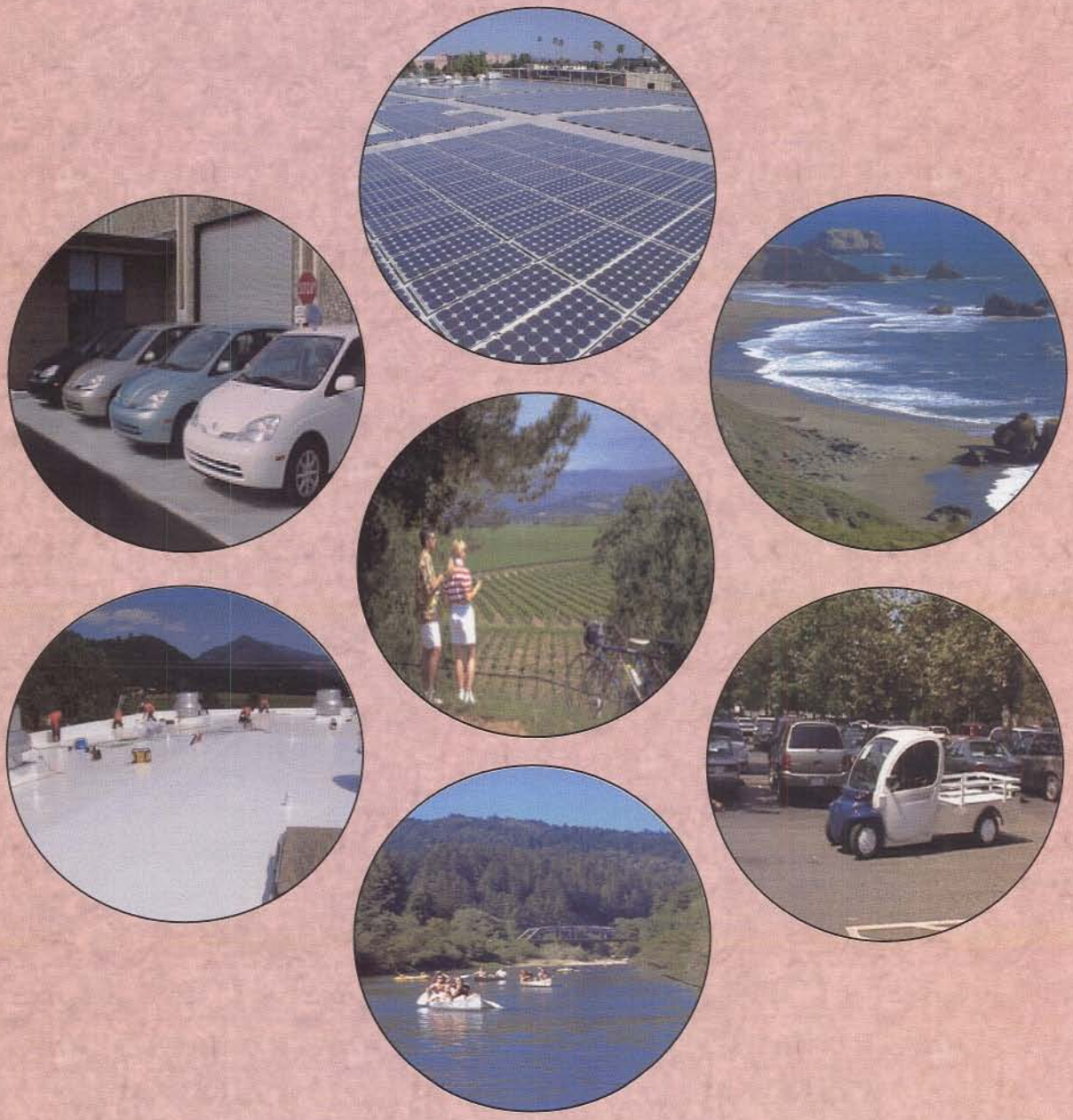
Climate Protection Action Plan for Sonoma County

Local Actions to Reduce
Greenhouse Gas Emissions



County of Sonoma General Services Department
June 2006

Acknowledgements

The Climate Protection Action Plan is the result of work and persistence of several people. These include staff at Sonoma County's Department of General Services and Kenwood Energy Consulting Services. Many hours of research, writing, database development, data analysis, and review was necessary.

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Amy Rider - County of Sonoma, Energy Intern: Conducted initial research on Greenhouse Gas reduction measures.

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Rob Kambak - County of Sonoma, County Architect: Provided assistance on building related energy projects that have been completed since the Greenhouse Gas emissions baseline of FY 2000-01, and future projects proposed to achieve the reduction target by 2010.

Paul Nicely - County of Sonoma, Associate Architect: Provided assistance on building related energy projects that have been completed since the Greenhouse Gas emissions baseline of FY 2000-01, and future projects proposed to achieve the reduction target by 2010.

Dave Head - County of Sonoma, Fleet Manager: Provided assistance on fleet and fuel alternative measures.

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Tim Holmes - Kenwood Energy Consulting Services: Developed database, prepared financial analysis, cash flow, and written report.

Sam Pierce – Kenwood Energy Consulting Services: Developed database and prepared financial analysis.

Dave Kronberg, General Services Director

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Executive Summary

The County of Sonoma has resolved to reduce Greenhouse Gas (GHG) emissions resulting from County operations by 20% by the year 2010. The Climate Protection Action Plan for Sonoma County has been an extraordinary effort to develop a viable plan to attain this goal.

The plan is organized into five Chapters.

Chapter 1 provides brief background information that summarizes why this effort was undertaken, the causes of climate change, the information considered in the decision to move forward with this effort, and the County's established baseline.

Chapter 2 details the County's contributors to GHG emissions, establishes the reduction targets, and summarizes actions that have been taken by County staff that already are contributing to the reduction goal.

Chapter 3 describes the methodology used to evaluate GHG reduction opportunities, and summarizes the potential GHG reduction potential of each of the actions considered.

Chapter 4 describes the results of the analysis, offers several steps to obtain the 20% reduction target, and presents two Action Plans that can be enacted by the County.

Chapter 5 is the Action Plan Team's conclusions and recommendations.

PRIOR ACTIONS:

The County has been completing energy management projects for many years. A number of projects were completed prior to the baseline, such as the installation of the Central Mechanical Plant (CMP) in 1988, a complete lighting retrofit of old technology T12 fluorescent lamps and magnetic ballasts to high quality T8 lamps and electronic ballasts in 1992, a de-lamping project in 2000 in which half of the lamps in many fixtures was removed, and the installation of motion sensors that automatically turn lights on and off in 1998.

More recent and notable energy management projects have been completed since the baseline year. These projects have helped to keep the growth of GHG emissions since the baseline year to a minimum. Some of these projects are: purchase of landfill gas generated renewable electricity; installation of a solar photovoltaic (PV) system on the ISD building roof; vending machine controllers; instant hot water heaters in the NCDF and the Animal Shelter; installation of "cool roofs" and roofing insulation; installation of "light tube" skylights to reduce electric lighting operating hours; conversion of cooling coils to a higher temperature differential; installation of improved control systems at the central campus; energy efficient HVAC systems at the PRMD; new air handlers at the Animal Shelter expansion; Energy Management System (EMS) at La Plaza B remodel; new boiler for the CMP.

GHG BASELINE:

The County's baseline separated the GHG contributors into three distinct segments that can each be addressed individually: Buildings, Fleet, and Commute. Buildings account for virtually all of the natural gas and electric use. The majority of gasoline consumption is from commute,

although the fleet uses significant amounts as well. Virtually all of the diesel consumption is by the fleet. In the baseline year of 2000 – 2001, the County's GHG emissions were just over 37,000 tons. It is worth noting that the combustion of gasoline and diesel for commuting and to power fleet vehicles accounts for 59% of the County's GHG emissions.

The baseline GHG emission calculation was updated during the implementation of this analysis. Although the values are not identical, they are within 1.5% of the original baseline. Variations are a result of updated fleet fuel use and staffing levels.

	Original Baseline	New Baseline
Buildings	15,576 Tons	15,467 Tons
Fleet	7,657 Tons	7,159 Tons
Commute	14,000 Tons	13,848 Tons
Totals	37,233 Tons	36,474 Tons

All targets and projects from this point forward will be based on the baseline developed in this analysis.

Since the baseline year, GHG emissions have changed. Buildings, Fleet, and Commute continue to change over time based on factors such as growth, improved efficiency, and changes in operation. However, each of the segments changed at varying rates for different reasons.

In the baseline year the County's emissions were 36,474 tons. A 20% reduction equates to 7,295 tons. The County's GHG footprint is projected to grow over the next several years, reaching nearly 37,630 tons by the year 2010 if the County takes no action. To reach the GHG emission target of approximately 29,000 tons, the County will have to reduce emissions by nearly 8,450 tons over the next few years.

	Baseline (Tons)	Target (Tons)	Reduction (Tons)	2010 BAU* (Tons)	Required Reduction (Tons)
Buildings	15,467	12,374	3,093	16,905	4,531
Fleet	7,159	5,727	1,432	8,129	2,401
Commute	13,848	11,078	2,770	12,596	1,518
TOTAL	36,474	29,179	7,295	37,630	8,450

*Business as Usual

Identifying a viable Action Plan to meet the County's goal presents a number of challenges. Many of the projects identified herein have annual cost savings, most have first year implementation costs, some are very capital intensive, while others have annual costs and no cost savings.

Thirty-eight GHG reduction opportunities were quantified in this study. A life cycle cost analysis was completed for each, taking into account projected energy cost increases, inflation rates, and other costs such as maintenance costs or savings, and residual value. A number of additional opportunities were studied but not quantified either due to complexity or too little cost and savings information available. Assumptions and conversion constants are included in Appendix A.

Each of the measures was then prioritized by its internal rate of return, which allowed the cost effectiveness of one measure to be compared to the other. The measures that were evaluated fell into two categories: those that generated income such as an energy efficiency project where the investment saves money; and those that have no offsetting income or cost savings stream. An example of this is a bus pass program where the County pays for the bus passes, resulting in decreased commuting and therefore decreased GHG emissions, but with no near term financial savings that can be measured.

The Action Plan is presented in several logical steps. The following table summarizes each step to accomplishing the County's goal, and alternate Plans.

Action Plan	Net Capital Cost*	Estimated First Year Net Savings	Simple Pay Back (years)	Internal Rate of Return (IRR)	Annual GHG Reduction (Tons)	Percentage GHG Target	Cost per Ton GHG
Step 1 - Completed Projects	$496,438	$105,665	4.7	29.6%	2756	32.6%	$180
Step 2 - No cost and low cost actions	$263,240	$139,983	1.9	99.4%	3929	46.5%	$67
Step 3 - Additional actions with an IRR > 10%	$3,523,700	$782,861	4.5	24.3%	7011	83.0%	$503
Action Plan A - Additional Actions with an IRR > 0%	$11,989,673	$1,122,559	10.7	12.1%	8498	100.6%	$1,411
Action Plan B - All projectss with an IRR > 10%, plus a commuter program	$3,917,501	$767,745	5.1	7.4%	8454	100.0%	$463

* Net capital cost is the initial cost less incentives and rebates.

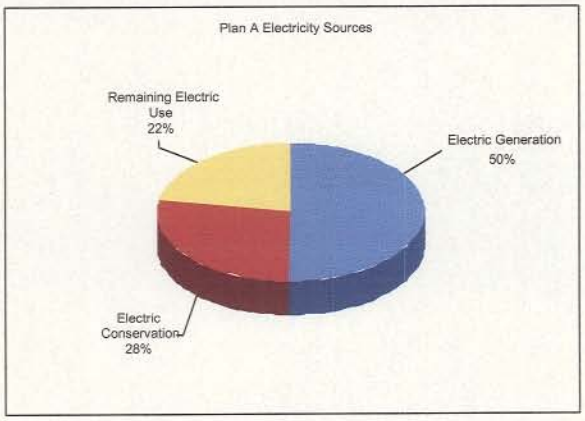
Each of the Steps and Plans are described in detail in Chapter 4 of this report.

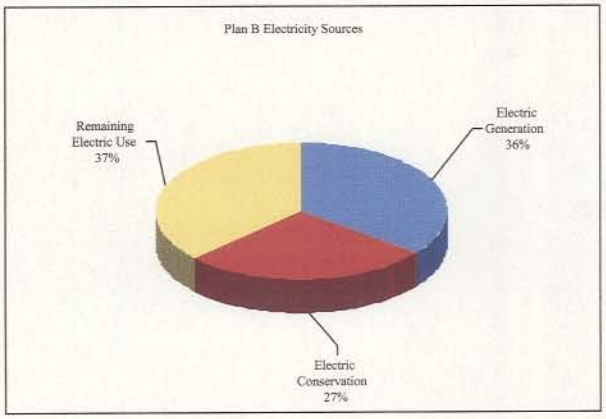
Plan A involves a significant capital investment. This alternative is highly dependent on distributed energy generation projects in the buildings segment, and includes the development of a substantial number of large photovoltaic (PV) systems generating 2.8 megawatts of renewable energy, covering roofs and bare ground. By contrast, lesser emphasis is placed on the employee commute section due to the challenge of predicting the feasibility of actually attaining significant reductions with confidence. Plan A includes all of the projects in Steps 2 and 3. Plan A calls for initial capital cost totaling $16,628,598 before rebates. Annual savings start at $1,122,559, but cash flow is negative until the seventh year.

Plan B is an alternate to Plan A, and places a much higher reliance on an extensive employee commute program and involves substantially less capital investment. Photovoltaic systems provide 1.2 megawatts of renewable energy. As presented, this alternative would require an additional 13% of the workforce, or 543 additional employees to alter commute habits by utilizing a host of different commute alternatives such as transit, car or van pool, telecommuting, or other means. The approach is incentive based. Implementation of this alternative will incur annual costs without any anticipated savings to the County budget. More study and added staff would be necessary to effectively implement such a program. Plan B includes all of the projects in Steps 2 and 3. Plan B calls for initial capital cost totaling $4,075,847 before rebates. Annual savings start at $767,745, but cash flow is negative until the ninth year.

Common to both plans are 243 new hybrid vehicles, a cogeneration project, CREBS program PV systems generating 1.2 megawatts of renewable energy, conversion of all diesel vehicles and equipment to bio-diesel fuel, and a large number of energy conservation projects.

The following two charts depict the amount of the County's current electric use that will be offset by conservation and generation for each plan. The blue segment of the chart represents electric generation, the red represents conservation, and the yellow represents the amount of electricity that the County will still purchase from the utility company.





Due to the complexity of the Climate Protection Action Plan and the approach of the target date, staff believes that the use of an Energy Service Company (ESCO) is the proper avenue to use in the implementation of most of the capital improvement related measures in the Plan. Staff has developed a Request for Qualifications to recruit a qualified ESCO to support the County in the Plan's implementation.

Both Plans presented herein are viable options to achieve the GHG reductions necessary to meet the target of no more than 29,600 tons by the year 2010.

Staff makes the following recommendations:

1. Implement Action Plan B, relying on the comprehensive commute program to achieve the goal.
2. Approve releasing a Request For Qualification for an energy services company to conduct a comprehensive energy project for County facilities.

3. Approve staffing three positions: one to manage the commute program and two to manage and implement energy management programs.
4. Create an energy fund that can be used to finance energy expenditures, debt services for energy related projects and employee commute program costs that reduce GHG emissions in the future. Energy cost savings would be retained in the energy fund to pay for and offset costs of future energy conservation and efficiency projects.
5. Direct that all major future construction and large County purchases and other program changes be subjected to an analysis of their GHG emission impact.
6. Require that staff report to the Board annually on the attainment of the County's stated GHG reduction target through the Sustainability Policies and Practices Project (SP3).
7. Direct staff to identify legislative and regulatory changes that could assist County departments to achieve new methods of GHG reduction as part of normal operations.

Plan B is recommended over Plan A for a number of reasons. First and foremost, County employee commutes account for more than 38% of the total GHG emissions included in this study. A comprehensive Climate Protection Action Plan must address the emissions from this segment. The second reason for preferring Plan B is that the first year cost is significantly lower, while still resulting in a significant Net Present Value (NPV).

The most significant difference between Plan B and Plan A is that the commute portion Plan B focuses on behavioral changes of County employee commuters, while Plan A relies on capital intensive PV construction projects. Specifically, Plan B adds a comprehensive commute program component, while not including 1,600 kW of roof mounted PV installations.

The effort undertaken here is more progressive than other GHG reduction plans we have reviewed. This Plan has focused on quantifying costs and savings associated with each step toward achieving the targeted reduction. Each of the specific plans we identified consists of numerous individual project components. As the Plan is implemented, cost and savings values will be refined, resulting in changes to the Plan.

The public interest in Climate Protection continues to build. Since staff was charged with developing this Plan, the Board, on September 27, 2005, adopted a community wide Greenhouse Gas Reduction Target of 25% from the 1990 level that will require efforts that go well beyond what we have identified here. We assume that the Board will expect County government to participate and be a leader in the community effort to meet this goal. This Plan is a first step and will become a subset of the community wide effort to meet the new target.

In addition, on June 1, 2005, Governor Schwarzenegger signed Executive Order S-3-50 which details GHG emissions reductions for the State of California. The Governor's three step approach mandates that GHG emissions will be reduced to 2000 levels by 2010, to 1990 levels by 2020, and to 80% below 1990 levels by 2050.

Implementation, management, and updating of this Plan will require trained and experienced staff leadership in this area to meet this challenge. This is a living document that will need continuous maintenance to ensure that the targets are met in a timely manner.

FINANCING:

Accomplishing the goals established by the Board will require an investment. To make the investment more affordable to the County, the County should consider financing options that allow the energy savings to pay for the investment, thus resulting in a neutral cost to the County. Following are financial summaries for both of the Plans described above. Each assumes a loan term of 4.6% over 15 years. We have also assumed an energy inflation rate of 4% and a discount rate of 5%.

	Plan A	Plan B
Initial Capital Cost	$16,628,598	$4,075,847
Rebate	$4,638,926	$158,346
Net Capital Cost	$11,989,673	$3,917,501
1st Year Cost Savings	$1,122,559	$767,745
Net Present Value	$9,836,480	$3,124,313

As can be seen, both Plans offer cost effective methods of implementing the Climate Protection Action Plan. Although Plan A has a higher NPV, Plan B has a lower initial cost. The financing Plan anticipates the use of savings from cost effective measures to help fund those that are less cost effective, while still providing a reasonable rate of return to the County.

The specific projects included in each of the Action Plan Steps and for each Action Plan are detailed in the following Table.

Summary of Projects

Baseline Sector	Action Plans	IRR	Net Capital Cost	Net Annual Cost (Savings) 1st Year	GHG Reduction
Measures Already Completed (Step 1)					
Buildings	ISD PV	10%	$ 310,128	$ 23,086	68
Buildings	Purchase Landfill Gas	1000%	$ -	$ -	1,938
Buildings	Vending Machine Controllers	27%	$ 3,880	$ 809	4
Buildings	Installed 17 Instant Hot Water Heaters	86%	$ 46,000	$ 20,348	105
Buildings	Hot Water Pump VFD	90%	$ 52,750	$ 23,893	118
Buildings	Re-Roof Adminstration Center Buildings	145%	$ 20,940	$ 12,049	84
Fleet	Existing Hybrid Vehicles	1000%	$ (3,500)	$ 25,479	52
Commute	Existing Bus Pass Program	Negative	$ 66,240	$ -	388
Totals		**29.6%**	**$ 496,438**	**$ 105,665**	**2,756**
No and Low Cost Measures (Step 2)					
	Ongoing Step 1 Savings				2,368
Buildings	CREBS PV	47%	$ 60,000	$ 5,422	889
Buildings	NCDF Water Reclamation	27%	$ 137,000	$ 25,940	61
Fleet	Future Hybrid Vehicles	1000%	$ -	$ 108,621	223
Commute	Bus Pass Program	Negative	$ 66,240		388
Totals		**99.4%**	**$ 263,240**	**$ 139,983**	**3,929**
Measures with IRR Greater Than 10% (Step 3)					
	Step 2 Projects	99%	$ 263,240	$ 139,983	3,929
Buildings	150 kW Cogeneration	71%	$ 330,055	$ 129,360	267
Buildings	Air Handler C02 Sensors	96%	$ 166,335	$ 78,269	385
Buildings	Chilled Water Pump VFD	569%	$ 28,107	$ 23,735	117
Buildings	CMP Performance Mapping	1000%	$ 14,623	$ 23,252	114
Buildings	Air Condition with Cooling Tower	27%	$ 263,217	$ 47,794	235
Buildings	Install more efficient Lighting	114%	$ 33,705	$ 17,354	85
Buildings	Repair Admin Center Economizers	41%	$ 146,073	$ 40,320	216
Buildings	New Economizers at HOJ and Admin	44%	$ 65,096	$ 18,328	96
Buildings	Replace Chillers 1 and 2	23%	$ 438,695	$ 69,274	341
Buildings	Admin Center VAV Conversions	11%	$ 1,425,858	$ 121,663	599
Buildings	CVRH Resets	1000%	$ 24,700	$ 26,809	383
Buildings	TES Thermocline sensors	277%	$ 21,935	$ 15,885	78
Buildings	County Center Light Voltage Control	25%	$ 11,500	$ 1,948	10
Buildings	Upgrade EMS	88%	$ 58,493	$ 26,169	114
Buildings	Dual Duct Resets	1000%	$ 1,300	$ 2,718	42
Buildings	Energy Management Staff	Negative	$ 230,768	$ -	-
Totals		**24.3%**	**$ 3,523,700**	**$ 782,861**	**7,011**
Plan A - Generation Focus					
	Step 3 Projects	24%	$ 3,523,700	$ 782,861	7,011
Buildings	Roof Mounted PV	3%	$ 1,064,605	$ 40,578	177
Buildings	Ground Mounted PV	4%	$ 7,265,215	$ 295,592	1,292
Buildings	Install EE Motors	8%	$ 16,730	$ 1,464	7
Buildings	High Delta Cooling Coils	Negative	$ 119,423	$ 2,065	10
Totals		**12.1%**	**$ 11,989,673**	**$ 1,122,559**	**8,498**
Plan B - Commute Focus					
	Step 3 Projects	24%	$ 3,523,700	$ 782,861	7,011
Fleet	Bio-Diesel	Negative	$ 50,000	$ (15,116)	161
Commute	Comprehensive Commute Program	Negative	$ 343,801	$ -	1,282
Totals		**7.4%**	**$ 3,917,501**	**$ 767,745**	**8,454**

Chapter 1 - Climate Change: Introduction and Background

1.1 - Introduction

The County of Sonoma has resolved to reduce Greenhouse Gas (GHG) emissions resulting from County operations by 20% by the year 2010, as compared to the baseline year of 2000. The Climate Protection Action Plan for Sonoma County has been an extraordinary effort to develop a viable plan to attain this goal.

