El Camino Real Alliance
El Camino Real Charter High School

California Clean Energy Jobs Act (Proposition 39)

Investment Grade Audit

October 2015
updated - January 2017

Submitted by:

OpTerra Energy Services
150 E. Colorado Blvd., Suite. 360
Pasadena, CA 91105
(626)377-9104
www.opterraenergy.com

Table of Contents

© 2015 OpTerra Energy Services

© 2015 OpTerra Energy Services

1. Executive Summary

Introduction

OpTerra Energy Services (OpTerra ES) is pleased to present this Investment Grade Audit (Report) as a component necessary to participate in the California Clean Energy Jobs Act (Prop. 39). This audit and analysis was prepared to assess the facilities' infrastructure and equipment and identify energy efficiency measures and opportunities to meet the rigorous guidelines and requirements of the Prop. 39.

The following El Camino Real Alliance Facility is included in this Report.

Facility	Address	Approximate Area (Square Feet)
El Camino Real Charter High School	**5440 Valley Circle Blvd. Woodland Hills, CA 91367**	**293,000**

The following actions were completed as part of this Report effort:

- Site surveys and walk-through with District and site operations staff
- Interviews of District staff
- Detailed room by room audit and investigation of lighting systems
- Investigation of mechanical heating, cooling and ventilating systems
- Detailed audit of electrical transformer systems
- Planning and evaluation of potential photovoltaic solar panel systems
- Evaluation of Energy Storage Systems

Summary of Energy Efficiency Measures (EEMs)

The Energy Efficiency Measures (EEMs) identified and recommended for the Prop. 39 Program are presented below, and presented with greater detail at the end of this section.

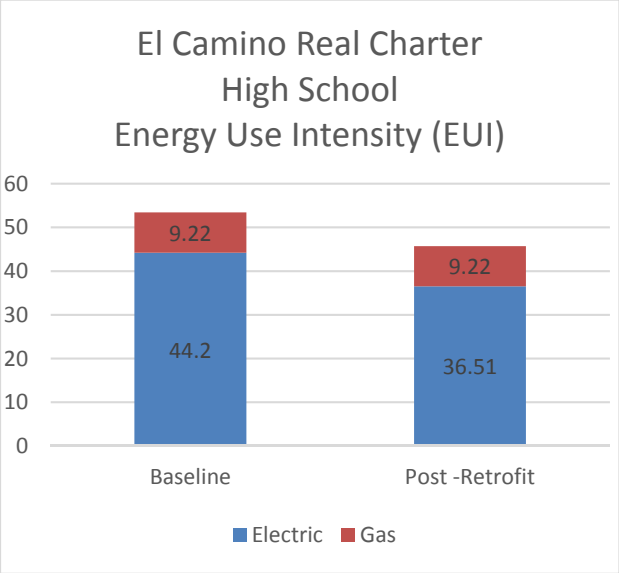
EEM	Energy Efficiency Measure
1.00	Comprehensive Interior and Exterior LED lighting upgrade
2.00	Solar Photovoltaic Carport Structures
3.00	Central Plant Upgrade: Variable Speed Drives on Pumps
4.00	High Efficiency Transformer Upgrade

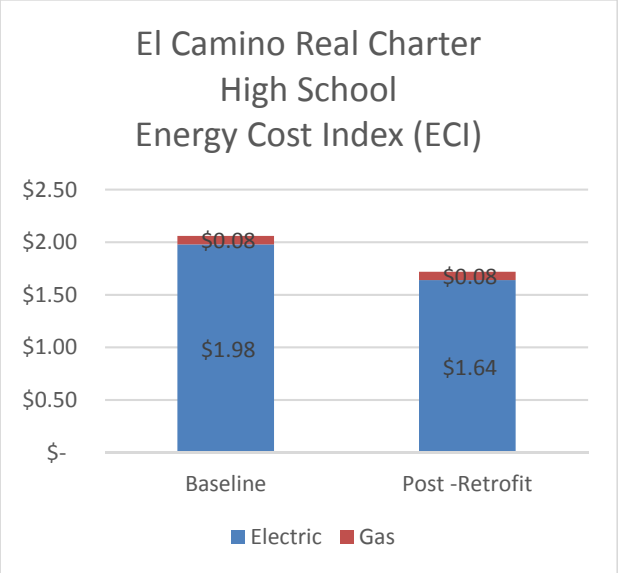
© 2015 OpTerra Energy Services

Summary of IGA Findings

The savings impact of the EEMs identified, developed and quantified in this IGA are presented as follows:

El Camino Real Charter High School	Total Annual Electric Use (kWh)	Total Annual Nat. Gas Use (Therms)	Total Annual Electricity Cost ($)	Total Annual Natural Gas ($)	Total Annual Utility Cost ($)
Baseline Consumption	3,795,200	27,008	$581,500	$22,354	$603,854
Post Retrofit Consumption	2,669,428	27,008	$407,247	$22,354	$429,601
Reduction	1,125,772	-	$174,253	-	$174,253
% Reduction	29.66%	-	29.97%	-	28.86%





© 2015 OpTerra Energy Services

Energy Expenditure Plan (EEP) Summary

The California Energy Commission Clean Energy Jobs Act requires LEAs to submit the program savings and costs in a standardized spreadsheet. The spreadsheet automatically calculates the Savings to Investment Ration (SIR) for each Energy Efficiency Measure (EEM), as well as a total SIR. The savings to investment ratio is an automatically calculated formula which results in a numerical index related to the long term savings value compared to the measure cost. The CEC requires that the total program SIR meets or exceeds the 1.01 ratio.

