

City of Newark
Climate Action Plan

January 2010 Initial Framework


Prepared by
City of Newark Public Works Maintenance Division, through a grant provided by the Bay Area Air Quality Management District Climate Protection Grant Program

Table of Contents

Executive Summary………………………………………………………. ES

Chapter 1: Introduction……………………………………………… 1

Chapter 2: Greenhouse Gas Baseline Inventory 2005………………. 7

Chapter 3: Municipal Action Items………………………………….. 10

Chapter 4: Residential Community Action Items…………………… 18

Chapter 5: Business Community Action Items……………………… 21

Chapter 6: Transportation Planning and Zoning…………………….. 23

Chapter 7: Goals and Monitoring Plan……………………………… 27

Chapter 8: Adaptation…………………………………………........ 30

Appendices:

Appendix A – Lighting Fixture Replacement and Aquatic Center Energy Saving Analysis Report………………………… A-1

Appendix B – Change Maintenance Fleet to CNG Report……………. B-1

Appendix C – Comprehensive Energy Analysis and Strategic Plan for the Silliman Activity and Family Aquatic Center………... C-1

Appendix D – City of Newark Greenhouse Gas Emission Analysis, August 2008………………………………………………. D-1

Appendix E – Community Center 5-Year HVAC Replacement Plan…… E-1

Executive Summary

The City of Newark recognizes that climate change poses a potential threat to the community and to the environment. This City also recognizes that the citizens and businesses of Newark must participate in emission reducing actions if this community is to successfully mitigate the risks posed by climate change. Newark therefore determined that we should reduce the amount of Greenhouse Gas (GHG) emissions from activities taking place within the City. A Climate Action Plan (CAP) is the instrument to establish a framework for the changes necessary to reduce GHG emissions.

This CAP does the following: presents a summary of actions the City has already taken towards the reduction of GHG emissions; summarizes the 2005 emissions inventory; presents actions the City, residents and businesses can take to further reduce emissions; sets reduction goals; and, describes a monitoring plan. This document is meant to be a dynamic document that will evolve and be re-evaluated on a regular basis. The measures and programs in the CAP will be implemented over an extended period of time.

Emission reduction goals have been set based on the analyses in this report and on the State's AB 32. Staff recommends adopting the following overall goals across City and community operations:

1. Set greenhouse gas emissions reduction targets as follows:
   A. A 5 % reduction from 2005 Municipal emissions levels by July 2012. This would equal a reduction of 194 metric tons eCO_2.
   B. A 5% reduction in City and Community emissions by July 2015. This would equal a reduction of 21,680 metric tons of eCO_2.
   C. A community-wide target of a 15% decrease from 2005 levels by 2020, equal to a reduction of 65,038 metric tons.

   Achieving goal C would enable Newark to match the State of California's goal of 1990 emission levels by the year 2020 (statewide it is estimated that 2005 emissions were 15% higher than 1990 emissions).

2. Incorporate carbon reduction into the City's General Plan goals to ensure continuity with other City priorities, continued action, and a long-term perspective.

3. Use this Climate Action Plan as a springboard for determining GHG reducing actions to take over the next few years. As possible, it shall be revisited and action steps reformulated at least biennially.

4. Maintain and report GHG inventories on a regular basis.

5. Promote participation by Newark businesses in inventory efforts.

Since 2005, the City of Newark has implemented some emission reduction actions. With these actions, we are about half way to making our 2012 goals. Proposed budget cut measures to be implemented in 2010 will provide energy reductions to surpass our 2012 goal.

Chapter 1: Introduction

Plan Purpose and Development:

The City of Newark recognizes that climate change poses a potential threat to the community and to the environment. Locally, the forecasted changes accompanying climate change could dramatically reduce the availability of hydro-generated electricity, increase the incidence of forest fires, and lead to a rise in the level of San Francisco Bay[1] that could impact lower elevation land in Newark. The residents and businesses of Newark recognize the challenges and appear willing to be part of the solution. We also recognize that activities taking place within the City result in the release of the global warming gases that contribute to climate change. Newark is therefore determined that we should reduce the amount of greenhouse gas (GHG) emissions from activities taking place within the City.

A Climate Action Plan (CAP) helps to identify and evaluate feasible and effective policies to reduce greenhouse gas emissions through a combination of public and private sector policies and programs. By taking a proactive approach to planning and implementing reduction measures, we can lower our GHG emissions, reduce our energy costs, protect air quality and improve the economy and the environment. This CAP will also address adaptability to climate change effects.

The primary goals of the final CAP are to present a comprehensive inventory of municipal (City government-generated) and community-generated emissions, identify reduction targets, and propose practical steps to reach those targets. The secondary goal of the final CAP is to identify and prepare for the environmental changes associated with climate change, such as the forecasted water level rise of the San Francisco Bay. This CAP will align City goals with State goals.

More specifically, the CAP is intended to achieve the following:

1. Analyze the available data on emissions from both municipal and community activities, to present a comprehensive inventory of emissions from (a) City government operations and (b) community-wide activities.
2. Present this inventory as a baseline against which to measure progress towards reducing GHG emissions.
3. Develop a set of emission reduction goals for municipal operations over the next 1-4 years (short term), from years 4-8 (medium term) and from year 8 and beyond (long term) timeframes.
4. Present actions that the citizens and businesses of Newark can implement in the medium and long-term to help reduce emissions from the Community.
5. Present long-term Planning efforts to layout future development with vehicle trip reduction as an important goal.

[1] Palo Alto Climate Protection Plan, 2007.

This CAP is meant to be a dynamic document that will evolve, fill in and be re-evaluated on a regular basis. The CAP begins with taking an inventory of emission producing activities in the community and specifically from municipal activity. This inventory is used to evaluate reduction measures that can be taken and to set reduction goals. The CAP recommends multiple actions and timelines with cost analyses where possible. The CAP also establishes a monitoring plan to determine the effectiveness of implemented measures.

The measures and programs in the CAP will be implemented over an extended period of time. This plan recognizes that it may not be possible to implement some of the ideas presented in the CAP with the current economic conditions. Nevertheless, it is important to keep ideas on the table if they could make a cost-effective contribution to reducing emissions at some future time in the life of the CAP.

This CAP also recognizes that the citizens and businesses of Newark must participate in emission reducing actions if this community is to successfully mitigate the risks posed by climate change. This CAP will pose and promote programs for the municipality and for the community.

Background of Climate Change:

A balance of naturally occurring gases dispersed in the atmosphere determines the Earth's climate by trapping solar radiation. This phenomenon is known as the greenhouse effect. Modern human activity, most notably the burning of fossil fuels for transportation and electricity generation, introduces large amounts of carbon dioxide and other heat-trapping gases into the atmosphere. Collectively, these gases intensify the natural greenhouse effect, causing global average surface temperature to rise, which is in turn expected to affect global climate patterns.

Evidence suggests that human activities are increasing the concentration of greenhouse gases in the atmosphere. In response to the threat of climate change, communities worldwide are voluntarily reducing greenhouse gas emissions[2]. In 1997, the Kyoto Protocol was initiated as an international effort to coordinate a global effort and more recently in 2009, leaders from around the world met in Copenhagen to discuss global efforts. World leaders have not come up with a global solution, but even without national direction, many states and local agencies have begun taking actions that will address the climate change threats.

The State of California has prepared a CAP that consists of an array of recommendations to reduce GHG emissions. Some of the State legislation is listed below:

- In 1988 Assembly Bill 4420 directed the California Energy Commission (CEC) to prepare and maintain the State's inventory of GHG emissions.
- The California Global Warming Solutions Act of 2006, AB32, instructed the California Air Resources Board (CARB) to establish State-wide goals for reducing GHG emissions. The targets established in AB32 Climate Change Draft Scoping Plan are to reduce the emission level to 1990 levels by 2020 and to reduce to 80% below 1990 levels by 2050. The 2050 target is based on what most climate scientists believe will be the needed reductions to avoid dangerous levels of global warming.

[2] City of Newark Greenhouse Gas Emissions Analysis Introduction, August 2008.

- In July 2002 AB 1493 was approved, also known as the "Pavley Bill" in reference to Assemblywoman Fran Pavley who introduced the bill. This bill instructs CARB to develop and adopt regulations that achieve the maximum feasible and cost-effective reductions of greenhouse gas emissions from motor vehicles. The regulations are not yet approved by the EPA.
- SB 375 requires CARB to work with the metropolitan planning organizations to set regional targets for reducing GHG emissions from passenger vehicles. This bill is looking for agencies to use a combination of zoning and transportation planning to reduce vehicle miles traveled. SB 375 was enacted in September 2008 and most agencies are still working to determine what the actual requirements are.

Newark Has Already Taken Action:

In 2007, the Mayor of Newark signed the U.S. Conference of Mayors Climate Protection Agreement which states, "We will strive to meet or exceed Kyoto Protocol targets for reducing global warming pollution by taking actions in our own operations and communities." In June 2006, the City joined ten other local governments in Alameda County participating in the Alameda County Climate Protection Project (ACCPP). By joining ACCPP, Newark embarked on an ongoing coordinated effort to reduce the emission of gases that cause global warming. ACCPP was launched by the Alameda County Waste Management Authority & Recycling Board (StopWaste.Org) in partnership with the Alameda County Conference of Mayors and ICLEI – Local Governments for Sustainability (ICLEI). In 2007, ICLEI completed the municipal and community inventories for the ACCPP.

The Newark City Council has made Climate Protection a top priority for several years and has committed to address climate protection in numerous arenas including:

1. U.S. Mayor's Climate Protection Agreement (Resolution #9263, February 8, 2007)
2. International Council of Local Environmental Initiatives (ICLEI) Cities for Climate Protection Campaign (membership effective June 2006)
3. Membership in Joint Venture Silicon Valley's Climate Protection Taskforce (since inception, April 2007)
4. Environmentally Preferable Purchasing Policy (Draft in place, final will be approved with 2010 Citywide Purchasing Policy Update)
5. Green Building and Construction and Demolition Recycling Ordinance (Ordinance #422, June 14, 2007)
6. Environmentally Friendly Landscape Guide (Original 1989, Resolution #6120; Updated June 14, 2007, Ordinance #422)
7. Cool City member (concurrent with passage of the U.S. Mayor's Climate Protection Agreement Resolution)
8. Waste Diversion Goals - 50% by 2000 met; 75% by 2015 (Resolution #9560, February 12, 2009)
9. Wood Burning Prohibition per State requirements.

Municipal staff has also already implemented many measures to reduce emissions, such as:

1. Lighting retrofits at City Hall, the Silliman Activity and Family Aquatic Center, the Newark Community Center and the Senior Center. Appendix A contains a report analyzing the savings achieved at the Silliman Center and the Community Center.
2. In 2008, the Public Works Parks Maintenance Division reduced water use by 12%. That equates to 7.5 million gallons saved in 2008. The California Energy Commission reports that in California it takes about 4 watt-hours to pump 1 gallon of water from its source to the output[3]. This water savings translates to 21 tons of reduced eCO_2. Although this type of savings would not show in our inventory, it is still a significant savings, with the additional benefit of water conservation.
3. There are currently four (4) Compressed Natural Gas (CNG) vehicles in the fleet. Appendix B contains a report analyzing the possibility of expanding the CNG fleet and adding other alternative fuel vehicles into the fleet. These vehicles have been in the fleet since 2000.
4. A strategic plan has been prepared for the Silliman Activity and Family Aquatic Center which analyzed energy efficiency options and laid out the strategy for implementing the recommended measures. The report is contained in Appendix C.
5. The City has been using a pavement slurry seal for several years that about one (1) year after application the pavement fades to a light gray color instead of staying black. This type of pavement is considered a cool pavement. Cool pavements help reduce the urban heat island effect[4].
6. The 2009 Housing Element was developed using "green" principles- Higher density Housing near Transit, and shopping and it includes transit oriented, mixed use development around the proposed Dumbarton Rail train station.
7. A grant was obtained to complete a Pedestrian and Bicycle Master Plan which is scheduled to be completed October 2010.
8. A grant was obtained to conduct a Bay Trail Realignment Feasibility Study which will allow for a continuous trail on the western edge of Newark. The study will be completed in late 2010.
9. The City of Newark has participated in Regional "smart growth planning efforts". Two areas, the area around the proposed train station and the Old town area, were designated as "Priority Development Areas" by the Association of Bay Area Governments.

ICLEI Methodology:

Newark has been using the ICLEI methodology to perform our inventory and to measure the effectiveness of proposed reductions. The ICLEI methodology calculates emissions resulting from consumption and waste generation. The ICLEI software is used by over 800 cities around the world. Other methodologies calculate the full lifecycle of all consumer products in an area. For example, the ICLEI methodology would account for the gas to deliver stock to the grocery stores and the waste associated with the use of products from that store. Other methodologies would also account for the production of those products from the field to the processing plant. The emission inventorying is more of a modeling tool rather then an exact calculation. All methods depend on numerous assumptions. The most important part of modeling emissions inventories is to use a

[3] http://www.energy.ca.gov/2007publications/CEC-999-2007-008/CEC-999-2007-008.PDF
[4] An urban heat island is an area where hard surfaces such as paving and roofs increase the temperature of the area by 3-20 degrees. Urban heat islands increase emissions by increasing energy consumption. www.epa.gov/heatisland/about/index.htm

consistent method during the tracking periods. ICLEI is continuing to improve their software with new data, emission coefficients and better estimation methods as they become available. ICLEI's software allows for updating past inventories with the newer versions of their software.

The 2005 inventory was prepared as part of the ACCPP, and ICLEI was trying to prepare not only an inventory for the City, but a countywide inventory. The different municipalities operated different functions; some operate waste water plants, some run their own garbage pick up. Therefore, any activity that can be associated with a municipality is included in our municipal inventory. For example, the emissions from the City of Newark municipal fleet include emissions from Waste Management's garbage trucks.

The ICLEI performance-based methodology provides five milestones to assist local governments in developing and implementing local approaches for reducing global warming. The milestone process consists of the following five milestones:

1. Conduct a baseline emissions inventory and emissions forecast
2. Adopt an emission reduction target
3. Develop a Climate Action Plan for reducing emissions
4. Implement policies and actions that will reduce emissions
5. Monitor and verify results

The baseline emissions inventory is summarized in Section 2 of this report and is posted on the City's website (www.newark.org). Milestones 2 and 3 will be completed with the adoption of this CAP. This report includes recommendations on how to begin work on Milestones 4 and 5.

Newark has slightly modified the 5 milestone approach in that we did not want to adopt a target until the CAP analyzed the effectiveness and the costs of potential reduction measures. The targets shown in this report are based upon the analysis contained in the rest of the report.

Cost Analysis:

Where costs are available, they have been incorporated into the action items. The costs to reduce greenhouse gas emissions are a key component of prioritizing which actions to take in implementing action items from this CAP. Some of these costs would be borne by the City; while other costs, either directly or indirectly, could potentially fall on the end user, or the community.

The process of estimating costs of specific eCO_2 reductions requires making some assumptions. The assumptions used in this report are described in each chapter's cost benefit section. In some instances, the assumptions use information taken from manufacturers' or other non-peer-reviewed materials and websites, and could not for this study be independently verified. This being the case, the cost benefit analyses should be considered as preliminary only. Additionally, more detailed financial and budgetary analyses should be carried out before many of the actions listed here are implemented.

In many cases the changes required to significantly reduce emissions bear significant costs. Some of the actions listed here have relatively low costs, but also low benefits. However, overall, significant investments will be required, especially surrounding alternative energy opportunities, such as solar power, to achieve significant reductions in emissions. In many instances, however, the benefits of actions extend beyond the climate change issue. For example, while achieving Zero Waste goals will significantly reduce carbon emissions, it will have other benefits in terms of reducing requirements for landfill space and cleaner air. In another example, adopting green building principals will lower emissions from energy use, but also reduce water demand, improve indoor air quality, and enhance overall standards of living. Including these "auxiliary" benefits into the cost benefit analyses was beyond the scope of this project.

The Comprehensive Energy Analysis and Strategic Plan: Silliman Activity and Family Aquatic Center report (Appendix C) has a section that discusses the benefit of financing energy efficiency installations. It states that the cost savings achieved from the reduced energy use can pay the payments for the project loan. There are several financing plans that establish the payment schedule based on the calculated savings therefore effectively providing a no net cost method for installing energy efficiency measures.

Co_2 Equivalent:

The greenhouse gas of key concern is carbon dioxide (CO_2). GHGs other than CO_2 can be converted to "CO_2 equivalent" (eCO_2) by multiplying the mass of that gas by the "global warming potential" (GWP), which indicates the equivalent greenhouse effect of a pound of the gas as compared to a pound of CO_2. Throughout this report, references to greenhouse gas (GHG) emission quantities follow the international convention of using metric tons (2205 pounds) of CO_2 or "CO_2 equivalent" when referring to non-CO_2 greenhouse gases. Sometimes pounds are used when those units are more illustrative. The key GHGs of interest are listed below in Table 1.1[5] along with their respective global warming potentials.

Table 1.1 Greenhouse Gas CO_2 Equivalents[5]

Gas	Symbol	Global Warming Potential (IPCC Second Assessment Report)
Carbon Dioxide	CO_2	1
Methane	CH_4	21
Nitrous Oxide	N_2O	310
Hydrofluorcarbons	HFC_S	140 – 12,100
Perfluorocarbons	PFC_S	6,500 – 9,200
Sulfur Hexaflouride	SF_6	23,900

[5] City of Palo Alto Climate Action Plan, 2007.

Chapter 2: Greenhouse Gas Baseline Inventory - 2005

In 2005, the Newark community emitted approximately 433,860 metric tons of eCO_2. Some of the highlighted statistics include:

- ► Per capita, in 2005, Newark emissions are estimated at 10.5 metric tons, which is slightly lower then the statewide average. (See State information below.)
- ► Of the total community emissions, the City of Newark municipal operations accounted for 3,880 metric tons or only about 0.9% of the total community emissions.

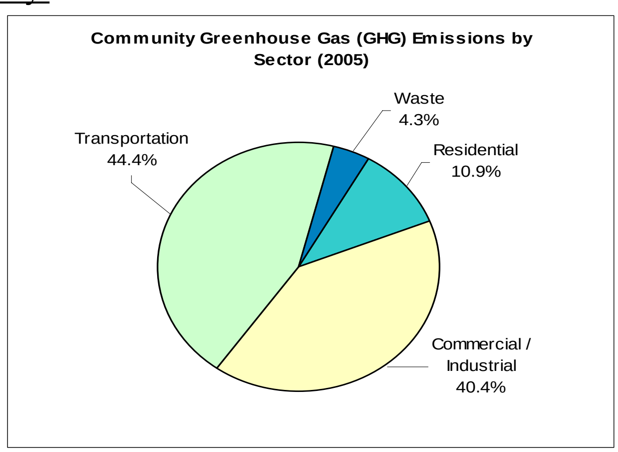
The complete inventory can be found in Appendix D.

Community Emissions Profile. The Newark community - businesses, residents and workers produce greenhouse gas emissions in a wide variety of ways. These include:

1. General economic and domestic activity which consumes electricity and natural gas to power and heat homes and businesses.
2. Non-commute travel on local roads.
3. Commuting by residents to their job within and outside of City limits, and by nonresidents commuting into the City for work. In this way, the "community" of Newark includes workers who come to the City for employment, but do not reside within city limits.
4. Production of waste material which, when landfilled, decomposes and in the process produces methane, a potent greenhouse gas.

Of the 44.4% emissions from the Transportation sector shown in the graph below, 54.6% of that is from the State highways that run adjacent to Newark. <u>That means that about 24% of the total emissions for Newark come from the State highway.</u>

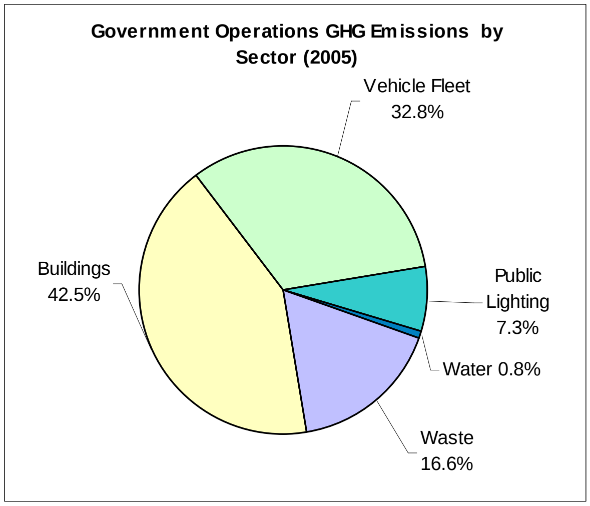
Figure 2.1 shows the breakdown of the community emissions.



Municipal Emissions Profile. City operations contribute to greenhouse gas emissions through five primary avenues:

1. The use of electricity and natural gas to power and heat City buildings and facilities.
2. The use of gasoline, compressed natural gas, diesel fuel and other fossil-based fuels to power vehicles, equipment, compressors and other machinery.

3. The use of electricity and natural gas used to transmit water and sewage in and out of the City.
4. Emissions from the collection and disposal of waste from City facilities.
5. Public lighting, such as street lights.

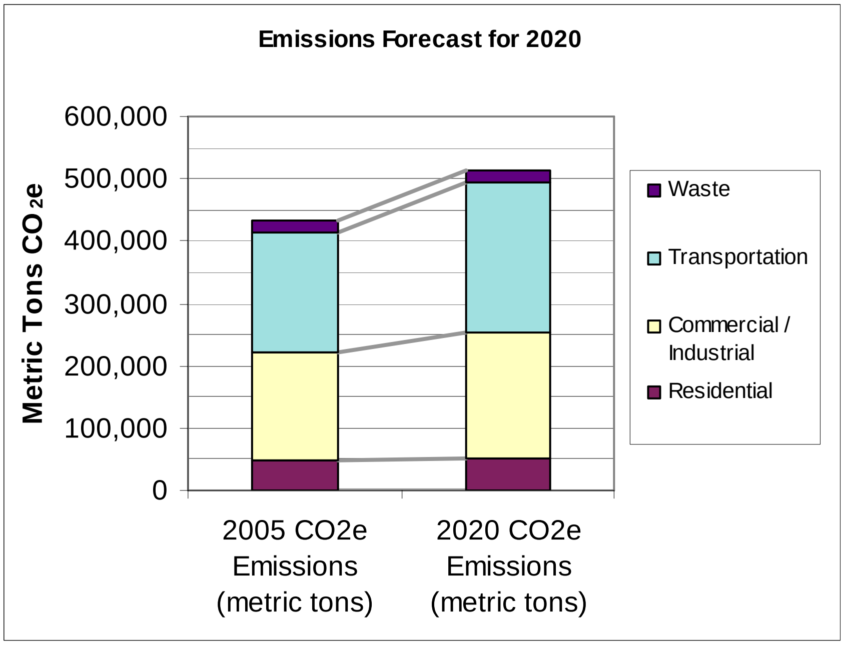


Newark was the only city in the 10 Alameda County cities in the ACCPP whose buildings are emitting more than the vehicle fleet (as noted above, the vehicle fleet includes Waste Management disposal trucks). This indicates that the City should focus on actions that will reduce our emissions from buildings.

Emissions Forecast:

2005 Community Emissions Growth Forecast by Sector	2005 CO_2e Emissions (metric tons)	2020 CO_2e Emissions (metric tons)	Annual Growth Rate	Percent Change from 2005 to 2020
Residential	47,313	52,215	0.659%	10.4%
Commercial / Industrial	175,096	200,310	0.901%	14.4%
Transportation	192,841	241,399	1.509%	25.2%
Waste	18,607	20,535	0.659%	10.4%
TOTAL	**433,857**	**514,459**	**--**	**18.6%**

Under a business-as-usual scenario, the City of Newark's emissions will grow approximately 18.6% by the year 2020. ABAG estimates for population growth were used for the forecast. The population is estimated to grow by 10.3% by 2020. From the chart above, the largest growth in emissions comes from the Transportation sector. This forecast does not include pending regulations on vehicle emissions and it was generated prior to the gasoline prices spiking in 2008. These two factors can greatly influence the future vehicle emissions. As stated above, a majority of the emissions from the Transportation sector come from the State highway, so it is important that Newark support regional efforts to improve transportation options that reduce highway travel.



National and State Data:

According to the U.S. Environmental Protection Agency (EPA), the average American emits 23 metric tons of carbon dioxide into the environment every year; 10 metric tons related directly to driving, home activities, and air travel, and 13 metric tons related to the purchase of products and services. Overall, each person emits 140 pounds of carbon dioxide per day.

Per capita CO_2 emissions in California are estimated by the California Energy Commission (CEC) to be approximately 11 metric tons per year. In California, GHG emissions are dominated by carbon dioxide, mostly from combustion of fossil fuels, followed by nitrous oxide, then methane, and then the remaining "high global warming potential" gases, chlorofluorinated refrigerants and sulfur hexafluoride. California GHG emissions are dominated by the transportation sector (41%) with the other sectors being electric power generation (22%), industrial (21%), agriculture and forestry (8%) and other (8%).

Chapter 3: Municipal Action Items

The City emissions account for only 0.9% of the total emissions in Newark, but the City needs to take action to lead the community and to be an example of projects that can make a difference. Chapter 1 listed several actions the City has already implemented that have started to reduce emissions. The following actions are planned for future implementation. Short-term actions are intended to help reach the first goal of a 5% reduction in Municipal emissions by 2012 (See Chapter 7 Goals and Monitoring Plan).

Municipal Action Item 3.1: Cool Roofs

As stated in the introduction, hard surfaces in an urban area contribute to the heat island effect. Roofs made of reflective material help reduce the head island effect and contribute to improving the energy efficiency of the building. When inquiring about the cost difference between cool roofs and traditional roofs, most roofing contractors have stated that there is not a price difference now that the cool roof materials are readily available.

Short Term –

1. City Hall-Public Works Annex install cool roof in 2009-2010 budget cycle.

Medium Term-

1. Consider cool roofs for all municipal building roof replacement projects.

Long Term-

1. Include in the Municipal Building Green Ordinance that all municipal building roofs must be cool roofs.

Municipal Action Item 3.2: Energy Efficient HVAC

Short Term –

1. Install Phase I of the Community Center 5-year HVAC Replacement Plan-Appendix E. The City received Community Development Block Grant (CDBG-R) and American Recovery and Reinvestment Act (ARRA) funding to install the two package units in the two rental halls. A majority of the Community Center is going to be closed for use beginning in 2010; all of the building except the daycare annex and the weekend rental of the two halls. The modifications to the Community Center's HVAC and use are estimated to save 100 metric tons of eCO_2 annually.
2. Senior Center Closure- eliminates HVAC energy use for the building. This closure is estimated to save 78 metric tons of eCO_2 annually.

Although both of these closures are considered temporary, the immediate emissions reductions will count towards our short-term reduction goals.

Medium Term –

1. Analyze all HVAC units being used in the City and plan for replacement with more efficient units at the time of replacement need.
   a. City Hall
   b. Service Center
   c. Fire Stations 1, 2 and 3
2. Implement HVAC options indicated in the Comprehensive Energy Analysis and Strategic Plan: Silliman Activity and Family Aquatic Center – Appendix C.

Long Term –

1. As part of the Municipal Building Green Ordinance, require all HVAC units be of a high level efficiency or are powered by green means.

Cost Analysis: In general, an energy efficient HVAC unit tends to cost 20% to 50% more then a less efficient unit. This upfront cost can be quickly recovered through the reduced utility bills.

Possible eCO_2 reductions: The reductions depend on the existing units and the level of energy efficiency of the new unit.

<u>Municipal Action Item 3.3: Solar Lighting</u>
Solar power is a fast developing technology. Solar powered lighting needs full exposure to the sun.

Short Term –

1. Install Pedestrian Lights at Lakeshore Park. Two (2) lights will be installed as a sample project funded by the ARRA grant.

Medium Term –

1. Prepare a report called the Solar Lighting Plan that documents a monitoring period of the lighting at Lakeshore Park to monitor the success/failure and determines locations throughout the City where similar solar lighting could replace other area lights.
2. Pursue funding opportunities for additional lights at Lakeshore Park.

Long Term-

1. Install solar lights in the areas determined in the Solar Lighting Plan.

Cost Analysis: The installation cost of a solar light is about twice the cost of a wired light. There are auxiliary benefits to a solar light; it can be installed as a stand alone feature in a full-sun location where wire is not accessible; there is no wiring to maintain; and since the existing wiring at Lakeshore Park is extremely deteriorated, adding new lights requires full wire replacement.

Possible eCO_2 reductions:

1. The current lights being installed are adding the proper pedestrian lighting to a highly used walking trail; they are not replacing existing lights.
2. The possible eCO_2 reductions for the citywide plan will be included in the Solar Lighting Plan.

<u>Municipal Action Item 3.4: Cool Pavements</u>
As with cool roofs, cool pavements help reduce the heat island effect. The City has 24.7 million square feet of paved streets.

Short Term –

1. Continue to use slurry seal that fades to gray.

Medium Term -

1. Continue to monitor research on cool pavements.
2. Write a report that specifically applies the ideas presented in the EPA Cool Pavements Study-Task 5 report to the City of Newark and includes cost comparisons.

Long Term -

1. Develop a policy on cool pavements.

Cost Analysis: The slurry product we currently use is about 30% less expensive then slurry products that do not fade. Other cool pavement methods such as installed concrete or painting the streets a light color add significant costs to street projects and are not being considered at this time.

Possible eCO_2 reductions: The eCO_2 reductions realized by this action item would show up as reduced energy bills in all Newark buildings.

Municipal Action Item 3.5: CNG Report Recommendations

The Change Maintenance Fleet to CNG report (Appendix B) discusses options for alternative fuels and concludes that CNG is a good interim solution for the next 20 to 30 years, but the long-term solution is electric vehicles. The electric vehicle technology is still developing and we do not recommend moving in that direction until the technology has been proven.

Short Term -

1. Continue to research grant opportunities to upgrade the current CNG fuel station.
2. Submit a capital improvement project request that will propose to upgrade the current CNG station with an improved compressor and additional stations.
3. Review each vehicle's potential to be replaced with a comparable CNG vehicle when they require replacement per the Equipment Replacement List.
4. Secure grant funding for upgrading gasoline/diesel vehicles replaced with CNG vehicles.

Medium Term –

1. Begin an information campaign to show Newark citizens the City's CNG vehicles and what CNG options are available to them.
2. Continue to follow the progress of LNG and Plug-in research.

Long Term –

1. Once technology has been proven, start purchasing electric vehicles at the time of replacement for vehicles.

Cost Analysis: The estimated cost to install the upgraded CNG station is $200,000 to $500,000 depending on the number of stations required.

Possible eCO_2 reductions: Changing eleven (11) pick ups to CNG could save the City 45 metric tons of eCO_2 a year.

Municipal Action Item 3.6: Silliman Center Strategic Plan recommendations

The Comprehensive Energy Analysis and Strategic Plan: Silliman Activity and Family Aquatic Center Report (Appendix C) was prepared to determine cost effective measures to improve the facility's energy efficiency. The report contains twelve (12) energy conservation measures (ECMs) and two (2) renewable generation options. The report contains a cost analysis with simple payback for each measure and a discussion on financing options. Measures are planned to be implemented as funding becomes available, not with financing.

Short Term-

1. Pursue grant opportunities to implement measures indicated in the report.
2. Implement ECMs 9 & 10; use existing EMS to reduce peak HVAC load during summer months. This measure will reduce eCO_2 by about 2 metric tons per year. The measure is estimated to cost $1,600.

3. As budget allows, install ECM 13; install variable frequency drives (VFD) on the pool filtration system. This measure will reduce eCO_2 by about 34 metric tons per year. The measure is estimated to cost $23,704.

Medium Term-

1. Propose CIP to install ECMs for lighting modifications.

Long Term-

1. Implement all remaining ECMs.

Cost Analysis: See Appendix C.

Possible eCO_2 reductions: Implementing the twelve conservation measures and one of the renewable generation options can reduce annual emissions by about 430 metric tons.

<u>Municipal Action Item 3.7: Commuter/Alternative Work Schedules/Work from Home Programs for City employees.</u>

This action aims to get City employees to avoid driving to work alone. Other agencies provide BART tickets, bus passes or commuter checks which reimburse for public transit commuting options.

Short Term-

1. Evaluate a plan based on job functions and cost considerations. Plan shall consider incentives for walking and biking to work.

Medium Term-

1. Implement program per the evaluation.

Long Term-

1. Monitor effectiveness and benefits of program.

Cost Analysis: A cost analysis will be included in the evaluation.

Possible eCO_2 reductions: Possible reductions depend upon the number of employees that can participate in the program.

<u>Municipal Action Item 3.8: Explore options in developing a car-sharing and/or bike sharing program for City employees.</u>

Several Bay Area municipalities have established car- and bike-sharing programs. Programs provide cars or bikes for around town transportation or for one-way trips. Analysis for a possible program would have to include research on the needs of employees. Appropriate demand to establish a program may require partnering with other local businesses.

Short Term-

1. Community Development will continue to research programs to determine a type of program appropriate for Newark.

Medium Term-

1. Prepare program analysis to determine participation and collaboration needs.

Long Term-

1. If determined feasible, implement program based on analysis.
2. Evaluate program effectiveness.

Cost Analysis: Program analysis should contain costs related to obtaining equipment and staff time to coordinate the program.

Possible eCO_2 reductions: Emission reductions will be determined by participation.

Municipal Action Item 3.9.1: New City Hall site should take into consideration transit availability.
As part of the long-term planning effort for a new City Hall building, staff will consider transit availability.

Municipal Action Item 3.9.2: New City Hall site should take into consideration green construction and functionality.
During design and construction of a possible new City Hall building, engineers and architects must consider green building methods.

Municipal Action Item 3.9.3: Water Conservation.
As part of the planning for a possible new City Hall building, the planners should consider water conservation measures.

The City uses approximately 68 million gallons of water a year at a cost of $234,000. As stated in the introduction of this report, to deliver a gallon of water it takes about 4 watt-hours in California. As part of the budget cuts, the City will be eliminating watering of 3 neighborhood parks. This will reduce emissions from water delivery by 26 eCO_2.

Short Term-

1. Approve CIP to install drought tolerate landscaping to replace turf in medians on Thornton Avenue and in front of the existing City Hall. These projects will provide examples of drought tolerant landscaping for residents.
2. Consider further water reducing and letting plant material die.

Medium Term-

1. New City Hall site should take into consideration using reclaimed water for landscape irrigation.

Long Term-

1. Implement policy that requires all City landscaping to be drought tolerant.
2. Only install turf for play fields.
3. Possible new City Hall building shall implement water conservation measure within the building and in the landscape and exterior design.

Municipal Action Item 3.10: In 2012 the City can negotiate into the garbage collection contract an alternative fuel requirement, strongly encouraging CNG or locally produced LNG.

Short Term –

1. Inform the City's garbage collection contractor of the City's greenhouse gas emission reduction goals; and express interest in the contractor's ability to partner with the City in achieving these goals.
2. Educate ourselves on the green practices of garbage collection contractors.

Medium Term –

1. Negotiate an alternative fuel requirement, strongly encouraging CNG or locally produced LNG, into the City's garbage collection contract.

Long Term –

1. Regularly evaluate the contract, and strengthen language as reasonable.
2. Use this contract language as a template for other contracts wherever possible.

Cost Analysis – Unknown. Through the negotiation process, if the contractor deems the cost of providing service with alternative fuels to be higher than that of diesel, a service trade or cost may be involved.

Possible eCO_2 reductions: After an agreement has been reached, the emissions reductions will be evaluated.

Municipal Action Item 3.11: Streetlight Energy Reduction.

Continue to research energy reduction options for street lighting, including LED and reduced use.

Short Term -

1. Complete Street Lighting report.
2. Publish Street Lighting report. (will be added to this CAP as a future Appendix)
3. Continue to monitor sample LED installed on main City street.
4. Install an additional LED sample in a residential setting.
5. Continue to monitor other jurisdictions' demonstration projects.

Medium Term –

1. Collect feedback and continue to monitor performance of sample LEDs.
2. Keep up-to-date on the latest technology and performance tests for LEDs.
3. Research grant and other funding opportunities.

Long Term-

1. Change City Streetlights to reduced energy type.

Cost Analysis: Will be discussed upon completion of Street Lighting Report.

Possible eCO_2 reductions: Will be discussed upon completion of Street Lighting Report.

Municipal Action Item 3.12: Prepare energy conservation plans for all city buildings and implement the plans.

Short Term-

1. Identify buildings in need of plans and determine which can be completed in-house and which need a consultant's expertise.

Medium Term-

1. Prepare plans or initiate RFP process.

Long Term-

1. Implement plans.

Cost Analysis: Several companies will prepare preliminary energy analyses for free, but a detailed analysis can cost between $5000 and $20,000.

Possible eCO_2 reductions: As stated previously, Newark buildings are the highest emission producer in the city operations, so reduction measures can produce significant energy savings.

Municipal Action Item 3.13: Municipal Green Building Ordinance

Short Term

1. Monitor the outcomes of discussions regarding legality of ordinances that require more stringent elements than the Building Code and our current Green Building Ordinance.
2. Participate in county and region-wide efforts that aim to achieve consistency in local jurisdictions' Municipal Green Building Ordinances.

Long Term-

1. Strengthen our Green Building Ordinance as it relates to Municipal Buildings, as appropriate or create a stand alone Municipal Buildings Ordinance.

<u>Municipal Action Item 3.14: Zero Waste for the City Operations</u>

Waste diversion is another action that reduces emissions with auxiliary benefits, such as decreasing the size of the landfills, reusing materials instead of depleting resources and produces nutrient rich compost to replenish planted soils.

Short Term-

1. Participate in the effort to accomplish the current goal of 75% diversion in 2015.

Medium Term-

1. Develop a plan to reach a zero waste level for municipal operations.

Long Term

1. Implement Zero Waste Plan for municipal operations.

Cost Analysis: To be discussed in Zero Waste Plan.

<u>Municipal Action Item 3.15: Adopt Environmentally Friendly Purchasing Policy</u>

Short Term –

1. Continue to work with stopwaste.org consultants to produce a model policy.

Medium Term –

1. Adopt an Environmentally Friendly Purchasing Policy.
2. Disseminate and discuss the policy with all applicable employees.

Long Term –

1. Monitor the effectiveness of the policy and suggest revisions as needed.

<u>Municipal Action Item 3.16: Update Tree Management Policy to include carbon discussion</u>

A healthy urban forest has several benefits, including:

- Reducing the energy consumption associated with air conditioned buildings by providing shade
- Reducing local ambient temperatures by shading paved and dark colored surfaces like streets and parking lots that absorb and store energy rather than reflecting it
- Intercepting and storing rainwater, thereby reducing water runoff volume

Trees also provide a GHG reduction benefit through a process called carbon sequestration. A single mature tree can absorb as much as 48 lbs. of carbon dioxide per year.

Medium Term –

1. Add carbon discussion to Tree Management Policy.

<u>Municipal Action Item 3.17: Conduct brown bag lunch trainings for employees to educate employees about GHG reductions.</u>

Short Term –

1. Develop desired learning outcomes and curriculum for training.
2. Work with the City's Human Resources Department to schedule employee training.
3. Work with business partners to provide GHG reduction-related freebies and other incentives to attract employee participation.

Medium Term –

1. Offer training to all employees; aim for 80% non-sworn personnel participation.
2. Consider a contest or other activity to keep employees motivated to learn about and implement additional GHG reduction actions.

Long Term –

1. Offer additional trainings to update employees on the City's GHG reduction efforts.
2. Encourage and allow employees the opportunity to peer educate.

Cost Analysis: Staff time would be required. At this time, no additional supply or service costs are expected.

Possible eCO_2 reductions: After education is provided, the emissions reductions will depend on the number of employees choosing to act and the number of actions taken by each employee.

Chapter 4: Residential Community Action Items

The Residential Community emissions account for about 10.9% of the total emissions in Newark. Residents in Newark probably contribute to about one half of the non-highway transportation emissions or about 10% of the total Newark emissions; resulting with the total Residential Community emissions equaling about 21% of the total emissions in Newark.

The overall plan for Residential Community action is to outreach, encourage and provide incentives when possible. Ordinances such as the Green Building Ordinance can help accomplish this goal. The Action Items listed below are intended to begin the outreach process and begin the discussion of the long-term goals for emissions reductions. A Residential Climate Task Force should be established to work with the citizens to determine which action items the residential community is willing to embrace and get behind.

Residents also set the tone for the local business communities. Residents can encourage businesses by only patronizing businesses that follow green practices.

Residential Community Action Item 4.1 – Personal Climate Action Plans

Just as the City has prepared this Climate Action Plan, each citizen can also create a personal plan. Sites such as www.green.yahoo.com can help individuals evaluate their carbon footprint and offer ideas on how to reduce their emissions. Understanding where emissions come from and being informed of the simple acts that can reduce those emissions is the basis for individuals to participate in emission reductions.

Action Item 4.1.1. Outreach

a. Attend HOA and other resident group meetings
b. Set-up booths at local events
c. Distribute information through schools

Action Item 4.1.2. Encourage application of other jurisdiction's successful tools available to residents:

a. Low Carbon Diet
b. Green Neighborhood Challenge
c. Green-Star Households

Residential Community Action Item 4.2 – Encourage use of Alternative Fuel Vehicles (AFVs)

Relatively speaking, municipal governments have limited opportunity to affect the technological improvements necessary to increase vehicle fuel efficiency and to lower the carbon content of fuels. But as residents, employees, business owners, city officials, students, etc., we affect our community's average fuel efficiency whenever we make a choice regarding the type of vehicle to drive (if we must drive at all). The role of city government and community-based agencies is to promote and provide incentives for low and zero-emissions vehicles as well as create the infrastructure necessary to support low carbon forms of transportation. The state and federal governments also have an important role to play. For example, the Pavley Bill (AB 1493, became state law in 2002) would require significant fuel efficiency improvements in automobiles sold in California and therefore have a direct impact on community-level greenhouse gas emissions. Under the Pavley Bill, the average motor vehicle in 2020 could be expected to emit approximately 16 percent fewer GHG emissions compared with today's average automobile. Whether a result of the Pavley Bill, a new piece of state or federal level legislation, or a combination of outreach and incentives at the community level, improved fuel efficiency requirements and the utilization of low-carbon fuels (including electricity) are necessary pieces of the puzzle for our community's GHG reduction targets. However, the City and its partners and citizens must ensure that low-carbon fuels such as bio-diesel are produced in a manner that does not have negative effects on food supply and that is shown to actually create a GHG reduction benefit when analyzed from a lifecycle perspective.[6]

Action Item 4.2.1. Outreach

a. Should include that City uses CNG and is looking to expand CNG fleet.
b. Research on the number of hybrid vehicles that citizens own in Newark.
c. Invite public and private partners to present the benefits of and answer questions about AFVs at local resident meetings

Action Item 4.2.2. Participate in the region wide electric car network to install plugs in Newark.

Action Item 4.2.3. Through grant opportunities, create incentives for residents to purchase high-efficiency vehicles.

<u>Residential Community Action Item 4.3 – Energy Conservation</u>

Using less energy is the most direct way to save energy. A personal climate action plan can help citizens recognize where they could easily reduce their energy use.

Action Item 4.3.1 As part of other outreach programs, prepare information on common ways to use less energy.

Action Item 4.3.2 Connect residents with private and public assistance programs, such as weatherization, PG&E, Energy Star, and Green Packages

Action Item 4.3.3 Continue to partner with Alameda County, stopwaste.org, and other California agencies to provide energy assessment and recommendation services and incentives to Newark residents.

<u>Residential Community Action Item 4.4 – CaliforniaFirst Program</u>

The City is participating in the development of a state-wide program to provide another financing option for homeowners to install energy efficiency measures on their homes. This program is in conjunction with the California Statewide Communities Development Authority and CaliforniaFirst program. Sacramento County has taken the lead in pursuing California Energy Program grant funding to create and administer the program. Stopwaste.org will be the local lead agency, providing all participating Alameda County cities with the action framework.

<u>Residential Community Action Item 4.5 – Increase Residential Recycling and Composting</u>

The City of Newark has already set a goal of 75% diversion of waste by 2015. The ultimate goal will be 100% diversion. Residents must make choices to use their recycle and green bins as

---

[6] City of Berkeley Climate Action Plan.

efficiently as possible and they must make choices to purchase items that can be recycled or composted.

Residential Community Action Item 4.6 – Water Conservation

As discussed earlier in this report, distribution of water requires about 4 watt-hrs per gallon. Water conservation saves energy and helps with the drought problem the State has been facing for the last several years.

Action Item 4.6.1	Research incentive programs for removing water intensive plants and replacing with drought tolerant plants.
Action Item 4.6.2	Outreach regarding drought tolerant landscapes.

Residential Community Action Item 4.7 – StopWaste.org Green Packages

RC Action Item 4.4 discusses one of the financing options for homeowners to install energy efficient measures on their homes. Bay Area residents and property owners can use the guidelines that Stopwaste.org is creating to determine which measures are appropriate for their homes. The Green Packages can be used independently of the financing opportunity.

Action Item 4.7.1	Continue to be serve on the Technical Advisory Group of the Green Packages Program.
Action Item 4.7.2	Use the City website and other communication avenues to market the Green Packages Program to residents
Action Item 4.7.3	Consider adding the Green Packages standards and specifications to this document when published.

Residential Community Action Item 4.8 – Multi-family Building Owners Assistance

Newark has several building

Action Item 4.8.1	Encourage participation in and educate the multi-family unit property owners of the Green Points Rated (up to three unit apartments) and LEED (four or more units) certification programs
Action Item 4.8.2	If funded, refer owners to the regional Multifamily Green Retrofit Fund for loan assistance to help pay for energy and water reduction capital purchases
Action Item 4.8.3	Partner with owners to encourage their residents' participation in planned residential actions

Chapter 5: Business Community Action Items

Business Community emissions account for 40.4% of the total emissions in Newark. Businesses in Newark probably contribute to about one half of the non-highway transportation emissions or about 10% of the total Newark emissions; resulting with the total Business Community emissions equaling about 50% of the total emissions in Newark. This is the largest single sector which means the largest benefit can come from businesses reducing their emissions.