The plan is organized into five Chapters.

Chapter 1 provides brief background information that summarizes why this effort was undertaken, the causes of climate change, the information considered in the decision to move forward with this effort, and the County's established baseline.

Chapter 2 details the County's contributors to Green House Gas (GHG) emissions, establishes the reduction targets, and summarizes actions that have been taken by County staff that already are contributing to the reduction goal.

Chapter 3 describes the methodology used to evaluate GHG reduction opportunities, and summarizes the potential GHG reduction potential of each of the actions considered.

Chapter 4 describes the results of the analysis and offers several steps to obtain the 20% reduction target, and presents two Action Plans that can be enacted by the County.

Chapter 5 is the Action Plan Team's conclusions and recommendations.

1.2 - History and Goal

The County has a history of working to minimize the impact its operations have on the environment. In 1989, the County adopted a Green Purchasing Policy that directed the County to buy environmentally friendly supplies whenever possible. In 1998, the Sonoma County Economic Development Board (EDB) proposed a Sustainable Policies and Practices Project (SP3). Through this program, the County pledged to maximize sustainable operations in a cost-effective manner. The SP3 committee continues to report annually on resource use. Other notable efforts include certification of the County Administration Center as a Sonoma Green Business, Level 2 in May 2003, and the implementation of a single-stream recycling program in January 2006.

In late 2001, the Sonoma County Board of Supervisors directed the SP3 committee to review the possibility of joining the International Council for Local Environmental Initiatives (ICLEI) Climate Protection Campaign. Following the ICLEI methodology, the SP3 committee then sponsored a project to prepare an inventory of greenhouse gases (GHG), the *Greenhouse Gas Emission Analysis for the County of Sonoma*,[1] prepared by Edwin (Ned) Orrett, P.E., to measure emissions from County operations.

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[1] Greenhouse Gas Emission Analysis for the County of Sonoma, Ned Orrett, P.E., August 2002

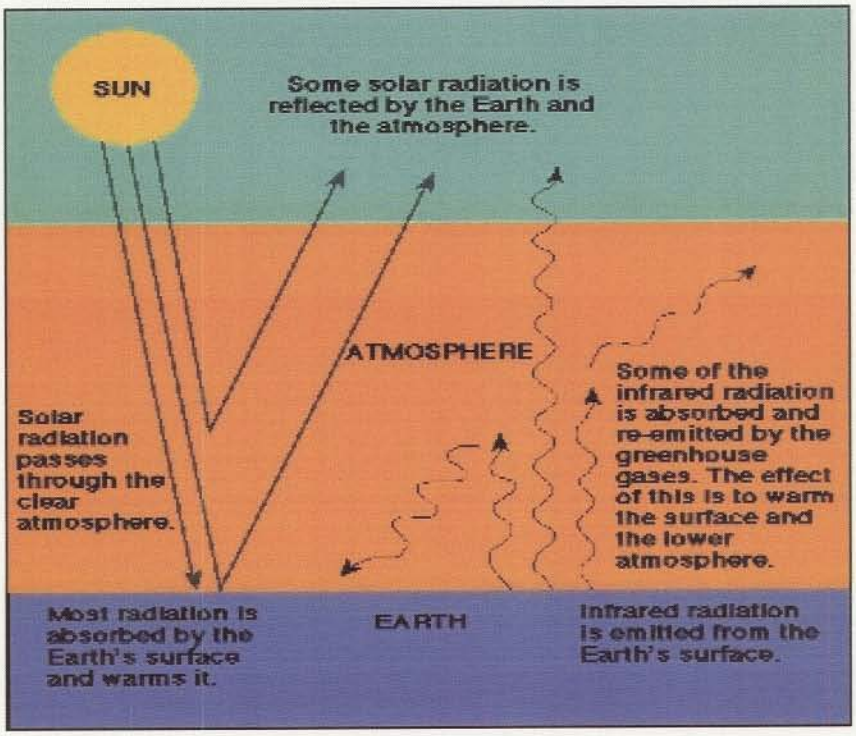
On August 20, 2002, the Board of Supervisors pledged to develop a Climate Protection Action Plan. This Plan would help the County achieve a reduction of carbon dioxide (CO_2) emissions from County operations by 20%, or 7,000 tons per year, from the FY 00-01 baseline of 37,000 tons. The County committed to a target reduction that would result in total GHG output of no more than 30,000 tons per year by the year 2010.

The Climate Protection Action Plan represents the County's strategy to achieve the 20% GHG emissions reduction commitment. In many cases the measures being suggested in the Plan are also being pursued as energy management and cost reduction projects. Most recently, the County has worked with the Association of Bay Area Government's Local Government Energy Partnership which has assisted in funding various energy studies, the recommendations from which form the basis of the suggested facility modifications included in this Plan.

1.3 - Causes of Climate Change

The main contributors to the GHG effect are carbon dioxide and methane. These gases exist in the earth's upper atmosphere and trap solar radiation, keeping the earth at a consistent temperature from year to year. Without the natural greenhouse gas effect, the average surface temperature on the earth would be below freezing.

Greenhouse gases remain in balance due to natural cycles. Animals breathe oxygen and exhale carbon dioxide, and a corresponding population of plants takes in the carbon dioxide and release oxygen back into the atmosphere. The carbon contained in this regenerative cycle remains consistent because it is recycling the carbon that exists on the surface of the earth.



However, human activities are increasing the amount of GHG that is in the atmosphere, creating an imbalance that is resulting in the gradual warming of the earth's surface. The main human contributions include:

- Fossil Fuels: Fossil fuels contain enormous amounts of carbon that for the last 250 million years have been trapped within the earths crust, and when burned to power cars and generate electricity, they create carbon dioxide and other GHG's. This carbon dioxide has not been part of the earth's natural cycles for hundreds of millions of years and creates an imbalance in the earth's natural carbon cycle.
- Land Use Practices: Deforestation has cleared ecosystems that were required to maintain the balance of the earth's cycle. Over the past 150 years, California has lost 80% of it coastal wetlands, 96% of its interior wetlands, and 99% of the valley grasslands.[2] Land use practices also contribute to methane production through landfills and agriculture.

Carbon dioxide and methane impact the earth in varying degrees. The following table summarizes the potential of a GHG to contribute to climate change. For example, the Global Warming Potential (GWP) of methane is 21 while the GWP of CO_2 is 1. This means that one ton of methane has 21 times the potential effect as does CO_2.

Greenhouse Gas	Atmospheric Lifetime	Sources	Global Warming Potential (GWP)*
Carbon Dioxide	Vaiable	Fossil Fuel Combustion, Forest Decimation, Cement Production	1
Methane	12.2	Fossil Fuel combustion, Rice paddies, waste Dumps, Livestock	21
Nitrous Oxide	120	Fertilizer, Industrial Processes, combustion	310
CFC-12	102	Liquid Coolants, Foam	6500
HCFC-22	12.1	Liquid Coolants	1350
Perfluoromethane	50000	Production of Aluminum	6500
Sulpher Hexa-fluoride	3200	Dielectric Fluid	23900

* the relative radiative impact, I.e.: the higher the number the greater the GHG impact.

Carbon dioxide and nitrous oxide emissions are the main byproduct of electricity generation, and the combustion of natural gas, gasoline, and diesel fuel. Carbon dioxide and nitrous oxide emissions are in proportion to each other. For the County's Action Plan we will track carbon dioxide emissions, and by association we will also be tracking nitrous emissions.

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[2] Franco Guido. California Energy Commission: Inventory of California GHG Emissions and Sinks: 1990-1999, Publication #600-02-001F. November 2002.

1.4 - Climate Change Background

The scientific opinion of Climate Change has evolved from ambiguous to near unanimous. In the early 1990s the oil industry and the majority of scientists did not believe that there was enough evidence to declare that a man-made greenhouse effect was in progress. The research now shows a strong scientific consensus that global warming is a phenomenon that poses real danger.

The National Research Council has determined that evidence shows major and widespread climate changes have occurred with startling speed.[3] In 2002, President Bush created the Climate Change Science Program, which in 2006 found that there is no longer a discrepancy in the rate of global average temperature increase for the surface compared with higher levels of GHG in the atmosphere.[4]

A great deal more information can be obtained by visiting the websites at the American Geophysical Union, the American Association for the Advancement of Science, The National Academy of Science, and the National Climate Data Center. Each has information on climate change, and each has reached the conclusion that human contributions to GHG in the atmosphere is a significant contributing factor to climate change.

While climate change is a global problem, the impacts will vary by region. In California the impact on climate and weather is believed to result in more severe storms, more frequent El Nino phenomenon, warmer average temperatures, and longer periods of drought, and more extreme tides that result in the loss of property are expected to occur once every 10 years instead of once every 100 years. The impact on California's ecosystem may include warmer temperatures that force some species to change habitats. Changes in Sierra runoff patterns may reduce the amount of fresh water available for agriculture and the amount of fresh water in the San Francisco Bay.

Eighty percent of California's annual rainfall occurs in the winter. Water resources for the state are stored in the snow packs of the mountain ranges. Warmer temperatures may result in more rain and less snowfall, accelerating the snow melt and resulting in water shortages. Actual changes in water quality, quantity, and demand will depend largely on water policy and operations, and on usage patterns.

The economic impact of climate change may also be significant. Two of Sonoma County's largest industries, tourism and agriculture, may be severely impacted by climate change. Sonoma County's main agricultural crop, grapes, is sensitive to small differences in climate and requires long term planning and investment to produce the highest quality grapes and wines. Climate change over a short period of time may require agriculture to change crops to adjust to new variations in climate.

1.5 - Sonoma County Baseline

In 2002, the County commissioned Pacific Technology Associates of Petaluma to complete the Greenhouse Gas Emissions Analysis for the County of Sonoma. The objective of the study

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[3] National Research Council; Abrupt Climate Changes: Inevitable Surprises; 2002

[4] U.S Climate Change Science Program, Press Release; May 2006

was to develop the baseline of GHG emissions on which the County's reduction targets would be focused.

The study focused on internal operations and included the County Administration Center, the Juvenile Justice Center (JJC), the Main Adult Detention Facility (MADF), the Chanate Complex, the Animal Shelter, and other outlying facilities, which currently totals about 1.74 million square feet. It should be noted that this is about 20% more square footage than the 2000-01 baseline year of the study.

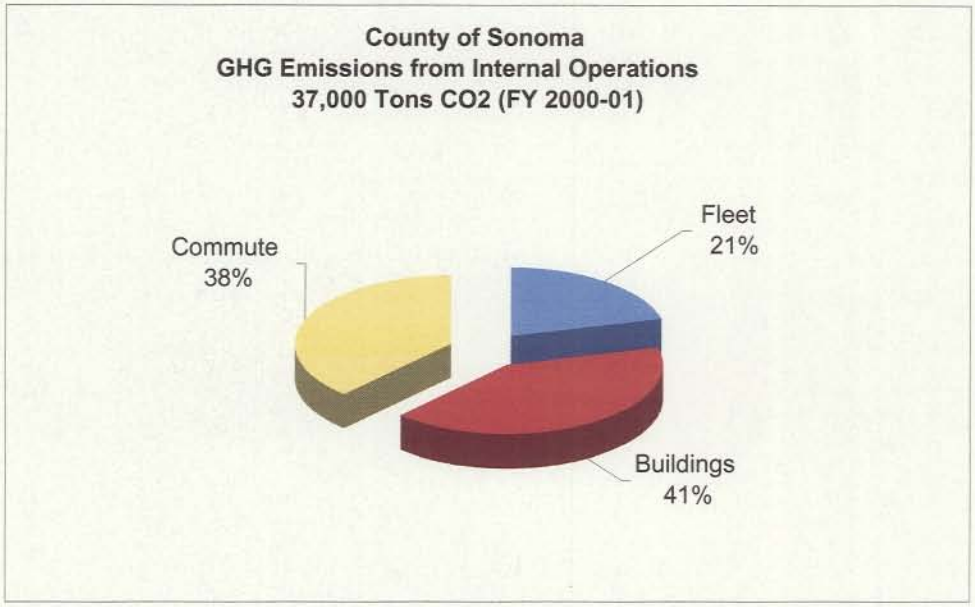
The components that contribute to GHG emissions in the County include the use of electricity and natural gas for building operations, gasoline for employee commute and fleet operations, and diesel fuel for fleet operations. The use of each of these fuel sources can be converted into pounds of carbon dioxide emitted into the atmosphere. For example, combusting one gallon of gasoline or diesel fuel results in the creation of about 20 pounds of CO_2. Conversion factors (coefficients) that were used to develop the baseline and throughout the remainder of this Plan are included in Appendix A.

The study broke the GHG contributors into three distinct segments that can each be addressed individually: Buildings, Fleet, and Commute. Buildings account for virtually all of the natural gas and electric use. The majority of gasoline consumption is from commute, although the fleet uses significant amounts as well. Virtually all of the diesel consumption is by the fleet. In the study's baseline year, the County's GHG emissions were just over 37,000 tons.

The baseline GHG emission calculation was updated during the implementation of this analysis. Although the values are not identical, they are within 1.5% of the original baseline. Variations are a result of updated fleet fuel use and updated staffing levels.

		Original Baseline	New Baseline
Buildings	County Administrative Center (17 buildings); Main Adult Detention Facility; North County Detention Facility; Chanate Medical Complex; and the Los Guilucos Juvenile Justice Center	15,576 Tons	15,467 Tons
Fleet	882 light and heavy duty gasoline, diesel, and hybrid vehicles	7,657 Tons	7,159 Tons
Commute	Travel for 4,317 County employees to and from the facilities listed above	14,000 Tons	13,848 Tons

It is important to note that all of the targets and projects from this point forward will be based on the baseline developed in this analysis. A visual depiction of the contribution of each segment follows.



Fleet and commute emissions are a result of gasoline and diesel consumption for vehicles, if these two segments are combined, then vehicle GHG emissions account for 59% of the total.

The study did not account for GHG emissions created by landfills, water and wastewater treatment, public transportation, solid waste management, other County property such as the fairgrounds and leased facilities, or residential and commercial impacts. This study addresses only the sections identified in the baseline.

Chapter 2 – County of Sonoma's Greenhouse Gas Emissions: Inventory and Reduction Targets

2.1 - Greenhouse Gas Contributors

Since the baseline year, the County's GHG emissions have changed. Buildings, fleet, and commute continue to change over time based on factors such as growth, improved efficiency, and changes in operation. However, each of the segments changed at varying rates for different reasons.

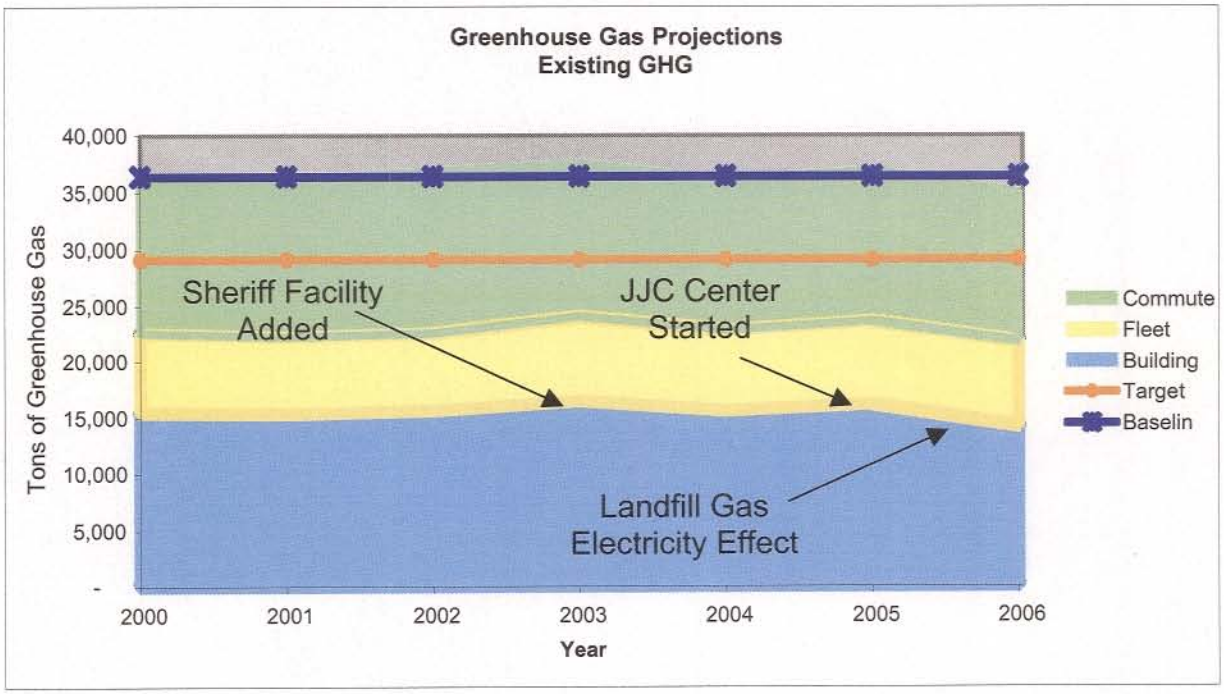
Building GHG emissions tend to change as the result of new facility construction and the implementation of energy management projects. The most notable increases in GHG emissions over the last six years are the result of the construction of two new, large facilities: the Sheriff facility and the Juvenile Justice Center. Although the square footage of buildings has increased 20% since the baseline year, energy use has increased only 5%. The next incremental increase in GHG emissions will result from the proposed construction of new facilities, which is projected to create 660 tons of CO_2 per year starting in 2008.

Increases in fleet emissions are the result of increased vehicle use. The Fleet Operations staff keeps detailed records of fuel consumption, so it is easy to track changes to emissions associated with the County's fleet. Fuel consumption has increased an average of 1.84% per year over the previous five years, even though staff has implemented a number of fuel consumption reduction projects since the baseline year including the purchase of hybrid vehicles. It is likely that this increase is related to growth in the County and increased support services required to support the growth.

Changes to commute related emissions vary based on staffing levels at the facilities.[5] Staffing has remained fairly constant over the past five years, with an annual average increase in staffing levels of 0.125%.

The following table depicts the contribution of each of the operation segments. Noticeable increase in GHG emissions corresponded to the construction and start-up of the Sheriff facility and the Juvenile Justice Center. Increases in fleet and commute emissions in the future are based on the average increases over the last five years.

[5] GHG emissions from commuting were based on the Commute Survey completed by the County. It does not account for possible increases or decreases in commute distance over time.



Greenhouse gas emissions are relatively flat over time, and in some cases actually decline. The main contributor to this phenomenon is the energy management projects that the County has implemented since the baseline year. These are discussed in more detail in Section 2.2 - Progress to Date. If these projects had not been implemented the current level of GHG emissions would be 2,756 tons higher than the current level.

2.2 - Progress to Date

The County has not been idle in efforts to save energy and money, and to be a good environmental steward. As a result, County staff has been implementing projects that result in GHG reductions as a byproduct of their intended impact. All segments of the internal operations have been active.

2.2.1 - Buildings

The County has been completing energy management projects for many years. A number of projects were completed prior to the baseline, such as the installation of the Central Mechanical Plant in 1988, a complete lighting retrofit of old technology T12 fluorescent lamps and magnetic ballasts to high quality T8 lamps and electronic ballasts in 1992, the installation of motion sensors that automatically turn lights on and off in 1998, and a de-lamping project in 2000 in which half of the lamps in many fixtures was removed. The County also installed a Thermal Energy Storage system that saves cost by using power during the "off-peak" hours when the utility electric system is less stressed. The Thermal Energy Storage (TES) project doesn't save energy, but uses energy when less polluting power plants are on-line.

More recent and notable energy management projects that have been completed since the baseline year include:

- Purchase of Landfill Gas generated renewable electricity
- Installation of a solar photovoltaic (PV) system on the ISD building roof
- Vending machine controllers
- Instant hot water heaters in the NCDF and the Animal shelter
- Installation of "cool roofs" and roofing insulation
- Installation of a variable speed control on the DMP hot water distribution pump
- Energy efficient heating, ventilation and air-condition (HVAC) systems at the PRMD, Fiscal, and Administration buildings

A single measure, the purchase of landfill gas generated electricity, results in a credit of 1,938 tons of GHG reduction. This is almost 23% of the reduction target and is achieved at virtually no cost. The landfill gas purchase became effective 7/1/06.

The County continues to identify energy efficiency and self generation projects, and many of the opportunities outlined in later sections of this report have been evaluated in energy management studies over the past year or so, which makes them ready for implementation in a relatively short timeframe.

2.2.2 - Fleet

Fleet Operations have been very progressive in evaluating and implementing clean fuel projects in the fleet. In the Mid – 90's the County was one of the founding members of the Redwood Empire Clean Air Vehicle Coalition and received a grant from the Bay Area Air Quality Management District (BAAQMD) to purchase a compressed natural gas (CNG) fueling system and to convert 10 vehicles to bi-fuel CNG/Gasoline. The program faded because of reduction in governmental incentives and lack of support by vehicle manufacturers.