The proposed program exceeds the minimum requirement, with a result of 1.18.

The following table is a representation of the worksheet results.

.

Energy Efficiency Measure Drop down menu	Description	Demand Savings (kW)	Annual Electric Savings (kWh)	Annual Cost Energy Savings ($)	Measure Cost ($)	Rebates ($)	Total Leveraged Funding ($)	EEM SIR
Example: Lighting- Interior Fixture Retrofit	*Replaced T12s with T8s*		*101,029*	*$ 14,511.00*	*$ 141,604.00*			*1.69*
Lighting- Interior Fixture Retrofit	LED Lighting Upgrades for all interior spaces	108.99	268,797	$ 41,207	$ 954,713	$ 26,880	$ 26,880	1.01
Lighting Controls	Upgrade Interior Fixtures with Lighting Controls						$ -	
Lighting- Exterior Fixture Retrofit	LED lighting fixtures for exterior fixtures	33.90	135,427	$ 16,251	$ 243,805	$ 13,543	$ 13,543	1.39
Pumps, Motors, Drives- Variable Frequency Drives	Variable Speed Drives on Chilled Water and Condenser Water Pumps		74,280	$ 11,387	$ 59,073	$ 7,428	$ 7,428	3.55
Electrical- High Efficiency Transformer	Remove and replace existing low efficiency transformers with new high efficiency units.	20.90	182,308	$ 27,948	$ 599,570	$ 18,231	$ 18,231	1.36
Solar PV	Carport Shade Structures in Staff Lot	200.00	464,960	$ 77,460	$ 1,542,300	$ 329,130	$ 329,130	1.09

LEA Level SIR Calculation	
Savings-to-Investment Ratio:	1.18

Acknowledgements

The success of this program depends on a respectful environment of shared thoughts, experiences, and knowledge, and we acknowledge the openness and willingness to share information. We would like to extend our sincere appreciation to all Charter School, District and Facility staff that provided friendly, helpful, and professional assistance during the course of this audit.

© 2015 OpTerra Energy Services

2. Existing Conditions

This section of the Report serves to document and discuss the existing conditions of the facilities.

El Camino Real Charter High School

Address: 5440 Valley Cir Blvd
Woodland Hills, CA 91367
Area: 293,000 sq. ft.
Students: 3,766 (2014/2015)

El Camino Real Charter High School is located in the Woodland Hills District of the city of Los Angeles, CA. Originally built in 1969, the school established their status as Charter school associated under Los Angeles Unified School District in 2011. A core mission to the school started in 2013 is to embark on sustainability initiatives; as directed by environmental, social, and economic influences. It is OpTerra Energy Services' goals to help the Charter school realize and implement measures around those sustainability goals.

Lighting Systems

Interior Lighting

The lighting fixtures in the administration offices, classrooms, hallways, locker rooms, and other interior spaces use mostly 4' T8 linear fluorescent lamps. This site does not have a central lighting control system but a recent lighting occupancy sensor project takes advantage of localized occupancy controls in most interior spaces. Bi-level lighting switches exist in most interior spaces as well. Some unique high wattage fixtures existing for select spaces on the high school campus. The gymnasium uses linear T8 fluorescent lamps in 1x4 high bay wire guarded wrap fixtures with 6 lamps. The theatre has some higher wattage incandescent fixtures.

© 2015 OpTerra Energy Services

The following is a summary of the existing interior lighting systems for major space groups:

Room Type	Description
Classrooms	T8 32-watt 2-Lamp 2x4 recessed lay-in troffer fixtures
Administration Offices	T8 32-watt 2-Lamp 2x4 recessed lay-in troffer fixtures
Library	T8 32-watt 2-Lamp 2x4 recessed lay-in troffer fixtures
Gym/PE/Locker Room Building	T8 32-watt 6-Lamp 1x4 surface mount box/wrap fixtures and T8 32-watt 2-Lamp 1x4 box/wrap fixtures and some compact fluorescent surface mounted square fixtures
Restrooms	T8 32-watt 2-Lamp 1x4 wrap fixtures and some compact fluorescent surface mounted square fixtures
Active Storage Spaces	Round circulene fluorescent fixtures

Exterior Lighting

Exterior lighting is provided by building mounted wall packs, canopy, and flood/ spotlight fixture types. A number of exterior pole mounted fixtures in the parking lots and major driveways to the campus have cobra, square shoebox, and post top fixtures. The site lighting is a mix of Compact Florescent Lamps (CFL) and High Intensity Discharge (HID) lamps that vary in wattage and appear to be older generation fixtures that should be considered for retrofit and/or replacement.

Better lighting quality (i.e. light level, color rendering, and optics), energy and operational savings will be realized by upgrading the lighting and control system to the latest California Energy Code Title 24 standards using compliant LED lighting and lighting controls, where applicable.

The following is a summary of the typical exterior lighting systems:

Area	Description
Area Pole Lighting	50-watt, 70-watt, 150-watt and 400-watt HID Shoebox, globe, post top, and flood pole top fixtures. 104-watt LED cobra head pole top fixtures
Building Exterior Lighting	70-watt, 175-watt, 250-watt and 400-watt HID Wall Packs and Flood Fixtures 100-watt HID Wall Packs 13-watt and 32-watt Compact Fluorescent fixtures

Overall the light levels are mediocre for both on the interior and exterior. The Illumination Engineer Society (IES) recommends interior light levels in classrooms being between 50-30 foot-candles. Measurements taken in the field during our site surveys found light levels averaging at 40 foot-candles across all interior spaces at El Camino Real Charter High School. It is our recommendation to maintenance equivalent light levels. Better light quality (level, color rendering, and optics), energy and operational savings will be realized by upgrading the lighting and control system to the latest California Energy Code Title 24 standards. Appendix 1 contains a detailed audit of existing interior and exterior fixtures.