The overall plan at this time for the business community is outreach starting with a partnership with the Chamber of Commerce.

<u>Business Community Action Item 5.1- Encourage businesses to prepare and make public a Climate Action Plan for their company.</u>

As with the municipal and personal Climate Action Plans, a business can take inventory of their emissions and review their operations for opportunities to reduce GHG emissions.

Action Item 5.1.1	Provide resources for businesses to create Climate Action Plans.
Action Item 5.1.2	Assist businesses with completed Climate Action Plans in information sharing and mentoring activities.
Action Item 5.1.3	Refer businesses to the Bay Area Green Business Program.
Action Item 5.1.4	Recognize businesses with Climate Action Plans

<u>Business Community Action Item 5.2- Increase Commercial and Business Recycling, Composting and Waste Reduction</u>

Action Item 5.2.1	Share City's goal of 75% waste reduction by 2015 with business community; request their support
Action Item 5.2.2	Facilitate information exchange between model businesses and those businesses in need of assistance.
Action Item 5.2.3	Provide green building, retrofit, and recycling information at the City's information portals i.e. permit counter, website, Channel 26, Community Center(s)

<u>Business Community Action Item 5.3- Consider Plastic Bag and Styrofoam Bans</u>

Action Item 5.3.1	Monitor success of other cities in the Bay Area that are enacting these restrictions.
Action Item 5.3.2	Assist businesses in marketing the use of reusable bags for shopping.
Action Item 5.3.3	Pursue grant opportunities to provide reusable bags to residents.
Action Item 5.3.4	Recognize businesses that encourage use of reusable bags and/or replace their Styrofoam use with biodegradable materials.

<u>Business Community Action Item 5.4- Green Building Standards</u>

Action Item 5.4.1 Require all modifications, additions and new buildings built for commercial or industrial purposes to use environmentally preferred building practices.

Action Item 5.4.2 Encourage LEED, HERS, and/or Green Point Rated Certification

Action Item 5.4.3 Provide resources and checklists to obtain green certifications through the City's Building Department

Business Community Action Item 5.5- Green Fleets

Action Item 5.5.1 Encourage the use of low-carbon emitting vehicles and fuels

Action Item 5.5.2 Share the City's experience with AFVs

Business Community Action Item 5.6- Assist businesses in developing and implementing commuter benefits programs

Action Item 5.6.1 Survey Newark businesses about their programs

Action Item 5.6.2 Encourage businesses with model programs to peer educate

Business Community Action Item 5.7- Water conservation

Action Item 5.7.1 Survey Newark businesses about their water conservation practices.

Action Item 5.7.2 Introduce Bay Area Friendly Landscaping and other successful programs to businesses.

Chapter 6: Transportation Planning and Zoning

Transportation accounts for 44.4% of the total emissions in Newark. Over half of that number is from the State highways adjacent to our city, but 20% of the emissions are from local driving. The Climate Action goal of transportation planning and zoning is to reduce vehicle miles traveled (VMT) by encouraging residents and employees to use alternative modes of transit and by improving the effectiveness of the transportation circulation system through land-use and zoning mechanisms. In 2005, the Metropolitan Transportation Commission estimated that 158.17 million vehicle miles traveled (VMT) occurred on Newark roads, emitting approximately 87,601 metric tons of eCO_2.[7] Newark has 104 miles of local roads.

The long-term goals of transportation planning and zoning are to:

- Reduce VMT of passenger vehicles to twenty (20%) percent below business-as-usual projections by 2030[8].
- Reduce VMT of heavy trucks to ten (10%) percent below business-as-usual projections by 2030.

In the AB32 Scoping Plan the California Air Resources Board points out that in order to meet statewide emission targets, local governments will have to make land use planning and urban growth decisions that minimize emissions. The Scoping Plan recognizes that local governments have the authority in those areas. The Scoping Plan discusses that major urban areas could provide a reduction of up to two percent over business as usual by 2020 with the implementation of planning and zoning emission reduction strategies but recognize that most of the transportation reductions will most likely be in the form of improved green vehicle technologies.[9]

Newark wants to be fully supportive of state-wide goals and the City will work diligently to implement planning and zoning strategies that will help reduce emissions.

Much of reducing VMT requires individual initiatives and different choices, such as walking, biking, and choosing public transit, instead of driving. Measures to encourage these changes include: incentives, programs, and policies by businesses, agencies, and other organizations. This may include ride sharing programs, subsidized transit passes, and locating employment near transit and activity centers; institutional policies and programs, including K-12 health educational classes and promotional materials and venues; and governmental policies, programs, guidelines, and standards, such as municipal transit policies and zoning code standards that cap the maximum rather than minimum number of parking requirements. Several factors will greatly influence the ease with which actions that reduce VMT can be implemented. These factors include:

Fuel Prices

[7] City of Newark Greenhouse Gas Emissions Analysis, August 2008. Page 7.

[8] The overall goals of this CAP are focused on 2020, but a 2030 goal is appropriate for discussions around long-term planning efforts. The Brookings Institute estimates that about half of the development that will exist in 2030 will have been built between 2000 and 2030. Brookings Institute. Dr. Arthur C. Nelson. www.citymayors.com/development/built_environment_usa.html

[9] California Air Resources Board, 2008 Draft AB 32 Scoping Plan. www.arb.ca.gov/cc/scopingplan/scopingplan.htm. Accessed January 2010.

Rising fuel prices, reduced driving frequency and trip length, whereas fuel price reductions spark an increase in driving. A UC Davis study shows that increasing auto costs by 50 percent decreased VMT by 16 percent.[10] It is clear that implementation will be greatly influenced by oil costs and other driving expenses.

Regional and State Collaboration
To achieve the required reduction in VMT, Newark will have to collaborate with other communities within the region, and with the state.

Resistance to Change Driving Patterns
Most drivers resist changing their travel modes. A survey conducted by the 1992 University of California, Irvine, the *Orange County Annual Survey* asked employed solo drivers to rate their likelihood of changing from solo driving in response to various fees and incentives. Fewer say they would be very likely to stop solo driving if they were subject to fees than if their employers paid them a cash bonus for no longer driving alone. Incentive or disincentive (% responding that it is very likely that incentive or disincentive would get them to stop driving along): parking fee (20%), smog fee (17%), congestion fee (16%), cash bonus to stop driving (28%), more public transit (33%) more carpools to work (35%).[11]

Challenges in Integrating Expansion of Transit and Transit-oriented Development
Expanded transit with land use intensification around light rail stations generally decreases VMT about 5% with the collateral benefit of decreased travel costs. Generally, increasing land use density succeeds only when walking and biking modes are adequate. Thus, support for implementation will depend on integrating both the form of development and the convenience, economy, safety, and the attractiveness of its mobility systems. Area 2 is planned around a future Dumbarton Rail Station that could utilize these ideas.

Competition with Roadway Infrastructure Improvements
Expanding road capacity generally increases auto travel and therefore, also increases emissions. In particular, new or expanded HOV lanes on freeways increase travel, so both provide significant constraints to other actions that reduce driving. As a result, ease of implementation will depend on other regional and State transportation decisions.

Perceived Threat of Climate Change
A well-documented and significant shift in the observable impact of climate changes - the reporting of the collapse of the Antarctic Ice Sheets, for example - could greatly accelerate the public‘s willingness to change travel behavior, and support governmental policies and standards for reducing emissions. But absent a dramatic climate change event reported by the mainstream media, or a displacement of climate change news by economic or political news, for example, it is less likely the public will change travel behavior.

Realizing Combined Benefits of Land Use, Transit, and Mobility Strategies

[10] Chester, Mikhail V., Life-cycle Environmental Inventory of Passenger Transportation in the United States. Institute of Transportation Studies, University of California Berkeley, August 1, 2008. The author‘s website includes related presentations, news coverage, and previous draft versions
[11] US Department of Transportation has published more information on Intelligent Transportation Systems (ITS): www.its.dot.gov, www.itsoverview.its.dot.gov

An American Public Transportation Association (APTA) study on public transit and land use found that switching from an auto trip to a transit trip not only saves a certain amount of fuel, but also the presence of transit itself helps create fuel-efficient neighborhoods. APTA found that in transit enabled built environments, people drove less, walked more, and used transit more. The secondary effect was twice the magnitude of the primary effect.[12] Thus, educating the public and policy makers on the combined benefits of both land use and transportation strategies will make implementation easier.

Cost

To be successful, residents and businesses will have to participate in efforts to reduce VMT. To achieve the level of participation that is necessary to meet aggressive emissions reductions goals, the City will have to pay for ongoing outreach, education, and marketing.

Investment costs associated with zoning and planning strategies include paying City staff to develop programs that aim to reduce VMT. The ongoing operation and maintenance costs include paying one person of a staff of people to coordinate all of numerous commuter programs and to administer the programs. Depending on how the City develops the programs, the City may not pay for operational costs.

Additional Benefits

Reducing VMT will result in a smaller amount of fuel burned within Newark. Reduced fuel consumption will result in a reduction of not only GHGs but a number of hazardous air pollutants including nitrogen oxides, sulfur oxides, ozone, and particulate matter. Reducing fuel consumption could result in health benefits and improved local and regional air quality. Near-source air pollution impacts have the most serious health consequences and are more akin to occupational exposures. Transportation emissions are not only diluted and dispersed fairly rapidly, but they evolve even more rapidly. Fresh mobile air pollutants evolve furiously in the first three seconds and subsequently into much less dangerous size, composition, and concentration the first three minutes after exhaust. For example, educational tools can be used to illustrate that those living within 100 yards of major congested highways or City streets can have occupational-scale exposures similar to long-haul truckers, urban delivery van drivers, or diesel rail engineers.[13]

Planning and Zoning Action Item 6.1:

During the next General Plan update, review and evaluate appropriate transit modes that can decrease the need for personal vehicles for travel within the City. When proposing changes to the transportation system, the City should consider the climate impacts and give preference to solutions that reduce auto dependency and minimize GHG emissions.

Planning and Zoning Action Item 6.2:

Encourage smart growth principles that support higher-density, mixed-use and well-designed development in areas near the proposed future transit station and areas near major bus routes.

Planning and Zoning Action Item 6.3:

---

[12] Journal of Public Transportation. Transit Price Elasticities and Cross-Elasticities. 2004, Vol 7, No. 2, pp. 37-58. WWW.nctr.usf.edu/jpt/pdf/JPT 7-2 litman.pdf. City of Hayward Climate Action Plan

[13] City of Hayward Climate Action Plan.

Explore the development of zoning and development standards that consider both the land uses and the urban design and form of buildings and public space, where the new standards will result in reduced GHG emissions.

Planning and Zoning Action Item 6.4:
Explore potential strategies related to the creation of additional affordable housing to sell to buyers employed in Newark, but who currently reside in other areas and commute to work in Newark.

Planning and Zoning Action Item 6.5:
Consider developing and adopting a Buy Local Plan that would give preference to local businesses. The plan should consider incentives such as marketing and promotion assistance for buy local businesses, continue to support the local farmers market, encouraging residents to grow food in home and community gardens, working with community partners to identify methodologies for tracking and reporting on the rate of local food production and consumption.

Planning and Zoning Action Item 6.6:
Accelerate Implementation of the City's Bicycle and Pedestrian Plans. Upon completion of the plan in October 2010, explore components whose implementation can be accelerated. This CAP should be updated with the recommendations of the completed plan.

Planning and Zoning Action Item 6.7:
Create ridesharing programs.

Planning and Zoning Action Item 6.8:
Enhance and expand outreach, marketing and education regarding landuse and transportation. Personal choice underlies many of the transportation-related changes that will have to occur in order for the community to achieve its GHG-reduction goal. Enhancing and expanding current education and outreach efforts is therefore fundamental to this plan. Such efforts are aimed at providing community members with access to information that enables them to make informed choices. For example, specific information about the economic and environmental impact of riding public transit or a bicycle as opposed to driving a car may influence the transportation choices one makes. Along with the City government, regional agencies and local community-based organizations are already playing a key role in providing information that can inform community members' choices.[14]

[14] City of Berkeley Climate Action Plan.

Chapter 7: Goals and Monitoring Plan

Goal Setting

In each of the previous chapters, staff presented and, where possible, evaluated actions for reducing emissions from several of the sectors comprising City and community GHG sources. Many of the recommendations were analyzed on a cost-benefit basis. Emission reduction goals have been set based on the analyses in this report and on the State's AB 32. Staff recommends adopting the following overall target goals across City and community operations:

1. Set greenhouse gas emissions reduction targets as follows:

   A. A 5 % reduction from 2005 Municipal emissions levels by July 2012. This would equal a reduction of 194 metric tons eCO_2.

   (194 mt eCO_2 is equivalent to the emissions from 11,000 gallons of gasoline combined with the energy used in 9 homes.[15])

   B. A 5% reduction in City and Community emissions by July 2015. This would equal a reduction of 21,680 metric tons of eCO_2.

   (21,680 mt eCO_2 is equivalent to the emissions from 1,230,000 gallons of gasoline combined with the energy used in 985 homes.)

   C. A community-wide target of a 15% decrease from 2005 levels by 2020, equal to a reduction of 65,038 metric tons.

   (65,038 mt eCO_2 is equivalent to the emissions from 3,650,000 gallons of gasoline combined with the energy used in 3000 homes.)

   Achieving goal C would enable Newark to match the State of California's goal of 1990 emission levels by the year 2020 (statewide it is estimated that 2005 emissions were 15% higher than 1990 emissions).

2. Incorporate carbon reduction into the City's General Plan goals to ensure continuity with other City priorities, continued action, and a long-term perspective.

3. Use this Climate Action Plan as a springboard for determining GHG reducing actions to take over the next few years. As possible, it shall be revisited and action steps reformulated at least biennially.

4. Maintain and report GHG inventories on a regular basis including:
   - Conducting regular community-wide GHG emission estimates using methodological advances to improve the estimates presented here.
   - As possible, conduct biannual municipal operations GHG emissions inventory.

[15] Equivalencies calculated with EPA's Greenhouse Gas Equivalencies Calculator (www.epa.gov/cleanenergy/energy-resources/calculator.html). The "home" unit is based on the national average single family household energy use.

5. Promote participation by Newark businesses in inventory efforts. These efforts should include:
    - Participating in regional efforts to promote consistent, science-based, reasonable, and transparent GHG inventory accounting.
    - Working with ICLEI, California Climate Action Registry, California Air Resources Board, US EPA or other broad based organizations who are working on developing new approaches to estimating emissions from refuse (landfills, recycling, composting) activities, water treatment, natural gas distribution systems, and other pertinent and applicable municipal operations.
    - Identifying and tracking long-term methodology and metrics for measuring progress (e.g. total, net, per-square-foot, per capita, per unit GDP, etc.).

Examples of other jurisdictions' goals

Jurisdiction	Climate Protection Budget*	GHG reduction target
Berkeley	~$10.1 million (FY2009,2010 only)	33% below 2000 level by 2020 and 80% below 2000 level by 2050
Chula Vista	~$2.8 million one-time costs; $1.99 million annually	20% below 1990 by 2010; 35% below 1990 level by 2035
Hayward	~$1.3 million	6% below 2005 level by 2013; 12.5% below 2005 level by 2020, 82.5% below 2005 level by 2050
Los Angeles		35% below 1990 level by 2030
Palo Alto		5% below 2005 level by 2012 and 15% below 2005 levels by 2020
Union City		Municipal Operations 30% below 2005 level by 2020.
Sacramento		1990 level by 2020, 25% below 1990 level by 2030, 80% below 1990 levels by 2050
San Jose		35% below 1990 level by 2020
Fremont		25% below 2005 level by 2020
Alameda County		80% below 2007 level by 2050
Marin County		15% below 2000 level by 2020
San Francisco		20% below 1990 level by 2012
Sonoma County (a)		25% below 1990 levels by 2015
State of California: AB 32		2000 level by 2012, 1990 level by 2020, and 80% below 1990 level by 2050
Kyoto Protocol		1990 level by 2012
U.S. Mayors' Climate Protection Agreement		1990 levels by 2012 (or better)

(a) All nine cities in Sonoma County have adopted targets at least as aggressive * as available

Monitoring

The City will measure its overall progress in reducing GHG emissions by:

- Completing the California Climate Action Registry inventory, or similar inventory, every two years, starting in 2011.
- Updating ICLEI inventory for community-wide emissions every five years.
- Monitoring the effectiveness of actions undertaken on an annual basis.

Actions to Date

Since 2005, the City of Newark has implemented some emission reduction actions. These actions work towards Goal 1-A.

Municipal Actions	Emissions in Metric Tons of eCO_2	% reduction
2005 Municipal Emissions	3881	
Community Center Lighting Retrofit	16.8	0.4%
Silliman Center Lighting Retrofit	5.5	0.1%
Fuel Use Reduction*	52	1.3%
Remaining Reduction neededto meet 2012 Goal	120	

*Due to driving policy modifications and reduced staffing levels, fuel use has decreased by about 7.7%, 5900 gallons, since 2005.

As mentioned in Chapter 3, measures that will be implemented in 2010 will provide us with the sufficient emission reductions to meet the 2012 goal.

Chapter 8: Adaptation

Even if the City of Newark, the State of California and the United States take a leadership role in combating climate change, there will still be some affects. The most notable in the Bay Area is the predicted rise in water level of the San Francisco Bay. Other affects include weather changes and an increase in fires in the surrounding areas.

Several documents are emerging on the topic of climate change adaptation. ICLEI has prepared a Guidebook for Local, Regional and State Governments and the State of California has prepared a Climate Adaptation Strategy Discussion Draft.

<u>Adaptation Action Item 8.1- Conduct a Vulnerability Assessment.</u>

<u>Adaptation Action Item 8.2- Develop a strategic plan of Climate Change Adaptation.</u>
New, more accurate information about the current and future effects of climate is becoming more and more available. Researchers at institutions such as UC Berkeley, Lawrence Berkeley National Labs (LBNL), the San Francisco Bay Conservation and Development Commission (BCDC), and the Union of Concerned Scientists are generating models that governments can incorporate into strategic and capital planning efforts. For example, according to a report released by the California Climate Change Center[16], if heat-trapping emissions continue unabated, the Sierra Nevada spring snow-pack could shrink by 90 percent by the end of the century. Shrinking snow-pack would affect this region's water supply. This is a regional issue with a regional solution; however Newark will work with regional agencies including the Alameda County Flood Control District and BCDC to adapt to any rise in water levels. Scientists also project that global warming may affect Californians' health by exacerbating air pollution and causing more extremely hot days.

Arnold Schwarzenegger issued Executive Order (EO) S-13-08 directing state agencies to enhance the State's management of climate impacts from sea level rise, increased temperatures, shifting precipitation and extreme weather events. As part of implementation of EO S-13-08, the California Resources Agency, along with the Cal/EPA, the Business Transportation and Housing Agency, the Department of Health and Human Services, and others, is developing the State's first comprehensive Climate Adaptation Strategy (CAS). Newark will participate, when possible in the planning and implementation of the CAS. This will help each level of government better understand its role in developing robust adaptive strategies. Further, cooperation across levels of government will assist cities, counties, regional agencies and the state to become better informed regarding adaptation efforts already underway and the resources available to become more resilient to a changing climate.

[16] "Our Changing Climate: Assessing the Risks to California," A summary report from the California Climate Change Center, July 2006

Introduction

This report provides a summary of three projects the City of Newark researched to conserve energy and improve efficiency at the City's recreation centers. A lighting retrofit at the Newark Community Center was selected as the first project. The second project was also a lighting retrofit, specific to the gymnasium room at the Silliman Activity Center. And finally, the Silliman Family Aquatic Center was identified as the third project. Many opportunities for energy efficiency exist at the Aquatic Center considering the equipment and amenities of its water features. Because of its prospects, options including renewable energy technologies were reviewed to increase energy efficiency. Each project is at a different stage of development and/or implementation.

All projects were stalled due to City budget cuts, which were unknown at the time of grant application. On March 31, 2008, the Maintenance Division was required to lay off one Building Mechanic position, leaving only three personnel to provide building maintenance to the City's approximately 240,000 square feet of facilities. This building mechanic was nearing completion of the Community Center project, and was scheduled to begin work on the Silliman Center gymnasium project shortly after his lay off.

The Newark Community Center Lighting Retrofit project has saved the City 18,333 pounds of eCO_2[1] to date by reducing the electricity use in these fixtures by 60%[2]. This translates to an overall savings at that site of 9%[3]. The Silliman Activity Center Gymnasium Lighting Retrofit project is estimated to reduce eCO_2 by 7,110 pounds per year by reducing the electricity use in these fixtures by approximately 70%. Due to the combined electricity usage data of the Silliman Activity Center and the Silliman Family Aquatic Center, it is impossible to determine the percentage of savings this represents for only the Silliman Activity Center site. We expect to have the lights installed in the gymnasium by summer 2009. The Silliman Family Aquatic Center project determined that a more in-depth study is the next step towards energy efficiency. A multitude of options is available, and the solution will likely incorporate more than one measure. Funding for this type of study (up to $15,000) will be pursued through the Economic Stimulus Funding Energy Efficiency and Conservation Block Grant Program. If awarded, staff will prepare a Request for Proposal to invite companies to bid on a complete energy efficiency study for the Silliman Family Aquatic Center. In addition, staff will pursue approval for study implementation recommendations including

---

[1] STAPPA/ ALAPCO, and ICLEI's Clean Air and Climate Protection software; estimated monthly kwh savings (wattage saved converted into kwh multiplied by estimated number of hours bulbs are in use per Recreation Coordinator Sheila Allen, manager of the Community Center building rental program) converted by software and multiplied by the number of months since completion of retrofit

[2] Number of bulbs multiplied by the wattage of bulbs of original lighting minus the number of bulbs multiplied by the wattage of new lighting converted into a percentage

[3] Per PG&E invoices, the July 2006 – June 2007 total kwh usage divided by 12 months, obtaining a monthly kwh usage average prior to commencement of the project; the monthly kwh savings divided by the monthly kwh usage averaged from FY06-07 converted into a percentage

requesting Capital Improvement Funds and researching grant opportunities. A time frame cannot be placed on this project until the funding source is identified.

The energy savings achieved by these projects so far has been 1.5% reduction in electricity use[4]. The overall energy savings expected from all three projects being complete is estimated at 43%[5]. This is slightly above what we expected before we analyzed these projects.

Project 1: Newark Community Center Lighting Retrofit

1.1 Existing Building Data

The Community Center building is a 15,000 square foot multi-use facility which includes a reception area, four offices, a staff common area, a vending room, two preschool rooms, a meeting room, two banquet rooms, and a kitchen with commercial appliances. Electricity is used to power the indoor and outdoor lighting, office equipment, vending machines, appliances, and HVAC system.

The Community Center's four decade old design presents many challenges for energy efficiency. Built in 1968, the Community Center's masonry and wood architecture with vaulted ceilings lend to a charming country feel. The building's award-winning architecture is highly regarded by Newark residents and visitors. Preserving the architectural integrity of the building is important to Newark, and as a result, an additional challenge when considering any energy upgrades. Therefore, structural changes or upgrades requiring design changes or physical alterations were not considered.

Inside the Community Center, the existing lighting included 50, 75, and 90 watt incandescent bulbs and T8 style 32 watt fluorescent tubes. Along the outdoor perimeter, 65 watt fluorescent bulbs were in use. This lighting configuration is estimated to have been using 16,009 kwh of electricity a month[6] or 17,373 pounds of eCO_2.[7] A lighting retrofit became the obvious choice to improve the building's energy efficiency. The lighting retrofit was estimated to cost $5,000 which could be

---

[4] Per PG&E bills, monthly kwh savings estimated from the completed Community Center and progress to date Silliman Center Gymnasium lighting retrofit projects divided by the monthly kwh average of the Newark Community Center, Silliman Activity Center, and Silliman Family Aquatic Center.
[5] Per PG&E bills, monthly kwh average of the Newark Community Center, Silliman Activity Center, and Silliman Family Aquatic Center divided by the monthly kwh savings estimated from the Community Center and Silliman Center gymnasium lighting retrofit projects; and the Aquatic Center project savings per the September 13, 2007 PacificWest Solutions Preliminary Energy Services Proposal (numbers within proposal were provided for illustrative purposes only).
[6] Original wattage of all lighting identified for retrofit converted to kwh multiplied by hours in use per month
[7] Clean Air and Climate Protection software used to convert kwh to eCO_2. Exact estimations of eCO_2 cannot be determined due to the various sources (natural gas, coal, nuclear, etc.) PG&E derives its power from and supplies our specific facilities.

accommodated within the existing Building Maintenance Budget (CIP 878: Citywide Building Upgrades, an ongoing fund replenished annually).

In addition, replacement of the original boiler HVAC system was also identified as a priority for energy efficiency reasons. It also needs replacement because it is past its functional life span. The estimated cost of replacing portions of the HVAC system to increase its life span and productivity is $250,000 and could not be accommodated in the existing budget.

1.2 Lighting Retrofit Data

In 2007, upon request from City staff, a lighting specialist toured the Community Center facility to evaluate the Community Center's lighting efficiency. Due to the tie in of the HVAC system to the lighting switches and the architectural challenges, options such as sensors and dimmers could not be considered. The only option was to change the lighting fixtures and/or bulbs. The lighting specialist presented recommendations for each room in the Community Center. Recommendations ranged from simply changing the type of bulb to installing entire new fixtures. City staff reviewed the recommendations and determined that several rooms could be retrofitted based on the City's staff and budget available at the time. Some of the recommendations were not authorized for implementation due to the complexity and potential cost of installing new fixtures. Funding for the scaled down project was identified within the existing building maintenance budget and assigned to staff to complete as time allowed.

From July 2007 to March 2008, ballasts and bulbs were replaced throughout the facility as time permitted. Only the staff offices and restrooms had already been upgraded to energy efficient lighting prior to 2007, so these areas were not included in the project. As mentioned earlier, layoffs halted this project near its completion. By the end of March 2008, the center's lobby, two banquet rooms, reception area, and hallway were retrofitted with 22 watt compact fluorescent light bulbs (cfls) and T5 type 25 watt fluorescent tubes. Along the outdoor perimeter, 22 watt cfls were installed. A total of 118 cfls were installed inside, 21 cfls were installed outside and 66 T5 tubes were installed. After the ballasts and bulbs were replaced, the reception area wall was painted to reflect more light, providing even greater efficiency and productivity.

All other areas in the Center are on hold until time permits existing staff to complete the project or the budget allows additional staffing. When the project restarts, three rooms will likely be included in the next phase. Collectively, these rooms contain 28 T8 type fluorescent tubes and 16 incandescent bulbs. Future retrofitting may include the tennis court and park lights.

1.3 Energy Savings Achieved

Each indoor incandescent bulb replaced with a cfl saved 53-68 watts. A total of 118 cfls were installed inside. Each outdoor 65 watt fluorescent bulb replaced with a cfl saved

43 watts. A total of 21 cfls were installed outside. Each T8 tube replaced with a T5 saved 7 watts. A total of 66 T5 tubes were installed.

Table 1.3.1 – Newark Community Center Lighting Retrofit – Completed to Date

Original Bulbs	Replacement Bulbs	Bulb Count	*Monthly Energy Savings*		
			kwh[8]	$[9]	eCO_2 (pounds)[10]
50, 75, & 90 watt incandescent	22 watt cfl	118	119	$17	129
T8 32 watt fluorescent	T5 25 watt fluorescent	66	302	$42	328
65 watt fluorescent	22 watt cfl	21	1,456	$204	1,580
TOTALS		**205**	**1,878**	**$263**	**2,037**

For building maintenance staff, retrofitting light bulbs to cfls and painting were fairly simple tasks, requiring a minimal amount of time per bulb. The T5 retrofit was the most involved; up to 60 minutes of staff time was needed for the typical two tube fixture. So far the retrofit has taken 46 hours of staff time. It is estimated an additional 16 hours is still needed to complete the project.

A review of the PG&E bills from fiscal year (July - June) 2006-2007 to fiscal year 2007-2008, show that the Community Center saved 31,000 kwh, an average of 2,583 kwh per month which equates to 2,803 pounds of eCO_2. This saved the City $3,517.82, an average of $293.15 per month. Savings are expected to increase over time in part because the longer lasting cfls have up to a double life expectancy, relieving staff time and reducing supply purchases for bulb replacement.

The cost of the project included $2,900 for up front purchase of the bulbs and ballasts, and $1,632 for staff time, making the total cost of the project $4,532.

1.4 Future Energy Efficiency Projects

As mentioned above, the lighting project will be completed as time permits.

The next project to improve energy efficiency at the Newark Community Center will be the HVAC system including the original boiler/chiller. The whole facility is controlled by a central system with a master thermostat panel. In addition to the antiquated, high energy using equipment, the existing HVAC system contains pumps and motors that run 24 hours a day. Realizing the potential for the HVAC system to fail in the near future because of its age, the City authorized funding through the citywide equipment

[8] Original bulb wattage minus the replacement bulb wattage converted into kwh multiplied by the number of hours used per month
[9] Kwh energy savings multiplied by the average kwh cost per FY06-07 PG&E bills for the Community Center
[10] Using Clean Air and Climate Protection software, converted kwh to eCO_2

replacement account. While the Center's architecture will still contribute to climate control issues and design challenges, funding will allow changes to the system that will result in improved energy efficiency. The proposed changes will separate out the two large banquet halls from the central system. This will require considerable less usage of the original boiler and chiller system (saving energy), and allow energy efficient units to service the two largest, revenue generating rooms in the facility. Design of potential changes is in progress. The project is scheduled to go to bid in 2009.

Project 2 - Silliman Activity Center Gymnasium Lighting Retrofit

2.1 Existing Building Data

The Silliman gymnasium is one room within a multi-use recreation facility. This particular area has an inefficient lighting system which differs from the rest of the facility. The lighting is inefficient in that it does not light the gym well, it warms up slowly and the bulbs are not low wattage bulbs. The 2001 installed system included (64) 250 watt Metal Halide bulbs – 36 bulbs in the ceiling fixtures, 18 wall washer fixtures, and 10 dormers.

Lights in the gymnasium were being turned on first thing every morning (between 5:00 and 6:00 a.m.), and left on all day (until 9:00 or 10:00 p.m.) because the lighting required a warm-up period of approximately 30 minutes. This challenged facility staff because throughout the day, hours were reserved for open gym. During open gym, a person could arrive at anytime unannounced requiring immediate access to the gymnasium. In order to accommodate customers in a timely manner, staff decided the lights were to remain on during all of the facility's operating hours.

In early 2008, staff reviewed operations and made several changes. Operating hours were decreased, and emphasis was put on saving energy. Staff decided that enough natural light entered the gymnasium, allowing staff to keep lights off when not in use. While lights warmed up for customers, natural light was enough to allow customers to use the gymnasium safely. This change alarmed some customers at first, but proved to be an effective method of energy savings.

2.2 Lighting Retrofit Data

In addition to operational changes, the Building Maintenance Division began planning a retrofit of the lighting. Maintenance Supervisor Robert McKinney[11] reviewed energy usage reports and observed the gymnasium in use. He visited similar facilities such as the San Leandro High School gymnasium and two community centers in the City of Fremont. At these sites, he spoke with representatives about their lighting system experiences, and studied the aesthetics and illumination each lighting system provided. Maintenance Supervisor McKinney found that two basic types of lighting existed for

[11] Maintenance Supervisor Robert McKinney oversees all building maintenance staff. He can be reached at 510-578-4802 or Robert.mckinney@newark.org

gymnasiums, and concluded that only one would fit with the Silliman Activity Center architecture.

Once the bulb was selected, Maintenance Supervisor McKinney considered variations of lighting numbers and types. Prior to installation, he predicted that the new layout would include just 24 fixtures. This is due to much of the gymnasium lighting being used is for aesthetic purposes versus functionality. Maintenance Supervisor McKinney concluded that the 18 wall washers and 10 dormer lights could be put out of service, as they appeared to provide no lighting for the courts or audience areas. He also concluded that 12 of the 36 ceiling fixtures could be put out of service without compromising the desired illumination.

With a new lighting layout plan, Maintenance Supervisor McKinney requested that PG&E visit the site to calculate the potential energy savings. Each original fixture consisted of one 250 watt metal halide bulb. Each new fixture includes eight (8) 40 watt compact fluorescent bulbs. PG&E and Maintenance Supervisor McKinney agreed that this retrofit could achieve at least a 70% energy savings[12].

Installation began in February 2009. As planned, 12 of the 36 ceiling fixtures were put out of service. The remaining 24 fixtures were replaced, and each fixture provides twice the lighting to the gymnasium floor compared to the original fixture[13]. However, each corner of the gymnasium was darker than desired. To provide lighting in these areas, Maintenance Supervisor McKinney decided to replace eight of the dormer fixtures. Four have been replaced to date at two of the gymnasium corners. This solution provides the desired illumination. The remaining four dormer fixtures are scheduled to be replaced by June 2009, contingent upon shipment of the additional fixtures (two are on hand and three are on order; two for installation and one for inventory). When all 32 fixtures are installed, a final evaluation will be conducted. It is expected that all remaining gymnasium fixtures not replaced with cfl bulbs will be electrically disconnected.

2.3 Energy Savings Data

The immediate savings will be attained by decreasing the gymnasium lighting by 8,000 watts; a reduction of 50%[14]. The overall energy savings will be realized by the aforementioned wattage reduction, and shorter usage time due to the ability to eliminate a warm-up period. With the new bulbs, the lights will only be on while the gym is in use. The City will also achieve a long term savings of changing the bulbs less often.

The new fixtures will increase the wattage from 250 to 320 watts, but a 50% reduction in fixtures creates the large overall wattage reduction. Reduced use and elimination of a

[12] Original wattage used multiplied by number of hours originally used minus new wattage multiplied by new number of hours used (no warm-up period and non-use when room is vacant)
[13] Building Maintenance staff used a foot candle meter at the gymnasium floor level, measuring 12 foot candles directly under the old lighting fixture and 24 foot candles directly under the new lighting fixture
[14] Original wattage total minus the new wattage total, converted into a percentage

warm-up period is expected to save an additional 25%[15], which equates to 273 kwh per month[16] or $38[17]. The long term staff time saved equates to 5.3 hours[18]. The expected monthly savings from the progress to date is $114 in PG&E costs[19] and 889 pounds of eCO_2[20]. Upon completion of this project, the total expected monthly savings in PG&E costs is $117[21]. The total expected monthly eCO_2 savings is 913 pounds[22].

In November 2008, building maintenance staff completed a mock installation of one fixture in order to estimate the staff time required for the lighting modification. At that time, the project appeared to require two Building Mechanics (2/3 of our current staff) and two (2) to three (3) hours per fixture to install. Building Mechanic staff continued to work with the model and determined that the original fixture's mounting bracket could be used with the new light fixtures. This step cut both the installation time and labor in half. Now, one Building Mechanic could safely install one lighting fixture in approximately one hour.

This solution required approximately eight hours of Maintenance Supervisor time for research, logistical coordination, and oversight. For the 28 completed fixtures and mock installation, one Building Mechanic II spent 31 hours of regular time. An additional eight hours of Building Mechanic II time is estimated for installation of the remaining fixtures and disconnection of the original fixtures. To date, staff costs are $1,592, and estimated to total $1,887 upon completion of the project. In addition to staff costs, 30 bulbs were purchased at a cost of $17,846. This order was based on the original goal of 24 fixtures. Once it was determined to increase the fixture total to 32, an order was placed for additional fixtures (two to complete the project and one for inventory) at an estimated cost of $1,800. Total costs for this project, including staff time, are expected to be approximately $21,533.

Project 3 - Silliman Family Aquatic Center

3.1 <u>Existing Building Data</u>

This 32,320 square foot indoor aquatic center was the second phase of a multi-use recreational facility. Though just a few years old, this facility consumes over 60% of the

---

[15] Estimated by PG&E and Maintenance Supervisor McKinney based on hours no longer needed due to replacement bulbs eliminating need for use while room is vacant.
[16] Converted percentage into kwh
[17] Multiplied kwh per month by average kwh cost
[18] Estimated original bulb maintenance time per fixture multiplied by number of fixtures minus new bulb maintenance time per fixture multiplied by number of fixtures divided by difference between expected life of current bulbs and expected life of replacement bulbs
[19] Added expected monthly cost savings of change in bulb wattage of replaced bulbs to date to expected monthly cost savings of additional savings from non-use while room is vacant.
[20] Using Clean Air and Climate Protection software, converted monthly cost savings into eCO_2
[21] Added expected monthly cost savings of change in bulb wattage of total project to expected monthly cost savings of additional savings from non-use while room is vacant.
[22] Using Clean Air and Climate Protection software, converted monthly cost savings into eCO_2

City's total PG&E bill. With energy costs continuing to rise and the City's desire to lead a greener Newark, this facility became the focus of potential financial savings and carbon dioxide emission reductions.

The facility includes a reception area, staff offices, restrooms, café, vending machines, and the natatorium. The current lighting system consists mainly of T8 fixtures with minimized control, contributing to a significant lighting load. The HVAC system consists of packaged roof units, an air to air heat exchanger, rooftop hot water boilers, and a CSI control system. Heating the pool requires four natural gas powered heaters. Ensuring quality water flow requires 12 electrical powered pumps, equivalent to over 115 horsepower. Two large air handlers, one which runs 24/7 and the other which runs approximately 18 hours per day, use a considerable amount of electrical power. Through PG&E's InterAct software, City staff has been able to review the facility's energy usage in great detail, assisting the City in focusing its energy saving efforts.

Over $30,000 is spent annually to maintain and repair the pool's heaters, pumps, and controls. In addition, one of the three Building Mechanics employed by the City is almost exclusively dedicated to this facility.

3.2 Energy Saving Alternatives Researched

Opportunities to increase energy efficiency and reduce carbon emissions are numerous. This section will look at the options that apply to the aquatic center and analyze the feasibility of each option based on cost, reduction potential, lifecycle impacts and site constraints. Information provided by vendors and experts is generally based on phone and email communications. Funding was not allocated for studies or other tools that could provide exact cost-benefit analyses. Two companies, PacificWest Solutions and Suntrek Industries, completed tours of the facility and collected utility information for their proposals. Numbers provided in their proposals are for illustrative purposes only.

3.2.1 Cogeneration

PacificWest Solutions[23] provided recommendations to improve the Aquatic Center's lighting, HVAC, and pool systems. Cogeneration, a way of using waste heat to generate electricity, was a top recommendation. Cogeneration requires the installation of a natural gas driven generator. In addition to reducing gas transportation, cogeneration would replace the four heating units as the pool's water heating source. Significant savings could be achieved through maintenance and repair reductions, in addition to both energy costs and carbon emissions reduction. A life cycle analysis of the exact CO_2 savings would reveal an even greater savings in the transportation and manufacturing phases.

[23] Contact information: Robert Cho, PE, CEM, CMVP, President, PacificWest Solutions, Inc., 3941 Park Drive, Suite 20-179, El Dorado Hills, CA 95762; 775-772-2123 Mobile; 916-941-8326 Office; 916-404-0392 Fax rcho@pacificwestsolutions.com

When PacificWest Solutions' original proposal was provided in 2007[24], the rebate incentive for cogeneration was much higher than it was in 2008[25]. The City hopes that the cogeneration rebate will rise again, making this a more viable option for the City. Cogeneration was one of several recommendations presented as a package, and therefore numbers related specifically to cogeneration are not available. The package as a whole is detailed in Section 3.3.1, including a return on investment analysis, upfront costs, ongoing costs, and projected savings. The City estimates cogeneration to cost $720,000.

3.2.2 Frequency Drive Controllers

Another top recommendation from PacificWest Solutions, which confirmed our own research, is to install variable frequency drive controllers on the pools' 12 pumps. This would assist in managing the flow rates, with special regard to the water features. Allowance for day and night variances would also assist in powering down the pumps, reducing the carbon emissions and energy costs. The addition of a computerized programmable logic control for the pump system would also be a beneficial feature. The control would modulate the pump speed and provide improved control.

Frequency Drive Controllers are estimated at $60,000. Installing Frequency Drive Controllers was one of several recommendations PacificWest Solutions presented as a package, and therefore their numbers related specifically to frequency drive controllers are not available. The package as a whole is detailed in Section 3.3.1, including a return on investment analysis, upfront costs, ongoing costs, and projected savings.

3.2.3 Heating, Ventilation and Air Conditioning (HVAC)

While the heating, ventilation, air conditioning (HVAC) units, and lighting systems are somewhat energy efficient, PacificWest Solutions noted that improvements can be made to further reduce carbon emissions. Recommendations included recommissioning the HVAC units for optimal operation, and taking advantage of the scheduling option in the automated building system to allow staff to fine tune operations and facilitate building equipment maintenance. The HVAC system has received regular preventative maintenance and does not need recommissioning at this time, but this is recommended to occur in about 6 years.

Without a detailed evaluation of the HVAC system, a recommissioning can be estimated to cost up to $100,000. HVAC modification was one of several recommendations PacificWest Solutions presented as a package, and therefore their numbers related specifically to HVAC modification are not available. The package as a whole is detailed in Section 3.3.1, including a return on investment analysis, upfront costs, ongoing costs, and projected savings.

---

[24] PacificWest Solutions Energy & Facility Services Preliminary Energy Services Proposal for the City of Newark, September 13, 2007

[25] PacificWest Solutions Energy & Facility Services Preliminary Energy Services Proposal for the City of Newark, December 12, 2008

3.2.4 Lighting Retrofit Options

PacificWest Solutions recommended changing the T8 lighting to T5. The City is concerned about the time involved in retrofitting the fixtures. A more in-depth study may reveal that the energy savings is minimal in comparison to the staff time required to complete this type of project. Another lighting recommendation included installing increased lighting controls, offering greater control of use.

The City estimates lighting upgrades to cost approximately $20,000. Lighting upgrades was one of several recommendations PacificWest Solutions presented as a package, and therefore their numbers related specifically to lighting upgrades are not available. The package as a whole is detailed in Section 3.3.1, including a return on investment analysis, upfront costs, ongoing costs, and projected savings.

3.2.5 Solar and Wind Power

Solar and wind power are natural, renewable forms of transforming energy into electricity. The facility's roof faces south-southeast, an ideal position to capture the sun's energy. A large field behind the facility may also be an option for a solar farm. Another option to consider would be construction of a carport structure in the existing parking lot with roof mounted solar panels, similar to the Alameda County Courthouse in Fremont. Solar requires a significant upfront cost, averaging a 15 year payback. Systems may be leased or owned, and various agreements can be entered into. Currently, the Joint Venture Silicon Valley Climate Protection Taskforce has a subcommittee exploring various financing options, including a power purchase agreement. Results are expected in 2009, and may provide the City of Newark an opportunity to significantly reduce the costs associated with solar systems.

Since sun is more prevalent than wind in terms of generating power in our region, solar power projects have been more common than wind. The City of Hayward purchased solar panels for one of its facilities. The cost was $1.8 million, half of which was paid for through a PG&E grant and half is being financed by the City of Hayward[26]. According to PowerLight[27], the vendor that installed the solar panels for the City of Hayward, the anticipated energy savings averaged $51,400 in reduced electrical costs and over 66 tons of eCO_2 annually. City of Hayward Facilities Manager Avila stated that the solar panels are generating more electricity than needed to power the facility housing the solar panels. While exact savings numbers were not available, the City of Hayward reports a positive experience with its solar project.

In addition to photovoltaic solar panels generating electricity, solar thermal systems generate heat, ideal for swimming pools. Representatives from Suntrek toured the Aquatic Center and reported several opportunities to use solar thermal to offset the City's heating costs. Each of the three pools would require its own system, and could

[26] Avila, Vic, Facilities Manager, City of Hayward, (510) 583-4820, vic.avila@hayward-ca.gov
[27] PowerLight Solar Electric Systems, 2955 San Pablo Avenue, Berkeley, CA 94702, (510) 540-0550, www.powerlight.com

be installed in 3-4 days. An additional system could be installed to generate heat for the domestic hot water system. The biggest hurdle is determining the best location for each system. The roof area with the greatest sun exposure is tiled with slate, which would likely be significantly damaged and troublesome for solar thermal system installation. Other roof areas, with less sun exposure, can host a portion of the systems, but would be unable to accommodate the entire system. The City must also consider that installation in areas with minimal sun exposure would likely not produce enough electricity to be cost-effective.

Solar thermal systems have a 20 – 25 year life expectancy, and require minimal maintenance. Solar photovoltaic systems have a 30 – 40 year life expectancy, and also require minimal maintenance.

Wind power may be more difficult in the City of Newark. Until a study is conducted, it is uncertain if enough wind is generated at the site to make wind turbines effective. Also, a structural analysis would have to be completed to determine if rooftop installation of a wind turbine would be an option. Benefits of wind power are similar to solar in regards to installation, maintenance, and life expectancy. However, wind turbines viewed to date are incongruent with the Silliman Center's architecture. Environmental concerns would also have to be addressed, such as any impact turbines may have on birds and other wildlife, if wind power is further explored. One positive is that wind turbines report a shorter payback period than solar, about three and one-half years compared to fifteen years.[28]

3.2.6 Geothermal

Adjacent to the Aquatic Center is the nation's first LEED Platinum Community College, Ohlone College. One of its energy systems is geothermal which works in conjunction with an Enthalpy Wheel. Generally, geothermal has a payback period of up to nine years. The Aquatic Center's proximity to the bay is advantageous, and perhaps like Ohlone College, the payback period could be as low as three years. Geothermal systems report a 25 to 30 year lifespan.