The County also participated in a joint demonstration project with PG&E of an electric/battery powered full size cargo van. The project lasted about 10 months and at its peak the van was able to travel 75 miles on an overnight charge. PG&E transferred the van to another location when the project was completed.

Since the baseline year the County has been testing hybrid sedans as possible replacement vehicles for compact cars in the fleet. The goal was to see if the life cycle cost of the vehicle would be comparable with a conventional vehicle even though the initial purchase price was much higher. To date 50 hybrid sedans and 7 hybrid compact SUV's are operating in the fleet. Results so far have been very encouraging as the County has seen a significant savings in fuel and maintenance and we anticipate that the resale value will be much higher than a conventional vehicle, making up the difference in the initial cost.

2.2.3 - Commute

Employee commute is the most difficult GHG segment to reach because we are addressing individual behavior. The County has implemented a number of commuter friendly programs that are designed to improve the lives of its employees by reducing commute time and costs.

These programs include free bus passes, telecommuting policies, flex time policies and preferred parking for carpoolers. The programs that are in place have demonstrated limited success, but have not been marketed intensively.

2.2.4 - Success to Date

The following table summarizes the impacts of projects that have already been implemented.

Completed Projects

Project	Net Capital Cost*	Annual Savings (1st Year)	Annual GHG eTons Saved	Project Net Present Value	Internal Rate of Return	Cost $/eTon
Existing Bus Pass Program	$ 66,240		388	$ (1,409,396)	Negative	$ 171
Re-Roof Aministration Center Buildings	$ 20,940	$ 12,049	84	$ 236,424	145%	$ 250
Hot Water Pump VFD	$ 52,750	$ 23,893	118	$ 269,248	90%	$ 449
Installed 17 Instant Hot Water Heaters	$ 46,000	$ 20,348	105	$ 228,280	86%	$ 440
Vending Machine Controllers	$ 3,880	$ 809	4	$ 3,690	27%	$ 974
Existing Hybrid Vehicles	$ (3,500)	$ 25,479	52	$ 334,668	1000%	$ (67)
ISD PV	$ 310,128	$ 23,086	68	$ 195,849	10%	$ 4,543
Purchase Landfill Gas	$ -	$ -	1,938	$ 2,513,209	1000%	$ -
Totals	$ 496,438	$ 105,665	2,756	2,371,972	29.6%	$ 180

* Net Cost Includes Rebates

2.3 - Reduction Targets

In the baseline year the County's emissions were 36,474 tons. A 20% reduction equates to 7,295 tons. The County's GHG footprint is projected to grow over the next several years, reaching nearly 37,630 tons by the year 2010 if the County takes no action. To reach the GHG emission target of approximately 29,000 tons, the County will have to reduce emissions by nearly 8,450 tons over the next few years.

	Baseline	Target	Reduction	2010 BAU*	Required Reduction
Buildings	15,467	12,374	3,093	16,905	4,531
Fleet	7,159	5,727	1,432	8,129	2,401
Commute	13,848	11,078	2,770	12,596	1,518
TOTAL	36,474	29,179	7,295	37,630	8,450

* Business as Usual

Chapter 3 – Actions to Reduce Sonoma County's Greenhouse Gas Emissions

3.1 - Methodology

Identifying a viable Action Plan to meet the County's goal presents a number of challenges. Many of the projects identified herein have annual cost savings, most have first year implementation costs, some are very capital intensive, while others have ongoing costs and no cost savings. Staff has identified a multiple step approach to understanding the options that are available to the County.

What is unique about this Action Plan is that staff has worked towards quantifying the potential GHG reductions and costs in detail by recording, evaluating, and tracking success in a relational database. The current form of the database is a very sophisticated spreadsheet, but staff anticipates importing the information into web based database software as the Action Plan is implemented. A web based database will allow multiple users to manage progress in real time.

Thirty-eight of the GHG reduction opportunities were quantified in this study. A life cycle cost analysis was completed for each, taking into account projected energy cost increases, inflation rates, and other costs such as maintenance costs or savings, and residual value. A number of additional opportunities were studied but not quantified either due to complexity or too little cost and savings information. Assumptions and conversion constants are included in Appendix A.

There are a number of financial metrics that can be used to evaluate energy management, capital improvement, and other investment projects. For the Action Plan we have used the following metrics to evaluate and prioritize the actions that were quantified. Cost and savings projections for each of the measures were obtained from existing energy management studies, from County staff, or were generated by completing energy management models of the measure. The cost and savings values were entered into the GHG calculation spreadsheet, which generated the life cycle cost analysis that calculated the following metrics. Calculations are available as Addendum A.

- Simple Payback: The Simple Payback (SPB) is the most simplistic financial criterion for evaluating the cost-benefit of an investment. It is the net initial investment divided by the first year's energy savings. It does not include inflation factors, loan interest, depreciation of the dollar, or the life of the project.
- Net Present Value (NPV): The NPV estimates today's value of a series of credits and debits, taking into account estimates for the inflation in the cost of electricity, loan payments, inflation, and the life of the project. The formula is:

$$\text{NPV} = \sum_{j=1}^{n} \frac{Value_j}{(1+Rate)^j}$$

The "Value" is the annual cost or savings associated with the project, accounting for the loan payment, energy cost inflation rate, and system power output depreciation. The

"Rate" is the assumed discount rate, which in this case is 5%. "J" is the year. A positive NPV indicates that the investment made money in today's dollars.

- Internal Rate of Return (IRR): The IRR represents the annualized return that will be realized from making an investment, taking into account inflation rates, depreciation, loan payments, and the life of the project. Each of the measures was then prioritized by its internal rate of return, which allowed the cost effectiveness of one measure to be compared to the other. The measures that were evaluated fell into two categories: those that generated income or savings such as an energy efficiency project where the investment saves money; and those that have no income or savings stream such as a bus pass program, but result in decreased commuting and GHG emissions.

It is important to note that the commute segment of this project does not offer any GHG reduction projects that result in some type of hard cost savings and therefore the IRR of commute projects is always negative. But to eliminate this segment of the GHG problem from the solution would result in a GHG reduction plan that misses some of the most significant opportunities.

Finally, there are intangibles to consider in finalizing an Action Plan, such as whether each segment has been addressed appropriately, whether the first cost is affordable, the maturity of the technology and ease of implementation.

3.2 - Building Actions

In the building segment GHG emissions are the result of electricity and natural gas use to heat, cool, and light the buildings, plus to operate all of the office equipment needed to administer County operations. Essentially all of the electricity and natural gas that is included in the GHG baseline is used for building operations.

GHG emissions associated with electricity and natural gas use can be addressed on the supply and demand side of the energy equation, i.e. generation and usage, respectively.

3.2.1 - Generation

In developing the Action Plan, staff used the same conversion factors as were used by the consultants that developed the original Baseline study. These are:

- 0.553 tons of CO2 per 1,000 kWh consumed, or 1.106 pounds per kWh
- One Therm Natural Gas = 100,000 BTU = 0.00617 tons

To offset GHG emissions resulting from centralized power generation, the County can implement any of four strategies.

1. Construct renewable energy generation facilities. These can take the form of Solar PV systems, wind power, or waste gas energy generation. The County has implemented this strategy by constructing a PV system on the ISD building, and the County has evaluated a number of other opportunities for PV systems at County owned facilities.

Cost Trends published by the Energy Analysis Office of the US Department of Energy indicate that renewable energy will become increasingly competitive. The cost per kilowatt-hour produced by wind, geothermal, solar thermal, photovoltaic, and biomass all trend rapidly downward over the next 15 years. Currently, wind competes with the cost of energy produced by natural gas and coal, while solar thermal is projected to become cost competitive in the next few years.

2. Install cogeneration systems. Cogeneration is the generation of two types of energy from one source. In this case, the County would use a natural gas powered motor to generate electricity and use the waste heat from the process to offset the need to consume natural gas. Cogeneration is not renewable energy, but because the County can use the waste heat from the generation cycle, the overall efficiency of the process can exceed 75%. A PG&E power plant has an efficiency of about 35 to 45%. The higher efficiency can be translated to GHG reductions. The cost effectiveness of a cogeneration system is highly dependant upon an available use for the waste heat.

3. Purchase "green" energy. In rare cases the County can purchase energy from a supplier other than the utility (Third Party Provider) and select energy that is generated from a source that does not generate as much CO_2 as PG&E's generation portfolio. Only one County facility has the option of purchasing energy from a third party. Because the County purchased electricity for the Main Adult Detention Facility from a third party prior to the "energy crisis" of 2000, the County can still purchase energy for this account from a third party. However, during the energy crisis, the state entered into long-term contracts for energy that are above current market rates. In order to ensure that the state had buyers for the electricity it purchased, the option of choosing a third party provider of electricity was discontinued for all additional accounts.

4. Green energy credits, or Green Tags[6]. The purchase of Green Tags supports the construction of green energy, and through the purchase the County can take credit for the GHG emissions offset by the energy generated. There would not be energy generated directly to County operations. PG&E has recently announced they will provide a program that will allow customers to pay an additional rate, the funds from which would be used to develop carbon reducing projects such as forest sequestration. This allows the customer to claim "carbon neutrality" in their use of energy from the utilities.

The following table summarizes the analysis results for the generation options identified and evaluated. Some observations to make include: PV systems are expensive for each ton of emission reduction, and they generate a relatively low return on investment; Cogeneration, when properly designed, results in a high rate of return and has a relatively low cost per ton of

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[6] Green Tags, Energy Credits, and GHG offsets are just a few of the names for the same thing, i.e. the purchase of a credit for energy "greenness." An energy credit trading market is in the process of being established. It is the GHG equivalent to pollution credit trading for industrial gross polluters. For example, if the County is not able to meet it's targets through capital investments, then credit for GHG reduction can be purchased from others. The investment the County makes in the credits will encourage others to invest in projects that reduce GHG emissions.

GHG emissions reduced; the purchase of Green Tags or other "offsets," is a very inexpensive way to get credit for GHG reductions, but since there is no revenue generated, the rate of return is negative; and finally, the purchase of Landfill Gas generated electricity has no additional cost when compared to current market prices for this direct access account, so the rate of return is extremely high and each ton of GHG reduction has essentially no cost.

Project	Net Capital Cost	Annual Savings (1st Year)	GHG eTons Saved	Life Cycle GHG eTons	Project Net Present Value	Internal Rate of Return	Cost $/eTon
Ground Mounted PV	$ 7,265,215	$ 295,592	1,292	32,305	$ (748,532)	4%	$ 5,622
150 kW Co-Gen	$ 330,055	$ 129,360	267	6,676	$ 2,438,063	71%	$ 1,236
PV Shade Structures	$ 3,074,157	$ 101,253	443	11,066	$ (820,852)	2%	$ 6,945
CREBS PV	$ 60,000	$ 5,422	889	22,230	$ 1,675,058	47%	$ 67
Roof Mounted PV	$ 1,064,605	$ 40,578	177	4,435	$ (167,774)	3%	$ 6,002
Purchase Solar Green Tags	$ 86,799	$ -	2,400	60,000	$ (1,846,838)	Negative	$ 36
Energy Management Staff	$ 230,768	$ -	-	-	$ (4,910,077)	Negative	n/a
Totals	$ 12,111,598	$ 572,205	5,468	136,712	(4,380,953)		$ 2,215

3.2.2 - Usage

To reduce GHG associated with energy use, the County must use less energy. Energy efficiency (EE) has been a core component of County operation since the 1970s. The County has completed numerous energy efficiency projects over the years as discussed in previous sections.

The first step to reducing energy use is to gain an understanding of where and how it is being used, and how it can be reduced. Since the baseline year, the County has had a number of energy management studies completed, including:

- Potential Energy Retrofit Projects, County of Sonoma Administration Center; HDR/Brown Vence and Associates, April 2006.
- Sonoma County Administration Center Central Mechanical Plant Expansion Energy Management Study: ESI Engineering Services, April 2004.
- Energy Management Study, Sonoma County Center; Kenwood Energy, August 2003
- Feasibility Study: Energy Efficiency Options for County of Sonoma Animal Shelter; Kenwood Energy, September 2002.

Many of the projects included in these analysis have been implemented, however, some of the more significant are still being considered and have been analyzed for their contribution to the County's GHG reduction goal.

Following is a list of the EE projects that were considered for the GHG reduction plan, sorted so that the most financially attractive are at the top. Detailed descriptions of the EE projects are included in the Appendix B.

Project	Net Capital Cost	Annual Savings (1st Year)	GHG eTons Saved	Life Cycle GHG eTons	Project Net Present Value	Internal Rate of Return	Cost $/eTon
CMP Performance Mapping	$ 14,623	$ 23,252	114	2,860	$ 198,270	1000%	$ 128
CVRH Resets	$ 24,700	$ 26,809	383	9,582	$ 221,128	1000%	$ 64
Dual Duct Resets	$ 1,300	$ 2,718	42	1,047	$ 11,462	1000%	$ 31
Chilled Water Pump VFD	$ 28,107	$ 23,735	117	2,919	$ 290,600	569%	$ 241
TES Thermocline Sensors	$ 21,935	$ 15,885	78	1,954	$ 317,090	277%	$ 281
Install more efficient Lighting	$ 33,705	$ 17,354	85	2,135	$ 199,951	114%	$ 395
Air Handler CO2 Sensors	$ 166,335	$ 78,269	385	9,627	$ 555,856	96%	$ 432
Hot Water Pump VFD	$ 52,750	$ 23,893	118	2,939	$ 269,248	90%	$ 449
Upgrade EMS	$ 58,493	$ 26,169	114	2,860	$ 294,215	88%	$ 511
New Econmizers at HOJ and Admin	$ 65,096	$ 19,528	96	2,402	$ 183,076	44%	$ 678
Repair Admin Center Economizers	$ 146,073	$ 43,820	216	5,390	$ 228,838	41%	$ 678
Air Condition w/ Cooling Tower	$ 263,217	$ 47,794	235	5,879	$ 766,230	27%	$ 1,119
NCDF Water Reclamation	$ 137,000	$ 25,940	61	1,519	$ 216,382	27%	$ 2,254
Street Light Voltage Regulator	$ 11,500	$ 1,948	10	240	$ 30,498	25%	$ 1,200
Replace Chillers 1 and 2	$ 438,695	$ 69,274	341	8,521	$ 1,056,154	23%	$ 1,287
Admin Center VAV Conversions	$ 1,425,858	$ 121,663	599	14,964	$ 761,266	11%	$ 2,382
Install EE Motors	$ 16,730	$ 1,464	7	180	$ 3,638	8%	$ 2,323
High Delta Cooling Coils	$ 119,423	$ 2,065	10	254	$ (69,803)	-2%	$ 11,756
Totals	$ 3,025,540	$ 571,579	3,011	75,271	5,603,900		$ 1,005

Implementation of these projects, which result in a Net Present Value of more than $5.6 million dollars for the County, should be implemented based on economic factors. In addition, the benefits of EE projects often extend beyond cost savings and GHG reductions, and include improved working conditions and reduced maintenance costs. The GHG reduction resulting from these projects account for more than 35% of the County's GHG emissions reduction target.

3.3 - Fleet Actions

Greenhouse gas emission associated with the County's fleet of vehicles is the result of the combustion of gasoline and diesel fuels. Every gallon of gasoline or diesel consumed creates about 20 pounds of CO_2 emissions. Reduction in GHG emissions must come from a reduction in fuel consumption or the consumption of cleaner burning fuels.

3.3.1 - Cleaner Fuels

Partly due to the rising cost of gasoline and diesel, and partly due to the unwavering environmental ideals of some individuals, a great deal of research has been done on cleaner burning fuels. However, implementation of cleaner fuel strategies can still be challenging due to limited infrastructure and conflicting legislation. Technologies that are under consideration include:

- Bio-diesel: Diesel fuel made from vegetable matter. Bio-diesel burns cleaner than petroleum based diesel, and it is manufactured from carbon sources that are on the surface of the earth and are already part of the earth's balanced carbon cycle. Bio-diesel comes in various blends, such as B5 and B20, which are 5% and 20% bio-diesel, respectively. Current research indicates that B5 and B20 fuels can be utilized by the County fleet without

much concern for vehicle maintenance issues or shortened vehicle life. Conversion to B100 fuels would require significant upgrades to the fleet to prevent damage to fuel lines and internal engine seals.

It should also be stressed that the use of bio-diesel in modern fleet vehicles is still relatively new. Staff expects challenges from regulatory agencies and vehicle and equipment manufacturers during the initial years of implementation. For example, the California Air Resources Board (CARB) has recently established regulations that mandate fuel and exhaust particulate filtration that may be incompatible with bio-diesel in some systems.

- Ethanol: A clean burning, high octane fuel that is produced from renewable sources that can be substituted for gasoline. At its most basic form, ethanol is grain alcohol. Ethanol is not used as a fuel in its pure form, but is mixed with unleaded gasoline. The result is to decrease gasoline cost, increase gasoline octane rating, and decrease harmful emissions. E10 (10% ethanol) is the most common form of ethanol fuel and it is approved for all vehicles sold in the U.S. E85 (85% ethanol) is intended for use in Flexible Fuel Vehicles (FFV), which are manufactured by all three US auto manufacturers. More than 4 million FFVs are on the road in the U.S. and more are being manufactured each year. FFVs run on E85, but can be switched to regular gasoline when E85 is not available. E85 will reduce GHG emissions by 17% to 24%.

  Challenges associated with Ethanol include CARB rules that makes it illegal in California in quantities greater than 10%, the need for flexible fuel vehicles to operate with the fuel, questionable availability at current production levels nationally, unknown cost when it is available and decreased range by 20-25%.

  The Fleet Manager has identified 139 compact and light (1/2 ton) trucks that would be appropriate for this fuel should it become available prove effective in reducing GHG's for the work the County needs to do.

Project	Net Cost	GHG eTons Saved	Life Cycle GHG eTons	Project Net Present Value	Internal Rate of Return	Cost $/eTon
Fleet Ethanol Use	$ -	-	-	$ -		$ -
Convert Heavy Fleet to Bio-diesel	$ 50,000	161	4,025	$ (249,737)	Negative	$ 311
Totals	$ 50,000	161	4,025	(249,737)		$ 311

At this point, GHG savings from the use of Ethanol is not projected in the Action Plan. However, staff suggests purchase of flex fuel vehicles, which can be obtained at a minimal marginal cost compared to standard vehicles, within the group of 139 as replacement comes due. This would allow the use of E85 if and when the regulatory roadblocks are removed.

3.3.2 - Lower Consumption

To reduce Fleet fuel use, the efficiency of the fleet vehicles must be improved, or the fleet vehicles must be operated less. The Fleet has replaced 50 sedans with hybrid vehicles, and

seven SUVs with the hybrid equivalent. This results is less fuel used for each mile traveled, thus reducing GHGs.

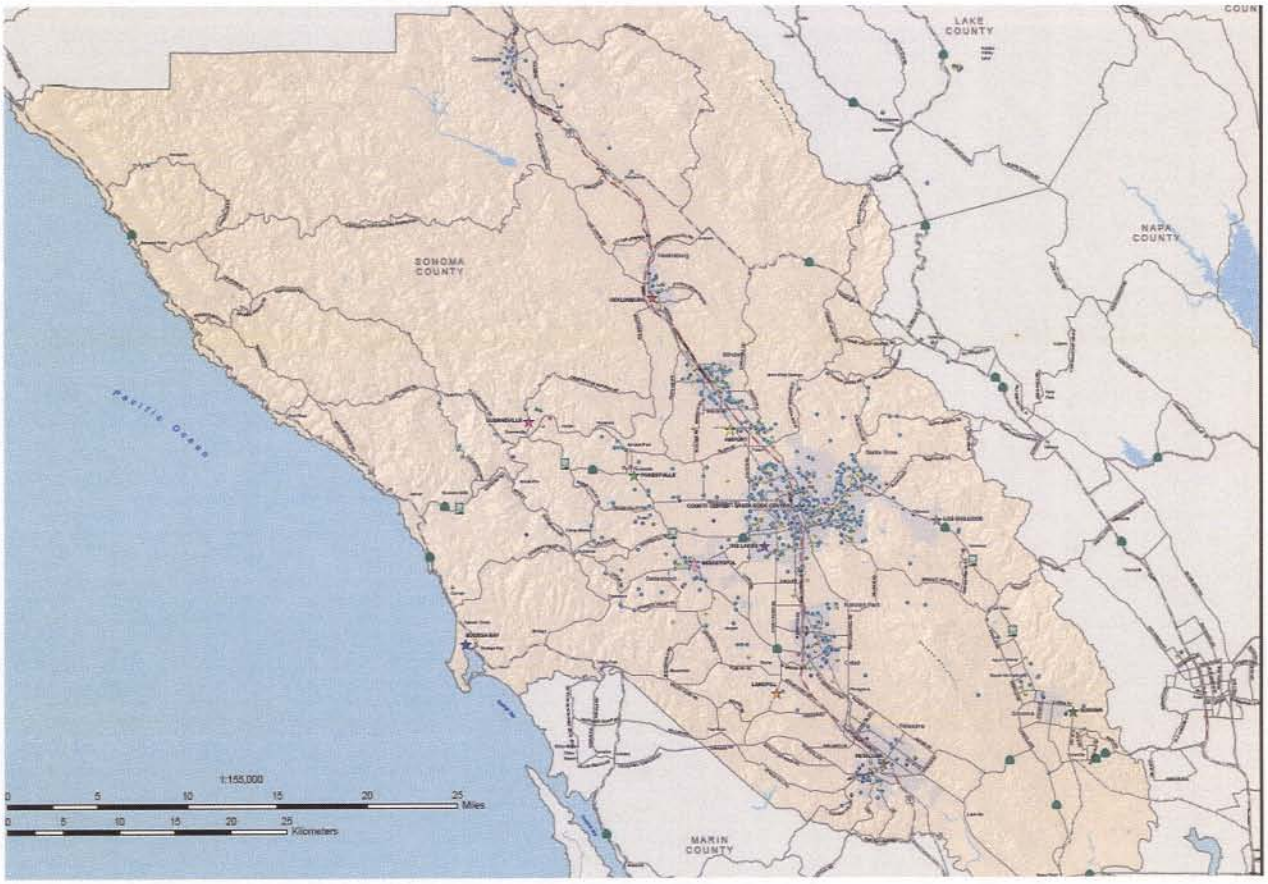
Project	Net Capital Cost	Annual Savings (1st Year)	GHG eTons Saved	Life Cycle GHG eTons	Project Net Present Value	Internal Rate of Return	Cost $/eTon
Existing Hybrid Vehicles	$ (3,500)	$ 25,479	52	1,306	$ 334,668	1000%	$ (67)
Future Hybrid Vehicles	$ -	$ 108,621	223	5,567	$ 1,412,532	1000%	$ -
Totals	$ (3,500)	$ 134,100	275	6,873	1,747,200		$ (13)

The County is also evaluating the potential of implementing an "Idling" program. Frequently, standard operating procedures for large fleet vehicles is for the engine to idle for extended periods of time to operate flashing lights and maintain vehicle comfort. A program that reduces idling by providing alternative methods of powering flashers and/or changing behavior can result in significant fuel reductions. However, savings from an idling reduction program cannot be quantified at this time. Therefore, GHG savings have not been included.