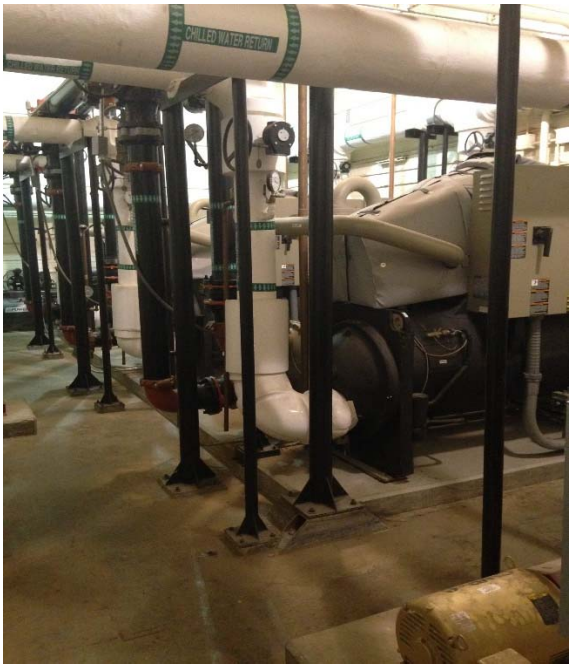
© 2015 OpTerra Energy Services

Mechanical Systems

The Heating Ventilation and Air-Conditioning system consists of central heating and cooling plant, air handling units, and packaged roof top units.

The school campus is widely spread out and has many buildings. Major buildings on site are served by central heating and cooling plant. The central cooling plant is only few years old. The chilled water is provided by (3) 250 ton Trane chiller with (3) chilled water pumps and (3) condensing water pumps. The (3) 250 ton chillers are paired with a Baltimore Air Coil (BAC) cooling tower located adjacent to central plant. The heating plant has four PK Thermific boilers which were installed in year 2001. The boilers are in good condition.

Type	Qty.	HP
Condensing Water Pumps	3	15
Chilled Water Pumps	3	20



Central Cooling Plant

Cooling Tower

© 2015 OpTerra Energy Services

Condensing Water Pumps

Chilled Water Pumps

Boilers

© 2015 OpTerra Energy Services

There are sixteen (16) air handling units throughout the campus. Majority of air handling units in main building (Building A, B, and C) are multi zone units and serve all 3 floors of the building. The supply and return fans on air handling units range from 1 to 10 hp. Building S is served by 8 rooftop package units.

The portable classrooms are served by wall mounted package air condition units (Bard). The portable buildings are served by Bard unitary package units with stand-alone programmable thermostats.

Typical Bard Units on Campus

© 2015 OpTerra Energy Services

3. Baseline and Benchmarking

This section of the Report serves to document the baseline energy use values and benchmark compared to similar schools.

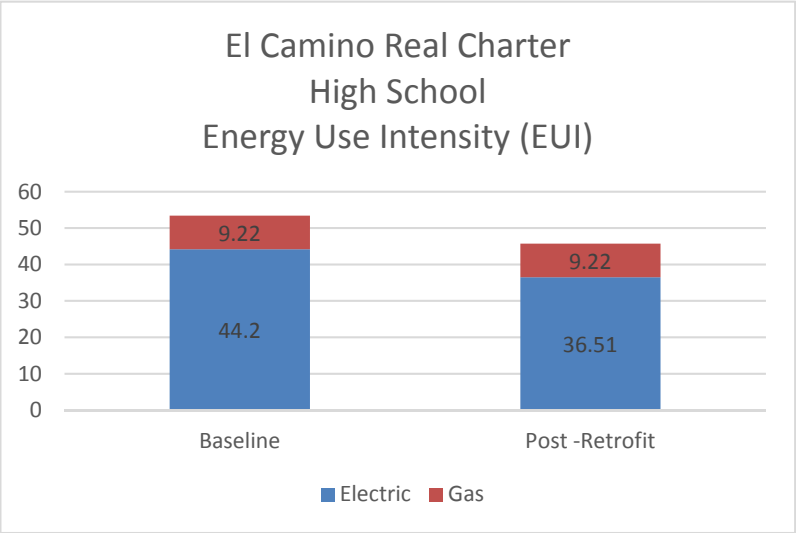
Baseline

The District provided OpTerra ES historic energy usage and cost data. This data was reviewed for completeness and analyzed for historical trends. The data was used to develop unit costs for each utility, utility usage profiles per account, and total energy usage for this facility. The utility use and costs for the fiscal year 2014-2015 are presented below.

Facility	Total Annual Electric Use (kWh)	Total Annual Nat. Gas Use (therms)	Total Annual Electricity Cost ($)	Total Annual Natural Gas ($)	Total Annual Utility Cost (non-water) ($)
El Camino Real Charter High School	3,795,200	27,008	$581,469	$22,354	$603,822

Energy Use Intensity (EUI)

A simple calculation of the total utility energy (in kBtu) divided by the facility area (square feet) results in a very useful comparison metric referred to as the Energy Use Intensity (EUI) index. The energy use per square foot, EUI, can then be used to compare the energy intensity of this facility to a group of peer sites, of similar use and age. From this comparison one can start to get an overall sense of the relative efficiency of the facility, as compared to peer facilities. The comparison of the Baseline EUI to the Post Retrofit EUI is shown below.

