0
2005	\$0	\$0	\$0	\$0
2006	\$0	\$0	\$0	\$0
2007	(\$5,000)	\$0	(\$5,000)	\$208,585
2008	\$51,144	(\$46,708)	\$4,436	\$382,488
2009	\$95,494	(\$80,100)	\$15,394	\$393,496
2010	\$114,306	(\$79,590)	\$34,717	\$1,211,527
2011	\$181,491	(\$205,160)	(\$23,668)	\$1,541,806
2012	\$111,756	(\$254,077)	(\$142,321)	\$1,348,630
2013	\$204,376	(\$254,077)	(\$49,700)	\$1,147,825
2014	\$212,523	(\$243,045)	(\$30,521)	\$950,119
2015	\$220,959	(\$211,928)	\$9,031	\$775,720
2016	\$229,694	(\$211,928)	\$17,766	\$594,433
2017	\$238,737	(\$211,928)	\$26,809	\$405,985
2018	\$248,101	(\$142,274)	\$105,826	\$279,747
2019	\$257,794	(\$119,930)	\$137,864	\$170,867
2020	\$214,923	(\$119,930)	\$94,993	\$57,686
2021	\$278,220	(\$59,965)	\$218,255	\$0
2022	\$58,215	\$0	\$58,215	\$0
2023	\$198,365	\$0	\$198,365	\$0
2024	\$311,636	\$0	\$311,636	\$0
2025	\$323,567	\$0	\$323,567	\$0

Measure	Description	Status
Measure 01	APS Measures	Completed
Measure 02	Lighting Retrofit (multi-bldg)	Completed
Measure 03	Building HVAC	Future
Measure 04	Computer Network Controls	Future
Measure 05	Addtl Lighting	Future
Measure 06	Pool Covers	Completed
Measure 07	Decommission Fountain	Future
Measure 09	Lift Station #1	Future
Measure 10	H-Pool Solar Wtr	Future
Measure 11	Pool Pump Measures	Future
Measure 13	PV-New City Hall	Future
Measure 15	PV APS	Completed
Measure 16	PV4	Future
Measure 17	PV5	Future
Measure 18	PV6 -CREBS	Future
Measure 20	Fleet 2000-2006	Completed
Measure 23	City Fleet New 1	Future
Measure 24	Biodiesel B100	Future
Measure 25	Ethanol E85	Future
Measure 26	Pump Measures (4 implemented)	Completed
Measure 28	Pump Measures (Savings criteria \$1500)	Future
Measure 29	Staff Coordinator	Future
Measure 30	APS Public Safety Central DDC	Future

Plan D	1,179	Tons CO2 Avoided	42.9%	GHG Reduction
<u>Community Benefit (over 25 year life of plan)</u>			<u>% Reduction</u>	
\$\$\$ Avoided Utility Company Payments	\$8,018,672		SPB:	16.5
\$\$\$ Avoided Fuel Purchases	\$2,614,190		IRR:	8.8%
\$\$\$ Invested Locally in GHG Projects	\$7,544,220		NPV:	\$975,586

Plan D: This plan includes all completed projects, and another 18 measures. In addition to many of the measures included in Plan B and C, Plan D includes the wide range of projects from building air conditioning to fleet fuel measures. This plan is less aggressive with PV projects and more aggressive with the fleet purchases and pump efficiency measures, resulting in a doubling of GHG emissions reduction as compared to the City target of 20%. However, these impressive results are not without additional costs, resulting in an Internal Rate of Return under 10%. The Net Present Value remains near \$1,000,000. The annual net cash flow is significantly more challenging than the previous plans.

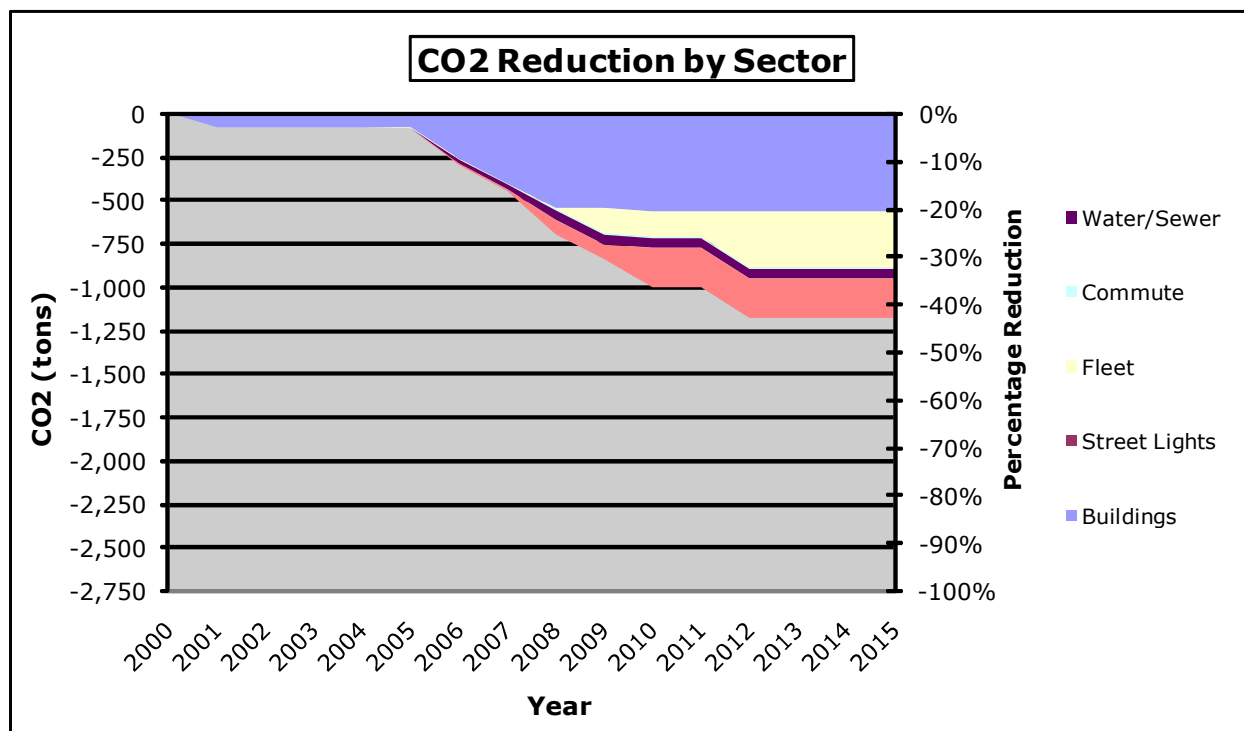


Figure 10: Plan D GHG Emissions Reduction by Sector

The tables below lists the measures included in Plan D, along with the measure status and the net cash flow.

Plan D Cash Flow Analysis				
Year	Cash Flow (gross)	Annual Debt Service Payments	Net Cash Flow	Outstanding Principal
2000	\$0	\$0	\$0	\$0
2001	\$0	\$0	\$0	\$0
2002	\$0	\$0	\$0	\$0
2003	\$0	\$0	\$0	\$0
2004	\$0	\$0	\$0	\$0
2005	\$0	\$0	\$0	\$0
2006	\$0	\$0	\$0	\$0
2007	(\$5,000)	\$0	(\$5,000)	\$149,365
2008	\$51,144	(\$36,859)	\$14,284	\$797,876
2009	\$101,741	(\$142,364)	(\$40,623)	\$1,119,028
2010	\$118,187	(\$177,935)	(\$59,748)	\$4,777,269
2011	\$431,592	(\$517,798)	(\$86,206)	\$4,448,174
2012	\$447,191	(\$506,750)	(\$59,559)	\$5,058,126
2013	\$509,957	(\$721,102)	(\$211,145)	\$4,541,995
2014	\$527,811	(\$710,070)	(\$182,259)	\$4,015,563
2015	\$546,267	(\$705,850)	(\$159,583)	\$3,471,569
2016	\$565,344	(\$640,244)	(\$74,901)	\$2,970,660
2017	\$585,063	(\$640,244)	(\$55,182)	\$2,448,885
2018	\$605,446	(\$421,844)	\$183,602	\$2,123,772
2019	\$336,229	(\$399,500)	(\$63,271)	\$1,808,161
2020	\$595,385	(\$346,370)	\$249,015	\$1,533,213
2021	\$670,803	(\$346,370)	\$324,433	\$1,247,405
2022	(\$1,364,165)	(\$346,370)	(\$1,710,536)	\$950,307
2023	\$718,122	(\$346,370)	\$371,752	\$641,473
2024	\$742,982	(\$339,863)	\$403,119	\$326,949
2025	\$768,678	(\$339,863)	\$428,815	\$0

Measure	Description	Status
Measure 01	APS Measures	Completed
Measure 02	Lighting Retrofit (multi-bldg)	Completed
Measure 03	Building HVAC	Future
Measure 04	Computer Network Controls	Future
Measure 05	Addtl Lighting	Future
Measure 06	Pool Covers	Completed
Measure 07	Decommission Fountain	Future
Measure 08	Boiler Replcmnt Sports Center	Future
Measure 09	Lift Station #1	Future
Measure 10	H-Pool Solar Wtr	Future
Measure 11	Pool Pump Measures	Future
Measure 12	City Fleet New 2	Future
Measure 13	PV-New City Hall	Future
Measure 14	PV Supplying 100% Wtr &Wste Energy Cost	Future
Measure 15	PV APS	Completed
Measure 18	PV6 -CREBS	Future
Measure 19	Commute	Future
Measure 20	Fleet 2000-2006	Completed
Measure 22	Fleet Natural Gas Conversions	Future
Measure 24	Biodiesel B100	Future
Measure 26	Pump Measures (4 implemented)	Completed
Measure 27	Pump Measures (Savings criteria \$800)	Future
Measure 29	Staff Coordinator	Future
Measure 30	APS Public Safety Central DDC	Future

Plan E	1,384	Tons CO2 Avoided	50.3%	GHG Reduction
<u>Community Benefit (over 25 year life of plan)</u>			<u>Financial Metrics</u>	
\$\$\$ Avoided Utility Company Payments	\$8,983,255		SPB: 20.1	
\$\$\$ Avoided Fuel Purchases	\$2,927,243		IRR: 3.4%	
\$\$\$ Invested Locally in GHG Projects	\$8,980,626		NPV: (\$357,822)	

Plan E: This plan includes all completed projects, and another 20 measures. All measures are implemented to their maximum identified potential. Two PV projects (measures 16 and 17) are doubled in size, to 60 kWac. The resulting reduction in GHG emissions approaches 50% by 2012. Yet, this strategy yields in a challenging cash flow and a low IRR of 3.4%. The NPV is negative, due in large part to the poor economics of the two PV projects mentioned above. The implementation date of 2011 of these projects is after the CPUC¹⁸ incentives are projected to expire. However, this plan provides the greatest security against energy cost escalations as detailed in Figure 6 discussed in the Energy Cost Vulnerability section.

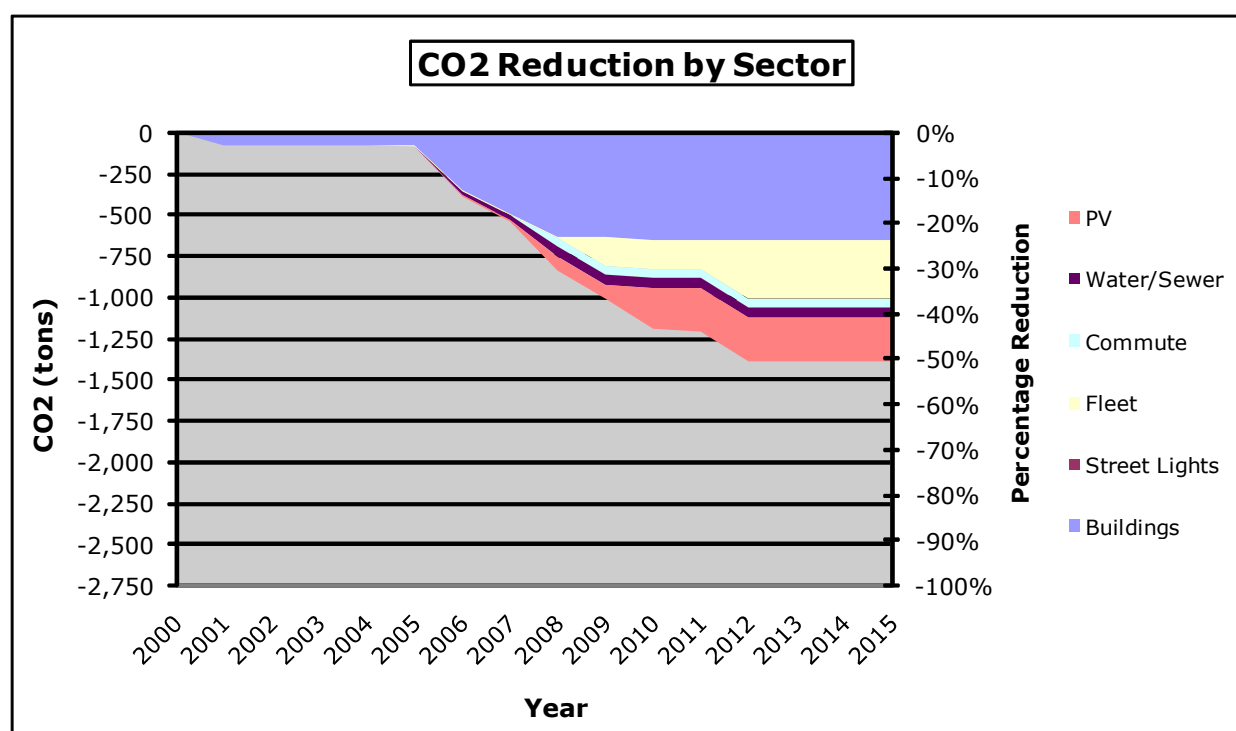


Figure 11: Plan E GHG Emissions Reduction by Sector

¹⁸ California Public Utilities Commission

The tables below lists the measures included in Plan E, along with the measure status and the net cash flow.

Plan E Cash Flow Analysis				
Year	Cash Flow (gross)	Annual Debt Service Payments	Net Cash Flow	Outstanding Principal
2000	\$0	\$0	\$0	\$0
2001	\$0	\$0	\$0	\$0
2002	\$0	\$0	\$0	\$0
2003	\$0	\$0	\$0	\$0
2004	\$0	\$0	\$0	\$0
2005	\$0	\$0	\$0	\$0
2006	\$0	\$0	\$0	\$0
2007	(\$5,000)	\$0	(\$5,000)	\$208,585
2008	\$51,144	(\$46,708)	\$4,436	\$1,046,834
2009	\$43,299	(\$185,015)	(\$141,716)	\$1,335,169
2010	\$64,891	(\$220,586)	(\$155,695)	\$5,446,880
2011	\$395,604	(\$620,414)	(\$224,810)	\$5,529,200
2012	\$429,082	(\$669,331)	(\$240,249)	\$6,017,273
2013	\$491,951	(\$883,228)	(\$391,277)	\$5,376,892
2014	\$509,395	(\$872,196)	(\$362,801)	\$4,721,304
2015	\$527,432	(\$858,127)	(\$330,695)	\$4,052,903
2016	\$546,083	(\$759,719)	(\$213,636)	\$3,455,476
2017	\$565,368	(\$759,719)	(\$194,351)	\$2,833,375
2018	\$585,309	(\$541,774)	\$43,535	\$2,403,519
2019	\$315,642	(\$519,430)	(\$203,787)	\$1,979,028
2020	\$574,341	(\$466,300)	\$108,040	\$1,590,900
2021	\$649,293	(\$406,335)	\$242,958	\$1,247,405
2022	(\$1,485,207)	(\$346,370)	(\$1,831,577)	\$950,307
2023	\$593,910	(\$346,370)	\$247,540	\$641,473
2024	\$720,024	(\$339,863)	\$380,161	\$326,949
2025	\$745,221	(\$339,863)	\$405,358	\$0

Measure	Description	Status
Measure 01	APS Measures	Completed
Measure 02	Lighting Retrofit (multi-bldg)	Completed
Measure 03	Building HVAC	Future
Measure 04	Computer Network Controls	Future
Measure 05	Addtl Lighting	Future
Measure 06	Pool Covers	Completed
Measure 07	Decommission Fountain	Future
Measure 08	Boiler Replcmnt Sports Center	Future
Measure 09	Lift Station #1	Future
Measure 10	H-Pool Solar Wtr	Future
Measure 11	Pool Pump Measures	Future
Measure 12	City Fleet New 2	Future
Measure 13	PV-New City Hall	Future
Measure 14	PV Supplying 100% Wtr & Wste Energy Cost	Future
Measure 15	PV APS	Completed
Measure 16	PV4	Future
Measure 17	PV5	Future
Measure 18	PV6 -CREBS	Future
Measure 19	Commute	Future
Measure 20	Fleet 2000-2006	Completed
Measure 22	Fleet Natural Gas Conversions	Future
Measure 24	Biodiesel B100	Future
Measure 26	Pump Measures (4 implemented)	Completed
Measure 27	Pump Measures (Savings criteria \$800)	Future
Measure 29	Staff Coordinator	Future
Measure 30	APS Public Safety Central DDC	Future

5.0 Measure Details

Table 6 below provides a complete list of the measures considered in this analysis along with the financial data and results for each. The individual measures are described in the Measure Results section of this report. Note that some measures have options that are not represented in this table. These options are detailed in the Measure Results section.

Description	Net Capital Cost	O&M Incremental Cost	Annual Cost Savings	Annual CO2 Reduction	Simple Payback	IRR	Net Present Value	% of Total GHG
APS Measures	\$920,216	(\$2,982)	\$54,228	235,782	17.0	7.3%	\$250,036	4.08%
Lighting Retrofit (multi-bldg)	\$96,850	\$0	\$48,425	163,309	2.0	55.2%	\$869,197	2.82%
Building HVAC	\$25,380	\$0	\$6,090	20,538	4.2	28.2%	\$96,740	0.35%
Computer Network Controls	\$4,138	\$0	\$2,500	8,431	1.7	66.0%	\$45,694	0.15%
Addtl Lighting	\$46,698	\$0	\$11,750	38,303	4.9	24.3%	\$178,109	0.66%
Pool Covers	\$18,738	\$0	\$10,087	124,470	1.9	59.2%	\$182,417	2.15%
Decommission Fountain	\$15,000	\$0	\$11,406	38,467	1.3	82.2%	\$212,175	0.66%
Boiler Replcmnt Sports Center	\$72,604	\$0	\$4,777	58,943	15.2	7.9%	\$25,688	1.02%
Lift Station #1	\$32,920	\$0	\$3,770	12,714	8.7	14.4%	\$43,497	0.22%
H-Pool Solar Wtr	\$30,688	\$0	\$16,982	209,555	1.8	60.8%	\$307,931	3.62%
Pool Pump Measures	\$33,140	0	\$13,340	44,988	2.5	45.2%	\$233,291	0.78%
City Fleet New 2	\$941,000	\$0	\$45,493	353,646	20.7	NA	(\$1,441,768)	6.11%
PV-New City Hall	\$181,684	\$632	\$5,145	19,181	35.3	6.1%	\$15,214	0.33%
PV Supplying 100% Wtr & Wste energy cost	\$3,791,975	\$9,476	\$142,763	287,720	26.6	8.6%	\$1,369,901	4.97%
PV APS	\$136,491	\$599	\$9,029	18,198	15.1	14.2%	\$154,123	0.31%
PV4	\$199,421	\$599	\$4,881	18,198	40.9	1.2%	(\$63,444)	0.31%
PV5	\$199,421	\$599	\$4,881	18,198	40.9	1.2%	(\$63,444)	0.31%
PV6 -CREBS	\$0	\$0	\$34,298	127,876	0.0	NA	\$1,303,182	2.21%
Commute	\$0	\$75,000	\$0	100,355	NA	NA	(\$1,404,117)	1.73%
Fleet 2000-2006	\$0	\$0	\$1,925	12,833	NA	NA	\$38,219	0.22%
Biodiesel B20	\$5,000	\$0	\$80	35,163	NA	NA	(\$3,175)	0.61%
Fleet Natural Gas Conversions	\$432,000	\$0	\$19,493	165,196	22.2	NA	(\$334,160)	2.86%
City Fleet New 1	\$76,000	\$0	\$15,416	102,774	4.9	19.5%	\$124,702	1.78%
Biodiesel B100	\$5,000	\$0	\$1,323	116,417	NA	NA	\$21,503	2.01%
Ethanol E85	\$96,000	\$0	-\$11,247	68,617	NA	NA	(\$452,398)	1.19%
Pump Measures (4 implemented)	\$197,247	\$0	\$12,758	43,027	15.5	7.7%	\$65,452	0.74%
Pump Measures (Savings criteria \$800)	\$394,494	\$0	\$15,366	51,819	25.7	3.3%	(\$70,638)	0.90%
Pump Measures (Savings criteria \$1500)	\$65,749	\$0	\$3,561	12,010	18.5	6.1%	\$8,089	0.21%
Staff Coordinator	\$0	\$50,000	\$0	0	NA	NA	(\$747,032)	0.00%
APS Public Safety Central DDC	\$5,000	\$0	\$18,463	182,314	0.3	385.7%	\$361,795	3.15%

Table 6: List of Measures

5.1 Measure Selection

Each Plan is comprised of measures from the tables above. The makeup of each plan is provided in the table below. A “y” in the column under the Action Plan (A –E) in the first five columns indicates that the measure is included in that plan. Action Plan A is comprised of 6 measures, which have already been implemented. Action Plan E is comprised of 26 individual measures.

Action Plan					Measure Summary	Description	Status
A	B	C	D	E			
y	y	y	y	y	Measure 1	APS Measures	Completed
y	y	y	y	y	Measure 2	Lighting Retrofit (multi-bldg)	Completed
n	y	y	y	y	Measure 3	Building HVAC	Future
n	n	y	y	y	Measure 4	Computer Network Controls	Future
n	y	y	y	y	Measure 5	Addtl Lighting	Future
y	y	y	y	y	Measure 6	Pool Covers	Completed
n	y	y	y	y	Measure 7	Decommission Fountain	Future
n	y	n	y	y	Measure 8	Boiler Replcmnt Sports Center	Future
n	n	y	y	y	Measure 9	Lift Station #1	Future
n	n	y	y	y	Measure 10	H-Pool Solar Wtr	Future
n	y	y	y	y	Measure 11	Pool Pump Measures	Future
n	n	n	y	y	Measure 12	City Fleet New 2	Future
n	y	y	y	y	Measure 13	PV-New City Hall	Future
n	n	n	y	y	Measure 14	PV Supplying 100% Wtr &Wste Energy Cost	Future
y	y	y	y	y	Measure 15	PV APS	Completed
n	n	y	n	y	Measure 16	PV4	Future
n	n	y	n	y	Measure 17	PV5	Future
n	y	y	y	y	Measure 18	PV6 -CREBS	Future
n	n	n	y	y	Measure 19	Commute	Future
y	y	y	y	y	Measure 20	Fleet 2000-2006	Completed
n	y	n	n	n	Measure 21	Biodiesel B20	Future
n	n	n	y	y	Measure 22	Fleet Natural Gas Conversions	Future
n	y	y	n	n	Measure 23	City Fleet New 1	Future
n	n	y	y	y	Measure 24	Biodiesel B100	Future
n	n	y	n	n	Measure 25	Ethanol E85	Future
y	y	y	y	y	Measure 26	Pump Measures (4 implemented)	completed
n	n	n	y	y	Measure 27	Pump Measures (Savings criteria \$800)	Future
n	y	y	n	n	Measure 28	Pump Measures (Savings criteria \$1500)	Future
n	y	y	y	y	Measure 29	Staff Coordinator	future
n	y	y	y	y	Measure 30	APS Public Safety Central DDC	Future
6	18	23	24	26			

Table 7: Plan Compositions

5.2 Measures Results

The measures considered for inclusion in the plans are described below. Each measure includes a table indicating which Action Plans include that measure. For example, Measure 3 - HVAC Measures is included in Plans B, C, D, and E as indicated by “y” under each plan. However, this measure is not included in Action Plan A.