3.4 - Commute Actions

Affecting peoples commute habits is the most challenging segment to understand and plan, because it addresses individual behavior. However as a segment that accounts for 38% of the County's total baseline GHG emissions, it is a critical component of a comprehensive Climate Protection Plan.

In September of 2005 the County conducted a survey of all employees to learn more about existing commute habits and actions that might entice the employees to reduce fuel consumption associated with commuting. Based on survey responses, the following map was developed that shows generally where County employees live.



The survey found that approximately 90% of the County's employees drive alone to and from work in personal vehicles. An important part of a successful GHG reduction plan will be to shift the current commute habits of County workers to alternative modes such as public transit, ride sharing, bicycling, or walking as much as possible. To meet the target and in consideration of other recommendations in Buildings and Fleet, it is necessary to shift the pattern of 543 employees each day away from single occupant vehicles.

Commute reduction ideas that reduce GHG's have been borrowed from programs that were specifically designed to address traffic congestion issues. A number of programs have been successfully implemented across the country and in Canada. The Federal Highway Administration has developed a guide[7] that provides a framework for developing a commuter program, and gives several case studies that can be referred to in developing one.

Staff considered a number of these programs when assessing the potential of implementing a successful commuter program in Sonoma County. Two of the programs addressed issues that are similar to those of the County, and have impacted the commute to levels similar to the County's assumed target level. The Nike Program in Beaverton Oregon was resulted in a total of 22% of employees using alternative transportation methods at a cost of $302,000 per year. The Swedish Medical Center in Seattle, WA, reached alternative commute levels as high as

[7] Mitigating Traffic Congestion, The Role of Demand-Side Strategies; Federal Highway Administration, US Department of Transportation; October 2004

60% at a cost of about $1.5M (the cost of this program is high due to the reliance on boat passes and ferries).

Implementing a commute program in Sonoma County will present challenges. The two successful programs mentioned above are in areas with good mass transit in place. The cost and effectiveness of these programs was averaged and used for estimating the cost and impact that the County would see, which may be optimistic.

A successful incentive based commute program consists of many components.

- Employer Sponsored Commute Pass Program: Commonly, employers provide discounted or free passes to employees as an inducement to use transit as a commute option. County employees that work at one of the pre-approved sites are entitled to receive free bus passes and/or tickets for Sonoma County Transit or Santa Rosa CityBus up to a value of $100 per month. Currently 184 County employees take advantage of the existing free bus pass program.
- Flex Time: Traffic management and commute reduction programs often include use of alternative work schedules that allow staff to reduce peak traffic at commute times and/or reduce the number of days that employees need to commute. Some flexibility in work shifts can also assist in making carpool or transit arrangements work. A number of County departments use alternative work schedules at the present time, but each situation must be viewed for its impact on employee productivity and customer service.
- Guaranteed Ride Home: This program guarantees staff that do not have a car at work due to alternative commuting are guaranteed a ride home either by the use of a fleet vehicle, taxi, or other option. This program is currently not in operation in the County.
- Preferred Parking: Staff that carpool or high efficiency vehicles are provided advantageous parking. The County parking ordinance allows preferential parking spaces for carpoolers but only 8 pairs are currently registered for the program.
- Telecommuting: Staff whose essential job functions are compatible with working at home are encouraged to do so when possible and some County departments have telecommuting programs. The Clerk, Recorder Assessor's Office is the department that has made the greatest use of it at the present time with approximately 19 personnel enrolled in the program.
- Car and Van Pool: Establish commute pools that reduce single occupancy vehicle driving to and from County facilities. This will also include the development of a system to connect employees with similar commutes. Van pooling could be useful for employees who commute long distances. Who provides and pays the cost of operation and maintenance of the vans is an area that would need development.

The County has many of the programmatic and policy measures in place. However, these measures have been treated as options available to departments and employees rather than specific priorities of the Board. To be effective in reducing GHG's, these measures will need additional policy emphasis from the Board, and program development and marketing to employees and departments.

A successful commute program also takes a great deal of management. One common theme in all of the successful commute programs analyzed was the dedication of at least one full time equivalent (FTE) employee to manage the program.

An added value of commute programs is the overall reduction in required parking area, resulting in increased land for future construction and delaying the need for potentially expensive parking structures. For example, the value of a single existing ground level parking spot is calculated to be from $7,700 to $13,900. If the construction of a new parking structure is required to house the growing number of cars, the value for each parking space is estimated to be more from $22,300 to $37,500.

In addition, successful programs often include a paid parking component as a disincentive to commute in a single occupant vehicle. In some cases, employers have offset the cost of the parking charge with a stipend that can be retained by the employee should they choose a commute alternative. The stipend provides an incentive to avoid driving alone because the employee can then spend the increase for other needs. The paid parking component creates a disincentive to drive alone due to the relatively high cost of parking. These two attributes of a paid parking program create a powerful incentive to not drive alone. However, this type of program can create equity and employee relations issues which would require significant further study before a program could be implemented.

At this point, and pending development of a comprehensive commute program, we have based cost and GHG reduction estimates on a purely incentive based program that does not include paid parking. This could be reconsidered depending upon program success in achieving GHG reduction goals.

Project	Annual Cost	GHG eTons Saved	Life Cycle GHG eTons	Project Net Present Value	Cost $/eTon
Comprehensive Commute Program	$ 343,801	1,282	32,038	$ (7,315,093)	$ 268
Totals		1,282	32,038	(7,315,093)	$ 268

The cost cited above is based on the experience of programs from other major employers who have successfully implemented commute programs. It is shown as a potential amount that could be required with a fully operational program. Staff would not request this amount at an initial phase. Rather, we would recommend hiring a staff commute coordinator plus consultant assistance to develop the program and return to the Board for specific funding approval.

Chapter 4 - An Implementation Strategy for the Near Term

4.1 - Plan Development

In developing a comprehensive Action Plan for the County, we must consider where we started, where we are now, and what steps must be take to reach the target. The Action Plan is presented in several logical steps. The following table summarizes each step to accomplishing the County's goal, and two different Plans.

Action Plan	Net Capital Cost*	Estimated First Year Net Savings	Simple Pay Back (years)	Internal Rate of Return (IRR)	Annual GHG Reduction (Tons)	Percentage GHG Target	Cost per Ton GHG
Step 1 - Completed Projects	$496,438	$105,665	4.7	29.6%	2756	32.6%	$180
Step 2 - No cost and low cost actions	$263,240	$139,983	1.9	99.4%	3929	46.5%	$67
Step 3 - Additional actions with an IRR > 10%	$3,523,700	$782,861	4.5	24.3%	7011	83.0%	$503
Action Plan A - Additional Actions with an IRR > 0%	$11,989,673	$1,122,559	10.7	12.1%	8498	100.6%	$1,411
Action Plan B - All projectss with an IRR > 10%, plus a commuter program	$3,917,501	$767,745	5.1	7.4%	8454	100.0%	$463

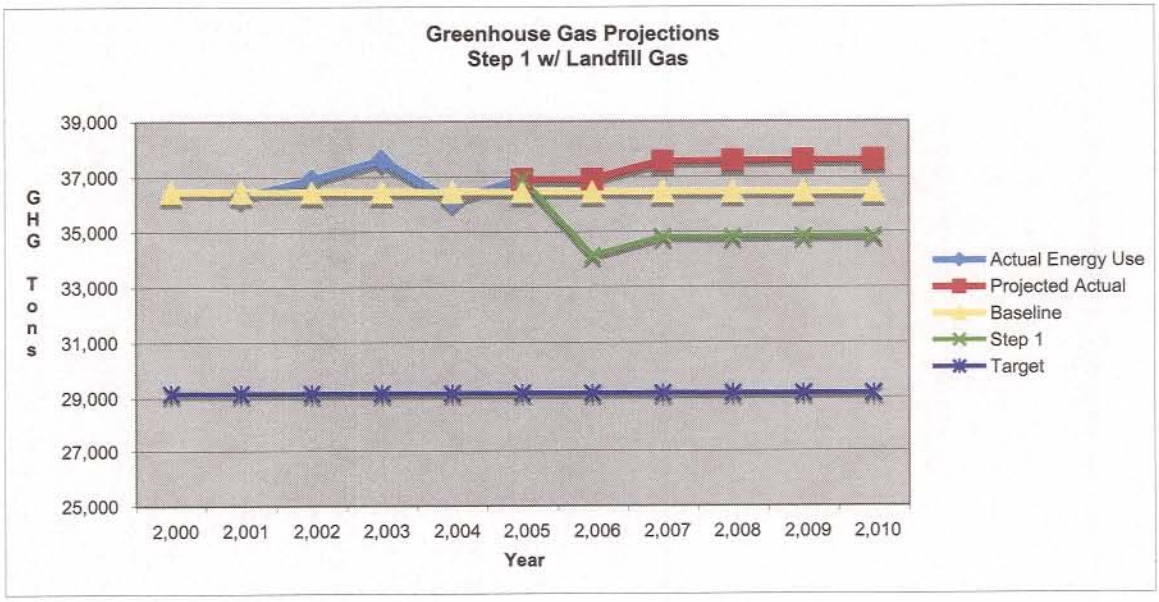
* Net capital cost is the initial cost less incentives and rebates.

Step 1: This includes all projects discussed in Section 2.2 - Progress to Date. These projects have already been completed, so there are no initial costs. However, the energy savings and the GHG reduction will continue through the life of the project, so the GHG reduction is cumulative in Step 2, Step 3, and both action plans. The County has already accomplished more than 32% of its goal through the implementation of these projects. Most of the effect of Step 1 is included in the current level of GHG use, except for the purchase of landfill gas electricity which was just completed and becomes effective July 1, 2006. The single step of purchasing landfill gas generated electricity saves 1,937 tons of GHGs annually or 23% of the total 2010 reduction goal. A chart showing Sonoma County's accomplishments to date including the effect of the landfill gas purchase follows.

Project	Net Capital Cost*	Annual Savings (1st Year)	Annual GHG eTons Saved	Project Net Present Value	Internal Rate of Return	Cost $/eTon
Existing Bus Pass Program	$ 66,240		388	$ (1,409,396)	Negative	$ 171
Re-Roof Aministration Center Buildings	$ 20,940	$ 12,049	84	$ 236,424	145%	$ 250
Hot Water Pump VFD	$ 52,750	$ 23,893	118	$ 269,248	90%	$ 449
Installed 17 Instant Hot Water Heaters	$ 46,000	$ 20,348	105	$ 228,280	86%	$ 440
Vending Machine Controllers	$ 3,880	$ 809	4	$ 3,690	27%	$ 974
Existing Hybrid Vehicles	$ (3,500)	$ 25,479	52	$ 334,668	1000%	$ (67)
ISD PV	$ 310,128	$ 23,086	68	$ 195,849	10%	$ 4,543
Purchase Landfill Gas	$ -	$ -	1,938	$ 2,513,209	1000%	$ -
Totals	$ 496,438	$ 105,665	2,756	2,371,972	29.6%	$ 180

* Net Cost Includes Rebates

Following is a graphic depiction of the impact of Step 1.



Step 2: Some opportunities won't require a significant investment or the cost savings pay for the project in the first year. Included in Step 2 are:

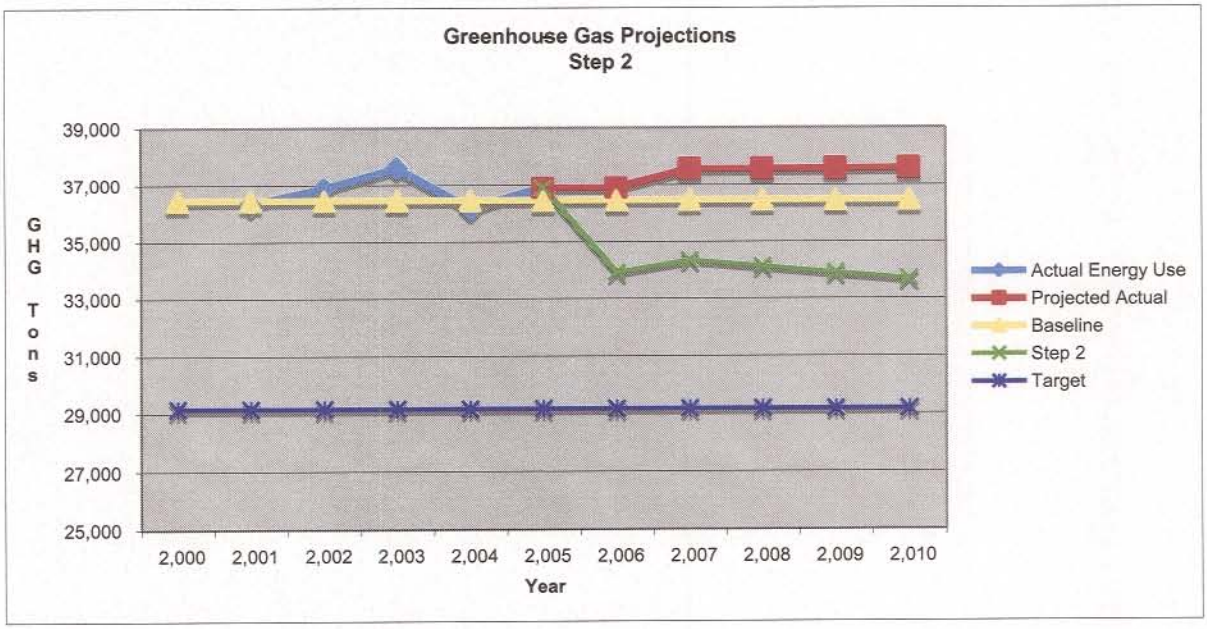
- CREBs Solar Electric Generation: The Energy Policy Act established the Clean Renewable Energy Bonds (CREBs) for entities that cannot take advantage of the federal production tax credit. The benefit is that the County will obtain PV production assets with no up front cost and purchase energy at a discounted rate compared to standard utility rates. CREBs solar sites include the Animal Shelter, PRMD, Orenda Center, the La Plaza Office Complex, the Juvenile Justice Center, and the Sheriff's Building

- NCDF laundry waste heat and water recovery system is a project in which the vendor bears the cost of construction and the County is responsible for payments that are less than the actual cost savings.
- New Hybrid Vehicles: Once the incremental cost adder is compared to the purchase rebate and the higher residual value, Hybrid vehicles actually cost less than the standard vehicles that the County would have purchased.

The following table summarizes the Step 2 Actions.

Project	Net Capital Cost	Annual Savings (1st Year)	Annual GHG eTons Saved	Project Net Present Value	Internal Rate of Return	Cost $/eTon
CREBS PV	$ 60,000	$ 5,422	889	$ 1,675,058	47%	$ 67
NCDF Water Reclamation	$ 137,000	$ 29,940	61	$ 216,382	27%	$ 2,254
Existing Bus Pass Prog.	$ 66,420	$ -	388	$ (1,409,396)	Neg	$ 171
Future Hybrid Vehicles	$ -	$ 108,621	223	$ 1,412,532	1000%	$ -
Totals	$ 263,240	$ 139,983	3,929	$ 1,894,575	99.4%	$ 67

Implementation of Step 2 gets the County 46% of the way to the target.

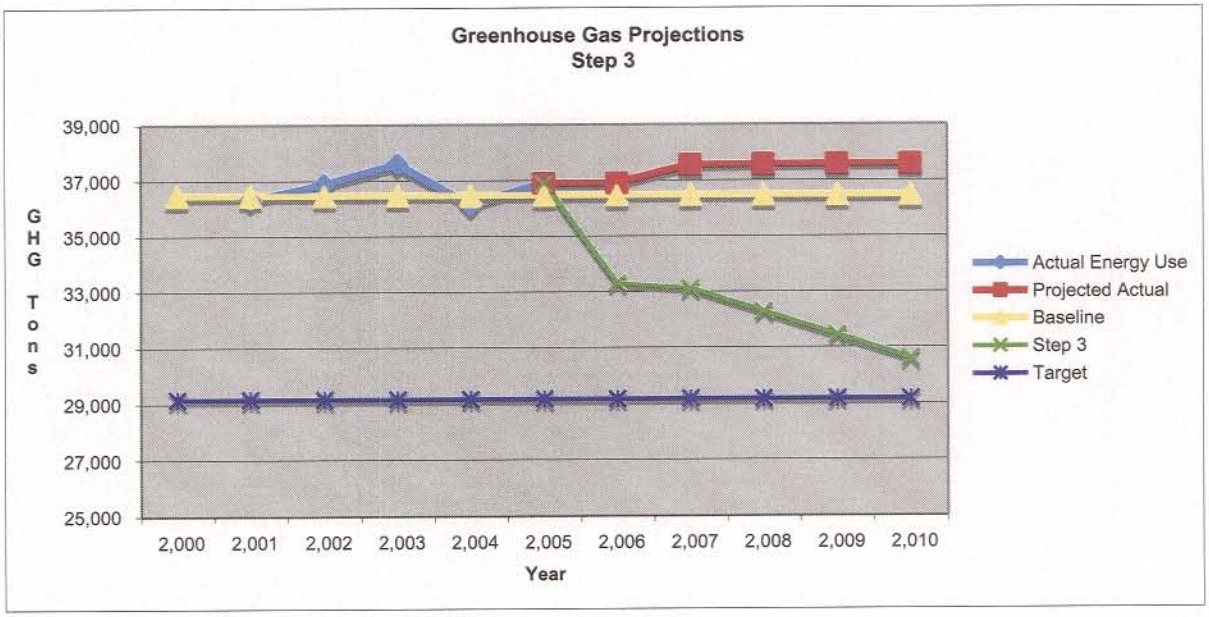


Step 3 is the implementation of all of the projects included in Step 2, plus GHG reduction options that result in an Internal Rate of Return of 10% or higher. This step requires a significant investment of County time, money, and resources. Due to the effort required to implement this option, two full time staff positions have been included to handle the planning

and administration of the project. The following table details all of the projects included in Step three. Note that cost and savings of Step 2 are included in Step 3.

Project	Net Capital Cost	Annual Savings (1st Year)	Annual GHG eTons Saved	Project Net Present Value	Internal Rate of Return	Cost $/eTon
Step 2 Projects	$ 263,240	$ 139,983	3,929	$ 5,407,595	99.4%	$ 67
CMP Performance Mapping	$ 14,623	$ 23,252	114	$ 198,270	1000%	$ 128
CVRH Resets	$ 24,700	$ 26,809	383	$ 221,128	1000%	$ 64
Dual Duct Resets	$ 1,300	$ 2,718	42	$ 11,462	1000%	$ 31
Chilled Water Pump VFD	$ 28,107	$ 23,735	117	$ 290,600	569%	$ 241
TES Thermocline sensors	$ 21,935	$ 15,885	78	$ 317,090	277%	$ 281
Install more efficient Lighting	$ 33,705	$ 17,354	85	$ 199,951	114%	$ 395
Air Handler CO2 Sensors	$ 166,335	$ 78,269	385	$ 555,856	96%	$ 432
Upgrade EMS	$ 58,493	$ 26,169	114	$ 294,215	88%	$ 511
150 kW Cogeneration	$ 330,055	$ 129,360	267	$ 2,438,063	71%	$ 1,236
New Econmizers at HOJ and Admin	$ 65,096	$ 19,528	96	$ 183,076	44%	$ 678
Repair Admin Center Economizers	$ 146,073	$ 43,820	216	$ 228,838	41%	$ 678
Air Condition with Coolling Tower	$ 263,217	$ 47,794	235	$ 766,230	27%	$ 1,119
County Center Light Voltage Control	$ 11,500	$ 1,948	10	$ 30,498	25%	$ 1,200
Replace Chillers 1 and 2	$ 438,695	$ 69,274	341	$ 1,056,154	23%	$ 1,287
Admin Center VAV Conversions	$ 1,425,858	$ 121,663	599	$ 761,266	11%	$ 2,382
Energy Management Staff	$ 230,768	$ -	$ -	$ (4,910,077)	Negative	$ -
Totals	$ 3,523,700	$ 782,861	7,011	$ 8,050,213	24.3%	$ 503

The effect of Step 3 is to get the County to 83% of its goal.



Staff has developed two Action Plans that independently achieve and exceed the target GHG emission goal of 29,600 tons by 2010. The two Plans have many measures in common. In the financial analysis for each Plan, the comprehensive package of measures includes some measures that have a very quick payback to offset measures that have a longer payback.