Geothermal works through installed coils underground, which use the Earth's natural moderate temperature to heat and cool a facility. Geothermal systems are also capable of heating water. Systems require a small amount of electricity for its compressors and heat exchangers. Coils are filled with water or an environmentally safe antifreeze solution, with some systems built to reintroduce the water into local reservoirs[29]. It is estimated that 70% of the energy used is renewable.[30] Also, geothermal fields produce

[28] Carrington, Mark, VP Field Operations, Marquiss Wind Power, 101 Parkshore Dr., Folsom, CA 95630; (916) 932-7195, www.marquisswindpower.com
[29] City of Santa Rosa, California, ci.santa-rosa.ca.us
[30] http://www.geoexchange.org/goethermal/geoexchange-explained/what-is-geoexchange/html

~~a~~ approximately one-sixth of the carbon dioxide that a relatively clean natural gas-fueled power plant produces.[31]

An Enthalpy Wheel can capture up to 95% of the wasted energy that is normally lost through exhaust. This recovery works with the geothermal system to moderate air temperature.

Michael Lucas, PE and Partner of Alfa Tech Cambridge Group[32] led the project at Ohlone College. Mr. Lucas recommended that an Energy Modeling and Life Cycle Cost Analysis be completed for the City's Aquatic Center in order to determine the best combination of energy systems.

3.2.7 *Other Options Not Considered*

The City of Lompoc, California chose to incorporate natural ventilation into their 2006 aquatic center design[33]. Motorized, retractable glass wall and roof panels provide natural day light and ventilation. All electrical needs and 75% of the pool heating needs will be covered through two fuel cells in a future design plan. Also, cogeneration is planned to provide additional heat. Excess power is expected to be generated, which will feed back into the city-owned electrical grid. Replacing the roof and walls at the Silliman Center is not a feasible option, as costs associated with re-constructing the facility would be prohibitive.

3.3 *Energy Saving Plan*

Looking at a variety of combinations of the above options is the best way to achieve a more desired carbon emissions reduction. The plan we are putting together for the aquatic center will continue to be dynamic because of the fast pace of technological changes and the lack of long-term analysis on some of the options that seem attractive right now.

The first step in the Energy Saving Plan for the Aquatic Center is to generate a thorough analysis of the potential energy efficient measures. Upon completion of the analysis, prioritizing the recommended actions and determining funding sources will be a next step. Energy efficiency measures can be implemented in phases as the money is available in the maintenance budget, or also be proposed as a future capital improvement project.

---

[31] U.S. Department of Energy - Energy Efficiency and Renewable Energy, Geothermal Technologies Program: Geothermal FAQs

[32] Michael Lucas, PE, Partner, Alfa Tech Cambridge Group, 120 Montgomery Street, #715, San Francisco, CA 94101; (415) 403-3000, Michael_lucas@atce.com

[33] City of Lompoc (Calif.) Aquatic Center Aquatic Design Group. (2007, July/August) *Aquatics International*.

3.3.1 *Cost Analysis*

An in-depth study of the various energy measures, such as the Energy Modeling and Life Cycle Cost Analysis recommended by Alfa Tech Cambridge Group or the Energy Study proposed by PacificWest Solutions, can cost up to $20,000. Funding opportunities to cover these costs exist. However, many require a level of commitment to recommended actions after the study is complete. Without knowing what actions may be recommended and a lack of funds appropriated in the City budget, it would be negligent to accept funding for an analysis that would require further commitment.

Examples of implementation costs were provided by a few contacts. A rough estimate of a complete geothermal system would be $800,000 to $1,000,000, according to Alfa Tech Cambridge Group,

SunTrek provided three scenarios of solar photovoltaic systems costs. To cover almost 100% of the Aquatic Center's electric use, a solar photovoltaic system would cost $6.3 million; generate $188,785 in annual savings; and allow a $246,463 rebate. The rate of return on this project would be approximately 19 years.

SunkTrek also provided preliminary costs for solar thermal systems for the Aquatic Center pools. Based on the pools' surface areas, local weather patterns, and other assumed factors, the estimated solar thermal system costs of each pool are:

Lazy River	$ 31,884
Leisure Pool	$ 39,376
Lap Pool	$ 46,194
Total:	$117,454

The payback period on these solar thermal systems is approximately three years.

To implement all of the measures recommended by PacificWest Solutions (cogeneration, controls optimizations, energy monitoring, HVAC upgrades and commissioning, lighting, and pool pump controls) would cost approximately $900,000; generate $161,400 in annual savings ($160,000 in energy costs, the remainder in operational costs); include a $30,000 rebate; making the payback period approximately six years. These numbers were provided for illustrative purposes only.

Grant funding, rebates, and other financial assistance will be necessary for the City of Newark to undertake any energy efficiency project at the Aquatic Center. The volatility of government support of renewable energy rebates is a concern, as projects can take several months to complete, sometimes spanning over two calendar years. However, it should be noted that Governor Schwarzenegger did sign several bills into law supporting energy efficiency, particularly with regard to solar power. The Obama administration has also promised funding for energy efficiency measures. The City is currently anticipating the release of direct funds and competitive grants through the Economic Stimulus Funding Energy Efficiency and Conservation Block Grant Program.

The Aquatic Center analysis and potential recommended actions may be viable projects within the scope of this funding program.

In addition to funding assistance, the options to purchase or lease potential equipment needs will be analyzed. The City will continue to follow the Joint Venture Silicon Valley Climate Protection Taskforce subcommittee on solar purchasing. It will also continue to track existing projects as they age, hoping to collect and interpret data on lease, purchase, and other financing alternatives.

Other considerations in putting together a comprehensive energy plan will include revenue generation opportunities. If excess electricity can be generated and sold back to the power grid, the City could benefit by either powering City facilities in addition to the site the source is physically located or in the form of compensation/credit from PG&E. Governor Schwarzenegger recently signed AB 2466 into law, allowing local governments to be credited with excess power generation.

Conclusion

The results of this research report are stated in the introduction. All of the described projects have resulted in current and projected energy savings, but just as important, they set an example for the community. The research paper titled Social Norms: An Underestimated and Underemployed Lever for Managing Climate Change[34] discusses that people do not realize the main factor impacting their decision to act and respond to environmental issues. According to the study, people were more likely to act when they saw others acting first, and they were completely unaware of this contributing factor. That is why it is so important that the City set an example and advertise the measures it is taking. This will have a significant impact on our community members' decisions to take similar measures.

In any case, locating funding assistance will be a priority. Future BAAQMD grants, PG&E charitable grants, state technical assistance and low financing programs, CARB, EPA, U.S. Department of Energy, and other resources will be researched extensively. Depending on the success of the City's private and public grant search, the timeframe for implementing these measures is unknown. Energy savings costs achieved would be set aside to fund the Special Assistant beyond September 2009 to continue with the City's efforts to become more energy efficient.

The City is proud of the savings it has achieved so far, and is eager to continue down a path of reducing both CO_2 and costs related to energy. The City will distribute information to other recreation facility staff as a model, describing the 1.5% reduction in energy savings from the lighting retrofit projects to date. This report will also be made available to local governments to assist in their efforts of researching energy efficiency alternatives.

[34] Griskevicius, Vladas, Cialdini, Robert B., and Goldstein, Noah H. (2008) , Social Norms: An Underestimated and Underemployed Lever for Managing Climate Change *www.ijsc-online.org | IJSC 3 (2008): 5-13*

Report Prepared By:

Lenka Diaz
Special Assistant - Climate Protection
City of Newark, California
Lenka.diaz@newark.org
510-578-4806

And

Susie Woodstock, PE
Maintenance Superintendent
City of Newark, California
Susie.woodstock@newark.org
510-578-4804

Released: December 31, 2008
Revised: March 13, 2009

Appendix B – Change Fleet to Compressed Natural Gas (CNG) Report

Introduction

The purpose of this paper is to analyze the feasibility of replacing the existing slow-fill CNG pump station to a quick-fill CNG station to accommodate changing additional vehicles in the City of Newark's fleet from gasoline to CNG fuel. Other alternative fuels will also be included in this report. CNG is the main focus because of the proven and readily available technology, the proven overall positive effect on the environment as compared to gasoline, and availability and cost of CNG. The City already has four CNG vehicles which use the slow-fill pump station.

CNG is a non-renewable resource. The United States has about 3% of the world's natural gas. The Natural Gas Supply Association estimates the United States untapped natural gas reserves at about 1,190 trillion cubic feet.[1] Current demand shows that we use about 1.5% of our natural gas a year,[2] which allows about 60 years of natural gas use at the current rate before we would have to start importing. Therefore, most sources believe that CNG is a good immediate alternative while other technologies are developed, but should be one part of a diversified energy conservation plan.[3]

From this analysis, the plan for increasing the CNG capacity of the fleet is to start by replacing four maintenance vehicles in the next five years as these vehicles are listed on the Equipment Replacement List. The existing slow fill station will accommodate these vehicles. In the meantime, we will continue to pursue grants and other funding opportunities to upgrade the fill station and for replacement or additions to the fleet vehicles; most notable the City will pursue grant opportunities for an additional street sweeper that runs on CNG. We will pursue a partnership with PG&E on outreach opportunities to educate our residents on CNG technology and encourage them to consider a CNG vehicle with a fill station at their home. Unfortunately, at this time, PG&E has cut its customer transportation program due to budget reductions. Most importantly, we will monitor new technologies and update our fleet plan annually.

1. Benefits of CNG

CNG provides many benefits. CNG is cleaner burning than gasoline, CNG is cheaper the gasoline, a CNG vehicle requires less maintenance, CNG is a commonly accepted alternative to gasoline and it is a reasonable option for the general public.

CNG is cleaner burning than gasoline. Harmful emissions of carbon monoxide, nitrogen oxides, non-methane hydrocarbons, and CO_2 are reduced by 35%, according to a study conducted by the U.S. Department of Energy .[4] The ongoing cost of CNG has been significantly cheaper then gasoline. The Energy Information Administration (EIA) forecasts the price of CNG to remain similar through 2030. Gasoline prices can

---

[1] Natural Gas Supply Association, www.naturalgas.org
[2] Energy Information Administration, Official Energy Statistics from the US Government, tonto.eia.doe.gov
[3] www.pickensplan.com
[4] Freedom CAR & vehicle technologies program *Just the Basics Natural Gas* (August 2003) U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy

dramatically fluctuate, but the EIA forecasts a continuous rise in crude oil prices.[5]

Retired City of Union City Public Works Superintendent Michael Klinkner shared his years of experience with CNG vehicle maintenance.[6] He determined that preventative maintenance is needed less often in a CNG vehicle, due to a cleaner motor. For example, a CNG vehicle requires an oil change every 8,000 – 10,000 miles versus every 3,000 in a gasoline vehicle. He also stated that breakdowns in CNG vehicles occur less often than their gasoline fueled counterparts.

Currently, CNG appears to be the most commonly accepted alternative to gasoline fueled vehicles. Hybrids are not considered an alternative fuel because they still run on gasoline for any travel over 25 mph. Accessibility should increase with increased demand. State and federal funding and rebate programs have and will likely continue to support CNG fueled vehicles. Vehicle manufacturers are diversifying their CNG fleet. Locally, our neighboring cities have successfully converted a portion of their fleet to CNG, with a large part of CNG vehicles being within the maintenance division. Waste haulers, buses systems and some taxi companies have successfully converted also.

Residential CNG fuel stations can be installed in garages, carports, or outdoors[7]. These home refueling appliances (HRA) average four hours of fuel time for 50 miles of driving. PG&E will coordinate with homeowners who want a fill station. Again, CNG is not the final answer to gasoline alternative, but it is a good alternative for the next few generations of vehicle purchases. A map of CNG fueling stations that are open to the public shows there are 24 stations in the Bay Area[8].

2. Existing Equipment Information

2.1 <u>Existing City Fleet</u>

According to the Master Equipment Replacement List, the City fleet consists of 109 vehicles. For purposes of this analysis, the City fleet can be divided into three groups: public safety, miscellaneous, and maintenance vehicles.

There are 68 public safety vehicles. There are nine miscellaneous vehicles which consist of vans, pick-up trucks, sport utility vehicles, and sedans used by Engineering, Zoning and Building Inspection, and as pool vehicles.

There are 32 Maintenance vehicles in the fleet consisting of a variety of types. There are 11 three quarter ton pickups (three of which run on CNG); one CNG Honda sedan used by maintenance staff for errands and meetings; two (2) half ton pickups; five (5) one ton pickups, and one (1) one and a quarter ton pickup; two (2) one ton vans and one (1) three quarter ton van; and a variety of specialty trucks including one (1) patch

---

[5] December 2008, EIA Report # Report #:DOE/EIA-0383(2009) Early Release
[6] Contact: Mike Klinkner, Mile High Technical Associates, Inc., 14590 Holly St, Brighton, CO 80602; (209) 839-9673, cell (510) 453-2219
[7] www.myphill.com/gaq.htm
[8] http://www.altfuelprices.com/index.php

truck, one (1) grinder truck, one (1) five yard dump truck, one (1) ten yard dump truck, one (1) tanker (water truck), one (1) loader, one (1) catch basin cleaner, and one (1) sweeper. Two sweepers are actually currently in use, however only one is approved for replacement. A second sweeper may be added to the fleet, as preventative maintenance and breakdowns would take the one and only sweeper off-line, once the current back-up fails and is not replaced.

Table 2.1 – Existing Maintenance Fleet

Type of Vehicle	Quantity
Pick up	19
Van	3
Sedan	1
Misc Equipment	9

2.2 Existing CNG Filling Station

The City's current CNG filling station is located at the Service Center. The existing CNG pumping station is a slow-fill, requiring overnight fueling. The filling station has one small compressor and three hoses with a pressure of 3,000 psi; allowing up to three vehicles to be fueled simultaneously. The station accommodates the City's current four CNG vehicles. All four employees assigned to the CNG vehicles work at the Service Center.

There are no CNG fueling stations open to the public in the City of Newark. The nearest open to the public CNG fuel station is in the City of Union City, approximately seven miles away[9]. No other public CNG filling stations are within a ten mile radius. Local "private" fueling stations, such as Newark Unified School District[10], are not suited for increased capacity to accommodate City vehicles.

2.3 Vehicle Replacement Process

The City's vehicle replacement process provides the regulations for replacing City fleet. The Master Equipment Replacement List assigns a life and a replacement cost to each vehicle. At the end of the assigned life, the vehicle is evaluated to determine if replacement is needed as estimated or if the vehicle can stay in use longer. Vehicles are replaced through state bid when possible; if not possible, vehicles are obtained by a competitive bid procedure. In December 2008 the only low emission vehicle on the State list is a neighborhood electric car. In 2008, the list did not include any CNG maintenance type vehicles.

3. Replacing and converting to CNG

[9] www.cleancarmaps.com
[10] Don Connell, Director Maintenance, Operation, Transportation, Newark Unified School District, 5715 Musick Avenue, Newark, California 94560; (510) 818-4103; dconnell@nusd.k12.ca.us

Public safety vehicles, such as fire trucks and police patrol cars, have requirements that make CNG impractical. CNG tanks are much larger than regular gas tanks; they would take up storage space for required equipment. Fire and police personnel regularly use their vehicle storage compartments at capacity for their special equipment needs. Local cities, including Newark, are finding it very challenging incorporating public safety vehicles in alternative fuel plans.

3.1 Vehicles Viable for Replacement

Miscellaneous vehicles can be replaced with CNG vehicles as they appear on the Equipment Replacement List. All nine of these vehicles will transition to CNG.

Table 3.1.1 – Existing Miscellaneous Fleet

Vehicle	Year Scheduled to be Replaced
¾ ton van	2010
SUV-4WD	2014
Sedan	2016
½ ton pickup	2017
Sedan	2017
Sedan	2017
Sedan	2018
SUV-4WD	2010
½ ton pickup	2022

Barriers to changing over the maintenance fleet are few, yet significant. The CNG tank utilizes a significant portion of bed space in maintenance trucks. This space is needed for hauling debris involved in daily maintenance duties. The maintenance field crews work either in pairs or groups of three. There are up to four crews. Each crew can be assigned one CNG truck with limited bed space and one truck with full bed space. This allows for reducing the emissions without impacting the functionality of the crews.

Table 3.1.2 – Maintenance Fleet Vehicles Replacement Schedule

Type of Vehicle	Quantity	# CNG	Years for Replacement with CNG
Pick up	19	3	2009, 2012
Van	3		
Sedan	1	1	
Misc Equipment	9		2012, 2013

CNG vehicles with 3,000 psi are being phased out and replaced with 3,600 psi. Therefore, we would purchase the newer psi style.

When initially purchased, CNG vehicles have a higher cost than gasoline fueled vehicles. Currently a CNG pick up truck would cost about $10,000 more and a large piece of equipment may cost up to $16,000.[11]

CNG vehicle conversion kits exist, but only for a limited number of models due to the numerous environmental guidelines they must adhere to.[12] Purchasing gasoline vehicles through the City process, then converting them to CNG may be a viable option. Conversion kits are available from such sources NGV Conversion, Inc. Kits suitable for maintenance vehicles range in price from $8,000 to $20,000.[13] At the time of purchasing of a new vehicle, the price of purchasing a new CNG vehicle verse purchasing a gasoline vehicle and a conversion kit will be evaluated.

Rebates, tax relief, grants, and other funding sources may assist the City in purchasing CNG vehicles. Grants may cover the difference in cost between a gasoline fueled vehicle and a CNG vehicle. Rebates change year-to-year, and can only be estimated. In 2007, tax credits ranged from $2,000 - $32,000, depending on the type of vehicle. If grants become available, we will adjust the Equipment Replacement List to take advantage of the grants.

3.2 Fueling Station

The existing fueling station can accommodate six more vehicles. The users would have to schedule nights to fill because the existing station only has three hoses. The tank on a new vehicle would not be filled completely with the 3000psi pump. The pump would fill the tank about ¾ full.

Fueling station considerations include what size of CNG fleet we are trying to accommodate, PG&E capacity, and the costs and payback period associated with the upgrades. Depending on the upgrade selected, the Service Center site may require retrofits in order to accommodate higher gas pressure, larger equipment, and other needs.

As stated above, CNG is an interim solution. We are assigning a life expectancy of twenty years to the CNG fleet; the fueling station upgrades installed will be expected to function until 2029. This life length should allow adequate time for development and debugging of alternative technology.

The City of Union City used a four phase plan to transition from slow-fill pumps to quick fill. Through Bay Area Air Quality Management grants and City funding, the City first purchased a large compressor and nine storage vessels. Then three tanks and one dispenser were added; then three additional tanks; and finally an additional dispenser

[11] NGV Conversion, Inc. 44335 Premier Plaza Dr., Suite 125, Ashburn, Va 20147; (703) 953-2380; http://ngvus.com/index.html

[12] Yacobucci, Brent D., CRS Report for Congress, Natural Gas Passenger Vehicles: Availability, Cost, and Performance, Order Code RS22971, October 20, 2008

[13] http://www.irs.gov/businesses/article/0,,id=201024,00.html

and three more tanks. The City of Union City also made upgrades to its equipment shop for safer handling of CNG vehicles during maintenance activities.

Options for upgrades to our current system include:

1. Upgrade current compressor and increase number of stations to six (6). Approximate cost: $150,000;
2. Upgrade to sixteen (16) stations and upgrade to a large compressor. Approximate cost: $300,000;
3. Convert a number of slow fill stations to quick fill and add storage. Approximate cost: $900,000.[14]

The options are structured so they can be implemented all at once or incrementally, in the order stated. If all three options were selected for implementation at once, the equipment and costs for all three options would be added together for a total cost and equipment needs. To obtain a more detailed analysis requires a consultant's service. The City of Newark is considering applying for funding of this service through the California Energy Commission's Energy Partnership Program of Technical Assistance[15]. This process may be a valuable resource for selecting the best option. The CEC may also be helpful in financing implementation of a fill station upgrade.

According to PG&E, current natural gas capacity is 5 -10 psig (pound-force per square inch gauge). This natural gas pressure will accommodate increasing the compressor to accommodate a quick fill station.

Grant opportunities, rebates, and other funding sources are available. Most grants require a match of City funds. Currently no City funds are allocated for upgrading the CNG pump station. Rebates change year-to-year, and can only be estimated. Passage of AB118 provides hope for 2009 funding.

Considering a public pump may create an ongoing new revenue stream for the City. Union City realizes $1,500 - $2,000 monthly revenue.[6] The City may qualify for the federal government rebate program of $0.50 per gallon. The San Jose International Airport takes advantage of this rebate, realizing over $250,000 annually.[16] The San Jose International Airport also received almost 50% of their construction costs in grant because they pledged to build a CNG pumping station that would be open to the public.

Staff costs, including time and training, were included in the cost-benefit analysis of upgrading the CNG filling station. Up to 40 minutes of Equipment Mechanic staff time per week may be spent on preventative maintenance measures, due to the upgraded equipment. Training costs can be as little as mileage and meals, if free trainings are

---

[14] Numbers were provided for illustrative purposes only by Don Farchone, Mile High Technical Associates, Inc.

[15] The California Energy Commission, Energy Partnership Program, www.energy.ca.gov/efficiency/partnership/index.html

[16] Stoflet, Tom, Environmental Services program Manager, San Jose International Airport; (409) 501-7701, tstoflet@sjc.org

available in our area at the time it is needed.[17] Recordkeeping, permits, and other associated administrative costs are expected to be comparable to that of maintaining the City's current CNG station.

A return on investment analysis reveals the most viable option for the City's fleet is to implement Option 1 which has a pay back period of approximately ten years.[18] This option allows an increase in CNG vehicles and will last the required life of twenty (20) years.

4. Public Campaign

In order to determine the best option for upgrading the City's CNG filling station, community demand will be considered. Opening the station to the public may be a viable for collecting revenue and providing service. Residential sector demand is unknown at this time. Local private sector demand is unknown at this time.

Partnering with neighboring service organizations and private businesses may support demand for a station upgrade. NUSD currently has three (3) CNG busses, and has no plans to increase its fleet. Its filling station has been recommended for an upgrade. A collaborative effort may be possible. Other potential partners, such as AC Transit, Waste Management, and Ohlone College, have either no intent in increasing their CNG fleet and/or maintain their own facilities to accommodate their filling needs.

Future contracts can be reviewed to require natural gas vehicles while providing the City service. For example, when the City's contract with Waste Management expires (2012 – 2015, depending on extension options), the City will consider requiring trash haulers within City limits to be fueled with natural gas (CNG or LNG)[19]. Currently Waste Management has contracts with three cities requiring LNG haulers.

With government operations comprising only .9% of the total City's emissions, a public campaign effort must be launched. The City must lead by example, then call on its residents and business community to make any significant emission reductions. After publishing articles in the City newsletter and on the City website about climate change, reducing carbon emissions, and fuel conservation, the City plans to take its education campaign to the next level.

Visiting residents and businesses at their homeowner association, service club, and chamber meetings to deliver the carbon reduction message will be the next step. We hope to partner with organizations such as PG&E to continue to educate and encourage the community to adopt practices and make purchases that reduce carbon emissions.

---

[17] Natural Gas Vehicle Institute, www.ngvi.com; Natural Gas Fueling Station Operation & Maintenance Certification Course, NGV Driver and mechanic Safety Training, and NGV Fuel Storage Cylinder Inspection Training provided at no cost through PG&E contract with NCVi

[18] Cost of Option 1 divided by the difference between the annual average vehicle mileage of a maintenance pick-up truck multiplied by the average gasoline per gallon cost and the annual average vehicle mileage of a maintenance pick-up truck multiplied by the average natural gas per gallon cost , multiplied by the number of vehicles

[19] Per Assistant City Manager Dennis Jones, City of Newark, 35501 Newark Boulevard, Newark, CA 94560; (510) 578-4204, dennis.jones@newark.org

We will also continue our information campaign in our quarterly newsletter and on our website.

5. Other Alternative Fuels

Other alternative fuels are liquified natural gas (LNG), electricity, hydrogen and biofuel. In consideration of other alternative fuels, it is important to have knowledge of the environmental lifecycle of the fuel. That is, GHG emissions that occur when the fuel is used, is only the end part of that fuel's environmental lifecycle.[20] Emissions also occur, and must be attributed to, the fuel's journey to its destination. Transportation, distribution, and in the case of electric vehicles, battery creation and recycling must all be counted toward the final emissions factor labeled for the various alternative fuels. Many local organizations support alternative fuels, such as Silicon Valley Clean Cities Coalition.[21] Both private and public sector individuals and agencies participate in this group, encouraging conversion to alternative fuels wherever possible.

LNG is as environmentally friendly as CNG and requires a smaller tank then CNG. LNG occupies about $1/600^{th}$ of the space of CNG.[4] Drawbacks include that the cost is higher due to the lack of research ("newness"); and accessibility is low, therefore LNG is largely imported, increasing the lifecycle footprint. This option may become more viable in the near future as research continues, particularly in hopes to lightening the fuel tanks to further increase engine efficiency. Locally, Waste Management, the City's garbage service vendor, is in the process of building a recovery system from the methane gas at its Altamont landfill and converting it into LNG.[22] Waste Management hopes to fuel its LNG fleet of trash haulers (currently at 35 or 14% of its fleet) through this method.

It is difficult to prove that the Plug-In Hybrid Electric Vehicle (PHEV) has a positive impact on the environment for several reasons.[23] The environmental benefits of a PHEV largely depend on the specific power plant fuel source used to power the battery charging station and most vehicles would plug in overnight when electricity is produced by emission producing methods. The battery itself also has an environment impact. Many can now be recycled, and better technology hopes to provide a longer lasting battery in future vehicles. Plug-in Bay Area is a local group promoting PHEVs[24]. This type of vehicle will become more and more attractive as PG&E increases their renewable energy production and the battery and engine technology continues to improve. We will evaluate vehicles such as the Chevy Volt which will be release in 2010.[25] The City will also continue to follow projects in progress such as those in

[20] Delucchi, Mark A., Overview of the Lifecycle Emissions Model (LEM) August 2002; Institute of Transportation Studies, University of California, One Shields Avenue, Davis, California 95616; mdelucchi@ucdavis.edu
[21] Silicon Valley Clean Cities Coalition, sponsored by the U.S. Department of Energy; www.svcleancities.org
[22] Angell, Bob, Waste Management; (510) 613-2833; rangell@wm.com
[23] Summary Report Discussion Meeting on Plug-In Hybrid Electric Vehicles, Office of FreedomCAR and Vehicle Technologies, Energy Efficiency and Renewable Energy, U.S. Department of Energy, August 2006; and Sustainable Research: New research – Life cycle assessment of greenhouse gas emissions from plug-in hybrid vehicles: Implications for policy, April 5, 2008, http://sustainableresearch.blogspot.com/2008/04/new-research-life-cycle-assessment-of.html
[24] Van Horn, Jodie, Coordinator, Plug-In Bay Area; Jodie@ran.org
[25] www.chevrolet.com

Vacaville[26] and San Jose[27]. The City of Vacaville weathered several ups and downs as it rolled out its electric vehicle program. The City of San Jose is expecting five curbside electric vehicle charging stations to be completed by the end of 2008. Drivers can access the stations through a pre-paid plan.

The Hydrogen Fuel Cell Vehicle is virtually pollution free.[28] However, accessibility is so low and cost so high, that this alternative cannot be considered at this time. Public bus transportation service in the City is provided by AC Transit, which is hailed worldwide for its comprehensive hydrogen fuel cell demonstration program. AC Transit runs three zero-emission hybrid-electric, hydrogen fuel cell busses, and has its own on-site hydrogen production and fueling station.[29]

Hybrids and Bio-diesel fuels were not included in this report, as research indicates that there is a net zero environmental positive impact in comparison to unleaded and diesel gasoline fueled vehicles.

Other Alameda County cities have committed to greening their fleet with CNG vehicles as well. Both Fremont[30] and Union City[6] have converted several vehicles to CNG, including sweepers, busses, and sedans. Both cities also have a combination Fast/Slow fill CNG fueling station.

Conclusion

Diversification is an essential aspect of a plan to "green" our fleet because there is not one method that we can apply to the whole fleet to change over to low emission vehicles. At this time most public safety vehicles cannot accommodate the tank for CNG operation.

After reviewing the various lower emission vehicles and CNG filling station options, the following plan will be presented to the City Council as the recommended plan:

- Replace vehicles with CNG as they require replacement per the Equipment Replacement List.
- Begin an information campaign to show Newark citizen's the City's CNG vehicles and what CNG options are available to them.
- In the 2010-2012 fiscal cycle submit a capital improvement project request that will propose to upgrade the current CNG station with an improved compressor and additional stations.
- Continue to follow the progress of LNG and Plug-in research

[26] Fleet Maintenance, *Welcome to Voltageville*, October 2008, p. 6 - 11
[27] CNN.com/technology; 2008, The Associated Press; http://cnn.hu/2008/TECH/10/20/electric.cars.ap/index.html
[28] California energy Commission, Transportation Energy, A Student's Guide to Alternative Fuel Vehicles, 2006; http://www.energyquest.ca.gov/transportation/hydrogen.html
[29] www.2transit.org/environment/hyroad_main.wu
[30] Collins, Mark P., Fleet Equipment Supervisor, City of Fremont, 42551 Osgood Road, Fremont, CA 94539; (510) 979-5739; mcollins@ci.fremont.ca.us

- Continue to reevaluate the use of CNG to determine if a fast-fill station is necessary. If so, propose a capital improvement project that details a project to install the quick-fill station and funds the conversion of the remaining maintenance fleet.

The plan may change to accommodate grant opportunities and new technologies.

Report Prepared By:

Lenka Diaz
Special Assistant - Climate Protection
City of Newark, California
Lenka.diaz@newark.org
510-578-4806

And

Susie Woodstock, PE
Maintenance Superintendent
City of Newark, California
Susie.woodstock@newark.org
510-578-4804

Released: December 31, 2008

Comprehensive Energy Analysis and Strategic Plan: ***Silliman Activity and Family Aquatic Center***

Prepared By: Joe Longfield

IES, Inc.

Information & Energy Services Inc

Mailing Address:
Syserco, Inc.
44244 Fremont Blvd.
Fremont, CA 94538

Quality Assurance Check by:

BRETT ILLERS, CEM

Date: 11/18/2009 Final.

Lenka Diaz
Special Assistant
Silliman Activity and Family Aquatic Center
6800 Mowry Ave.
Newark, CA 94560-4954

Dear Lenka,

Enclosed please find the results of the Comprehensive Energy Analysis and Strategic Plan (CEASP) performed by the Syserco and IES team for the **Silliman Activity and Family Aquatic Center (SAFAC)**. This CEASP provides a road map for the Activity Center to generate approximately $123,089 in energy cost avoidance and power generation cost offsets. In addition to the savings resulting from the recommendations, PG&E offers a rebate and incentive program that will help offset the cost of the implementing the various projects. In all, nineteen energy conservation and renewable energy projects were evaluated, with fourteen being recommended in this report.

The recommendations include the following:

- In total, **twelve (12) Energy Conservation and two (2) Renewable Generation Measures** are recommended in this CEASP.
- The budget to implement all Energy Conservation Measures including solar thermal is approximately $658,665 and will provide a **simple payback of 7.29 years.**
- The budget to implement Solar PV is approximately $1,121,000 and will provide a **simple payback of approximately fifteen (15) years.**
- If all measures are implemented, the City could **reduce its CO2 emissions by over 1,300,000** lbs per year.

The Syserco/IES Team look forward to discussing in detail the report and its associated recommendations. Table 1.1 in the executive summary provides post implementation reduction in electricity and gas usage and the corresponding reduction in CO2 emissions. A financial summary of the recommendations is represented in table 1.2. Should the City elect to implement some or all of the recommendations, the Syserco/ IES Team offer turnkey support for the implementation of the project(s) as well as performing ongoing services including Measurement and Verification after the project is complete.

I am available to discuss any aspect of this CEASP, as well as the details of PG&E's energy efficiency programs. Thank you for selecting the Syserco/ IES Team! We look forward to helping you implement the recommendations of this CEASP.

Sincerely,
Joe Longfield
General Manager
Syserco, Inc.

Contents

1 Executive Summary 1
2 Facility Overview 5
General information 5
2.1.1 Lighting 5
2.1.2 HVAC 6
2.1.3 Other mechanical 7
2.1.4 Current system issues 8
3 Site Energy Usage 9
3.1.1 Utility Rate 9
3.1.2 Utility Use profile 11
3.1.3 Electric use 12
3.1.4 Natural Gas 13
4 Energy Conservation Opportunities 14
Energy Conservation Measures: *renewable energy measures* 15
4.1.1 ECM 1 Solar Photo Voltaic Electricity 15
4.1.2 ECM 2 Solar Thermal Water Heating 18
Energy Conservation Measures: *Lighting Retrofits* 22
4.1.3 ECM 3 Replace Natatorium Rail Lighting 22
4.1.4 ECM 4 Retrofit Parking Pole Fixtures 23
4.1.5 ECM 5 Replace and Retrofit Wall Mounted HID Fixtures 24
Energy Conservation Measures: *Lighting Controls* 25
4.1.6 ECM 6 Install Ambient Lighting Sensors on Selected Fixtures 25
4.1.7 ECM 7 Install Ambient Light Control Natatorium Rail/Catwalk Fixtures 26
4.1.8 ECM 8 Control After Hours Lighting Through Current EMS 27
Energy Conservation Measures: *Controls Measures* 28
4.1.9 ECM 9 Raise Gymnasium Cooling Set-Point 28
4.1.10 ECM 10 Establish Peak Limiting Program for Specified HVAC Units 29
4.1.11 ECM 11 Install Occupancy Controllers for HVAC in Specified Areas 30
4.1.12 ECM 12 Install Controls on Facility's Pool Boiler Plant 31
energy conservation measures: *mechanical upgrades* 32
4.1.13 ECM 13 Install VFD System on Pool Filtration Pumps 32
4.1.14 ECM 14 Replace Gym with AAON Units Digital Scroll Compressors 34
5 Other Considerations 36
Measures not Viable 36
5.1.1 Geothermal Heating/ Cooling 36
5.1.2 Wind Power 36
5.1.3 Domestic Solar Hot Water 38
5.1.4 Domestic Hot Water Plant Controls 38
5.1.5 Cogeneration 38
6 City of Newark Strategic Implementation Plan 39
Basis of Recommendations 39

6.1.1 Project Funding 40
6.1.2 Recommendation #1 Align Financial Vehicle and City Energy Goals 42
6.1.3 Recommendation #2 Install Solar PV for Renewable Generation............44
6.1.4 Recommendation #3 Install Solar Thermal to preheat pool water 50
6.1.5 Recommendation #4 Install VFD Motors on pool filtration pumps..........51
6.1.6 Recommendation #5 Install Lighting retrofits..52
6.1.7 Recommendation #6 Install Controls on pool boiler plant 53
6.1.8 Recommendation #7 Install Energy Management Control upgrades 53
6.1.9 Recommendation #8 Replace Gymnasium Units 54
6.1.10 Next Steps 55
7 Appendices Appendix 1 56
7.1.1 Attachments & Supporting data...56
7.1.2 Terminology kW, kWh, MW...57
7.1.3 Methodology 57
7.1.4 Budgeting & Incentives 66
7.1.5 Financing Vehicles...66
7.1.6 Project Implementation Plan...71

1 Executive Summary

Introduction

The City of Newark published a request for proposal (RFP) dated April 24th, 2009 for a comprehensive Energy Analysis and Strategic Plan for the Silliman Activity and Family Aquatic Center. The Syserco/IES team responded and was selected to do the analysis and to include a plan to implement recommendations if so desired by the City.

Over the past ninety (90) days our team has conducted complete site surveys, compiled historical energy usage data, and cataloged all energy consuming equipment. The goal of this CEASP was to identify ways in which the City could:

- cost effectively improve its overall energy efficiency
- reduce its carbon footprint
- potentially self generate energy using renewable technologies

Interviews were conducted with City personnel to understand facility use, goals and any known comfort and equipment issues. Further, the sites major gas and electric consuming equipment were analyzed to determine a set of possible energy conservation measures. Fourteen energy conservation measures were identified and made final consideration as part of this CEASP. Other considerations that were not in the final consideration were placed in the appendix for reference.

This Comprehensive Energy Analysis and Strategic Plan (CEASP) provide the City with recommendations, plans and budgets to implement energy conservation measures. This CEASP is presented to the City as two analyses:

- A series of energy conservation measures that could be implemented individually or as a project
- The opportunity to implement a renewable solar photo voltaic system as a separate project

This approach of keeping the analysis separate provides greater visibility to the City as they consider the recommendations.

Funding of projects is key to a successful Strategic Plan. This CEASP introduces funding vehicles for the City that provide cash flow neutral, self-funding approaches to implementing a majority of the recommendations. In essence, the energy cost avoidance produced from the energy conservation measures pays for the installation over the financing period. This offers the city the opportunity to take advantage of the historically low cost of money available in the marketplace from State and Federal sources to implement these measures.

The City's current plan is to use the CEASP to apply for grants as they become available or implement measures with Captial funding as it is available.

Current Status

For the twelve month period beginning January 2008 the SAFAC spent $190,615 on electricity and $98,968 on natural gas for a total of $289,583. This equated to an average cost of $5.26/square foot; $3.46/square foot for electricity use and $1.80/square foot for natural gas use (figures rounded to nearest cent). Analysis of Utility bills estimates that 60% of the cities' utility spending is for the SAFAC.

Results

Through the CEASP process we have identified annual energy cost avoidance and offset opportunities of approximately 543,000 kilowatt hours, 57,000 therms and $87,268 dollars. The recommendations in this CEASP include upgrades to the lighting, lighting controls, expansion of the energy management system, mechanical upgrades and renewable energy measures. This CEASP provides a complete explanation of each identified energy conservation measure (ECM) including the projected cost to complete, energy cost avoidance, carbon reduction, simple payback and any resulting rebates or incentives.

The tables below illustrate the impact of the energy conservation measures by ranking them by both annual CO2 reduction and by shortest simple payback.

Table 1.1: Summary of Energy Conservation / Generation Measures ranked by CO2 reduction

ECM #	Demand Response Measures	Estimated kWh Reduction	Estimated Therms Reduction	Estimated CO2 Reduction
2	Add Thermal Solar Collectors to Preheat Pool Hot Water	-	54,645	602,184
1	Install Solar Photo Voltaic Panel for Renew able Generation	278,311	-	345,136
3	Replace Natatorium Rail Lighting	54,750	-	67,972
4	Retrofit HID Parking Lot Lighting	50,135	-	62,243
13	Add VFDs to Pool Filtration Pumps	47,676	-	59,190
7	Install Ambient Light Controller on the Natatorium Rail and Catw alk Fixtures	40,715	-	50,548
12	Install Controls on Pool Boiler Plant	-	2,791	30,753
8	Control After Hours Lighting Through Current EMS	23,400	-	29,051
14	Replace Gymnasium Units w ith AAON Units Containing Digital Scroll Compressors	15,999	362	23,848
6	Install Ambient Lighting Sensors on Selected Fixtures	14,894	-	18,491
5	Replace and Retrofit Wall Mounted HID Fixtures	9,353	-	11,612
11	Install Occupancy Controllers for HVAC in Specified Areas	5,088	-	6,316
9	Use Existing EMS to Reduce HVAC Load in the Gymnasium	2,040	-	2,533
10	Use Existing EMS to Reduce Peak HVAC Load During Summer Months	1,529	-	1,898
Total		543,890	57,797	1,311,775

Table 1.2: Summary of Energy Conservation / Ranked by Shortest Simple Payback

ECM #	Demand Response Measures	Total energy cost avoidance	Implementation Cost	Simple Payback (rebates Applied)
7	Install Ambient Light Controller on the Natatorium Rail and Catwalk Fixtures	$ 4,967	$ 8,062	0.65
10	Use Existing EMS to Reduce Peak HVAC Load During Summer Months	$ 396	$ 875	2.21
4	Retrofit HID Parking Lot Lighting	$ 4,168	$ 14,783	2.70
6	Install Ambient Lighting Sensors on Selected Fixtures	$ 1,817	$ 7,482	3.14
9	Use Existing EMS to Reduce HVAC Load in the Gymnasium	$ 249	$ 875	3.51
12	Install Controls on Pool Boiler Plant	$ 3,237	$ 12,860	3.97
11	Install Occupancy Controllers for HVAC in Specified Areas	$ 621	$ 3,180	4.46
13	Add VFDs to Pool Filtration Pumps	$ 3,964	$ 23,704	5.02
2	Add Thermal Solar Collectors to Preheat Pool Hot Water	$ 54,645	$ 377,994	6.92
5	Replace and Retrofit Wall Mounted HID Fixtures	$ 1,377	$ 10,770	7.35
3	Replace Natatorium Rail Lighting	$ 7,508	$ 69,925	8.61
1	Install Solar Photo Voltaic Panel for Renewable Generation	escalating	$ 1,121,000	14.50
8	Control After Hours Lighting Through Current EMS	$ 1,945	$ 30,993	15.93
14	Replace Gymnasium Units with AAON Units Containing Digital Scroll Compressors	$ 2,374	$ 97,162	39.84
Total		$ 87,268	$ 658,665	7.29

Notes:

1. Simple payback is less incentives e.g. (cost-incentives) / (annual $ savings)
2. Solar cost offset escalates on an annual basis
3. Totals do not include solar PV values due to the difference in financial models
4. Solar PV simple payback analysis is based upon ground mount installation with CREB's financing model which includes utility rate escalation, installation charges, finance costs, maintenance, insurance and rebates applied
5. ECM #7 is not a stand-alone item and must be combined with ECM #3
6. ECM #9 payback is based upon implementing ECM #14. ECM #9 can be a stand alone measure.
7. Rebates apply to ECM's 1,3-7,11,13,14.

Conclusion

The City of Newark has an excellent opportunity to drive additional energy costs out of the Silliman Activity and Family Aquatic Center. The existing control infrastructure in place provides the appropriate platform to execute many of the energy conservation measures considered in this CEASP.

Syserco has included as part of this document a sample project implementation plan that would be utilized to build this project with the City.

Table 1.3: Process Participants

Name	Role	Organization
Susie Woodstock, P.E.	Maint. Superintendent	City of Newark, Ca.
Lenka Diaz	Special Assistant	City of Newark, Ca.
Victoria Hernandez	Finance	City of Newark, Ca.
Robert McKinney	Maintenance Supervisor	City of Newark, Ca.
Peter Beireis	Sr. Recreation Supervisor	City of Newark, Ca.
Joe Longfield	General Manager	Syserco Energy Services
Mike Hill	Project Manager	Syserco Energy Services
Brad Leonard	System Technician	Syserco Energy Services
Brett Illers, C.E.M.	Lead Auditor	IES, Inc.
James Bottomley	Engineering	IES, Inc.
Mike Rogers, P.E., C.E.M.	Reviewing Engineer	IES, Inc.
Bob Hopper	Consultant	ClearPeak Advisors

2 Facility Overview

GENERAL INFORMATION

The SAFAC is a multi-use recreation center owned and operated by the City of Newark. Phase 1 of this facility was opened in 2001. It consisted of a large two court gymnasium, locker room, teen center, meeting space, large pre-school, exercise and dance studio. Phase 2 was opened in 2004 and consists of an additional locker room facility and large aquatic center which includes 3 large pools and a spa. The facility hours of operation are seasonal, but are operated year round with core hours from 6:00 am to 9:00 pm Monday through Friday and until 7:00 pm on Saturday and Sunday.

A facility that provides as many services as the SAFAC consists of many various energy consuming systems. In the following pages this CEASP will outline some of these major systems in order to give a basis for our energy conservation recommendations later in the report.

2.1.1 Lighting

The facility is illuminated by a number of compact fluorescent and linear fluorescent fixtures with several high intensity discharge lamps (HID) in the natatorium, gymnasium and parking lot. The building was designed to collect as much natural light as possible through skylights and clear story windows. However, the current lighting system does not take advantage of this light. This is most notable in the Natatorium as over one hundred and forty-five compact fluorescent fixtures (each with four 45W PL compact florescent lamps) are directed upwards to skylights and an off-white ceiling (fig. 2.1). This system when enabled consumes over 26 kW of electricity while only putting out an average of 18 foot candles on the pool deck.

Figure 2.1: Silliman Natatorium Lighting

On three separate visits to the Natatorium we noticed all of the lights were being enabled. Although the lighting in this area is tied to a control panel it is not used to control the lighting nor are any ambient sensors controlling the system in an effort to take advantage of the ample amounts of daylight in this area. This is similar to many other areas of the facility where day-lighting could be used in place of the fluorescent lighting system but the proper controls are not in place.

City Staff has done an excellent job of eliminating some of the unnecessary lighting in the facility. The best example of this is in the large gymnasium where the City has removed almost all of the 250-watt metal halide fixtures and replaced them with T5 fluorescent fixtures.

The new lighting system produces a much better light and has probably reduced the lighting electrical use in this area by 50%. Additionally, this lighting system requires no “warm up” time so it can easily be paired with lighting controls. It should also be noted that several 250-watt metal halide wall wash sconces were also permanently powered off with no loss of lighting in the gymnasium.

2.1.2 HVAC

Except for the Natatorium, the entire facility is mechanically cooled by rooftop gas electric package units. In total there are (17) units providing 105 tons of cooling to the facility. On the Phase 1 side all the units are Carrier HJD style units while on the Phase 2 side units are a mix of AAON and Carrier. According to the plans all units had an efficiency of 11 or 12 SEER when installed.

Overall the Package units appeared to be in good condition. The Gymnasium units are beginning to show signs of wear on the coils.

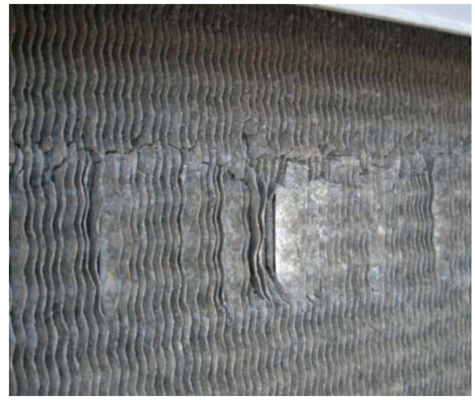


Figure 2.2: Gymnasium Unit Coils

The Natatorium is not mechanically cooled instead the area is served by two large air handlers that have 350,000 Btu furnaces for heating and controlling humidity and an indirect-direct evaporative cooling system. This was a very wise choice by the designers of the aquatic center since mechanical cooling for this area would have been unnecessary and extremely expensive to operate.