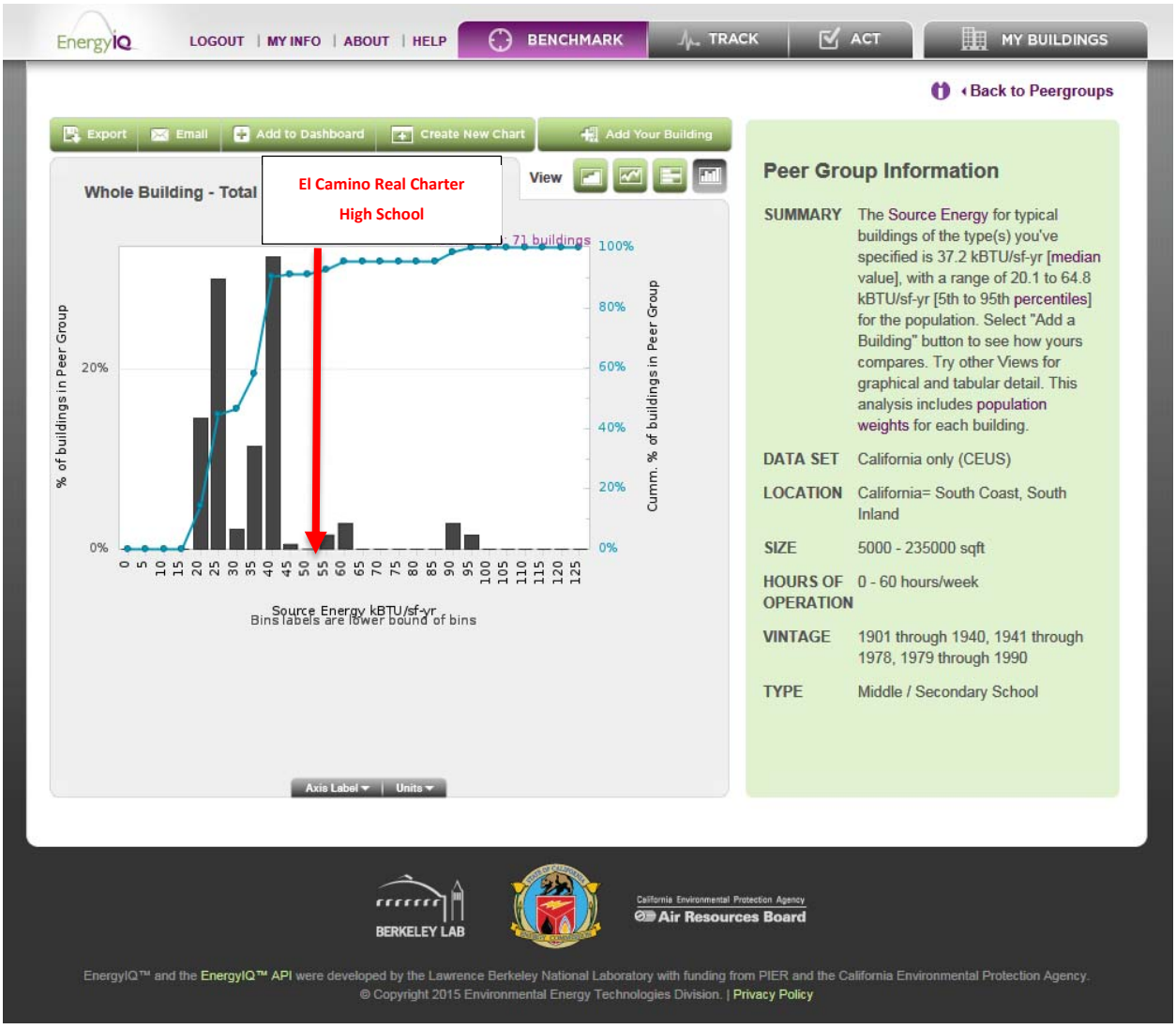


© 2015 OpTerra Energy Services

Benchmarking Data

Using the data provided by LAUSD, the EUI was calculated then compared to other schools using the tool developed by Lawrence Berkeley National Laboratory with funding from PIER (Public Interest Energy Research) and the California Environmental Protection Agency, called Energy IQ. See attached chart.

According to the Energy IQ calculation, based on source energy, El Camino Real Charter High School has a EUI of 53.4 kBtu/sf/year. The benchmarking results show a median EUI value of 37.2 kBtu/sf/yr. with a range of 20.1to 64.8 kBtu/sf/yr. for all the school buildings in the sample. El Camino Real Charter High School campus has energy consumption in the 100% percentile of the peer group on a per square foot basis, based on buildings of the same type and located in the same climate zone.

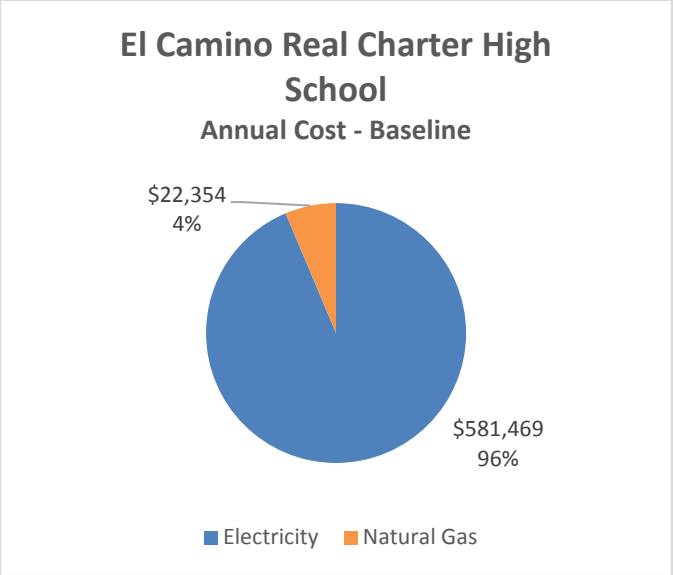


4. Utility Data Analysis

This section of the Report serves to document the use of energy by this facility with respect to historical usage and cost information.