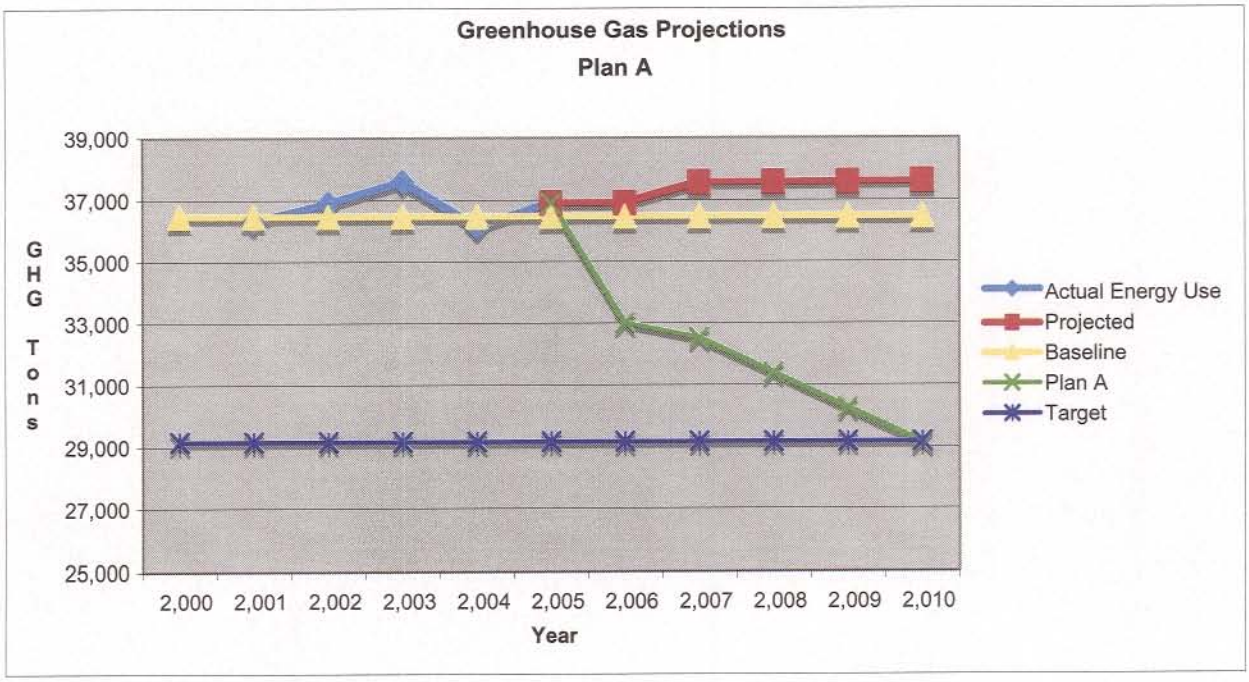
Plan A involves a significant capital investment in projects that have an IRR less than 10%. This alternative is highly dependent on distributed energy generation projects in the buildings segment through the development of a substantial number of large PV systems covering roofs, and bare ground. By contrast, lesser emphasis is placed on the employee commute section due to the inability to predict the feasibility of actually attaining significant reductions with confidence, or without substantial change to County policy and a significant impact on County workforce. Plan A includes all of the projects in Steps 2 and 3, plus those in the following table.

Plan A Projects

Project	Net Capital Cost	Annual Savings (1st Year)	Annual GHG eTons Saved	Project Net Present Value	Internal Rate of Return	Cost $/eTon
Step 3 Projects	$ 3,523,700	$ 782,861	7,011	$ 8,050,213	24.3%	$ 503
Ground Mounted PV	$ 7,265,215	$ 295,592	1,292	$ (748,532)	4.0%	$ 5,622
Install EE Motors	$ 16,730	$ 1,464	7	$ 3,638	8.4%	$ 2,323
Roof Mounted PV*	$ 1,064,605	$ 40,578	177	$ (167,774)	3.4%	$ 6,002
High Delta Cooling Coils	$ 119,423	$ 2,065	10	$ (69,803)	-2.2%	$ 11,756
Totals	$11,989,673	$ 1,122,559	8,498	$ 7,067,742	12.1%	$ 1,411

*Photovoltaic

The effect of Plan A is to get the County to 100% of its goal.



Plan B is an alternate to Plan A and places a much higher reliance on an extensive employee commute program and involves substantially less capital investment. As presented, this alternative would require an additional 13% of the workforce, or 543 additional employees to alter commute habits by utilizing a host of different commute alternatives such as transit, car or van pool, telecommuting, or other means. The approach is incentive based. Implementation of this alternative will incur annual costs without any savings to the County budget. Much more study and added staff would be necessary to effectively implement such a program. Plan B includes all of the projects in Steps 2 and 3, less the Ongoing Bus Pass Program that is now an inherent part of the Comprehensive Commute Program.

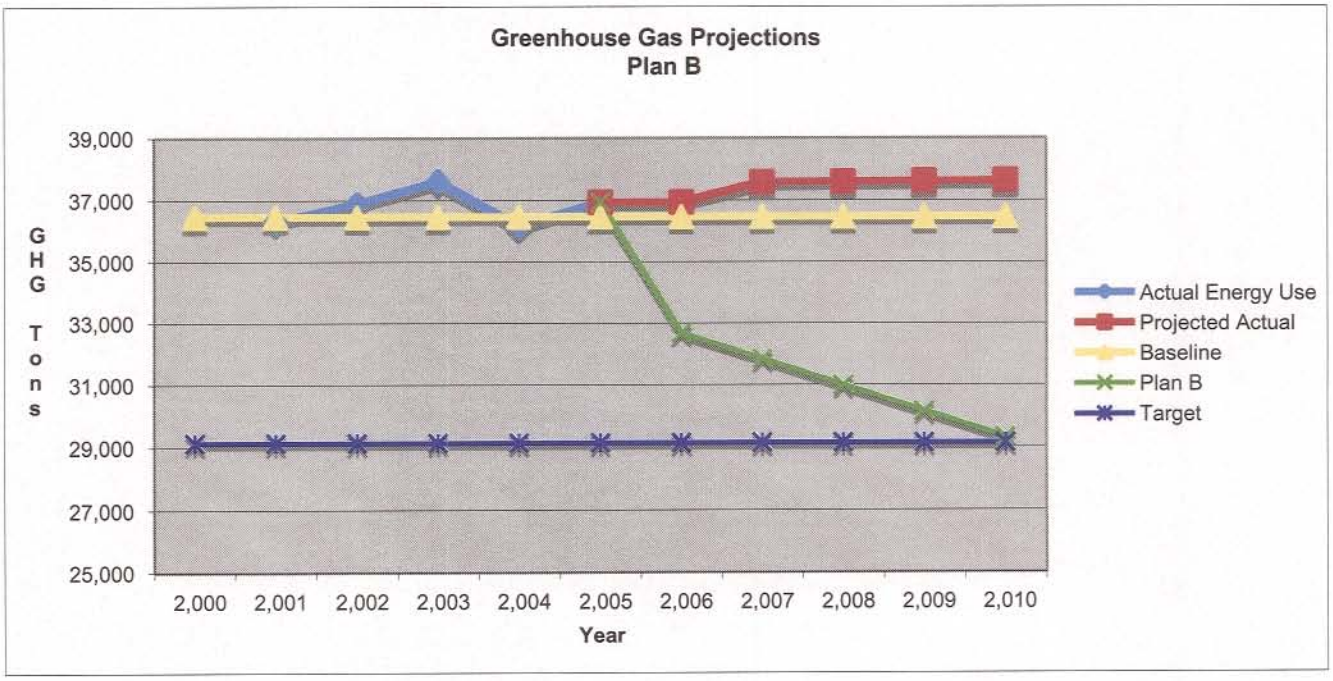
Plan B Projects

Project	Net Capital Cost	Annual Savings (1st Year)	Annual GHG eTons Saved	Project Net Present Value	Internal Rate of Return	Cost $/eTon
Step 3 Projects	$ 3,523,700	$ 782,861	7,011	$ 8,050,213	24.3%	$ 503
Bio Diesel	$ 50,000	$ (15,116)	161	$ (249,737)	Neg	$ -
Commute Program*	$ 343,801	$ -	1,282	$ (7,315,093)	Neg	$ 268
Totals	$ 3,917,501	$ 767,745	8,454	$ 485,384	7.4%	$ 463

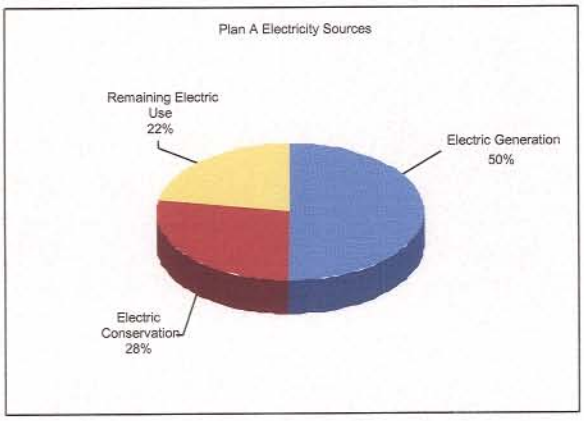
A rough projection of annual costs for implementing a basic comprehensive commute program is in the table below. The main components of the budget are increased bus passes and the staff required to develop and implement the program.

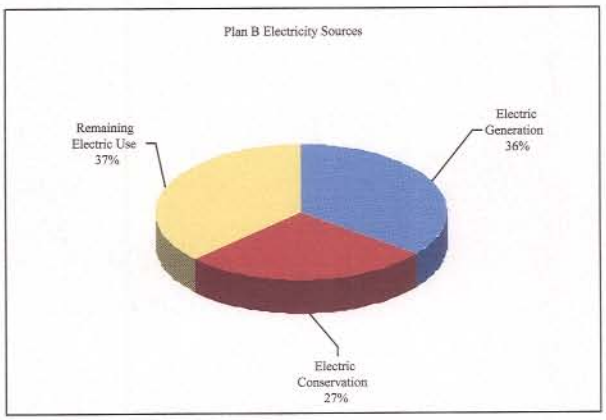
Year	Projected Cost
1	$ 343,801
2	$ 403,441
3	$ 311,419
4	$ 323,875
5	$ 336,830
6	$ 350,304
7	$ 364,316
8	$ 378,888
9	$ 394,044
10	$ 409,806
Total	$ 3,616,723

The effect of Plan B is to get the County to 100% of its goal.



The following two charts depict the amount of the County's current electric use that will be offset by conservation and generation for each plan. The blue segment of the chart represents electric generation, the red represents conservation, and the yellow represents the amount of electricity that the County will still purchase from the utility company.





4.2 - Accumulative Capital Outlay (ACO) Fund

Accomplishing the goals established by the Board will require a significant investment. To make the investment more affordable to the County, the County must consider financing options that allow the energy savings to pay for the investment, thus resulting in a neutral or

positive cost to the County. In addition, the County must consider the need for funding ongoing projects into the future.

An Accumulative Capital Outlay (ACO) fund will allow the County to address both of these considerations, i.e.: funding projects now and funding projects in the future. In summary, a fund would be created to pay for energy expenditures for buildings, energy conservation measures for buildings including debt service, commute programs and staff that support GHG reductions. This fund would allow financial bundling of all of the projects and retaining any savings from one year to the next to fund future cash flow.

In a simple scenario, such as the installation of basic energy efficiency measures, the energy savings will be equal to or greater than the loan payment. However, in the case of the County's Climate Protection Action Plan, there are a number of ongoing costs that do not have ongoing savings associated with them, such as the staffing of positions and funding the commute program.

4.3 - Action Plan Financing

Following are cash flow summaries for both of the Plans described above. Each assumes a loan term of 4.6% over 15 years. We have also assumed an energy inflation rate of 4% and a discount rate of 5%. The loan payments are based on borrowing the Net Capital Cost of the project.

	Plan A	Plan B
Initial Capital Cost	$16,628,598	$4,075,847
Rebate	$4,638,926	$158,346
Net Capital Cost	$11,989,673	$3,917,501
1st Year Cost Savings	$1,122,559	$767,745
Net Present Value	$9,836,480	$3,124,313

Plan A results in a higher NPV, but it requires taking on a significantly higher debt. The following tables show the actual cash flow on an annual basis for each of the Plans based on financing the initial investment.

PLAN A - GENERATION FOCUS
Cash Flow Analysis

	Year	Financed
Annual Cash Flow	1	($343,828)
	2	($229,337)
	3	($172,100)
	4	($119,406)
	5	($64,033)
	6	($5,851)
	7	$55,277
	8	$119,495
	9	$186,953
	10	$257,810
	11	$332,230
	12	$410,387
	13	$236,255
	14	$578,649
	15	$669,143
	16	$1,869,217
	17	$1,968,966
	18	$2,073,682
	19	$2,183,607
	20	$2,298,991
	21	$2,680,608
	22	$2,812,929
	23	$2,951,646
	24	$3,097,066
	25	$3,249,510

	Year	Financed
Cumulative Cash Flow	1	($343,828)
	2	($573,165)
	3	($745,265)
	4	($864,670)
	5	($928,703)
	6	($934,555)
	7	($879,278)
	8	($759,783)
	9	($572,830)
	10	($315,021)
	11	$17,209
	12	$427,596
	13	$663,852
	14	$1,242,501
	15	$1,911,644
	16	$3,780,860
	17	$5,749,826
	18	$7,823,509
	19	$10,007,115
	20	$12,306,106
	21	$14,986,714
	22	$17,799,644
	23	$20,751,290
	24	$23,848,355
	25	$27,097,865

PLAN B - COMMUTE FOCUS
Cash Flow Analysis

	Year	Financed
Annual Cash Flow	1	($292,829)
	2	($157,148)
	3	($129,873)
	4	($108,339)
	5	($85,373)
	6	($60,894)
	7	($34,817)
	8	($7,053)
	9	$22,494
	10	$53,923
	11	$87,339
	12	$122,851
	13	$160,576
	14	$200,637
	15	$243,161
	16	$572,111
	17	$619,976
	18	$670,733
	19	$724,539
	20	$781,560
	21	$1,102,481
	22	$1,171,676
	23	$1,244,743
	24	$1,321,887
	25	$1,403,324

	Year	Financed
Cumulative Cash Flow	1	($292,829)
	2	($449,977)
	3	($579,850)
	4	($688,189)
	5	($773,562)
	6	($834,456)
	7	($869,273)
	8	($876,326)
	9	($853,831)
	10	($799,908)
	11	($712,569)
	12	($589,718)
	13	($429,142)
	14	($228,505)
	15	$14,656
	16	$586,767
	17	$1,206,743
	18	$1,877,475
	19	$2,602,014
	20	$3,383,574
	21	$4,486,055
	22	$5,657,731
	23	$6,902,474
	24	$8,224,361
	25	$9,627,685

As can be seen, the annual cash flow is negative for a number of years for both action plans. This means that for the County's Climate Protection Action Plan, there are a number of

ongoing costs that do not have ongoing savings associated with them, such as the staffing of positions and funding the commute program.

The detailed, project-by-project cash flow for each Plan is included in Appendix E.

As can be seen, both Plans offer cost effective methods of implementing the Climate Protection Action Plan. Although Plan A has a higher Net Present Value, Plan B has a lower initial cost. The advantage of financing the Plan is that the most cost effective actions can help to fund those that are less cost effective, while still providing a reasonable rate of return to the County.

4.4 - Implementation

The implementation of the Climate Protection Action Plan can be quite complex. Some activities, such as planning and financing facility improvements or implementing a commute program, will require significant effort. Other measures will be relatively easy to implement, such as changing the specification for an asset or commodity the County already purchases.

The effort to develop this Action Plan was staffed by a combination of college interns, consultant services and in house County technical and administrative staff from the Fleet Operations, Architecture and Administrative Divisions of the General Services Department. However, the Department currently does not have a specialized staff resource that is trained and experienced to the depth necessary to keep pace with technological changes, financing opportunities and regulatory requirements to keep the County in the forefront in these areas.

A Program Improvement in the 2006-07 County Budget has been requested that would establish a Division of Energy and Sustainability within the General Services Department. This Division would consist of a Division Manager and a Secretary at a cost of $230,768. This position would oversee the County's efforts to implement this Plan and to develop new strategies that could assist in sustaining compliance with the target beyond 2010 and lead efforts to meet the new goal established by the Board.

Should the Board approve a strong commute reduction program as part of the Action Plan, we would also request a Departmental Analyst, costing $84,000 - to work in this new Division to develop and implement commute reduction strategies. The cost of these positions and related expenses have been included in the cash flows of the Action Plan.

For facility changes, the County must consider a number of different implementation paths, and the advantages and disadvantages of each. The three most common methods of implementation include:

- In House Delivery in which existing staff are tasked with developing, evaluating, and implementing the Action Plan.
- The use of Energy Consultants to lead the development, evaluation, and implementation of the Plan.
- The use of an Energy Service Company (ESCO) to develop and implement the Plan.

County staff has been implementing energy management projects for a number of years. The usual method is to implement projects on a one by one basis, resulting in significant staff time and long implementation times.

Due to the number and complexity of the Climate Protection Action Plan and the approach of the target date, staff believes that the use of an energy services company (ESCO) is the most efficient method of implementing those portions of the Plan involving construction of facility improvements including energy conservation and distributed generation measures. Government Code section 4217.10 et seq. allows public agencies to award energy service contracts for energy-saving projects on the basis of contractor's experience, type of technology employed by the contractor, cost to the local agency, and any other relevant considerations. Contracting by this method is far more flexible than traditional design/bid/build. Through a competitive process, an ESCO would be selected to evaluate the County's buildings including all of the measures identified in this report and others that the contractor could identify. These projects would be bundled together, priced, savings estimated and a contract executed with the design and construction performed by a single entity. The statute requires certain findings be made by the Board of Supervisors by resolution after a public hearing on the project. Staff believes this contracting approach to be the most expeditious and least costly to implement the conservation/generation measures identified in the Plan.

Staff has developed a Request for Qualifications to recruit a qualified ESCO to support the County in the Plan's implementation. An agenda item bringing forth this implementation step will follow presentation of this Action Plan.

4.5 - Above and Beyond

Staff has developed two viable Action Plans that are based on GHG reduction actions that are quantifiable and can be implemented with confidence using technology that is available today. However, there are a number of other GHG reduction actions that are worth discussing. We have included a short description of a few herein.

- Campus Services: Increase Administration Campus services such as food services, exercise facilities, bike lockers, showers, community vehicles, etc., to reduce the need to travel off campus once the workday has started.
- Green Tags: Purchase renewable energy credits, or Green Tags that give the County credit for the GHG reductions.
- Sonoma County PV Program: Develop and implement a County wide Program that provides subsidies for locally installed PV systems in which the County secures the green tags.
- Forestry Offsets: Similar to renewable energy credits are Forestry Credits. By purchasing the credits the County is supporting the planting of forests that absorb greenhouse gases.
- Fuel Cells: Fuel cells use a chemical process to convert the energy in a gas to electricity and heat, and are more efficient than a utility power plant.

4.6 - Monitoring and Measuring

Although the science of climate change is mature and there is widespread agreement that human activity is effecting the CO2 levels in our atmosphere, the science of translating energy use into a quantifiable GHG baseline, estimating project GHG reduction impacts, and tracking the Climate Protection Plan progress is a relatively new science. As the Plan is implemented, regular updates to the Plan will be required to ensure that the County is on track to meet the established targets based on the most recent science.

A monitoring and measurement system is being implemented to track the effectiveness of the initial proposed reduction projects and is an established step in the ICLEI Climate Protection Campaign. At the present time, the SP3 Committee produces an annual report tracking the use of resources within the County operations. This report has the advantage of being updated annually and provides a relatively consistent benchmark, and contains the necessary data for use in this Plan. We will report to the Board at least annually on the progress toward attaining the Climate Protection goals of the County through this mechanism.

To supplement this effort, the County anticipates importing the information that was developed during this effort into a web based database. This will allow for real time management of data that tracks the implementation of the Plan by each of the affected segments: Buildings, Fleet, and Commute.

Staff also recommends that the Board direct that major facility and programmatic changes be evaluated individually as they are brought to the Board so that the impact on the County's Climate Protection goals can be considered. Proponents should be encouraged to consider minimizing the impact on the climate as different projects are brought before the Board.

Chapter 5 - Conclusion and Recommendations

5.1 - Conclusion

Staff has completed a great deal of research in evaluating GHG emission reduction actions that address emissions in all three County operation segments: Buildings, Fleet, and Commute. Many of the actions in the building and fleet segments typically involve the installation or modification of energy using equipment. The benefit is that these actions tend to be quantifiable.

Reducing GHG emissions from the commute segment presents a greater challenge. In this case, we are addressing human behavior and choices of lifestyle and we can only create incentives and disincentives to influence behavior, hence success is not predictable.

Staff has identified two viable options to achieve the GHG reductions necessary to meet the target of no more than 29,600 tons by the year 2010. Plus implementation and financing modes have been evaluated that will enable Staff to implement the Plan in a timely manner and on a cost neutral basis.

5.2 - Recommendations

Staff makes the following recommendations:

1. Implement Action Plan B, relying on the comprehensive commute program to achieve the goal.
2. Approve releasing a Request For Qualification for an energy services company to conduct a comprehensive energy project for County facilities (discussed further in following agenda item).
3. Approve staffing three positions: one to manage the commute program and two to manage and implement energy management programs.
4. Create an energy fund that can be used to finance energy expenditures, debt services for energy related projects and employee commute program costs that reduce GHG emissions. Energy cost savings would be retained in the energy fund to pay for and offset costs of future energy conservation and efficiency projects.
5. Direct that all major future construction and large County purchases and other program changes be subjected to an analysis of their GHG emission impact.
6. Require that staff report to the Board annually on the attainment of the County's stated GHG reduction target through the Sustainable Policies and Practices Project (SP3).
7. Direct staff to identify legislative and regulatory changes that could assist County departments to achieve new methods of GHG reduction as part of normal operations.