All of the large air conditioning units are controlled by an Alerton® Energy Management System (EMS). The system is used to schedule the runtimes of the equipment and set the temperatures for the areas they serve. Upon close inspection it was noted that most of the facility (including the gym) are cooled between 69° and 72°. While this is fine for smaller areas, larger areas like the gymnasium are very hard to keep to these low temperatures which cause the units to work harder than necessary to maintain these temperatures. This could account for the premature wear found on the gymnasium units.

Overall the facility staff seems to keep the facility well controlled. Common areas are scheduled to run while open but individual rooms are put on a specific schedule while in use; however, during several of our site walks we did notice a number of rooms such as the dance studio and meeting room running while unoccupied. The EMS is also used to program the large air handler units on the natatorium; currently the maintenance staff at the SAFAC has been very diligent in shutting off one of the two big air handlers at night in an effort to save energy and reduce wear on the large units.

2.1.3 Other mechanical

Pool Boilers

All four pools for the SAFAC have their own boiler dedicated to them. Temperatures for the pools range from 81º to 84º with the spa temperature set to 103º (see Table 2.1 below for details). These boilers are enabled around the clock and do not contain any nighttime setback features or time clock controls. We estimate that up to 65% of the facility's gas use is from the pool boiler plant.

Table 2.1: Pool Boiler Size and Temperature

Pool Served	Boiler Size (Btu)	Temperature Observed
Lap Pool	750,000	81º
Leisure Pool	1,260,000	84º
Lazy River	990,000	81º
Spa	150,000	103º

Domestic Hot Water Heaters

The SAFAC has two separate domestic hot water plants for the facility. The first phase consists of two 199,000 Btu rapid recovery hot water heaters that supply all the hot water for the Phase 1 bathrooms and locker facilities. This hot water heater is enabled around the clock and is only controlled by the tanks temperature. The second hot water plant consist of two 200,000 Btu boilers mounted on the roof that supply two hot water tanks below. This system supplies all the Phase 2 area bathrooms and locker room facilities. Like the first plant this domestic hot water system is enabled year round and is only controlled by the tanks internal temperature.

Pool Pumps

As with any pool facility one of the largest and most constant loads is the pumping and filtering of water. The SAFAC has twelve (12) separate pumps to run all of the pools filtration and water features. The breakdown of their sizes and use is illustrated in the Table 2.2 below.

Table 2.2: SAFAC Pool Pump Breakdown

Pool	Use	Size	Enabled
Lap Pool	Filtration	7.5 Hp	24 / 7
Lazy River	Current Pump	10 Hp	On Demand
	Current Pump	10 Hp	On Demand
	Current Pump	10 Hp	On Demand
	Water Features	7.5 Hp	On Demand
	Filtration	10 Hp	24 / 7
	Water Slide	15 HP	On Demand
	Water Slide	15 HP	On Demand
Leisure Pool	Water Features	7.5 Hp	On Demand
	Filtration Pumps	10 Hp	24 / 7
Spa	Filtration Pumps	7.5 Hp	24 / 7
	Booster Pump	10 Hp	On Demand

In our site walks it appears that pool staff does a good job of running the water feature pumps only when the public require them. We never saw these pumps running when the site was not in use. The filtration pumps are constant speed and are always running in order to provide filtration to the pools. The 24 hour pool pumping is noticeable when watching the interval data of the facility. Interval data is illustrated on chart 3.1.

2.1.4 Current system issues

The SAFAC truly is a state of the art recreation center, however many of its systems where designed without a focus on energy conservation and / or energy conservation measures were downgraded based on construction cost overruns. Through good facility management the staff at the SAFAC has been able to do the best they can to keep the energy cost in check; however, the SAFAC accounts for two-thirds of the City of Newark's energy consumption according to utility analysis. The next section of this CEASP analyzes the facility's energy use to better illustrate how and when the facility can develop ways to curtail usage through conservation measures.

3 Site Energy Usage

3.1.1 Utility Rate

The SAFAC is served by a one electric and one gas meter. Currently the center is on an E-19 rate which has both a demand and time of use component where the cost of power changes with the time of day and year. This is important to note because this means that the savings associated with different energy conservation measures considered in the CEASP will vary based on **when** and **how much** energy the measure conserves. Details on how each energy conservation measure savings were calculated are located in section 7.1.3- methodology.

In Table 3.1 below is the most current rate schedule for the E-19 rate supplied by PG&E. The areas in gray denote the rate that the SAFAC is currently paying.

Table 3.1: E-19 Electrical Rate Breakdown

Season	Time-of-Use Period	Demand Charge (per kW)			Time-of-Use Period	Total Energy Charge (per kWh)				"Average" Total Rate[1/] (per kWh)
Summer	Max. Peak	$13.51	$12.29	$9.90	Peak	$0.15553	$0.15606	$0.11536		Secondary $0.13732
	Part Peak	$3.07	$2.79	$2.24	Part Peak	$0.10556	$0.10407	$0.09153		
	Maximum	$7.70	$6.66	$4.68	Off Peak	$0.08506	$0.08154	$0.07728		Primary $0.13214
Winter	Part Peak	$1.04	$0.78	$0.00	Part Peak	$0.09348	$0.08882	$0.08288		
	Maximum	$7.70	$6.66	$4.68	Off Peak	$0.08189	$0.07737	$0.07304		Transmission $0.13523

Electricity is more expensive during the summer season when the demand is highest.
PG&E defines summer and winter season as outlined below.

Summer Season (May-October):

Peak Hours: 12:00 noon to 6:00 pm, Monday-Friday (except holidays)

Partial-Peak Hours: 8:30 am to 12:00 noon AND 6:00 pm to 9:30 pm, Monday-Friday (except holidays)

Off-Peak Hours: 9:30 pm to 8:30 am, Monday-Friday; All day Saturday, Sunday and holidays

Winter Season (November-April):

Partial-Peak Hours: 8:30 am to 9:30 pm, Monday-Friday (except holidays)

Off-Peak Hours: 9:30 pm to 8:30 am, Monday-Friday (except holidays); All day Saturday, Sunday and holidays

The current rate the SAFAC is on is well suited for its current use. However, if the city were to install renewable solar electric generation at this facility and it were enough to significantly reduce the peak hour load of the facility then a time-of-use rate, such as an A-6 rate, should be evaluated.

Table 3.2: Breakdown of Monthly Utility Costs

SAFAC Monthly Utility Costs						
Month	**kWh**	**$**	**$/kWh**	**Therms**	**$**	**$/therm**
Jan-08	129,280	$ 12,208	$ 0.09	11,920	$ 12,003	$ 1.01
Feb-08	126,400	$ 11,868	$ 0.09	9,970	$ 10,461	$ 1.05
Mar-08	135,680	$ 12,699	$ 0.09	9,062	$ 10,784	$ 1.19
Apr-08	127,040	$ 12,280	$ 0.10	7,651	$ 9,326	$ 1.22
May-08	120,480	$ 17,505	$ 0.15	6,099	$ 8,406	$ 1.38
Jun-08	132,480	$ 18,939	$ 0.14	5,332	$ 7,820	$ 1.47
Jul-08	141,280	$ 20,182	$ 0.14	4,693	$ 7,456	$ 1.59
Aug-08	135,200	$ 20,029	$ 0.15	4,392	$ 5,961	$ 1.36
Sep-08	143,680	$ 20,211	$ 0.14	4,904	$ 5,801	$ 1.18
Oct-08	119,680	$ 18,462	$ 0.15	4,855	$ 5,127	$ 1.06
Nov-08	126,400	$ 13,562	$ 0.11	5,391	$ 5,461	$ 1.01
Dec-08	123,680	$ 12,670	$ 0.10	11,073	$ 10,362	$ 0.94
Totals	**1,561,280**	**$ 190,615**	**$ 0.12**	**85,342**	**$ 98,968**	**$ 1.16**

The average cost of a kWh for the SAFAC was 12.2¢ and the average cost for a therm of gas was $1.16.

Averages are helpful as a point of reference, but each energy conservation measure considered as part of this report could have different savings associated based on when, what type and how much energy is conserved.

Although the average cost of a therm was $1.16 for the study period, natural gas rates continue to decline and $1.00 per therm was used as a baseline when energy conservation measure savings were calculated.

3.1.2 Utility Use profile

The average demand for the SAFAC fluctuates between 155 kW and 215 kW depending on the time of year, with the higher demands occurring during the summer months. Chart 3.1 below shows the fluctuation in demand throughout the day.

Chart 3.1 Load Profile Graph

Load Profile Table

Period Ending	Average (kW)	Max Value (kW)	% of Max	Max Timestamp	Min Value	Min Timestamp
6/2/2009	165.36	224.4	96.0	10:30 AM	91.49	04:15 AM
6/3/2009	167.65	232.1	100.0	11:00 AM	93.26	10:15 PM

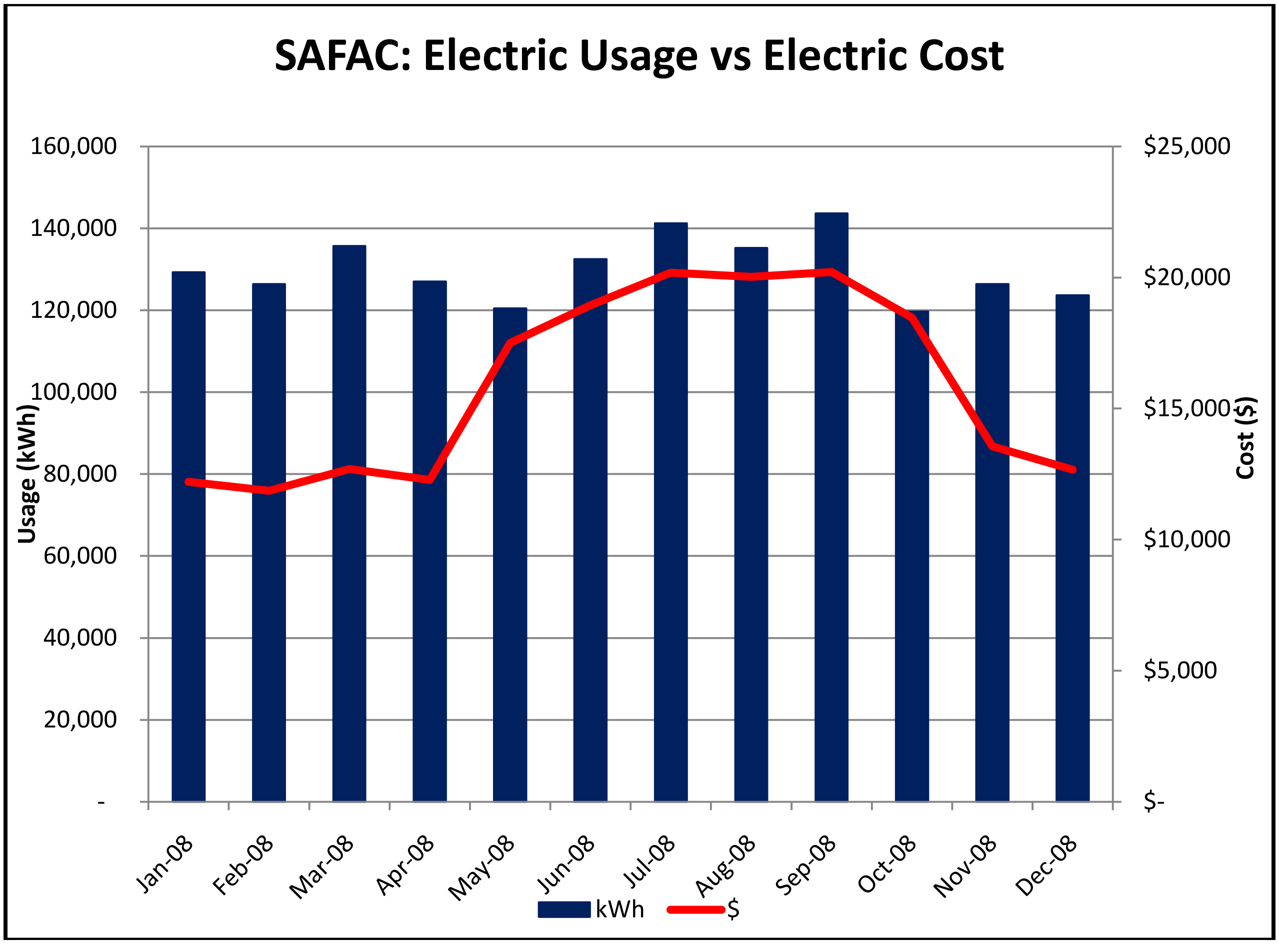
The data in Chart 3.1 above was taken for the days of Tuesday, June 2nd and Wednesday, June 3rd 2009. Through extensive analysis we have found that this load profile is typical regardless of the time of year it is taken. The facility's base load never goes below 90 kW due to the filtration pumping, emergency lighting and ventilation of the natatorium.

Typically the SAFAC reaches its max peak in the early afternoon and continues until closing around 9:30pm. What this CEASP found interesting is the facility's energy use ramps up again around 10:30pm and remains at a higher level until around 4:00am. We feel that this second peak is due to custodial staff turning on all of the lighting and possibly some HVAC during the night and leaving it on until they leave.

3.1.3 Electric use

Throughout the year the SAFAC energy use fluctuates slightly with the highest use in the summer months. Unfortunately, this is also the period when energy costs are at their highest. Chart 3.2 below was constructed from utility billing information and illustrates how the electricity use fluctuates for the SAFAC throughout the year, along with the cost of energy throughout the year.

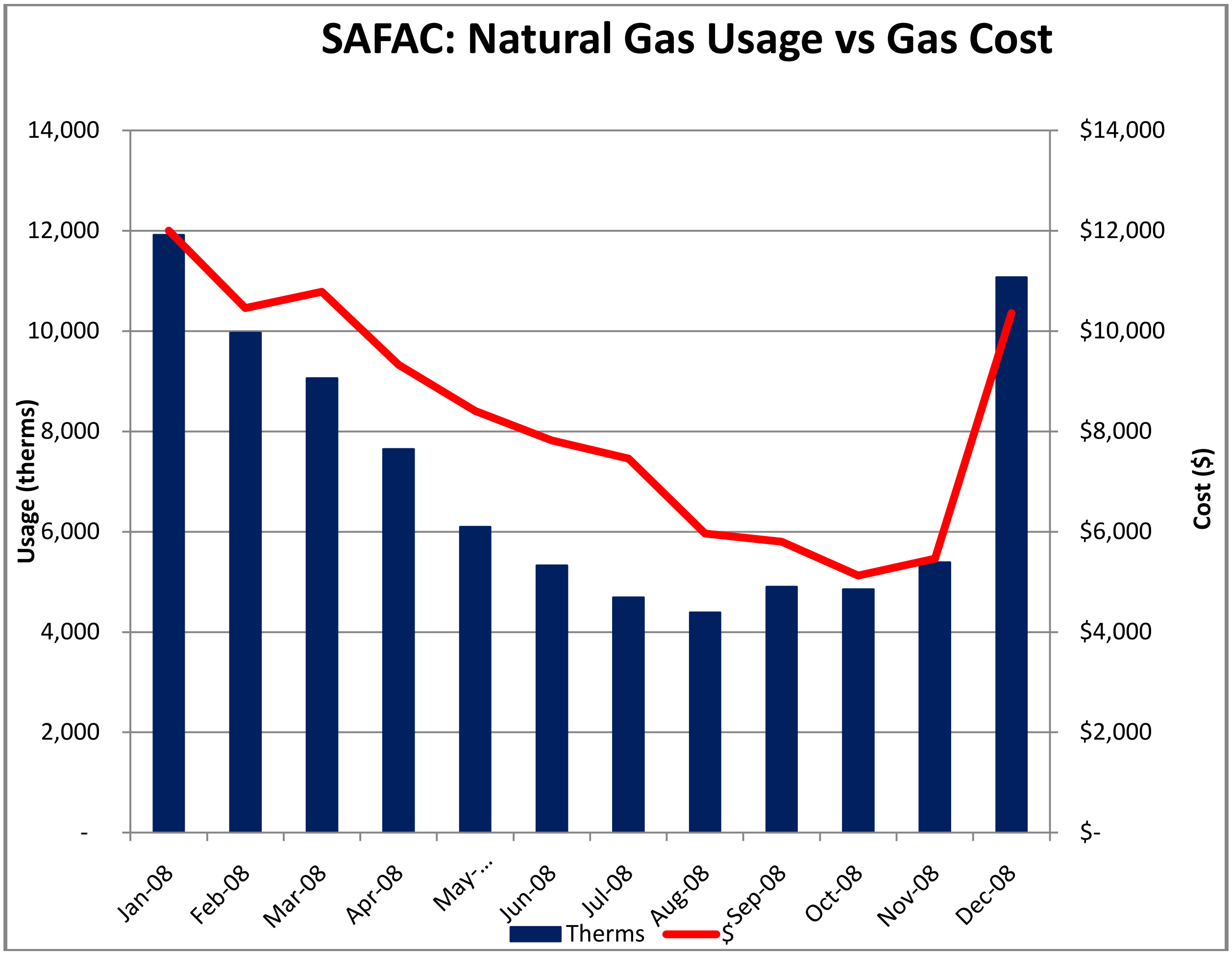
Chart 3.2 Electric Use vs. Cost



3.1.4 Natural Gas

Natural Gas use for the facility varies greatly with the majority of gas being used during the winter months. The summertime gas use for the facility represents mostly heating water either for the pool or domestic use. Chart 3.3 below was constructed from utility billing information and illustrates the yearly gas use for the facility along with the cost of natural gas during those times.

Chart 3.3 Natural Gas Use vs. Cost



Through various site walks and an extensive review of the utility use for the SAFAC our team has a better understanding of how, where and when the facility uses energy. With this information this CEASP has been able to better develop Energy Conservation Measures for the center which will help to reduce energy use especially during times of high energy costs.

4 Energy Conservation Opportunities

Through the analysis of the current facility this CEASP has identified multiple Energy Conservation Measures to reduce the SAFAC energy consumption and carbon footprint. In this CEASP we looked at all reasonable energy retrofits and generation strategies that could be applied to the facility; some were very promising while others were less so. We have analyzed each of these measures in the anticipation that the city will implement some of them. The analysis is written in a way that city personnel can pick and choose the measures in the report to custom tailor a program that best meets their current needs and requirements.

The following energy conservation measures are split into five different categories. They are Renewable Energy Systems, Lighting Retrofits, Lighting Controls, Control Measures and Mechanical Upgrades.

Section 5 of this report is devoted to energy conservation measures that were not viable and the reasons which are explained in that section.

Table 4.1 below gives a detailed overview of all energy conservation measures along with energy cost avoidance and CO2 reduction if the measure were implemented.

Table 4.1 Summary of Energy Conservation Measures Studied- Annual Savings

ECM #	Demand Response Measures	Estimated kWh Reduction	Estimated Therms Reduction	Estimated CO2 Reduction
1	Install Solar Photo Voltaic Panel for Renew able Generation	278,311	-	345,136
2	Add Thermal Solar Collectors to Preheat Pool Hot Water	-	54,645	602,184
3	Replace Natatorium Rail Lighting	54,750	-	67,972
4	Retrofit HID Parking Lot Lighting	50,135	-	62,243
5	Replace and Retrofit Wall Mounted HID Fixtures	9,353	-	11,612
6	Install Ambient Lighting Sensors on Selected Fixtures	14,894	-	18,491
7	Install Ambient Light Controller on the Natatorium Rail and Catw alk Fixtures	40,715	-	50,548
8	Control After Hours Lighting Through Current EMS	23,400	-	29,051
9	Use Existing EMS to Reduce HVAC Load in the Gymnasium	2,040	-	2,533
10	Use Existing EMS to Reduce Peak HVAC Load During Summer Months	1,529	-	1,898
11	Install Occupancy Controllers for HVAC in Specified Areas	5,088	-	6,316
12	Install Controls on Pool Boiler Plant	-	2,791	30,753
13	Add VFDs to Pool Filtration Pumps	47,676	-	59,190
14	Replace Gymnasium Units w ith AAON Units Containing Digital Scroll Compressors	15,999	362	23,848
Total		543,890	57,797	1,311,775

ENERGY CONSERVATION MEASURES: *RENEWABLE ENERGY MEASURES*

4.1.1 ECM 1 Solar Photo Voltaic Electricity

When evaluating sites at the City for Solar Photo Voltaic this CEASP looked at many options and took into account many factors. Due to the high cost and long-term life of Photo Voltaic (PV) one must look at the following criteria when selecting a site:

- **Utility Support**- Ensure facility is in a utility that allows net metering and has access to renewable incentives. PG&E, under the A6 rate, allows for you to "credit" excess kWh production to your account and use the credit when you produce less kWh. For systems designed to provide 80-100% of kWh use this is critical. PG&E offers incentives based on the size of system, product selection, orientation (efficiency), production capabilities and timing. Incentives paid for solar PV installations have declined as the volume of installed base has increased.
- **System Sizing**- Right size the amount of PV on a building. Ideally Solar PV would be able to provide 60-80% of the facility kWh requirements. This average ensures the facility receives enough solar power to provide an impact on your monthly electricity bill while reducing CO2. Sizing also has an impact on how you purchase your system. Small systems are less likely to be able to be purchased through some financing vehicles.
- **Access**- Install PV in an out of the way location that is hard to access by vandals or thieves. Although panels are well constructed, they are not impervious to vandals. Solar panels are ideally located in areas that are not easily accessible to the public.
- **Space**- Solar PV systems can vary greatly in size based on the kWh production capability and the efficiency of the equipment installed. Ideally, the space would be open, not cluttered with HVAC units. The space must be free of shading from trees and other obstructions to provide direct sunlight into the solar panels.
- **Orientation**- Roofs must also have correct orientation to provide the most cost effective installations. South facing orientations are best for solar PV collection.
- **Aesthetics**- Facility owners must decide how the appearance of Solar PV will impact the facility. Installation techniques, metal fabrication and design have helped solar PV become more aesthetically acceptable in recent years.

Three possible sites were considered for the installation of a Solar Photo Voltaic system:

A. **The parking lot north of the SAFAC.** This location has enough physical space for the solar array with a workable orientation to the sun, but has added cost of labor and materials to install across a completed parking lot and far from utility connection points. The construction of a metal parking structures will also add considerable expense to the project. Orientation is gained by having the roof with a pitch to enhance efficiency. Vandalism and car damage could be a risk to the carports as well as graffiti. This approach does have the added benefit of providing covered parking to guests.

B. **The dirt field area east of the center.** This area could be fenced off and the solar array installed within a protective barrier. The field is in close proximity to electrical connections, has sizing flexibility, access and orientation. The dirt field does pose a risk for vandalism and may not be aesthetically pleasing. After discussion with City Staff this site may require a modification to the Newark Sportsfield Park Master Plan for this area.

C. **The roof of the aquatic center.** The roof is challenging because of the orientation of available roof areas and the construction of the roof tiles being slate and very fragile. A large roof mounted installation would require the removal of slate tiles and the installation of composite type roofing. Any replacement roofing inherently includes concerns of structural integrity and leakage. Removal and replacement of roofing is also a considerable additional expense. The roof provides acceptable access and orientation but has limited space available. The roof has approximately 4000 square feet of flat potentially usable area (no slate tile removal or re-roofing) that could accommodate a smaller solar PV system.

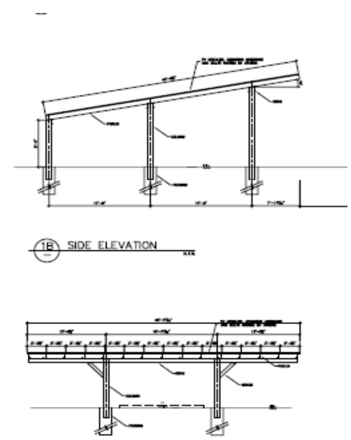


Figure 4.1 Parking Structure Cross Section view of installation for Solar PV

Outside of the boundaries of this analysis the City could also consider that AB 2466, codified as Section 2830 of the Public Utilities Code, was signed into law by Governor Schwarzenegger in September 2008 and became effective on January 1, 2009. The law allows a local government to install renewable generation of up to 1 MW at one location within its geographic boundary and generate credits that can be used to offset charges at one or more other locations within the same geographic boundary. If the City has a more practical installation location it may prove to provide the same benefit at a lower cost to install and faster payback. Rebate eligibility for this approach has not yet been decided by the CPUC.

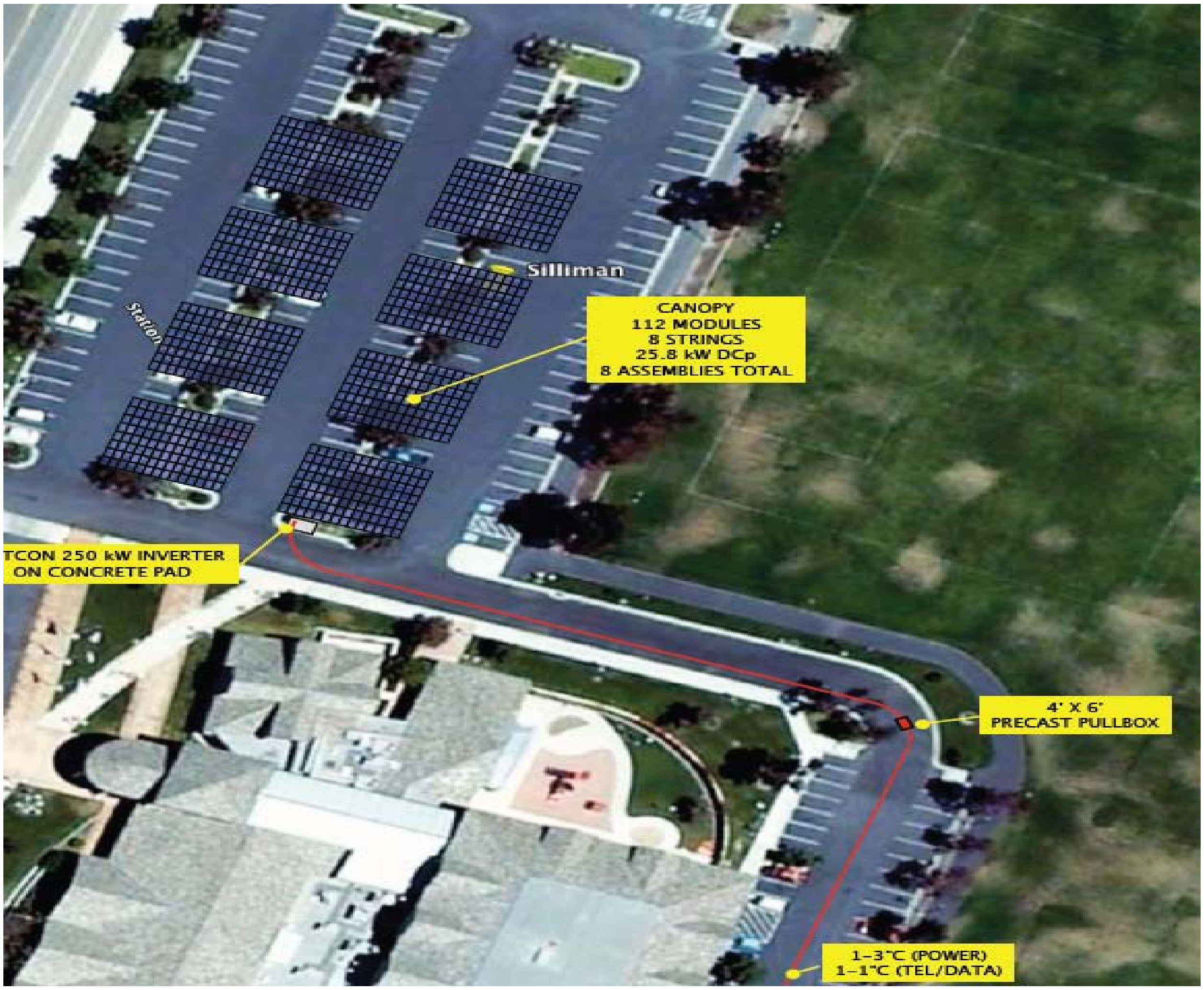


Figure 4.2 SAFAC Solar PV installation parking structure for illustrative purposes only.
View - north parking lot carports- Red line is where trenching would occur for installation.

The budget for this retrofit would be $1,121,000 for a ground mount installation behind the SAFAC, with a simple payback in 14.5 years. The budget for a parking structure style retrofit is $1,483,000 (as illustrated above) with a simple payback of 18.5 years. The budget for a smaller kWh capacity roof mount installation (based on available surface area) is $401,000 with a simple payback of 23.5 years. Paybacks are calculated on the City paying for installation from Capital budgets, estimated rebates are used to discount the cost and assume an annual 5.89% utility escalation rate.

Table 4.2 Summary of Solar PV

Add Solar Photo Voltaic Parking Structure or Field Analysis				
		Annual		
ECM #1A, 1B	Serves	Estimated kWh Generated	Estimated benefit of kWh Generated year one	Estimated CO2 reduction (lbs per year)
	20% of use	278,000	$ 34,982	345,136
Reduction/Savings		278,000	$ 34,982	345,136

Add Solar Photo Voltaic Roof Mount Analysis					
		Annual			
ECM #1C	Serves	Estimated kWh Generated	Estimated benefit of kWh Generated year one		Estimated CO2 reduction (lbs per year)
	4% of use	60,000	$	7,550	74,490
Reduction/Savings		60,000	$	7,550	74,490

4.1.2 ECM 2 Solar Thermal Water Heating

In an effort to reduce costs and still maintain year round comfort of the pools, this CEASP evaluated an open loop solar hot water system to supplement heating pool water for all three large pools. The Spa was not evaluated due to its small size which would increase the payback of the entire system.

Utility support, system sizing, access, space, orientation and aesthetics are all considered for solar thermal as they were for solar PV.

- **Utility Support**- Ideally, the utility would provide incentives for solar thermal installations. Currently, no PG&E incentives are available for solar thermal projects.
- **System Sizing**- Right size the amount of solar thermal. Ideally you would provide 100% of your pool heating needs during optimal summer months. Capacity beyond this provides more heating than needed and is wasted.
- **Access**- Install solar thermal in an out of the way location that is hard to access by vandals. Solar thermal is not as “interesting” to vandalize and has no resell value. Solar thermal material is ideally located in areas that are not easily accessible to the public.
- **Space**- Solar thermal systems can vary greatly in size based on the therm production capability and the efficiency of the equipment installed. For the three pools evaluated, approximately 8000 square feet of space is needed. Location is also critical. Locations far from the pool require extensive plumbing and additional cost. The space must be free of shading from trees and other obstructions to provide direct sunlight into the solar material. Long, straight areas for installation are ideal.
- **Orientation**- Roofs must also have correct orientation to provide the most cost effective installations. South facing orientations are best for solar thermal, but orientation is less critical to solar thermal than solar PV collection.

- **Aesthetics**- Facility owners must decide how the appearance of solar thermal will impact the facility. Installation techniques, metal fabrication and design have helped solar thermal PV become more aesthetically acceptable in recent years.

The solar hot water system would be challenging to install on the facility's roof due to the delicate nature of the slate tiles and the lack of available roof area with the correct orientation. Figure 4.3 shows where 6500 square feet of roof space is available with 8000 square feet required.

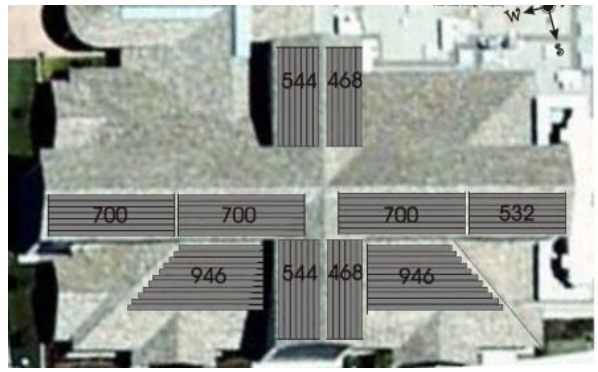


Figure 4.3 SAFAC Roof limited space

This will leave the City with three options; install a smaller roof mount installation, install a ground mount installation in the dirt field behind the SAFAC, or construct a carport parking structure to mount the solar thermal installation.

Three possible sites were considered for the installation of a Solar Thermal system:

A. **The parking lot east of the SAFAC.** This location has enough physical space for the solar array with a workable orientation to the sun, but has added cost of labor and materials to install across a completed parking lot. The construction of a metal parking structures will also add considerable expense to the project. Trees removal would be required along the back of the SAFAC. Vandalism and car damage could be a risk to the carports as well as graffiti. This approach does have the added benefit of providing covered parking to guests.
B. **The dirt field area east of the center.** This area could be fenced off and the solar thermal installed within a protective barrier. The field is in close proximity to plumbing connections, has sizing flexibility, access and orientation. The dirt field does pose a risk for vandalism and may not be aesthetically pleasing. After discussion with City Staff this site may require a modification to the Newark Sportsfield Park Master Plan for this area.
C. **The roof of the aquatic center.** The roof is challenging because of the orientation of available roof areas and the construction of the roof tiles being slate and very fragile. A large roof mounted installation would require the removal of slate tiles and the installation of composite type roofing. Any replacement roofing inherently includes concerns of structural integrity and leakage. Removal and replacement of roofing is also a considerable additional expense. The roof provides acceptable access and orientation but has limited space available. The roof has approximately 6500 square feet of potentially usable area that could accommodate solar thermal for two of the three pools.

The solar thermal hot water plant would provide all of the pool heating in the summer months and a portion of the necessary pool heating during the winter months. The city will not only see savings in the reduced amount of natural gas used to heat the pool but will also see savings in the reduced maintenance and increased life of the boiler system.

In discussion with the city, the best locations for a parking structure installation would have to be a location behind the building (see Figure 4.5). This location also is in close proximity to the pools mechanical room so long complex trench runs would not be necessary. Drawbacks to the parking structure scenario are the increased cost and trees along the back of the building would need to be removed to prevent shading of the array.

Figure 4.4 Solar Thermal Installation (typical)

The budget for this retrofit based on a parking structure mount would be $377,994 and would save the facility $54,645 per year in energy costs, which has a simple payback of 6.92 years without consideration of deferred maintenance savings. The budget for a roof top installation was limited to the Lap Pool and Lazy River Pool based on the available 6000 square feet of correctly oriented roof. The budget for the roof installation is $273,936 and would save the facility $36,317 per year in energy costs with a simple payback of 7.5 years.

A savings breakdown for this measure is provided in Table 4.3 below:

Table 4.3: solar thermal savings large pools

Add Thermal Solar Collectors to Preheat Pool Hot Water Analysis				
		Annual		
ECM #2A, 2B, 2C	Serves	Estimated Gas Therm Savings (84% boiler efficiency)	Estimated therm cost savings	Estimated CO2 reduction (lbs per year)
	Lap Pool	21,734	$ 21,734	239,510
	Lazy River Pool	14,583	$ 14,583	160,708
excluded in 2C	Leisure Pool	18,327	$ 18,327	201,966
Reduction/Saving		54,645	$ 54,645	602,184

Figure 4.5 SAFAC Solar Thermal installation locations shown in blue illustrate where Car port installations could be located.

ENERGY CONSERVATION MEASURES: *LIGHTING RETROFITS*

In this CEASP lighting retrofits is an umbrella term that includes the replacement of inefficient lighting systems with more efficient ones and the retrofitting of current fixtures to make them more efficient. In all instances the light levels produced by the newer systems will equal or be better than the systems they replace.

4.1.3 ECM 3 Replace Natatorium Rail Lighting

As illustrated in the lighting section below the Natatorium rail fixtures consume very large amounts of energy yet produce very little light. The system was designed to utilize up lighting to illuminate the Natatorium. While up lighting has its benefits, it is misapplied in this application. Not only does this system have a high lumen-to-watt ratio (inefficient) but since it uses compact fluorescents it has a much shorter life when compared to linear style fluorescents.

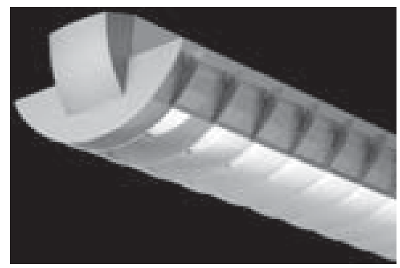


Figure 4.6: Proposed Natatorium Fixture

Initially this CEASP looked at ways to modify or control the current fixtures in order to gain efficiency, however the custom nature of the fixture did not allow many options in order to modify it. Therefore, we chose to evaluate replacing the existing rails with new fixtures suspended in a similar fashion.

We determined that if we removed the current fixture and replaced it with a linear T5 fixture utilizing three tubes (see figure 4.6) we could replace the existing fixtures and reduce the fixtures by half. The energy consumption would be reduced by over 50%. In addition, the lamps in this new fixture are rated for 20,000 hours (as opposed to 10,000 hours of the current system) and would not need to be replaced as often producing operational savings for the City. Light levels in the Natatorium would increase with the new fixtures which would allow for more lights to be turned off during the day.

The budget for this retrofit would be $69,925 and would save the facility $7,508 per year in energy costs, which has a simple payback of 8.61 years without consideration of deferred maintenance savings.

Table 4.4 Savings Analysis for Natatorium Rail Lighting

Replace Natatorium Rail Light Savings Analysis						
		Annual				
ECM #3	Fixture Wattage	Fixture Count	Estimated Hours Used	Estimated kWh	Estimated kWh cost	Estimated CO2 reduction (lbs)
Current	180	88	5,355	84,823	$ 11,632	105,308
Proposed	108	52	5,355	30,074	$ 4,124	37,336
Reduction/Savings	72	36	-	54,750	$ 7,508	67,971

4.1.4 ECM 4 Retrofit Parking Pole Fixtures

Currently the SAFAC has (59) 250 watt pole fixtures (see figure 4.7) and (39) 150 watt small pole fixtures. These poles utilize metal Halide bulbs which were considered state of the art when the facility was constructed. In recent years compact fluorescent lamps have improved to a point where they can be used as suitable replacements for metal halide and other HID lighting sources.

For the pole style fixtures in the parking lot we evaluated them to be retrofit to a 48 and 96 watt compact fluorescent system. The new system will maintain light levels (currently measured between at .3 and 1.4 foot-candles) in the parking lot but will do so at almost half the wattage of the current fixture.

Figure 4.7: Outdoor parking lights

The budget for this retrofit would be $14,783 and would save the facility $4,168 per year in energy costs, which has a simple payback of 2.7 years without consideration of deferred maintenance savings.

Table 4.5 Exterior Lightng Retrofit Savings Summay

Retrofit HID Parking Lot Lighting Analysis							
			Annual				
ECM #4	Fixture Wattage	Fixture Count	Estimated Hours Used	Estimated kWh	Estimated kWh cost		Estimated CO2 reduction (lbs)
Current	280	59	4,015	66,328	$	5,514	82,346
	118	39	4,015	18,477	$	1,536	22,939
Proposed	110	59	4,015	26,057	$	2,166	32,350
	55	39	4,015	8,612	$	716	10,692
Reduction/Savings	233	-	-	50,135	$	4,168	62,243

4.1.5 ECM 5 Replace and Retrofit Wall Mounted HID Fixtures

The exterior of the SAFAC has several different lighting fixtures. However, two fixtures make up the bulk of the wall mounted exterior lighting: "house style" fixture and an Up/Down style fixture (see Figure 4.8 and 4.9 below).

Figure 4.8: 50W HID

Figure 4.9: 100W Up / Down Fixture

Both of these fixtures utilize metal halide lighting which can be replaced by compact fluorescents. The "house style" wall wash fixture could be replaced with a similar fixture that utilizes a 26 watt CFL which would reduce the fixture wattage by half while maintaining current light levels (measured at 1.7 foot-candles). The up/down style fixture would be retrofit to a 39 watt compact fluorescent which would replace the existing 100 watt metal halide.

The budget for this retrofit would be $10,770 and would save the facility $1,377 per year in energy costs, which has a simple payback of 7.35 years without consideration of deferred maintenance savings.

Table 4.6 Exterior Lighting Retrofit Savings Summay

Retrofit Wallmounted HID Fixtures Analysis						
			Annual			
ECM #5	Fixture Wattage	Fixture Count	Estimated Hours Used	Estimated kWh	Estimated kWh cost	Estimated CO2 reduction (lbs per year)
Current	118	31	3,213	11,753	$ 1,730	14,591
	59	14	3,213	2,654	$ 391	3,295
Proposed	39	31	3,213	3,885	$ 572	4,823
	26	14	3,213	1,170	$ 172	1,452
Reduction/Savings	112	-	-	9,353	$ 1,377	11,612

ENERGY CONSERVATION MEASURES: *LIGHTING CONTROLS*

During our analysis of the SAFAC our staff noticed a number of areas that could be illuminated with ambient lighting or where excessive after hours runtime of the lighting was occurring. In order to reduce the energy consumption of the facility we developed a number of lighting control options to take advantage of the natural light as well as reduce after-hours runtime of the lighting. The following ECM's are meant to address these issues.

4.1.6 ECM 6 Install Ambient Lighting Sensors on Selected Fixtures

The SAFAC was designed with many skylights and luminous ceilings to take advantage of natural lighting. Unfortunately, its lighting system was not designed with controls to take advantage of this. In some areas like the gymnasium atrium site staff has done an excellent job of turning off fixtures they do not need. Several areas were noted by our staff that could be shut off during daylight hours.

In order to do this effectively the lighting circuit should have an ambient sensor installed on it that would turn off the lights whenever sufficient natural light was present. These sensors work off the existing fixture voltage and can be adjusted for various light levels.

Table 4.7 below defines the areas proposed and the wattage of the fixtures reduced along with the foot candle readings after lights have been turned off.

Table 4.7 Ambient Fixture Installation

Fixture Location	# Fixtures Affected	Total Wattage Reduced	Remaining Foot Candles
Locker Room Hallway Wall Wash	9	351	37
Gymnasium Lighting	8	2560	34
Aquatic Center Cove Fixtures	22	2304	73

All the remaining light levels exceed illumination standards for the areas they serve. This CEASP estimates that the yearly hours of operation for most of these fixtures would drop from 5,355 to 2,499 resulting in a savings of 14,895 kWh.

The budget for this retrofit would be $7,482 and would save the facility $1,817 per year in energy costs, which has a simple payback of 3.14 years without consideration of deferred maintenance savings.

Table 4.8 Ambient Light Sensor Savings Summary

Install Ambient Light Controller on Selected Fixtures Analysis							
			Annual				
ECM #6	Fixture Count	Fixture Wattage	Pre-hours	Post-hours	Estimated kWh savings	Estimated kWh cost savings	Estimated CO2 reduction (lbs per year)
Cove 8' fixt	17	117	5,355	2,499	5,681	$ 693	7,052
Cove 4' fixt	1	59	5,355	2,499	169	$ 21	209
Cove 6' fixt	2	85	5,355	2,499	486	$ 59	603
Cove 3' fixt	2	43	5,355	2,499	246	$ 30	305
Gym 320-Watt PL	26	320	4,284	1,428	7,311	$ 892	9,077
Locker Rm Wall Wash	13	39	5,355	2,499	1,002	$ 122	1,245
Reduction/Savings				17,136	14,894	$ 1,817	18,491

4.1.7 ECM 7 Install Ambient Light Control Natatorium Rail/Catwalk Fixtures

As was mentioned in the facility's overview the Natatoriums lighting is not very efficient on a cost per lumen basis. However, if the rail fixtures were to be replaced as outlined in ECM 3 much of the lighting could be turned off during the day. A lighting sensor would be installed in the Natatorium that would be tied to the existing Alerton EMS which would allow for the sensor to be adjusted to different light levels and even overridden when needed by facility staff.

Lighting levels could be reduced on all of the Catwalk lighting and perhaps as much as 50% of the new rail lighting while maintaining sufficient light. This retrofit would save approximately 40,715 kWh.

The budget for this retrofit would be $8,062 and would save the facility $4,967 per year in energy costs, which has a simple payback of .65 years without consideration of deferred maintenance savings.

Due to the existing poor light levels in the Natatorium (see lighting section 2.1.1) ambient light control would require implementing ECM 3, Natatorium Rail Lighting before implementing this ECM.

This payback is based on implementing ECM 3, Natatorium Rail Lighting.

Table 4.9 Natatorium Ambient Controller Savings Summary

Install Ambient Light Controller on Natatorium Rail and Catwalks Analysis							
			Annual				
ECM #7	Fixture Count	Fixture Wattage	Pre-hours	Post-hours	Estimated kWh savings	Estimated kWh cost savings	Estimated CO2 reduction (lbs per year)
Catwalk 180W Fixt	48	180	5,355	2,499	24,676	$ 3,010	30,635
Catwalk 180W Fixt	14	180	8,760	8,760	-	$ -	-
Natatorium FT-50 x 4 (NEW	52	108	5,355	2,499	16,039	$ 1,957	19,913
Reduction/Savings				5,712	40,715	$ 4,967	50,548

4.1.8 ECM 8 Control After Hours Lighting Through Current EMS

As was noted in the utility analysis section of this CEASP, it appears that custodial staff is turning on a majority of the lighting when they come in to clean the facility. In order to reduce this "nighttime peak" and the cost it creates we have developed a way to use the existing EMS and GE lighting panel to control excessive after hour runtime.

The current Alerton System has a module that will allow it to integrate with the existing GE lighting panel which would allow more comprehensive scheduling of all the lighting utilizing the Alerton system. The new systems control could work as follows:

- 10 pm all lighting except emergency fixtures are turned off
- all light switches are programmed as bypass timers during after hours

With this approach when cleaning staff is working in the facility the light switches would turn on the lights in occupied rooms for a fixed period which could be programmed to only run, for example, 45 minutes, then turn off. This would allow enough time for them to clean the room but limits the amount of time the fixtures are on. The bypass time on each area could be programmed via the Alerton EMS and allow for custom time limits to be set.

The CEASP estimates that this measure will save the facility 23,400 kWh annually.

The budget for this upgrade includes multiple GE lighting panel upgrade boards, interface modules, interface software and programming.