Action Plan				
A	B	C	D	E
n	y	y	y	y

The description of each measure also includes a table listing the results of the measure: the cost of implementation, the annual savings, the GHG impact and the financial metrics of simple payback, internal rate of return (IRR) and net present value (NPV). Again using Measure 3- HVAC as an example:

Measure Summary	Description	Net Capital Cost	O&M incremental Cost	Annual Cost Savings	Annual CO2 Reduction	Simple Payback	IRR	Net Present Value	% of Total GHG
Measure 03	Building HVAC	\$25,380	\$0	\$6,090	20,538	4.2	28.2%	\$96,740	0.35%

Finally, each measure description includes the Selection Evaluation table to enable a comprehensive appraisal and relational comparison of the benefits of each opportunity. The complete table of measure evaluations is provided in the Appendices. The Selection Evaluation table for Measure 3 is provided below as an example:

Selection Evaluation (5=favorable, 3= neutral, 0=not favorable)							
Cost	Financial Metrics	Resolution of Existing Problem	GHG Impact	Public Visibility	Employee Impact	Energy Cost Stabilization	Measure Score
5	4	5	1	3	3	5	26

Table 8: Example Measure Evaluation Table

The measures considered in this analysis are listed in the following pages, with a brief description of each. The inputs, assumptions and results are provided for each measure in the Appendices.

Action Plan				
A	B	C	D	E
y	y	y	y	y

1-APS Energy Services (Implementation Date: 2006)

Measure Summary	Description	Net Capital Cost	O&M incremental Cost	Annual Cost Savings	Annual CO2 Reduction	Simple Payback	IRR	Net Present Value	% of Total GHG
Measure 01	APS Measures	\$920,216	(\$2,982)	\$54,228	235,782	17.0	7.3%	\$250,036	4.08%

These measures were identified in the "City of Rohnert Park Technical Energy Audit Report" APS Energy Services, May, 2005. This analysis assumes that all measures were implemented in 2006 except as noted below. The 30kW PV project was implemented and is evaluated individually to allow for reporting by sector.

The following projects were included in the APS recommendations.

- 1) LED Pedestrian Crossing Lights
- 2) Programmable Thermostats
- 3) HVAC Direct Digital Controls (DDC) and Retro-Commissioning (RCx) (not implemented, but included in this analysis as measure 30)
- 4) HVAC Condensing Units
- 5) Economizers and VSDs
- 6) Vending Mizers
- 7) 30kW Photovoltaic System for Sports Center (included as measure 15)
- 8) HVAC Rooftop Servicing

The cost for this package (\$907,257) and the annual energy savings estimate (337,833 kWh) reflect the cost and savings provided in the APS report, after the 30kW Photovoltaic System for the Sports Center is removed for separate analysis as Measure 15.

The table below provides the comprehensive evaluation of this measure. This analysis assigns values between 0 and 5 for seven important aspects of the measures. The maximum measure score is 31. The minimum score is 14. The average score of all measures is 22.6. The median score is 22.5.

Selection Evaluation (5=favorable, 3= neutral, 0=not favorable)							
Cost	Financial Metrics	Resolution of Existing Problem	GHG Impact	Public Visibility	Employee Impact	Energy Cost Stabilization	Measure Score
0	4	4	5	3	3	5	24

Measure 1 is included all plans as a completed measure.

Action Plan				
A	B	C	D	E
y	y	y	y	y

2-Lighting Upgrades -Chevron Energy Service (Implementation Date: 2001)

Measure Summary	Description	Net Capital Cost	O&M incremental Cost	Annual Cost Savings	Annual CO2 Reduction	Simple Payback	IRR	Net Present Value	% of Total GHG
Measure 02	Lighting Retrofit (multi-bldg)	\$96,850	\$0	\$48,425	163,309	2.0	55.2%	\$869,197	2.82%

These measures were identified in the *Draft Plan: City of Rohnert Park Building Energy Efficiency and Greenhouse Gas* and based on the Chevron Energy Services lighting retrofit project implemented in 2001. This analysis assumes that all measures identified in the associated report were implemented. The cost for this measure is not available. However, an assumed cost has been developed from the cost savings information provided by Staff. A simple payback (SPB) of 2.0 years as applied to the savings to determine an estimate of the project cost for this analysis. A SPB of 2.0 for lighting projects is a conservative estimate.

The buildings and facilities involved include:

- 1) Sports Center
- 2) Swimming Pool
- 3) Main Station
- 4) Parks
- 5) Spreckels Performing Arts Center
- 6) Animal Shelter
- 7) Senior Center

The table below provides the results for this measure for the Selection Matrix. This analysis assigns values between 0 and 5 for seven important aspects of the measures. The maximum measure score is 31. The minimum score is 14. The average score of all measures is 22.6, and the median score is 22.5.

Selection Evaluation (5=favorable, 3= neutral, 0=not favorable)							
Cost	Financial Metrics	Resolution of Existing Problem	GHG Impact	Public Visibility	Employee Impact	Energy Cost Stabilization	Measure Score
3	4	5	5	3	4	5	29

Action Plan				
A	B	C	D	E
n	y	y	y	y

3-HVAC Measures (Implementation Date: 2007)

Description	Net Capital Cost	O&M incremental Cost	Annual Cost Savings	Annual CO2 Reduction	Simple Payback	IRR	Net Present Value	% of Total GHG
Building HVAC	\$25,380	\$0	\$6,090	20,538	4.2	28.2%	\$96,740	0.35%

The APS report identified numerous HVAC measures serving several buildings for possible retrofit. The report did not provide the cost or savings associated with these recommendations. However, the ABAG EW program has quantified the projected cost and potential savings for three Community Center units.

The table below provides the comprehensive evaluation of this measure. This analysis assigns values between 0 and 5 for seven important aspects of the measures. The maximum measure score is 31. The minimum score is 14. The average score of all measures is 22.6. The median score is 22.5.

Selection Evaluation (5=favorable, 3= neutral, 0=not favorable)							
Cost	Financial Metrics	Resolution of Existing Problem	GHG Impact	Public Visibility	Employee Impact	Energy Cost Stabilization	Measure Score
5	4	5	1	3	3	5	26

Action Plan				
A	B	C	D	E
n	n	y	y	y

4-Computer Network Controls (Implementation Date: 2008)

Description	Net Capital Cost	O&M incremental Cost	Annual Cost Savings	Annual CO2 Reduction	Simple Payback	IRR	Net Present Value	% of Total GHG
Computer Network Controls	\$4,138	\$0	\$2,500	8,431	1.7	66.0%	\$45,694	0.15%

This measure was identified in the "City of Rohnert Park Technical Energy Audit Report" APS Energy Services, May, 2005. This measure has not been implemented, and cost and savings were specified. However, an estimated savings of \$25 per unit is estimated based on discussions with ABAG EW. The number of computer units (CPU) is estimated to be 100. Support for this measure is available from PG&E via ABAG EW. The project cost of \$5,000 is a rough estimate. This measure is available for evaluation by the ABAG EW program.

The table below provides the comprehensive evaluation of this measure. This analysis assigns values between 0 and 5 for seven important aspects of the measures. The maximum measure score is 31. The minimum score is 14. The average score of all measures is 22.6. The median score is 22.5.

Selection Evaluation (5=favorable, 3= neutral, 0=not favorable)							
Cost	Financial Metrics	Resolution of Existing Problem	GHG Impact	Public Visibility	Employee Impact	Energy Cost Stabilization	Measure Score
5	5	2	1	3	2	5	23

Action Plan				
A	B	C	D	E
n	y	y	y	y

5- Lighting Retrofit (T8 first generation to T8 third generation)

(Implementation Date: 2007)

Description	Net Capital Cost	O&M incremental Cost	Annual Cost Savings	Annual CO2 Reduction	Simple Payback	IRR	Net Present Value	% of Total GHG
Addtl Lighting	\$46,698	\$0	\$11,750	38,303	4.9	24.3%	\$178,109	0.66%

The Chevron Energy Services lighting retrofit implemented in 2001 replaced building T-12 lighting with first generation T-8 linear fluorescent lamps and electronic ballasts. The results of this retrofit are presented in Measure 1 above. Since then, T-8 lighting technology has advanced considerably which provides the opportunity for considerable savings by replacing the T-8 first generation lighting with new third generation T-8 technology lamps and ballasts. This measure has been recommended by the ABAG EW program.¹⁹ They are available to support the City Staff in implementation.

The table below provides the comprehensive evaluation of this measure. This analysis assigns values between 0 and 5 for seven important aspects of the measures. The maximum measure score is 31. The minimum score is 14. The average score of all measures is 22.6. The median score is 22.5.

Selection Evaluation (5=favorable, 3= neutral, 0=not favorable)							
Cost	Financial Metrics	Resolution of Existing Problem	GHG Impact	Public Visibility	Employee Impact	Energy Cost Stabilization	Measure Score
4	5	3	3	3	3	5	26

¹⁹ Draft Preliminary Audit Report for City of Rohnert Park Facilities, ABAG EW, June 1, 2007

Action Plan				
A	B	C	D	E
y	y	y	y	y

6- Pool Covers (Implementation Date: 2006)

Description	Net Capital Cost	O&M incremental Cost	Annual Cost Savings	Annual CO2 Reduction	Simple Payback	IRR	Net Present Value	% of Total GHG
Pool Covers	\$18,738	\$0	\$10,087	124,470	1.9	59.2%	\$182,417	2.15%

Pools lose heat energy in a variety of ways, but evaporation is by far the largest source of energy loss for swimming pools. When compared to evaporation, all other losses are small. The reason evaporation has such an impact is that evaporating water requires large amounts of energy. Evaporation is approximately 70% of the heat loss from a pool. Pool covers will reduce energy consumption by 40 to 60%, reduce make-up water by 30-50% and reduce the pool’s chemical consumption by 35-60%.²⁰

This measure is now being utilized consistently at all pools and is considered a completed measure for this analysis.

The table below provides the comprehensive evaluation of this measure. This analysis assigns values between 0 and 5 for seven important aspects of the measures. The maximum measure score is 31. The minimum score is 14. The average score of all measures is 22.6. The median score is 22.5.

Selection Evaluation (5=favorable, 3= neutral, 0=not favorable)							
Cost	Financial Metrics	Resolution of Existing Problem	GHG Impact	Public Visibility	Employee Impact	Energy Cost Stabilization	Measure Score
5	5	3	5	4	2	5	29

²⁰ Draft Preliminary Audit Report for City of Rohnert Park Facilities, ABAG EW, June 1, 2007, pg 9.

Action Plan				
A	B	C	D	E
n	y	y	y	y

7-Decommissioning the Community Center Fountain (Implementation

Date: 2010)

Description	Net Capital Cost	O&M incremental Cost	Annual Cost Savings	Annual CO2 Reduction	Simple Payback	IRR	Net Present Value	% of Total GHG
Decommission Fountain	\$15,000	\$0	\$11,406	38,467	1.3	82.2%	\$212,175	0.66%

This measure was identified in the APS report but not implemented. It is listed in the CIP for decommissioning in 2006-07. This measure may be implemented in 2007, rather than the assumed 2010 date, which will improve the overall cash flow of Plans B through E.

The table below provides the comprehensive evaluation of this measure. This analysis assigns values between 0 and 5 for seven important aspects of the measures. The maximum measure score is 31. The minimum score is 14. The average score of all measures is 22.6. The median score is 22.5.

Selection Evaluation (5=favorable, 3= neutral, 0=not favorable)							
Cost	Financial Metrics	Resolution of Existing Problem	GHG Impact	Public Visibility	Employee Impact	Energy Cost Stabilization	Measure Score
5	5	3	3	3	3	5	27

Action Plan				
A	B	C	D	E
n	n	n	y	y

8-Replacement of Sport Center Boiler (Implementation Date: 2008)

Description	Net Capital Cost	O&M incremental Cost	Annual Cost Savings	Annual CO2 Reduction	Simple Payback	IRR	Net Present Value	% of Total GHG
Boiler Replcmnt Sports Center	\$72,604	\$0	\$4,777	58,943	15.2	7.9%	\$25,688	1.02%

This measure was identified in the "City of Rohnert Park Technical Energy Audit Report" APS Energy Services, May, 2005. This measure has not been implemented. Rough cost and savings were provided by ABAG EW, based on an assumed 20% energy savings, and the natural gas consumption of the Sports Center. This measure is available for evaluation by the ABAG EW program. Staff identified the following 25 year old units as needing replacement: (1) 300k BTU watertube boiler supplying hydronic system; (1) 300k BTU watertube boiler supplying domestic HW.

The table below provides the comprehensive evaluation of this measure. This analysis assigns values between 0 and 5 for seven important aspects of the measures. The maximum measure score is 31. The minimum score is 14. The average score of all measures is 22.6. The median score is 22.5.

Selection Evaluation (5=favorable, 3= neutral, 0=not favorable)							
Cost	Financial Metrics	Resolution of Existing Problem	GHG Impact	Public Visibility	Employee Impact	Energy Cost Stabilization	Measure Score
3	4	5	4	3	3	5	27

Action Plan				
A	B	C	D	E
n	n	y	y	y

9- Waste Water Lift Station #1 (Implementation Date: 2007)

Description	Net Capital Cost	O&M incremental Cost	Annual Cost Savings	Annual CO2 Reduction	Simple Payback	IRR	Net Present Value	% of Total GHG
Lift Station #1	\$32,920	\$0	\$3,770	12,714	8.7	14.4%	\$43,497	0.22%

City Staff has identified the sewage pump station #1 as a likely opportunity for energy savings. A preliminary review by ABAG EW outlines the measure:

Retrofitting the two 60 HP pumps with VFDs and new inverter duty motors will reduce energy consumption by approximately 26,000 kWh/year assuming the VFD is 10% more efficient than a magnetic pickup drive.²¹

The table below provides the comprehensive evaluation of this measure. This analysis assigns values between 0 and 5 for seven important aspects of the measures. The maximum measure score is 31. The minimum score is 14. The average score of all measures is 22.6. The median score is 22.5.

Selection Evaluation (5=favorable, 3= neutral, 0=not favorable)							
Cost	Financial Metrics	Resolution of Existing Problem	GHG Impact	Public Visibility	Employee Impact	Energy Cost Stabilization	Measure Score
5	4	4	2	3	3	5	26

²¹ Draft Preliminary Audit Report for City of Rohnert Park Facilities, ABAG EW, June 1, 2007, pg 11.

Action Plan				
A	B	C	D	E
n	n	y	y	y

10-Solar Water Heating for H-Pool (Implementation Date: 2008)

Description	Net Capital Cost	O&M incremental Cost	Annual Cost Savings	Annual CO2 Reduction	Simple Payback	IRR	Net Present Value	% of Total GHG
H-Pool Solar Wtr	\$30,688	\$0	\$16,982	209,555	1.8	60.8%	\$307,931	3.62%

This measure was identified in the "City of Rohnert Park Technical Energy Audit Report" APS Energy Services, May, 2005. This measure has not been implemented, and cost and savings have been estimated using general assumptions identified in the measure inputs in the Appendices.

The table below provides the comprehensive evaluation of this measure. This analysis assigns values between 0 and 5 for seven important aspects of the measures. The maximum measure score is 31. The minimum score is 14. The average score of all measures is 22.6. The median score is 22.5.

Selection Evaluation (5=favorable, 3= neutral, 0=not favorable)							
Cost	Financial Metrics	Resolution of Existing Problem	GHG Impact	Public Visibility	Employee Impact	Energy Cost Stabilization	Measure Score
5	4	2	5	5	3	5	29

Action Plan				
A	B	C	D	E
n	y	y	y	y

11-Pool Pump Measures (Implementation Date: 2007)

Description	Net Capital Cost	O&M incremental Cost	Annual Cost Savings	Annual CO2 Reduction	Simple Payback	IRR	Net Present Value	% of Total GHG
Pool Pump Measures	\$33,140	0	\$13,340	44,988	2.5	45.2%	\$233,291	0.78%

There are several measures available to reduce the energy consumption of the pools. These include limiting the filtration pumping to meet public health regulatory requirements and adding VFDs on the pumps. A preliminary review by ABAG EW outlines the measure:

We recommend installing controllers that cycle the pumps at night as well as installing variable frequency drives (VFDs) on the pool pumps so that the pump flow rates can be varied over the day...Estimated savings for the addition of pump speed control is 50% of current kWh or about 92,000 kWh per year.²²

The table below provides the comprehensive evaluation of this measure. This analysis assigns values between 0 and 5 for seven important aspects of the measures. The maximum measure score is 31. The minimum score is 14. The average score of all measures is 22.6. The median score is 22.5.

Selection Evaluation (5=favorable, 3= neutral, 0=not favorable)							
Cost	Financial Metrics	Resolution of Existing Problem	GHG Impact	Public Visibility	Employee Impact	Energy Cost Stabilization	Measure Score
3	5	2	5	4	2	5	26

²² Draft Preliminary Audit Report for City of Rohnert Park Facilities, ABAG EW, June 1, 2007, pg 8.

Action Plan				
A	B	C	D	E
n	n	n	y	y

12- New Fleet Purchase Strategy 2 (Implementation Date: 2012)

Description	Net Capital Cost	O&M incremental Cost	Annual Cost Savings	Annual CO2 Reduction	Simple Payback	IRR	Net Present Value	% of Total GHG
City Fleet New 2	\$941,000	\$0	\$45,493	353,646	20.7	NA	(\$1,441,768)	6.11%

This is a very aggressive strategy which maximizes the potential fleet GHG emissions reductions by directing future fleet purchases to the most energy efficiency purchases. The high cost vs. energy cost savings results in both a negative IRR and NPV. However, the implementation date of this measure is 2012. There are rapidly emerging electric vehicle opportunities based on the lithium battery, as demonstrated by the PG&E commitment to the Phoenix pilot program. These opportunities should expand and be available for consideration within the life of these Action Plans. More information on road worthy electric vehicles is provided in Appendices. The full fleet list for each fleet measure is also provided in the appendices.

The following substitutions are included in this measure, affecting 46 unit purchases. The last entry Neighborhood Electric Vehicle (NEV) was applied to one unit. This strategy can be expanded for units driven less than 30 miles per day. Furthermore, advances in battery technology just entering the market will expand the range of these vehicles.

Strategy				
Original	Replacement	Fuel	MPG/ MPkWh	Incremental Cost
Taurus	Prius	Gasoline	48.0	4000
Escape	Escape Hybrid	Gasoline	30.0	4000
Explorer	Escape Hybrid	Gasoline	30.0	4000
Expedition	Phoenix SUV	Electric	3.7	15,000
Sonoma	Phoenix SUT	Electric	3.7	31,000
Accord	Prius	Gasoline	48.0	4000
Ranger	Phoenix SUT	Electric	3.7	31,000
2500 SL	Phoenix SUT	Electric	3.7	21,000
Selected	NEV	Electric	5	-2000

The table below provides the comprehensive evaluation of this measure. This analysis assigns values between 0 and 5 for seven important aspects of the measures. The maximum measure score is 31. The minimum score is 14. The average score of all measures is 22.6. The median score is 22.5.

Selection Evaluation (5=favorable, 3= neutral, 0=not favorable)							
Cost	Financial Metrics	Resolution of Existing Problem	GHG Impact	Public Visibility	Employee Impact	Energy Cost Stabilization	Measure Score
0	0	2	5	5	1	4	17

Action Plan				
A	B	C	D	E
n	y	y	y	y

13-Photovoltaic System on new City Hall (Implementation Date: 2008)

Description	Net Capital Cost	O&M incremental Cost	Annual Cost Savings	Annual CO2 Reduction	Simple Payback	IRR	Net Present Value	% of Total GHG
PV-New City Hall	\$181,684	\$632	\$5,145	19,181	35.3	2.5%	(\$39,715)	0.33%

A 30kW (ac) system will be included on the new City Hall building due to be occupied December 2007.

The table below provides the comprehensive evaluation of this measure. This analysis assigns values between 0 and 5 for seven important aspects of the measures. The maximum measure score is 31. The minimum score is 14. The average score of all measures is 22.6. The median score is 22.5.

Selection Evaluation (5=favorable, 3= neutral, 0=not favorable)							
Cost	Financial Metrics	Resolution of Existing Problem	GHG Impact	Public Visibility	Employee Impact	Energy Cost Stabilization	Measure Score
0	2	3	2	5	3	5	20

Action Plan				
A	B	C	D	E
y	y	y	y	y

14-Photovoltaic Systems to offset metered usage at water system pumps (Implementation Date: 2010)

Description	Net Capital Cost	O&M incremental Cost	Annual Cost Savings	Annual CO2 Reduction	Simple Payback	IRR	Net Present Value	% of Total GHG
PV Supplying 100% Wtr &Wste energy cost	\$3,791,975	\$9,476	\$142,763	287,720	26.6	7.1%	\$880,685	4.97%

Photovoltaic (PV) systems are available for electricity generation to offset the energy consumption of water pumping. This strategy has been successfully used within other Sonoma County enterprise funds, providing a positive cash flow to the fund by financing the measure with an appropriately long term for repayment. The application of PV systems to water supply pumping situations is particularly attractive due the ability to schedule the majority of the pumping at night when energy rates are low (utilizing the capacity of the storage tanks). The PV systems generate energy during the day when it is most valuable. Therefore the energy produced is much more valuable than the energy purchased from the utility for that meter. This advantage is reflected in the attractive IRR and NPV relative to the financial metrics of PV measures 16 and 17.

The table below provides the comprehensive evaluation of this measure. This analysis assigns values between 0 and 5 for seven important aspects of the measures. The maximum measure score is 31. The minimum score is 14. The average score of all measures is 22.6. The median score is 22.5.