Utility Data Overview

El Camino Real Charter High School is provided with electricity and natural gas service from Los Angeles Department of Water and Power (LA DWP) and Southern California Gas Company (SoCalGas) respectively. For this report, the school year 2014-2015 data was used, starting in July 2014 and ending June 2015. The data was provided by El Camino School staff and was found to be complete. Water / sewer costs are not included.



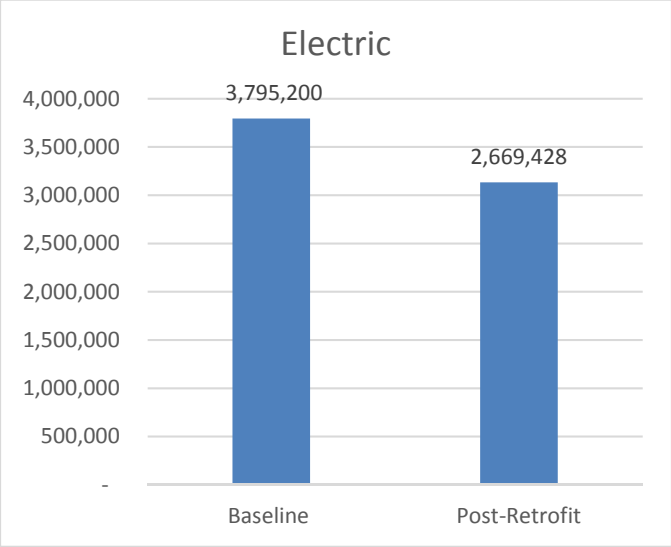
Utility Use Reductions and Cost Savings

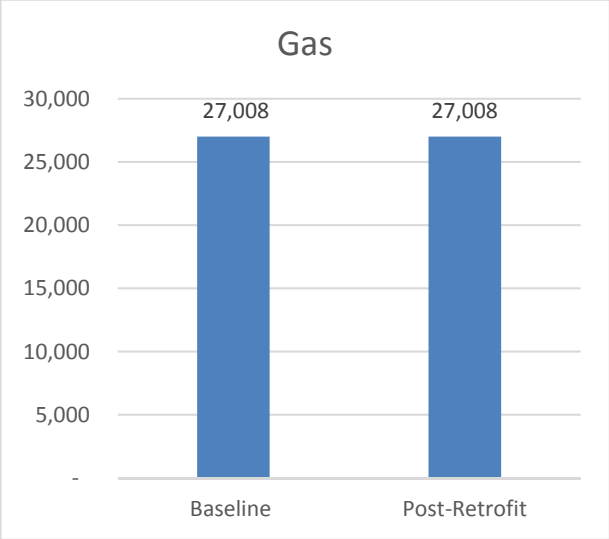
The following table summarizes the savings impact of the EEMs identified, excluding the EEM 2.0 – Solar PV System, developed and quantified in this IGA.

El Camino Real Charter High School	Total Annual Electric Use (kWh)	Total Annual Nat. Gas Use (Therms)	Total Annual Electricity Cost ($)	Total Annual Natural Gas ($)	Total Annual Utility Cost ($)
Baseline	3,795,200	27,008	$581,500	$22,354	$603,854
Post retrofit	2,669,428	27,008	$407,247	$22,354	$429,601
Proposed reduction	1,125,772	-	$174,253	-	$174,253
Percent Proposed reduction	29.66%	-	29.97%	-	28.86%

© 2015 OpTerra Energy Services

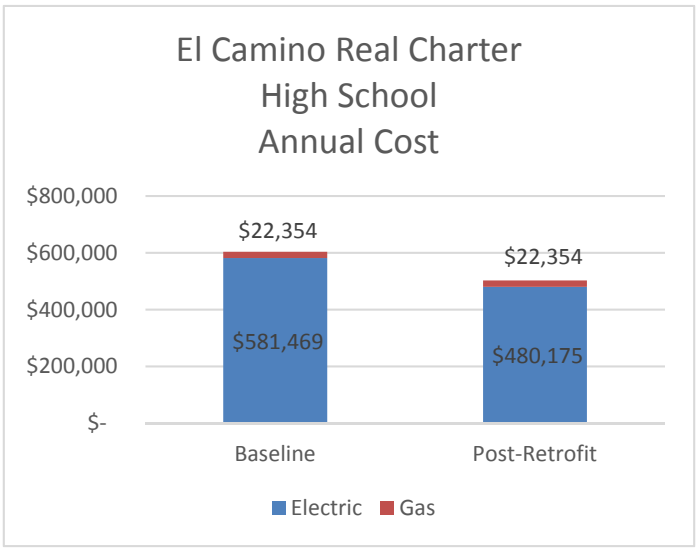
The reduction in the energy use, electricity and natural gas, are shown in the following graphs.