The budget for this retrofit would be $30,993 and would save the facility $1,945 per year in energy costs, which has a simple payback of 15.93 years without consideration of deferred maintenance savings.

Table 4.10 After Hours lighting Control Savings Summary

Control After Hours Lighting Through Current EMS Analysis					
		Annual			
ECM #8	Fixture Count	Hours Saved	Estimated kWh savings	Estimated kWh cost savings	Estimated CO2 reduction (lbs per year)
excess load	All	780	23,400	$ 1,945	29,051
Reduction/Savings		780	23,400	$ 1,945	29,051

The SAFAC could consider an alternate approach to this energy conservation measure. SAFAC could build into the janitorial contract a behavioral agreement. The agreement would require the janitorial crew to use only the lights required for cleaning and then require them to be shut off. An "allowance" for after hours lighting kWh could be established and if the night usage is greater than the allowance the contract would allow for a back-charge. This would allow the SAFAC to recoup the additional costs incurred for unnecessary night lighting.

The lighting back-charge agreement may prove to be difficult to enforce because there is no technical way to sub-meter (measure) the lighting use after hours without additional hardware. This additional hardware required is at a greater cost than approach above that automates it. The City would be left with a more subjective observation and manual trend-log based approach to document abuses by the cleaning crew after hours and the associated back charge calculations.

ENERGY CONSERVATION MEASURES: *CONTROLS MEASURES*

Currently the SAFAC has an Alerton energy management system to control all of the HVAC at the facility. The measures in this section look at strategies to better control the HVAC in the building through the current system as well as expanding the system to control other pieces of equipment in the facility.

Figure 4.10: Alerton Thermostat

4.1.9 ECM 9 Raise Gymnasium Cooling Set-Point

As illustrated in Table 4.11 and 4.12 below, electrical savings can be realized by adjusting the temperature set-point of the two HVAC units that serve the Gymnasium using the existing EMS to increase the set-point by four degrees.

Two tables are presented below, Table 4.11 shows savings for this measure under the assumption that ECM #14 has been adopted and the two Gymnasium HVAC units have been replaced with new AAON units. Table 4.12 shows the savings for this measure with the building as is, with the existing Carrier HVAC units.

The current space temperature set-point is 72F; the existing EMS would be programmed with a new set-point of 76F. This 4 degree F increase would be a step toward a more energy efficient facility's management plan, and would allow the facility to save money every month on their energy costs. The higher set point does have a risk of a decrease in guest satisfaction.

This CEASP estimates that this measure will produce a savings of 2,040 kWh per year if the Gymnasium HVAC unit replacement (ECM #13) has taken place, or 3,640 kWh with the existing units still in place. The kWh savings are higher on the existing equipment because it is less energy efficient and consumes more energy to operate than the new equipment in ECM #13.

The budget for this retrofit would be approximately $875 with either the existing or replacement units. This measure is estimated to save the facility $249 per year with the AAON replacement units or $444 per year with the existing units, based on the blended average electric rate and would pay for itself within 3.5 years with the new unit or 1.95 years with existing equipment. Simple paybacks are longer when based on the newer equipment due to higher efficiency. No material is required for this ECM and could be executed by trained City staff.

Table 4.11 Gymnasium Set-Point Savings Analysis w/ New Gym Units

Use Existing EMS to Reduce HVAC load in Gymnasium using new AAON units Analysis							
					Annual		
ECM #9A	Serves	Estimated Annual Operating Hours	Temp Increase	Base kW	Estimated kWh savings	Estimated kWh cost savings	Estimated CO2 reduction (lbs per year)
AAON RM-013	Gymnasium	4,368	4	2.3	1,020	$ 125	1,266
AAON RM-013	Gymnasium	4,368	4	2.3	1,020	$ 125	1,266
Reduction/Savings				-	2,040	$ 249	2,533

Table 4.12 Gymnasium Set-Point Savings Analysis w/ Existing Gym Units

Use Existing EMS to Reduce HVAC load in Gymnasium using existing HVAC units Analysis							
					Annual		
ECM #9B	Serves	Estimated Annual Operating Hours	Temp Increase	Base kW	Estimated kWh savings	Estimated kWh cost savings	Estimated CO2 reduction (lbs per year)
Carrier: 48HJF-01	Gymnasium	4,368	4	4.2	1,820	$ 222	2,260
Carrier: 48HJF-01	Gymnasium	4,368	4	4.2	1,820	$ 222	2,260
Reduction/Saving				-	3,640	$ 444	4,519

4.1.10 ECM 10 Establish Peak Limiting Program for Specified HVAC Units

Currently at the SAFAC much of the HVAC units are set to cool between 68 and 72 degrees while occupied. The U.S. Department of Energy Recommends 78 degrees as an acceptable cooling set point. While we feel 78 degrees may be too high, we believe the current set points are set too low especially during peak hour (12:00 pm – 6:00 pm) in the summer when energy costs are at a premium.

We have developed a program for the energy management system that would increase the temperatures on the largest HVAC units up to 75 degrees F during peak hours in the months of May through October when electricity is at a premium. Our experience at other locations where we have done similar strategies is that most occupants hardly notice the increase in temperature. This would be a very low cost measure for the city since the SAFAC already has an energy management system installed.

Table 4.13 below illustrates the units selected as well as the savings from this measure.

The budget for this retrofit would be $875 and would save the facility $396 per year in energy costs, which has a simple payback of 2.21 years without consideration of deferred maintenance savings. No material is required for this ECM and could be executed by trained City staff.

Table 4.13 Peak Demand Limiting Program Savings Summary

Use Existing EMS to Reduce Peak HVAC load during summer months Analysis							
					Annual		
ECM #10	Serves	Estimated Annual Operating Hours	Temp Increase	Base kW	Estimated kWh savings	Estimated kWh cost savings	Estimated CO2 reduction (lbs per year)
Carrier: 48HJD-014	Atrium	780	3	5.47	320	83	397
Carrier: 48HJD-008	Teen Center	780	4	2.86	223	58	277
Carrier: 48HJD-008	Teen Center	780	4	2.86	223	58	277
Carrier: 48HJD-004	Activity Room	780	4	1.13	88	23	109
Carrier: 48HJD-009	Exercise Room	780	2	3.08	120	31	149
AAON: RK-10-2	Pool Entry	780	3	3.75	219	57	272
AAON: RK-03	Entry Offices	780	3	1.12	65	17	81
AAON: RK-03	Offices	780	3	1.12	65	17	81
AAON: RK-04	Lockers	780	3	1.49	87	23	108
AAON: RK-05	Lockers	780	2	1.88	73	19	91
AAON: RK-02	Lifeguard Room	780	3	0.76	45	12	55
Reduction/Savings				-	1,529	$ 396	1,898

4.1.11 ECM 11 Install Occupancy Controllers for HVAC in Specified Areas

As illustrated in Table 4.14 below, electrical savings can be realized by controlling the temperature set-point of the two HVAC units that serve the Meeting Room and the Dance Studio. This can be accomplished by using occupancy sensors combined with the existing Energy Management System (EMS) to increase the set-point by a few degrees when the room is unoccupied.

Occupancy Sensors sense when a room has been occupied and activate for a programmable time period the EMS system to allow for heating and cooling. The system would lower the temperature to the current set-point after the room has been occupied for 5 minutes.

The HVAC unit that serves the Meeting Room is a 5-ton Carrier 48HJD-006. The EMS will be programmed to raise this unit's set-point from the current 72 F to the new set-point of 78 F when the room is unoccupied.

The HVAC unit that serves the Dance Studio is a 7.5-ton Carrier 48HJD-008. The EMS will be programmed to raise this unit's set-point from the current 69 F to the new set-point of 78 F when the room is unoccupied. This higher set point requires less cooling and saves energy when unoccupied.

The staff makes efforts to schedule the room temperature control to align with planned meetings. This ECM is an added layer of protection for SAFAC to accommodate last minute schedule changes and prevent cooling / heating of unoccupied rooms.

This CEASP estimates that for approximately 1,820 hours per year in the Meeting Room and 910 hours per year in the Dance Studio the temperature can be set to an energy efficient 78 F. This measure will save both electrical consumption and demand charges, while using occupancy sensors to minimize impact on guest usage of the facility.

We estimate that this measure will produce a savings of 5,088 kWh per year.

Budget calculations for this ECM include Occupancy Sensor purchase and installation, connection to existing EMS system and EMS programming.

The budget for this retrofit would be $3,180 and would save the facility $621 per year in energy costs, which has a simple payback of 4.46 years without consideration of deferred maintenance savings.

Table 4.14 HVAC occupancy Controllers Savings Summary

Install Occupancy Controllers for HVAC in Specified Areas Analysis							
				Annual			
ECM #11	Serves	Temperature Increase	Base kW	Estimated Annual Unoccupied Hours	Estimated kWh savings	Estimated kWh cost savings	Estimated CO2 reduction (lbs per year)
Carrier: 48HJD-006	Meeting Room	6	1.4	1,820	2,482	$ 303	3,081
Carrier: 48HJD-008	Dance Studio	9	2.0	1,274	2,606	$ 318	3,235
Reduction/Savings				-	5,088	$ 621	6,316

4.1.12 ECM 12 Install Controls on Facility's Pool Boiler Plant

Figure 4.11: pool boiler

As illustrated in Table 4.15 below, significant natural gas savings can be realized by controlling the runtime of the boilers serving the various swimming pools. The boilers currently run 24 hours a day, every day. The boilers can be optimized to only maintain the water temperature to the current set-point between 80 and 84 degrees F during the hours when the pool is in use.

This CEASP has determined that the pool boilers can be disabled between the hours of 9:00 P.M. and 4:30 A.M. seven days a week. During these 7.5 hours per day the water temperature would be allowed to drift, and at 4:30 A.M. the boilers would be re-enabled to bring the water up to its normal set-point. We expect increased natural gas consumption between 4:30 A.M. and approximately 6:00 A.M. while the pool is being brought back up to temperature, however the savings generated from not heating the pool at night will be greater than this increase. Natural gas consumption can be reduced with no impact on guest comfort, simply by not heating the water when the pools are closed. Because the interior temperature of the Natatorium is maintained through the night, minimum heat loss off the surface of the pool water is expected and pool temperatures are estimated to drop around 4 degrees.

We estimate that this measure will produce a savings of 5% of the previous natural gas consumption level, or 2,791 therms per year.

The budget for this retrofit would be $12,860 and would save the facility $3,237 per year in energy costs, which has a simple payback of 3.97 years without consideration of deferred maintenance savings.

Table 4.15 Place Boilers on EMS

Install Controls on Pool Boiler Plant Analysis						
				Annual		
ECM #12	Serves	Pre hours	Post hours	Estimated therm savings	Estimated therm cost savings	Estimated CO2 reduction (lbs per year)
Boiler	Lap Pool	8,760	6,023	700	$ 812	7,718
Boiler	Lazy River	8,760	6,023	808	$ 937	8,905
Boiler	Activity Pool	8,760	6,023	1,067	$ 1,237	11,755
Boiler	Spa	8,760	6,023	215	$ 250	2,375
Reduction/Savings			10,950	2,791	$ 3,237	30,753

ENERGY CONSERVATION MEASURES: *MECHANICAL UPGRADES*

4.1.13 ECM 13 Install VFD System on Pool Filtration Pumps

Significant electrical savings can be realized by controlling the speed of the filtration pumps serving the swimming pools. The systems currently run 24 hours a day, every day at full speed.

The pumps can be optimized to reduce the flow rate to the rate needed to fulfill health code requirements (table 4.16) for minimum turnover rates for the pools during the hours when the pool is not in use. During hours that the pool is open the filtration pumps will be run at full speed as they are now.

This CEASP has determined that the filtration pumps can be run at a reduced level for eight hours each night during the week and on weekends can run at a reduced level for ten hours per night. As we show in Table 4.16 below, the reduced flow rate is based on the minimum rate needed to satisfy the turnover requirement for each pool.

Table 4.16 Minimum Filtration Requirements

SYSERCO - NEWARK AQUATIC CENTER: Required Filtration Flowrates

Lap Pool (222 GPM required by law to meet turnover rate)
79,650 Gallons
Filter Area: 20 sq. ft.
Normal Filter Flow rate: 300 GPM
Backwash Flow rate: 300 GPM
Recirculation pump: 7.5 HP, 300GPM
Turnover rate: under 5 hours
Heater: 650K BTU-Lockinvar

Lazy River (167 GPM required by law to meet turnover rate)
57,270 Gallons
Filter Area: 40 sq. ft.
Max Filter Flow rate: 450 GPM
Backwash Flow rate: 300 GPM
Recirculation pump: 10 HP, 450GPM
Turnover rate: 3 hours
Heater: 750K BTU-Lochinvar

Activity Pool (140 GPM required by law to meet turnover rate)
47,820 Gallons
Filter Area: 30 sq. ft.
Max Filter Flow rate: 450 GPM
Backwash Flow rate: 225 GPM
Recirculation pump: 10 HP, 450GPM
Turnover rate: under 2 hours
Heater: 990K BTU-Lochinvar

Spa (117 GPM required by law to meet turnover Rate)
3515 Gallons
Filter Area: 14.12 sq. ft.
Max Filter Flow rate: 210 GPM
Backwash Flow rate: 105GPM
does not meet flow rate minimum can not be open during backwash
Recirculation pump: 5 HP, 176GPM
Turnover rate: under 20 min
Heater: 24KW-Lochinvar

Figure 4.12 – Variable Frequency Drive (VFD)

This measure will require the installation of a variable frequency drive (VFD) on each pump listed in Table 4.17. These three VFDs represent the major cost associated with this measure, and are required in order to control the speed of the pumps. Other costs associated with this measure will be connecting the new VFDs to the EMS so that they can be scheduled to automatically change their speed at the pre-determined times. Electrical consumption can be reduced while satisfying health code requirements at all times by reducing the speed of the filtration pumps when the pools are closed. The VFD motors would need to be installed outside of the pool filtration area, most likely in the adjoining electrical room.

We estimate that this measure will produce a savings of 24% of the previous consumption level, or 47,676 kWh per year.

Budget calculations for this ECM included three Variable Frequency Drives, enclosures, installation in adjoining electrical room, conduit, wiring, connection to existing EMS system and programming of existing EMS system.

The budget for this retrofit would be $23,704 and would save the facility $3,964 per year in energy costs, which has a simple payback of 5 years without consideration of deferred maintenance savings.

Table 4.17 VFD System for Pool Boilers Savings Summary

Install VFD's to Pool Filtration Pumps Analysis							
				Annual			
ECM #13	Serves	kW Pre	kW Post	Estimated Annual Hours	Estimated kWh savings	Estimated kWh cost savings	Estimated CO2 reduction (lbs per year)
	Lap Pool Pump	6.32	2.98	8,760	10,433	$ 867	12,953
	Lazy River Pump	8.43	2.46	8,760	18,622	$ 1,548	23,119
	Activity Pool Pump	8.43	2.46	8,760	18,622	$ 1,548	23,119
Reduction/Savings		23.2	7.9	-	47,676	$ 3,964	59,190

4.1.14 ECM 14 Replace Gym with AAON Units Digital Scroll Compressors

As illustrated in Table 4.18 on the following page, electrical savings can be realized by replacing the two package units that serve the Gymnasium with variable capacity units. This CEASP has determined that by using units with variable capacity compressors and fans in this application electrical savings will be realized, especially when the units are running under low load conditions.

The existing Carrier model 48HJF-014, 12½ ton package units have badly corroded condenser coils. An example of the damage is shown in Figure 4.13. The existing units were installed in 2001 and have an expected service life between 8 and 15 years. Despite this, this measure needs to be considered in the near future because the Carrier units are showing significant signs of wear. Corroded condenser coils mean that the air conditioner cannot perform as efficiently as it did when it was new, and these units are not only corroded but have damage that will increase with time, eventually forcing a maintenance related replacement to become necessary.

Figure 4.13 – Carrier Coil Deterioration

In addition to deferred maintenance savings, replacement with variable capacity units such as the AAON 16.7 SEER package units being evaluated will save money every month by virtue of their improved efficiency. Most air conditioning systems are not under maximum load all the time. This is true for the Gymnasium at the SAFAC which has intermittent use by guests. Variable capacity units which have high efficiency even at low load can take advantage of situations such as this where a space has fluctuating HVAC demand. The replacement units will be ½ ton larger than the existing units because this is the most closely matched unit available. Despite providing a total of one extra ton of cooling at maximum output when called upon, the new units will be less expensive to operate every day.

It has been our experiences that on average commercial grade package units will last 15 years. However, many factors can lengthen or shorten this lifespan of these units. For example longer duty cycles, or closer proximity to salt water can shorten the lifespan of a unit (this is the case with the gymnasium equipment). The opposite is true to lengthen the lifecycle of a unit. There are literally hundreds of factors that play into the lifecycle of a unit. Our best approach is to continually monitor each unit through regular maintenance and replace once major repairs become more frequent or within 15 years whichever comes first.

The City maintenance staff maintains a building mechanical equipment replacement list for the aquatic center and has a planned replacement year of 2011 for these two HVAC units.

Costs associated with this measure include the cost of the replacement units and curb adapters, installation labor cost, the disposal fees for the existing units, and the cost to integrate the new units with the EMS. In addition to electrical savings, natural gas savings will be realized during the winter months when the package units are used to heat the space.

As shown in Table 4.18, the replacement units are estimated to have a 2% higher Annual Fuel Utilization Efficiency (AFUE) than the existing units. Table 4.19 shows the combined electric and natural gas savings for the measure.

Electrical and natural gas consumption can be reduced while improving guest comfort at all times by replacing the Gymnasium HVAC units with new high efficiency variable capacity units.

We estimate that this measure will produce an electric consumption savings of 47% of the previous consumption level, or 15,999 kWh per year. We estimate a natural gas savings of 362 therms per year.

The budget for this retrofit would be $97,162 and would save the facility $2,373 per year in energy costs, which has a simple payback of 39.9 years without consideration of deferred maintenance savings.

This CEASP has determined that this measure would be eligible for $2,601 in incentives from PG&E, which are included in the payback calculation.

Table 4.18 Gymnasium Package Unit Replacement Savings Summary

Replace Gymnasium HVAC units with AAON units with Digital Scrool Compressors Analysis						
		Annual				
ECM #14	Serves	Estimated Operating Hours	Estimated kWh savings	Estimated Therm Saving	Estimated therm/kWh cost savings	Estimated CO2 reduction (lbs per year)
Carrier: 48HJF-014	Gymnasium	4,368	7,999	181	$ 1,187	11,924
Carrier: 48HJF-014	Gymnasium	4,368	7,999	181	$ 1,187	11,924
Reduction/Savings		-	15,999	362	$ 2,374	23,848

5 Other Considerations

MEASURES NOT VIABLE

This section outlines those ECM's that were considered for the report but did not make the final report either due to a poor payback or other measures providing a better solution. While they did not meet the criteria for this CEASP, they could be considered by the City in modernization or new construction projects.

5.1.1 Geothermal Heating/ Cooling

Geothermal heating and cooling uses the Earth's natural heat to provide conditioning for a building- typically via a heat pump. Geothermal heat pumps are very efficient and buildings that are conditioned by them often times have lower operating costs than those that are conditioned by more conventional methods. The major drawback is the large upfront cost and the availability of space to put the necessary in ground wells or coils.

The SAFAC is located in close proximity to two sports fields that could be a potential location to install coil type geothermal wells. Coil type wells are shallower but require more land to be excavated in order to place the coil fields. Deep well geothermal consists of large deep wells and does not require near the land but would not be a good fit at this site because of the close proximity to the bay and potential for groundwater intrusion.

Geothermal installations are better suited for new construction where they can be planned into the overall building design and equipment. In a retrofit application such as the SAFAC, the conventional air conditioning would still be needed in order to supplement the geothermal heat pumps on extreme days. The SAFAC would be required to retrofit the existing conventional air conditioning equipment at a cost estimated around $1.4 million.

The cost to excavate the land along with the cost of the existing system retrofit would push this measure well outside reasonable payback criteria. Geothermal would have an estimated payback beyond its' useful life and therefore not considered.

Geothermal is a good idea if you are constructing a new facility with enough free land around it in where you can place the wells or fields. For a retrofit of an existing building the cost of the installation does not cover the benefit received in energy savings. Therefore, geothermal was not considered a feasible option at SAFAC.

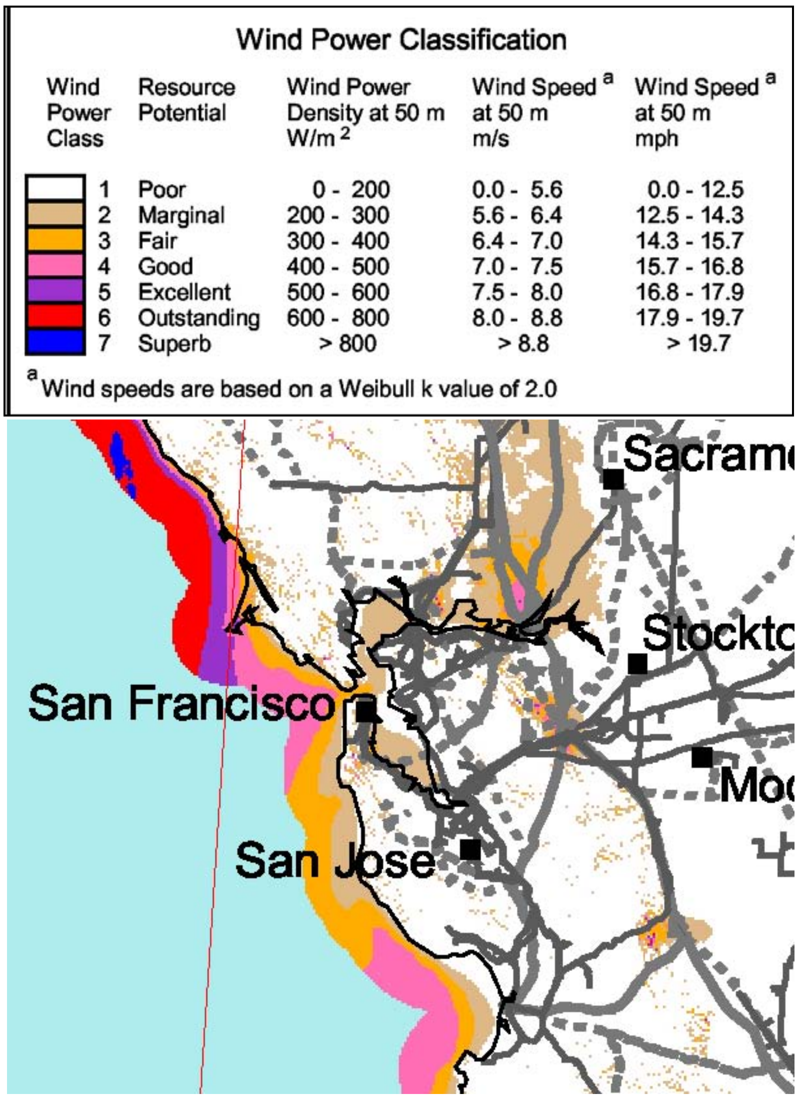
5.1.2 Wind Power

Wind turbines are probably the most cost effective means of generating renewable power. The one drawback is that they are unpredictable in areas that do not have consistent high velocity wind patterns.

The Department of Energy's Wind Program and the National Renewable Energy Laboratory (NREL) published a wind resource map for the state of California. This resource map shows wind speed estimates at 50 meters above the ground and depicts the resource that could be used for utility-scale wind development. Future plans are to provide wind speed estimates at 30 meters, which are useful for identifying small wind turbine opportunities.

As a renewable resource, wind is classified according to wind power classes, which are based on typical wind speeds. These classes range from Class 1 (the lowest) to Class 7 (the highest). In general, at 50 meters, wind power Class 4 or higher can be useful for generating wind power with large turbines.

The California Wind Resource Map (Source US Department of Energy) show below identifies Newark in Class 1 or Class 2 which is poor or marginal wind availability.



Wind Power Classification

Wind Power Class	Resource Potential	Wind Power Density at 50 m W/m^2	Wind Speed [a] at 50 m m/s	Wind Speed [a] at 50 m mph
1	Poor	0 - 200	0.0 - 5.6	0.0 - 12.5
2	Marginal	200 - 300	5.6 - 6.4	12.5 - 14.3
3	Fair	300 - 400	6.4 - 7.0	14.3 - 15.7
4	Good	400 - 500	7.0 - 7.5	15.7 - 16.8
5	Excellent	500 - 600	7.5 - 8.0	16.8 - 17.9
6	Outstanding	600 - 800	8.0 - 8.8	17.9 - 19.7
7	Superb	> 800	> 8.8	> 19.7

[a] Wind speeds are based on a Weibull k value of 2.0

Figure 5.1 – DOE wind resource map

Although it is located in an area with wind, it is not of the velocity and predictability that is needed for wind turbines to be cost effective. Other means such as solar PV are better options for the SAFAC if they are looking to install some form of renewable energy.

5.1.3 Domestic Solar Hot Water

Initially in this proposal Solar Hot Water was considered to supplement the existing domestic hot water boilers located on the roof. The proposed plan was to install a closed loop glycol system on the existing flat portion of the roof.

Closed loop systems use a heat-transfer fluid to collect heat and a heat exchanger to transfer the heat to domestic water. Active closed loop systems use electric pumps, valves, and controllers to circulate the heat-transfer fluid, usually a glycol-water antifreeze mixture, through the collectors.

A closed loop is important to utilize when drinking water is involved to ensure contaminants do not enter the through the solar thermal system.

However after initial budget estimates of $220,000 and a 25 year simple payback it provided an extremely low return on investment.

5.1.4 Domestic Hot Water Plant Controls

Along with solar thermal for the domestic hot water we looked at placing the current plant on the EMS to shut it down at night. The budget to do this would have been approximately $7,200. However, the measure only saved the facility $388 per year yielding an 18.5 year simple payback. Due to the low return on investment this ECM was removed from the overall recommendations.

5.1.5 Cogeneration

A few years ago and under different criteria the SAFAC would have been an ideal location to install a small 80 to 150 kW cogeneration unit. The unit could have provided enough power to trim a significant portion of the facility’s base load and much of the waste heat could have been used to supplement the current pool heaters. However, the rebates that once made cogeneration an attractive option are not available. Additionally, small system cogeneration is not as reliable as once thought. If a cogeneration system is down for a few hours during peak time the savings for the month could be completely forfeited. Cogeneration also puts the burden of purchasing fuel (natural gas) at a competitive rate on the owner.

Based on fuel cost and ongoing maintenance expense of the cogeneration system better options exist in the form of solar hot water systems to heat the pools and PV systems to supply power to the facility that contain no moving parts, have no fuel procurement issues, provide more reliable power and provide more carbon offsets than cogeneration does. With this in mind cogeneration does not appear to be a feasible option for the SAFAC.

6 City of Newark Strategic Implementation Plan

BASIS OF RECOMMENDATIONS

This Comprehensive Energy Analysis and Strategic Plan provides the following recommendations as outlined in this section. The basis for the recommendations is based on four criteria:

1. Total energy reduction the Solar Electric measure produces as a standalone measure
2. Overall energy reduction ranking of all other measures (excluding Solar Electric)
3. Most energy reducing for the cost (simple payback) of all other measures (excluding Solar Electric) to provide a guide for the City to follow as they identify funding sources.
4. Ability of energy conservation measures to self fund and provide cash flow neutral or better results for the City.

Because of the magnitude of the solar electric energy conservation measure in comparison to all other measures, it is separated to provide visibility and not mask the benefit of the other recommendations.

Table 6.1 provides a perspective on the recommendations on how impactful the recommendations would be to the overall annual energy cost avoidance and corresponding savings.

Table 6.1 ranked by annual energy cost avoidance

ECM #	Demand Response Measures	Estimated CO2 Reduction	Total energy cost avoidance	Implementation Cost	Estimated Rebate	Simple Payback (rebates Applied)
2	Add Thermal Solar Collectors to Preheat Pool Hot Water	602,184	$ 54,645	$ 377,994	$ -	6.92
1	Install Solar Photo Voltaic Panel for Renewable Generation	345,136	escalating	$ 1,121,000	$ 357,024	14.50
3	Replace Natatorium Rail Lighting	67,972	$ 7,508	$ 69,925	$ 5,264	8.61
7	Install Ambient Light Controller on the Natatorium Rail and Catwalk Fixtures	50,548	$ 4,967	$ 8,062	$ 4,846	0.65
4	Retrofit HID Parking Lot Lighting	62,243	$ 4,168	$ 14,783	$ 3,509	2.70
13	Add VFDs to Pool Filtration Pumps	59,190	$ 3,964	$ 23,704	$ 3,814	5.02
12	Install Controls on Pool Boiler Plant	30,753	$ 3,237	$ 12,860	$ -	3.97
14	Replace Gymnasium Units with AAON Units Containing Digital Scroll Compressors	23,848	$ 2,374	$ 97,162	$ 2,601	39.84
8	Control After Hours Lighting Through Current EMS	29,051	$ 1,945	$ 30,993	$ -	15.93
6	Install Ambient Lighting Sensors on Selected Fixtures	18,491	$ 1,817	$ 7,482	$ 1,773	3.14
5	Replace and Retrofit Wall Mounted HID Fixtures	11,612	$ 1,377	$ 10,770	$ 655	7.35
11	Install Occupancy Controllers for HVAC in Specified Areas	6,316	$ 621	$ 3,180	$ 407	4.46
10	Use Existing EMS to Reduce Peak HVAC Load During Summer Months	1,898	$ 396	$ 875	$ -	2.21
9	Use Existing EMS to Reduce HVAC Load in the Gymnasium	2,533	$ 249	$ 875	$ -	3.51
Total		1,311,775	$ 87,268	$ 1,779,665	$ 379,893	7.29

A second table 6.2 is provided to show a summary of these same recommendations based on energy cost avoidance to cost (simple payback). This provides a perspective on the recommendations on how impactful the recommendations would be to the operating and / or capital budgets:

Table 6.2 Simple Payback

ECM #	Demand Response Measures	Estimated CO2 Reduction	Total energy cost avoidance	Implementation Cost	Estimated Rebate	Simple Payback (rebates Applied)
7	Install Ambient Light Controller on the Natatorium Rail and Catwalk Fixtures	50,548	$ 4,967	$ 8,062	$ 4,846	0.65
10	Use Existing EMS to Reduce Peak HVAC Load During Summer Months	1,898	$ 396	$ 875	$ -	2.21
4	Retrofit HID Parking Lot Lighting	62,243	$ 4,168	$ 14,783	$ 3,509	2.70
6	Install Ambient Lighting Sensors on Selected Fixtures	18,491	$ 1,817	$ 7,482	$ 1,773	3.14
9	Use Existing EMS to Reduce HVAC Load in the Gymnasium	2,533	$ 249	$ 875	$ -	3.51
12	Install Controls on Pool Boiler Plant	30,753	$ 3,237	$ 12,860	$ -	3.97
11	Install Occupancy Controllers for HVAC in Specified Areas	6,316	$ 621	$ 3,180	$ 407	4.46
13	Add VFDs to Pool Filtration Pumps	59,190	$ 3,964	$ 23,704	$ 3,814	5.02
2	Add Thermal Solar Collectors to Preheat Pool Hot Water	602,184	$ 54,645	$ 377,994	$ -	6.92
5	Replace and Retrofit Wall Mounted HID Fixtures	11,612	$ 1,377	$ 10,770	$ 655	7.35
3	Replace Natatorium Rail Lighting	67,972	$ 7,508	$ 69,925	$ 5,264	8.61
1	Install Solar Photo Voltaic Panel for Renewable Generation	345,136	escalating	$ 1,121,000	$ 357,024	14.50
8	Control After Hours Lighting Through Current EMS	29,051	$ 1,945	$ 30,993	$ -	15.93
14	Replace Gymnasium Units with AAON Units Containing Digital Scroll Compressors	23,848	$ 2,374	$ 97,162	$ 2,601	39.84
Total		1,311,775	$ 87,268	$ 1,779,665	$ 379,893	7.29

All projects that have a eleven (11) year simple payback or less are recommended as part of this plan based on their ability to be financed and implemented on a cash flow neutral or better position.

Additionally, the replacement of the Gymnasium AC Units are included in this recommendation based on the expected remaining limited life of these units, detailed out in recommendation #8.

6.1.1 Project Funding

Critical to any implementation plan is the availability of funding. There is a variety of ways to fund these energy conservation measures. We have focused on the financing approaches we feel are most suitable for the City.

The City has been active in pursuing Federal and State grants for projects and grants may supplement a portion of these projects. In addition, some operating and capital budgets may be identified that could be utilized to implement several of these energy conservation measures.

Typically the City has waited for capital and operating budgets to be available to implement projects. However, many other cities municipal energy projects are funded through financing vehicles such as Municipal Leases and/or Power Purchase Agreements. In addition to these traditional funding methods, the California Energy Commission is currently offering on a first come, first serve basis a low interest rate loan (3%) for up to $3 Million dollar projects to implement energy savings projects for cities. Clean Renewable Energy Bonds could also be considered.

Renewable energy opportunities for Public entities used to be thought of as only small scale or demonstration level projects. However, over the past few years with the evolution of Power Purchase Agreements and Municipal Leases, larger renewable energy ventures such as Solar Photo Voltaic and Wind Generation have become viable options for Cities and other public entities.

The information describing how a Power Purchase Agreement (PPA), Municipal Lease, California Energy Commission Energy Efficiency Financing and Clean Energy Renewable Bonds (CREB) operate as well as some of the benefits and drawbacks of entering into these agreements can be found in the appendices section 7.15.

Table 6.3 Summary of the four financing approaches:

Financing Type	**CEC Low Interest Loan**	**Municipal Lease**	**Power Purchase Agreement (PPA)**	**Clean Renewable Energy Bonds (CREBs)**
Description	Loan provided by CEC for qualifying projects	Loan provided by bank for qualifying projects	Purchase of power generated by system owned by third party	Federally backed bond underwritten by bank for qualifying projects
Qualified Projects	Energy Efficiency	Energy Efficiency and Solar	Solar	Solar
Minimum Term (years)	10	5	15	10
Maximum Term (years)	15	20	25	15
Interest Rate	3.0-3.5%	5.5-7.0%	NA	Effective Rate of ~ 1%
End of Term Options	City owns equipment	City owns equipment	City buys equipment at fair market value	City owns equipment
Incentives	Kept by City	Kept by City	Kept by system owner	Kept by City
Insurance	Provided by City	Provided by City	Provided by system owner	Provided by City
Tax Credits	Lost	Lost	Monetized by system owner	Lost
Operations and Maintenance	City's responsibility after warranty period	City's responsibility after warranty period	System owner's responsibility	City's responsibility after warranty period

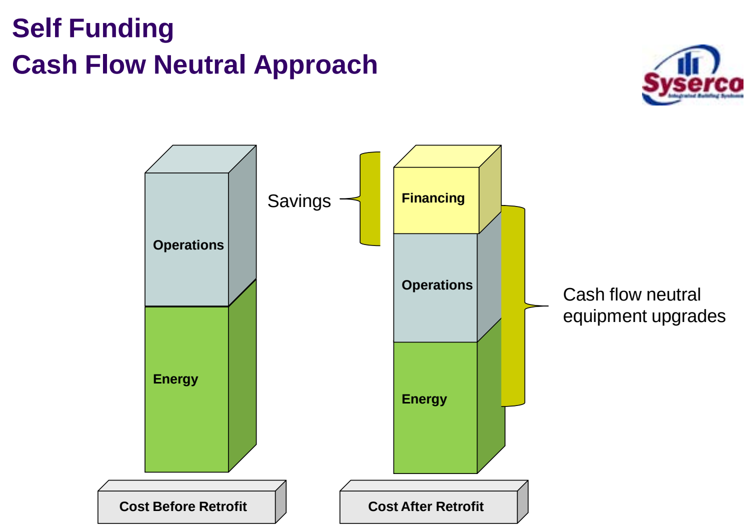
Financing is an important component of the strategic plan. Knowing what size project, term, rate and availability is critical to a successful project.

6.1.2 Recommendation #1 Align Financial Vehicle and City Energy Goals

A brief workshop was conducted on July 28th, 2009 with City representatives Susie Woodstock and Victoria Hernandez. The purpose of the workshop was to review the four financing vehicles outlined in this study and to answer questions on the alternative financing options.

A successful project will require the City to determine which energy conservation measures they both highly value and can financially justify. The determination of which energy conservation measures are valued must be aligned with the financing vehicles available. This alignment must then be tested against the requirements of the financing vehicle to confirm the project is eligible for the program.

Critical to the approach is that the implementation costs to the City are "cash flow neutral" where the energy savings, operational savings, tax credits and utility rebates are at least equal to the finance payment on a yearly basis. This self funding approach makes energy projects highly desirable.



Based on the identified energy projects, we believe the most suitable financing vehicles are for the City to utilize the CEC low interest loan for the energy conservation measures and to utilize the CREB for the solar renewable energy implementation.

The CEC low interest loan will provide the City a self funding cash flow neutral project for the thirteen recommended energy conservation measures (all but solar PV).

The CREB will not be cash flow neutral each year but contributes a substantial savings over a twenty-five year period for the ground mount solar renewable energy measure.

The next step is for the City to determine their energy goals and how to align them with their finances.

The City historically has created capital and operating budgets to address facility retrofits. However, energy conservation retrofits have a unique quality where the savings they produce can pay for the upgrades through this self funding cash flow neutral model.

In working with SAFAC and City maintenance staff the following scenario would typically be the approach for a retrofit of an end of life piece of equipment- (2) AC rooftop units for the Gymnasium:

1. Determine end of life for equipment of rooftop AC units based on equipment age, reliability, maintenance record, field experience

2. Request capital budget dollars for replacement of units, looking for an improvement in energy efficiency over existing unit if possible and affordable

3. Once capital budget is approved, schedule replacement

The results of this will be a request to replace the two gymnasium AC units in the year 2011 at a budget of $97,162. Based on the delay of the replacement, it is expected that the city will pay $2200 a year on 3rd party maintenance on those same AC units until replaced. These two gymnasium AC units have a life cycle remaining of approximately two years.

Beyond capital budgeting is the existing operating budget of SAFAC. The SAFAC spends from $15,000 to $20,000 a year in lighting replacement / bulb replacement. $10,000 is a rough estimate of how much of that lighting is spent on bulb replacement for the lighting that would be retrofitted as part of this plan. That bulb replacement operating cost would be relieved for two years based on new fixtures and bulbs being installed as part of the portfolio of ECM's recommended as part of the CEASP.

Taking just these two examples, the City could realize real cash flow (incentives from implementing the measures) and real operating and capital budget relief of over $145,000 over the next two years if they executed a self funding* cash flow neutral approach versus their historical approach of capital and operational budgeting. The table below illustrates these savings:

Measure	Year	Real Cash Flow	Budget Relief	Running Total
Rebates ECM's- portfolio except solar pv	1	$ 23,677	$ -	$ 23,677
3rd party HVAC repair savings Gym Units	1	$ -	$ 2,200	$ 25,877
Lighting replacement budget relief (bulbs)	1	$ -	$ 10,000	$ 35,877
Total Year 1 Budget				$ 35,877
Rebates	2	$ -	$ -	$ -
(2) AC units replacement Gymnasium	2	$ -	$ 97,162	$ 97,162
3rd Party HVAC repair savings Gym Units	2	$ -	$ 2,200	$ 99,362
Lighting replacement budget relief (bulbs)	2	$ -	$ 10,000	$ 109,362
Total Year 2 Budget				$ 109,362
Total year 1 and 2 year Budget impact		$ 23,677	$ 121,562	$ 145,239

*payments to finance company are no greater than the calculated savings generated from implementing the measures

6.1.3 Recommendation #2 Install Solar PV for Renewable Generation

The project with the largest energy conservation and CO_2 reduction impact is the Solar Photo Voltaic renewable energy installation. The project provides 278,311 kWh of energy reduction, 345,523 lbs of CO_2 reduction which is the equivalent of planting over 1,000 trees. For the ground mount and parking cover designs the city has at minimum three methods to procure the funding necessary to implement this energy conservation measure by way of a Municipal Lease, Power Purchase Agreement or Clean Renewable Energy Bond.

The big decision for the City is to evaluate if they can accept the risk of vandalism of the solar PV system if it were either ground mount with protective fencing or parking cover design. These two designs have the better simple paybacks and are stronger economic choices.

Although the roof mount is ideal from a protection perspective, this design has significant disadvantages:

1. The available roof space is limited so the solar PV would only serve a small amount of electrical usage.

2. The simple payback is beyond the available financing terms with all except PPA financing, and the kWh output of the roof installation is too small for a PPA to consider. This would require the city to provide capital to implement the project with this design.

The City could also consider if there is an alternate City owned, long term location for a Solar PV program that would provide a safe and more economical installation. The CPUC has not yet ruled on whether a local government participating in the 2466 program can also receive rebates which would most likely offset the economic benefit of an alternate site.

This CEASP recommends option 1b below, and that the most suitable financing vehicle for the City to utilize is the CREB for the solar renewable energy implementation.

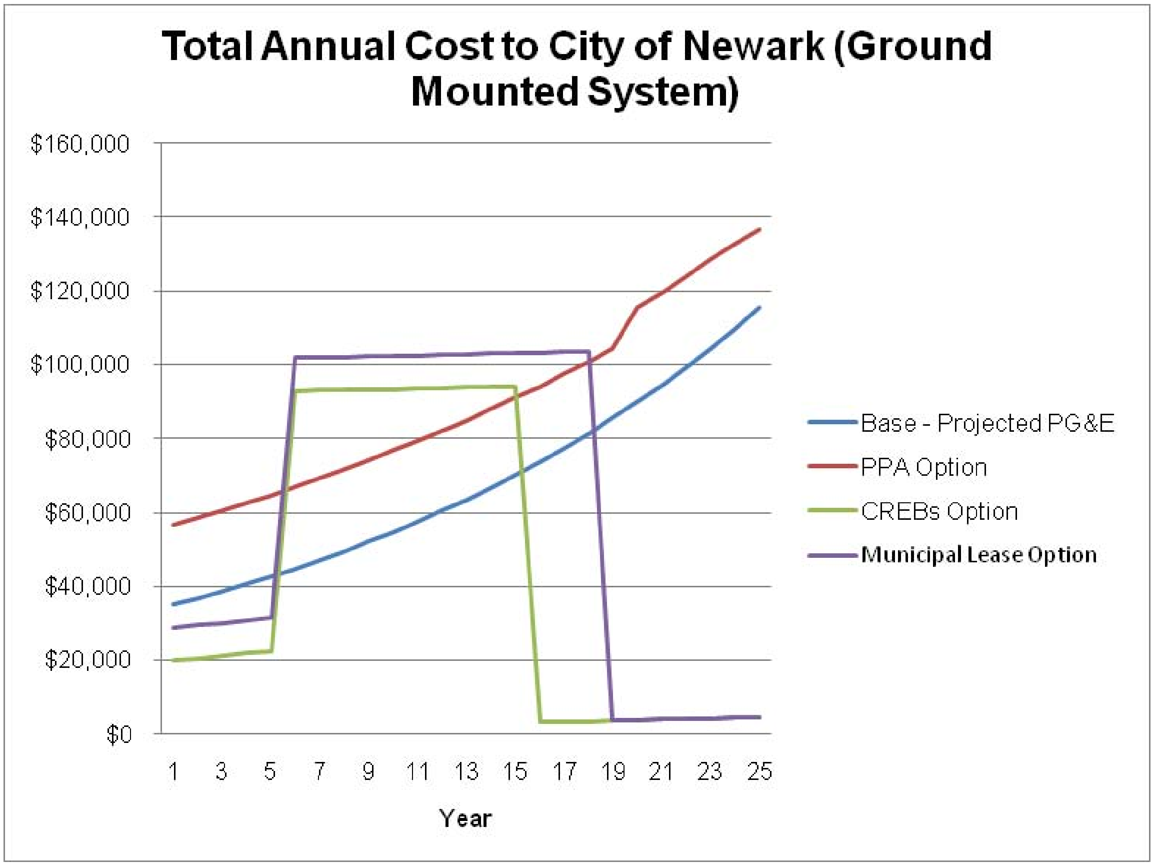
This recommendation is contingent on the ability to get the cost of the electricity from the Solar PV renewable source at or below the cost they currently project to pay to the Utility. Moving the solar installation to the dirt field is outlined in option 1b below. This option may require the City to modify the Newark Sportsfield Park Master Plan.

The financial models to implement this measure are shown in the table below. The budgets per year take into consideration the installation, cost to maintain, the cost of money to finance, and warranty (PPA only) to ensure the installation has a life cycle of 25 years.

The CREB financing option captures the utility rebates for the first five years, making the payment less for the city during that period. Years 6 through 15 are higher payments. The system debt is then satisfied and the savings are significant over years 16 through 25. The CREB does not allow for the payments to be evened out on an annual basis, therefore this is not cash flow neutral each year. If the City can manage this cash flow model yearly then the overall savings are in excess of $600,000 over the twenty-five year period.