Selection Evaluation (5=favorable, 3= neutral, 0=not favorable)							
Cost	Financial Metrics	Resolution of Existing Problem	GHG Impact	Public Visibility	Employee Impact	Energy Cost Stabilization	Measure Score
0	4	3	5	5	3	5	25

Action Plan				
A	B	C	D	E
y	y	y	y	y

15-Photovoltaic System (APS) Sports Center (Implementation Date: 2006)

Description	Net Capital Cost	O&M incremental Cost	Annual Cost Savings	Annual CO2 Reduction	Simple Payback	IRR	Net Present Value	% of Total GHG
PV APS	\$136,491	\$599	\$9,029	18,198	15.1	14.2%	\$154,123	0.31%

A photovoltaic (30kWac) system was installed as part of the APS energy efficiency package and completed in 2006. The cost and rebate are based on the current values. This measure was included in the comprehensive APS package. The cost and energy savings have been disaggregated to allow reporting by sector (building, PV, etc).

The table below provides the comprehensive evaluation of this measure. This analysis assigns values between 0 and 5 for seven important aspects of the measures. The maximum measure score is 31. The minimum score is 14. The average score of all measures is 22.6. The median score is 22.5.

Selection Evaluation (5=favorable, 3= neutral, 0=not favorable)							
Cost	Financial Metrics	Resolution of Existing Problem	GHG Impact	Public Visibility	Employee Impact	Energy Cost Stabilization	Measure Score
3	4	3	2	5	3	5	25

Action Plan				
A	B	C	D	E
n	n	y	n	y

16-Photovoltaic System (Implementation Date: 2010)

Strategy A

Photovoltaic (30kWac) system installation which would offset the kWh consumption of a city building, installed on the existing roof or as a parking shade structure. *Strategy A was not included in any of the action plans, but is available for analysis.*

Description	Net Capital Cost	O&M incremental Cost	Annual Cost Savings	Annual CO2 Reduction	Simple Payback	IRR	Net Present Value	% of Total GHG
PV4	\$199,421	\$599	\$4,881	18,198	40.9	1.2%	(\$63,444)	0.31%

Selection Evaluation (5=favorable, 3= neutral, 0=not favorable)							
Cost	Financial Metrics	Resolution of Existing Problem	GHG Impact	Public Visibility	Employee Impact	Energy Cost Stabilization	Measure Score
0	0	3	2	5	3	5	18

Strategy B

Photovoltaic (60 kWac) system installation which would offset the kWh consumption of a city building, installed on the existing roof or as a parking shade structure. This strategy is included in Action Plan C and E. The negative IRR and NPV reflect the diminishing CPUC incentives over the next few years. The current incentive programs will end prior to the implementation date of 2010. However, the CPUC may refund the PV incentive programs, which would improve the financial metrics of this opportunity.

Measure Summary	Description	Net Capital Cost	O&M incremental Cost	Annual Cost Savings	Annual CO2 Reduction	Simple Payback	IRR	Net Present Value	% of Total GHG
Measure 16	PV4	\$487,583	\$1,215	\$9,894	36,887	49.3	-0.4%	(\$207,986)	0.64%

Selection Evaluation (5=favorable, 3= neutral, 0=not favorable)							
Cost	Financial Metrics	Resolution of Existing Problem	GHG Impact	Public Visibility	Employee Impact	Energy Cost Stabilization	Measure Score
0	0	3	2	5	3	5	18

Action Plan				
A	B	C	D	E
n	n	y	n	y

17-Photovoltaic System (Implementation Date: 2011)
 (note: this is a duplicate of measure 16)

Strategy A

Photovoltaic (30kWac) system installation which would offset the kWh consumption of a city building, installed on the existing roof or as a parking shade structure. This strategy was not included in any of the action plans, but is available for analysis.

Description	Net Capital Cost	O&M incremental Cost	Annual Cost Savings	Annual CO2 Reduction	Simple Payback	IRR	Net Present Value	% of Total GHG
PV4	\$199,421	\$599	\$4,881	18,198	40.9	1.2%	(\$63,444)	0.31%

Selection Evaluation (5=favorable, 3= neutral, 0=not favorable)							
Cost	Financial Metrics	Resolution of Existing Problem	GHG Impact	Public Visibility	Employee Impact	Energy Cost Stabilization	Measure Score
0	0	3	2	5	3	5	18

Strategy B

Photovoltaic (60 kWac) system installation which would offset the kWh consumption of a city building, installed on the existing roof or as a parking shade structure. This strategy is included in Action Plan C and E. The negative IRR and NPV reflect the diminishing CPUC incentives over the next few years. The current incentive programs will end prior to the implementation date of 2011. However, the CPUC may refund the PV incentive programs, which would improve the financial metrics of this opportunity.

Measure Summary	Description	Net Capital Cost	O&M incremental Cost	Annual Cost Savings	Annual CO2 Reduction	Simple Payback	IRR	Net Present Value	% of Total GHG
Measure 16	PV4	\$487,583	\$1,215	\$9,894	36,887	49.3	-0.4%	(\$207,986)	0.64%

Selection Evaluation (5=favorable, 3= neutral, 0=not favorable)							
Cost	Financial Metrics	Resolution of Existing Problem	GHG Impact	Public Visibility	Employee Impact	Energy Cost Stabilization	Measure Score
0	0	3	2	5	3	5	18

Action Plan				
A	B	C	D	E
n	y	y	y	y

18- CREBS funded Photovoltaic Systems (Implementation Date: 2008)

Description	Net Capital Cost	O&M incremental Cost	Annual Cost Savings	Annual CO2 Reduction	Simple Payback	IRR	Net Present Value	% of Total GHG
PV6 -CREBS	\$0	\$0	\$34,298	127,876	0.0	NA	\$1,303,182	2.21%

Clean Renewable Energy Bonds (CREBS) are IRS enabled tax free bonds for renewable energy allowing the installation of photovoltaic systems at no cost to the City. These can be installed on existing buildings and on parking shade structures. The “rights” to the power are assigned to the bondholders and a power purchase agreement is established with the city. The rate is set marginally below the utility rate. At the end of the term of the contract the rights to the power revert back to the city for the remainder of the life of the system. This analysis is based on total of 200kW ac, installed as numerous smaller systems (~30kW) on city owned facilities yet to be defined.

The table below provides the comprehensive evaluation of this measure. This analysis assigns values between 0 and 5 for seven important aspects of the measures. The maximum measure score is 31. The minimum score is 14. The average score of all measures is 22.6. The median score is 22.5.

Selection Evaluation (5=favorable, 3= neutral, 0=not favorable)							
Cost	Financial Metrics	Resolution of Existing Problem	GHG Impact	Public Visibility	Employee Impact	Energy Cost Stabilization	Measure Score
5	5	3	5	5	3	5	31

Action Plan				
A	B	C	D	E
n	n	n	y	y

19-Commute Reduction (Implementation Date: 2008)

Description	Net Capital Cost	O&M incremental Cost	Annual Cost Savings	Annual CO2 Reduction	Simple Payback	IRR	Net Present Value	% of Total GHG
Commute	\$0	\$75,000	\$0	100,355	NA	NA	(\$1,404,117)	1.73%

The general assumptions of a transit demand management (TDM) program are based on the documented cost and impact of successful programs provided in published case studies. This analysis assumes a minimal investment of \$75k per year resulting in an impact of 20% on the commuting patterns of city employees. A general summary of commute programs is provided in the appendices. Further study is recommended to allow a more aggressive analysis of commute program impacts.

The table below provides the comprehensive evaluation of this measure. This analysis assigns values between 0 and 5 for seven important aspects of the measures. The maximum measure score is 31. The minimum score is 14. The average score of all measures is 22.6. The median score is 22.5.

Selection Evaluation (5=favorable, 3= neutral, 0=not favorable)							
Cost	Financial Metrics	Resolution of Existing Problem	GHG Impact	Public Visibility	Employee Impact	Energy Cost Stabilization	Measure Score
3	3	3	3	3	4	3	22

Action Plan				
A	B	C	D	E
y	y	y	y	y

20- City Fleet 2000 to 2007 (Single retired vehicle, not replaced)

(Implementation Date: 2005)

Description	Net Capital Cost	O&M incremental Cost	Annual Cost Savings	Annual CO2 Reduction	Simple Payback	IRR	Net Present Value	% of Total GHG
Fleet 2000-2006	\$0	\$0	\$1,925	12,833	NA	NA	\$0	0.22%

This measure documents the elimination of one vehicle from the City fleet, from the baseline year of 2000 to the present (based on best available information). This is a completed measure, which does not have a significant impact on the results of this analysis.

Selection Evaluation (5=favorable, 3= neutral, 0=not favorable)							
Cost	Financial Metrics	Resolution of Existing Problem	GHG Impact	Public Visibility	Employee Impact	Energy Cost Stabilization	Measure Score
3	3	3	2	3	3	3	20

Action Plan				
A	B	C	D	E
n	y	n	n	n

21-Fleet use of Biodiesel (B20) (Implementation Date: 2009)

Description	Net Capital Cost	O&M incremental Cost	Annual Cost Savings	Annual CO2 Reduction	Simple Payback	IRR	Net Present Value	% of Total GHG
Biodiesel B20	\$5,000	\$0	\$80	35,163	NA	NA	(\$3,175)	0.61%

This measure changes the fuel mix for all diesel vehicles to a 20/80% (biodiesel/diesel) blend for all fleet vehicles currently using diesel fuel. Biodiesel is now readily available at a reasonable price allowing rapid implementation of this GHG reduction strategy. This analysis assumes \$4.00 per gallon and \$5,000 for infrastructure improvements (tanks, etc). Local prices are now \$3.05 per gallon, similar to the cost of standard diesel fuel. Therefore, the annual cost and NPV will actually be closer to zero.

The table below provides the comprehensive evaluation of this measure. This analysis assigns values between 0 and 5 for seven important aspects of the measures. The maximum measure score is 31. The minimum score is 14. The average score of all measures is 22.6. The median score is 22.5.

Selection Evaluation (5=favorable, 3= neutral, 0=not favorable)							
Cost	Financial Metrics	Resolution of Existing Problem	GHG Impact	Public Visibility	Employee Impact	Energy Cost Stabilization	Measure Score
3	2	2	3	4	2	2	18

Action Plan				
A	B	C	D	E
n	n	n	y	y

22- Fleet use of Compressed Natural Gas (CNG)

(Implementation Date: 2009)

Description	Net Capital Cost	O&M incremental Cost	Annual Cost Savings	Annual CO2 Reduction	Simple Payback	IRR	Net Present Value	% of Total GHG
Fleet Natural Gas Conversions	\$432,000	\$0	\$19,493	165,196	22.2	NA	(\$334,160)	2.86%

This measure specifies the use of Compressed Natural Gas in the Crown Victoria units (PD patrol). The implementation date is aggressive, assuming that all units would be converted to CNG by 2009. The IRR and NPV are both negative for this measure.

The table below provides the comprehensive evaluation of this measure. This analysis assigns values between 0 and 5 for seven important aspects of the measures. The maximum measure score is 31. The minimum score is 14. The average score of all measures is 22.6. The median score is 22.5.

Selection Evaluation (5=favorable, 3= neutral, 0=not favorable)							
Cost	Financial Metrics	Resolution of Existing Problem	GHG Impact	Public Visibility	Employee Impact	Energy Cost Stabilization	Measure Score
0	0	2	5	4	2	1	14

Action Plan				
A	B	C	D	E
n	y	y	n	n

23- Purchase of Fuel Efficient Vehicles (Implementation Date: 2009)

Description	Net Capital Cost	O&M incremental Cost	Annual Cost Savings	Annual CO2 Reduction	Simple Payback	IRR	Net Present Value	% of Total GHG
City Fleet New 1	\$76,000	\$0	\$15,416	102,774	4.9	19.5%	\$124,702	1.78%

This is a less aggressive fleet purchase strategy which relies on more energy efficiency fleet purchases. The full fleet list for each fleet measure is provided in the appendices.

The following fleet purchase substitutions are included in this measure, affecting 19 unit purchases.

Strategy				
Original	Replacement	Fuel	MPG/MPkWh	Incremental Cost
Taurus	Prius	Gasoline	48	\$4,000
Escape	Escape Hybrid	Gasoline	30	\$4,000
Explorer	Escape Hybrid	Gasoline	30	\$4,000
Expedition	Escape Hybrid	Gasoline	30	\$4,000

The table below provides the comprehensive evaluation of this measure. This analysis assigns values between 0 and 5 for seven important aspects of the measures. The maximum measure score is 31. The minimum score is 14. The average score of all measures is 22.6. The median score is 22.5.

Selection Evaluation (5=favorable, 3= neutral, 0=not favorable)							
Cost	Financial Metrics	Resolution of Existing Problem	GHG Impact	Public Visibility	Employee Impact	Energy Cost Stabilization	Measure Score
3	4	3	4	5	2	4	25

Action Plan				
A	B	C	D	E
n	n	y	y	y

24- Fleet use of Biodiesel (B100) (Implementation Date: 2009)

Measure 24 is based on two strategies. Strategy A assumes 100% biodiesel is utilized in all diesel vehicles model year 1995 and later. It is assumed that no conversion is required for these vehicles. As the price of biodiesel is now on par with diesel, a new development since the analysis was completed, the annual cost savings and NPV will be closer to zero. Strategy B assumes that all diesel units utilize 100% biodiesel, requiring the conversion of rubber hoses in the model years earlier than 1995. Again, the cost of biodiesel is on par with diesel. Therefore the annual cost savings will be closer to zero. The cost of the tanks is assumed to be \$5,000.

Strategy A (All Diesel Vehicles model year 1995 and later) utilized in Plan D.

Description	Net Capital Cost	O&M incremental Cost	Annual Cost Savings	Annual CO2 Reduction	Simple Payback	IRR	Net Present Value	% of Total GHG
Biodiesel B100	\$5,000	\$0	\$1,323	116,417	NA	NA	\$21,503	2.01%

This strategy assumes that 11 units are fueled with 100% biodiesel. The table below provides the comprehensive evaluation of this measure. This analysis assigns values between 0 and 5 for seven important aspects of the measures. The maximum measure score is 31. The minimum score is 14. The average score of all measures is 22.6. The median score is 22.5.

Selection Evaluation (5=favorable, 3= neutral, 0=not favorable)							
Cost	Financial Metrics	Resolution of Existing Problem	GHG Impact	Public Visibility	Employee Impact	Energy Cost Stabilization	Measure Score
3	1	2	5	4	2	2	19

Strategy B (All Diesel Vehicles, conversion kits required for model years earlier than 1995) utilized in Plans C and E.

Description	Net Capital Cost	O&M incremental Cost	Annual Cost Savings	Annual CO2 Reduction	Simple Payback	IRR	Net Present Value	% of Total GHG
Biodiesel B100	\$11,000	\$0	\$1,998	175,817	NA	NA	\$29,191	3.04%

This strategy assumes that 16 units are fueled with 100% biodiesel.

Selection Evaluation (5=favorable, 3= neutral, 0=not favorable)							
Cost	Financial Metrics	Resolution of Existing Problem	GHG Impact	Public Visibility	Employee Impact	Energy Cost Stabilization	Measure Score
3	1	2	5	4	2	2	19

Action Plan				
A	B	C	D	E
n	n	y	n	n

25- Fleet use of Ethanol (E85) (Implementation Date: 2012)

Description	Net Capital Cost	O&M incremental Cost	Annual Cost Savings	Annual CO2 Reduction	Simple Payback	IRR	Net Present Value	% of Total GHG
Ethanol E85	\$96,000	\$0	-\$11,247	68,617	NA	NA	(\$452,398)	1.19%

This measure assumes the use of of 85% / 15% mix of ethanol/gasoline (E85) in all Crown Victoria units (PD patrol). Flex fuel versions of this model are available. The implementation date of 2012 allows for the conversion as new units are purchased.

The table below provides the comprehensive evaluation of this measure. This analysis assigns values between 0 and 5 for seven important aspects of the measures. The maximum measure score is 31. The minimum score is 14. The average score of all measures is 22.6. The median score is 22.5.

Selection Evaluation (5=favorable, 3= neutral, 0=not favorable)							
Cost	Financial Metrics	Resolution of Existing Problem	GHG Impact	Public Visibility	Employee Impact	Energy Cost Stabilization	Measure Score
2	0	2	4	4	2	1	15

Action Plan				
A	B	C	D	E
y	y	y	y	y

26- Water Supply Pump Measures Completed (Implementation Date: 2006)

Description	Net Capital Cost	O&M incremental Cost	Annual Cost Savings	Annual CO2 Reduction	Simple Payback	IRR	Net Present Value	% of Total GHG
Pump Measures (4 implemented)	\$197,247	\$0	\$12,758	43,027	15.5	NA	\$0	0.74%

All water supply pumps were tested for efficiency resulting in the retrofit of four pump stations.

The table below provides the comprehensive evaluation of this measure. This analysis assigns values between 0 and 5 for seven important aspects of the measures. The maximum measure score is 31. The minimum score is 14. The average score of all measures is 22.6. The median score is 22.5.

Selection Evaluation (5=favorable, 3= neutral, 0=not favorable)							
Cost	Financial Metrics	Resolution of Existing Problem	GHG Impact	Public Visibility	Employee Impact	Energy Cost Stabilization	Measure Score
1	3	3	3	3	3	5	21

Action Plan				
A	B	C	D	E
n	n	n	y	y

27-Water Supply Pump Measures (Implementation Date: 2008)

The remaining water supply pumps, tested but not retrofitted are considered for energy efficiency improvements. Strategy A sets the annual energy savings at the minimal level of \$500 for selection for retrofit. This aggressive approach is more costly, but yields the greatest benefits. Strategy B sets the annual energy savings criteria of selection at \$800 which results in fewer pumps meeting the criteria.

Strategy A: \$500 savings required for selection, utilized in Plan E (a pump list is provided in the appendices).

Description	Net Capital Cost	O&M incremental Cost	Annual Cost Savings	Annual CO2 Reduction	Simple Payback	IRR	Net Present Value	% of Total GHG
Pump Measures (Savings criteria \$500)	\$591,741	\$0	\$19,431	65,530	30.5	2.0%	(\$177,775)	1.13%

Selection Evaluation (5=favorable, 3= neutral, 0=not favorable)							
Cost	Financial Metrics	Resolution of Existing Problem	GHG Impact	Public Visibility	Employee Impact	Energy Cost Stabilization	Measure Score
0	1	3	4	3	3	5	19

Strategy B: \$800 Savings required for selection, utilized in Plan D and E.

Description	Net Capital Cost	O&M incremental Cost	Annual Cost Savings	Annual CO2 Reduction	Simple Payback	IRR	Net Present Value	% of Total GHG
Pump Measures (Savings criteria \$800)	\$394,494	\$0	\$15,366	51,819	25.7	3.3%	(\$70,638)	0.90%

Selection Evaluation (5=favorable, 3= neutral, 0=not favorable)							
Cost	Financial Metrics	Resolution of Existing Problem	GHG Impact	Public Visibility	Employee Impact	Energy Cost Stabilization	Measure Score
0	1	3	4	3	3	5	19

Action Plan				
A	B	C	D	E
n	y	y	n	n

28- Water Pumps 2 (Implementation Date: 2010) utilized in Plan B.

Description	Net Capital Cost	O&M incremental Cost	Annual Cost Savings	Annual CO2 Reduction	Simple Payback	IRR	Net Present Value	% of Total GHG
Pump Measures (Savings criteria \$1500)	\$65,749	\$0	\$3,561	12,010	18.5	6.1%	\$8,089	0.21%

This measure sets the annual energy savings at the minimal level of \$1500 for selection for retrofit. This much less aggressive approach yields modest GHG results but also is less costly.

Selection Evaluation (5=favorable, 3= neutral, 0=not favorable)							
Cost	Financial Metrics	Resolution of Existing Problem	GHG Impact	Public Visibility	Employee Impact	Energy Cost Stabilization	Measure Score
3	3	3	2	3	3	5	22

Action Plan				
A	B	C	D	E
n	y	y	y	y

29- Staff Efficiency Coordinator (Implementation Date: 2008)

Description	Net Capital Cost	O&M incremental Cost	Annual Cost Savings	Annual CO2 Reduction	Simple Payback	IRR	Net Present Value	% of Total GHG
Staff Coordinator	\$0	\$50,000	\$0	0	NA	NA	(\$747,032)	0.00%

The implementation and monitoring of an aggressive GHG emissions reduction program, and the associated energy cost savings, will be greatly enhanced with the dedicated time of a City Staff member. Plans B - E include a 0.5 FTE position. The expense for this position is included in the financial analyses, and the net cash flow for each plan. Essentially, the cost savings for the added halftime position are funded by the plans with a positive cash flow.

Selection Evaluation (5=favorable, 3= neutral, 0=not favorable)							
Cost	Financial Metrics	Resolution of Existing Problem	GHG Impact	Public Visibility	Employee Impact	Energy Cost Stabilization	Measure Score
1	0	5	3	3	4	3	19

Action Plan				
A	B	C	D	E
n	y	y	y	y

30- Public Safety HVAC DDC Controls (Implementation Date: 2007)

Description	Net Capital Cost	O&M incremental Cost	Annual Cost Savings	Annual CO2 Reduction	Simple Payback	IRR	Net Present Value	% of Total GHG
APS Public Safety Central DDC	\$5,000	\$0	\$18,463	182,314	0.3	385.7%	\$361,795	3.15%

This measure was recommended and implemented by the APS Energy Services contract completed in 2006. However, comfort issues and staff needs apparently were not adequately addressed and the DDC controls were reversed and the system reverted back to the original controls methodology. The opportunities with this measure are significant. The implementation costs assigned to this measure are intended to cover the retro-commissioning required to implement the DDC controls, and to resolve the comfort and staff needs issues.

The table below provides the comprehensive evaluation of this measure. This analysis assigns values between 0 and 5 for seven important aspects of the measures. The maximum measure score is 31. The minimum score is 14. The average score of all measures is 22.6. The median score is 22.5.

Selection Evaluation (5=favorable, 3= neutral, 0=not favorable)							
Cost	Financial Metrics	Resolution of Existing Problem	GHG Impact	Public Visibility	Employee Impact	Energy Cost Stabilization	Measure Score
5	5	2	5	3	1	5	26

Additional Opportunities not quantified in this report.**HVAC and Hot Water**

These measures were identified in the "City of Rohnert Park Technical Energy Audit Report" APS Energy Services, May, 2005. These measures have not been implemented, and cost and savings were not estimated.

The measures included are:

Animal Shelter: Replace (2) Rooftop gas/electric units, add two economizers

- Cultural Arts: (9) rooftop units EER =9.0, AFUE =78%
- All buildings: HVAC controls and/or controls retro-commissioning (RCx)
- Reactivate disabled economizers on numerous HVAC units.
- Community Center: Consider Economizers
- Corporation Yard: HVAC repl. (3) units "EER"=9.5, 9.5 and 7.8;afue=75%

Direct Digital Control System Expansion

This measure was identified in the "City of Rohnert Park Technical Energy Audit Report" APS Energy Services, May, 2005. This measure has not been implemented, and cost and savings were not estimated.

Insulating Corp Yard buildings

This measure was identified in the "City of Rohnert Park Technical Energy Audit Report" APS Energy Services, May, 2005. This measure has not been implemented, and cost and savings were not estimated.