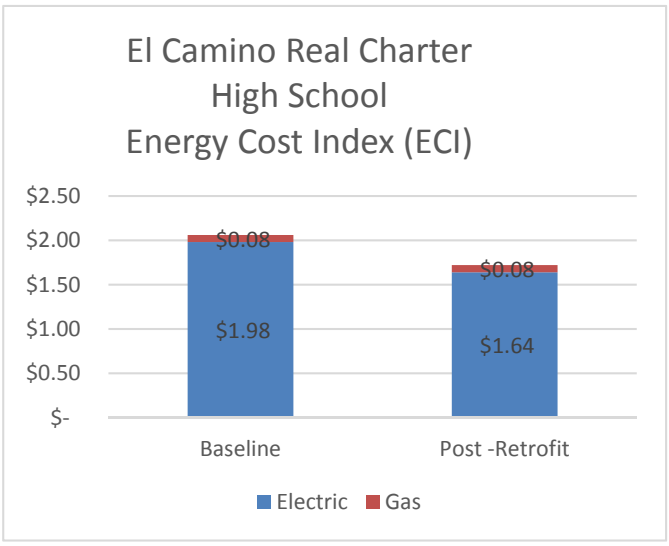




Energy Cost Index (ECI)
Presented in graphical format, the comparable Baseline and Post Retrofit utility costs identified in this IGA are shown below. By the table above and the graphs below, most of the savings proposed is a result of reductions in the electric use and demand. The modeling and savings calculations support the Post Retrofit condition.

The Energy Cost Index (ECI) of the facility is calculated as the annual utility cost (excluding water& sewer charges) divided by the total area of the school. The Baseline ECI is $2.06/sf, and the Post Retrofit ECI is $1.72/sf which is a reasonable value for an efficient school facility.





© 2015 OpTerra Energy Services

Electricity Infrastructure

The table below provides a summary of the electric meters and accounts for El Camino Real Charter High School that will be impacted by the energy efficiency measures as identified in this report. The utility providing the electrical service is Los Angeles Department of Water and Power (LA DWP).

Meter Count	SA ID	Meter No.	Service Address
(1)	5836180464	APMYV02019-00000315	5440 Valley Circle Blvd. Woodland Hills, CA 91367

Electric Rate Analysis

Electrical utility service at El Camino Real Charter High School is provided by the Los Angeles Department of Water and Power (LA DWP). LA DWP is a municipal owned utility company serving the greater Los Angeles area.

In parallel with the utility analysis, the electrical data was analyzed to see if there were any opportunities for savings from switching accounts to a different utility rate. In some cases utility cost savings can be achieved by merely switching to a more advantageous rate based usage. For this facility, a rate change is not available at this time.

Gas Infrastructure

The table below provides a summary of the gas accounts that were included in this utility analysis. The utility providing the natural gas service is the Southern California Gas Company.

Meter Count	Account No.	Meter No.
(1)	0690132500	10140364

© 2015 OpTerra Energy Services

5. Energy Efficiency Measures

Overview

The development of this program has incorporated a systematic approach towards determining how to meet the technical, operational goals and requirements of the Prop. 39 program. Various system configurations and technologies have been evaluated for cost-effectiveness and technical consistency.

EEM 001.00: Lighting Upgrade

Interior Lighting Upgrade

OpTerra ES has investigated the use of LED lighting technology for a variety of different lighting applications. With the advancement of this technology, there is an opportunity to utilize LED lighting for classrooms, office spaces, open spaces, and other locations within the facilities. LED replacements will make an immediate difference and will be noticed with light coverage, lamp quality, energy savings, maintenance savings, long life and efficiency.

The survey of the facilities revealed that the majority of the interior lighting consists of linear fluorescent fixtures with older generation T8 linear fluorescent lamps, recessed-can fixtures with screw-in and plug-in compact fluorescent lamps of various wattages, as well as miscellaneous HID fixtures.

Exterior Lighting Upgrade

The survey of the facilities revealed that the majority of the exterior pole mounted fixtures and area lighting fixtures include flood, wall pack, and canopy fixtures with metal halide, high pressure sodium, and CFL lamps. Lighting technologies available today have advanced to be more energy efficient and have made it possible to retrofit lighting that is only a few years old and still provide a reasonable return on investment.

Lighting Controls

In most cases, the control strategy will include reusing the automatic operation of the lighting, but will also take into account the needs of the space's occupants as well as what is necessary to comply with mandatory energy codes. Further control strategy decisions will involve what devices will be employed to satisfy those needs.

Control technologies, on the other hand, usually refer to the type of device that will be used to carry out a specific strategy and what method the device will use to operate (passive infrared, ultrasonic or dual technology sensors, timers, daylighting controllers or multi-level dimming control).

Occupancy-based Control
Switching lighting off and on in response to the occupancy of a particular space is not dependent on time intervals or scheduled periods, but responds to the individual usage of a controlled space.

Vacancy-based Control
Switching lighting off in response to a space becoming vacant is not dependent on time intervals or scheduled periods, but responds to the individual usage of a controlled space. This kind of device is currently most often used to meet California's Title 24 requirements for residential buildings. Manual-on requirements are emerging in recent energy code revisions, including ASHRAE 90.1-2010 and others.

Scheduled Control
Managing lighting according to time schedules based on when buildings are open/occupied and closed/unoccupied.

© 2015 OpTerra Energy Services

Photo sensor Control (Exterior applications)
Photo sensors sense ambient light conditions and disable the lighting when sufficient ambient light exists. These are typically for all types of outdoor lighting.

The lighting sensors and controls researched for wireless or non-wireless sensors meet T24 requirements with options to shut off interior lighting when rooms are unoccupied or dim using a photo sensor to capture natural lighting while not losing any desktop light levels.