Option 1b Solar ground mounted behind SAFAC:

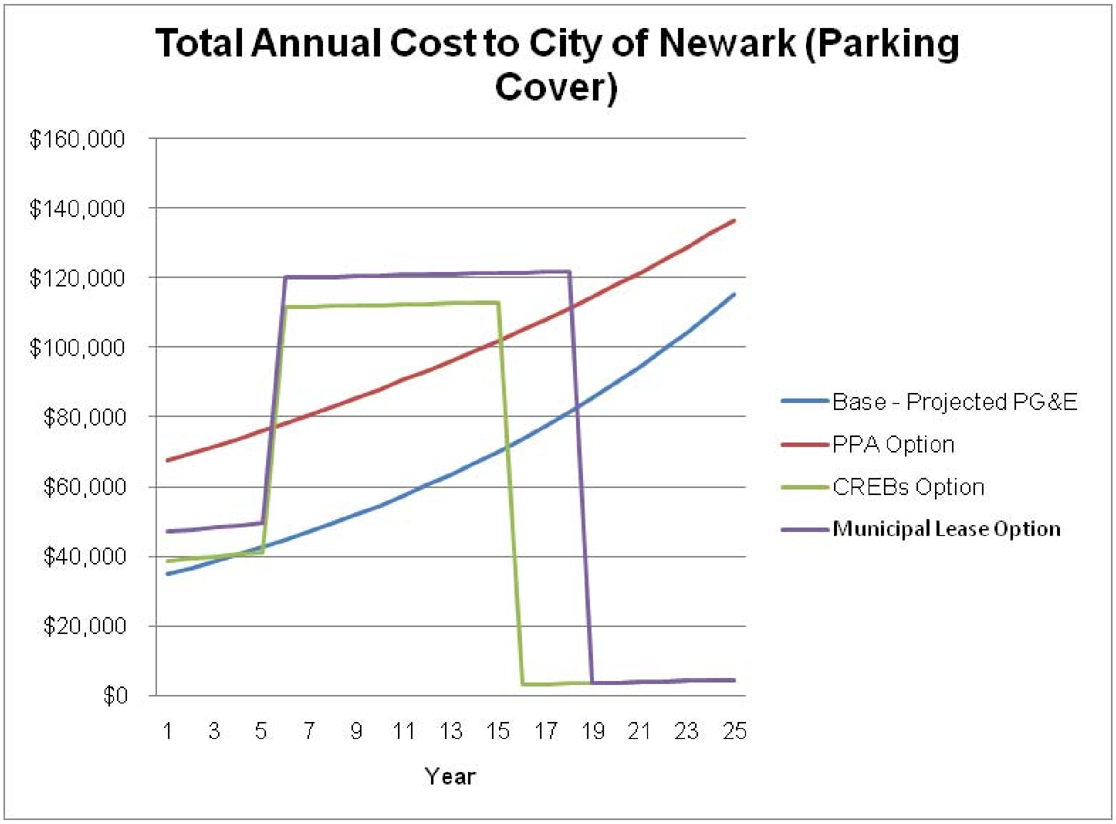
Year	Total Cost to City (Ground Mounted)			
	Base - Projected PG&E	**PPA Option**	**CREBs Option**	**Municipal Lease Option**
1	$34,982	$56,495	$19,956	$28,876
2	$36,765	$58,454	$20,588	$29,509
3	$38,638	$60,481	$21,219	$30,139
4	$40,607	$62,579	$21,847	$30,767
5	$42,676	$64,749	$22,473	$31,393
6	$44,851	$66,995	$92,904	$101,825
7	$47,137	$69,318	$93,028	$101,948
8	$49,539	$71,722	$93,153	$102,074
9	$52,063	$74,209	$93,280	$102,201
10	$54,716	$76,783	$93,409	$102,330
11	$57,504	$79,446	$93,650	$102,571
12	$60,435	$82,201	$93,783	$102,703
13	$63,514	$85,052	$93,917	$102,838
14	$66,751	$88,002	$94,054	$102,975
15	$70,152	$91,054	$94,193	$103,114
16	$73,727	$94,212	$3,176	$103,255
17	$77,484	$97,479	$3,320	$103,399
18	$81,433	$100,860	$3,465	$103,544
19	$85,582	$104,358	$3,613	$3,613
20	$89,943	$115,596	$3,763	$3,763
21	$94,527	$119,605	$3,916	$3,916
22	$99,344	$123,754	$4,071	$4,071
23	$104,406	$128,803	$4,229	$4,229
24	$109,726	$132,631	$4,389	$4,389
25	$115,318	$136,573	$4,572	$4,572
Total	**$1,691,821**	**$2,241,410**	**$1,079,968**	**$1,514,017**


Total Annual Cost to City of Newark (Ground Mounted System)
$160,000
$140,000
$120,000
$100,000
$80,000
$60,000
$40,000
$20,000
$0
1 3 5 7 9 11 13 15 17 19 21 23 25
Year
Base - Projected PG&E
PPA Option
CREBs Option
Municipal Lease Option

Under the current design and location outlined in option 1a below, the cost of the Solar Photo Voltaic is higher than the current Utility cost. For the solar project to be fiscally viable, the city must either consider the alternate location in the dirt field behind the SAFAC to place the solar or acquire a down-payment in the form of a grant or other means to buy down the cost of option 1a.

Option 1a Solar built with Parking Structure:

	Total Cost to City (Parking Cover)			
Year	**Base - Projected PG&E**	**PPA Option**	**CREBs Option**	**Municipal Lease Option**
1	$34,982	$67,626	$38,654	$47,040
2	$36,765	$69,636	$39,286	$47,672
3	$38,638	$71,706	$39,917	$48,302
4	$40,607	$73,837	$40,545	$48,931
5	$42,676	$76,031	$41,171	$49,556
6	$44,851	$78,291	$111,603	$119,988
7	$47,137	$80,617	$111,726	$120,112
8	$49,539	$83,013	$111,851	$120,237
9	$52,063	$85,480	$111,978	$120,364
10	$54,716	$88,021	$112,107	$120,493
11	$57,504	$90,636	$112,371	$120,754
12	$60,435	$93,330	$112,503	$120,887
13	$63,514	$96,104	$112,638	$121,021
14	$66,751	$98,960	$112,775	$121,158
15	$70,152	$101,901	$112,914	$121,297
16	$73,727	$104,929	$3,199	$121,438
17	$77,484	$108,047	$3,342	$121,582
18	$81,433	$111,258	$3,488	$121,727
19	$85,582	$114,565	$3,633	$3,633
20	$89,943	$117,970	$3,783	$3,783
21	$94,527	$121,476	$3,936	$3,936
22	$99,344	$125,086	$4,091	$4,091
23	$104,406	$128,803	$4,249	$4,249
24	$109,726	$132,631	$4,409	$4,409
25	$115,318	$136,573	$4,572	$4,572
Total	**$1,691,821**	**$2,456,526**	**$1,360,742**	**$1,841,233**


Total Annual Cost to City of Newark (Parking Cover)
$160,000
$140,000
$120,000
$100,000
$80,000
$60,000
$40,000
$20,000
$0
1 3 5 7 9 11 13 15 17 19 21 23 25
Year
Base - Projected PG&E
PPA Option
CREBs Option
Municipal Lease Option

Under the current design and location outlined in option 1c below, the City would be required to supply their own capital to implement the project.

Option 1c Solar roof mount:

Year	starting balance		$ 401,000
	utility avoided @ 5.89% annual escalation	rebate	running balance
1	$ 7,045	$ 61,672	$ 332,283
2	$ 7,460	$ -	$ 324,823
3	$ 7,900	$ -	$ 316,923
4	$ 8,365	$ -	$ 308,558
5	$ 8,858	$ -	$ 299,701
6	$ 9,379		$ 290,321
7	$ 9,932		$ 280,390
8	$ 10,517		$ 269,873
9	$ 11,136		$ 258,737
10	$ 11,792		$ 246,945
11	$ 12,487		$ 234,458
12	$ 13,222		$ 221,236
13	$ 14,001		$ 207,235
14	$ 14,825		$ 192,410
15	$ 15,699		$ 176,711
16	$ 16,623		$ 160,088
17	$ 17,602		$ 142,485
18	$ 18,639		$ 123,846
19	$ 19,737		$ 104,109
20	$ 20,900		$ 83,209
21	$ 22,131		$ 61,078
22	$ 23,434		$ 37,644
23	$ 24,814		$ 12,830
24	$ 26,276		$ (13,446)
25	$ 27,824		$ (41,270)
Totals	$ 215,482	$ 61,672	

Both option 1a & 1b budgets include installation, finance costs, maintenance (PPA only), insurance, rebates and / or tax credits applied.

Option 1c budgets include installation and rebates applied. The city would be required to supply the capital to implement the project.

Simple paybacks with utility escalation but without the cost of money are calculated as follows:

Table 6.4 Solar PV simple payback calculations

Add Solar Photo Voltaic Ground Mount Payback Calculation								
ECM #1A	Budget Project Equipment	Budget Project Installation	Total Project Budget	Estimated Annual Savings	Simple Payback (years)	Estimated Incentives / (Incentive paid over five years based on production)	Payback with rebate (years)- no kWh rate escalation considered	Payback with Rebate (years)- kWh rate escalation considered
Budget/Payback	$ 840,741	$ 280,247	$ 1,120,988	$ 34,982	32.0	$ 357,024	21.8	14.50

Add Solar Photo Voltaic Parking Structure Payback Calculation								
ECM #1B	Budget Project Equipment	Budget Project Installation	Total Project Budget	Estimated Annual Savings	Simple Payback (years)	Estimated Incentives / (Incentive paid over five years based on production)	Payback with rebate (years)- no kWh rate escalation considered	Payback with Rebate (years)- kWh rate escalation considered
Budget/Payback	$ 1,112,250	$ 370,750	$ 1,483,000	$ 34,982	42.4	$ 357,024	32.2	18.50

Add Solar Photo Voltaic Roof Mount Payback Calculation								
ECM #1C	Budget Project Equipment	Budget Project Installation	Total Project Budget	Estimated Annual Savings	Simple Payback (years)	Estimated Incentives / (Incentive paid over five years based on production)	Payback with rebate (years)- no kWh rate escalation considered	Payback with Rebate (years)- kWh rate escalation considered
Budget/Payback	$ 300,750	$ 100,250	$ 401,000	$ 7,045	56.9	$ 60,700	48.3	23.50

The Utility rate structure, after evaluation, should remain at E19 and not move to an A6.

This recommendation references ECM # 1.

6.1.4 Recommendation #3 Install Solar Thermal to preheat pool water

This recommendation is based on the solar thermal installation being constructed with a parking structure behind the SAFAC. The budget allows for 8000 square feet of solar thermal collection on approximately a 9000 square foot parking structure.

This energy conservation measure has both a high energy and CO2 saving potential, but also an attractive financial payback of less than 7 years.

Table 6.5 Thermal Solar Pool Heaters Savings Summary Parking Structure design

Add Thermal Solar Collectors to Preheat Pools (on parking structure) Payback Calculation							
ECM #2A	Budget Project Equipment	Budget Project Installation	Total Project Budget	Estimated Annual Savings	Simple Payback (years)	Estimated One time estimated Rebate / Incentive	Payback with rebate (years)
Budget/Payback	$ 130,000	$ 247,994	$ 377,994	$ 54,645	6.9	$ -	6.9

If the City evaluates the installation of the solar thermal system on a parking structure as high risk because of the concern with either Vandalism and / or maintenance of the parking structure they could choose to install a large enough system (6000 square feet) to heat the lap pool and lazy river pool on the roof. The budget for this approach includes the removal and saving (as possible) of 6000 square feet of slate tile, installation of asphalt shingle roofing including self adhering underlayment. This design is subject to structural integrity/structural compliance and has no budget dollars planned for structural modification.

The energy conservation measure still delivers high energy and CO2 savings potential and has a 7.5 year payback.

Table 6.6 Thermal Solar Pool Heaters Savings Summary Roof Mount design

Add Thermal Solar Collectors to Preheat Pools (2 pools roof installation) Payback Calculation							
ECM #2B	Budget Project Equipment	Budget Project Installation	Total Project Budget	Estimated Annual Savings	Simple Payback (years)	Estimated One time estimated Rebate / Incentive	Payback with rebate (years)
Budget/Payback	$ 97,000	$ 176,936	$ 273,936	$ 36,317	7.5	$ -	7.5

The most suitable financing vehicle for the City to utilize is the CEC low interest loan for this energy conservation measure. The CEC low interest loan will provide the City a self funding cash flow neutral project for this recommendation.

If the city were to consider placing the solar thermal array on the dirt lot area of the property the cost to implement the project and corresponding savings would be minimal. The savings of no parking structure are largely offset by the concrete and metal fabrication work required for the dirt field installation.

This recommendation references ECM#2.

6.1.5 Recommendation #4 Install VFD Motors on pool filtration pumps

This energy conservation measure of installing Variable Frequency Drive Motors on the pool filtration pumps has both a high energy and CO2 saving potential, but also an attractive financial payback of 5 years. This budgeted amount will ensure the pool filtration requirements will be met and the additional life you will get from the equipment with reduced run hours will be an additional benefit.

Table 6.7 VFD Pool Pump Savings Summary

Install VFD's to Pool Filtration Payback Calculation							
ECM #13	Budget Project Equipment	Budget Project Installation	Total Project Budget	Estimated Annual Savings	Simple Payback (years)	Estimated One time estimated Rebate / Incentive	Payback with rebate (years)
Budget/Payback	$ 9,400	$ 14,304	$ 23,704	$ 3,964	6.0	$ 3,814	5.0

The most suitable financing vehicle for the City to utilize is the CEC low interest loan for this energy conservation measure. The CEC low interest loan will provide the City a self funding cash flow neutral project for this recommendation. This recommendation references ECM #13.

6.1.6 Recommendation #5 Install Lighting retrofits

Incentives / rebates for lighting retrofits for Cities are currently enhanced and the additional incentive rate should be captured by the city while available. This budget allows for the implementation of energy conservation measures 3,4,5,6,7 and 8 of this analysis. The lighting retrofits, when combined together provide for 193,247 kWh of energy and 239,916 pounds of CO2 reduction and have a financial payback of less than 6 years.

Lighting retrofits are highly visible to the public as well as lighting schedules and this retrofit provides very visible energy savings as well as an attractive overall financial payback.

Table 6.8 Lighting Measures Saving Summary

Replace Natatorium Rail Light Payback Calculations							
ECM #3	Budget Project Equipment	Budget Project Installation	Total Project Budget	Estimated Annual Savings	Simple Payback (years)	Estimated One time estimated Rebate / Incentive	Payback with rebate (years)
Budget/Payback	$ 41,955	$ 27,970	$ 69,925	$ 7,508	9.3	$ 5,264	8.6

Retrofit HID Parking Lot Lighting Payback Calculations							
ECM #4	Budget Project Equipment	Budget Project Installation	Total Project Budget	Estimated Annual Savings	Simple Payback (years)	Estimated One time estimated Rebate / Incentive	Payback with rebate (years)
Budget/Payback	$ 7,400	$ 7,383	$ 14,783	$ 4,168	3.5	$ 3,509	2.7

Retrofit Wallmounted HID Payback Calculations							
ECM #5	Budget Project Equipment	Budget Project Installation	Total Project Budget	Estimated Annual Savings	Simple Payback (years)	Estimated One time estimated Rebate / Incentive	Payback with rebate (years)
Budget/Payback	$ 6,462	$ 4,308	$ 10,770	$ 1,377	7.8	$ 655	7.3

Install Ambient Light Controller on Selected Fixtures Payback Calculations							
ECM #6	Budget Project Equipment	Budget Project Installation	Total Project Budget	Estimated Annual Savings	Simple Payback (years)	Estimated One time estimated Rebate / Incentive	Payback with rebate (years)
Budget/Payback	$ 2,619	$ 4,863	$ 7,482	$ 1,817	4.1	$ 1,773	3.1

Install Ambient Light Controller on Natatorium Rail and Catwalks Payback Calculations							
ECM #7	Budget Project Equipment	Budget Project Installation	Total Project Budget	Estimated Annual Savings	Simple Payback (years)	Estimated One time estimated Rebate / Incentive	Payback with rebate (years)
Budget/Payback	$ 4,162	$ 3,900	$ 8,062	$ 4,967	1.6	$ 4,846	0.6

Control After Hours Lighting Through Current EMS Payback Calculations							
ECM #8	Budget Project Equipment	Budget Project Installation	Total Project Budget	Estimated Annual Savings	Simple Payback (years)	Estimated One time estimated Rebate / Incentive	Payback with rebate (years)
Budget/Payback	$ 17,046	$ 13,947	$ 30,993	$ 1,945	15.9	-	15.9

If the City determines they are able to control after hour lighting use by behavior changes to the after-hours cleaning crew then they should not proceed with ECM #8.

The most suitable financing vehicle for the City to utilize is the CEC low interest loan for this energy conservation measure. The CEC low interest loan will provide the City a self funding cash flow neutral project for this recommendation.

6.1.7 Recommendation #6 Install Controls on pool boiler plant

The simple payback of this project of 3.97 years makes this energy conservation project a high priority. In addition to the energy cost avoidance, this measure will also potentially increase the life of the boiler equipment by reducing the run hours dramatically on an annual basis.

Table 6.9 Pool Boiler Controls Saving Summary

Install Controls on Pool Boiler Plant Payback Calculation							
ECM #12	Budget Project Equipment	Budget Project Installation	Total Project Budget	Estimated Annual Savings	Simple Payback (years)	Estimated One time estimated Rebate / Incentive	Payback with rebate (years)
Budget/Payback	$ 8,260	$ 4,600	$ 12,860	$ 3,237	4.0	$ -	4.0

The most suitable financing vehicle for the City to utilize is the CEC low interest loan for this energy conservation measure. The CEC low interest loan will provide the City a self funding cash flow neutral project for this recommendation.

6.1.8 Recommendation #7 Install Energy Management Control upgrades

This combines the recommendations of reducing HVAC use in the gymnasium (ECM9), peak HVAC during summer months (ECM 10) and in selective areas by occupancy (ECM11). Together they provide energy cost avoidance of $ 1,266 per year. The overall costs to implement these projects are minimal and may be able to be funded by way of existing operational budgets. The simple payback of 3.57 years makes them desirable projects to implement.

Table 6.10 Demand Response Measure Savings Summary

Use Existing EMS to Reduce HVAC load in Gymnasium using new AAON units Payback Calculations							
ECM #9A	Budget Project Equipment	Budget Project Installation	Total Project Budget	Estimated Annual Savings	Simple Payback (years)	Estimated One time estimated Rebate / Incentive	Payback with rebate (years)
Budget/Payback	$ -	$ 875	$ 875	$ 249	3.5	$ -	3.5

Use Existing EMS to Reduce Peak HVAC load during summer months Payback Calculation							
ECM #10	Budget Project Equipment	Budget Project Installation	Total Project Budget	Estimated Annual Savings	Simple Payback (years)	Estimated One time estimated Rebate / Incentive	Payback with rebate (years)
Budget/Payback	$ -	$ 875	$ 875	$ 396	2.2	$ -	2.2

Install Occupancy Controllers for HVAC in Specified Payback Calculation							
ECM #11	Budget Project Equipment	Budget Project Installation	Total Project Budget	Estimated Annual Savings	Simple Payback (years)	Estimated One time estimated Rebate / Incentive	Payback with rebate (years)
Budget/Payback	$ 1,272	$ 1,908	$ 3,180	$ 621	5.1	$ 407	4.5

The most suitable financing vehicle for the City to utilize is the CEC low interest loan for this energy conservation measure. The CEC low interest loan will provide the City a self funding cash flow neutral project for this recommendation.

6.1.9 Recommendation #8 Replace Gymnasium Units

This recommendation is an accelerated replacement within 2 years. Based on the life-cycle analysis of the existing units, the ideal timeframe to budget and replace the units would be in approximately 2011.

The gymnasium HVAC units were well maintained, however they have begun to show considerable coil deterioration. This is largely attributed to two factors: the long duty cycle placed on the units by trying to maintain 72° in the large gymnasium and the close proximity of the units to the corrosive salt water of The Bay. Together these two factors have greatly reduced the life of these units. The replacement units specified in the report not only have a higher efficiency but they also are equipped with a special coating to help delay corrosion due to salt water.

The following table shows the electricity and natural gas savings of the proposed unit.

Table 6.11 AAON Package unit Replacement Electrical Savings Summary

Replace Gymnasium HVAC units with AAON units with Digital Scrool Compressors Payback Calculation							
ECM #14	Budget Project Equipment	Budget Project Installation	Total Project Budget	Estimated Annual Savings	Simple Payback (years)	Estimated One time estimated Rebate / Incentive	Payback with rebate (years)
Budget/Payback	$ 54,000	$ 43,162	$ 97,162	$ 2,374	40.9	$ 2,601	39.8

The energy cost avoidance and simple payback calculations on these units do not support a replacement at this time. **The units are recommended for replacement based on near end of life status.** If added to the portfolio of other measures this ECM can be financed through the CEC low interest loan program and will provide the City a self funding cash flow neutral project with this recommendation.

6.1.10 Next Steps

The City of Newark has an excellent opportunity to reduce carbon emissions and drive additional energy costs out of the Silliman Activity and Family Aquatic Center.

The next steps for the City are:

- Determine their energy goals
- Determine their financial approach (budgeting vs. financed)
- Determine their best financial vehicle (if financed)
- Select the best portfolio of ECM's to align with their budgets / finances

Syserco will support the City to build the appropriate portfolio of energy conservation measures to align with the City's financial plan.

7 Appendices Appendix 1

7.1.1 Attachments & Supporting data

Energy is delivered to the SAFAC as electricity and as natural gas. Some measures in this report recommend ways to conserve natural gas resources. These measures save money, conserve an important natural resource, and also help to offset the release of carbon into the atmosphere. When natural gas is used (combusted) carbon dioxide is released into the atmosphere at a rate of 11.02 pounds per therm[i].

Conserving natural gas and electricity are both important ways that the SAFAC can reduce its carbon dioxide emissions. Implementing all the measures in this report will offset 1,190,841 pounds of CO2 from being released into the atmosphere each year.

The calculation to estimate this is provided by the EPA and states that the portion of the natural gas that is made of carbon is completely oxidized into CO2[ii]. The average heat content of natural gas is 0.1 mmbtu per therm[iii]. The average carbon coefficient of natural gas is 14.74 kg per million btu[iv]. The amount of CO2 released per therm that is consumed is calculated according to the EPA formula by multiplying: (heat content X carbon coefficient X fraction oxidized X molecular weight ratio of carbon dioxide to carbon (44/12)).

To calculate the amount of carbon dioxide release that is offset by each measure we first must know how much carbon is released for every kWh of electricity that is generated. The electric power that is used by the SAFAC in Newark California is generated from a variety of sources. In northern California, the power provided by PG&E is generated from a mix of hydroelectric, geothermal, wind, nuclear sources as well as coal and natural gas fired power plants.

When coal and natural gas are burned carbon is released into the atmosphere; this total amount of carbon released is divided by the total amount of electricity generated by all sources to find the average amount of carbon released per kWh generated. For every kWh of electricity not used by the SAFAC, one kWh of electricity does not need to be generated. By not generating one kWh of electricity 1.2415 pounds of CO2 that would have otherwise been released is offset[v].

Citations

i. Environmental Protection Agency. http://www/epa.gov/RDEE/energy-resources/refs.html Retrieved 7-17-2009
ii. 2006 IPCC Guidelines for National Greenhouse Gas Inventories. Intergovernmental Panel on Climate Change, Geneva, Switzerland.
iii. Inventory of U.S. Greenhouse Gas Emissions and Sinks: Fast Facts 1990-2005. Conversion Factors to Energy Units (Heat Equivalents) Heat Contents and Carbon Content Coefficients of Various Fuel Types. U.S. Environmental Protection Agency, Washington, D.C.. USEPA #430-R-07-002 (PDF).
iv. Ibid.
v. California Center for Sustainable Energy. http://energycenter.org/ Retrieved 7-17-2009

7.1.2 Terminology kW, kWh, MW

Terms to understand

Kilowatt (kW): A unit of measure for the amount of electricity needed to operate given equipment. One kW equals 1000 watts.

Kilowatt-hour (kWh): The most commonly used unit of measure indicating the amount of electricity consumed over time. It means one kilowatt of electricity supplied for one hour.

Megawatt (MW): Equals 1,000 kW or 1,000,000 watts. According to the California Independent System Operator, one megawatt of utility supplied power is enough electrical capacity to power 750 average homes.

7.1.3 Methodology

The following is a description of how the Energy Conservation Measure calculations were performed, including example equations. The average cost of a kWh for the SAFAC was 12.2¢ and the average cost for a therm of gas was $1.16.

Averages are helpful as a point of reference, but each energy conservation measure considered as part of this report could have different savings associated based on when and how much energy is conserved.

Although the average cost of a therm was $1.16 for the study period, natural gas rates continue to decline (as illustrated in table 3.3) and $1.00 per therm was used as a baseline when energy conservation measure savings were calculated. This more conservative approach allows for savings greater than what was calculated in this report.

ECM #1

Energy Conservation Measure #1 is installing Solar Photo Voltaic to generate electricity. The calculation is done by using Utility offered web based tools to estimate the kWh production based on site location, product, design and orientation to the sun.

The following two pages utilize the California Solar Initiative incentive tool to estimate kWh production and rebates based on customer type, system size, orientation, product, design and location. The pages show the kWh production and rebates for the parking structure / field solar PV installation and the roof installation.

California Solar Initiative

Incentive Calculator - Current Standard PV

Save as a PDF

	Proposed
Site Specifications:	
Project Name	CONewark
ZIP Code	94560
City	Newark
Utility	PG&E
Customer Type	Government/Non-Profit
Incentive Type	PBI
PV System Specifications:	
PV Module	Sharp:ND-U230C1 230.0W STC, 198.0W PTC
Number of Modules	868
Mounting Method	>1" to 3" average standoff
DC Rating (kW STC)	199.6400
DC Rating (kW PTC)	171.8640
Inverter	SatCon Technology:PVS-100 (480 V)
Number of Inverters	2
Inverter Efficiency (%)	96.00 %
Shading	Minimal Shading
Array Tilt (degrees)	10
Array Azimuth (degrees)	200

Results	
Annual kWh	274,634
Summer Months	May-October
Summer kWh	172,734
CEC-AC Rating	**164.989 kW**
Capacity Factor[1]	19.002%
Prevailing Capacity Factor[2]	20.000%
Design Factor[3]	**95.010%**
Eligible Annual kWh[4]	**274,634**
Incentive Rate	**$0.26/kWh**
Incentive[5]	**$357,024**
Report Generated on	10/12/2009 4:15:31 PM

The CSI-EPBB calculator is a tool available to the public and participants of the CSI program, whose sole purpose is to determine the EPBB Design Factor and calculate an appropriate incentive level based on a reasonable expectation of performance for an individual system. The results of the calculator should not be interpreted as a guarantee of system performance. Actual performance of an installed PV system is based on numerous factors, and may differ with the results summarized in the CSI-EPBB calculator. For this reason, contractors, participating customers, and other interested parties should only utilize the calculator to determine an appropriate incentive when applying to the CSI incentive program. Additional uses for the calculator other than its intended purpose as stated above are not endorsed or encouraged.

Notes:

1. **Capacity Factor**: This is the estimated annual output of the proposed system divided by 8760 times the CEC-AC rating.
2. **Prevailing Capacity Factor**: This is 18% during incentive steps 2 and 3 and 20% during incentive steps 4 through 10.
3. **Design Factor**: This is the ratio of the Capacity Factor and the Prevailing Capacity Factor.
4. **Eligible Annual kWh**: For systems greater than 1MW (CEC-AC Rating), this is the prorated estimated annual output of the proposed system.
5. **Incentive**: This is the estimated total incentive for the proposed system, and is calculated as the estimated eligible annual output times the incentive rate times 5 years. The incentive paid will be based on the actual production of the installed system.
   Please be aware that the final CSI incentive rate that is reserved for you will be determined by your CSI Program Administrator at the time your reservation request (RR) application is approved, and may be lower than the current incentive rate shown in the CSI Statewide Trigger Point Tracker. Please note that final incentive amounts are subject to change based upon the configuration of the as-built system. (Per the CSI Handbook, no projects or applications are reserved CSI funding until all required information has been submitted and approved in writing by the Program Administrator.)
6. As of 8/10/07, the CSI-EPBB calculator performs rounding as follows:
   - Estimated kWh production is rounded to the kWh
   - CEC-AC rating is rounded to the watt
   - Capacity factor is rounded to 5 significant digits
   - Design factor is rounded to 5 significant digits

California Solar Initiative

Incentive Calculator - Current Standard PV

Save as a PDF

	Proposed	Reference
Site Specifications:		
Project Name	Silliman Roof Mount PV	
ZIP Code	94560	92867
City	Newark	Orange
Utility	PG&E	
Customer Type	Government/Non-Profit	
Incentive Type	EPBB	
PV System Specifications:		
PV Module	SunPower:PL-SUNP-SPR-310 310.0W STC, 285.3W PTC, 282.9W PTC_{adj}[1]	
Number of Modules	135	
Mounting Method	>1" to 3" average standoff	
DC Rating (kW STC)	41.8500	
DC Rating (kW PTC)	38.5155	
Inverter	Ballard Power Systems:EPC-PV-480-30kW	
Number of Inverters	2	
Inverter Efficiency (%)	93.00 %	
Shading	Minimal Shading	Minimal Shading
Array Tilt (degrees)	5	
Array Azimuth (degrees)	200 True North 0°	
Optimal Tilt (proposed azimuth)	23	
Optimal Tilt (facing South)	21	17
Results		
Annual kWh	55,085 (a)	
at optimal tilt	60,311 (b)	
facing south at optimal tilt	60,093 (c)	61,659 (d)
Summer Months	May-October	May-October
Summer kWh	35,379 (e)	
at optimal tilt	36,743 (f)	
facing south at optimal tilt	36,593 (g)	35,724 (h)
CEC-AC Rating	**35.819 kW**	
Design Correction[2]	96.288%	
Geographic Correction[3]	97.460%	
Installation Correction[4]	99.174%	
Design Factor[5]	**93.067%**	
CSI Rating[6]	**33.336 kW**	
Incentive Rate	**$1.85/Watt**	
Incentive[7]	**$61,672**	
Report Generated on	10/21/2009 11:23:18 AM	

The CSI-EPBB calculator is a tool available to the public and participants of the CSI program, whose sole purpose is to determine the EPBB Design Factor and calculate an appropriate incentive level based on a reasonable expectation of performance for an individual system. The results of the calculator should not be interpreted as a guarantee of system performance. Actual performance of an installed PV system is based on numerous factors, and may differ with the results summarized in the CSI-EPBB calculator. For this reason, contractors, participating customers, and other interested parties should only utilize the calculator to determine an appropriate incentive when applying to the CSI incentive program. Additional uses for the calculator other than its intended purpose as stated above are not endorsed or encouraged.

Notes:

1. **PTC_{adj}**: The adjusted PTC rating is calculated based on the installation method and panel specifications. See the User Guide Appendix A for details on the adjusted PTC calculation.
2. **Design Correction**: This is the ratio of the summer output of the proposed system (e) and the summer output of the summer optimal system at the proposed location (f).
3. **Geographic Correction**: This is the ratio of the annual output of the summer optimal south facing system at the proposed location (c) and the annual output of the summer optimal south facing system at the reference location (d).
4. **Installation Correction**: This is the ratio of the adjusted PTC rating and the unadjusted PTC rating.
5. **Design Factor**: This is the product of the Design Correction, Geographic Correction, and Installation Correction.
6. **CSI Rating**: This is the product of the Design Factor and the CEC-AC Rating.
7. **Incentive**: This is the total incentive for the proposed system. It is the product of the CSI Rating and the Incentive Rate.
   Please be aware that the final CSI incentive rate that is reserved for you will be determined by your CSI Program Administrator at the time your reservation request (RR) application is approved, and may be lower than the current incentive rate shown in the CSI Statewide Trigger Point Tracker. Please note that final incentive amounts are subject to change based upon the configuration of the as-built system. (Per the CSI Handbook, no projects or applications are reserved CSI funding until all required information has been submitted and approved in writing by the Program Administrator.)
8. As of 6/20/08, the CSI-EPBB calculator performs rounding as follows:
   - Estimated kWh production is rounded to the kWh
   - CEC-AC rating is rounded to the watt
   - CSI rating is rounded to the watt
   - Design factor is rounded to 5 significant digits
   - Incentive is rounded to the dollar

ECM #2

Energy Conservation Measure #2 saves energy by installing solar water heating panels above the parking lot. The panes are estimated to produce 45,902 therms of heat energy. This is calculated to offset 54, 645 therms of natural gas consumption each year.

N. Gas Reduction: $$Therms\ Saved\ per\ year = \frac{Panel\ therms}{year} \times \frac{1}{0.84}$$

Where: *Panel Therms/Year = Panel Heat in Therms per Year*
84% = Estimated boiler efficiency

CO_2 Reduction: $$lbs\ CO_2 = Therms\ Saved\ per\ Year \times 11.02$$

Where: *11.02 pounds of Scope I (direct) CO_2 emissions are avoided for every Therm of natural gas not used. Source: US Environmental Protection Agency (EPA).*

ECM #3

Energy Conservation Measure #3 saves energy by replacing the Natatorium Rail Lighting with more efficient fixtures. The equations used to calculate these savings are shown below:

kW Savings: $$kW\ Reduced = \frac{(Watt_{Pre} \times Qty_{Pre}) - (Watt_{Post} \times Qty_{Post})}{1000}$$

Where: *$Watt_{Pre}$ = the watts that each existing fixture consumes*
Qty_{Pre} = the number of existing fixtures currently needed
$Watt_{Post}$ = the watts that each replacement fixture consumes
Qty_{Post} = the number of replacement fixtures that will be needed

kWh Savings: $$kWh\ per\ Year = \left(\frac{(Watt_{Pre} \times Qty_{Pre})}{1000} \times 5{,}355\ hrs\right) - \left(\frac{(Watt_{Post} \times Qty_{Post})}{1000} \times 5{,}355\ hrs\right)$$

Where: *Natatorium lights are energized for 5,355 hours per year, which is derived from 6:00 AM to 9:00 PM, 357 days per yr.*

CO_2 Reduction: $$lbs\ CO_2 = kWh\ per\ Year \times 1.2415$$

Where: *1.2415 pounds of Scope II (indirect) CO_2 emissions are avoided for every kWh saved. Source: California Center for Sustainable Energy (CCSE)*

ECM #4

Energy Conservation Measure #4 saves energy by replacing the Parking Lot Lighting with more efficient fixtures. The equations used to calculate these savings are shown below:

kW Savings: $$kW\ Reduced = \frac{(Watt_{Pre} \times Qty_{Pre}) - (Watt_{Post} \times Qty_{Post})}{1000}$$

Where: *$Watt_{Pre}$ = the watts that each existing fixture consumes*
Qty_{Pre} = the number of existing fixtures currently needed
$Watt_{Post}$ = the watts that each replacement fixture consumes
Qty_{Post} = the number of replacement fixtures that will be needed

kWh Savings: $$kWh\ per\ Year = \left(\frac{(Watt_{Pre} \times Qty_{Pre})}{1000} \times 4{,}015\ hrs\right) - \left(\frac{(Watt_{Post} \times Qty_{Post})}{1000} \times 4{,}015\ hrs\right)$$

Where: *Parking lot lights are conservatively estimated to be energized for 4,015 hours per year, which is 11 hours per day, 365 days per yr.*

CO_2 Reduction: $$lbs\ CO_2 = kWh\ per\ Year \times 1.2415$$

Where: *1.2415 pounds of Scope II (indirect) CO_2 emissions are avoided for every kWh saved. Source: California Center for Sustainable Energy (CCSE)*

ECM #5

Energy Conservation Measure #5 saves energy by replacing the Natatorium Wall-Mounted HID Lighting with more efficient fixtures. The equations used to calculate these savings are shown below:

kW Savings: $kW\ Reduced = \frac{(Watt_{Pre} \times Qty_{Pre}) - (Watt_{Post} \times Qty_{Post})}{1000}$

Where: $Watt_{Pre}$ *= the watts that each existing fixture consumes*
Qty_{Pre} *= the number of existing fixtures currently needed*
$Watt_{Post}$ *= the watts that each replacement fixture consumes*
Qty_{Post} *= the number of replacement fixtures that will be needed*

kWh Savings: $kWh\ per\ Year = \left(\frac{(Watt_{Pre} \times Qty_{Pre})}{1000} \times 3{,}213\ hrs\right) - \left(\frac{(Watt_{Post} \times Qty_{Post})}{1000} \times 3{,}213\ hrs\right)$

Where: *Natatorium lights are energized for 3,213 hours per year, which is 9 hours per day, 357 days per yr.*

CO_2 Reduction: $lbs\ CO_2 = kWh\ per\ Year \times 1.2415$

Where: *1.2415 pounds of Scope II (indirect)* CO_2 *emissions are avoided for every kWh saved. Source: California Center for Sustainable Energy (CCSE)*

ECM #6

Energy Conservation Measure #6 saves energy by installing ambient lighting sensors on selected fixtures. Ambient lighting sensors save energy by reducing the number of hours that the lighting system is energized. The equations used to calculate these savings are shown below:

kWh Savings: $kWh\ per\ Year = \frac{Watt \times Qty}{1000} \times (Hours_{Pre} - Hours_{Post})$

Where: *Watt = the watts that each existing fixture consumes*
Qty = the number of existing fixtures currently used
$Hours_{Pre}$ *= The hours in one year that the fixtures are currently used, for the locker room wall wash fixtures this is 5,355 hours per year, which is derived from 6:00 AM to 9:00 PM, 357 days per yr. For the Gymnasium this is 4,284 hours per year, which is derived from 12 hours per day, 357 days per yr.*
$Hours_{Post}$ *= The hours in one year that the fixtures are estimated to be used when ambient lighting sensors are installed. An estimated average of 8 hours per day will be dropped off runtime. More in summer, less in winter*

CO_2 Reduction: $lbs\ CO_2 = kWh\ per\ Year \times 1.2415$

Where: *1.2415 pounds of Scope II (indirect)* CO_2 *emissions are avoided for every kWh saved. Source: California Center for Sustainable Energy (CCSE)*

ECM #7

Energy Conservation Measure #7 saves energy by installing ambient lighting sensors on selected Natatorium Rail and Catwalk Fixtures. Ambient lighting sensors save energy by reducing the number of hours that the lighting system is energized. The equations used to calculate these savings are shown below:

kWh Savings: $kWh\ per\ Year = \frac{Watt \times Qty}{1000} \times (Hours_{Pre} - Hours_{Post})$

Where: *Watt = the watts that each existing fixture consumes*
Qty = the number of existing fixtures currently used
$Hours_{Pre}$ *= The hours in one year that the fixtures are currently used, this is 5,355 hours per year, which is derived from 6:00 AM to 9:00 PM, 357 days per yr.*

$Hours_{Post}$ = The hours in one year that the fixtures are estimated to be used when ambient lighting sensors are installed. An estimated average of 8 hours per day will be dropped off runtime. More in summer, less in winter

CO_2 Reduction: $lbs\ CO_2 = kWh\ per\ Year \times 1.2415$

Where: *1.2415 pounds of Scope II (indirect) CO_2 emissions are avoided for every kWh saved. Source: California Center for Sustainable Energy (CCSE)*

ECM #8

Energy Conservation Measure #8 saves energy by controlling the afterhours runtime of the lighting systems using the existing Energy Management System (EMS). An estimated 30 kW can be saved for 3 hours per day, 5 days per week. The equations used to calculate these savings are shown below:

kWh Savings: $kWh\ per\ Year = 30\ kW\ Saved \times 3\ \frac{Hours}{Day} \times 5\frac{Days}{Week} \times 52\frac{Weeks}{Year}$

CO_2 Reduction: $lbs\ CO_2 = kWh\ per\ Year \times 1.2415$

Where: *1.2415 pounds of Scope II (indirect) CO_2 emissions are avoided for every kWh saved. Source: California Center for Sustainable Energy (CCSE)*

ECM #9A

Energy Conservation Measure #9A saves energy by using the existing EMS to reduce the HVAC load in the Gymnasium. Adjusting the HVAC space temperature set point reduces the load on the mechanical equipment by 2.5% per degree. Measure 7A assumes that the replacement of the two (2) Carrier units has already taken place. This measure refers to the gymnasium HVAC units, two (2) AAON model number RM-013 package units with 13 tons of cooling capacity each. The equations used to calculate these savings are shown below:

kW Savings: $kW\ Reduced = 2\ units \times 13\ tons \times 25\% \times \Delta T \times \frac{2.5\%}{°F} \times \frac{12}{SEER}$

Where: *25% = Estimated Load Factor / Duty Cycle*
ΔT = the temperature adjustment in °F
SEER = Seasonal Energy Efficiency Ratio. Manufacturer's ARI rating used.

kWh Savings: $kWh\ per\ Year = kW\ Reduced \times 4{,}368\ hrs$

Where: *Units are estimated to be enabled 4,368 hours per year, which is 12 hrs per day, 7 days per week, and 52 weeks per yr.*

CO_2 Reduction: $lbs\ CO_2 = kWh\ per\ Year \times 1.2415$

Where: *1.2415 pounds of Scope II (indirect) CO_2 emissions are avoided for every kWh saved. Source: California Center for Sustainable Energy (CCSE)*

ECM #9B

Energy Conservation Measure #9B saves energy by using the existing EMS to reduce the HVAC load in the Gymnasium. Adjusting the HVAC space temperature set point reduces the load on the mechanical equipment by 2.5% per degree. Measure 7B assumes that the replacement of the two (2) Carrier units has NOT taken place. This measure refers to the gymnasium HVAC units, two (2) Carrier model number 48HJF-014 package units with 12.5 tons of cooling capacity each. The equations used to calculate these savings are shown below:

kW Savings: $kW\ Reduced = 2\ units \times 12.5\ tons \times 25\% \times \Delta T \times \frac{2.5\%}{°F} \times \frac{12}{SEER}$

Where: *25% = Estimated Load Factor / Duty Cycle*
ΔT = the temperature adjustment in °F
SEER = Seasonal Energy Efficiency Ratio. IES estimated the SEER based on manufacturer's ARI rating and the condition of the units.

kWh Savings: $$kWh\ per\ Year = kW\ Reduced \times 4{,}368\ hrs$$

Where: *Units are estimated to be enabled 4,368 hours per year, which is 12 hrs per day, 7 days per week, and 52 weeks per yr.*

CO_2 Reduction: $$lbs\ CO_2 = kWh\ per\ Year \times 1.2415$$

Where: *1.2415 pounds of Scope II (indirect) CO_2 emissions are avoided for every kWh saved. Source: California Center for Sustainable Energy (CCSE)*

ECM #10

Energy Conservation Measure #10 saves energy by using the existing EMS to reduce the HVAC peak load in the summer. Adjusting the HVAC space temperature set point reduces the load on the mechanical equipment by 2.5% per degree. Measure 8 will only taken place 6 hours a day, on weekdays for 26 week each summer and will reduce peak electric demand. This measure refers to 11 package units with a combined 66 tons of cooling capacity. The equations used to calculate these savings are shown below:

kW Savings/unit: $$kW\ Reduced\ per\ unit = tons \times 35\% \times \Delta T \times \frac{2.5\%}{°F} \times \frac{12}{EER}$$

Where: *35% = Estimated Load Factor / Duty Cycle*
ΔT = the temperature adjustment in °F
EER = Energy Efficiency Ratio. Manufacturer's ARI rating used.

kW Savings: $$Total\ kW\ Reduced = kW\ Reduced\ Unit\ 1 + Unit\ 2 + \cdots + Unit\ 11$$

kWh Savings: $$kWh\ per\ Year = Tot.kW\ Reduced \times 780\ hrs$$

Where: *Measure to be in effect 780 hours per year, which is 6 hrs per day, 5 days per week, and 26 weeks per y (Summer).*

CO_2 Reduction: $$lbs\ CO_2 = kWh\ per\ Year \times 1.2415$$

Where: *1.2415 pounds of Scope II (indirect) CO_2 emissions are avoided for every kWh saved. Source: California Center for Sustainable Energy (CCSE)*

ECM #11

Energy Conservation Measure #11 saves energy by using occupancy sensors to reduce the HVAC load in the Meeting Room and Dance Studio. When the room is in an un-occupied state the space temperature set point will be adjusted. Adjusting the HVAC space temperature set point reduces the load on the mechanical equipment by 2.5% per degree. Measure 9 is estimated to occur for a total of 5 hours a day in the Meeting Room, and 3.5 hours a day in the dance studio, both rooms 7 days a week for 52 week each year. This measure refers to two (2) package units with a combined 12.5 tons of cooling capacity. The equations used to calculate these savings are shown below:

kW Savings/unit: $$kW\ Reduced\ per\ unit = tons \times 25\% \times \Delta T \times \frac{2.5\%}{°F} \times \frac{12}{SEER}$$

Where: *25% = Estimated Load Factor / Duty Cycle*
ΔT = the temperature adjustment in °F
. SEER =Seasonal Energy Efficiency Ratio. Manufacturer's ARI rating used.

kW Savings: $$Total\ kW\ Reduced = kW\ Reduced\ Unit\ 1 + kW\ Reduced\ Unit\ 2$$

kWh Savings: $$kWh\ per\ Year = Tot.kW\ Reduced \times Unoccupied\ Hours$$

CO_2 Reduction: $$lbs\ CO_2 = kWh\ per\ Year \times 1.2415$$

Where: *1.2415 pounds of Scope II (indirect) CO_2 emissions are avoided for every kWh saved. Source: California Center for Sustainable Energy (CCSE)*

ECM #12

Energy Conservation Measure #12 saves energy by installing controls on pool boiler plant. The boiler plant will be shut down for 7.5 hours each night; this is estimated to produce a 5% savings.

N. Gas Reduction/unit: $$Therms\ Saved\ per\ unit = Heat_{IN} \times \frac{LF}{DC}\% \times 82\% \times 5\% \times Hours_{Pre}$$

Where: *$Heat_{IN}$ = Heating Capacity in Therms*
LF/DF% = Estimated Load Factor / Duty Cycle
82% = Estimated boiler efficiency
$Hours_{Pre}$ = The hours in one year that the boilers are currently used, this is 8,760 hours per year, the maximum which is 24 hours a day, 365 days per yr.