Cogeneration for Pools

This measure was identified in the "City of Rohnert Park Technical Energy Audit Report" APS Energy Services, May, 2005. This measure has not been implemented, and cost and savings were not estimated.

Carbon Credits

This is an emerging industry. The report in the Appendices provides the range of programs available, and a brief analysis.

E-Billing

The city billing can be converted to electronic billing for those customers willing to participate. There would be considerable material and cost savings associated with this measure. However, verifiable data on the savings was not available for this analysis.

6.0 Summary and Conclusions

The GHG emissions reduction of 20% by 2010 can be achieved by a number of paths documented in this report. Each path, or Action Plan, is comprised of up to 26 individual measures and each is evaluated for the financial, cost, and the other benefits they contribute to the overall strategy. The analysis model underpinning these results will be available for incorporating new information and technologies as they come available, as well as truing the analysis with monitoring data. The comprehensive approach to addressing this goal allows the City to meet a number of related goals, including improving the long term financial health of Rohnert Park, addressing the existing maintenance demands of aging equipment, and providing the public demonstration of commitment and progress in the highly visible challenge of greenhouse gas emissions reduction.

7.0 Appendices

- 7.1 Action Plan Evaluations
- 7.2 Plan Comparisons Including Completed Projects
- 7.3 Pump Lists
- 7.4 Vehicle Lists
- 7.5 Carbon Credits
- 7.6 Electric Vehicles
- 7.7 Commute Programs
- 7.8 Measure Input Summaries

7.1 Action Plan Evaluations

The GHG Emission Reduction Action Plans involve more than CO₂e reduction and cash flow. There are critical concerns that should be factored into the decision making process. These include the financial metrics of internal rate of return (IRR) and net present value (NPV) used to evaluate the worthiness of the investment; the cost of implementing the measure, some measures come with a large price tag which will challenge liquidity; the degree to which the plan resolves existing problems, such as old, high maintenance air conditioning units; the visibility of the measures to the public, for example the photovoltaic systems are a physical example of actions taken the city and communicate action and commitment to the community. Other key considerations include the employee impacts of new equipment or procedures, which may generate internal opposition; and the impact on the variability of future energy costs and the associated budgetary vulnerability.

Each measure, and the plans as a whole are evaluated by the following considerations:

- Measure Capital Cost:
- Financial Metrics (IRR and NPV)
- Resolution of Existing Problems
- GHG Impact
- Public Visibility
- Employee Impact
- Energy Cost Stabilization

Table 9 below provides the evaluation results for each measure by individual criteria. The individual scores for each category (cost, financial metrics, etc) are summed to provide an overall score for that measure. While this table provides important information to be considered when selecting measures, the scores are advisory only. A relatively low score does not preclude a measure, nor should a high score guarantee inclusion of the measure in the Action Plans. There will always be additional considerations that are not reflected in the Selection Evaluation process. The “adjusted measure score” is a feature under development which will allow the weighting of the criteria. This feature is not active for this analysis.

Description	Selection Evaluation (5=favorable, 3= neutral, 0=not favorable)								Adjusted Measure Score
	Cost	Financial Metrics	Resolution of Existing Problem	GHG Impact	Public Visibility	Employee Impact	Energy Cost Stabilization	Measure Score	
PV6 -CREBS	5	5	3	5	5	3	5	31	31.00
Lighting Retrofit (multi-bldg)	3	4	5	5	3	4	5	29	29.00
Pool Covers	5	5	3	5	4	2	5	29	29.00
H-Pool Solar Wtr	5	4	2	5	5	3	5	29	29.00
Decommission Fountain	5	5	3	3	3	3	5	27	27.00
Boiler Replcmnt Sports Center	3	4	5	4	3	3	5	27	27.00
Building HVAC	5	4	5	1	3	3	5	26	26.00
Addtl Lighting	4	5	3	3	3	3	5	26	26.00
Lift Station #1	5	4	4	2	3	3	5	26	26.00
Pool Pump Measures	3	5	2	5	4	2	5	26	26.00
APS Public Safety Central DDC	5	5	2	5	3	1	5	26	26.00
PV Supplying 100% Wtr &Wste energy cost	0	4	3	5	5	3	5	25	25.00
PV APS	3	4	3	2	5	3	5	25	25.00
City Fleet New 1	3	4	3	4	5	2	4	25	25.00
APS Measures	0	4	4	5	3	3	5	24	24.00
Computer Network Controls	5	5	2	1	3	2	5	23	23.00
Commute	3	3	3	3	3	4	3	22	22.00
Pump Measures (Savings criteria \$1500)	3	3	3	2	3	3	5	22	22.00
Pump Measures (4 implemented)	1	3	3	3	3	3	5	21	21.00
PV-New City Hall	0	2	3	2	5	3	5	20	20.00
Fleet 2000-2006	3	3	3	2	3	3	3	20	20.00
Biodiesel B100	3	1	2	5	4	2	2	19	19.00
Pump Measures (Savings criteria \$800)	0	1	3	4	3	3	5	19	19.00
Staff Coordinator	1	0	5	3	3	4	3	19	19.00
PV4	0	0	3	2	5	3	5	18	18.00
PV5	0	0	3	2	5	3	5	18	18.00
Biodiesel B20	3	2	2	3	4	2	2	18	18.00
City Fleet New 2	0	0	2	5	5	1	4	17	17.00
Ethanol E85	2	0	2	4	4	2	1	15	15.00
Fleet Natural Gas Conversions	0	0	2	5	4	2	1	14	14.00

Table 9: Measure List and Evaluations

* Scoring: Higher Score = More Favorable

Table 10 below compiles the scoring for each measure included in each plan (the measure scoring is provided in Table 9) and yields an average score for each metric. The Energy Cost Stabilization is based on the reduction of reliance on electricity and natural gas, whose associated costs are vulnerable to rapid escalation. Because Plan E is the most aggressive, and therefore has the greatest impact on reducing vulnerability, it is assigned a value of 5. The scoring for each of the other plans is defined by its impact relative to the impact of Plan E. A higher score indicate more a more favorable evaluation for that metric. The GHG Impact metric is omitted from this aggregated scoring to avoid disproportionate influence of this category.

Plan Scoring					
Metric \ Plan	A	B	C	D	E
Cost	2.5	3.1	2.9	2.8	2.5
Financial Metrics	3.8	3.7	3.2	3.3	3.0
Resolution of Existing Problem	3.5	3.3	3.1	3.1	3.2
Public Visibility	3.5	3.6	3.8	3.7	3.8
Employee Impact	3.0	2.8	2.9	2.8	2.5
Energy Cost Stabilization	1.5	2.9	4.0	4.4	5.0
Total	17.9	19.4	19.9	20.0	19.9

Table 10: Evaluation Matrix

Figure 12 below presents the information in the table above in graph form to allow visual comparison of the plans on the various metrics.

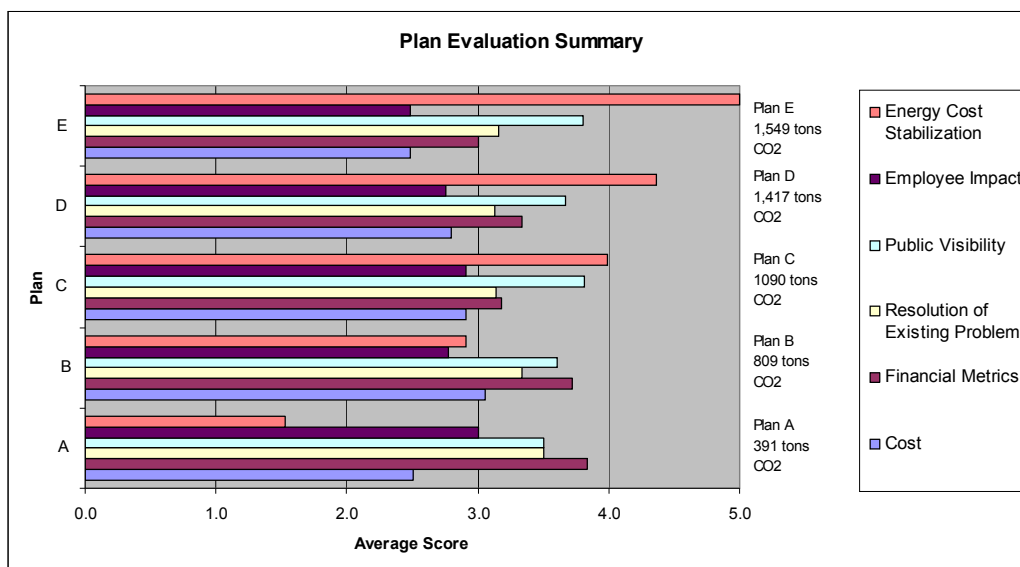


Figure 12: Relative Strengths of Each Plan

7.2 Plan Comparisons Including Completed Projects

This cash flow comparison includes the projects that were completed between 2000 and 2007. The results are significantly more favorable due to the large energy cost savings associated with these efforts. The completed projects affecting the analysis are listed below.

- APS Measures
- Chevron Energy Services Lighting Retrofit
- Pool Covers
- APS Photo-voltaic System
- Fleet Enhancements from 2000 through 2006
- Water System Pump Improvements

The financial results are provided below.

GHG Action Plan Summary					
Analysis	Plan A	Plan B	Plan C	Plan D	Plan E
% Reduction	10.9%	23.2%	35.6%	42.9%	50.3%
SPB	2.1	0.9	7.9	12.0	16.0
IRR	76.6%	133.5%	26.4%	20.2%	11.2%
NPV	\$1,758,018	\$3,377,939	\$3,478,383	\$3,262,793	\$2,256,514
Annual Cash Flow	Plan A	Plan B	Plan C	Plan D	Plan E
2000	\$0	\$0	\$0	\$0	\$0
2001	\$0	\$0	\$0	\$0	\$0
2002	\$34,014	\$34,014	\$34,014	\$34,014	\$34,014
2003	\$35,768	\$35,768	\$35,768	\$35,768	\$35,768
2004	\$37,583	\$37,583	\$37,583	\$37,583	\$37,583
2005	\$39,463	\$39,463	\$39,463	\$39,463	\$39,463
2006	\$24,662	\$24,662	\$24,662	\$24,662	\$24,662
2007	\$15,744	\$10,744	\$29,680	\$10,744	\$29,680
2008	\$21,330	\$39,899	\$45,365	\$35,615	\$45,365
2009	\$43,216	\$77,111	\$92,217	\$15,915	(\$64,893)
2010	\$49,196	\$93,755	\$118,229	\$2,769	(\$72,183)
2011	\$55,383	\$124,325	\$66,765	\$101,144	(\$15,730)
2012	\$61,783	\$136,271	(\$44,726)	\$134,193	(\$24,008)
2013	\$68,406	\$148,638	\$55,304	(\$10,772)	(\$167,626)
2014	\$108,060	\$191,955	\$101,630	\$44,447	(\$112,003)
2015	\$115,149	\$226,480	\$149,115	\$74,212	(\$71,965)
2016	\$122,483	\$240,204	\$166,056	\$47,582	(\$65,346)
2017	\$130,071	\$254,412	\$183,591	\$74,889	(\$37,569)
2018	\$87,728	\$229,860	\$221,200	\$271,330	\$158,909
2019	\$146,045	\$215,488	\$312,523	\$82,774	(\$29,129)
2020	\$154,449	\$280,480	\$279,057	\$403,464	\$292,105
2021	\$163,145	\$349,705	\$412,051	\$487,578	\$436,754
2022	\$269,648	\$464,102	\$359,587	(\$1,440,888)	(\$1,530,205)
2023	\$278,956	\$481,587	\$510,156	\$650,708	\$559,331
2024	\$288,587	\$506,193	\$634,207	\$691,706	\$702,732
2025	\$298,552	\$524,928	\$657,292	\$727,367	\$739,084

Table 11: Net Cash Flow Including Completed Projects

7.3 Pump Lists

\$500 Savings Criteria	Pump List	Provided in Test Reports					Additional Information		
		Included	Description	Total Annual Usage (kWh)	kWh	Cost	Cost Savings	Efficiency	VFD
yes	Well #9, 40hp, 570 Southwest Blvd, Ref# 100949		35,548	13,443	\$32,875	\$1,949	36.1% to 58.0%	no	40
yes	Well #29, 20hp, 4699 Snyder Ln. Ref# 100964		24,683	11,118	\$32,875	\$1,612	34.1% to 62.0%	no	20
yes	Well #20, 30hp, 1150 Golf Course Dr, Ref# 100967		21,616	10,670	\$32,875	\$1,547	31.4% to 62.0%	no	30
yes	Well #11, 60hp, 6096 Daphine Ct, Ref# 100971		36,151	9,900	\$32,875	\$1,436	47.2% to 65.0%	no	60
yes	Tanks STA 4, P1&2, 60hp, Ref # 100963		45,041	8,959	\$32,875	\$1,299	49.7% to 62.0%	no	60
yes	Well #8A, 15hp, 842 Lunar Ct. Ref# 100946		16,697	8,784	\$32,875	\$1,274	27% to 57.0%	no	15
yes	Tank #3, 60hp, 1432 Jasmine Circle, Ref# 100979		15,360	8,617	\$32,875	\$1,249	28.5% to 65.0%	no	60
yes	Well #41, 40hp, 4613 Harmony Place, Ref# 100973		35,534	7,720	\$32,875	\$1,119	50.9% to 65.0%	no	40
yes	Well #22, 20hp, Medical Center Dr. Ref# 100944		14,668	7,169	\$32,875	\$1,040	29.1% to 57.0%	no	20
yes	Well #39, 40hp, 7309 Rebas Way, Ref# 100943		35,971	7,031	\$32,875	\$1,019	52.3% to 65.0%	no	40
yes	Well #15, 60hp, 200 Golf Course Drive, Ref# 100977		51,398	6,399	\$32,875	\$928	56.9% to 65.0%	no	60
yes	Tank #1 50hp, 779 East Cotati Ave		44,740	6,338	\$32,875	\$919	49.8% to 58.9%	no	50
yes	Well #18, 50hp, 610 Hudis, Ref# 100965		16,240	6,160	\$32,875	\$893	35.8% to 58.0%	no	50
yes	Well#40, 30hp, 5302 Business Park Drive, Ref# 100978		24,761	5,043	\$32,875	\$731	46.2% to 58.0%	no	30
yes	Well # 21, 20hp, 5165 Snyder Lane, Ref# 100983		14,819	4,569	\$32,875	\$663	42.2% to 61.0%	no	20
yes	Tank STA. 4,P2, 30hp, ref #100961		24,605	4,539	\$32,875	\$658	47.3% to 58.0%	no	30
yes	Well #42, 30hp, 4613 Harmony Place, 100968		22,673	4,182	\$32,875	\$606	50.6% to 62.0%	no	30
yes	Well #34, 10hp, 8069 Broadway Parkway, Ref# 100958		9,096	3,367	\$32,875	\$505	36.5% to 58.0%	no	10

\$800 Savings Criteria	Pump List	Provided in Test Reports					Additional Information		
		Included	Description	Total Annual Usage (kWh)	kWh	Cost	Cost Savings	Efficiency	VFD
yes	Well #9, 40hp, 570 Southwest Blvd, Ref# 100949		35,548	13,443	\$32,875	\$1,949	36.1% to 58.0%	no	40
yes	Well #29, 20hp, 4699 Snyder Ln. Ref# 100964		24,683	11,118	\$32,875	\$1,612	34.1% to 62.0%	no	20
yes	Well #20, 30hp, 1150 Golf Course Dr, Ref# 100967		21,616	10,670	\$32,875	\$1,547	31.4% to 62.0%	no	30
yes	Well #11, 60hp, 6096 Daphine Ct, Ref# 100971		36,151	9,900	\$32,875	\$1,436	47.2% to 65.0%	no	60
yes	Tanks STA 4, P1&2, 60hp, Ref # 100963		45,041	8,959	\$32,875	\$1,299	49.7% to 62.0%	no	60
yes	Well #8A, 15hp, 842 Lunar Ct. Ref# 100946		16,697	8,784	\$32,875	\$1,274	27% to 57.0%	no	15
yes	Tank #3, 60hp, 1432 Jasmine Circle, Ref# 100979		15,360	8,617	\$32,875	\$1,249	28.5% to 65.0%	no	60
yes	Well #41, 40hp, 4613 Harmony Place, Ref# 100973		35,534	7,720	\$32,875	\$1,119	50.9% to 65.0%	no	40
yes	Well #22, 20hp, Medical Center Dr. Ref# 100944		14,668	7,169	\$32,875	\$1,040	29.1% to 57.0%	no	20
yes	Well #39, 40hp, 7309 Rebas Way, Ref# 100943		35,971	7,031	\$32,875	\$1,019	52.3% to 65.0%	no	40
yes	Well #15, 60hp, 200 Golf Course Drive, Ref# 100977		51,398	6,399	\$32,875	\$928	56.9% to 65.0%	no	60
yes	Well #18, 50hp, 610 Hudis, Ref# 100965		16,240	6,160	\$32,875	\$893	35.8% to 58.0%	no	50

\$1500 Savings Criteria	Pump List	Provided in Test Reports					Additional Information		
		Included	Description	Total Annual Usage (kWh)	kWh	Cost	Cost Savings	Efficiency	VFD
yes	Well #29, 20hp, 4699 Snyder Ln. Ref# 100964		24,683	11,118	\$32,875	\$1,668	34.1% to 62.0%	no	20
yes	Well #9, 40hp, 570 Southwest Blvd, Ref# 100949		35,548	13,443	\$32,875	\$1,614	36.1% to 58.0%	no	40

7.4 Vehicle Lists

Vehicle Summary	
Crn Vic	48
Sonoma	11
Ranger	9
Taurus	7
2500 SL	6
Explorer	6
Pumper	6
Expedition	5
2500 Cheyenne	4
PD Mtrcycle	4
3500	3
Crew Cab	3
2500 HD	2
F150	2
Impala	2
Pickup	2
Ram 2500	2
S-10	2
3500 HD	1
3500 HD BOOM TR	1
3500SL Sierra	1
4600LP Dump Tr	1
4700 DUMP TR	1
51600 Dump Tr	1
7000 SIERRA	1
Accord	1
Aerial	1
AEROSTAR	1
Airtruck	1
ASTRO	1
Astro Van	1
Bus	1
CHEROKEE	1
E-250 Clubwagon	1
E-250 Econoline	1
E250 Van	1
E-350 Clubwagon	1
Escape	1
G-20 VAN	1
Malibu	1
Mustang	1
Penetrator	1
Ram 1500	1
S-15	1
S-15 Jimmy	1
Sable	1
Vacon	1
VAN	1

The following fleet tables provide the vehicle substitutions analyzed in Measure 12.

Fire Services, Recreation, Performing Arts and Misc.

Vehicle No.	Dept.	Make	Year	Model	Fuel Type	MPG	Miles/Year	Replace	Vehicle	Incr. Cost	Fuel	MPkWh
C-2	Misc. Vehicles	FORD	1996	TAURUS	gasoline	17	3500	yes	Prius	\$4,000	Gasoline	48.0
C-3	Misc. Vehicles	FORD	1996	TAURUS	gasoline	17	3500	yes	Prius	\$4,000	Gasoline	48.0
C-6	Misc. Vehicles	HONDA	2001	ACCORD	gasoline	23	3500	yes	Prius	\$4,000	Gasoline	48.0
C-9	Misc. Vehicles	MERCURY	1994	SABLE	gasoline	19	3500	yes	NEV	-\$2,000	Electric	5.0
P-1	Misc. Vehicles	GMC	1997	SONOMA	gasoline	17	3500	yes	Phoenix SUT	\$31,000	Electric	3.7
P-19	Misc. Vehicles	GMC	1989	S-15	gasoline	17	3500	no				
P-43	Misc. Vehicles	GMC	1993	S-15 Jimmy	gasoline	16	3500	no				
P-61	Misc. Vehicles	FORD	2005	ESCAPE	gasoline	20	3500	yes	Escape Hybrid	\$4,000	Gasoline	30.0
172	Animal Shelter	CHEV	1999	ASTRO VAN	gasoline	15	3500	no				
103	Animal Shelter	FORD	1990	RANGER	gasoline	16	3500	yes	Phoenix SUT	\$31,000	Electric	3.7
9935	Fire Services	VAN PELT	1978	PUMPER	Diesel	6	3500	no				
9940	Fire Services	FORD	1995	BUS	gasoline	8	3500	no				
9943	Fire Services	CHEV	1994	AIRTRUCK	gasoline	8	3500	no				
9950	Fire Services	INT'L	1995	AERIAL	Diesel	8	3500	no				
9960	Fire Services	GMC	1989	PUMPER	Diesel	6	3500	no				
9980	Fire Services	HTE	1998	PENETRATOR	Diesel	8	3500	no				
9982	Fire Services	PIERCE	2006	PUMPER	Diesel	6	3500	no				
9983	Fire Services	VAN PELT	1985	PUMPER	Diesel	6	3500	no				
9984	Fire Services	INTL	1991	PUMPER	Diesel	6	3500	no				
9985	Fire Services	PIERCE	2005	PUMPER	Diesel	6	3500	no				
C-14	Recreation	FORD	1998	E-350 Clubwagon	gasoline	12	3500	no				
C-16	Recreation	CHEV	1986	G-20 VAN	gasoline	15	3500	no				
C-18	Recreation	CHEV	1999	ASTRO	gasoline	15	3500	no				
C-25	Recreation	FORD	1991	E-250 Clubwagon	gasoline	11	3500	no				
C-26	Recreation	FORD	1997	VAN	gasoline	14	3500	no				
C-27	Recreation	FORD	1991	AEROSTAR	gasoline	16	3500	no				
C-28	Recreation	FORD	1993	TAURUS	gasoline	18	3500	yes	Prius	\$4,000	Gasoline	48.0
C-7	Performing Arts	JEEP	2001	CHEROKEE	gasoline	15	3500	no				
P-20	Performing Arts	FORD	1990	RANGER	gasoline	16	3500	yes	Phoenix SUT	\$31,000	Electric	3.7