Appendices

Appendix A – CO_2 Reduction Estimate Assumptions

- Energy
  - One Megawatt Hour (mWh) = 1,000 kilowatt hours (kWh) = 0.553 Tons
  - One Therm Natural Gas = 100,000 BTU = 0.00617 Tons
  - One Gallon Gasoline = 0.0109 Tons
  - One Gallon Diesel = 0.01065 Tons
- Costs
  - Electricity - $0.1124 per kWh
  - Natural Gas - $1.20 per Therm
  - Gasoline – $3.0588 per gallon
  - Diesel $2.8468 per gallon
- Economic Assumptions
  - Energy Inflation Rate = 4% per year
  - Economic Inflation Rate = 3% per year
  - Financing Interest Rate = 4.6% APR
  - Discount Rate = 5% per year

Appendix B – Summaries of Sonoma County Greenhouse Reduction Projects

GROUND MOUNTED PHOTOVOLTAIC SYSTEM: The County has the land necessary to install a large amount of photovoltaic energy. This includes open space at Los Guilucos Juvenile and other locations throughout the County. An inventory of acreage would be necessary to evaluate the actual amount. In this analysis we have assumed that enough space is available for 1.4 MW of PV power (1,400 kW), which would require approximately 10 acres of land.

Initial Cost	$11,184,398
Rebate	$3,919,183
Net Capital Cost	$7,265,215
Annual Savings	$295,592
Annual eTons Reduction	1,292
Lifecycle eTons Reduction	32,305
Net Present Value	($748,532)
Internal Rate of Return	4%
Cost per eTon GHG Saved	$5,622

STREET LIGHTS – COUNTY CENTER: Install a voltage control device on exterior High Intensity Discharge lights. Savings of approximately 22% can be achieved on the County's 48, 480 watt street lights. The technology works by controlling the voltage of the lighting circuit after an initial warm up period. The equipment will be installed adjacent to the existing equipment electric panel.

Initial Cost	$11,500
Rebate	$0
Net Capital Cost	$11,500
Annual Savings	$1,948
Annual eTons Reduction	10
Lifecycle eTons Reduction	240
Net Present Value	$30,498

Internal Rate of Return	25%
Cost per eTon GHG Saved	$1,200

CO2 SENSORS: Heating and air conditioning fans operate during business hours to meet outdoor air requirements. However, many areas are unoccupied and these fans are providing no benefit. CO2 sensors can be used to measure the actual CO2 level in the County's office spaces, thus providing a more accurate measure of the air flow that is required based on actual human occupation levels. The fans can either be shut off, or the fan speed can be reduced to meet the actual fresh air requirements based on the CO2 levels within the conditioned space.

Initial Cost	$166,335
Rebate	$0
Net Capital Cost	$166,335
Annual Savings	$78,269
Annual eTons Reduction	385
Lifecycle eTons Reduction	9,627
Net Present Value	$555,856
Internal Rate of Return	96%
Cost per eTon GHG Saved	$432

INSTANT HOT WATER HEATERS: Most water heaters have storage tanks and are designed to keep water a high temperature throughout the day and night. Heat is lost through the tank and the water must therefore be reheated throughout the day to maintain the desired temperature. The water used for heating or domestic water purposes is instantly heated to the desired temperature as it is needed, thus eliminating the need of reheating storage water to maintain a desired temperature.

Initial Cost	$62,900
Rebate	$16,900
Net Capital Cost	$46,000
Annual Savings	$20,348

Annual eTons Reduction	105
Lifecycle eTons Reduction	2,616
Net Present Value	$228,280
Internal Rate of Return	86%
Cost per eTon GHG Saved	$440

VENDING MACHINE CONTROLLERS: Occupancy sensors are installed on refrigerated vending machines to control the operation of lights and refrigeration compressors when the equipment is not being used. Vending machine controllers reduce refrigeration compressor cycling, but maintain the contents at appropriate temperatures. Vending machine controllers have been installed on 20 County Center Vending machines.

Initial Cost	$3,880
Rebate	$0
Net Capital Cost	$3,880
Annual Savings	$809
Annual eTons Reduction	4
Lifecycle eTons Reduction	100
Net Present Value	$3,690
Internal Rate of Return	27%
Cost per eTon GHG Saved	$974

ISD PV SYSTEM: In July of 2002, the County installed a 95 kW PV system on the ISD building roof. The system is designed to generate 123,500 kWh of electricity per year, saving the County approximately $23,000 per year. The installation of this system was very cost effective as a result of the high rebates available at the time. Since this system was installed the rebates have dropped about 40%. In addition, this analysis is based on the electric rates that were in effect at that time.

Initial Cost	$654,456
Rebate	$344,328
Net Capital Cost	$310,128
Annual Savings	$23,086
Annual eTons Reduction	68
Lifecycle eTons Reduction	1,707
Net Present Value	$195,849
Internal Rate of Return	10%
Cost per eTon GHG Saved	$4,543

COOLING TOWER FREE COOLING: Install a plate and frame heat exchanger between the cooling tower condenser water loop and the County Center chilled water loop. Currently, the County Center requires that chilled water be supplied to the facility 24 hours per day, and an electric chiller generates all of the chilled water. On very cool days, and frequently at night, the cooling tower water can be cooled down to the chilled water loop temperature. By connecting the two loops together the County can take advantage of the cool weather to chill the water instead of the chillers.

Initial Cost	$263,217
Rebate	$0
Net Capital Cost	$263,217
Annual Savings	$47,794
Annual eTons Reduction	235
Lifecycle eTons Reduction	5,879
Net Present Value	$766,230
Internal Rate of Return	27%
Cost per eTon GHG Saved	$1,119

CHILLED WATER PUMP VARIABLE FREQUENCY DRIVE (VFD): The County Center chilled water is distributed through two pumps located at the Central Mechanical Plant. The pumps operate at a constant speed regardless of the demand for chilled water. The demand

for chilled water usually requires the operation of a single pump, however during the summer months the demand for chilled water requires the operation of both pumps. Installation of a VFD will allow the pump speed to be modulated to meet the actual demand of the Center, saving electricity during periods when the demand is less than the maximum.

Initial Cost	$45,000
Rebate	$16,893
Net Capital Cost	$28,107
Annual Savings	$23,735
Annual eTons Reduction	117
Lifecycle eTons Reduction	2,919
Net Present Value	$290,600
Internal Rate of Return	569%
Cost per eTon GHG Saved	$241

REPLACE CHILLERS 1 AND 2: Chillers 1 and 2 are in very good condition for their age. However, the equipment is almost 20 years old, which places it at the end of its design life. In addition, the equipment uses an outdated refrigerant (Freon 12) and is relatively inefficient. Replace the existing equipment with new chillers that have modern refrigerants and much higher efficiencies.

Initial Cost	$438,695
Rebate	$0
Net Capital Cost	$438,695
Annual Savings	$69,274
Annual eTons Reduction	341
Lifecycle eTons Reduction	8,521
Net Present Value	$1,056,154
Internal Rate of Return	23%
Cost per eTon GHG Saved	$1,287

WATER RECLAMATION AT NCDF: A new laundry facility has been constructed at the NCDF. This facility operates 10 hours per day, seven days per week, using more than 1.5 M gallons of hot water per year. A hot water reclamation system will re-use approximately 60% of the hot water, resulting in significant water and energy savings.

Initial Cost	$137,000
Rebate	$0
Net Caital Cost	$137,000
Annual Savings	$25,940
Annual eTons Reduction	61
Lifecycle eTons Reduction	1,519
Net Present Value	$216,382
Internal Rate of Return	27%
Cost per eTon GHG Saved	$2,254

ENERGY EFFICIENT MOTORS: A typical motor will cost 100 times as much to run over its lifetime than it costs to purchase. Install new energy efficient motors on the MADF air handlers. Nearly all of the air handlers are operating 24 hours per day and small increases in efficiency can result in significant energy savings.

Initial Cost	$16,730
Rebate	$0
Net Capital Cost	$16,730
Annual Savings	$1,464
Annual eTons Reduction	7
Lifecycle eTons Reduction	180
Net Present Value	$3,638
Internal Rate of Return	8%
Cost per eTon GHG Saved	$2,323

HIGH TEMPERATURE DELTA COOLING COILS: The County's Central Mechanical Plant is designed to operate at a high temperature difference, meaning that the supply water is designed to be 24F cooler than the returning water temperature. Many of the cooling coils located in the County Center air handling equipment are designed for a low temperature delta (12F). In order to supply the required cooling to a space, a 12F cooling coil requires twice as much chilled water as a 24F coil. By changing the coils to 24F the County can reduce the chilled water flow, saving pumping energy. The cost and savings in this action only address 10 of the existing low temperature delta coils. The remainder are too difficult to cost effectively change.

Initial Cost	$119,423
Rebate	$0
Net Capital Cost	$119,423
Annual Savings	$2,065
Annual eTons Reduction	10
Lifecycle eTons Reduction	254
Net Present Value	($69,803)
Internal Rate of Return	-2%
Cost per eTon GHG Saved	$11,756

INSTALL COGENERATION: Cogeneration means the generation of two energy sources from one generation plant. To the County it means using a natural gas fired reciprocating engine to generate electricity and hot water. The hot water generated by a 150 kW cogeneration system will offset much of the hot water currently heated by natural gas fired boilers. The key to designing a cogeneration system that is cost effective and results in the reduction of Green House Gases is to use as much of the hot water generated by the cogeneration system as possible. For example, if the County installed a larger cogeneration system, the County would be able to use all of the electricity generated, but much of the hot water would go to waste. Additional study will be required to accurately size the cogeneration system.

Initial Cost	$471,508
Rebate	$141,453
Net Capital Cost	$330,055
Annual Savings	$129,360
Annual eTons Reduction	267

Lifecycle eTons Reduction	6,676
Net Present Value	$2,438,063
Internal Rate of Return	71%
Cost per eTon GHG Saved	$1,236

CENTRAL MECHANICAL PLANT PERFORMANCE MAPPING: The County Central Mechanical Plant (CMP) has four chillers. Chillers operate most efficiently at specific points in their performance curve, i.e. a chiller is most efficient when it is nearly fully loaded. By completing a performance mapping study, the County will know when the chillers are most efficient. The County's energy management system can be programmed to control chiller and TES operation to result in the most efficient operation of the existing equipment.

Initial Cost	$14,623
Rebate	$0
Net Capital Cost	$14,623
Annual Savings	$23,252
Annual eTons Reduction	114
Lifecycle eTons Reduction	2,860
Net Present Value	$198,270
Internal Rate of Return	1000%
Cost per eTon GHG Saved	$128

CONSTANT VOLUME REHEAT SYSTEM RESETS: The County has 18 Constant Volume Reheat systems (CVRH) in County Center buildings. The operation of these systems is controlled based on the temperature of the supply air. Automatically reset the supply air temperature based on outside air temperature, or as an alternative, lockout either heating or cooling based on outside air temperature.

Initial Cost	$24,700
Rebate	$0
Net Capital Cost	$24,700

Annual Savings	$26,809
Annual eTons Reduction	383
Lifecycle eTons Reduction	9,582
Net Present Value	$221,128
Internal Rate of Return	1000%
Cost per eTon GHG Saved	$64

DUAL DUCT HVAC SYSTEM RESETS: The ISD building has dual duct air handlers. Cooled air and heated air are both supplied to the space, and the proper temperature is reached by mixing the cool air with the heated air. This is inefficient and simultaneous heating and cooling should be eliminated when possible. It is often possible to eliminate coincident heating and cooling by resetting the supply air temperature based on the outside air temperature.

Initial Cost	$1,300
Rebate	$0
Net Capital Cost	$1,300
Annual Savings	$2,718
Annual eTons Reduction	42
Lifecycle eTons Reduction	1,047
Net Present Value	$11,462
Internal Rate of Return	1000%
Cost per eTon GHG Saved	$31

THERMOCLINE SENSORS ON THE THERMAL ENERGY STORAGE (TES) TANK: The TES tank is equipped with 14 thermowells, which are instrumentation ports that allow the operators to track the available cooling in the tank. However, only four of the thermowells are currently being used. Operators are not able to accurately track the TES cooling capacity, which will result in less than optimal operation. Installing temperature sensors in the remaining thermowells will allow the operators to track the TES capacity more closely, allowing then to balance TES cooling water supply with chiller cooling water supply, resulting in optimal efficiency.

Initial Cost	$21,935
Rebate	$0
Net Capital Cost	$21,935
Annual Savings	$15,885
Annual eTons Reduction	78
Lifecycle eTons Reduction	1,954
Net Present Value	$317,090
Internal Rate of Return	277%
Cost per eTon GHG Saved	$281

EXPAND THE ENERGY MANAGEMENT SYSTEM (EMS): The CMP has a couple of generations of EMS technology represented, from a test-based system to the more intuitive Andover Continuum system. The County is in the process of upgrading and expanding the Andover control system. This will include monitoring the heating hot water and chilled water usage in each building as well as more extensive data logging and reporting. Migrating the control of all of the CMP equipment and systems to a common continuum platform will greatly improve the integration and operability of the plant. The EMS expansion is key to realizing the savings afforded by the other CMP upgrades.

Initial Cost	$58,493
Rebate	$0
Net Capital Cost	$58,493
Annual Savings	$26,169
Annual eTons Reduction	114
Lifecycle eTons Reduction	2,860
Net Present Value	$294,215
Internal Rate of Return	88%
Cost per eTon GHG Saved	$511

ECONOMIZERS: Six of the air handlers at the HOJ and Administration buildings do not have existing out side air economizers. Economizers enable the air handler to use outside air to

heat and cool the facility. Currently all heating and cooling is supplied through mechanical means, resulting in unnecessary energy use.

Initial Cost	$65,096
Rebate	$0
Net Capital Cost	$65,096
Annual Savings	$19,528
Annual eTons Reduction	96
Lifecycle eTons Reduction	2,402
Net Present Value	$183,076
Internal Rate of Return	44%
Cost per eTon GHG Saved	$678

ECONOMIZER REPAIR: An economizer is a set of louvers that are opened and closed by a motor, which is controlled by a computer. Proper operation and effectiveness of an economizer is subject to good maintenance practices. Economizers require annual maintenance and adjustment to ensure proper operation. It is estimated that half of the 32 existing economizers are not functioning properly or don't function at all. Repair and maintain the economizers to ensure optimal energy use.

Initial Cost	$146,073
Rebate	$0
Net Capital Cost	$146,073
Annual Savings	$43,820
Annual eTons Reduction	216
Lifecycle eTons Reduction	5,390
Net Present Value	$228,838
Internal Rate of Return	41%
Cost per eTon GHG Saved	$678

VARIABLE AIR VOLUME (VAV) CONVERSIONS: Fifty-two of the air handlers located at the MADF, HOJ, ISD, Human Services, and Fleet buildings are Constant Volume (CV), meaning that they supply conditioned air at a constant rate regardless of the demand for heating and cooling. Convert these air handlers to VAV so that air flow is proportional to the load on the facility, reducing fan motor energy use.

Initial Cost	$1,425,858
Rebate	$0
Net Capital Cost	$1,425,858
Annual Savings	$121,663
Annual eTons Reduction	599
Lifecycle eTons Reduction	14,964
Net Present Value	$761,266
Internal Rate of Return	11%
Cost per eTon GHG Saved	$2,382

VFD Control of CMP Hot Water Pump: As part of the boiler replacement project at the CMP, Staff installed a new variable frequency drive pump to modulate hot water flow based on the demand.

Initial Cost	$58,750
Rebate	$6,000
Net Capital Cost	$52,750
Annual Savings	$23,893
Annual eTons Reduction	118
Lifecycle eTons Reduction	2,939
Net Present Value	$269,248
Internal Rate of Return	90%
Cost per eTon GHG Saved	$449

LIGHTING: Upgrade the existing T8 fluorescent lighting throughout the County Center with premium efficiency T8 fluorescent lamps and premium efficiency electronic ballasts. To maximize energy savings and optimize the aesthetic impact of the new lighting, the new lamps should have a color rendering index of at least 80, and a color temperature rating of at least 4100K, and maybe as high as 5000K.

Initial Cost	$33,705
Rebate	$0
Net Capital Cost	$33,705
Annual Savings	$17,354
Annual eTons Reduction	85
Lifecycle eTons Reduction	2,135
Net Present Value	$199,951
Internal Rate of Return	114%
Cost per eTon GHG Saved	$395

SOLAR PHOTOVOLTAIC (PV) ELECTRIC SYSTEMS ON CARPORT STRUCTURES IN PARKING LOTS: PV panels convert sunlight directly into electricity. Rebates are still available that help to offset the initial construction cost of the system. A number of studies have been completed evaluating the cost effectiveness of PV systems installed on Carports at the JJC and at the County Center. The benefit of carport PV is the added benefit of creating preferred parking by creating shaded parking areas. The following analysis assumes a total of 616 parking spaces distributed throughout County properties. This is enough space to generate 1.0 MW of power. The disadvantage of carport PV is the additional cost of the carport reduces the economic attractiveness of the system. The analysis has been updated herein to reflect current rebate levels, performance projections, utility rates, and cost estimates.

Initial Cost	$4,475,000
Rebate	$1,400,843
Net Capital Cost	$3,074,157
Annual Savings	$101,253
Annual eTons Reduction	443
Lifecycle eTons Reduction	11,066

Net Present Value	($820,852)
Internal Rate of Return	2%
Cost per eTon GHG Saved	$6,945

SOLAR PHOTOVOLTAIC (PV) ELECTRIC SYSTEMS ON BUILDING ROOFS: PV panels convert sunlight directly into electricity. Rebates are still available that help to offset the initial construction cost of the system. A number of studies have been completed evaluating the cost effectiveness of PV systems that might be installed on the roof of buildings at the JJC and the County Center. The benefit of roof mounted PV is that the facility acts as the mounting structure for the PV system, minimizing installation costs. The following analysis assumes that 100 kW systems can be installed on four different roofs at the County Center, and that 273 kW can be installed at the JJC. This is enough space to generate 673 kW of power. The analysis has been updated herein to reflect current rebate levels, performance projections, utility rates, and cost estimates.

Initial Cost	$1,626,001
Rebate	$561,397
Net Capital Cost	$1,064,605
Annual Savings	$40,578
Annual eTons Reduction	177
Lifecycle eTons Reduction	4,435
Net Present Value	($167,774)
Internal Rate of Return	3%
Cost per eTon GHG Saved	$6,002

LANDFILL GAS GENERATED ELECTRICITY PURCHASE: The County has the ability to purchase electricity generated from the methane that is the waste product of the old County landfill for its one direct access account that serves the Main Adult Detention Facility. The Bay Area Air Quality Management Board requires that all landfill gas be burned to reduce the GHG gas effect of the waste gas. By using the combustion of the landfill gas to generate electricity, the County can avoid the purchase of electricity from the utility, thus avoiding the GHG impact of the utility generation of electricity. The cost of landfill gas generated electricity is slightly less than the current purchase price of utility supplied electricity. In addition, the energy cost inflation rate is fixed at 1.5% for the first three years, with inflation after that estimated at 3%.

Utility rate increases are estimated at 4% per year. So this action has no initial cost or initial savings, although it does result in cost savings in the future.

Initial Cost	$0
Rebate	$0
Net Capital Cost	$0
Annual Savings	$0
Annual eTons Reduction	1,938
Lifecycle eTons Reduction	48,443
Net Present Value	$2,513,209
Internal Rate of Return	1000%
Cost per eTon GHG Saved	$0

HYBRID VEHICLES - EXISTING: Hybrid vehicles use less gasoline by using an electric motor to assist in powering the vehicle. The electric motor is powered by energy that is generated when the vehicle is coasting or slowing down. The County has purchased 50 hybrid sedans and seven hybrid SUVs. Based on an incremental cost of $6,000 per vehicle, a $2,000 per vehicle credit from the BAAQMB, and a residual value about $3,500 greater than a standard vehicle, the use of hybrid vehicles costs less than the use of standard vehicles while using significantly less fuel and generating less GHG.

Initial Cost	($3,500)
Rebate	$0
Net Capital Cost	($3,500)
Annual Savings	$25,479
Annual eTons Reduction	52
Lifecycle eTons Reduction	1,306
Net Present Value	$334,668
Internal Rate of Return	1000%
Cost per eTon GHG Saved	($67)

HYBRID VEHICLES - NEW: Hybrid vehicles use less gasoline by using an electric motor to assist in powering the vehicle. The electric motor is powered by energy that is generated when the vehicle is coasting or slowing down. The County plans to purchase approximately 240 more hybrids between now and the 2010 target year to achieve the GHG goal. Based on an incremental cost of $6,000 per vehicle, a $2,000 per vehicle credit from the BAAQMB, and a residual value about $3,500 greater than a standard vehicle, the use of hybrid vehicles costs less than the use of standard vehicles while using significantly less fuel and generating less GHG.

Initial Cost	$0
Rebate	$0
Net Capital Cost	$0
Annual Savings	$108,621
Annual eTons Reduction	223
Lifecycle eTons Reduction	5,567
Net Present Value	$1,412,532
Internal Rate of Return	1000%
Cost per eTon GHG Saved	$0

CREB PV: The Clean Renewable Energy Bond (CREB) allows municipally and cooperatively owned utilities and eligible nonprofit entities to issue "no-interest" bonds to finance PV projects. Purchasers of the bonds are then eligible for the renewable energy tax credits rather than interest payments. The County has applied to participate in one of the Bond offerings. The County will then purchase electricity from the eligible entity at a cost that is less than the utility's current cost for a period of 15 years at which time ownership of the PV system will transfer to the County. Initial costs are estimated to address administrative costs during start-up.