N. Gas Reduction: $$Total\ Therms\ Saved = Therms\ Saved\ Unit\ 1 + Unit\ 2 + \cdots + Unit\ 11$$

CO_2 Reduction: $$lbs\ CO_2 = Therms\ Saved\ per\ Year \times 11.02$$

Where: *11.02 pounds of Scope I (direct) CO_2 emissions are avoided for every Therm of natural gas not used. Source: US Environmental Protection Agency (EPA).*

ECM #13

Energy Conservation Measure #13 saves energy by installing variable frequency drives on four (4) pool filtration pumps. Energy would be saved by running the pumps at a reduced speed during off hours. The recommended reduced speed set point for each pump is the minimum speed required to keep the required turnover rate for each pool. The equations used to calculate these savings are shown below:

kWh Savings/unit: $$kWh\ Reduced\ per\ unit = \left(hp \times 0.746 \times \frac{1}{0.885} \times Hours_{Pre}\right) - \left(\left(hp \times 0.746 \times \frac{1}{0.885} \times (Hours_{Pre} - Hours_{Low})\right) + \left(hp \times 0.746 \times \frac{1}{0.885} \times Speed_{Low}{}^{2.5} \times HoursLow\right.\right.$$

Where: *hp = The horsepower of the pump motor*
88.5% = Efficiency of pump motors are estimated to be no better than 88.5%
2.5 = Affinity Law pump constant
$Hours_{Pre}$ = The hours in one year that the pumps are currently used, this is 8,760 hours per year, the maximum which is 24 hours a day, 365 days per yr.
$Hours_{Low}$ = The hours in one year that the measure will be enacted.
$Speed_{Low}$ = The minimum recommended speed, as % of full speed.

kWh Savings: $$kWh\ Reduced = kWh\ Reduced\ Unit\ 1 + Unit\ 2 + Unit\ 3 + Unit\ 4$$

CO_2 Reduction: $$lbs\ CO_2 = kWh\ per\ Year \times 1.2415$$

Where: *1.2415 pounds of Scope II (indirect) CO_2 emissions are avoided for every kWh saved. Source: California Center for Sustainable Energy (CCSE)*

ECM #14

Energy Conservation Measure #14 saves energy by replacing the two (2) Carrier 48HJF-014 rooftop package units with two (2) AAON RM-013 rooftop package units with variable capacity scroll compressors. The new HVAC units will be more efficient, especially as partial load conditions. The cooling capacity will be increased from 25 tons to 26 tons and less energy will be consumed. The equations used to calculate these savings are shown below:

N. Gas Reduction: $$Therms\ Saved = 2\ units \times \frac{Hours}{1\ Year} \times 10\% \times ((Heat_{Pre} \times AFUE_{Pre}) - (Heat_{Post} \times AFUE_{Post}))$$

Where: *$Heat_{Pre}$ = Existing Heating Capacity in Therms*
$Heat_{Post}$ = Replacement Heating Capacity in Therms
10% = Estimated Heating Mode Load Factor / Duty Cycle
$AFUE_{Pre}$ = Existing Annual Fuel Use Efficiency, in %
$AFUE_{Post}$ = Replacement Annual Fuel Use Efficiency, in %
Hours = The hours in one year that the units are currently enabled, this is 4,368 hours per year, which is 12 hours a day, 7 days per week, and 52 weeks per year.

kWh Savings: $$kWh\ Reuction = 2\ \times \frac{Hours}{1\,Year} \times 25\% \times \left[\left(Tons_{Pre} \times \frac{12}{SEER_{Pre}}\right) - \right.$$
$$TonsPost\times 12SEERPost$$

Where: *$Tons_{Pre}$ = Existing Cooling Capacity in Tons*
$Tons_{Post}$ = Replacement Cooling Capacity in Tons
25% = Estimated Cooling Mode Load Factor / Duty Cycle %
$SEER_{Pre}$ = Existing unit Seasonal Energy Efficiency Ratio. IES estimated the SEER based on manufacturer's ARI rating and the condition of the units.
$SEER_{Post}$ = Replacement unit Seasonal Energy Efficiency Ratio. Manufacturer's ARI rating used.
Hours = The hours in one year that the units are currently enabled, this is 4,368 hours per year, which is 12 hours a day, 7 days per week, and 52 weeks per year.

CO_2 Reduction: $$lbs\ CO_2 = (Therms\ Saved\ \times 11.02) + (kWh\ Saved \times 1.2415)$$

Where: *11.02 pounds of Scope I (direct) CO_2 emissions are avoided for every Therm of natural gas not used. Source: US Environmental Protection Agency (EPA).*
1.2415 pounds of Scope II (indirect) CO_2 emissions are avoided for every kWh saved. Source: California Center for Sustainable Energy (CCSE)

ECM # NOT CONSIDERED

This Energy Conservation Measure saves energy by installing controls on the domestic hot water system. The system will be shut down each night when the facility is closed; this is estimated to produce a 2% natural gas savings from the two natural gas boilers as well as an electrical savings from the ½ horsepower circulation pump.

N. Gas Reduction: $$Therms\ Saved = 2\ units \times Heat_{IN} \times 30\% \times 82\% \times 2\% \times Hours_{Pre}$$

Where: *$Heat_{IN}$ = Heating Capacity in Therms*
30% = Estimated Load Factor / Duty Cycle
82% = Estimated boiler efficiency
$Hours_{Pre}$ = The hours in one year that the boilers are currently used, this is 8,760 hours per year, the maximum which is 24 hours a day, 365 days per yr.

kWh Savings: $$kWh\ per\ Year = (hp \times 80\% \times \left(\frac{1}{0.885}\right) \times 0.746 \times (Hours_{Pre} -$$
$$HoursPost$$

Where: *hp = The horsepower of the pump motor*
80% = Estimated Load Factor / Duty Cycle
88.5% = Efficiency of circulation pump motor estimated to be no better than 88.5%
$Hours_{Pre}$ = The hours in one year that the boilers are currently used, this is 8,760 hours per year, the maximum which is 24 hours a day, 365 days per yr.
. *$Hours_{Post}$ = The hours in one year that the pump will be enabled after controls have been installed.*

CO_2 Reduction: $$lbs\ CO_2 = (Therms\ Saved\ \times 11.02) + (kWh\ Saved \times 1.2415)$$

Where: *11.02 pounds of Scope I (direct) CO_2 emissions are avoided for every Therm of natural gas not used. Source: US Environmental Protection Agency (EPA).*
1.2415 pounds of Scope II (indirect) CO_2 emissions are avoided for every kWh saved. Source: California Center for Sustainable Energy (CCSE)

7.1.4 Budgeting & Incentives

Pricing budgets are valid for 60 days.

Incentives are provided by the Utility and can be increased, decreased or eliminated until reserved.

7.1.5 Financing Vehicles

Power Purchase Agreement Explained (for Solar Electric Installations)

Before Power Purchase Agreements (PPA) existed for solar power generation, cities looking to install solar or wind generation either had to put large sums of money up front to buy and install the equipment or go out and find alternate funding, often times in the form of municipal leases. When one considers the cost of a small scale 150 kW solar array is around one (1) million dollars the amount a city would have to finance for a medium to large system would be several million dollars. In addition, all of the maintenance for the generation equipment would have to be paid for by the city over the life of the generation asset. Considering all of this, few cities installed larger solar generation systems over the last decade.

A PPA differs from leases and direct purchases in that the city does not have to purchase the systems, but rather buys the power generated by the system. In a PPA, a PPA provider contracts with a developer to install the generation asset on city property. All rebates are assigned to the PPA provider by the city and the PPA provider is eligible for federal tax credits. The PPA provider and the city agree upon a cost per kWh for all electricity produced from the solar array for a fixed term (typically 20 to 25 years). This cost is typically at or below the cost of electricity from the utility based on historical pricing and escalation and the price escalates at a predetermined rate for the term of the contract. During the term of the contract, the PPA provider would maintain the system, and be responsible for any equipment replacement at no additional cost to the city. At the end of the term, the city can typically choose one of the following options:

1. Purchase the generation asset at fair market value from the PPA provider
2. Extend the contract with developer for a period of 1 to 5 or more years
3. Have the generation asset removed at the PPA provider’s expense

If the city chooses to purchase the generation asset, the fair market value is typically a fraction of the original installation cost and may be a sound investment. This is because solar arrays typically have a 25 year warranty and have an estimated lifespan of 40+ years. The primary benefit of the PPA is that it allows the city to purchase a small to medium size portion of its power at a predetermined cost for a period of time, avoiding electric market fluctuations.

There are some drawbacks to this model, most notably the unknown final cost of the generation asset at the end of the term. Following are the pros and cons of the PPA system vs. direct buy:

Pros:

- The City gets renewable generation without upfront cost and does not impact its borrowing ability.
- The City is able to purchase power at a predetermined rate for the term of the contract
- The City is able to take indirect advantage of federal and state tax credits through the private PPA provider
- The City has no maintenance cost for the generation asset for the term of the contract
- The City can purchase a larger system than they would through traditional methods

Cons:

- The City does not know the purchase option price at the end of the term as it is based on fair market value
- If utility escalation rates fall short of projections, the City may spend more for renewable generation than they would have buying electricity from the utility
- Smaller projects <200,000 kWh are not attractive to PPA providers and would be cost prohibitive.

Municipal Lease Explained (For Solar and other energy conservation measures)

The primary means of financing energy efficiency projects in the public sector is through a municipal lease purchase agreement executed in tandem with an energy savings performance contract (ESPC).

An ESPC enables a public entity to pay for energy efficiency upgrades and renewable energy installation by setting aside dollars in its utility budget to allow for program costs. When properly structured, this financing mechanism draws on the dollars to be saved for future utility bills to pay for new, energy efficient equipment today, and annual savings are typically guaranteed by the service provider.

Annual payments are structured to match the energy savings cash flow of the energy project in order to maintain a "budget neutral" program for the public entity. Interest rates are lower than those on a taxable commercial lease purchase agreement because the interest paid is exempt from federal income. In addition, a tax-exempt lease/purchase agreement does not constitute a long-term debt obligation because of the non-appropriation language included in the agreement.

Key Elements

- Security is in the installed equipment, not a building or other real property
- Payments are subject to annual appropriation by the public agency
- Interest income is exempt from federal income tax (state tax varies by state)
- Is not tied to tax revenue and does not require voter approval
- Requires an escrow account be funded to enable service provider to draw payments during installation

Rates and Terms

Rates are priced off of 10 year Treasury Notes and currently range between 4.25% and 7% based on term, credit and other considerations and rates are higher than a GO Bond and Revenue Bond. Terms range from 7-20 years and most terms are 10-12 years and are limited by either state or federal laws (e.g., HUD financing can extend to 20 years, DOD and DOE can extend to 25 years, state of Massachusetts is up to 10 years if efficiency only, 25 years if cogeneration is included.)

Project Size and Scope

Projects will range from $1 million to $25 million with an average project size of approximately $2.5 million. Project scope of work includes controls, lighting, heating, ventilating and air-conditioning (HVAC) and in some cases, photovoltaic system installation.

California Energy Commission Low interest rate loans Explained (For Solar and other energy conservation measures- 11 year simple payback limitation)

Eligible Projects

You can purchase and install any commercially-available energy efficiency equipment with proven energy and/or capacity savings. Examples of qualified projects:

- Lighting
- Motors and pumps
- Heating and air conditioning systems
- Automated energy management systems and controls
- Cogeneration equipment
- Light emitting diode traffic signal modules

- Renewable energy systems
- Thermal energy storage systems

Projects already funded with an existing loan or already installed are ineligible.

Loans for energy audits and feasibility studies may be considered. Call for information regarding eligibility.

Your application must be on file before you can start your project, and **only project-related costs that are invoiced and paid for after Energy Commission approval may be included in the loan request**. Applicants assume all financial risk should the Commission disapprove the application or if all loan documents are not executed. If the loan is disapproved for any reason, the Energy Commission is not responsible for reimbursement of any costs.

Existing buildings or other energy using facilities are eligible. Some new buildings and facilities may also be eligible.

Loans can finance up to 100 percent of the project costs.

This solicitation is open continuously with no published final filing date. Applications for funding will be accepted on a first come, first served basis, reviewed by a technical committee, and awarded based on project merit. The Energy Commission reserves the right to close the solicitation period at any time.

Energy efficiency projects must be technically and economically feasible. Loans must be repaid from savings within 15 years, including principal and interest. This results in an approximate 11 year simple payback.

$$\text{Simple Payback (yrs)} = \frac{\text{Amount of Loan (\$)}}{\text{Anticipated Annual Energy Cost Savings (\$/yr)}}$$

The interest rate is a fixed 3 percent for the term of the loan.

Loan Security Requirements are simple. A promissory note, a loan agreement between you and the Energy Commission, and a Tax Certificate are all that is required to secure the loan.

Funds are available on a reimbursement basis. For each reimbursement request, receipts and invoices for incurred expenses must be submitted along with payment verification by your organization.

The final 10 percent of the funds will be retained until the project is completed. Interest is charged on the unpaid principal computed from the date of each disbursement to the borrower.

The repayment schedule is based on the estimated annual projected energy cost savings from the aggregated project(s), using energy costs and operating schedules at the time of loan approval. In some cases, the loan repayment schedule can be extended up to 15 years.

Applicants will be billed twice a year after the projects are completed.

Clean Renewable Energy Bonds (CREBs) (For Solar Electric Installations)

Clean renewable energy bonds (CREBs) may be used by certain entities -- primarily in the public sector -- to finance renewable energy projects. The list of qualifying technologies is generally the same as that used for the federal renewable energy production tax credit (PTC). CREBs may be issued by electric cooperatives, government entities (states, cities, counties, territories, Indian tribal governments or any political subdivision thereof), and by certain lenders. CREBs are issued -- theoretically -- with a 0%-3% interest rate. The borrower pays back only the principal of the bond, and the bondholder receives federal tax credits in lieu of the traditional bond interest.

The Energy Improvement and Extension Act of 2008 (Div. A, Sec. 107) allocated $800 million for new Clean Renewable Energy Bonds (CREBs). In February 2009, the American Recovery and Reinvestment Act of 2009 (Div. B, Sec. 1111) allocated an additional $1.6 billion for new CREBs, for a total new CREB allocation of $2.4 billion. The Energy Improvement and Extension Act of 2008 also extended the deadline for previously reserved allocations ("old CREBs") until December 31, 2009, and addressed several provisions in the existing law that previously limited the usefulness of the program for some projects.

In April 2009 the IRS issued Notice 2009-33 soliciting applications for the new CREB allocation and providing interim guidance on certain program rules and changes from prior CREB allocations. The expiration date for new CREB applications under this solicitation is August 4, 2009. Further guidance on CREBs is available in IRS Notices 2006-7 and 2007-26 to the extent that the program rules were not modified by 2008 and 2009 legislation.

Participation in the program is limited by the volume of bonds allocated by Congress for the program. Participants must first apply to the Internal Revenue Service (IRS) for a CREBs allocation, and then issue the bonds within a specified time period. The new CREBs allocation totaling $2.4 billion does not have a defined expiration date under the law; however, the recent IRS solicitation for new applications requires the bonds to be issued within 3 years after the applicant receives notification of an approved allocation.

7.1.6 Project Implementation Plan

Project Implementation Plan

Silliman Activity and Family Aquatic Center

Newark, Ca.

June, 2009
Revision: 02

Table of Contents

1. **Approval Sheet**
2. **Document Purpose**
3. **Statement of Work**
   - 3.1. Description of Work
   - 3.2. Project Specifics
   - 3.3. Project Documents
4. **System Overview**
5. **Project Organization**
   - 5.1. Organizational Chart
   - 5.2. Project Team
   - 5.3. Roles and Responsibilities
   - 5.4. Staffing and Resources
6. **Project Execution**
   - **6.1. Project Planning and Scheduling**
     - 6.1.1. Kickoff Meeting
     - 6.1.2. Schedule
     - 6.1.3. Revisions to Schedule
     - 6.1.4. Progress Measurement and Tracking
   - **6.2. Disaster Recovery**
   - **6.3. Technical Execution**
   - **6.4. Engineering Design Phase**
   - **6.5. Engineering Design Phase Deliverables**
   - **6.6. Application Software Design Phase**
     - 6.6.1. General Approach
     - 6.6.2. Control Code Development
     - 6.6.3. Test Procedure Development
     - 6.6.4. Application Software Design Phase Deliverables
   - **6.7. Construction / Installation Phase**
   - **6.8. Start-up Commissioning Phase**
     - 6.8.1. Start-up Commissioning
     - 6.8.2. Start-up Commissioning Phase Deliverable
   - **6.9. City of Newark Personnel Training**
   - **6.10. Turnover Documentation**
7. **Quality Plan**
   - 7.1. General
   - 7.2. System Design and Software Development
8. **Project Revisions**

1. Approval Sheet

This sheet is provided for information only. The Approval by Customer Representative is optional unless specifically required by project requirements:

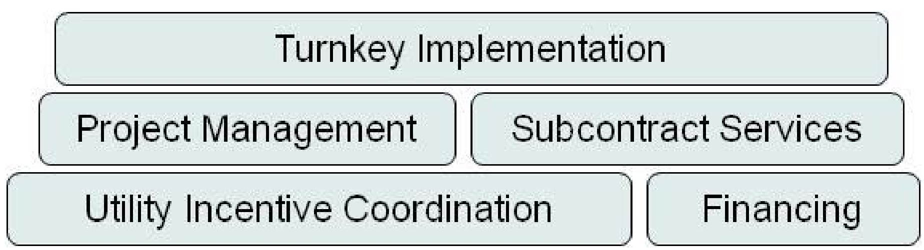
Name & Function	Approval Status	Signature	Date
Syserco's Project Manager: Mike Hill	☐ Submit for Approval	---------------------------	
Customer's Representative: Lenka Diaz	☐ Approved as Submitted ☐ Approved as Noted ☐ Revise & Re-submit	---------------------------	

2. Document Purpose

The purpose of this document is to provide the City of Newark, Silliman Activity and Family Aquatic Center project team a comprehensive description of Syserco's standard execution plan. This plan contains an overview of the system and its architecture, a concise description the project team and its roles and responsibilities and a detailed narrative of Syserco's execution plan of the engineering, installation and start-up and commissioning phases.

Syserco's project manager, Mike Hill has ultimate responsibility for ensuring that the project execution plan is developed and maintained. Other team members such as Syserco's engineering manager and lead technician may have assigned responsibilities relative to, or for portions of this plan. Maintaining this plan will be done as necessary or as mandated by project documents.

Once the project is fully engineered, identified and agreed to by the customer, Syserco will design, install, provide project management, subcontract, coordinate incentives, financing and ensure the energy projects are completed on time and on budget. Syserco utilizes Project Implementation plans that are co-authored with the input of the customer so that disruptions to occupied building operations are minimized.



Statement of Work

The project execution plan provides guidance to the implementation of the SAFAC project.

3.1 Description of Work

Provide turnkey implementation of Energy Conservation Measures selected by the City of Newark for the Silliman Activity and Family Aquatic Center on time and on budget. Measures may include lighting retrofit and integration, control measures, mechanical upgrades, renewable energy and other miscellaneous measures. Coordination work with local utilities to ensure incentives are captured with the projects.

3.2 Project Specifics

- ✓ Provide a design/build energy management system that achieves the functionality specified in the Comprehensive Energy Report and agreed to by the City of Newark
- ✓ Provide turnkey implementation of energy conservation measures accepted and agreed to by the City of Newark
- ✓ Provide subcontractor management
- ✓ Organize and execute project Commissioning
- ✓ Conduct Customer training
- ✓ Coordinate incentive utilities
- ✓ Coordinate with financing, if applicable
- ✓ Coordinate with power purchase agreement partners, if applicable

3.3 Project Documents

The following project documents were the source of the above scope of work:

- ✓ Comprehensive Energy Analysis Report by Syserco and IES, Inc.
- ✓ Drawings supplied by the City of Newark
- ✓ Rate and use information provided by Utility and the City of Newark

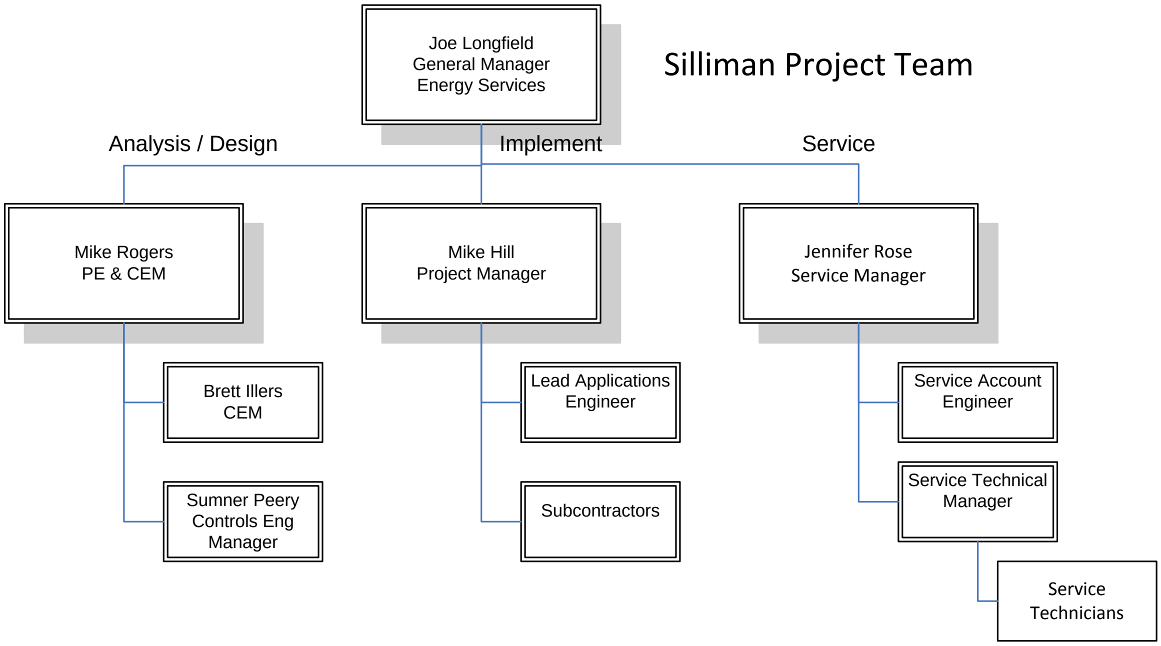
4. System Overview

The system will be developed from the following Energy Conservation Measures as selected and agreed upon by the City of Newark for the SAFAC:

SYSERCO - George M. Silliman Activity Center: Savings Analysis							
ECM #	Demand Response Measures	kWh Reduction	Therms Reduction	CO2 Reduction	kWh $	Therm $	Total $
1	Replace Natatorium Rail Lighting	54,750	-	67,972	$ 7,508	$ -	$ 7,508
2	Retrofit HID Parking Lot Lighting	50,135	-	62,243	$ 4,168	$ -	$ 4,168
3	Replace and Retrofit Wall Mounted HID Fixtures	9,353	-	11,612	$ 1,377	$ -	$ 1,377
4	Install Ambient Lighting Sensors on Selected Fixtures	41,635	-	51,690	$ 5,502	$ -	$ 5,502
5	Install Ambient Light Controller on the Natatorium Rail and Catwalk Fixtures	40,715	-	50,548	$ 4,967	$ -	$ 4,967
6	Control After Hours Lighting Through Current EMS	31	-	39	$ 4	$ -	$ 4
7	Use Existing EMS to Reduce HVAC Load in the Gymnasium	2,040	-	2,533	$ 249	$ -	$ 249
8	Use Existing EMS to Reduce Peak HVAC Load During Summer Months	1,529	-	1,898	$ 396	$ -	$ 396
9	Install Occupancy Controllers for HVAC in Specified Areas	5,088	-	6,316	$ 621	$ -	$ 621
10	Install Controls on Pool Boiler Plant	[illegible]	2,791	30,753	$ -	$ 3,237	$ 3,237
11	Install Controls on Domestic Hot Water System	[illegible]	210	2,496	$ 144	$ 244	$ 388
12	Add VFDs to Pool Filtration Pumps	[illegible]	[illegible]	[illegible]	4,803	$ -	$ 4,803
13	Replace Gymnasium Units with AAON Units Containing Digital Scroll Compressors	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	$ [illegible]
14	Install Solar Photo Voltaic Panel for Renewable Generation	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
15	Add Thermal Solar Collectors to Preheat Pool Hot Water	-	54,645	[illegible]	[illegible]	[illegible]	[illegible]
16	Add Thermal Solar Collectors to Preheat Domestic Hot Water	-	0	0	$ -	[illegible]	[illegible]
Total		280,789	58,007	985,864	$ 31,694	$ 58,545	$ [illegible]

5. Project Organization

5.1 Organizational Chart



5.2 Project Team

Mike Hill [Project Manager]: 10 years of industry experience managing large complex projects including Pharmaceutical and Biotech manufacturing facilities.

Brett Illers [Certified Energy Manager]: 10+ years of industry experience in energy conservation measure identification, analysis and design.

Sumner Peery [engineering Manager]: 17 years of industry experience engineering controls systems and managing design teams.

Brad Leonard [Lead Programmer]: 17 years of industry experience programming and commissioning controls systems including large and complex facilities.

5.3 Roles and Responsibilities

The project will be executed from Syserco's Fremont office. The project team introduced in the previous section of this document will represent the core team executing this project. The roles and responsibilities of the core team include the following:

Project Manager: The Project Manager is responsible for the overall execution of the scope of work and is Syserco's point of contact with the SAFAC project team. Additional responsibilities include:

- ✓ Responsible for overall customer satisfaction
- ✓ Responsible for delivering the project on time and budget
- ✓ Manages the contract and work scope
- ✓ Manages the Energy Management System EMS Construction Schedule to ensure deadlines are met and reports any deviations to the SAFAC project team
- ✓ Responsible for work quality and workmanship
- ✓ Acts as the primary interface between SAFAC project team and Syserco's
- ✓ Coordinates and manages Syserco's field work and labor
- ✓ Attends jobsite meetings
- ✓ Acts as the safety officer on site
- ✓ Coordinates and schedules customer training
- ✓ Ensures the PEP is read and understood by Syserco's project team

Engineering Manager: The Engineering Manager is responsible for the overall engineering design of the project and in delivering a system in accordance with the scope of work. Additional responsibilities include:

- ✓ Manages the engineering design process including submittals
- ✓ Conducts peer reviews on engineering submittals including point to point drawings, PID Diagrams, Sequence of Operations and other engineering deliverables
- ✓ Conducts peer reviews on applications programs and graphic screens
- ✓ Acts as the technical expert in the field of controls and electro-mechanical systems
- ✓ Acts as the technical consultant to the project team and helps resolve field technical challenges
- ✓ Reports to the project manager

Lead Programmer: The Lead Programmer is responsible for software development of all application specific software. Additional responsibilities include:

- ✓ Develops application programming for all systems in scope
- ✓ Develops graphic screens

- ✓ Coordinate with the engineering team and reviews engineering submittals for accuracy
- ✓ Oversees the start-up and commissioning of the controls system
- ✓ Works with the engineering manager in developing start-up and commissioning sheets specific to the system

5.4 Staffing and Resources

All of the proposed individuals on this project have gone through the Alerton training courses relative to product, engineering and programming as well as other industry related trainings depending on their role and function. Some of these classes include:

- ✓ Visio Programming
- ✓ Alerton Training
- ✓ Project Management
- ✓ Quality Management System
- ✓ Good Engineering and Documentation Practices

6. Project Execution

Project Management

This section describes the Project Management Methodology and Controls to be used by Syserco on the City of Newark Project:

6.1 Project Planning and Scheduling

6.1.1 Kickoff Meeting

A Kickoff Meeting will be held after award of contract. The purpose of the meeting is to introduce the Syserco Project team to the City of Newark and to define certain roles and responsibilities between Syserco and the City. In addition, and due to the retrofit nature of the project, Syserco realizes the importance of coordinating work in occupied spaces as well as shutdown of equipments and therefore, will use this meeting to go over the proposed construction schedule for this project.

6.1.2 Schedule

Syserco will prepare a detailed project schedule, plan and schedule all trades, manage subcontracts, identify all major tasks based on milestones needed for the successful execution of this project. Syserco's schedule will include all related tasks required for the timely completion of this Project. All project related activities have been divided into small phases which are as follows:

- Engineering Design
- Programming development
- Graphics development
- Financing alignment
- Installation
- Subcontract management
- Procurement of materials
- Start-up and Commissioning
- Final Punch list / Project closeout
- Customer Training

6.1.3 Revisions to Schedule

If necessary, Syserco's Project Manager will inform the City of Newark of any schedule changes in order to ensure that coordination is done properly with minimum interruptions. All or any changes to the schedule will be reviewed proactively with the City prior to making the change.

6.1.4 Progress Measurement and Tracking

Syserco will coordinate the execution of the project through scheduled meetings between Syserco's Project Manager and the City of Newark Project team. Such meetings would review project progress and address any issues such as pending RFIs, anticipated schedule changes, schedule coordination, etc. Meeting notes will be maintained to document action items and follow-ups by Syserco.

6.2 Disaster Recovery

Syserco's Project personnel will perform daily backups of project design data, application software and other computer-generated programs. This will be done to ensure that loss of data will be fully recoverable.

6.3 Technical Execution

This section is intended to describe the execution of the technical scope of the work of this project. It outlines the planned engineering flow along with all phases and the deliverables at the end of each phase. The technical execution consists of the following four phases:

- Engineering Design
- Application Software Design
- Construction / Installation
- Start-up and Commissioning

The Systems will be designed and developed as outlined in the project specifics (Section 3.2). The experienced project team will provide leadership for the engineering design and development effort and will meet on regular basis to review design-related issues and set strategies and milestones for the phase being executed.

In order to ensure quality throughout the technical execution of the project, the project team will be utilizing Syserco's existing and proven practices to support the execution of the project.

6.4 Engineering Design Phase

The Engineering Design Phase includes all design activities directed towards:

- Selecting and specifying hardware
- Developing field wiring and panel layouts
- Assigning required I/O and developing I/O Controllers
- Controlling change and source document tracking of all documentation.

During the Engineering Phase, the Syserco Engineering team, along with the Project Manager, will meet on an as needed basis to discuss Engineering progress, RFI disposition and status, including engineering design and other related issues.

6.5 Engineering Design Phase Deliverables

Syserco will provide the following engineering design documents as deliverables at the end of this phase:

- Hardware Equipment List
- Points List
- EMS Architecture Block Diagram
- I/O Controllers Detail Drawings
- Field Interface Panel Details
- Sequences of Operations
- Syserco's Standard Commissioning Procedures
- Product submittals from any applicable subcontractors

6.6 Application Software Design Phase

The documents generated during the Engineering Design Phase form the source documents for this phase.

6.6.1 General Approach

Syserco's Project Manager will oversee the work performed by the project team. This will ensure that documentation, development, and testing activities adhere to the guidelines of Syserco's Standard SOPs as well as standards and procedures that may be specifically developed by Syserco and approved by the City of Newark.

6.6.2 Control Code Development

All application specific programs associated with this project shall be developed as outlined in Syserco's standards. In addition to the above referenced standards, the project team will utilize Syserco SOPs and any other necessary documents from this project.

The software development will consist of the following activity sequence:

1) The Project Manager assigns the software development work to the Lead Construction Programmer. (LCP)
2) The LCP select the programming modules from Syserco's Software library and links them together.
3) The LCP tests and debugs the program until it satisfies the sequence of operations being programmed.
4) The LCP submits code to the Engineering Supervisor who does a Peer Review.
5) If all tests and reviews pass, the code is then submitted for archival into the project software library.
6) If a test fails, the LCP review the cause of the failure and corrective action will be taken to address any failed items.
7) Re-testing will be performed as determined by the LCP.

In addition to the above Peer Review, Syserco will review each project deliverable before submitting for approval. Reviews consist of checking submittal documents against Project Documents (in this case, as-builts) and against Syserco's Approved Engineering Submittals. Reviews will be performed by Syserco personnel other than the person who completed the deliverable document.

6.6.3 Test Procedures Development

Syserco will be utilizing its standard testing procedures for the complete point to point start-up. Test procedures developed will be for functional and structural testing of the sequences of Operations as detailed in Start-up and Commissioning Phase section of this document. A hard copy of the appropriate test procedure will be issued to the Lead Technician who will use this copy to record the test results and submit the completed copy to the Project Manager.

This Library will be maintained by the Lead Construction Programmer, Lead Design Engineer and the Project Manager.

6.6.4 Application Software Design Phase Deliverables

Syserco will provide the following Application Software documents as deliverables at the end of this phase:

- Copies of all programs
- Names of all new Graphics Screens

6.7 Construction / Installation Phase

During this phase, Syserco's electricians and subcontractors will engage in the field installation of instruments, motors, mechanical equipment, renewable, panels and controllers. Daily activities will be coordinated by the General Foreman and the Project Manager.

6.8 Start-up and Commissioning Phase

After the installation of each of the four areas is complete and point to point checkout testing of the field instruments and I/O has commenced, Syserco Technician and Electrician will perform the final quality check by reviewing connections and terminations to field devices. The results will be noted on the drawings.

In addition, activities in this phase will be directed towards ensuring that Syserco' installed EMS functions as outlined in the sequence of operations. Also, during this phase, all field checkouts are executed per Syserco's standard commissioning procedures.

6.8.1 Start-up and Commissioning

The standard procedures will be provided to the City of Newark for their records.

6.8.2 Start-up and Commissioning Phase Deliverables

Syserco will provide the following commissioning documents as deliverables at the end of this phase:

- Test Forms/Reports
- Graphics Screens

6.9 City of Newark Personnel Training

Upon completion of the commissioning phase, Syserco will coordinate City personnel with training as outlined in proposal. The training will be specific to the installed energy conservation measures at the City of Newark SAFAC Retrofit Project.

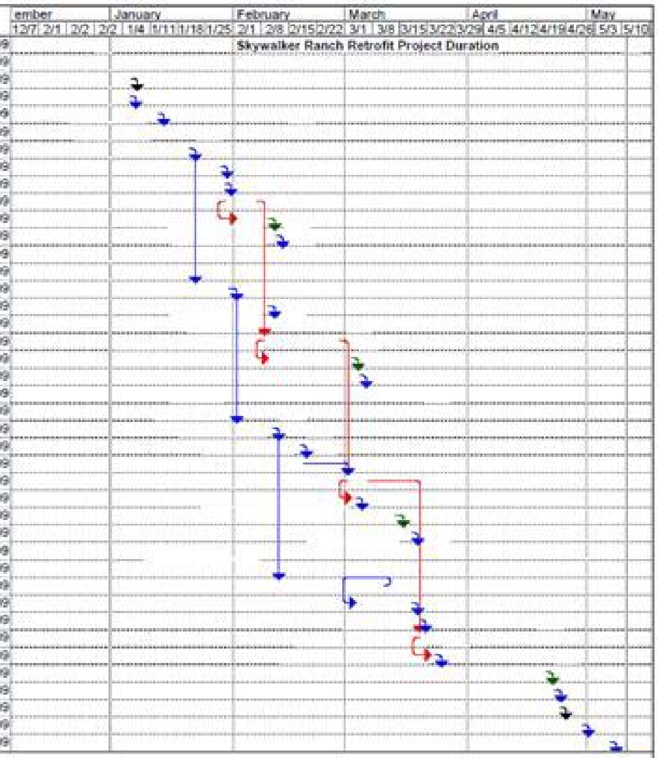
6.10 Turnover Documentation

In addition to the deliverables from the Engineering Design Phase, Application Software Design Phase and Start-up and Commissioning Phase, Syserco' Turnover Package will include hard as well as soft copies (as applicable) for the following:

- Panel Location As-Builts
- I/O Controllers As Builts
- As-Builts Sequences of Operations
- Copies of Program Code
- Operations and Maintenance Manuals

A sample project implementation plan is shown below. Syserco aligns project milestones and resources to ensure the project implementation is done without disruption to the customers business.

ID		Task Name	Duration	Start
1		**Skywalker Ranch Retrofit Project Duration**	**88 days**	**Mon 1/5/09**
2		Contract Award	0 days	Mon 1/5/09
3		Kickoff Meeting	1 day	Mon 1/5/09
4		Detailed Site Survey	5 days	Tue 1/6/09
5		**Farm Group**	**22 days**	**Tue 1/13/09**
6		Engineering	6 days	Tue 1/13/09
7		Programming	6 days	Wed 1/21/09
8		Load Graphics	1 day	Thu 1/29/09
9		Installation	6 days	Fri 1/30/09
10		Startup/Commissioning	6 days	Mon 2/2/09
11		Final Punchlist	2 days	Tue 2/10/09
12		Area Complete	0 days	Wed 2/11/09
13		**Main Group**	**31 days**	**Wed 1/21/09**
14		Engineering	8 days	Wed 1/21/09
15		Programming	6 days	Mon 2/2/09
16		Load Graphics	1 day	Tue 2/10/09
17		Installation	15 days	Mon 2/9/09
18		Startup/Commissioning	15 days	Tue 2/10/09
19		Final Punchlist	2 days	Tue 3/3/09
20		Area Complete	0 days	Wed 3/4/09
21		**Archives**	**32 days**	**Mon 2/2/09**
22		Engineering	7 days	Mon 2/2/09
23		Programming	5 days	Wed 2/11/09
24		Load Graphics	1 day	Wed 2/18/09
25		Installation	5 days	Mon 3/2/09
26		Liebert Integration	1 day	Tue 3/3/09
27		Startup/Commissioning	8 days	Wed 3/4/09
28		Final Punchlist	2 days	Mon 3/16/09
29		Area Complete	0 days	Tue 3/17/09
30		**Technical Building**	**51 days**	**Wed 2/11/09**
31		Engineering	20 days	Wed 2/11/09
32		Programming	10 days	Wed 3/4/09
33		Load Graphics	2 days	Wed 3/18/09
34		Installation	20 days	Fri 3/20/09
35		ABB VFD Integration	1 day	Mon 3/23/09
36		Startup/Commissioning	20 days	Tue 3/24/09
37		Final Punchlist	2 days	Tue 4/21/09
38		Area Complete	0 days	Wed 4/22/09
39		Final Punchlist	5 days	Thu 4/23/09
40		As-Builts & TOP	5 days	Thu 4/30/09
41		Project Complete	0 days	Wed 5/6/09



Project: Schedule
Date: Mon 5/11/09

Task	Milestone	External Tasks
Split	Summary	External MileTask
Progress	Project Summary	Split

Page 1

7. Quality Plan

7.1 General

To ensure final quality product, Syserco follows Good Engineering Practices and ensures that its Engineers and Technicians are trained and up to date with technology. The team members will attend a project orientation during which the project standards will be shared and discussed. Similar meetings during the project life cycle will be held regularly to ensure that all team members are aware of and adhere to these standards during project execution. While the Project Manager has the direct responsibility for Quality Assurance, the core project team members shall comprise the Quality Assurance team. The QA team shall ensure suitable quality standards are maintained and that appropriate documentation is prepared to map the completed ECM's to the City of Newark Sequences of Operations.

7.2 System Design and Software Development

Every software developer shall undergo a project orientation during which the Lead Construction Programmer will review project standards which includes the programming methodologies including naming conventions, test methodology etc. adopted for the project.

The Project Manager will assign appropriate peer reviewers to provide technical review and debugging of written and/or configured deliverables. The peer review activities will include the following:

- Verifying the technical approach.
- Document that proper and appropriate procedures are followed.
- Provide a technical evaluation that the work product achieves the desired intent.
- Verify that the work product is complete and that all documentation (printouts, hard copies of code, etc.) is attached.

The person performing the peer review tasks will have the required experience to perform peer reviews as the project team member who performed the work being reviewed. The Project Manager will sign completion records. Software will be submitted for testing only after the Project Manager for the project signs it as complete. Application software, which has undergone successful testing, shall be archived and access to it will be controlled by the Lead. All software in this category includes application specific programs, graphic screens, etc.

8. Revision History

This document has been revised as follows:

Revision #	Date	Sections Revised	Reasons for Changes
0	06/30/09	Submitted with Energy Analysis	Not Applicable

END OF PROJECT IMPLEMENTATION PLAN

[i] Environmental Protection Agency. http://www/epa.gov/RDEE/energy-resources/refs.html Retrieved 7-17-2009
[ii] 2006 IPCC Guidelines for National Greenhouse Gas Inventories. Intergovernmental Panel on Climate Change, Geneva, Switzerland.
[iii] Inventory of U.S. Greenhouse Gas Emissions and Sinks: Fast Facts 1990-2005. Conversion Factors to Energy Units (Heat Equivalents) Heat Contents and Carbon Content Coefficients of Various Fuel Types. U.S. Environmental Protection Agency, Washington, D.C.. USEPA #430-R-07-002 (PDF).
[iv] Ibid.
[v] California Center for Sustainable Energy. http://energycenter.org/ Retrieved 7-17-2009

City of Newark

Greenhouse Gas Emissions Analysis

2005 Community Emissions Inventory
&
2005 Municipal Operations Emissions Inventory

newark
california

August 2008

Credits and Acknowledgements

This Greenhouse Gas Emissions Inventory was completed through the generous support of many individuals and organizations. The staff at the City of Newark has been most helpful in gathering core data and doing subsequent analysis. Particular thanks go to Susie Woodstock, Maintenance Superintendent at the City of Newark.

ICLEI would also like to acknowledge the following individuals and organizations for their contributions:

Alameda County Waste Management Authority (Stopwaste.org)
Debra Kaufman, Senior Program Manager
Meghan Starkey, Senior Program Manager

Bay Area Air Quality Management District
Amir Fanai, Principal Air Quality Engineer

Metropolitan Transportation Commission
Harold Brazil, Air Quality Associate

ICLEI – Local Governments for Sustainability
Gary Cook, California Director
Alden Feldon, California Manager
Brooke Lee, Program Officer
Jonathan Strunin, Program Officer
Wesley Look, Program Associate
Jonathan Knauer, Program Associate
Ayrin Zahner, Former Program Associate
Jennifer Holzer, Former Program Associate
Palak Joshi, Former Program Associate

This inventory report was prepared by Brooke Lee, Palak Joshi, Ayrin Zahner, Jonathan Strunin, and Wesley Look of ICLEI–Local Governments for Sustainability U.S.A. The authors gratefully acknowledge the dedication of staff of the City of Newark, who provided much of the insight and local information necessary for the completion of this report.

ICLEI Local Governments for Sustainability

With generous support from Stopwaste.org

Table of Contents

1. Introduction 4

    1.1. Introduction and History 4

    1.2. Climate Change Background 4

    1.3. ICLEI Membership and the Five Milestones.. 5

    1.4. Sustainability and Climate Change Mitigation Activities in Newark.. 5

2. City of Newark 2005 Greenhouse Gas Emissions Inventory 6

    2.1. Methods.. 6

        2.1.1.CACP Software.. 6

        2.1.2. Creating the Inventory 6

    2.2. Inventory Results 7

        2.2.1. Community Emissions Inventory 7

        2.2.2. Community Emissions Forecast 9

        2.2.3. Government Operations Emissions Inventory 11

        2.2.4. Government Operations Emissions Forecast 14

3. Conclusion 16

4. Appendices..17

    4.1. Appendix A: Forecast Data from ABAG's *Projections 2005* 17

    4.2. Appendix B: Emissions Factors Used in the Alameda County Climate Protection Partnership..18

    4.3. Appendix C: Waste Calculation Methodology 19

    4.4. Appendix D: Detailed CACP Report: Government Operations Greenhouse Gas Emissions in 2005.. *(attached)*

    4.5. Appendix E: Detailed CACP Report: Community Greenhouse Gas Emissions in 2005 .... *(attached)*

1. Introduction

1.1. Introduction and History

In 2007, Newark Mayor David W. Smith signed the U.S. Mayors Climate Protection Agreement, thereby committing the City to taking action for climate protection. The City has also joined all of the other local governments in Alameda County in committing to becoming a member of ICLEI and participating in the Alameda County Climate Protection Project. The project was launched by ICLEI in partnership with StopWaste.Org and the Alameda County Conference of Mayors.

Through these actions, the City of Newark recognized that "climate disruption is a reality and that human activities are largely responsible for increasing concentrations of global warming pollution." Through energy efficiency in its facilities and vehicle fleet, clean alternative energy sources, waste reduction efforts, land use and transportation planning, and other activities, the City of Newark can achieve multiple benefits, including lower energy bills, improved air quality, economic development, expanded transit options, waste reduction and a better quality of life throughout the community.

This greenhouse gas emissions inventory represents completion of the first step in Newark's climate protection process. As advised by ICLEI, it is essential to first quantify recent-year emissions to establish: 1) a baseline, against which to measure future progress, and 2) an understanding of where the highest percentages of emissions are coming from, and, therefore, where the greatest opportunities for emissions reductions are. Presented here are estimates of greenhouse gas emissions in 2005 resulting from the community as a whole, and from City government operations.

1.2. Climate Change Background

A balance of naturally occurring gases dispersed in the atmosphere determines the Earth's climate by trapping solar radiation. This phenomenon is known as the greenhouse effect. Modern human activity, most notably the burning of fossil fuels for transportation and electricity generation, introduces large amounts of carbon dioxide and other heat-trapping gases into the atmosphere. Collectively, these gases intensify the natural greenhouse effect, causing global average surface temperature to rise, which is in turn expected to affect global climate patterns.

Overwhelming evidence suggests that human activities are increasing the concentration of greenhouse gases in the atmosphere, causing a rise in global average surface temperature and consequent climate change. In response to the threat of climate change, communities worldwide are voluntarily reducing greenhouse gas emissions. The Kyoto Protocol, an international effort to coordinate mandated reductions, went into effect in February 2005 with 161 countries participating. The United States is one of three industrialized countries that chose not to sign the Protocol.

In the face of federal inaction, many communities in the United States are taking responsibility for addressing climate change at the local level. The community of Newark might very well be impacted by resultant changes in the height, salinity and behavior of the San Francisco Bay, or by any of the other predicted results of changing temperatures such as: an increase in wild fires, the development of drought as a result of reduced snow pack in the Sierras, the spread of vector-borne diseases, and a general disruption of ecosystems, habitats and agricultural activities.

Although one jurisdiction alone cannot independently resolve the issue of climate change, local governments together can make a powerful cumulative impact. This is the impetus of the Alameda County Climate Protection Project.

1.3. ICLEI Membership and the Five Milestones

By adopting a resolution committing the City to climate protection, Newark has joined an international movement of local governments. More than 800 local governments, including over 450 in the United States, are members of ICLEI. Currently, 120 of ICLEI USA members are located in the State of California – approximately 80 of which are located in the San Francisco Bay Area. In addition to Newark, all 14 Alameda municipalities and the County are ICLEI members, and are working to advance through ICLEI's Five Milestone Process.