Public Safety

Vehicle No.	Dept.	Make	Year	Model	Fuel Type	MPG	Miles/Year	Replace	Vehicle	Incr. Cost	Fuel	MPkWh
8	Public Safety	FORD	2006	F150	gasoline	14	7500	no				
9	Public Safety	FORD	2004	CREW CAB	gasoline	15	7500	no				
10	Public Safety	FORD	2003	CRN VIC	gasoline	13	7500	no				
11	Public Safety	FORD	2003	CRN VIC	gasoline	13	7500	no				
12	Public Safety	FORD	2003	CRN VIC	gasoline	13	7500	no				
13	Public Safety	FORD	2003	CRN VIC	gasoline	13	7500	no				
14	Public Safety	FORD	2003	EXPEDITION	gasoline	13	7500	yes	Phoenix SUV	\$15,000	Electric	3.7
16	Public Safety	FORD	2004	CRN VIC	gasoline	13	7500	no				
17	Public Safety	FORD	2004	CRN VIC	gasoline	13	7500	no				
18	Public Safety	FORD	2004	CRN VIC	gasoline	13	7500	no				
19	Public Safety	FORD	2004	CRN VIC	gasoline	13	7500	no				
20	Public Safety	FORD	2005	CRN VIC	gasoline	18	7500	no				
21	Public Safety	FORD	1998	EXPLORER	gasoline	14	7500	yes	Escape Hybrid	\$4,000	Gasoline	30.0
22	Public Safety	FORD	2005	CRN VIC	gasoline	18	7500	no				
23	Public Safety	FORD	2005	CRN VIC	gasoline	18	7500	no				
24	Public Safety	FORD	2006	CRN VIC	gasoline	17	7500	no				
25	Public Safety	FORD	2006	CRN VIC	gasoline	17	7500	no				
26	Public Safety	FORD	2006	CRN VIC	gasoline	17	7500	no				
27	Public Safety	FORD	2006	CRN VIC	gasoline	17	7500	no				
28	Public Safety	FORD	1993	TAURUS	gasoline	18	7500	yes	Prius	\$4,000	Gasoline	48.0
29	Public Safety	FORD	1993	TAURUS	gasoline	18	7500	yes	Prius	\$4,000	Gasoline	48.0
30	Public Safety	FORD	1993	TAURUS	gasoline	18	7500	yes	Prius	\$4,000	Gasoline	48.0
32	Public Safety	FORD	2001	CRN VIC	gasoline	15	7500	no				
33	Public Safety	FORD	2005	CRN VIC	gasoline	18	7500	no				
35	Public Safety	FORD	2005	CRN VIC	gasoline	18	7500	no				
36	Public Safety	FORD	2006	CRN VIC	gasoline	17	7500	no				
37	Public Safety	FORD	2000	CRN VIC	gasoline	15	7500	no				
38	Public Safety	FORD	2005	CRN VIC	gasoline	18	7500	no				
42	Public Safety	FORD	1994	TAURUS	gasoline	18	7500	yes	Prius	\$4,000	Gasoline	48.0
43	Public Safety	FORD	2005	CRN VIC	gasoline	18	7500	no				
45	Public Safety	FORD	1996	CRN VIC	gasoline	17	7500	no				
48	Public Safety	GMC	1997	SONOMA	gasoline	17	7500	yes	Phoenix SUT	\$31,000	Electric	3.7
49	Public Safety	GMC	1997	SONOMA	gasoline	17	7500	yes	Phoenix SUT	\$31,000	Electric	3.7
50	Public Safety	FORD	2005	EXPEDITION	gasoline	14	7500	yes	Phoenix SUV	\$15,000	Electric	3.7

Public Safety

Vehicle No.	Dept.	Make	Year	Model	Fuel Type	MPG	Miles/Year	Replace	Vehicle	Incr. Cost	Fuel	MPkWh
51	Public Safety	FORD	2005	CREW CAB	gasoline	15	7500	no				
52	Public Safety	FORD	1997	CRN VIC	gasoline	17	7500	no				
53	Public Safety	FORD	1997	CRN VIC	gasoline	17	7500	no				
54	Public Safety	FORD	1997	EXPLORER	gasoline	14	7500	yes	Escape Hybrid	\$4,000	Gasoline	30.0
55	Public Safety	FORD	1997	EXPLORER	gasoline	14	7500	yes	Escape Hybrid	\$4,000	Gasoline	30.0
56	Public Safety	FORD	2001	RANGER	gasoline	15	7500	yes	Phoenix SUT	\$31,000	Electric	3.7
57	Public Safety	FORD	1997	EXPLORER	gasoline	14	7500	yes	Escape Hybrid	\$4,000	Gasoline	30.0
58	Public Safety	FORD	1997	EXPLORER	gasoline	14	7500	yes	Escape Hybrid	\$4,000	Gasoline	30.0
59	Public Safety	FORD	1999	CRN VIC	gasoline	14	7500	no				
60	Public Safety	FORD	1999	CRN VIC	gasoline	14	7500	no				
61	Public Safety	FORD	1999	CRN VIC	gasoline	14	7500	no				
62	Public Safety	FORD	1999	CRN VIC	gasoline	14	7500	no				
63	Public Safety	FORD	1999	CRN VIC	gasoline	14	7500	no				
65	Public Safety	FORD	1999	CRN VIC	gasoline	14	7500	no				
66	Public Safety	FORD	1999	CRN VIC	gasoline	14	7500	no				
67	Public Safety	FORD	1999	CRN VIC	gasoline	14	7500	no				
68	Public Safety	FORD	1999	CRN VIC	gasoline	14	7500	no				
69	Public Safety	FORD	1998	MUSTANG	gasoline	17	7500	no				
71	Public Safety	CHEV	1999	MALIBU	gasoline	20	7500	no				
72	Public Safety	FORD	2006	CRN VIC	gasoline	17	7500	no				
73	Public Safety	FORD	1997	EXPLORER	gasoline	14	7500	yes	Escape Hybrid	\$4,000	Gasoline	30.0
74	Public Safety	GMC	2000	SONOMA	gasoline	17	7500	yes	Phoenix SUT	\$31,000	Electric	3.7
75	Public Safety	FORD	2001	RANGER	gasoline	14	7500	yes	Phoenix SUT	\$31,000	Electric	3.7
76	Public Safety	FORD	2005	PICKUP	gasoline	16	7500	no				
77	Public Safety	FORD	2000	CROWN	gasoline	15	7500	no				
78	Public Safety	FORD	2000	CROWN	gasoline	15	7500	no				
79	Public Safety	FORD	2000	CROWN	gasoline	15	7500	no				
80	Public Safety	CHEV	2006	IMPALA	gasoline	18	7500	no				
81	Public Safety	FORD	2005	PICKUP	gasoline	16	7500	no				
82	Public Safety	FORD	2005	CRN VIC	gasoline	18	7500	no				
83	Public Safety	FORD	2005	CRN VIC	gasoline	18	7500	no				
84	Public Safety	FORD	2001	CRN VIC	gasoline	15	7500	no				
85	Public Safety	FORD	2001	CRN VIC	gasoline	15	7500	no				
86	Public Safety	FORD	2001	CRN VIC	gasoline	15	7500	no				
87	Public Safety	FORD	2002	CRN VIC	gasoline	15	7500	no				
88	Public Safety	FORD	2003	CRN VIC	gasoline	13	7500	no				
89	Public Safety	FORD	2003	CRN VIC	gasoline	13	7500	no				
90	Public Safety	FORD	2003	CRN VIC	gasoline	13	7500	no				
91	Public Safety	CHEV	2005	IMPALA	gasoline	19	7500	no				
92	Public Safety	FORD	2005	CRN VIC	gasoline	18	7500	no				
93	Public Safety	FORD	2006	EXPEDITION	gasoline	14	7500	yes	Phoenix SUV	\$15,000	Electric	3.7
94	Public Safety	FORD	2006	EXPEDITION	gasoline	14	7500	yes	Phoenix SUV	\$15,000	Electric	3.7
95	Public Safety	FORD	2006	EXPEDITION	gasoline	14	7500	yes	Phoenix SUV	\$15,000	Electric	3.7
96	Public Safety	FORD	2006	CRN VIC	gasoline	17	7500	no				
97	Public Safety	FORD	2006	CRN VIC	gasoline	17	7500	no				
98	Public Safety	FORD	2006	CRN VIC	gasoline	17	7500	no				
99	Public Safety	FORD	2005	CREW CAB	gasoline	16	7500	no				
118	Public Safety	FORD	2006	E250 VAN	gasoline	17	7500	no				
M-1	Public Safety	BMW	2002	PD Mtrcycle	gasoline	19	7500	no				
M-2	Public Safety	BMW	2002	PD Mtrcycle	gasoline	19	7500	no				
M-3	Public Safety	KAWASA	1989	PD Mtrcycle	gasoline	18	7500	no				
M-4	Public Safety	YAMAHA	1983	PD Mtrcycle	gasoline	18	7500	no				

Public Works

Vehicle No.	Dept.	Make	Year	Model	Fuel Type	MPG	Miles/Year	Replace	Vehicle	Incr. Cost	Fuel	MPKWh
B-1	Public Works	SEARS	1970	BOAT	gasoline	0	6000	no				
P-2	Public Works	GMC	1997	SONOMA	gasoline	16	6000	yes	Phoenix SUT	\$31,000	Electric	3.7
P-3	Public Works	GMC	1997	SONOMA	gasoline	16	6000	yes	Phoenix SUT	\$31,000	Electric	3.7
P-4	Public Works	GMC	1997	SONOMA	gasoline	16	6000	yes	Phoenix SUT	\$31,000	Electric	3.7
P-5	Public Works	GMC	1997	SONOMA	gasoline	16	6000	yes	Phoenix SUT	\$31,000	Electric	3.7
P-6	Public Works	GMC	1997	SONOMA	gasoline	16	6000	yes	Phoenix SUT	\$31,000	Electric	3.7
P-7	Public Works	CHEV	1998	2500 CHEYENNE	gasoline	14	6000	no				
P-8	Public Works	CHEV	1998	2500 CHEYENNE	gasoline	14	6000	no				
P-9	Public Works	DODGE	1999	RAM 1500	gasoline	12	6000	no				
P-10	Public Works	DODGE	1999	RAM 2500	gasoline	12	6000	no				
P-11	Public Works	GMC	2000	2500 SL	gasoline	14	6000	yes	Phoenix SUT	\$31,000	Electric	3.7
P-12	Public Works	CHEV	2000	500 HD BOOM T	gasoline	14	6000	no				
P-13	Public Works	GMC	2000	2500 SL	gasoline	14	6000	yes	Phoenix SUT	\$31,000	Electric	3.7
P-14	Public Works	GMC	2000	2500 SL	gasoline	14	6000	yes	Phoenix SUT	\$31,000	Electric	3.7
P-15	Public Works	GMC	2000	2500 SL	gasoline	14	6000	yes	Phoenix SUT	\$31,000	Electric	3.7
P-16	Public Works	GMC	2000	2500 SL	gasoline	14	6000	yes	Phoenix SUT	\$31,000	Electric	3.7
P-17	Public Works	FORD	1999	RANGER	gasoline	16	6000	yes	Phoenix SUT	\$31,000	Electric	3.7
P-18	Public Works	FORD	1989	RANGER	gasoline	16	6000	yes	Phoenix SUT	\$31,000	Electric	3.7
P-21	Public Works	CHEV	1988	S-10	gasoline	17	6000	no				
P-22	Public Works	CHEV	2006	2500 HD	gasoline	14	6000	no				
P-23	Public Works	CHEV	2006	2500 HD	gasoline	14	6000	no				
P-24	Public Works	FORD	2006	F150	gasoline	14	6000	no				
P-29	Public Works	CHEV	2005	3500	gasoline	15	6000	no				
P-30	Public Works	CHEV	2005	3500	gasoline	15	6000	no				
P-34	Public Works	CHEV	1988	2500 CHEYENNE	gasoline	14	6000	no				
P-35	Public Works	CHEV	1988	S-10	gasoline	17	6000	no				
P-37	Public Works	GMC	1987	2500 SIERRA	gasoline	15	6000	no				
P-44	Public Works	CHEV	1990	3500	gasoline	15	6000	no				
P-46	Public Works	FORD	1990	RANGER	gasoline	16	6000	yes	Phoenix SUT	\$31,000	Electric	3.7
P-49	Public Works	FORD	1991	RANGER	gasoline	16	6000	yes	Phoenix SUT	\$31,000	Electric	3.7
P-50	Public Works	FORD	1991	E-250 Econoline	gasoline	11	6000	no				
P-51	Public Works	FORD	1991	RANGER	gasoline	16	6000	yes	Phoenix SUT	\$31,000	Electric	3.7
P-52	Public Works	GMC	1991	2500 CHEYENNE	gasoline	13	6000	no				
P-54	Public Works	CHEV	1991	500 CHEYENNE	gasoline	13	6000	no				
P-55	Public Works	FORD	1991	E-350 Econoline	gasoline	11	6000	no				
P-57	Public Works	GMC	1996	SONOMA	gasoline	16	6000	yes	Phoenix SUT	\$31,000	Electric	3.7
P-58	Public Works	GMC	1996	SONOMA	gasoline	16	6000	yes	Phoenix SUT	\$31,000	Electric	3.7
P-59	Public Works	GMC	1996	2500 SL	gasoline	14	6000	yes	Phoenix SUT	\$31,000	Electric	3.7
P-60	Public Works	DODGE	1995	RAM 2500	gasoline	11	6000	no				
T-1	Public Works	INT'L	1991	4600LP Dump Tr	Diesel	8	6000	no				
T-4	Public Works	CHEV	1998	3500 HD	Diesel	15	6000	no				
T-5	Public Works	INTL	2004	Vacon	Diesel	8	6000	no				
T-6	Public Works	INT'L	1987	51600 Dump Tr	Diesel	8	6000	no				
T-7	Public Works	GMC	1989	3500SL Sierra	gasoline	15	6000	no				
T-8	Public Works	GMC	1996	3500 SL	gasoline	15	6000	no				
T-9	Public Works	GMC	1980	7000 SIERRA	gasoline	8	6000	no				
T-10	Public Works	INTL	1999	4700 DUMP TR	Diesel	8	6000	no				
C-14	Recreation	FORD	1998	E-350 Clubwagon	gasoline	12	3500	no				
C-16	Recreation	CHEV	1986	G-20 VAN	gasoline	15	3500	no				
C-18	Recreation	CHEV	1999	ASTRO	gasoline	15	3500	no				
C-25	Recreation	FORD	1991	E-250 Clubwagon	gasoline	11	3500	no				
C-26	Recreation	FORD	1997	VAN	gasoline	14	3500	no				
C-27	Recreation	FORD	1991	AEROSTAR	gasoline	16	3500	no				
C-28	Recreation	FORD	1993	TAURUS	gasoline	18	3500	yes	Prius	\$4,000	Gasoline	48.0
C-7	Performing Arts	JEEP	2001	CHEROKEE	gasoline	15	3500	no				
P-20	Performing Arts	FORD	1990	RANGER	gasoline	16	3500	yes	Phoenix SUT	\$31,000	Electric	3.7

7.5 Carbon Credits

Carbon Offsets/Green Tags

Prepared by Peter Spencer

The David Suzuki Organization defines a carbon offset as “an emission reduction credit from another organization’s project that results in less carbon dioxide or other greenhouse gases in the atmosphere than would otherwise occur. Carbon offsets are typically measured in tons of CO₂-equivalents (or 'CO₂e') and are bought and sold through a number of international brokers, online retailers, and trading platforms.”

http://www.davidsuzuki.org/Climate_Change/What_You_Can_Do/carbon_offsets.asp

A green tag is a specific type of carbon offset also referred to as Renewable Energy Certificates (RECs). According to the Environmental Protection Agency, “Renewable Energy Certificates represent the environmental, social, and other positive attributes of power generated by renewable resources.”

The carbon offset is a generic term for all types of purchasable GHG reduction programs sold in the market. For example, CO₂ emissions can be offset by paying a group to plant trees anywhere in the world. The green tag, a subset of carbon offsets, is specific to electricity generation. To offset CO₂ emissions with a green tag, a purchase is made which supports renewable electricity generation and consumption somewhere else. That green-generated electricity becomes part of the total pool of power and thereby reduces emissions from overall electricity production.

Individuals and organizations can purchase carbon offsets to reduce climate impacts from their activities. When carbon emissions are too difficult or costly to avoid, it’s possible to pay someone else to reduce GHG. Dozens of companies, both commercial and nonprofit, offer a variety of offset types and prices.

The most common type of offset involves trees, either reforestation or avoided deforestation. Other common offsets are renewable energy and energy conservation projects. Prices for offsets/green tags vary widely from \$3.56 to \$30.00 per metric ton. (See survey in appendix) These prices are low compared to many other mitigation measures.

Renewable energy offsets, sold as green tags, fund wind, solar, biomass, and biodiesel projects worldwide. For every megawatt of power produced by a renewable source, one green tag is issued to the producer. The green tags can be sold to raise profits from renewable energy generation thus making it more competitive in the market. Energy conservation offsets often involve purchasing a GHG emission allowance from a company on the Chicago Climate Exchange. This “retires” the allowance preventing others from purchasing it to emit GHG.

Verification and accounting systems for offsets differ and there are currently no accepted standards. There is a wide variation of GHG baseline calculations for activities and also for the calculations of GHG reductions from projects. However, many providers make a good effort to ensure their product’s value and provide documentation. The Green-e program is the most accepted certification program and referenced by the EPA. (<http://www.green-e.org/>)

Arguments in favor of Carbon Offsets:

- Supports growth of the renewable energy industry
- Compensates for GHG emissions which are too difficult or costly to avoid
- Lowers cost of GHG reductions
- Provides a market-based system for GHG reduction
- Can benefit poor countries with investments
- Positive PR for organizations that reduce emissions
- Raises awareness and encourages public policy changes

Sources of supportive information:

An excellent resource for consumers with ratings for top providers:

A Consumer's Guide to Retail Offset Providers

Clean Air-Cool Planet:

<http://www.cleanair-coolplanet.org/ConsumersGuidetoCarbonOffsets.pdf>

EPA description of various green purchasing options:

Guide to Purchasing guide for Green Power

Environmental Protection Agency:

http://www.epa.gov/greenpower/pdf/purchasing_guide_for_web.pdf

Realistic assessment supportive of offsets with large number of links:

How the Retail Carbon Offsets Market Can Further Global Warming Mitigation Goals

EM Market Insights:

http://conserveonline.org/workspaces/climate.change/carbonmarkets/em_going_carbon_neutral.pdf

Arguments against Carbon Offsets:

Trees:

- Trees store carbon, but don't reduce total biological carbon brought to the earth's surface in fossil fuels
- Planting releases carbon from the soil
- An unrealistic amount of trees would need to be planted to be effective
- Most projects are planting monocultures causing ecosystem problems
- Predicting the carbon performance of trees is not possible
- Increasingly challenged by scientists as unsuccessful strategy

All methods:

- Don't address the fundamental problem of emissions
- Makes it easy to avoid measures reducing emissions
- Removes money from local economy
- Poor accountability
- No proof that there is an overall improvement in the climate with offset system
- Short-term solution with little direct benefit to offset purchasing organization
- May ignore local problems such as air pollution or need for more power plants
- Questionable future of unregulated and unproven strategies in new offset industry
- Doesn't create lasting benefit for organization

Ecobusinesslinks.com Carbon Offset Survey						
Carbon Offset Provider	Price (US\$/Metric ton CO2)	Non-profit	Projects Types	Project Choice	Offset Types	Product Certification/ Verification
AtmosClear Climate Club US	\$3.56 ^a - \$25.00	No	Methane	No	Car, Home	Environmental Resources Trust
Carbonfund.org US	\$4.30 ^b - 5.50	Yes	Renewables, Efficiency, Reforestation	Yes	Home, Car, Air, Events, Business	Green-e, Chicago Climate Exchange, Environmental Resources Trust
e-BlueHorizons US	\$5.00	No	Renewables, Reforestation	No	Home, Car, Air	Chicago Climate Exchange, Environmental Resources Trust
Terrapass US	\$7.35 ^c - 11.00	No	Renewables, Efficiency	No	Car, Air, Events, Business	Green-e, Chicago Climate Exchange, Center for Resource Solutions
DriveNeutral.org US	\$7.50 & up	Yes	Efficiency	No	Car	Chicago Climate Exchange
Native Energy US	\$13.20	No	Renewables	Yes	Home, Car, Air, Events, Business	Green-e
The CarbonNeutral Company UK	\$14.00-18.00	No	Renewables, Efficiency, Reforestation	Yes	Business, Home, Car, Air, Events	KPMG, Edinburgh Centre for Carbon Management, Independent Advisory Committee
Climate Friendly Aus	\$16.00-19.00	No	Renewables	No	Home, Car, Air, Business	Office of the Renewable Energy Regulator, NSW Government, Ernst & Young.
Sustainable travel International US, Switzerland	\$18.00	Yes	Renewables	No	Air, Car, Home, Hotel	See Myclimate
Bonneville Environmental Foundation US	\$29.00	Yes	Renewables	No	Home, Air, Business, Event	Green-e
Myclimate Switzerland	\$30.00	Yes	Renewables	No	Air, Events, Business	Designated Operational Entity
Global Cool UK	£20.00 (\$39.48)	Yes	Renewables, Efficiency	No	n/a	CDM
Services for which independent product certification or verification information not available						
Carbon Offset Provider	Price (US\$/Metric ton CO2)	Non-profit	Projects Types	Project Choice	Offset Types	Product Certification/ Verification
DrivingGreen Ireland	\$8.00	No	Renewables	No	Car, Air, Events	n/a
Solar Electric Light Fund US	\$10.00	Yes	Renewables	No	External Calculators	n/a
Carbon Clear UK	\$17.00	No	Reforestation	No	Home, Car, Air, Babies	n/a
a: Atmos Clear - Low price for 25 Ton option at \$89 b: Carbonfund.org - Low price for ZeroCarbon tags option: 18 Ton + 5 Ton match, pay \$99 for \$23 Ton c: Terrapass - Low price when purchasing 204 metric ton of carbon offsets for \$1,499.95 1. Offset Types: There are hundreds of potential offset types. We have limited our survey to just the most common. 2. Verification: "n/a" means we were unable to determine a third-party verification body. The projects may, however, be verified. 3. Choice: refers to whether customers may choose between project types and/or specific projects. 4. Price: prices change and exchange rates fluctuate. The data listed was first gathered from the respective websites July 21, 2006 5. Other offset providers may exist. This survey provides a cross section of the industry, projects may be added or removed over time. 6. Some information may be incomplete or has changed. We welcome updates.						

Sources of Offset critical information:

The most complete, well-written analysis of climate science and offsets: **Carbon Trading: A Critical Conversation on Climate Change, Privatization and Power**
Dag Hammarskjöld Centre:
http://www.dhf.uu.se/pdfiler/DD2006_48_carbon_trading/carbon_trading_web.pdf

Excellent analysis from a sustainability perspective:
The International Challenge of Climate Change
United Kingdom, Environmental Audit Committee:
<http://www.defra.gov.uk/environment/climatechange/pubs/eac/pdf/cc-govres.pdf>

Scientific paper explaining why reforestation won't help climate change:
Planting trees will not cancel out climate change:
Nature:
<http://www.scidev.net/pdffiles/nature/nature04486.pdf>

Short negative view of green tags:
The woolly world of green tags out of Kirby Mountain:
<http://kirbymtn.blogspot.com/2006/04/woolly-world-of-green-tags.html>

In-depth assessment of trading systems and their limitations:
Is the US Experience with Pollution Markets Really an Argument for Global Carbon Trading?
McGill International Journal of Sustainable Development, Law and Policy, fall 2005:
http://www.fern.org/media/documents/document_3657_3658.pdf

Good short summary of why offsets don't work:
Carbon 'offset' - no magic solution to 'neutralize' fossil fuel emissions
Forests and the European Union Resource Network:
http://www.fern.org/media/documents/document_884_885.pdf

Strong short letter opposing carbon trading:
We must reduce fossil fuel use, not trade carbon:
Financial Times:
http://www.fern.org/media/documents/document_3634_3635.pdf
(Source: http://www.ecobusinesslinks.com/carbon_offset_wind_credits_carbon_reduction.htm)

For the most complete and up to date list of green tag products and marketers, visit the Green Power Network, part of the U.S. Dept of Energy, Energy Efficiency and Renewable Energy Office.