Initial Cost	$60,000
Rebate	$0
Net Capital Cost	$60,000
Annual Savings	$5,422
Annual eTons Reduction	889
Lifecycle eTons	22,230

Reduction	
Net Present Value	$1,675,058
Internal Rate of Return	47%
Cost per eTon GHG Saved	$67

Solar Green Credits: Green Tags, Energy Credits, and GHG offsets are just a few of the names for the same thing, i.e. the purchase of a credit for energy "greenness." An energy credit trading market is in the process of being established. It is the GHG equivalent to pollution credit trading for industrial gross polluters. For example, if the County is not able to meet it's targets through capital investments, then credit for GHG reductions can be purchased from others. The investment the County makes in the credits will encourage others to invest in projects that reduce GHG emissions. Solar Green Credits are the purchase of Green Credits from a solar company, thus ensuring that the County is supporting solar energy as a preferred type of renewable energy.

Initial Cost	$86,799
Rebate	$0
Net Capital Cost	$86,799
Annual Savings	$0
Annual eTons Reduction	2,400
Lifecycle eTons Reduction	60,000
Net Present Value	($1,846,838)
Internal Rate of Return	Negative
Cost per eTon GHG Saved	$36

Sonoma County Solar Program: This Program is based on the concept of purchasing Green Energy Credits to contribute to the County's GHG reduction targets. In this Program the County would purchase 15 years of Green Credits from individuals and businesses in Sonoma County that install PV. The County would purchase the credit through a supplemental rebate that would be in addition to the existing CEC rebate program. The benefit of purchasing Green Credits in this fashion is that the County is affecting change within the County as opposed to purchasing Green Credits from an entity outside of the County.

Initial Cost	$579,964
Rebate	$0
Net Capital Cost	$579,964
Annual Savings	$0
Annual eTons Reduction	885
Lifecycle eTons Reduction	22,118
Net Present Value	($552,347)
Internal Rate of Return	Negative
Cost per eTon GHG Saved	$656

Re-roofing Program: The County has initiated a policy in which reproofing projects include the installation of additional insulation and "cool roofs." A number of projects have already been installed, including La Plaza A, the Fiscal building, and the Professional building.

Initial Cost	$22,500
Rebate	$1,560
Net Capital Cost	$20,940
Annual Savings	$12,049
Annual eTons Reduction	84
Lifecycle eTons Reduction	2,098
Net Present Value	$236,424
Internal Rate of Return	145%
Cost per eTon GHG Saved	$250

Staff Energy Management Positions: Staff believes that the implementation of energy management projects, and the Climate Protection Action Plan requires qualified, dedicated staff. Two additional staff positions are included.

Initial Cost	$230,768
Rebate	$0
Net Capital Cost	$230,768

Annual Savings	$0
Annual eTons Reduction	0
Lifecycle eTons Reduction	0
Net Present Value	($4,910,077)
Internal Rate of Return	Negative
Cost per eTon GHG Saved	$0

Bio-Diesel: Diesel fuel made from vegetable matter burns cleaner than petroleum based diesel, and it is manufactured from carbon sources that are on the surface of the earth and are already part of the earth's balanced carbon cycle. Bio-diesel comes in various blends, such as B5 and B20, which are 5% and 20% bio-diesel, respectively. Current research indicates that B5 and B20 fuels can be utilized by the County fleet without much concern for vehicle maintenance issues or shortened vehicle life. Conversion to B100 fuels would require significant upgrades to the fleet to prevent damage to fuel lines and internal engine seals. It should also be stressed that the use of bio-diesel in modern fleet vehicles is still relatively new, and we should expect challenges during the initial years of implementation. For example, the California Air Resources Board has legislated changes to fuel filters and carburetion that may be incompatible with bio-diesel. The analysis is based on converting the County's entire fleet to B15 fuel.

Initial Cost	$50,000
Rebate	$0
Net Capital Cost	$50,000
Annual Savings	($15,116)
Annual eTons Reduction	161
Lifecycle eTons Reduction	4,025
Net Present Value	($249,737)
Internal Rate of Return	Negative
Cost per eTon GHG Saved	$311

Existing Bus Pass Program: The County provides free bus passes to any employee that wishes to participate in the Program. The management and marketing of the Program is fairly limited. The Program has a recurring annual cost and no cost savings resulting from it.

Initial Cost	$66,240
Rebate	$0
Net Capital Cost	$66,240
Annual Savings	$0
Annual eTons Reduction	388
Lifecycle eTons Reduction	8,592
Net Present Value	($1,409,396)
Internal Rate of Return	Negative
Cost per eTon GHG Saved	$171

Comprehensive Commute Program: A successful commute program consists of many components.

- Employer Sponsored Commute Pass Program: County employees that work at one of the pre-approved sites are entitled to receive free bus passes and/or tickets for Sonoma County Transit or Santa Rosa CityBus. Currently 184 County employees take advantage of the existing free bus pass program.
- Flex Time: Staff is encouraged to take advantage of the ability to modify their commute to either avoid peak commute times or carpool with others.
- Guaranteed Ride Home: Guarantee staff that do not have a car at work due to alternative commuting are guaranteed a ride home either by the use of a fleet vehicle, taxi, or other option.
- Preferred Parking: Staff that use alternative methods to driving alone or high efficiency vehicles are provided advantageous parking.
- Telecommuting: Staff whose essential job functions are compatible with working at home are encouraged to do so when possible.
- Car and Van Pool: Establish commute pools that reduce single occupancy vehicle driving to and from County facilities. This will also include the development of a system to connect employees with similar commutes.

A successful commute program also takes a great deal of management. One common theme in all of the successful commute programs analyzed was the dedication of at least one full time equivalent (FTE) employee to manage and administer the program.

Initial Cost	$343,801
Rebate	$0
Net Capital Cost	$343,801

Annual Savings	
Annual eTons Reduction	1,282
Lifecycle eTons Reduction	32,038
Net Present Value	($7,315,093)
Internal Rate of Return	Negative
Cost per eTon GHG Saved	$268

Appendix C – Sonoma County Board of Supervisors Resolution

THE WITHIN INSTRUMENT IS A CORRECT COPY OF THE ORIGINAL ON FILE IN THIS OFFICE.

ATTEST: AUG 20 2002

EEVE T. LEWIS, County Clerk & ex-officio Clerk of the Board of Supervisors of the State of California, in & for the County of Sonoma

BY _____ DEPUTY

#43

RESOLUTION NO. 02-0893

County of Sonoma
Santa Rosa, CA 95403

Date: August 20, 2002

RESOLUTION OF THE BOARD OF SUPERVISORS OF THE COUNTY OF SONOMA COMMITTING TO PARTICIPATE IN THE CLIMATE PROTECTION CAMPAIGN SPONSORED BY THE INTERNATIONAL COUNCIL FOR LOCAL ENVIRONMENTAL INITIATIVES

WHEREAS, a scientific consensus has developed that carbon dioxide (CO_2) and other greenhouse gas (ghg) emissions released into the atmosphere have a potentially significant negative effect on the Earth's climate due to the strong correlation between CO^2 concentration in the atmosphere and global temperature; and

WHEREAS, scientific evidence, including the Third Assessment Report from the International Panel on Climate Change (IPCC) and the U.S. Global Change Research Program's (USGCRP) First National Assessment, indicate that global warming has begun, with the 1990's being the hottest decade in recorded history; and

WHEREAS, more than 160 countries pledged under the United Nations Framework Convention on Climate Change to reduce their ghg emissions; and

WHEREAS, in 2001, at the request of the Administration, the National Academy of Sciences (NAS) reviewed and confirmed the concerns of the environment and public health communities and declared global warming a real problem impacting key vulnerable populations. The NAS report also confirmed that global warming is caused in part by the actions of humankind; and

WHEREAS, energy consumption, specifically the burning of fossil fuels, accounts for more than 80% of U.S. ghg emissions; and

WHEREAS, local governments significantly influence the community's energy usage by exercising key powers over land use, transportation, construction, waste management, and energy supply and management; and

WHEREAS, local government actions taken to reduce ghg emissions and increase energy efficiency provide multiple local benefits by decreasing air pollution, creating jobs, reducing energy expenditures, and saving money for the local government, its businesses and its residents; and

WHEREAS, the Cities and Counties for Climate Protection Campaign, sponsored by the International Council for Local Environmental Initiatives (ICLEI). has invited the County of Sonoma to become a partner in the Campaign; and

WHEREAS, the Sonoma County Board of Supervisors directed the Sustainable Policies and Practices Project (SP3) Committee to review the ICLEI Climate Protection Campaign and return with a recommendation on joining the Campaign; and

WHEREAS, the SP3 Committee has studied the issue, obtained information on the County's ghg emissions, and determined that it would benefit the County and the environment to participate in the Campaign; and, therefore, recommends that the County join the ICLEI Climate Protection Campaign.

NOW, THEREFORE, BE IT RESOLVED that the County of Sonoma commits to participate in the Climate Protection Campaign and, as a participant, pledges to take a leadership role in promoting public awareness about the causes and impacts of climate change. The County of Sonoma also agrees to undertake the Climate Protection Campaign program's five milestones to reduce both greenhouse gas and air pollution emissions throughout the community, specifically:

1. Conduct a ghg emissions inventory and forecast to determine the source and quantity of ghg emissions as a result of the County's operations and services in Sonoma County;
2. Establish a ghg emissions reduction target for County operations;
3. Develop an action plan with both existing and future actions which, when implemented, will meet the local ghg reduction target;
4. Implement the action plan; and
5. Monitor to review progress.

BE IT FURTHER RESOLVED that the County of Sonoma requests assistance from the International Council for Local Environmental Initiatives' Climate Protection Campaign as it progresses through the milestones.

SUPERVISORS:

Brown aye Smith aye Kelley aye Reilly aye Kerns aye

Ayes 5 Noes _____ Abstain _____ Absent _____

SO ORDERED.

THE WITHIN INSTRUMENT IS A CORRECT COPY OF THE ORIGINAL ON FILE IN THIS OFFICE.

ATTEST: JUL 0 7 2006

EEVE T. LEWIS,
County Clerk & ex-officio Clerk of the Board of Supervisors of the State of California, in & for the County of Sonoma
BY C Woodson DEPUTY

#37

RESOLUTION NO. 05-0827

County of Sonoma
Santa Rosa, CA 95403

Dated: September 27, 2005

RESOLUTION OF THE BOARD OF SUPERVISORS OF THE COUNTY OF SONOMA, STATE OF CALIFORNIA, JOINING THE NINE CITIES IN THE ESTABLISHMENT OF A COMMUNITY-WIDE GREENHOUSE GAS EMISSION REDUCTION TARGET

WHEREAS, actions taken by local government to reduce greenhouse gas emissions and increase energy efficiency provide multiple local benefits by improving air quality and public health, reducing energy expenditures, and saving money for the local government, its businesses, and its residents; and

WHEREAS, local governments greatly influence the community's energy usage through their actions concerning land use, transportation, construction, waste management, energy supply, and energy management; and

WHEREAS, increased temperatures due to higher greenhouse gas levels in the atmosphere threaten to adversely impact water quality and supply, to exacerbate air quality problems, and to adversely impact human health by increasing heat stress and related deaths, the incidence of infectious disease, and the risk of asthma, respiratory and other health problems; and

WHEREAS, California has taken a leadership role in climate protection by implementing the motor vehicle greenhouse gas emission reduction regulations, implementing the Renewable Portfolio Standard, implementing the most effective building and appliance efficiency standards in the world, and on June 1, 2005, establishing greenhouse gas reduction targets for the State: by 2010 to reduce greenhouse gas emissions to 2000 levels, by 2020 reduce greenhouse gas emissions to 1990 levels, and by 2050 to reduce greenhouse gas emissions to 80 percent below 1990 levels; and

WHEREAS, Sonoma County has taken a leadership role in climate protection by being the first county in the nation where 100 percent of its cities and the County pledged by resolution to reduce both greenhouse gas and air pollution emissions throughout the community, and by being the first county in the nation where 100 percent of its cities and the County determined their baseline greenhouse gas emissions for municipal operations; and

WHEREAS, the County of Sonoma on August 20, 2002, resolved to be part of Cities for Climate Protection and follow its five milestone program, and established a greenhouse gas emission reduction target for its internal operations of 20 percent below 2000 levels by 2010; and

WHEREAS on May 21, 2005, thirty-two representatives from Sonoma's nine cities and the County considered targets for the community and consequently recommended that the cities

and the County adopt a target to reduce greenhouse gas emissions 25 percent below 1990 levels by the year 2015; and

WHEREAS each of the nine cities in Sonoma County has adopted a resolution to reduce greenhouse gas emissions produced community wide 25 percent below 1990 levels by the year 2015;

NOW, THEREFORE, BE IT RESOLVED that the County of Sonoma agrees to join the nine cities in the establishment of a climate protection target to reduce greenhouse gas emissions produced community wide to 25 percent below 1990 levels by the year 2015.

SUPERVISORS:

Brown absent Smith aye Kelley no Reilly aye Kerns aye

Ayes 3 Noes 1 Abstain _____ Absent 1

SO ORDERED

Appendix D – PG&E Fuel Mix

Power Content Label

Annual report of actual electricity purchases for
Pacific Gas and Electric in 2004

Energy Resources	**PG&E Actual Power Mix**
Eligible Renewable	**12%**
Biomass and Waste	5%
Geothermal	2%
Small Hydroelectric	3%
Solar	0%
Wind	1%
Coal	**3%**
Large Hydroelectric	**17%**
Natural Gas	**48%**
Nuclear	**21%**
Other	**0%**
TOTAL	**100%**

For all but one category, the percentage PG&E projected was within 5 percentage points of the actual percentage. Natural gas was 48 percent of PG&E's generation, rather than the predicted 42 percent, due to lower hydroelectric conditions, two nuclear refueling outages and higher than predicted retail sales.

For specific information about this electricity product, .contact Pacific Gas and Electric Company. For General Information about the Power Content Label, contact the California Energy Commission at **1.800.555.7794** or **www.energy.ca.gov/consumer**.

Appendix E - Project by Project Cash Flow

PLAN A - GENERATION FOCUS
Annual Cash Flow (Completed projects = $0)

Project Year	Annual Cash Flow	Carport PV	Roof PV	ISD PV	Ground PV	CREBS PV	Landfill	Cogen	C02 Sensors	CHP VFD	CMP Map	PFHX	Lighting	Motors	Repair Econ	New Econ	MADF VFD	Chillers	Center VAV	Vending	Instant HW	VFD	CV Resets	TES	Street	EMS	Reroof	NCDF Hot Water	Well	DD Reset	Cooling Coils	Solar Green Tags	32 EM FTEs	Bio-Diesel	Existing Hybrid Purchases	New Hybrid Purchases	Ongoing Bus Pass Program	Expanded Bus Pass Program	Compr. Commute Program
1	$ (343,828)	$ -	$ (59,234)	$ -	$ (385,559)	$ (54,578)	$ -	$ 98,415	$ 62,674	$ 21,099	$ 21,881	$ 23,116	$ 14,194	$ (5,990)	$ 26,625	$ 12,225	$ -	$ 28,144	$ (12,019)	$ -	$ -	$ -	$ 24,493	$ 13,828	$ 870	$ 20,908	$ -	$ -	$ -	$ 2,596	$ (9,132)	$ -	$ (230,768)	$ -	$ -	$ 108,621	$ (66,240)	$ -	$ -
2	$ (229,337)	$ -	$ (57,611)	$ -	$ (373,735)	$ 10,953	$ 16,802	$ 103,590	$ 65,805	$ 22,049	$ 22,811	$ 25,028	$ 14,888	$ (5,066)	$ 28,238	$ 12,958	$ -	$ 30,915	$ (7,152)	$ -	$ -	$ -	$ 25,565	$ 14,464	$ 948	$ 21,955	$ -	$ -	$ -	$ 2,705	$ (9,049)	$ -	$ (239,999)	$ -	$ -	$ 112,492	$ (68,890)	$ -	$ -
3	$ (172,100)	$ -	$ (55,923)	$ -	$ (361,438)	$ 16,865	$ 34,695	$ 108,971	$ 69,061	$ 23,036	$ 23,779	$ 27,016	$ 15,610	$ (4,106)	$ 29,915	$ 13,720	$ -	$ 33,797	$ (2,091)	$ -	$ -	$ -	$ 26,680	$ 15,124	$ 1,029	$ 23,044	$ -	$ -	$ -	$ 2,818	$ (6,963)	$ -	$ (249,599)	$ -	$ -	$ 116,504	$ (71,645)	$ -	$ -
4	$ (119,406)	$ -	$ (54,167)	$ -	$ (348,650)	$ 23,180	$ 46,321	$ 114,568	$ 72,447	$ 24,063	$ 24,785	$ 29,084	$ 16,361	$ (3,107)	$ 31,660	$ 14,513	$ -	$ 36,794	$ 3,173	$ -	$ -	$ -	$ 27,840	$ 15,812	$ 1,113	$ 24,176	$ -	$ -	$ -	$ 2,936	$ (6,874)	$ -	$ (259,583)	$ -	$ -	$ 120,661	$ (74,511)	$ -	$ -
5	$ (64,033)	$ -	$ (52,342)	$ -	$ (335,350)	$ 29,921	$ 58,825	$ 120,388	$ 75,969	$ 25,131	$ 25,831	$ 31,234	$ 17,142	$ (2,068)	$ 33,474	$ 15,338	$ -	$ 39,911	$ 8,647	$ -	$ -	$ -	$ 29,047	$ 16,526	$ 1,201	$ 25,353	$ -	$ -	$ -	$ 3,058	$ (6,781)	$ -	$ (269,966)	$ -	$ -	$ 124,970	$ (77,491)	$ -	$ -
6	$ (5,851)	$ -	$ (50,443)	$ -	$ (321,518)	$ 37,110	$ 72,260	$ 126,442	$ 79,631	$ 26,242	$ 26,919	$ 33,470	$ 17,954	$ (988)	$ 35,361	$ 16,196	$ -	$ 43,153	$ 14,340	$ -	$ -	$ -	$ 30,301	$ 17,270	$ 1,292	$ 26,578	$ -	$ -	$ -	$ 3,185	$ (6,684)	$ -	$ (280,765)	$ -	$ -	$ 129,435	$ (80,591)	$ -	$ -
7	$ 55,277	$ -	$ (48,468)	$ -	$ (307,132)	$ 44,772	$ 86,681	$ 132,737	$ 83,440	$ 27,397	$ 28,051	$ 35,796	$ 18,798	$ 135	$ 37,323	$ 17,088	$ -	$ 46,524	$ 20,261	$ -	$ -	$ -	$ 31,606	$ 18,043	$ 1,387	$ 27,851	$ -	$ -	$ -	$ 3,318	$ (6,584)	$ -	$ (291,995)	$ -	$ -	$ 134,063	$ (83,815)	$ -	$ -
8	$ 119,495	$ -	$ (46,414)	$ -	$ (292,172)	$ 52,933	$ 102,148	$ 139,284	$ 87,402	$ 28,598	$ 29,227	$ 38,215	$ 19,677	$ 1,304	$ 39,363	$ 18,015	$ -	$ 50,030	$ 26,418	$ -	$ -	$ -	$ 32,963	$ 18,847	$ 1,485	$ 29,176	$ -	$ -	$ -	$ 3,455	$ (8,479)	$ -	$ (303,675)	$ -	$ -	$ 138,860	$ (87,167)	$ -	$ -
9	$ 186,953	$ -	$ (44,278)	$ -	$ (276,613)	$ 61,622	$ 118,722	$ 146,093	$ 91,522	$ 29,847	$ 30,451	$ 40,731	$ 20,590	$ 2,519	$ 41,486	$ 18,980	$ -	$ 53,677	$ 32,822	$ -	$ -	$ -	$ 34,374	$ 19,683	$ 1,588	$ 30,553	$ -	$ -	$ -	$ 3,598	$ (8,371)	$ -	$ (315,822)	$ -	$ -	$ 143,832	$ (90,654)	$ -	$ -
10	$ 257,810	$ -	$ (42,057)	$ -	$ (260,431)	$ 70,865	$ 136,469	$ 153,175	$ 95,806	$ 31,147	$ 31,724	$ 43,347	$ 21,540	$ 3,783	$ 43,693	$ 19,983	$ -	$ 57,469	$ 39,482	$ -	$ -	$ -	$ 35,841	$ 20,552	$ 1,695	$ 31,986	$ -	$ -	$ -	$ 3,747	$ (8,258)	$ -	$ (328,455)	$ -	$ -	$ 148,985	$ (94,280)	$ -	$ -
11	$ 332,230	$ -	$ (39,747)	$ -	$ (243,602)	$ 80,694	$ 155,457	$ 160,540	$ 100,262	$ 32,498	$ 33,048	$ 46,068	$ 22,528	$ 5,097	$ 45,989	$ 21,027	$ -	$ 61,413	$ 46,409	$ -	$ -	$ -	$ 37,368	$ 21,457	$ 1,806	$ 33,476	$ -	$ -	$ -	$ 3,902	$ (8,140)	$ -	$ (341,593)	$ -	$ -	$ 154,326	$ (98,051)	$ -	$ -
12	$ 410,387	$ -	$ (37,344)	$ -	$ (226,100)	$ 91,140	$ 175,760	$ 168,199	$ 104,897	$ 33,903	$ 34,425	$ 48,898	$ 23,556	$ 6,464	$ 48,376	$ 22,112	$ -	$ 65,515	$ 53,613	$ -	$ -	$ -	$ 38,955	$ 22,397	$ 1,921	$ 35,025	$ -	$ -	$ -	$ 4,063	$ (8,018)	$ -	$ (355,257)	$ -	$ -	$ 159,862	$ (101,973)	$ -	$ -
13	$ 236,255	$ -	$ (67,366)	$ -	$ (431,586)	$ 102,236	$ 197,453	$ 176,165	$ 109,716	$ 35,365	$ 35,857	$ 51,841	$ 24,624	$ 7,886	$ 50,859	$ 23,241	$ -	$ 69,781	$ 61,104	$ -	$ -	$ -	$ 40,606	$ 23,375	$ 2,041	$ 36,637	$ -	$ -	$ -	$ 4,230	$ (7,891)	$ -	$ (369,467)	$ -	$ -	$ 165,600	$ (106,052)	$ -	$ -
14	$ 578,649	$ -	$ (32,247)	$ -	$ (188,968)	$ 114,018	$ 220,619	$ 184,449	$ 114,729	$ 36,885	$ 37,346	$ 54,902	$ 25,736	$ 9,364	$ 53,441	$ 24,414	$ -	$ 74,217	$ 68,896	$ -	$ -	$ -	$ 42,323	$ 24,393	$ 2,166	$ 38,313	$ -	$ -	$ -	$ 4,404	$ (7,758)	$ -	$ (384,246)	$ -	$ -	$ 171,549	$ (110,294)	$ -	$ -
15	$ 669,143	$ -	$ (29,544)	$ -	$ (169,281)	$ 126,523	$ 245,342	$ 193,065	$ 119,942	$ 38,465	$ 38,894	$ 58,085	$ 26,892	$ 10,902	$ 56,126	$ 25,635	$ -	$ 78,831	$ 76,999	$ -	$ -	$ -	$ 44,108	$ 25,451	$ 2,295	$ 40,056	$ -	$ -	$ -	$ 4,585	$ (7,621)	$ -	$ (399,616)	$ -	$ -	$ 177,715	$ (114,706)	$ -	$ -
16	$ 1,869,217	$ -	$ 73,079	$ -	$ 532,345	$ 139,789	$ 271,711	$ 232,970	$ 140,958	$ 42,745	$ 41,876	$ 86,074	$ 31,254	$ 41,577	$ 72,614	$ 33,008	$ -	$ 124,759	$ 219,108	$ -	$ -	$ -	$ 48,281	$ 28,607	$ 3,508	$ 47,129	$ -	$ -	$ -	$ 4,895	$ 3,719	$ -	$ (415,600)	$ -	$ -	$ 184,107	$ (119,294)	$ -	$ -
17	$ 1,968,966	$ -	$ 76,002	$ -	$ 553,638	$ 153,857	$ 299,822	$ 242,288	$ 146,596	$ 44,454	$ 43,551	$ 89,517	$ 32,504	$ 43,240	$ 75,519	$ 34,328	$ -	$ 129,750	$ 227,872	$ -	$ -	$ -	$ 50,212	$ 29,752	$ 3,649	$ 49,014	$ -	$ -	$ -	$ 5,091	$ 3,867	$ -	$ (432,224)	$ -	$ -	$ 190,733	$ (124,066)	$ -	$ -
18	$ 2,073,682	$ -	$ 79,042	$ -	$ 575,784	$ 168,770	$ 329,774	$ 251,980	$ 152,460	$ 46,233	$ 45,293	$ 93,097	$ 33,804	$ 44,970	$ 78,540	$ 35,701	$ -	$ 134,940	$ 236,987	$ -	$ -	$ -	$ 52,221	$ 30,942	$ 3,795	$ 50,975	$ -	$ -	$ -	$ 5,295	$ 4,022	$ -	$ (449,513)	$ -	$ -	$ 197,602	$ (129,029)	$ -	$ -
19	$ 2,183,607	$ -	$ 82,203	$ -	$ 598,815	$ 184,572	$ 361,673	$ 262,059	$ 158,559	$ 48,082	$ 47,105	$ 96,821	$ 35,156	$ 46,769	$ 81,681	$ 37,129	$ -	$ 140,337	$ 246,466	$ -	$ -	$ -	$ 54,309	$ 32,179	$ 3,947	$ 53,014	$ -	$ -	$ -	$ 5,507	$ 4,183	$ -	$ (467,494)	$ -	$ -	$ 204,723	$ (134,190)	$ -	$ -
20	$ 2,298,991	$ -	$ 85,492	$ -	$ 622,768	$ 201,313	$ 395,629	$ 272,541	$ 164,901	$ 50,005	$ 48,989	$ 100,694	$ 36,562	$ 48,639	$ 84,948	$ 38,614	$ -	$ 145,951	$ 256,325	$ -	$ -	$ -	$ 56,482	$ 33,467	$ 4,104	$ 55,135	$ -	$ -	$ -	$ 5,727	$ 4,350	$ -	$ (486,193)	$ -	$ -	$ 212,105	$ (139,558)	$ -	$ -
21	$ 2,680,608	$ -	$ 88,911	$ -	$ 647,679	$ 479,550	$ 431,759	$ 283,443	$ 171,497	$ 52,005	$ 50,949	$ 104,722	$ 38,025	$ 50,585	$ 88,346	$ 40,159	$ -	$ 151,789	$ 266,578	$ -	$ -	$ -	$ 58,741	$ 34,805	$ 4,269	$ 57,340	$ -	$ -	$ -	$ 5,956	$ 4,524	$ -	$ (505,641)	$ -	$ -	$ 219,758	$ (145,140)	$ -	$ -
22	$ 2,812,929	$ -	$ 92,468	$ -	$ 673,586	$ 503,527	$ 470,186	$ 294,781	$ 178,357	$ 54,086	$ 52,987	$ 108,911	$ 39,546	$ 52,608	$ 91,880	$ 41,765	$ -	$ 157,860	$ 277,241	$ -	$ -	$ -	$ 61,091	$ 36,198	$ 4,439	$ 59,633	$ -	$ -	$ -	$ 6,194	$ 4,705	$ -	$ (525,867)	$ -	$ -	$ 227,693	$ (150,946)	$ -	$ -
23	$ 2,951,646	$ -	$ 96,166	$ -	$ 700,529	$ 528,703	$ 511,040	$ 306,572	$ 185,491	$ 56,249	$ 55,106	$ 113,267	$ 41,128	$ 54,713	$ 95,555	$ 43,436	$ -	$ 164,175	$ 288,331	$ -	$ -	$ -	$ 63,534	$ 37,645	$ 4,617	$ 62,019	$ -	$ -	$ -	$ 6,442	$ 4,893	$ -	$ (546,901)	$ -	$ -	$ 235,919	$ (156,983)	$ -	$ -
24	$ 3,097,066	$ -	$ 100,013	$ -	$ 728,550	$ 555,139	$ 554,456	$ 318,835	$ 192,911	$ 58,499	$ 57,310	$ 117,798	$ 42,773	$ 56,901	$ 99,378	$ 45,173	$ -	$ 170,742	$ 299,864	$ -	$ -	$ -	$ 66,076	$ 39,151	$ 4,802	$ 64,500	$ -	$ -	$ -	$ 6,700	$ 5,089	$ -	$ (568,777)	$ -	$ -	$ 244,448	$ (163,263)	$ -	$ -
25	$ 3,249,510	$ -	$ 104,014	$ -	$ 757,692	$ 582,895	$ 600,580	$ 331,588	$ 200,627	$ 60,839	$ 59,603	$ 122,510	$ 44,484	$ 59,177	$ 103,353	$ 46,980	$ -	$ 177,571	$ 311,858	$ -	$ -	$ -	$ 68,719	$ 40,717	$ 4,994	$ 67,080	$ -	$ -	$ -	$ 6,968	$ 5,293	$ -	$ (591,529)	$ -	$ -	$ 253,290	$ (169,793)	$ -	$ -