The scope of work includes the following:

Existing light fixtures will be retrofitted new LED tubes and drivers and control systems necessary to meet the CA Title 24 energy codes. An effort has been made for standardization of fixtures. The associated school district to El Camino Charter High School, Los Angeles Unified School District has a list of pre-approved fixtures that they have qualified for installation on their campuses. An effort has been made to utilize those fixtures were applications were appropriate. In general, OpTerra ES proposes converting all existing fixtures on a one-for-one basis, and will not redesign or change the existing layouts and quantities. Existing structural attachments will be reused. OpTerra ES will provide photometric analyses of select representative areas on an as-needed basis.

- Complete final engineering and prepare plans and specification.
- Record pre and post light-levels.
- Provide equipment submittal for approval and compliance with LAUSD specifications.
- Upgrade existing fixtures with new LED tubes and drivers.
- Provide vacancy/occupancy, dimming, and shutoff controls as applicable to meet CA Title 24 requirements.
- Existing fixtures receiving kits will be cleaned.
- Disposal of old lamps and ballasts per EPA, or other state and local regulations. The District will be provided documentation (manifest etc.) of proper disposal.

Renewable Energy

Renewable energy solar photovoltaic solutions offset a large portion of the utility costs, meet the savings to investment ratio outlined by Prop. 39

EEM 002.00: Solar Photovoltaic Carport Structures

El Camino Real Charter High School's faculty parking provides adequate space to locate three double cantilever solar shade canopies, totaling 318.3kW.

PV Syst information

PVsyst was used to model the annual generation on the proposed solar PV system at El Camino Real Charter High School. Three array parking canopies were identified by the school as adequate locations for solar PV to be connected to the main meter on campus. Weather data for Los Angeles Metro was used to model the anticipated production levels for a solar photovoltaic system in Woodland Hills.

The scope of work includes the following:

- Perform final engineering and design.
- Select equipment in accordance to Los Angeles Department of Water and Power Solar Incentive Program
- File Solar Incentive Program Application and pay application deposit.
- Confirm material pricing and subcontractor labor requirements.

© 2015 OpTerra Energy Services

Mechanical & Electrical

The mechanical system audit and pre-commissioning process identified the following mechanical EEMs that would improve efficiency (energy and operation) and reduce maintenance costs. These mechanical EEMs are practical solutions to provide utility cost relieve while meeting the savings to investment ratio outlined by Prop. 39

EEM 003.00: Variable Speed Drives on Chiller Plant Pumps

El Camino Real Charter High School's main buildings are served by a central chilled water and heating hot water plant. This EEM will convert chilled water central plants' constant speed pump motors (condensing water and chilled water) to variable speed by installing frequency drives on them. Currently, the pumps in chilled water system are running constantly during the hours of operation of the facility. The pumps don't ramp up or down depending on the cooling load of the building. After the conversion, the pumps will change its speed depending on load which will be a significant energy reduction.

The scope of work includes the following:

- Perform final engineering and design.
- Select equipment in accordance to LAUSD technical specifications or request and obtain a variance.
- Prepare construction drawings and specifications.
- Obtain Division of State Architect approval.
- Furnish and install devices and equipment (2-way valves, variable frequency drives, etc.).
- Testing Adjusting and Balance report will be provided to LAUSD for review and acceptance.
- Start-up and commission new system.
- Provide training of District personnel in accordance to the District's Specifications and General Conditions

EEM 004.00: High Efficiency Transformer Upgrade

Transformers continue to operate (and consume energy) whether equipment is plugged in and turned on or not. A majority of today's building connected load is electronic in nature, indicating a need for transformers that are K-rated and UL-Listed per code. Replacing the older inefficient distribution transformers with energy efficient transformers will bring the facility up to code and increase the reliability of the electrical infrastructure.

Replacing the old, inefficient transformers with new, ultra-high efficient transformers will yield energy savings and renew a key component of the infrastructure that powers all connected equipment. The table below, sizes and quantities of transformers that are recommended for replacement. In addition to efficiency improvements, the new transformers require less mechanical cooling to maintain and acceptable operating space temperature.

© 2015 OpTerra Energy Services

The energy savings and energy cost avoidance was derived from a spreadsheet analysis.

Transformer Identifier / Location	Qty.	Transformer Size kVA	Existing Efficiency	Proposed Efficiency
Bldg. A electrical room basement	1	75	93.1%	98.6%
Bldg. A electrical room basement	1	500	95.4%	99.2%
Bldg. A electrical room basement	1	300	94.3%	99.1%
Main electrical room	1	500	95.4%	99.2%
Main electrical room	1	225	94.0%	98.9%
Main electrical room	1	112.5	94.3%	98.8%
Bldg. H electrical room facing field	1	300	94.3%	99.1%
Bldg. G gym north side	1	300	94.3%	99.1%
Cafeteria north side	1	500	95.4%	99.2%
Bldg. A electrical room basement one door down	1	400	95.0%	99.0%

© 2015 OpTerra Energy Services

Evaluated but Not Recommended

EEM: Energy Storage

OpTerra ES has investigated the inclusion of battery storage systems at this site. With advancements in this technology, there is an opportunity to utilize battery storage systems to reduce KW load during LADWP'S peak demand billing rates while re-charging the battery systems during the low peak rates. These systems effectively move utility usage from less desirable times to more desirable times when rates are lower. The battery storage system reduces demand charges through counteracting the peaks and valleys of a facility's variable energy use by discharging from and charging up its batteries at key moments. This flattens the spikes in power usage, which reduces your demand charges.