<http://www.eere.energy.gov/greenpower/markets/certificates.shtml?page=0>

For a detailed report on the status of green power marketing, check out the following publication from the National Renewable Energy Laboratory:

<http://www.eere.energy.gov/greenpower/resources/pdfs/40904.pdf>

7.6 Electric Vehicles

Electric Vehicle Current Status

Jim Housman, P.E. (retired)

May 7, 2007

Battery powered electric vehicles pose opportunities for cost savings and enhanced convenience in an increasing number of applications where their unique properties can be used to advantage. While gasoline as a motor fuel has significantly higher energy density and lower cost per unit of energy, when the overall “well-to-wheel efficiencies of electrical power are taken into account it can be advantageous to operate electrical vehicles in place of their gasoline or diesel counterparts.

The majority of electric vehicles available today, not including hybrids, are classified as “Neighborhood Electric Vehicles” (NEV). In general these vehicles are limited to a top speed of 25 miles per hour and are only permitted on public roads with speed limits below 35 miles per hour. They have minimal requirements for lighting and passenger protection in keeping with their low speed nature. Some of the larger manufacturers of NEVs are listed on the following web site:

http://www.eere.energy.gov/afdc/afv/elec_vehicles.html

In a recent study (2001) the Department of Energy²³ evaluated the performance of 348 NEVs operated in 15 automotive fleets. The fleets included in the study belonged to military, commercial, municipal, rental and transportation organizations. The NEVs were found to be successful replacements for gasoline powered vehicles in most circumstances. Success was indicated by satisfied users, improved economy and reliability of the vehicles.

The study did find some areas where improvements could be made. Higher speed capability and improved range were listed as desirable. In addition users would have liked improved passenger protection, including solid doors and roll down windows. Both were lacking in the majority of the fleet vehicles. While the study found that 91% of the vehicles had operated without problems there were some reliability issues. Fourteen vehicles had battery packs replaced, Five had problems with switches and four controllers were replaced.

By a large majority the study found that fleet owners were satisfied with the performance of their vehicles. Some were used only on public roads, some were never used on public roads and some were used under both circumstances. Specific uses included police work, material handling, towing, personnel transportation and community shopping uses.

A large market currently exists for this type of vehicle permitting competitive pricing. The most sophisticated of the NEVs retail in the \$10 to \$15 thousand dollar range. At the higher end of this range will be found vehicles with features and styling that compare favorably with

²³ <http://avt.inel.gov/pdf/nev/nevstudy.pdf>

conventional automobiles but lacking only the gasoline engine performance. The simplest and least expensive NEVs, resembling golf carts can be purchased for less than \$5000. Used but functional vehicles are generally available under \$1000.²⁴ Because of the simplicity of the electric power train vehicle maintenance costs are a fraction of that required for gasoline or diesel engines. There is no oil to change, no sparkplugs, filters or coolant issues. The light weight of most electrical vehicles also means that brakes, tires and suspension components are very durable.

Currently one of the most conventional appearing NEVs is the Zenn. While still relying on traditional lead-acid battery technology the Toronto Canada based company has created an unusually sophisticated NEV using a small urban vehicle built in France and converted in Canada to electric power. Because of the volume production already in place with the basic car (originally diesel powered) Zenn has managed to price the vehicle just above the “golf cart” market while delivering a vehicle with both the style and convenience of a small gasoline powered vehicle.

The majority of NEVs currently on the market use technology that has not changed significantly for the past half century. They use lead-acid batteries, DC motors and simple control systems. A new regime of electrical vehicles are appearing in the market in the very near future, most likely prompted by the rapidly increasing price of fossil fuels and the increased awareness of Americans that our access to fossil fuels is becoming precarious. One of these new electrical vehicles, the Tesla roadster, is a technological showcase in the form of a high performance sports car. Another, the Phoenix SUT (sport utility truck), also uses state-of-the-art technology in a practical utility vehicle.

Both vehicles use sophisticated AC motors, Lithium ion batteries, heat pump HVAC systems, regenerative braking and computerized control systems. Both are advertising operating ranges of over 100 miles on a single charge and, based on the battery technology, charge times of under 30 minutes should be expected. Early test data on both vehicles describe performance equal to comparable gasoline powered vehicles. In the case of the Tesla roadster that means acceleration to 60 miles per hour in less than 6 seconds and a top speed of 130 miles per hour.²⁵ The Phoenix SUT boasts a 1000 pound payload, 90 mile per hour top speed and 60 mile an hour in less than 10 seconds

While these vehicles are especially designed for specific audiences they represent logical entry points for new technologies into an existing, mature, market. The Tesla roadster is aimed at the wealthy car enthusiast who is willing to pay above market price for the uniqueness of an electric powered performance car. The Phoenix is marketed to fleet purchasers who value their environmental image above the short term ownership cost. Success in these two markets will work as both test beds for these technologies in real operating environments and as bootstrapping operations to bring down the cost of these technologies as production volumes increase.

For the past one hundred years battery technology has been the limiting factor in keeping electric powered vehicles from competing with fossil fuel powered vehicles. For most of this time the

²⁴ <http://www.eaaev.org/eaalinks.html>

²⁵ <http://www.teslamotors.com/>

only practical battery technology for use in electric cars was the same lead-acid battery used for starting power in conventional automobiles. The combination of high weight, slow re-charging, and low energy density prevented the development of electric vehicles even moderately competitive with liquid fueled vehicles. In the late 1990s electric car and hybrid-electric car developers began investigating the advances made in battery technology for use in portable computers and other electronic devices.

The first of these technologies evaluated for vehicle use was the Nickel-Metal Hydride battery. This battery was promising enough to be used in the second generation EV1 electric car developed by General Motors for compliance with the proposed California Zero Emissions Standard. While not significantly lighter than the lead-acid battery it replaced, the increased energy-to-size ratio allowed for a significantly increased range for the EV1.

Since that time electric car enthusiasts have turned their attention to the Lithium ion battery. These batteries have both significantly better energy-to-weight and energy-to-volume characteristics. Early versions of these batteries were sensitive to high discharge rates and to certain manufacturing defects which resulted in a number of fires occurring in portable computers using this technology. Since that time changes in the cathode material, manufacturing improvements and the development of external control methods have potentially eliminated the problem. As a result a new wave of enthusiasm for electric vehicles is developing. Both the high performance Tesla Roadster sports car and the Phoenix Sport Utility Trucks (SUT) are designed around the latest versions of the Lithium ion battery.²⁶

Phoenix Motorcars plans to sell approximately 500 Sport Utility Trucks in 2007 to selected fleet operators. One such operator is Pacific Gas and Electric, the northern California utility company. Phoenix plans to begin selling to individual users in 2008 and estimates that it will sell 6000 vehicles in that year. Pricing for the 2008 model year should be in the \$40 to \$50 thousand range.⁴ First shipments of the Tesla Roadster are scheduled for August 2007.

Technological changes are appearing rapidly. Recently EEStor, a Texas company has announced a breakthrough battery/ultra-capacitor system that may leapfrog the Lithium ion battery technology with improved storage capacity, discharge rate and cost. Zenn motorcars has signed an exclusive agreement with EEStor to provide storage systems for their next generation of electric vehicles²⁷. Regardless of the success of such efforts it is an indication of a growing interest in non-fossil fueled power systems.

For short distance, light load applications electric powered vehicles are the right choice for a large number of applications. The long charging times needed by lead-acid batteries limit the application of these vehicles to under fifty miles per day in most cases. For those fleet applications that can justify the high first cost Phoenix Motorcars SUTs are a practical vehicle available this year. With the rapid changes taking place in battery, motor and motor controller technologies look for increased choices in the zero emission vehicle market.

²⁶ <http://en.wikipedia.org/wiki/Altairnano>

²⁷ <http://www.technologyreview.com/Biztech/18086/page1/>

Further Reading

The GM EV1:

<http://www.thejaffes.org/rory/ev1/ev1.pdf>

The French postal service plans to order 10,000 electric vehicles:

<http://www.autobloggreen.com/2007/04/18/the-french-postal-service-plans-to-order-10-000-electric-vehicle/>

Nissan and NEC to produce electric-car batteries:

<http://www.detnews.com/apps/pbcs.dll/article?AID=/20070413/UPDATE/704130433/1148/rss25>

Electric car batteries might serve as reservoirs of green power?:

http://www.edn.com/index.asp?layout=blog&blog_id=1470000147&blog_post_id=1170007917

Basic battery technology:

<http://www.batteryuniversity.com/index.htm>

Battery data:

http://en.wikipedia.org/wiki/Nickel_metal_hydrate_battery

http://en.wikipedia.org/wiki/Lithium_ion

http://en.wikipedia.org/wiki/Lead_acid

Specs on Altair nano battery:

http://www.altairnano.com/documents/NanoSafe_Datasheet.pdf

Johnson Controls reveals new hybrid-electric car batteries:

<http://wistechology.com/article.php?id=1485>

Altairnano lithium ion battery system:

<http://www.azonano.com/news.asp?newsID=1967>

Safety of lithium ion batteries:

http://www.technologyreview.com/read_article.aspx?id=17250&ch=biztech

Lithium ion battery improvements:

http://www.technologyreview.com/read_article.aspx?id=16384&ch=biztech

7.7 Commute Programs

Commute Programs: Examples of Success

6/17/07

Jim Housman, PE

The United States of America consumes 9.2 million barrels of gasoline every day, approximately 25% of all the gasoline consumed in the world.²⁸ Yet the United States contains only 4.5% of the world's population. We drive bigger vehicles and we drive them farther each year than any other society. We have the cheapest gasoline of any nation that imports more petroleum than it exports (excepting China and Thailand)²⁹. Americans are used to using their cars for virtually 100% of their transportation needs. We have built our cities, and even our small towns, around the assumption that everyone who wants to go anywhere will drive. Our driving has been cheap and convenient. But in recent years that has begun to unravel. As our homes have become farther away from our workplaces and as our need to import oil has increased driving has become more and more expensive and more irksome. And in spite of spectacular efforts to reduce pollution our driving has continued to be a major factor in environmental degradation.

Slowly over time these factors have been at the root of a change in behavior that is taking place all over the continent. In all 50 states, and in Canada, programs are arising to limit the number of automobiles on the road during peak driving hours. A number of states have established transportation demand management (TDM) legislation to reduce public road usage. In addition, local governments have established regional traffic mitigation programs to assist local employers in encouraging their workforce to stop driving to work alone. Often these programs enable groups of employers to share incentives and facilities to enhance the commuter experience while reducing costs for both employer and employee. California has no state wide traffic mitigation program, however the recently passed AB1431 (Vehicle Greenhouse Gas Emissions) will almost certainly address the effects of commuting on greenhouse gases.

The US Department of Transportation has created a program dubbed "Best Workplaces for Commuters" (BWC) to acknowledge those employers that have done the most to make alternate commute options work the best for their employees. As of June 2007 the site has over 1,400 employers listed as meeting the department's stringent standard for inclusion on the list. Typically to win acknowledgement employers must provide emergency ride home capabilities for transit and car/van pool commuters, provide some kind of subsidy or support for those not driving to work alone and commit to having 14% of employees participate in the program within 18 months. In addition to the BWC program the Internal Revenue Service permits employers to pay for certain commute benefits with pre-tax dollars, saving money for both employers and employees.³⁰

28 <http://www.eia.doe.gov/neic/quickfacts/quickoil.html>

29 <http://europe.theoildrum.com/node/2653>

30 <http://www.bwc.gov/>

Commute programs exist at the federal, state, county and jobsite levels because they work. In a survey funded by the US Department of Transportation (DOT) in 2004 found that well designed commute programs reduced vehicle trips by an average of 15.3%.³¹ That kind of reduction pays off. It pays off in savings to the employer, government at all levels and the employee.

Most employers are probably so accustomed to providing parking spaces for employees that it is not considered to be a real cost of doing business. Yet some employers must set aside more land for parking than is used for generating income. The Victoria (B.C.) Transport Policy Institute estimated in 2000 that parking lot construction costs can vary between \$1500 (US) and \$1900 (US) per space. That cost is in addition to the value of the unimproved land. When parking structures become necessary per space costs can exceed \$9000 per space. In addition there are annual maintenance costs.³² One estimate of the value to U.S. employers of this unproductive land placed the rental value nationwide at over 35 billion dollars.³³

DOT estimates that current freeway construction costs exceed one-quarter million dollars per lane-mile with a continuing cost of about one percent of that amount for annual maintenance. While this cost is not apparent directly to the taxpayer it is there and as more roadways are constructed to accommodate peak traffic loads for commuters both the capital costs of construction and the annual maintenance costs are an increasing burden on taxpayers and on the local officials who must negotiate to find the funds.³⁴

Commute costs to employees is more than the obvious. A UC Berkeley study in 1990 indicated that the average Bay Area one-way commute distance increased between 1980 and 1990 from 10.6 miles to 11.8 and the average duration from 27.7 minutes to 29.0 minutes. Over a 50 week working year that amounts to 5900 miles per year and 242 hours on the road. With per-mile driving costs approaching 50 cents employees are spending almost \$3000 per year just to get to work. Since employers do not pay for the time that commuters sit in their cars in heavy traffic it is the individual worker whose time is wasted crawling through traffic. According to the Texas Transportation Institute California commuters who have recently moved to a metropolitan area spend, on average, 250 hours per year in commuter traffic.

There are great success stories in communities developing programs to reduce vehicle miles traveled (VMT). Boulder, Colorado has a program called Ride Arrangers that reports having saved 28 million VMT in 2006. Ride Arrangers has 6,000 people in their carpool database, 380 people vanpooling with a waiting list to fill 10 more vans. There are 4,000 “teleworkers” and 11,000 families enrolled in the “schoolpool” database. In the annual Bike to Work Day in 2006 there were 20,000 participants.³⁵

³¹ Mitigating Traffic Congestion; Association for Commuter Transportation; PO Box 15542, Washington, DC 20003-0542;2004

³² Todd Litman; Parking Management Strategies, Evaluation and Planning; Victoria Transport Policy Institute; 2006

³³ http://72.14.253.104/search?q=cache:biyCdgRbNHQJ:www.commuterchoice.gov/pdf/sanfran/bwc-present-sfa.ppt+sonoma+best+workplaces&hl=en&ct=clnk&cd=2&gl=us&lr=lang_en

³⁴ [http://www.publicpurpose.com/hwy-fy\\$.htm](http://www.publicpurpose.com/hwy-fy$.htm)

³⁵ Linda Dowlin, Denver TDM Manager; personal communication; 6/11/07

In the Bay area Contra Costa county reports that their SchoolPool program has reduced VMT by 4 million miles in 2002⁸. The San Mateo County Commute Alternatives Program has mailed 80,000 Commuter Checks to employees of 3,200 employers in the county since 1991.³⁶ C2HM Hill reports a 115,000 mile reduction in VMT in 2002 at a single worksite in Denver. In Seattle the University of Washington estimates that the UPASS program has eliminated 91 million vehicle trips since it was established in 1991⁴. These examples show that in a large variety of environments and over long periods of time employers, employees, taxpayers and the environment are benefiting from well designed commute programs.

Today, more than ever in the past, it makes sense to create programs allowing commuters to get out of their cars and find more appropriate ways to get to and from work. The ability of the modern passenger vehicle to take us anywhere we want, when we want is at its least beneficial when we are traveling the same path at the same time of day over many months and years. The rising cost of operation, the increasing time spent unproductively and the anger and frustration so often connected with present day commuting will continue to get worse in the future. We cannot pave the entire nation to enable every person to drive effortlessly where ever they want to go at any time of day. It follows that community leaders in every American community should be emulating the examples of those communities that have gained so much by instituting these programs.

36 <http://www.smccap.org/index.jsp>

FURTHER READING

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5. Commuter Connections, Metropolitan Council of Governments; Washington DC; <http://www.mwcog.org/commuter/ccindex.html>
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7. Santa Cruz Commute Solutions; <http://www.commuterconnections.org/>
8. Commuter Calculator; <http://www.rideworks.com/rwcalc2.htm>
9. Strategies for Increasing the Benefits of Commuter Benefits Programs; TCRP Report 87; Transportation Research Board; 2003
10. Commuter Check; Section 132 (f) pre-tax transportation benefit program; <http://www.commutercheckpremium.com/>
11. Bay Area Commuter Comments; <http://www.ibabuzz.com/transportation/>
12. Westchester County New York Commute Program: http://www.westchestergov.com/smartcommute/programs_services.htm
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14. Washington State Commute Trip Reduction Program; <http://www.pewclimate.org/states.cfm?ID=14>
15. Boulder, CO "GOBoulder program: http://www.bouldercolorado.gov/index.php?option=com_content&task=view&id=705&Itemid=311
16. Accordia Northwest, Inc., Seattle WA; Commute Trip Reduction Program;
17. <http://www.commuterchallenge.org/cc/daw99acordia.html>
18. Sustainable Transportation Success Stories; Smart Communities Network; <http://www.smartcommunities.ncat.org/transprt/trsstoc.shtml>
19. Ride Solutions; Mid Ohio Regional Planning Commission; <http://ridesolutions.morpc.org/>
20. City of Palo Alto Way 2 Go Program; <http://www.city.palo-alto.ca.us/transportation-division/commute-index.html>
21. Washington D.C.; Capital Rideshare Program; <http://capitolrideshare.com/index.htm>

Examples of Successful Programs

Program name	Location	Demographics	% of Transit Population Participating										BWC(@)	% Participating	Control (\$)		
			Car pool	Van pool	Transit pass	Car/Van Parking	Guaran. Ride Home	Tele commute flextime	Work week	Shuttle	Bicycle/Walk	Other					
Upass	U. of Washington	39,000 students	x		x	x									Yes		Univ.
SchoolPool	Contra Costa Cty, CA	157,000 students	x		x										No		County
Transportation Options	Aspen, CO	15,000 residents	x			x					x				Yes		Blanket
TNT/TMA	Lake Tahoe Basin	56,000 residents, large tourist influx			x								x		No		Govt
Vanpool Program	Bal Harbour Village, FL	3309 pop.		x											Yes		Govt
Calibre Transportation Benefits	Alexandria, VA	na	x		x			x				x	x		Yes		Corp
C2HM Hill Telework & Flextime	Denver, CO	na	5.0%		3.0%			8.0%				0.5%			No	16.5%	Corp
Georgia Power Smartride	Allanta, GA	5,500 employees	7.0%	6.0%			x	20.0%		x					Yes	33.0%	Corp
Transit Plan	Hennepin County, MN	13,000 county employees	15.0%	2.0%	15.0%			8.0%							Yes	40.0%	Blanket
Johns Manville tbp	Denver, CO	est. 400 empl Denver only	x	0.5%	44.0%	x							0.5%		Yes	45.0%	Corp
Nike TRAC Program	Beaverton, OR	5,000 employees	10.0%		5.0%		x	5.0%				2.0%	Prizes		Yes	22.0%	Corp
Overlake Christian Church tbp	Redmond, Wash	109 employees	26.0%		1.0%			12.0%	8.0%		1.0%				No	48.0%	Corp
Simmons College tbp	Boston, MA	740 faculty & staff			27.0%		x			x			32.0%		Yes	59.0%	Corp
Swedish Medical Center tbp	Seattle, WA	758 staff & dr	19.0%	2.0%	23.0%	x	x	2.0%	x						Yes	46.0%	Corp
Texas Children's Hospital tbp	Houston, TX	758 staff & dr	10.0%		10.0%	x	x	x		x					Yes	20.0%	Corp
King County TOD	Seattle, WA	metro Seattle	x		x	x							car share		No		Blanket
Acordia Northwest Inc.	Seattle	118 employees	x	x	x		x	x							No		Corp
GO Boulder	Boulder, CO	County employees	x	x	x		x	x			x		4100 bikers, walkers, transit riders		No		Blanket
Commute Alternatives Program	San Mateo, CA county	City and surrounding area	x	x	x	x	x								Yes		Blanket
Ride Arrangers	Denver, CO	School, city & business employees	x	x			x	x			x				No		Blanket
GoGreen	Vancouver BC	906,000 pop	x	x	x			x			x				No		Blanket
Smart Commute Program	Westchester County, NY		x	x	x	x	x	x	x						Yes		Blanket
CTR	Redmond Wash	23,500 pop													No		Blanket
RideSolutions	Mid-Ohio Regional Planning Comm.	11 counties around Columbus, OH	x	x	x		x				x				No		Blanket
Employee Commute Program	Palo Alto		x	x	x		x			x	x				No		Blanket
Travel Reduction Program	Greater Tucson area	486669	x		x						x				No		Blanket
Capital Rideshare	Phoenix, AZ	4,000 state employees plus 50 companies.	x	x	x	x	x	x	x		x				No		Blanket
This program is an umbrella function for all Wash state programs																	
Commuter Trip Reduction State of Wash																	
This program is an umbrella function for all Wash state programs																	
MassRides State Of Mass.																	
*Note corp participation is voluntary so financial benefits are at employer discretion																	
\$ Control refers to the type of organization sponsoring the program.																	
Blanket refers to a government sponsorship organization that helps other organizations to form commute programs.																	
@ BWC= Listed on federal program called "Best Workplace for Commuters"																	

7.8 Measure Input Summaries

City of Rohnert Park Green House Gas Reduction Plan		
B1-APS Measures		
Measures Name	APS Measures	<u>Notes</u>
Measure Category	Building	
Measure Status	Completed	2006
Capital Cost	\$920,216	Source
Incremental Capital Cost %	100%	Provided
Incremental Capital Cost	\$920,216	<u>Next Steps</u>
Rebate	\$0	Provided
Net Capital Cost	\$920,216	Provided
Annual O&M (incremental cost)	-\$2,982	Provided
Annual Cost Savings	\$54,228	Provided
Peak Demand Reduction (kW)	1.0	Provided
Annual Energy Savings (kWh)	304,416	Provided
Annual Energy Savings (Therms)	7,044	Provided
Annual CO2 Savings (lbs)	235,782	Calculated
Financed (yes/no)	yes	
Payment Amount	(\$85,273)	
Incremental Replacement Cost	\$0	
Component Life	15	
Inputs Used in Analysis (subject to individual measure override)		<u>Key Assumptions</u>
Term of Analysis	25	
Term of Finance	15	
Discount Rate	5.00%	
Energy Inflation	3.50%	
Energy Cost (\$/kWh)	\$0.145	
Energy Cost (\$/Therm)	\$1.00	
Interest Rate	4.43%	
Inflation Rate	2.00%	
Time of Use (PV)	0.00	
Incremental Capital Cost	100%	
Exclude "completed" measure C/B	yes	
Results		Source:
SPB	17.0	ESCO: Includes PV, HVAC, LED lighting.
IRR	#NUM!	
NPV	\$0	
CO2 reduction (tons)	117.89	