PLAN B - COMMUTE FOCUS
Annual Cash Flow (Completed projects = $0)

Project Year	Annual Cash Flow	Carport PV	Roof PV	ISD PV	Ground PV	CREBS PV	Landfill	Cogen	C02 Sensors	CHP VFD	CMP Map	PFHX	Lighting	Motors	Repair Econ	New Econ	MADF VFD	Chillers	Center VAV	Vending	Instant HW	VFD	CV Resets	TES	Street	EMS	Reroof	NCDF Hot Water	Well	DD Reset	Cooling Coils	Solar Green Tags	32 EM FTEs	Bio-Diesel	Existing Hybrid Purchases	New Hybrid Purchases	Ongoing Bus Pass Program	Expanded Bus Pass Program	Compr. Commute Program
1	$ (292,829)	$ -	$ -	$ -	$ -	$ (54,578)	$ -	$ 98,415	$ 62,674	$ 21,099	$ 21,881	$ 23,116	$ 14,194	$ -	$ 26,625	$ 12,225	$ -	$ 28,144	$ (12,019)	$ -	$ -	$ -	$ 24,493	$ 13,828	$ 870	$ 20,908	$ -	$ -	$ -	$ 2,596	$ -	$ -	$ (230,768)	$ (65,116)	$ -	$ 108,621	$ -	$ -	$ (410,040)
2	$ (157,148)	$ -	$ -	$ -	$ -	$ 10,953	$ 16,802	$ 103,590	$ 65,805	$ 22,049	$ 22,811	$ 25,028	$ 14,888	$ -	$ 28,238	$ 12,958	$ -	$ 30,915	$ (7,152)	$ -	$ -	$ -	$ 25,565	$ 14,464	$ 948	$ 21,955	$ -	$ -	$ -	$ 2,705	$ -	$ -	$ (239,999)	$ (15,720)	$ -	$ 112,492	$ -	$ -	$ (426,442)
3	$ (129,873)	$ -	$ -	$ -	$ -	$ 16,865	$ 34,695	$ 108,971	$ 69,061	$ 23,036	$ 23,779	$ 27,016	$ 15,610	$ -	$ 29,915	$ 13,720	$ -	$ 33,797	$ (2,091)	$ -	$ -	$ -	$ 26,680	$ 15,124	$ 1,029	$ 23,044	$ -	$ -	$ -	$ 2,818	$ -	$ -	$ (249,599)	$ (16,349)	$ -	$ 116,504	$ -	$ -	$ (443,500)
4	$ (108,339)	$ -	$ -	$ -	$ -	$ 23,180	$ 46,321	$ 114,568	$ 72,447	$ 24,063	$ 24,785	$ 29,084	$ 16,361	$ -	$ 31,660	$ 14,513	$ -	$ 36,794	$ 3,173	$ -	$ -	$ -	$ 27,840	$ 15,812	$ 1,113	$ 24,176	$ -	$ -	$ -	$ 2,936	$ -	$ -	$ (259,583)	$ (17,003)	$ -	$ 120,661	$ -	$ -	$ (461,240)
5	$ (85,373)	$ -	$ -	$ -	$ -	$ 29,921	$ 58,825	$ 120,388	$ 75,969	$ 25,131	$ 25,831	$ 31,234	$ 17,142	$ -	$ 33,474	$ 15,338	$ -	$ 39,911	$ 8,647	$ -	$ -	$ -	$ 29,047	$ 16,526	$ 1,201	$ 25,353	$ -	$ -	$ -	$ 3,058	$ -	$ -	$ (269,966)	$ (17,683)	$ -	$ 124,970	$ -	$ -	$ (479,689)
6	$ (60,894)	$ -	$ -	$ -	$ -	$ 37,110	$ 72,260	$ 126,442	$ 79,631	$ 26,242	$ 26,919	$ 33,470	$ 17,954	$ -	$ 35,361	$ 16,196	$ -	$ 43,153	$ 14,340	$ -	$ -	$ -	$ 30,301	$ 17,270	$ 1,292	$ 26,578	$ -	$ -	$ -	$ 3,185	$ -	$ -	$ (280,765)	$ (18,390)	$ -	$ 129,435	$ -	$ -	$ (498,877)
7	$ (34,817)	$ -	$ -	$ -	$ -	$ 44,772	$ 86,681	$ 132,737	$ 83,440	$ 27,397	$ 28,051	$ 35,796	$ 18,798	$ -	$ 37,323	$ 17,088	$ -	$ 46,524	$ 20,261	$ -	$ -	$ -	$ 31,606	$ 18,043	$ 1,387	$ 27,851	$ -	$ -	$ -	$ 3,318	$ -	$ -	$ (291,995)	$ (19,126)	$ -	$ 134,063	$ -	$ -	$ (518,832)
8	$ (7,053)	$ -	$ -	$ -	$ -	$ 52,933	$ 102,148	$ 139,284	$ 87,402	$ 28,598	$ 29,227	$ 38,215	$ 19,677	$ -	$ 39,363	$ 18,015	$ -	$ 50,030	$ 26,418	$ -	$ -	$ -	$ 32,963	$ 18,847	$ 1,485	$ 29,176	$ -	$ -	$ -	$ 3,455	$ -	$ -	$ (303,675)	$ (19,891)	$ -	$ 138,860	$ -	$ -	$ (539,585)
9	$ 22,494	$ -	$ -	$ -	$ -	$ 61,622	$ 118,722	$ 146,093	$ 91,522	$ 29,847	$ 30,451	$ 40,731	$ 20,590	$ -	$ 41,486	$ 18,980	$ -	$ 53,677	$ 32,822	$ -	$ -	$ -	$ 34,374	$ 19,683	$ 1,588	$ 30,553	$ -	$ -	$ -	$ 3,598	$ -	$ -	$ (315,822)	$ (20,687)	$ -	$ 143,832	$ -	$ -	$ (561,169)
10	$ 53,923	$ -	$ -	$ -	$ -	$ 70,865	$ 136,469	$ 153,175	$ 95,806	$ 31,147	$ 31,724	$ 43,347	$ 21,540	$ -	$ 43,693	$ 19,983	$ -	$ 57,469	$ 39,482	$ -	$ -	$ -	$ 35,841	$ 20,552	$ 1,695	$ 31,986	$ -	$ -	$ -	$ 3,747	$ -	$ -	$ (328,455)	$ (21,514)	$ -	$ 148,985	$ -	$ -	$ (583,615)
11	$ 87,339	$ -	$ -	$ -	$ -	$ 80,694	$ 155,457	$ 160,540	$ 100,262	$ 32,498	$ 33,048	$ 46,068	$ 22,528	$ -	$ 45,989	$ 21,027	$ -	$ 61,413	$ 46,409	$ -	$ -	$ -	$ 37,368	$ 21,457	$ 1,806	$ 33,476	$ -	$ -	$ -	$ 3,902	$ -	$ -	$ (341,593)	$ (22,375)	$ -	$ 154,326	$ -	$ -	$ (606,960)
12	$ 122,851	$ -	$ -	$ -	$ -	$ 91,140	$ 175,760	$ 168,199	$ 104,897	$ 33,903	$ 34,425	$ 48,898	$ 23,556	$ -	$ 48,376	$ 22,112	$ -	$ 65,515	$ 53,613	$ -	$ -	$ -	$ 38,955	$ 22,397	$ 1,921	$ 35,025	$ -	$ -	$ -	$ 4,063	$ -	$ -	$ (355,257)	$ (23,270)	$ -	$ 159,862	$ -	$ -	$ (631,238)
13	$ 160,576	$ -	$ -	$ -	$ -	$ 102,236	$ 197,453	$ 176,165	$ 109,716	$ 35,365	$ 35,857	$ 51,841	$ 24,624	$ -	$ 50,859	$ 23,241	$ -	$ 69,781	$ 61,104	$ -	$ -	$ -	$ 40,606	$ 23,375	$ 2,041	$ 36,637	$ -	$ -	$ -	$ 4,230	$ -	$ -	$ (369,467)	$ (24,200)	$ -	$ 165,600	$ -	$ -	$ (656,488)
14	$ 200,637	$ -	$ -	$ -	$ -	$ 114,018	$ 220,619	$ 184,449	$ 114,729	$ 36,885	$ 37,346	$ 54,902	$ 25,736	$ -	$ 53,441	$ 24,414	$ -	$ 74,217	$ 68,896	$ -	$ -	$ -	$ 42,323	$ 24,393	$ 2,166	$ 38,313	$ -	$ -	$ -	$ 4,404	$ -	$ -	$ (384,246)	$ (25,168)	$ -	$ 171,549	$ -	$ -	$ (682,747)
15	$ 243,161	$ -	$ -	$ -	$ -	$ 126,523	$ 245,342	$ 193,065	$ 119,942	$ 38,465	$ 38,894	$ 58,085	$ 26,892	$ -	$ 56,126	$ 25,635	$ -	$ 78,831	$ 76,999	$ -	$ -	$ -	$ 44,108	$ 25,451	$ 2,295	$ 40,056	$ -	$ -	$ -	$ 4,585	$ -	$ -	$ (399,616)	$ (26,175)	$ -	$ 177,715	$ -	$ -	$ (710,057)
16	$ 139,789	$ -	$ -	$ -	$ -	$ 139,789	$ 271,711	$ 232,970	$ 140,958	$ 42,745	$ 41,876	$ 86,074	$ 31,254	$ -	$ 72,614	$ 33,008	$ -	$ 124,759	$ 219,108	$ -	$ -	$ -	$ 48,281	$ 28,607	$ 3,508	$ 47,129	$ -	$ -	$ -	$ 4,895	$ -	$ -	$ (415,600)	$ (27,222)	$ -	$ 184,107	$ -	$ -	$ (738,459)
17	$ 619,976	$ -	$ -	$ -	$ -	$ 153,857	$ 299,822	$ 242,288	$ 146,596	$ 44,454	$ 43,551	$ 89,517	$ 32,504	$ -	$ 75,519	$ 34,328	$ -	$ 129,750	$ 227,872	$ -	$ -	$ -	$ 50,212	$ 29,752	$ 3,649	$ 49,014	$ -	$ -	$ -	$ 5,091	$ -	$ -	$ (432,224)	$ (28,311)	$ -	$ 190,733	$ -	$ -	$ (767,998)
18	$ 670,733	$ -	$ -	$ -	$ -	$ 168,770	$ 329,774	$ 251,980	$ 152,460	$ 46,233	$ 45,293	$ 93,097	$ 33,804	$ -	$ 78,540	$ 35,701	$ -	$ 134,940	$ 236,987	$ -	$ -	$ -	$ 52,221	$ 30,942	$ 3,795	$ 50,975	$ -	$ -	$ -	$ 5,295	$ -	$ -	$ (449,513)	$ (29,443)	$ -	$ 197,602	$ -	$ -	$ (798,718)
19	$ 724,539	$ -	$ -	$ -	$ -	$ 184,572	$ 361,673	$ 262,059	$ 158,559	$ 48,082	$ 47,105	$ 96,821	$ 35,156	$ -	$ 81,681	$ 37,129	$ -	$ 140,337	$ 246,466	$ -	$ -	$ -	$ 54,309	$ 32,179	$ 3,947	$ 53,014	$ -	$ -	$ -	$ 5,507	$ -	$ -	$ (467,494)	$ (30,621)	$ -	$ 204,723	$ -	$ -	$ (830,666)
20	$ 781,560	$ -	$ -	$ -	$ -	$ 201,313	$ 395,629	$ 272,541	$ 164,901	$ 50,005	$ 48,989	$ 100,694	$ 36,562	$ -	$ 84,948	$ 38,614	$ -	$ 145,951	$ 256,325	$ -	$ -	$ -	$ 56,482	$ 33,467	$ 4,104	$ 55,135	$ -	$ -	$ -	$ 5,727	$ -	$ -	$ (486,193)	$ (31,846)	$ -	$ 212,105	$ -	$ -	$ (863,893)
21	$ 1,102,481	$ -	$ -	$ -	$ -	$ 479,550	$ 431,759	$ 283,443	$ 171,497	$ 52,005	$ 50,949	$ 104,722	$ 38,025	$ -	$ 88,346	$ 40,159	$ -	$ 151,789	$ 266,578	$ -	$ -	$ -	$ 58,741	$ 34,805	$ 4,269	$ 57,340	$ -	$ -	$ -	$ 5,956	$ -	$ -	$ (505,641)	$ (33,120)	$ -	$ 219,758	$ -	$ -	$ (898,449)
22	$ 1,171,676	$ -	$ -	$ -	$ -	$ 503,527	$ 470,186	$ 294,781	$ 178,357	$ 54,086	$ 52,987	$ 108,911	$ 39,546	$ -	$ 91,880	$ 41,765	$ -	$ 157,860	$ 277,241	$ -	$ -	$ -	$ 61,091	$ 36,198	$ 4,439	$ 59,633	$ -	$ -	$ -	$ 6,194	$ -	$ -	$ (525,867)	$ (34,445)	$ -	$ 227,693	$ -	$ -	$ (934,387)
23	$ 1,244,743	$ -	$ -	$ -	$ -	$ 528,703	$ 511,040	$ 306,572	$ 185,491	$ 56,249	$ 55,106	$ 113,267	$ 41,128	$ -	$ 95,555	$ 43,436	$ -	$ 164,175	$ 288,331	$ -	$ -	$ -	$ 63,534	$ 37,645	$ 4,617	$ 62,019	$ -	$ -	$ -	$ 6,442	$ -	$ -	$ (546,901)	$ (35,823)	$ -	$ 235,919	$ -	$ -	$ (971,762)
24	$ 1,321,887	$ -	$ -	$ -	$ -	$ 555,139	$ 554,456	$ 318,835	$ 192,911	$ 58,499	$ 57,310	$ 117,798	$ 42,773	$ -	$ 99,378	$ 45,173	$ -	$ 170,742	$ 299,864	$ -	$ -	$ -	$ 66,076	$ 39,151	$ 4,802	$ 64,500	$ -	$ -	$ -	$ 6,700	$ -	$ -	$ (568,777)	$ (37,255)	$ -	$ 244,448	$ -	$ -	$ (1,010,633)
25	$ 1,403,324	$ -	$ -	$ -	$ -	$ 582,895	$ 600,580	$ 331,588	$ 200,627	$ 60,839	$ 59,603	$ 122,510	$ 44,484	$ -	$ 103,353	$ 46,980	$ -	$ 177,571	$ 311,858	$ -	$ -	$ -	$ 68,719	$ 40,717	$ 4,994	$ 67,080	$ -	$ -	$ -	$ 6,968	$ -	$ -	$ (591,529)	$ (38,746)	$ -	$ 253,290	$ -	$ -	$ (1,051,058)