The Five Milestone Process provides a framework for local communities to identify and reduce greenhouse gas emissions. The Milestones are as follows:

(1) Conduct an **inventory** of local greenhouse gas emissions;

(2) Establish a greenhouse gas emissions **reduction target**;

(3) Develop a **climate action plan** for achieving the emissions reduction target;

(4) **Implement** the climate action plan; and,

(5) **Re-inventory** emissions to monitor and report on progress.

This report represents the completion of the first CCP milestone, and provides a foundation for future work to reduce greenhouse gas emissions in Newark.

1.4. Sustainability and Climate Change Mitigation Activities in Newark

<Instruction to jurisdiction: Enter climate protection activities here. Table of contents update may be necessary. >

2. City of Newark 2005 Greenhouse Gas Emissions Inventory

2.1. Methods

ICLEI assists local governments in systematically tracking energy and waste related activities within their jurisdiction, and in calculating the relative quantities of greenhouse gases produced by each activity and sector. The greenhouse gas inventory protocol involves performing two assessments: 1) a community-wide assessment, and 2) a separate inventory of municipal facilities and activities. The municipal inventory is a subset of the community inventory.

Once completed, these inventories provide the basis for policy development, progress measurement, emissions forecasting, and the establishment of an informed emissions reduction target.

2.1.1. CACP Software

To facilitate community efforts to reduce greenhouse gas emissions, ICLEI developed the Clean Air and Climate Protection (CACP) software in partnership with the State and Territorial Air Pollution Program Administrators (STAPPA), the Association of Local Air Pollution Control Officials (ALAPCO)[1], and Torrie Smith Associates. This software calculates emissions resulting from energy consumption and waste generation. The CACP software determines emissions using specific factors (or coefficients) according to the type of fuel used. CACP aggregates and reports the three main greenhouse gas emissions (CO_2, CH_4, and N_2O) in terms of equivalent carbon dioxide units, or CO_2e. Converting all emissions to equivalent carbon dioxide units allows for the consideration of different greenhouse gases in comparable terms. For example, methane (CH_4) is twenty-one times more powerful than carbon dioxide on a per weight basis in its capacity to trap heat in the atmosphere. The CACP software converts one metric ton of methane emissions to 21 metric tons of carbon dioxide equivalents.[2] The CACP software is also capable of reporting input and output data in several formats, including detailed, aggregate, source-based and time-series reports.

The emissions coefficients and quantification methods employed by the CACP software are consistent with national and international inventory standards established by the Intergovernmental Panel on Climate Change (1996 Revised IPCC Guidelines for the Preparation of National Inventories) and the U.S. Voluntary Greenhouse Gas Reporting Guidelines (EIA form1605).

The CACP software has been and continues to be used by over 400 U.S. cities, towns and counties to quantify their greenhouse gas emissions. However, it is worth noting that, although the software provides Newark with a sophisticated and useful tool, calculating emissions from energy use with precision is difficult. The model depends upon numerous assumptions, and it is limited by the quantity and quality of available data. With this in mind, it is useful to think of any specific number generated by the model as an approximation of reality, rather than an exact value. It should also be understood by policy makers, staff, and the public that the final total may change as new data, emissions coefficient sets, and better estimation methods become available.

2.1.2. Creating the Inventory

The greenhouse gas emissions inventory consists of two distinct components: one for the Newark community as a whole defined by its geographic borders, and the second for emissions resulting from the City of Newark's municipal operations. The municipal inventory is effectively a subset of the community-scale inventory (the two are not mutually exclusive). This allows the municipal government, which has formally committed to reducing emissions, to track its individual facilities and vehicles and to

[1] Now the National Association of Clean Air Agencies (NACAA).
[2] The potency of a given gas in heating the atmosphere is defined as its Global Warming Potential, or GWP. For more information on GWP see: IPCC Fourth Assessment Report, Working Group I, Chapter 2, Section 2.10.

evaluate the effectiveness of its emissions reduction efforts at a more detailed level. At the same time, the community-scale analysis provides a performance baseline against which the Newark community can build policies and demonstrate progress.

Creating this emissions inventory required the collection of information from a variety of sources, including the Pacific Gas and Electric Company (PG&E), Stopwaste.org, the Bay Area Air Quality Management District (BAAQMD), the Metropolitan Transportation Commission (MTC), CalTrans, the California Integrated Waste Management Board (CIWMB), the California Energy Commission (CEC), and the Association of Bay Area Governments (ABAG).

2.2. Inventory Results

2.2.1. Community Emissions Inventory

There are numerous items that can be included in a community scale emissions inventory. This inventory includes emissions sources from the following sectors:

- Residential
- Commercial / Industrial
- Transportation
- Waste

Emissions by Sector

The community of Newark emitted approximately *433,857 metric tons of CO_2e in the year 2005*. As visible in Figure 1 and Table 1 below, the transportation sector (44.4%) and the commercial / industrial sector (40.4%) were the largest emitters of greenhouse gases in 2005. Emissions from the residential sector produced 10.9% of total emissions, and the remaining 4.3% was the result of emissions from waste sent to landfill.

Figure 1 – *Community Greenhouse Gas (GHG) Emissions by Sector*

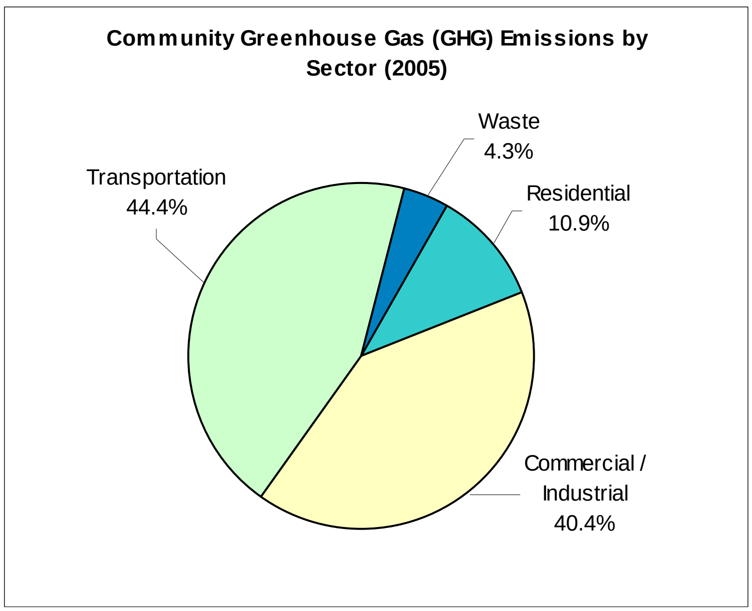


Table 1 – *Community GHG Emissions by Sector (metric tons CO_2e)*

Community Emissions by Sector	Residential	Commercial / Industrial	Transportation	Waste	TOTAL
CO_2e (metric tons)	47,313	175,096	192,841	18,607	433,857
Percentage of Total CO2e	10.9%	40.4%	44.4%	4.3%	100%
MMBtu	821,208	3,037,836	2,602,723	0	6,461,767

Transportation

As with other San Francisco Bay area cities, travel by motorized vehicle constitutes the greatest percentage of greenhouse gas emissions in Newark. As Table 1 and Figure 1 show, nearly 45 percent of community emissions (192,841 metric tons) came from the transportation sector in 2005. These emissions are the result of travel on local city roads and state highways – this analysis does not include emissions from passenger or freight rail operating within the jurisdictional boundaries of Newark.

Figure 2 – *Community GHG Emissions by Road Type*

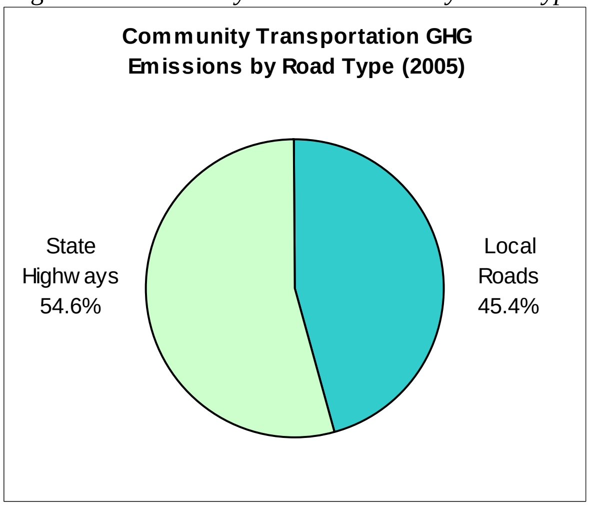


Table 2 and Figure 2 divide emissions from the transportation sector into two primary sources: local roads and state highways. In 2005, MTC estimated that 158.17 million vehicle miles traveled (VMT) occurred on local Newark roads, emitting approximately 87,601 metric tons of CO_2e, or 45.4% transportation sector emissions. The 190.01 million vehicle miles traveled along state highways in the city accounted for 105,240 metric tons of CO_2e, or 54.6% of total emissions from the transportation sector.

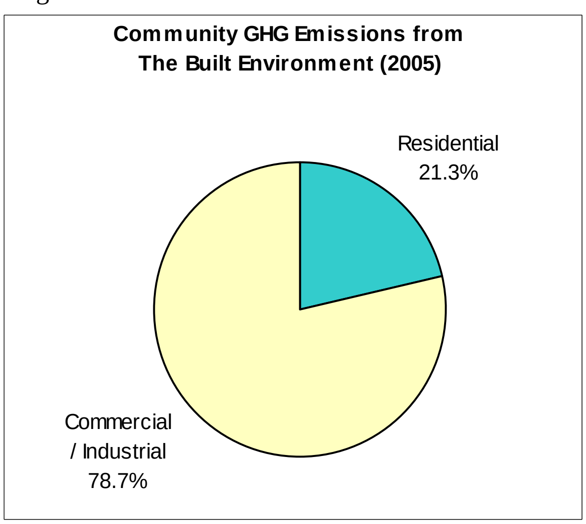
Please see the appendices for more detail on methods and emissions factors used in calculating emissions from the transportation sector.

Table 2 – *Transportation GHG Emissions by Road Type*

Transportation Road Type Emissions Sources	Local Roads	State Highways	TOTAL
CO_2e (metric tons)	87,601	105,240	192,841
Percentage of Total CO_2e	45.4%	54.6%	100%
Total Vehicle Miles Traveled	158,165,450	190,013,890	348,179,340

The Built Environment (Residential, Commercial, Industrial)

Figure 3 – *Built Environment Emissions*



In 2005, 51.3 % of total community wide emissions came from the built environment, which is comprised of the residential, commercial and industrial sectors. These sectors consumed about 390.3 million kWh of electricity and 25.3 million therms of natural gas. Within this report the commercial and industrial sectors have been combined due to a mandatory aggregating of commercial and industrial data by PG&E.[3]

The Newark community receives the majority of its electricity from Pacific Gas & Electric Company (PG&E).[4] The 2005 emission coefficients for electricity provided by PG&E are included in the notes in Appendix B. The types of power sources

[3] CPUC 15/15 Rule.

[4] There is potential that large electricity buyers in Newark hold Direct Access accounts with other electricity providers, however these data were not obtained for this report, due to state privacy rules and other constraints.

that make up a utility's electricity generation mix have a significant impact on a city's greenhouse gas emissions. A coal fired power plant, for example, releases 1.3 metric tons of CO_2e per megawatt-hour of electricity generated versus 0.7 metric tons for gas turbines and 0 metric tons for renewable sources such as solar, wind, or hydroelectric power.

Nearly 80 percent of Newark's emissions from the built environment in 2005 came from the commercial/industrial sector (see Figure 3). All of the emissions that are being calculated from the built environment are the result of local natural gas consumption and local consumption of electricity that is being generated outside of Newark.

Residential

In 2005, Newark's 44,400[5] residents consumed approximately 82.7 million kWh of electricity, or 6,174 kWh per household; and approximately 5.4 million therms of natural gas, or 403 therms per household[6]. This consumption resulted in a release of 47,313 metric tons of CO_2e, or approximately 3.5 metric tons CO_2e per household.[7] Major residential energy uses include refrigeration, lighting and water heating.

Commercial/Industrial

In 2005, Newark's commercial/industrial sector (stationary sources only) consumed 307.7 million kWh of electricity and 19.9 million therms of natural gas. This consumption resulted in a release of 175,096 metric tons of CO_2e into the atmosphere.

Waste

In 2005, Newark sent approximately 57,633 short tons of solid waste, and 12,016 short tons of alternative daily cover (ADC)[8] to landfill, resulting in a total of 18,607 metric tons of CO_2e.

Emissions from the waste sector are an estimate of methane (CH_4) generation that will result from the anaerobic decomposition of waste sent to landfill in the base year (2005). It is important to note that only a small percentage of these emissions are generated in the base year. The majority of waste emissions will occur over the 100+ year timeframe in which the waste generated in 2005 will gradually decompose. This "frontloading" of future emissions allows for simplified accounting and accurate comparison of the emissions impacts of waste disposed in each year[9].

ICLEI attained Newark's municipal solid waste (MSW) and alternative daily cover (ADC) tonnage figures from the California Integrated Waste Management Board's (CIWMB) online Disposal Reporting System (DRS)[10]. In order to determine the specific composition of Newark's municipal solid waste stream, ICLEI utilized the 2000 Alameda County Waste Characterization Study. The characterization of ADC tonnage was provided by the CIWMB via the DRS.

---

[5] Populations and household estimates are from ABAG's *Projections 2005.*

[6] Ibid.

[7] This estimate was calculated using 2005 electricity and natural gas consumption data provided by PG&E, and only includes consumption through residential buildings. Data on residential equipment usage, such as lawnmowers or on-site electricity generation, is not included in this inventory. Data on resident travel outside of Newark (such as train or air travel) or upstream emissions associated with goods consumption are also not included. GHG emissions associated with residential transportation and residential waste generation are included separately in the Transportation and Waste Sector emissions totals.

[8] The California Integrated Waste Management Board defines ADC as "Alternative cover material other than earthen material placed on the surface of the active face of a municipal solid waste landfill at the end of each operating day to control vectors, fires, odors, blowing litter, and scavenging."

[9] As the emissions reductions associated with decreasing the amount of waste being landfilled are real and there are usually few external variables that change those emissions levels later, this front-loading is considered to be an accurate practice for counting and reporting emissions that will be generated over time.

[10] http://www.ciwmb.ca.gov/LGCentral/drs/reports/

Another important variable in the waste sector calculation is the methane recovery factor. Following the recommendation of the Alameda County Waste Management Authority, adhering to US EPA standards[11], and keeping with general IPCC guidelines to err towards conservative estimation, ICLEI has adopted 60% as the methane recovery factor used in these calculations.

The CACP model does not capture the emissions reductions in "upstream" energy use from recycling (or any other emissions reduction practice) in the inventory. However, it should be noted that *recycling and composting programs can have significant additional impact on GHG emissions*, as manufacturing products with recycled materials avoids emissions from the energy that would have been used during extraction, transporting and processing of virgin materials.

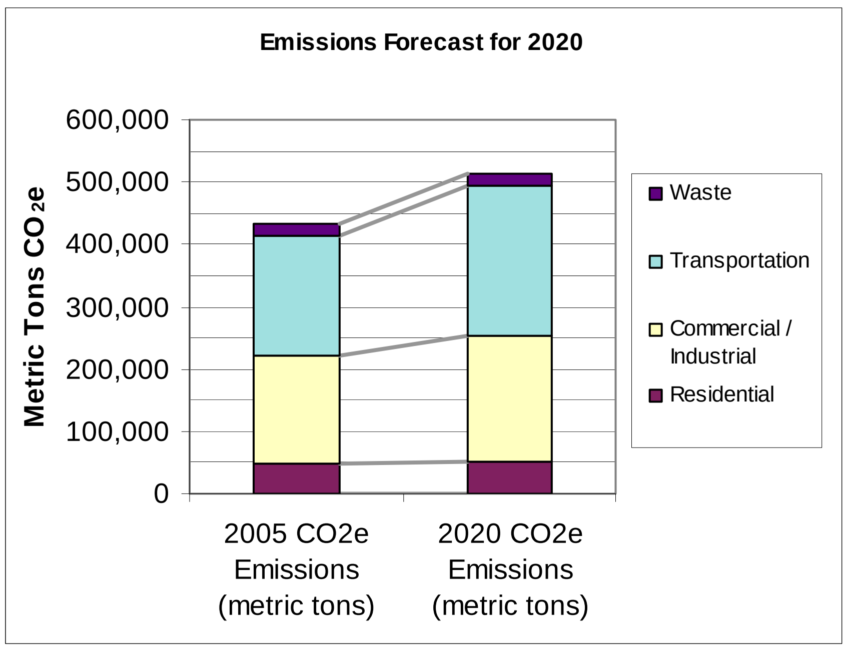
Table 3 – *Community Waste Composition and GHG Emissions by Waste Type*[12]

Waste Type	Paper Products	Food Waste	Plant Debris	Wood/ Textiles	All Other Waste	TOTAL
CO_2e (metric tons)	9,883	2,962	2,497	3,265	0	18,607
Percentage of Total CO_2e	53.1%	15.9%	13.4%	17.5%	0.0%	100%
Percent of Total Tonnage Disposed	22.1%	11.7%	6.9%	25.8%	33.5%	100%

2.2.2. Community Emissions Forecast

Under a business-as-usual scenario, the City of Newark's emissions will grow over the next decade and a half by approximately 18.6%, from 433,857 to 514,459 metric tons CO_2e. To illustrate the potential emissions growth, ICLEI conducted an emissions forecast for the year 2020 based on projected trends in energy use, driving habits, job growth, and population growth. Figure 4 and Table 4 (below) show the results of the forecast. A variety of different reports and projections were used to create the emissions forecast.

Figure 4 – *Community GHG Emissions Forecast*



<u>Residential Forecast Methodology</u>

For the residential sector, ICLEI calculated the compounded annual population growth rate[13] between 2005 and 2020, using population projections from ABAG's *Projections 2005.* This growth rate (0.659%) was used to estimate average annual compound growth in energy demand. ABAG estimates that the Newark population was 44,400 in 2005, and will be 49,000 in 2020.

[11] AP 42, section 2.4 Municipal Solid Waste, 2.4-6, http://www.epa.gov/ttn/chief/ap42/index.html
[12] Waste characterization study conducted by Stopwaste.org for the year 2000.
[13] Compounded annual growth rate= ((2020 population/2005 population)^(1/15))-1

Commercial / Industrial Forecast Methodology
Analysis contained within "California Energy Demand 2008-2018: Staff Revised Forecast[14]," a report by the California Energy Commission (CEC), shows that commercial floor space and the number of jobs have closely tracked the growth in energy use in the commercial sector. Using job growth projections for the City of Newark from ABAG's *Projections 2005*, it was calculated that the compounded annual growth in energy use in the commercial sector between 2005 and 2020 will be 0.901%.[15]

Transportation Forecast Methodology
For the transportation sector, projected growth in energy demand was obtained from the CEC 2008 energy demand forecast referenced above. The recently passed federal Corporate Average Fuel Economy standards and the State of California's pending tailpipe emission standards could significantly reduce the demand for transportation fuel in Newark. An analysis of potential fuel savings from these measures at a scale that would be useful for the purpose of this report has not been conducted, nor would such an analysis produce a true business-as-usual estimation. Regardless of future changes in the composition of vehicles on the road as a result of state or federal rulemaking, emissions from the transportation sector will continue to be largely determined by growth in vehicle-miles-traveled (VMT). In "Transportation Energy Forecasts for the 2007 Integrated Energy Policy Report" [16] the CEC projects that on-road VMT will increase at an annual rate of 1.509% per year through 2020. This is the number that was used to estimate emission growth in the transportation sector for the Newark forecast.

Waste Forecast Methodology
As with the residential sector, the primary determinate for growth in emissions in the waste sector is population. Therefore, the compounded annual population growth rate for 2005 to 2020, which is 0.659%[17] (as calculated from ABAG population projections), was used to estimate future emissions in the waste sector.

Table 4 – *Community Emissions Growth Projections by Sector*

2005 Community Emissions Growth Forecast by Sector	2005 CO_2e Emissions (metric tons)	2020 CO_2e Emissions (metric tons)	Annual Growth Rate	Percent Change from 2005 to 2020
Residential	47,313	52,215	0.659%	10.4%
Commercial / Industrial	175,096	200,310	0.901%	14.4%
Transportation	192,841	241,399	1.509%	25.2%
Waste	18,607	20,535	0.659%	10.4%
TOTAL	**433,857**	**514,459**	**--**	**18.6%**

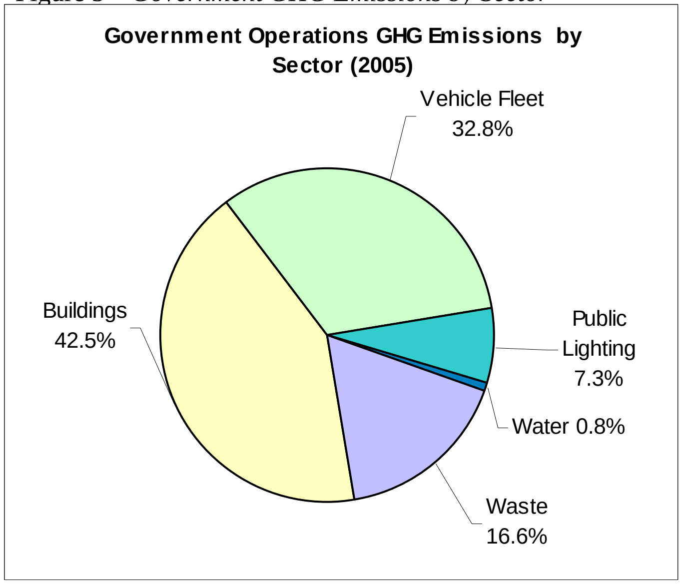
[14] http://www.energy.ca.gov/2007publications/CEC-200-2007-015/CEC-200-2007-015-SF2.PDF
[15] See Appendix A for more detail on ABAG projections.
[16] Report available at: http://www.energy.ca.gov/2007publications/CEC-600-2007-009/CEC-600-2007-009-SF.PDF.
Compounded Annual growth rate for 2005-2020 is calculated from Table 4 on page 12. In light of recent fuel cost increases, the calculation assumes high fuel cost scenario.
[17] Ibid

2.2.3. Government Operations Emissions Inventory

The sources of emissions that are being counted in the Government Inventory are facilities and equipment owned and operated by the City. The Government Operations Inventory includes sources from the following sectors:

- Buildings
- Vehicle Fleet
- Public Lighting
- Water Pumping and Irrigation
- Solid Waste

Figure 5 – *Government GHG Emissions by Sector*



Emissions by Sector

In 2005, the City of Newark's municipal operations emitted approximately *3,881 metric tons of CO_2e*. As visible in Table 5 and Figure 5, electricity & natural gas consumed by City buildings, and fuel consumed by City fleet and contracted vehicles caused the greatest amount of greenhouse gas emissions in 2005 – together these two sources generated approximately 75 percent of all municipal emissions. The remainder of municipal emissions came from waste generated by City facilities (16.6%), and from electricity consumed by City-owned streetlights (7.3%) and water distribution infrastructure (0.8%).

Energy Related Costs

In addition to generating estimates on emissions per government operation, ICLEI has calculated the approximate cost of energy consumption in the various government operations. Costs associated with the use of transportation fuels in the City fleet are estimates calculated using annual average fuel prices[18][19], and cost records provided by Waste Management (WM) -- the company responsible for hauling waste for the City of Newark. Costs associated with solid waste only include fuel use in WM trucks.

During 2005, Newark spent approximately $715,289 on PG&E electricity and natural gas to power its buildings, public lighting and water management infrastructure. Estimated costs from diesel and gasoline use in the municipal fleet (including WM vehicles) were $202,896 and $121,221 respectively. In total, it is estimated that the City of Newark, including WM fuel consumption, spent just over 1 million dollars on energy in 2005[20]. Beyond curtailing harmful greenhouse gases, any future reductions in municipal energy use will also decrease these costs.

Table 5 – *Government GHG Emissions by Sector*

Government Emissions 2005	Buildings	Vehicle Fleet	Public lighting	Water	Waste	TOTAL
CO_2e (metric tons)	1,650	1,274	283	31	643	3,881
Percentage of Total CO_2e	42.5%	32.8%	7.3%	0.8%	16.6%	100.0%
MMBtu	27,547	16,300	4,313	468	-	48,628
Cost ($)	$545,296	$324,116	$150,835	$19,158	-	$1,055,126

[18] Regional Bay Area 2005 gasoline prices: http://www.mtc.ca.gov/maps_and_data/datamart/stats/gasprice.htm
[19] Statewide 2005 diesel prices: http://energyalmanac.ca.gov/transportation/
[20] This total includes $181,876 of total 2005 fuel costs associated with vehicle operation by Waste Management, the contractor responsible for hauling Newark's solid waste. These costs are included in the fleet cost total, however they are not direct costs seen by the City.

Facilities / Municipal Buildings

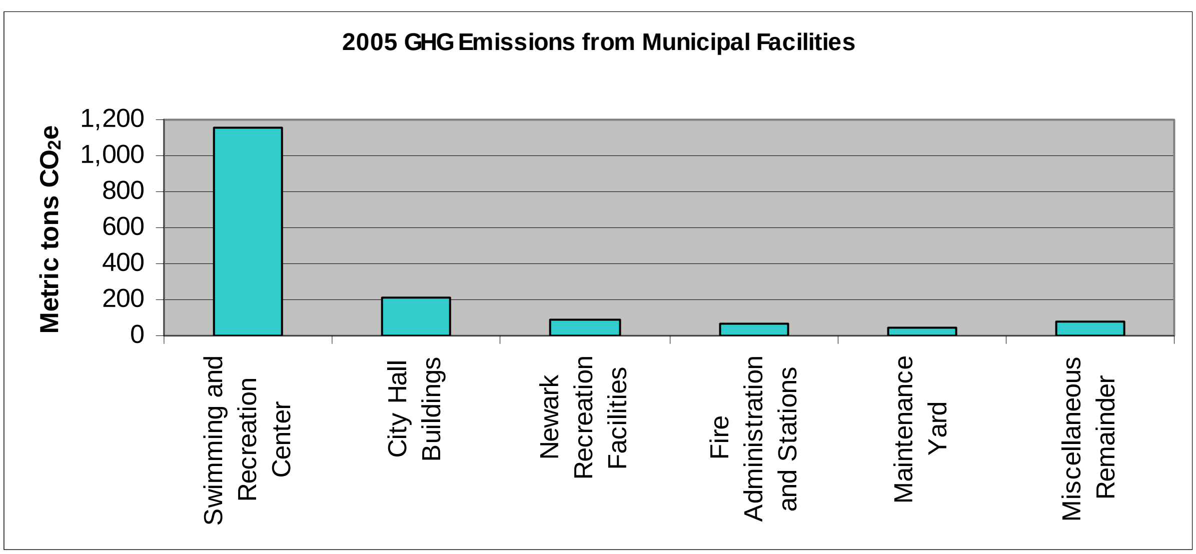
In 2005, Newark's municipal buildings and other facilities consumed approximately 4.3 million kWh of electricity and 128 thousand therms of natural gas, which together resulted in a release of 1,650 metric tons of CO_2e emissions into the atmosphere.

As stated above, and as visible in Figure 5, buildings and facilities generated 42.5 percent of total municipal emissions in 2005. Table 6 and Figure 6 portray emissions by facility. 70.1 percent of 2005 emissions from City buildings came from the Swimming and Recreation Center (a total of 1,157 metric tons of CO_2e). The next highest percentage (12.8%) came from City Hall Buildings. Cumulatively, the City spent approximately $545,296 on electricity and natural gas to power City facilities in 2005.

Table 6– *GHG Emissions from Municipal Facilities*

Facility	CO_2e (metric tons)	Percentage of Total CO_2e	Electricity Consumption (kWh)	Natural Gas Consumption (therms)	Energy Equivalent (MMBtu)	Cost ($)
Swimming and Recreation Center	1,157	70.1%	2,837,120	97,714	19,454	$314,849
City Hall Buildings	212	12.8%	652,400	12,265	3,454	$101,753
Newark Recreation Facilities	87	5.3%	264,451	5,315	1,435	$39,092
Fire Administration and Stations	67	4.1%	150,466	6,227	1,137	$26,450
Maintenance Yard	45	2.7%	123,420	3,237	745	$21,125
Miscellaneous Remainder	82	5.0%	304,431	2,835	1,322	$42,027
TOTAL	**1,650**	**100%**	**4,332,288**	**127,593**	**27,547**	**$545,296**

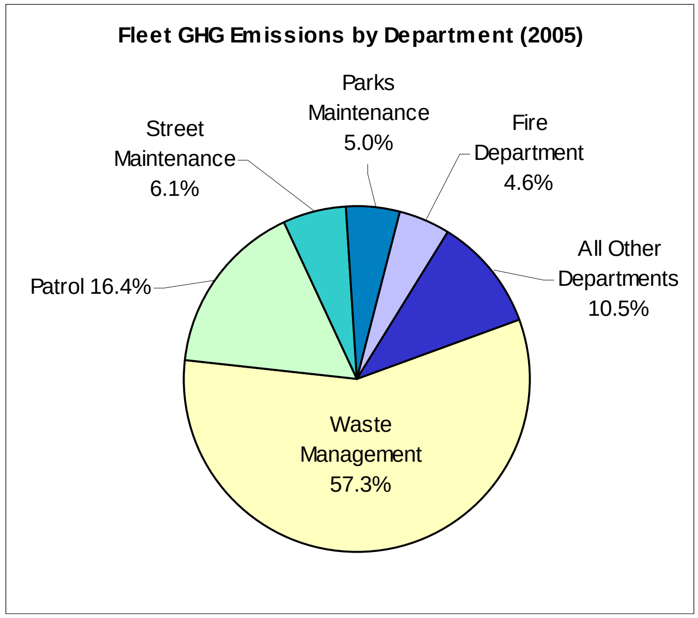
Figure 6 – *GHG Emissions from Municipal Facilities*



City Vehicle Fleet

As visible in Figure 7, the fleet of City-owned and contracted vehicles was the second largest source of municipal emissions in 2005, producing approximately 32.8% of total municipal emissions.

Figure 7 – *GHG Emissions from City Fleet Vehicles*



The City's vehicle fleet and contracted waste hauling vehicles consumed approximately 48,036 gallons of gasoline and 84,149 gallons of diesel in 2005, emitting approximately 1,274 metric tons of CO_2e. It is important to note that the municipal fleet category in this report includes all vehicles owned and operated by the City of Newark, plus vehicles contracted from Waste Management -- the company responsible for hauling solid waste throughout the City of Newark. As portrayed in Figure 7 and Table 7, the greatest percentage of fleet emissions (57.3%) indeed came from gasoline and diesel consumption in vehicles operated by Waste Management. These data were included in this report under the understanding that waste hauling is a core municipal function, and that the City has the power to influence the operations of the companies that it contracts with.

Table 7 – *2005 City Vehicle Fleet Emissions and Fuel Consumption*

Department	CO_2e (metric tons)	Percentage of Total CO_2e	Gasoline Consumption (gal)	Diesel Consumption (gal)	Energy Equivalent (MMBtu)	Cost ($)
Waste Management	730	57.3%	3,035	73,058	9,295	$181,876
Patrol	209	16.4%	21,478	0	2,698	$54,125
Street Maintenance	78	6.1%	2,072	6,075	1,001	$21,016
Parks Maintenance	64	5.0%	5,161	1,452	825	$16,782
Fire Department	59	4.6%	2,544	3,564	755	$15,677
All Other Departments	134	10.5%	13,746	0	1,726	$34,640
TOTAL	**1,274**	**100%**	**48,036**	**84,149**	**16,300**	**$324,116**[21]

Public Lighting

In 2005, municipal streetlights and traffic signals consumed 1.3 million kWh of electricity, which produced 283 metric tons of CO_2e, or 7.3% of total municipal emissions. The City spent an estimated $150,835 on electricity to power its lighting and signal infrastructure in 2005.

[21] Total cost figure includes estimated fuel expenses accrued by Waste Management for hauling Newark solid waste. Excluding these expenses, the City paid approximately $142,240 for fuel consumed by the City fleet in 2005.

Water/Sewage
The City of Newark is responsible for operating and maintaining infrastructure for the processing and distribution of water.[22] In 2005, water distribution consumed 137,340 kWh of electricity, which resulted in a release of 31 metric tons of CO_2e. Table 8 breaks down energy use and emissions from the water sector by type of operation. Water management facilities accounted for approximately 0.8% of total municipal emissions – the smallest contributor to City emissions.

Table 8 – *Water/Sewage GHG Emissions and Energy Use*

Technology Type	CO_2e (metric tons)	Percent CO_2e of Total Fleet Emissions	Electricity Consumption (kWh)	Energy Equivalent (MMBtu)	Cost ($)
Water Pumps	23	74.2%	102,937	351	$12,406.00
Irrigation / Sprinkler Systems	8	25.8%	34,403	117	$6,752.00
TOTAL	**31**	**100%**	**137,340**	**468**	**$19,158**

Solid Waste
Solid waste generated by City-owned facilities and infrastructure produced an estimated 16.6% (Figure 5) of the total emissions from government operations. As in the community analysis (see pp. 8-9), these emissions are an estimate of future methane generation over the full, multi-year decomposition period of the waste generated in the year 2005.

In 2005, City facilities sent approximately 2,042 short tons of solid waste to landfill, resulting in a total of 643 metric tons of CO_2e.

In the absence of a centralized disposal record like the CIWMB Disposal Reporting System, waste generation figures from government operations, as well as the characterization of government waste, were estimated by Newark staff. Additionally, the final emissions number generated by the CACP software used the 60% methane recovery factor discussed above.

2.2.4. Government Operations Emissions Forecast

While the community emissions growth forecast is based upon known per capita energy consumption, workforce expansion, and population growth projections, the forecast of growth within municipal operations is based upon the expansion of City services or infrastructure. It was not within the scope of this project to estimate growth of City infrastructure or services, and, therefore, the government operations emissions forecast is not included. ICLEI advises that the City conduct such a forecast to be included in this report at a later date, and to inform the process of selecting an emission reduction target for City operations.

[22] Newark's infrastructure is comprised mainly of pumps and irrigation equipment.

3. Conclusion

In passing a resolution to endorse the U.S. Conference of Mayors Climate Protection Agreement, the City of Newark made a formal commitment to reduce its greenhouse gas emissions. This report lays the groundwork for those efforts by estimating baseline emission levels against which future progress can be demonstrated.

This analysis found that the Newark community as a whole was responsible for emitting *433,857 metric tons of CO_2e in the base year 2005*, with the transportation and commercial/industrial sectors contributing the most (approximately 75% cumulatively) to this total. The City of Newark's own municipal operations were responsible for *3,881 metric tons of CO_2e in the year 2005*, with the greatest percentage of emissions coming from municipal buildings and the City vehicle fleet.

In addition to establishing the baseline for tracking progress over time, this report serves to identify the major sources of Newark's emissions, and therefore the greatest opportunities for emission reductions. In this regard, the emissions inventory ought to inform the areas of focus within the Newark Climate Action Plan.

Following the ICLEI methodology, we also recommend that the City of Newark utilize the inventory to begin to consider potential greenhouse gas reduction targets for the community and for municipal operations.

As Newark moves forward with considering emission reduction targets and works to create the Climate Action Plan, the City should identify and quantify the emission reduction benefits of projects that have already been implemented since 2005, as well as the emissions reduction benefits of proposed future measures. The benefits of both existing and proposed strategies can be tallied against the baseline established in this report to determine the appropriate set of actions that will deliver the City to its chosen emissions reduction goal.

4. Appendices

4.1. Appendix A: Forecast Data from ABAG's *Projections 2005*

Forecast Table 1 – ABAG Projections on Job Growth in Newark

TOTAL JOBS					
JURISDICTIONAL BOUNDARY	**2000**	**2005**	**2010**	**2015**	**2020**
ALAMEDA	27,380	27,960	34,750	37,990	41,080
ALBANY	5,190	4,940	5,560	5,650	5,670
BERKELEY	78,320	76,890	79,080	80,580	81,690
DUBLIN	16,540	19,950	24,770	29,170	32,030
EMERYVILLE	19,860	20,140	21,460	21,750	21,900
FREMONT	104,830	96,530	105,060	119,360	136,770
HAYWARD	76,320	73,670	80,030	84,330	88,790
LIVERMORE	32,820	33,660	40,420	46,170	55,070
NEWARK	21,420	21,180	23,310	23,810	24,230
OAKLAND	199,470	207,100	223,490	235,030	250,260
PIEDMONT	2,120	2,120	2,140	2,160	2,190
PLEASANTON	58,670	58,670	66,050	72,020	73,410
SAN LEANDRO	44,370	42,790	44,840	50,460	54,380
UNION CITY	19,310	19,920	24,000	29,010	34,900
UNINCORPORATED	43,540	41,980	43,880	47,480	50,940

Forecast Table 2 – ABAG Projections on Population Growth in Newark

TOTAL POPULATION					
JURISDICTIONAL BOUNDARY	**2000**	**2005**	**2010**	**2015**	**2020**
ALAMEDA	72,259	75,400	77,600	79,900	82,300
ALBANY	16,444	16,800	17,200	17,400	17,800
BERKELEY	102,743	105,300	107,200	109,500	111,900
DUBLIN	29,973	40,700	50,000	57,000	63,800
EMERYVILLE	6,882	8,000	8,800	9,300	9,900
FREMONT	203,413	211,100	217,300	226,900	236,900
HAYWARD	140,030	146,300	151,400	156,600	160,300
LIVERMORE	73,345	78,000	84,300	90,200	96,300
NEWARK	42,471	44,400	46,000	47,400	49,000
OAKLAND	399,484	414,100	430,900	447,200	464,000
PIEDMONT	10,952	11,100	11,200	11,200	11,200
PLEASANTON	63,654	68,200	72,600	76,500	80,400
SAN LEANDRO	79,452	82,400	84,300	87,500	90,800
UNION CITY	66,869	71,400	75,100	78,600	82,600
UNINCORPORATED	135,770	143,900	150,600	153,600	157,300

4.2. Appendix B: Emissions Factors Used in the Alameda County Climate Protection Partnership

PG&E Emission Factors:

Emission Source	GHG	Emission Factor	Emission Factor Source
PG&E Electricity	CO_2	0.489155 lbs/kwh (for 2004 and 2005), 0.6246947 lbs/kWh for 2003	The certified CO_2 emission factor for delivered electricity is publicly available at http://www.climateregistry.org/CarrotDocs/19/2005/2005_PUP_Report_V2_Rev1_PGE_rev2_Dec_1.xls
	CO_2e	0.492859 lbs/kwh	PG&E-this factor includes release of CH_4 and N_2O
Default Direct Access Electricity	CO_2	343.3 short tons/GWh	ICLEI/Tellus Institute (2005 Region 13 - Western Systems Coordinating Council/CNV Average Grid Electricity Coefficients)
	CH_4	0.035 short tons/GWh	
	N_20	0.027 short tons/GWh	
Natural Gas	CO_2	53.05 kg/MMBtu	PG&E/CCAR. Emission factors are derived from: California Energy Commission, Inventory of California Greenhouse Gas Emissions and Sinks: 1990-1999 (November 2002); and Energy Information Administration, Emissions of Greenhouse Gases in the United States 2000 (2001), Table B1, page 140.
	CH_4	0.0059 kg/MMBtu	CCAR. Emission factors are derived from: U.S. EPA, “Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2000” (2002), Table C-2, page C-2. EPA obtained original emission factors from the Intergovernmental Panel on Climate Change, Revised IPCC Guidelines for National Greenhouse Gas Inventories: Reference Manual (1996), Tables 1-15 through 1-19, pages 1.53-1.57.
	N_20	0.001 kg/MMbtu	

Alameda County Transportation Sector Emission Factors:

CH_4 Rates (grams/mile)		N_2O Rates (grams/mile)		VMT Mix		CO_2 Rates- (grams/gallon)		Fuel Efficiency (miles/gallon)	
Gas	Diesel	Gas	Diesel	Gas (Passenger Vehicles)	Diesel (Heavy Trucks)	Gas	Diesel	Gas	Diesel
0.062	0.042	0.070	0.050	92.8%	7.2%	8,599	10,092	19.1	6.4

Provided by the Bay Area Air Quality Management District EMFAC Model

Alameda County Waste Sector Emission Factors:

Waste Type	Methane Emissions (tonne/tonne of waste disposed)	Sequestration (tonne/tonne of waste disposed)
Paper Products	2.138262868	0
Food Waste	1.210337473	0
Plant Debris	.685857901	0
Wood/Textiles	.605168736	0
All Other Waste	0	0

Methane recovery factor of 60% derived from the US EPA AP 42 Emissions Factors report (http://www.epa.gov/ttn/chief/ap42/index.html).

4.3. Appendix C: Waste Calculation Methodology

Emissions Calculation Methods

CO_2e emissions from waste and ADC disposal were calculated using the *methane commitment method* in the CACP software, which uses a version of the EPA WARM model. This model has the following general formula:

$CO_2e = W_t * (1-R)A$

Where:
W_t is the quantify of waste type 't',
R is the methane recovery factor,
A is the CO_2e emissions of methane per metric ton of waste at the disposal site (the methane factor)

While the WARM model often calculates upstream emissions, as well as carbon sequestration in the landfill, these dimensions of the model were omitted for this particular study for two reasons:

1) This inventory functions on a end-use analysis, rather than a life-cycle analysis, which would calculate upstream emissions), and

2) This inventory solely identifies emissions sources, and no potential sequestration 'sinks'.

4.4. Appendix D: Detailed CACP Report: Government Operations Greenhouse Gas Emissions in 2005 *(attached)**

4.5. Appendix E: Detailed CACP Report: Community Greenhouse Gas Emissions in 2005 *(attached)**

***Note: Due to numerical rounding, there are slight discrepancies in the CACP report data that have been corrected for this narrative inventory report. As such, you may notice slight differences between the numbers in this inventory report and the numbers in the CACP reports.**

City of Newark **MEMO**

DATE: June 15, 2009

TO: Susie Woodstock, Maintenance Superintendent

FROM: Robert McKinney, Maintenance Supervisor

SUBJECT: Energy upgrade of Community Center HVAC

The Community Center HVAC system is over forty years old and is need of a complete upgrade.

The goal of this memo is to plan and identify funding to up-grade the complete HVAC system at Community Center with a cost effective, low energy and manageable system.

The existing system is a complex system with a chiller, condenser, boiler, various pumps, control valves, fan coils, piping and antiquated controls. The water piping and control wiring run in the entire building with controls, duct sensors, return air sensors, thermostats and time clocks located through out the building. There is no way to access much of the water piping or control wiring with out cutting into walls and ceilings. Over the years the system has been modified various times and some of the controls have not functioned for many years. The system currently will not work in automatic and requires shifting from heating to cooling manually. Because of the type of construction of the building and the mild climate in Newark we have been able to maintain a reasonable comfort level for customers and staff but at a cost of using more energy and maintenance staff time than acceptable. There have been numerous maintenance issues with leaks in the piping, valves and fan coils over the last several years and will only increase with age. The way the system is currently designed there is no way to replace all the components cost effectively or reduce the demand for energy usage.

Over the past several years we have been concerned that the chiller and main condenser, the largest (single- cost) components in the system, will fail before we get the replacement scheduled. The in-kind replacement of these two components would not decrease energy usage nor would it eliminate the other issues through out the building.

We have come to the conclusion that energy efficient package units should replace the chiller/boiler system; considering the energy usage, the cost of upgrading the entire system and the usage of the building.

The entire building is rarely used at the same time. Most of the time the office spaces, reception and pre schools will be in use but not the meeting room, lounge, social hall or patio room.

After evaluating the building, I recommend that we install package units throughout the building. This will allow us to install the new equipment over a period of time and better fund the projects by spreading the projects over several years of the equipment replacement budget. It will also minimize the disruption of use of the building. By installing as many as twelve different package units we should be able to reduce the energy usage substantially because if a space is not being used the zone(s) (rooms) could be programmed off.

The phasing is being proposed due to funding limitations. Multiple phases could be completed at the same time or partial phases could be completed at one time. If funding came available, the preferred method would be to install all the package units at once.

Attached is a set of plans showing the possible zones that could accomplish the phased installation.

Phase I - Recommend we start with the Social Hall and Patio Room (this would include the lounge area). These are the largest rooms at Community Center and are used for the larger meetings and rental functions. Engineers estimate for this phase would be approximately $250,000.

Phase II - This would include two units, one unit for the Front Office spaces, Supply Room and Break Room. One unit for Reception Area and part of the Main Lobby. Engineers estimate for this phase is approximately $150,000.

Phase III - This would include two units, one unit for the remaining Office Spaces and Women's Room. One unit for the part of the Main Lobby. Engineers estimate for the phase is approximately $125,000.

Phase IV - Arts and Crafts Room and Meeting Room #1. This would include two units. One for the Meeting Room and one for the Arts & Crafts Room. Engineers estimate for this phase is approximately $125,000.

Phase V - Kitchen, Janitor's Storage, Men's Room and part of the Long Hallway. Engineers estimate for this phase is approximately $125,000.

Phase VI - Upper Pre School room. Engineers estimate for this phase is approximately $50,000.

Recommendations are all based on my initial evaluation and the use and layout of the building. All phases as stated are subject to change with a more in depth review of structural availability of space, electrical and gas supply.

It should be noted that major energy reduction will not be achieved until the main components of the system, chiller, condenser, pumps and main air handler, are taken out of service.

The existing HVAC system may fail at any time. I recommend we act on this phased installation plan before the system fails.

January 2010 Addendum:

Phase I has been funded by ARRA EECBG. The units are scheduled for installation in 2010.

Due to budget reductions, the majority of the Community Center is being taken out of use. The Social Hall and Patio rooms will still be used for rentals.

We will continue to pursue funding options for installation of the other phases as the closure is assumed to be temporary.