B2-Lighting Retrofit (multi-bldg)		
Measures Name	Lighting Retrofit (multi-bldg)	<u>Notes</u>
Measure Category	Building	
Measure Status	Completed	2001
		<u>Source</u>
		<u>Next Steps</u>
Capital Cost	\$96,850	Provided
Incremental Capital Cost %	100%	
Incremental Capital Cost	\$96,850	
Rebate	\$0	Provided
Net Capital Cost	\$96,850	Provided
Annual O&M (incremental cost)	\$0	Provided
Annual Cost Savings	\$48,425	Provided
Peak Demand Reduction (kW)	0.0	Provided
Annual Energy Savings (kWh)	333,966	Provided
Annual Energy Savings (Therms)	0	Provided
Annual CO2 Savings (lbs)	163,309	Calculated
Financed (yes/no)	yes	
Payment Amount	(\$16,106)	
Incremental Replacement Cost	\$0	
Component Life	15	
Inputs Used in Analysis (subject to individual measure override)		<u>Key Assumptions</u>
Term of Analysis	25	
Term of Finance	7	
Discount Rate	5.00%	
Energy Inflation	3.50%	
Energy Cost (\$/kWh)	\$0.145	
Energy Cost (\$/Therm)	\$1.00	
Interest Rate	3.95%	
Inflation Rate	3.00%	
Time of Use (PV)	NA	
Incremental Capital Cost	100%	
Exclude "completed" measure C/B	yes	
Results		<u>Source:</u>
SPB	2.0	Draft Plan: City of Rohnert Park Building Energy Efficiency and Greenhouse Gas Emission Reduction, CPC August 2006.
IRR	#NUM!	
NPV	\$0	
CO2 reduction (tons)	81.65	

B3-Bldg HVAC		
Measures Name	Building HVAC	<u>Notes</u>
Measure Category	Building	
Measure Status	Future	2007
		<u>Source</u>
		<u>Next Steps</u>
Capital Cost	\$84,600	Provided
Incremental Capital Cost %	30%	
Incremental Capital Cost	\$25,380	
Rebate	\$0	Provided
Net Capital Cost	\$25,380	Provided
Annual O&M (incremental cost)	\$0	Provided
Annual Cost Savings	\$6,090	Provided
Peak Demand Reduction (kW)	0.0	Provided
Annual Energy Savings (kWh)	42,000	Provided
Annual Energy Savings (Therms)	0	Provided
Annual CO2 Savings (lbs)	20,538	Calculated
Financed (yes/no)	yes	
Payment Amount	(\$4,221)	
Incremental Replacement Cost	\$0	
Component Life	15	
Inputs Used in Analysis (subject to individual measure override)		<u>Key Assumptions</u>
Term of Analysis	25	
Term of Finance	7	
Discount Rate	5.00%	
Energy Inflation	3.50%	
Energy Cost (\$/kWh)	\$0.145	
Energy Cost (\$/Therm)	\$1.00	
Interest Rate	3.95%	
Inflation Rate	3.00%	
Time of Use (PV)	NA	
Incremental Capital Cost	100%	
Exclude "completed" measure C/B	yes	
Results		<u>Source:</u>
SPB	4.2	ABAG EW Report 5/07
IRR	28.2%	
NPV	\$96,740	
CO2 reduction (tons)	10.27	

B4-Computer Network Controls		
Measures Name	Computer Network Controls	<u>Notes</u>
Measure Category	Building	
Measure Status	Future	2008
Capital Cost	\$5,000	<u>Source</u> <u>Next Steps</u>
Incremental Capital Cost %	100%	Provided
Incremental Capital Cost	\$5,000	
Rebate	\$862	Provided
Net Capital Cost	\$4,138	Provided
Annual O&M (incremental cost)	\$0	Provided
Annual Cost Savings	\$2,500	Provided
Peak Demand Reduction (kW)	0.0	Provided
Annual Energy Savings (kWh)	17,241	Provided
Annual Energy Savings (Therms)	0	Provided
Annual CO2 Savings (lbs)	8,431	Calculated
Financed (yes/no)	no	
Payment Amount	\$0	
Incremental Replacement Cost	\$0	
Component Life	15	
Inputs Used in Analysis (subject to individual measure override)		<u>Key Assumptions</u>
Term of Analysis	25	
Term of Finance	7	
Discount Rate	5.00%	
Energy Inflation	3.50%	
Energy Cost (\$/kWh)	\$0.145	
Energy Cost (\$/Therm)	\$1.00	
Interest Rate	3.95%	
Inflation Rate	3.00%	
Time of Use (PV)	NA	
Incremental Capital Cost	100%	
Exclude "completed" measure C/B	yes	
Results		<u>Source:</u>
SPB	1.7	Assumes 100 CPU's, \$25 savings per unit, kWh
IRR	66.0%	savings based on estimated cost savings
NPV	\$45,694	provided by ABAG EW. Project Cost is
CO2 reduction (tons)	4.22	estimated with no substantiation.

B5-Addtl Lighting			
Measures Name	Addtl Lighting	<u>Notes</u>	
Measure Category	Building		
Measure Status	Future	<u>Source</u>	<u>Next Steps</u>
Capital Cost	\$57,925	Provided	
Incremental Capital Cost %	100%		
Incremental Capital Cost	\$57,925	2007	
Rebate	\$11,227	Provided	
Net Capital Cost	\$46,698	Provided	
Annual O&M (incremental cost)	\$0	Provided	
Annual Cost Savings	\$11,750	Provided	
Peak Demand Reduction (kW)	0.0	Provided	
Annual Energy Savings (kWh)	78,330	Provided	
Annual Energy Savings (Therms)	0	Provided	
Annual CO2 Savings (lbs)	38,303	Calculated	
Financed (yes/no)	yes		
Payment Amount	(\$11,032)		
Incremental Replacement Cost	\$0		
Component Life	15		
Inputs Used in Analysis (subject to individual measure override)		<u>Key Assumptions</u>	
Term of Analysis	25		
Term of Finance	6		
Discount Rate	5.00%		
Energy Inflation	3.50%		
Energy Cost (\$/kWh)	\$0.150		
Energy Cost (\$/Therm)	\$1.00		
Interest Rate	3.95%		
Inflation Rate	3.00%		
Time of Use (PV)	NA		
Incremental Capital Cost	100%		
Exclude "completed" measure C/B	yes		
Results		<u>Source:</u>	
SPB	4.9	ABAG EW Report 5/07	
IRR	24.3%		
NPV	\$178,109		
CO2 reduction (tons)	19.15		

B6-Pool Covers		
Measures Name	Pool Covers	<u>Notes</u>
Measure Category	Building	
Measure Status	Completed	2006
		<u>Source</u>
		<u>Next Steps</u>
Capital Cost	\$18,738	Provided
Incremental Capital Cost %	100%	
Incremental Capital Cost	\$18,738	
Rebate	\$0	Provided
Net Capital Cost	\$18,738	Provided
Annual O&M (incremental cost)	\$0	Provided
Annual Cost Savings	\$10,087	Provided
Peak Demand Reduction (kW)	0.0	Provided
Annual Energy Savings (kWh)	0	Provided
Annual Energy Savings (Therms)	10,087	Provided
Annual CO2 Savings (lbs)	124,470	Calculated
Financed (yes/no)	no	
Payment Amount	\$0	
Incremental Replacement Cost	\$0	
Component Life	15	
Inputs Used in Analysis (subject to individual measure override)		<u>Key Assumptions</u>
Term of Analysis	25	
Term of Finance	7	
Discount Rate	5.00%	
Energy Inflation	3.50%	
Energy Cost (\$/kWh)	\$0.145	
Energy Cost (\$/Therm)	\$1.00	
Interest Rate	3.95%	
Inflation Rate	3.00%	
Time of Use (PV)	NA	
Incremental Capital Cost	100%	
Exclude "completed" measure C/B	yes	
Results		<u>Source:</u>
SPB	1.9	City Staff
IRR	#NUM!	
NPV	\$0	
CO2 reduction (tons)	62.24	

B7-Fountain Decommissioning		
Measures Name	Decommission Fountain	<u>Notes</u>
Measure Category	Building	
Measure Status	Future	2010
		<u>Source</u>
		<u>Next Steps</u>
Capital Cost	\$15,000	Provided
Incremental Capital Cost %	100%	
Incremental Capital Cost	\$15,000	
Rebate	\$0	Provided
Net Capital Cost	\$15,000	Provided
Annual O&M (incremental cost)	\$0	Provided
Annual Cost Savings	\$11,406	Provided
Peak Demand Reduction (kW)	0.0	Provided
Annual Energy Savings (kWh)	78,664	Provided
Annual Energy Savings (Therms)	0	Provided
Annual CO2 Savings (lbs)	38,467	Calculated
Financed (yes/no)	no	
Payment Amount	\$0	
Incremental Replacement Cost	\$0	
Component Life	15	
Inputs Used in Analysis (subject to individual measure override)		<u>Key Assumptions</u>
Term of Analysis	25	
Term of Finance	7	
Discount Rate	5.00%	
Energy Inflation	3.50%	
Energy Cost (\$/kWh)	\$0.145	
Energy Cost (\$/Therm)	\$1.00	
Interest Rate	3.95%	
Inflation Rate	3.00%	
Time of Use (PV)	NA	
Incremental Capital Cost	100%	
Exclude "completed" measure C/B	yes	
Results		<u>Source:</u>
SPB	1.3	APS recommendation (not adopted)
IRR	82.2%	
NPV	\$212,175	
CO2 reduction (tons)	19.23	

B8-Sports Cntr Boiler Replacement		
Measures Name	Boiler Replcmnt Sports Center	<u>Notes</u>
Measure Category	Building	
Measure Status	Future	2008
Capital Cost	\$76,426	<u>Source</u> <u>Next Steps</u>
Incremental Capital Cost %	100%	Provided
Incremental Capital Cost	\$76,426	
Rebate	\$3,821	Provided
Net Capital Cost	\$72,604	Provided
Annual O&M (incremental cost)	\$0	Provided
Annual Cost Savings	\$4,777	Provided
Peak Demand Reduction (kW)	0.0	Provided
Annual Energy Savings (kWh)	0	Provided
Annual Energy Savings (Therms)	4,777	Provided
Annual CO2 Savings (lbs)	58,943	Calculated
Financed (yes/no)	yes	
Payment Amount	(\$6,507)	
Incremental Replacement Cost	\$0	
Component Life	15	
Inputs Used in Analysis (subject to individual measure override)		<u>Key Assumptions</u>
Term of Analysis	25	
Term of Finance	15	
Discount Rate	5.00%	
Energy Inflation	3.50%	
Energy Cost (\$/kWh)	\$0.145	
Energy Cost (\$/Therm)	\$1.00	
Interest Rate	3.95%	
Inflation Rate	3.00%	
Time of Use (PV)	NA	
Incremental Capital Cost	100%	
Exclude "completed" measure C/B	yes	
Results		<u>Source:</u>
SPB	15.2	APS recommendation (not adopted)
IRR	7.9%	
NPV	\$25,688	
CO2 reduction (tons)	29.47	

W4-Lift Station #1		
Measures Name	Lift Station #1	<u>Notes</u>
Measure Category	Water/Sewer	
Measure Status	Future	2007
		<u>Source</u>
		<u>Next Steps</u>
Capital Cost	\$35,000	Provided
Incremental Capital Cost %	100%	
Incremental Capital Cost	\$35,000	
Rebate	\$2,080	Provided
Net Capital Cost	\$32,920	Provided
Annual O&M (incremental cost)	\$0	Provided
Annual Cost Savings	\$3,770	Provided
Peak Demand Reduction (kW)	0.0	Provided
Annual Energy Savings (kWh)	26,000	Provided
Annual Energy Savings (Therms)	0	Provided
Annual CO2 Savings (lbs)	12,714	Calculated
Financed (yes/no)	yes	
Payment Amount	(\$4,049)	
Incremental Replacement Cost	\$0	
Component Life	15	
Inputs Used in Analysis (subject to individual measure override)		<u>Key Assumptions</u>
Term of Analysis	25	
Term of Finance	10	
Discount Rate	5.00%	
Energy Inflation	3.50%	
Energy Cost (\$/kWh)	\$0.145	
Energy Cost (\$/Therm)	\$1.00	
Interest Rate	3.95%	
Inflation Rate	3.00%	
Time of Use (PV)	NA	
Incremental Capital Cost	100%	
Exclude "completed" measure C/B	yes	
Results		<u>Source:</u>
SPB	8.7	ABAG EW report 5/07
IRR	14.4%	
NPV	\$43,497	
CO2 reduction (tons)	6.36	

B10-Pools Solar Wtr		
Measures Name	H-Pool Solar Wtr	<u>Notes</u>
Measure Category	Building	
Measure Status	Future	2008 <u>Source</u> <u>Next Steps</u>
Capital Cost	\$30,688	Provided
Incremental Capital Cost %	100%	
Incremental Capital Cost	\$30,688	
Rebate	\$0	Provided
Net Capital Cost	\$30,688	Provided
Annual O&M (incremental cost)	\$0	Provided
Annual Cost Savings	\$16,982	Provided
Peak Demand Reduction (kW)	0.0	Provided
Annual Energy Savings (kWh)	0	Provided
Annual Energy Savings (Therms)	16,982	Provided
Annual CO2 Savings (lbs)	209,555	Calculated
Financed (yes/no)	yes	
Payment Amount	(\$11,048)	
Incremental Replacement Cost	\$0	
Component Life	15	
Inputs Used in Analysis (subject to individual measure override)		<u>Key Assumptions</u>
Term of Analysis	25	
Term of Finance	3	
Discount Rate	5.00%	
Energy Inflation	3.50%	
Energy Cost (\$/kWh)	\$0.145	
Energy Cost (\$/Therm)	\$1.00	
Interest Rate	3.95%	
Inflation Rate	3.00%	
Time of Use (PV)	NA	
Incremental Capital Cost	100%	
Exclude "completed" measure C/B	yes	
Results		<u>Source:</u>
SPB	1.8	APS recommendation (not adopted)
IRR	60.8%	
NPV	\$307,931	
CO2 reduction (tons)	104.78	

B11-Pool Measures		
Measures Name	Pool Pump Measures	<u>Notes</u>
Measure Category	Building	
Measure Status	Future	2007 <u>Source</u> <u>Next Steps</u>
Capital Cost	\$40,500	Provided
Incremental Capital Cost %	100%	
Incremental Capital Cost	\$40,500	
Rebate	\$7,360	Provided
Net Capital Cost	\$33,140	Provided
Annual O&M (incremental cost)	\$0	Provided
Annual Cost Savings	\$13,340	Provided
Peak Demand Reduction (kW)	0.0	Provided
Annual Energy Savings (kWh)	92,000	Provided
Annual Energy Savings (Therms)	0	Provided
Annual CO2 Savings (lbs)	44,988	Calculated
Financed (yes/no)	yes	
Payment Amount	(\$17,558)	
Incremental Replacement Cost	\$0	
Component Life	15	
Inputs Used in Analysis (subject to individual measure override)		<u>Key Assumptions</u>
Term of Analysis	25	
Term of Finance	2	
Discount Rate	5.00%	
Energy Inflation	3.50%	
Energy Cost (\$/kWh)	\$0.145	
Energy Cost (\$/Therm)	\$1.00	
Interest Rate	3.95%	
Inflation Rate	3.00%	
Time of Use (PV)	NA	
Incremental Capital Cost	100%	
Exclude "completed" measure C/B	yes	
Results		<u>Source:</u>
SPB	2.5	ABAG EW (savings estimate, rebate, cost) CPC
IRR	45.2%	report 8/06 (annual NG usage)
NPV	\$233,291	
CO2 reduction (tons)	22.49	

F7-City Fleet New 2		
Measures Name	City Fleet New 2	<u>Notes</u>
Measure Category	Fleet	
Measure Status	Future	2012 <u>Source</u> <u>Next Steps</u>
Capital Cost	\$939,000	Provided
Incremental Capital Cost %	100%	
Incremental Capital Cost	\$939,000	
Rebate	\$0	Provided
Net Capital Cost	\$939,000	Provided
Annual O&M (incremental cost)	\$0	Provided
Annual Cost Savings	\$45,999	Provided
Peak Demand Reduction (kW)	0.0	Provided
Annual Energy Savings (kWh)	0	Provided
Annual Energy Savings (Therms)	0	Provided
Annual CO2 Savings (lbs)	357,699	Calculated
Financed (yes/no)	yes	
Payment Amount	(\$213,896)	
Incremental Replacement Cost	\$939,000	
Component Life	10	
Inputs Used in Analysis (subject to individual measure override)		<u>Key Assumptions</u>
Term of Analysis	25	
Term of Finance	5	
Discount Rate	5.00%	
Energy Inflation	2.50%	
Energy Cost (\$/kWh)	\$0.145	
Energy Cost (\$/Therm)	\$1.00	
Interest Rate	4.50%	
Inflation Rate	3.00%	
Time of Use (PV)	NA	
Incremental Capital Cost	100%	
Exclude "completed" measure C/B	yes	
Results		<u>Source:</u>
SPB	20.4	MSI
IRR	NA	
NPV	(\$1,428,048)	
CO2 reduction (tons)	178.85	

PV1			
Measures Name	PV-New City Hall	<u>Notes</u>	
Measure Category	PV	31.6	Size (kWac)
Measure Status	Future	2008	Implementation Date
Capital Cost	\$254,332	<u>Source</u>	<u>Next Steps</u>
Incremental Capital Cost %	100%	Calculated	
Incremental Capital Cost	\$254,332		
Rebate	\$72,648	Calculated	
Net Capital Cost	\$181,684	Calculated	
Annual O&M (incremental cost)	\$632	Calculated	
Annual Cost Savings	\$5,145	Calculated	
Peak Demand Reduction (kW)	0.0	Calculated	
Annual Energy Savings (kWh)	39,226	Calculated	
Annual Energy Savings (Therms)	0	Calculated	
Annual CO2 Savings (lbs)	19,181	Calculated	
Financed (yes/no)	yes		
Payment Amount	(\$22,344)		
Incremental Replacement Cost	\$37,108		
Component Life	12		
Inputs Used in Analysis (subject to individual measure override)		<u>Key Assumptions</u>	
Term of Analysis	25		
Term of Finance	10		
Discount Rate	5.00%		
Energy Inflation	3.50%		
Energy Cost (\$/kWh)	\$0.120		
Energy Cost (\$/Therm)	\$1.00		
Interest Rate	3.95%		
Inflation Rate	3.00%		
Time of Use (PV)	1.00		
Incremental Capital Cost	100%		
Exclude "completed" measure C/B	yes		
Results		<u>Source:</u>	
SPB	35.3	Green Building Studio Report on City Hall renovation	
IRR	2.5%		
NPV	(\$39,715)		
CO2 reduction (tons)	9.59		

PV2		
Measures Name	PV Supplying 100% Wtr &Wste energy cost	<u>Notes</u>
Measure Category	PV	473.8 Size (kWac)
Measure Status	Future	2010 Implementation Date
Capital Cost	\$3,791,975	<u>Source</u> <u>Next Steps</u>
Incremental Capital Cost %	100%	Calculated
Incremental Capital Cost	\$3,791,975	
Rebate	\$0	Calculated
Net Capital Cost	\$3,791,975	Calculated
Annual O&M (incremental cost)	\$9,476	Calculated
Annual Cost Savings	\$142,763	Calculated
Peak Demand Reduction (kW)	0.0	Calculated
Annual Energy Savings (kWh)	588,384	Calculated
Annual Energy Savings (Therms)	0	Calculated
Annual CO2 Savings (lbs)	287,720	Calculated
Financed (yes/no)	yes	
Payment Amount	(\$339,863)	
Incremental Replacement Cost	\$556,623	
Component Life	12	
Inputs Used in Analysis (subject to individual measure override)		<u>Key Assumptions</u>
Term of Analysis	25	
Term of Finance	15	
Discount Rate	5.00%	
Energy Inflation	3.50%	
Energy Cost (\$/kWh)	\$0.120	
Energy Cost (\$/Therm)	\$1.00	
Interest Rate	3.95%	
Inflation Rate	3.00%	
Time of Use (PV)	1.85	
Incremental Capital Cost	100%	
Exclude "completed" measure C/B	yes	
Results		<u>Source:</u>
SPB	26.6	MSI
IRR	7.1%	
NPV	\$880,685	
CO2 reduction (tons)	143.86	

PV3			
Measures Name	PV APS	Notes	
Measure Category	PV	30.0	Size (kWac)
Measure Status	Completed	2006	Implementation Date
		<u>Source</u>	<u>Next Steps</u>
Capital Cost	\$241,373	Calculated	
Incremental Capital Cost %	100%		
Incremental Capital Cost	\$241,373		
Rebate	\$104,882	Calculated	
Net Capital Cost	\$136,491	Calculated	
Annual O&M (incremental cost)	\$599	Calculated	
Annual Cost Savings	\$9,029	Calculated	
Peak Demand Reduction (kW)	0.0	Calculated	
Annual Energy Savings (kWh)	37,214	Calculated	
Annual Energy Savings (Therms)	0	Calculated	
Annual CO2 Savings (lbs)	18,198	Calculated	
Financed (yes/no)	yes		
Payment Amount	(\$12,233)		
Incremental Replacement Cost	\$35,205		
Component Life	12		
Inputs Used in Analysis (subject to individual measure override)		<u>Key Assumptions</u>	
Term of Analysis	25		
Term of Finance	15		
Discount Rate	5.00%		
Energy Inflation	3.50%		
Energy Cost (\$/kWh)	\$0.120		
Energy Cost (\$/Therm)	\$1.00		
Interest Rate	3.95%		
Inflation Rate	3.00%		
Time of Use (PV)	1.85		
Incremental Capital Cost	100%		
Exclude "completed" measure C/B	yes		
Results		<u>Source:</u>	
SPB	15.1	APS report	
IRR	#NUM!		
NPV	\$0		
CO2 reduction (tons)	18.61		

PV4			
Measures Name	PV4	Notes	
Measure Category	PV	60.7	Size (kWac)
Measure Status	Future	2010	Implementation Date
		Source	Next Steps
Capital Cost	\$487,583	Calculated	
Incremental Capital Cost %	100%		
Incremental Capital Cost	\$487,583		
Rebate	\$0	Calculated	
Net Capital Cost	\$487,583	Calculated	
Annual O&M (incremental cost)	\$1,215	Calculated	
Annual Cost Savings	\$9,894	Calculated	
Peak Demand Reduction (kW)	0.0	Calculated	
Annual Energy Savings (kWh)	75,434	Calculated	
Annual Energy Savings (Therms)	0	Calculated	
Annual CO2 Savings (lbs)	36,887	Calculated	
Financed (yes/no)	yes		
Payment Amount	(\$59,965)		
Incremental Replacement Cost	\$71,362		
Component Life	12		
Inputs Used in Analysis (subject to individual measure override)		Key Assumptions	
Term of Analysis	25		
Term of Finance	10		
Discount Rate	5.00%		
Energy Inflation	3.50%		
Energy Cost (\$/kWh)	\$0.120		
Energy Cost (\$/Therm)	\$1.00		
Interest Rate	3.95%		
Inflation Rate	3.00%		
Time of Use (PV)	1.00		
Incremental Capital Cost	100%		
Exclude "completed" measure C/B	yes		
Results		Source:	
SPB	49.3	MSI	
IRR	-0.4%		
NPV	(\$207,986)		
CO2 reduction (tons)	18.44		

PV5			
Measures Name	PV5	Notes	
Measure Category	PV	60.7	Size (kWac)
Measure Status	Future	2011	Implementation Date
		<u>Source</u>	<u>Next Steps</u>
Capital Cost	\$487,583	Calculated	
Incremental Capital Cost %	100%		
Incremental Capital Cost	\$487,583		
Rebate	\$0	Calculated	
Net Capital Cost	\$487,583	Calculated	
Annual O&M (incremental cost)	\$1,215	Calculated	
Annual Cost Savings	\$9,894	Calculated	
Peak Demand Reduction (kW)	0.0	Calculated	
Annual Energy Savings (kWh)	75,434	Calculated	
Annual Energy Savings (Therms)	0	Calculated	
Annual CO2 Savings (lbs)	36,887	Calculated	
Financed (yes/no)	yes		
Payment Amount	(\$59,965)		
Incremental Replacement Cost	\$71,362		
Component Life	12		
Inputs Used in Analysis (subject to individual measure override)		<u>Key Assumptions</u>	
Term of Analysis	25		
Term of Finance	10		
Discount Rate	5.00%		
Energy Inflation	3.50%		
Energy Cost (\$/kWh)	\$0.120		
Energy Cost (\$/Therm)	\$1.00		
Interest Rate	3.95%		
Inflation Rate	3.00%		
Time of Use (PV)	1.00		
Incremental Capital Cost	100%		
Exclude "completed" measure C/B	yes		
Results		<u>Source:</u>	
SPB	49.3	MSI	
IRR	-0.4%		
NPV	(\$207,986)		
CO2 reduction (tons)	18.44		

PV6-CREBS			
Measures Name	PV6 -CREBS	Notes	
Measure Category	PV	210.6	Size (kWac)
Measure Status	Future	2008	Implementation Date
		<u>Source</u>	<u>Next Steps</u>
Capital Cost	\$0	Provided	
Incremental Capital Cost %	100%		
Incremental Capital Cost	\$0		
Rebate	\$0	Provided	
Net Capital Cost	\$0	Provided	
Annual O&M (incremental cost)	\$0	Provided	
Annual Cost Savings	\$34,298	Calculated	
Peak Demand Reduction (kW)	0.0	Calculated	
Annual Energy Savings (kWh)	261,504	Calculated	
Annual Energy Savings (Therms)	0	Calculated	
Annual CO2 Savings (lbs)	127,876	Calculated	
Financed (yes/no)	no		
Payment Amount	\$0		
Incremental Replacement Cost	\$0		
Component Life	12		
Inputs Used in Analysis (subject to individual measure override)		<u>Key Assumptions</u>	
Term of Analysis	25		
Term of Finance	7		
Discount Rate	5.00%		
Energy Inflation	3.50%		
Energy Cost (\$/kWh)	\$0.120		
Energy Cost (\$/Therm)	\$1.00		
Interest Rate	3.95%		
Inflation Rate	3.00%		
Time of Use (PV)	1.00		
Incremental Capital Cost	100%		
Exclude "completed" measure C/B	yes		
Results		<u>Source:</u>	
SPB	0.0	MSI	
IRR	#DIV/0!		
NPV	\$1,303,182		
CO2 reduction (tons)	63.94		

C1-Commute			
Measures Name	Commute	<u>Notes</u>	
Measure Category	Commute		
Measure Status	Future	2008	<u>Next Steps</u>
Capital Cost	\$0	Source	Calculated
Incremental Capital Cost %	100%		
Incremental Capital Cost	\$0		
Rebate	\$0	Calculated	
Net Capital Cost	\$0	Calculated	
Annual O&M (incremental cost)	\$75,000	Calculated	
Annual Cost Savings	\$0	Calculated	
Peak Demand Reduction (kW)	0.0	Calculated	
Annual Energy Savings (kWh)	0	Calculated	
Annual Energy Savings (Therms)	0	Calculated	
Annual CO2 Savings (lbs)	100,355	Calculated	
Financed (yes/no)	no		
Payment Amount	\$0		
Incremental Replacement Cost	\$0		
Component Life	15		
Inputs Used in Analysis (subject to individual measure override)		<u>Key Assumptions</u>	
Term of Analysis	25		
Term of Finance	7		
Discount Rate	5.00%		
Energy Inflation	3.50%		
Energy Cost (\$/kWh)	\$0.145		
Energy Cost (\$/Therm)	\$1.00		
Interest Rate	3.95%		
Inflation Rate	3.00%		
Time of Use (PV)	0.20		
Incremental Capital Cost	100%		
Exclude "completed" measure C/B	yes		
Results		<u>Source:</u>	
SPB	#DIV/0!	MSI	
IRR	#DIV/0!		
NPV	(\$1,404,117)		
CO2 reduction (tons)	50.18	20.00%	% impact

F1-City Fleet Completed		
Measures Name	Fleet 2000-2006	<u>Notes</u>
Measure Category	Fleet	
Measure Status	Completed	2005 <u>Source</u> <u>Next Steps</u>
Capital Cost	\$0	Calculated
Incremental Capital Cost %	100%	
Incremental Capital Cost	\$0	
Rebate	\$0	Calculated
Net Capital Cost	\$0	Calculated
Annual O&M (incremental cost)	\$0	Calculated
Annual Cost Savings	\$1,925	Calculated
Peak Demand Reduction (kW)	0.0	Calculated
Annual Energy Savings (kWh)	0	Calculated
Annual Energy Savings (Therms)	0	Calculated
Annual CO2 Savings (lbs)	12,833	Calculated
Financed (yes/no)	no	
Payment Amount	\$0	
Incremental Replacement Cost	\$0	
Component Life	15	
Inputs Used in Analysis (subject to individual measure override)		<u>Key Assumptions</u>
Term of Analysis	25	
Term of Finance	7	
Discount Rate	5.00%	
Energy Inflation	3.50%	
Energy Cost (\$/kWh)	\$0.145	
Energy Cost (\$/Therm)	\$1.00	
Interest Rate	3.95%	
Inflation Rate	3.00%	
Time of Use (PV)	0.00	
Incremental Capital Cost	100%	
Exclude "completed" measure C/B	yes	
Results		<u>Source:</u>
SPB	0.0	
IRR	#NUM!	
NPV	\$0	
CO2 reduction (tons)	6.42	

F2-Biodiesel B20		
Measures Name	Biodiesel B20	<u>Notes</u>
Measure Category	Fleet	
Measure Status	Future	2009
		<u>Source</u>
		<u>Next Steps</u>
Capital Cost	\$5,000	Calculated
Incremental Capital Cost %	100%	
Incremental Capital Cost	\$5,000	
Rebate	\$0	Calculated
Net Capital Cost	\$5,000	Calculated
Annual O&M (incremental cost)	\$0	Calculated
Annual Cost Savings	\$80	Calculated
Peak Demand Reduction (kW)	0.0	Calculated
Annual Energy Savings (kWh)	0	Calculated
Annual Energy Savings (Therms)	0	Calculated
Annual CO2 Savings (lbs)	35,163	Calculated
Financed (yes/no)	no	
Payment Amount	\$0	
Incremental Replacement Cost	\$0	
Component Life	15	
Inputs Used in Analysis (subject to individual measure override)		<u>Key Assumptions</u>
Term of Analysis	25	
Term of Finance	7	
Discount Rate	5.00%	
Energy Inflation	3.50%	
Energy Cost (\$/kWh)	\$0.145	
Energy Cost (\$/Therm)	\$1.00	
Interest Rate	3.95%	
Inflation Rate	3.00%	
Time of Use (PV)	0.20	
Incremental Capital Cost	100%	
Exclude "completed" measure C/B	yes	
Results		<u>Source:</u>
SPB	62.6	
IRR	-2.8%	
NPV	(\$3,175)	
CO2 reduction (tons)	17.58	

F3-City Fleet CNG			
Measures Name	Fleet Natural Gas Conversions	<u>Notes</u>	
Measure Category	Fleet		
Measure Status	Future	2009	<u>Next Steps</u>
Capital Cost	\$432,000	<u>Source</u> Calculated	
Incremental Capital Cost %	100%		
Incremental Capital Cost	\$432,000		
Rebate	\$0	Calculated	
Net Capital Cost	\$432,000	Calculated	
Annual O&M (incremental cost)	\$0	Calculated	
Annual Cost Savings	\$19,493	Calculated	
Peak Demand Reduction (kW)	0.0	Calculated	
Annual Energy Savings (kWh)	0	Calculated	
Annual Energy Savings (Therms)	0	Calculated	
Annual CO2 Savings (lbs)	165,196	Calculated	
Financed (yes/no)	yes		
Payment Amount	(\$53,129)		
Incremental Replacement Cost	\$216,000		
Component Life	10		
Inputs Used in Analysis (subject to individual measure override)		<u>Key Assumptions</u>	
Term of Analysis	25		
Term of Finance	10		
Discount Rate	5.00%		
Energy Inflation	3.50%		
Energy Cost (\$/kWh)	\$0.145		
Energy Cost (\$/Therm)	\$1.00		
Interest Rate	3.95%		
Inflation Rate	3.00%		
Time of Use (PV)	NA		
Incremental Capital Cost	100%		
Exclude "completed" measure C/B	yes		
Results		<u>Source:</u>	
SPB	22.2		
IRR	#DIV/0!		
NPV	(\$334,160)		
CO2 reduction (tons)	82.60		

F4-City Fleet New 1		
Measures Name	City Fleet New 1	<u>Notes</u>
Measure Category	Fleet	
Measure Status	Future	2009
Capital Cost	\$76,000	<u>Source</u> <u>Next Steps</u>
Incremental Capital Cost %	100%	Calculated
Incremental Capital Cost	\$76,000	
Rebate	\$0	Calculated
Net Capital Cost	\$76,000	Calculated
Annual O&M (incremental cost)	\$0	Calculated
Annual Cost Savings	\$15,416	Calculated
Peak Demand Reduction (kW)	0.0	Calculated
Annual Energy Savings (kWh)	0	Calculated
Annual Energy Savings (Therms)	0	Calculated
Annual CO2 Savings (lbs)	102,774	Calculated
Financed (yes/no)	yes	
Payment Amount	(\$17,048)	
Incremental Replacement Cost	\$0	
Component Life	15	
Inputs Used in Analysis (subject to individual measure override)		<u>Key Assumptions</u>
Term of Analysis	25	
Term of Finance	5	
Discount Rate	5.00%	
Energy Inflation	3.50%	
Energy Cost (\$/kWh)	\$0.145	
Energy Cost (\$/Therm)	\$1.00	
Interest Rate	3.95%	
Inflation Rate	3.00%	
Time of Use (PV)	NA	
Incremental Capital Cost	100%	
Exclude "completed" measure C/B	yes	
Results		<u>Source:</u>
SPB	4.9	
IRR	24.3%	
NPV	\$233,690	
CO2 reduction (tons)	51.39	

F5-Biodiesel B100		
Measures Name	Biodiesel B100	<u>Notes</u>
Measure Category	Fleet	
Measure Status	Future	2009
		<u>Source</u>
		<u>Next Steps</u>
Capital Cost	\$11,000	Calculated
Incremental Capital Cost %	100%	
Incremental Capital Cost	\$11,000	
Rebate	\$0	Calculated
Net Capital Cost	\$11,000	Calculated
Annual O&M (incremental cost)	\$0	Calculated
Annual Cost Savings	\$1,998	Calculated
Peak Demand Reduction (kW)	0.0	Calculated
Annual Energy Savings (kWh)	0	Calculated
Annual Energy Savings (Therms)	0	Calculated
Annual CO2 Savings (lbs)	175,817	Calculated
Financed (yes/no)	no	
Payment Amount	\$0	
Incremental Replacement Cost	\$0	
Component Life	15	
Inputs Used in Analysis (subject to individual measure override)		<u>Key Assumptions</u>
Term of Analysis	25	
Term of Finance	7	
Discount Rate	5.00%	
Energy Inflation	3.50%	
Energy Cost (\$/kWh)	\$0.145	
Energy Cost (\$/Therm)	\$1.00	
Interest Rate	3.95%	
Inflation Rate	3.00%	
Time of Use (PV)	1.00	
Incremental Capital Cost	100%	
Exclude "completed" measure C/B	yes	
Results		<u>Source:</u>
SPB	NA	
IRR	NA	
NPV	\$29,191	
CO2 reduction (tons)	87.91	

F6-Ethanol			
Measures Name	Ethanol E85	<u>Notes</u>	
Measure Category	Fleet		
Measure Status	Future	2012	<u>Next Steps</u>
Capital Cost	\$96,000	<u>Source</u>	Calculated
Incremental Capital Cost %	100%		
Incremental Capital Cost	\$96,000		
Rebate	\$0	Calculated	
Net Capital Cost	\$96,000	Calculated	
Annual O&M (incremental cost)	\$0	Calculated	
Annual Cost Savings	-\$11,247	Calculated	
Peak Demand Reduction (kW)	0.0	Calculated	
Annual Energy Savings (kWh)	0	Calculated	
Annual Energy Savings (Therms)	0	Calculated	
Annual CO2 Savings (lbs)	68,617	Calculated	
Financed (yes/no)	no		
Payment Amount	\$0		
Incremental Replacement Cost	\$96,000		
Component Life	10		
Inputs Used in Analysis (subject to individual measure override)		<u>Key Assumptions</u>	
Term of Analysis	25	#/gal Ethanol	17.73
Term of Finance	7	Participation Rate	80%
Discount Rate	5.00%	% locally processed	0%
Energy Inflation	3.50%		
Energy Cost (\$/kWh)	\$0.145		
Energy Cost (\$/Therm)	\$1.00		
Interest Rate	3.95%		
Inflation Rate	3.00%		
Time of Use (PV)	0.85		
Incremental Capital Cost	100%		
Exclude "completed" measure C/B	yes		
Results		<u>Source:</u>	
SPB	-8.5		
IRR	#DIV/0!		
NPV	(\$452,398)		
CO2 reduction (tons)	34.31		

W1-Pump Measures			
Measures Name	Pump Measures (4 implemented)	<u>Notes</u>	
Measure Category	Water/Sewer		
Measure Status	completed	2006	Implementation Date
Capital Cost	\$197,247	Provided	(Provided or Calculated)
Incremental Capital Cost %	100%		
Incremental Capital Cost	\$197,247		
Rebate	\$0	Provided	(Provided or Calculated)
Net Capital Cost	\$197,247	Provided	(Provided or Calculated)
Annual O&M (incremental cost)	\$0	Provided	(Provided or Calculated)
Annual Cost Savings	\$12,758	Provided	(Provided or Calculated)
Peak Demand Reduction (kW)	0.0	Provided	(Provided or Calculated)
Annual Energy Savings (kWh)	87,989	Provided	(Provided or Calculated)
Annual Energy Savings (Therms)	0	Provided	(Provided or Calculated)
Annual CO2 Savings (lbs)	43,027	Calculated	(Provided or Calculated)
Financed (yes/no)	yes		
Payment Amount	(\$32,803)		
Incremental Replacement Cost	\$0		
Component Life	12		
Inputs Used in Analysis (subject to individual measure override)		<u>Key Assumptions</u>	
Term of Analysis	25	Identify pump efficiency problems and correct Modeling for scheduling and VFD opportunities	
Term of Finance	7		
Discount Rate	5.00%		
Energy Inflation	3.50%		
Energy Cost (\$/kWh)	\$0.145		
Energy Cost (\$/Therm)	\$1.00		
Interest Rate	3.95%		
Inflation Rate	3.00%		
Time of Use (PV)	NA		
Incremental Capital Cost	100%		
Exclude "completed" measure C/B	yes		
Results		<u>Source:</u>	
SPB	15.5	City Staff	
IRR	#NUM!		
NPV	\$0		
CO2 reduction (tons)	21.51		

W2-Pump Measures			
Measures Name	Pump Measures (Savings criteria \$500)	<u>Notes</u>	
Measure Category	Water/Sewer		
Measure Status	Future	2008	Implementation Date
Capital Cost	\$591,741	Provided	(Provided or Calculated)
Incremental Capital Cost %	100%		
Incremental Capital Cost	\$591,741		
Rebate	\$0	Provided	(Provided or Calculated)
Net Capital Cost	\$591,741	Provided	(Provided or Calculated)
Annual O&M (incremental cost)	\$0	Provided	(Provided or Calculated)
Annual Cost Savings	\$19,431	Provided	(Provided or Calculated)
Peak Demand Reduction (kW)	0.0	Provided	(Provided or Calculated)
Annual Energy Savings (kWh)	134,008	Provided	(Provided or Calculated)
Annual Energy Savings (Therms)	0	Provided	(Provided or Calculated)
Annual CO2 Savings (lbs)	65,530	Calculated	(Provided or Calculated)
Financed (yes/no)	yes		
Payment Amount	(\$98,408)		
Incremental Replacement Cost	\$0		
Component Life	12		
Inputs Used in Analysis (subject to		<u>Key Assumptions</u>	
Term of Analysis	25	Identify pump efficiency problems and correct	
Term of Finance	7	Modeling for scheduling and VFD opportunities	
Discount Rate	5.00%		
Energy Inflation	3.50%		
Energy Cost (\$/kWh)	\$0.145		
Energy Cost (\$/Therm)	\$1.00		
Interest Rate	3.95%		
Inflation Rate	3.00%		
Time of Use (PV)	NA		
Incremental Capital Cost	100%		
Exclude "completed" measure C/B	yes		
Results		<u>Source:</u>	
SPB	30.5	ABAG EW	
IRR	2.0%		
NPV	(\$177,775)		
CO2 reduction (tons)	32.76		

W3-Pump Measures				
Measures Name	Pump Measures	Notes		
Measure Category	Water/Sewer			
Measure Status	Future	2010	Implementation Date	
Capital Cost	\$394,494	Provided		
Incremental Capital Cost %	100%			
Incremental Capital Cost	\$394,494			
Rebate	\$0	Provided		
Net Capital Cost	\$394,494	Provided		
Annual O&M (incremental cost)	\$0	Provided		
Annual Cost Savings	\$15,366	Provided		
Peak Demand Reduction (kW)	0.0	Provided		
Annual Energy Savings (kWh)	105,970	Provided		
Annual Energy Savings (Therms)	0	Provided		
Annual CO2 Savings (lbs)	51,819	Calculated		
Financed (yes/no)	yes			
Payment Amount	(\$65,605)			
Incremental Replacement Cost	\$0			
Component Life	12			
Inputs Used in Analysis (subject to individual measure override)			<u>Key Assumptions</u>	
Term of Analysis	25		Identify pump efficiency problems and correct Modeling for scheduling and VFD opportunities	
Term of Finance	7			
Discount Rate	5.00%			
Energy Inflation	3.50%			
Energy Cost (\$/kWh)	\$0.145			
Energy Cost (\$/Therm)	\$1.00			
Interest Rate	3.95%			
Inflation Rate	3.00%			
Time of Use (PV)	NA			
Incremental Capital Cost	100%			
Exclude "completed" measure C/B	yes			
Results				<u>Source:</u>
SPB	25.7			ABAG EW
IRR	3.3%			
NPV	(\$70,638)			
CO2 reduction (tons)	25.91			

Staff Coordinator			
Measures Name	Staff Coordinator	<u>Notes</u>	
Measure Category	building		
Measure Status	future	2008	Implementation Date
Capital Cost	\$0	Provided	(Provided or Calculated)
Incremental Capital Cost %	100%		
Incremental Capital Cost	\$0		
Rebate	\$0	Provided	(Provided or Calculated)
Net Capital Cost	\$0	Provided	(Provided or Calculated)
Annual O&M (incremental cost)	\$50,000	Provided	(Provided or Calculated)
Annual Cost Savings	\$0	Provided	(Provided or Calculated)
Peak Demand Reduction (kW)	0.0	Provided	(Provided or Calculated)
Annual Energy Savings (kWh)	0	Provided	(Provided or Calculated)
Annual Energy Savings (Therms)	0	Provided	(Provided or Calculated)
Annual CO2 Savings (lbs)	0	Calculated	(Provided or Calculated)
Financed (yes/no)	no		
Payment Amount	\$0		
Incremental Replacement Cost	\$0		
Component Life	12		
Inputs Used in Analysis (subject to		<u>Key Assumptions</u>	
Term of Analysis	25	0	
Term of Finance	7	0	
Discount Rate	5.00%		
Energy Inflation	3.50%		
Energy Cost (\$/kWh)	\$0.150		
Energy Cost (\$/Therm)	\$1.00		
Interest Rate	3.95%		
Inflation Rate	1.00%		
Time of Use (PV)	NA		
Incremental Capital Cost	100%		
Exclude "completed" measure C/B	yes		
Results		<u>Source:</u>	
SPB	#DIV/0!	MSI	
IRR	#DIV/0!		
NPV	(\$747,032)		
CO2 reduction (tons)	0.00		

APS Public Safety DDC			
Measures Name	APS Public Safety Central DDC	<u>Notes</u>	
Measure Category	building		
Measure Status	Future	2007	Implementation Date
Capital Cost	\$5,000	Provided	(Provided or Calculated)
Incremental Capital Cost %	100%		
Incremental Capital Cost	\$5,000		
Rebate	\$0	Provided	(Provided or Calculated)
Net Capital Cost	\$5,000	Provided	(Provided or Calculated)
Annual O&M (incremental cost)	\$0	Provided	(Provided or Calculated)
Annual Cost Savings	\$18,463	Provided	(Provided or Calculated)
Peak Demand Reduction (kW)	0.0	Provided	(Provided or Calculated)
Annual Energy Savings (kWh)	33,417	Provided	(Provided or Calculated)
Annual Energy Savings (Therms)	13,450	Provided	(Provided or Calculated)
Annual CO2 Savings (lbs)	182,314	Calculated	(Provided or Calculated)
Financed (yes/no)	no		
Payment Amount	\$0		
Incremental Replacement Cost	\$0		
Component Life	25		
Inputs Used in Analysis (subject to individual measure override)		<u>Key Assumptions</u>	
Term of Analysis	25		
Term of Finance	7		
Discount Rate	5.00%		
Energy Inflation	3.50%		
Energy Cost (\$/kWh)	\$0.150		
Energy Cost (\$/Therm)	\$1.00		
Interest Rate	3.95%		
Inflation Rate	3.00%		
Time of Use (PV)	NA		
Incremental Capital Cost	100%		
Exclude "completed" measure C/B	yes		
Results		<u>Source:</u>	
SPB	0.3	APS Recommendation	
IRR	385.7%		
NPV	\$361,795		
CO2 reduction (tons)	91.16		