The survey of the facility revealed that there is an opportunity at this location for battery storage peak KW load reduction. We propose:

- Interconnecting of the battery storage system. This will require the campus to be offline for the interconnection (which takes place right before the system goes live).
- The units can be installed indoor or outdoor although outdoor is preferred for this location since these units are the bigger size units. The unit evaluated was a 500kw/1MWh system which is a configuration of 2 250/500kwh units.
-

Load Leveling Graph

Site Name:

El Camino Real Academy

ESS Size:

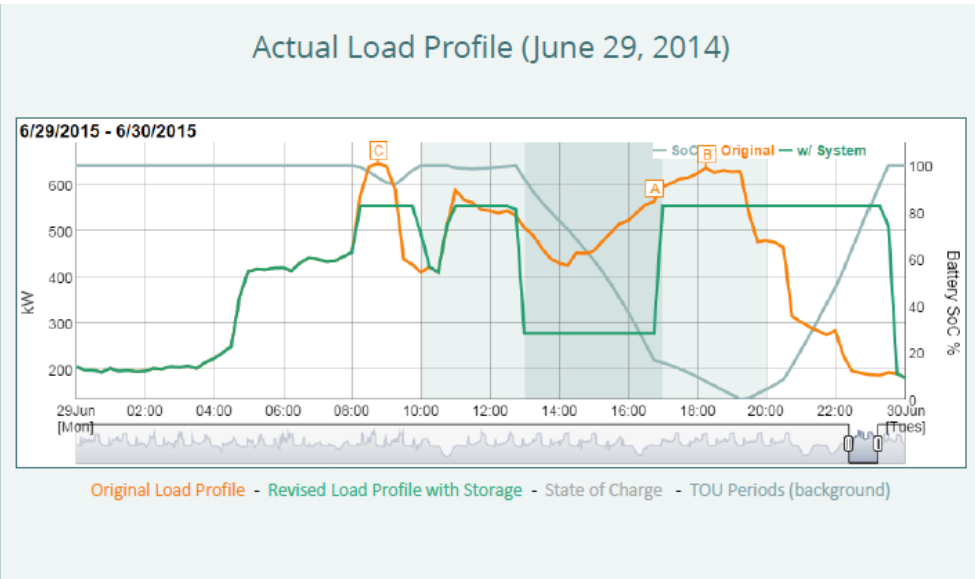
500 kW / 1000 kWh

Meter No.:

9347

Utility Tariff:

LADWP A-3 Subtransmission



Recommendation: Based on the analysis, due to the low peak demand rates in LADWP, Energy Storage is not a financially advisable solution.

© 2015 OpTerra Energy Services

6. STEM EnVision Education Curriculum

Overview

El Camino Real Charter Alliance Education Partnership

As an extension of our facility upgrades, we strive to leverage our work in improving campus facilities to provide educational opportunities that give students an avenue to connect what they learn in the classroom to real-world conservation and sustainability applications. We offer a suite of customizable educational opportunities that engages students and staff in energy awareness and STEM experiences through the following pillars:

- Living Laboratories
- STEM Support Materials & Resources
- STEM Career Exposure
- Professional Development
- Behavioral Programs

Scope of Work

Energy Education Offering
Solar Living Laboratory
Hands on Solar Energy Resources
Integrated STEM Project Based Learning Resources
Professional Development

Education Program Opportunities

OpTerra staff works in collaboration with our partners to discover their goals and needs for improving and coordinating STEM education efforts in the areas of sustainability and energy. Based on the facilities scope and the conversations we have had with ECRCHS, the education program components for ECRCHS include:

- The **Solar Living Laboratory** will provide students and teachers with live data from the school's solar arrays. Data from the arrays will be available to ECRCHS and may include data points for local weather, solar production in kWh, and CO_2 offsets from the project. The data will be displayed on a student and teacher friendly website that can host photos, videos, links, education resources, and any other sustainability messaging, programs, and information ECRCHS wishes to highlight. The real and relevant data on the dashboards helps teachers to implement Common Core, while supporting lessons about energy, one of the cross-cutting concepts in the Next Generation Science Standards.

- **Hands-on solar energy resources**- Resources to promote inquiry and materials to help support and enrich science and STEM instruction. These hands-on resources include working solar panels that students can wire, position, and experiment with to better understand solar energy production. These resources make the connection between the solar arrays in the parking lots, the Living Laboratory online solar data, and the classroom with lesson plans, activities, etc.

- Access to online **project based learning** prompts and assessments- This resource focuses on interdisciplinary STEM lessons and includes both literacy and performance tasks, including grading rubrics for each assessment. Assignments are supported with videos, background reading, and an

© 2015 OpTerra Energy Services

optional online assignment center. Tasks are aligned to current state standards, Common Core standards, and Next Generation Science Standards.

- **Professional development-** Sessions to improve content knowledge, model pedagogy, and familiarize teachers with energy, solar energy, and the energy education resources provided through this program. We have designed sessions to refresh teachers' knowledge of energy including electricity, renewables, and efficiency. These sessions will prepare teachers to utilize all of the resources that are part of the custom ECRCHS education program. Professional development can be delivered in a number of formats, locations, dates and times which will be determined in concert with ECRCHS.

© 2015 OpTerra Energy Services

7. Incentives and Rebates

Financial incentives for energy efficiency measures are sometimes offered through local utilities, as well as directly from the State of California. We investigated the availability of programs applicable to the project. It is very important to note that although these programs were in effect at the time this Report was issued, incentive programs can and do change or expire from time to time.

Local Utility

Los Angeles Department of Water and Power

The schools are located in the Los Angeles, Department of Water and Power (LADWP) service region. LADWP currently has the following incentives programs available for the EEMs identified:

- Energy Efficiency Technical Assistance Program (EETAP)
- Custom Express Program
- Custom Performance Program

Summary of Available Incentives

Energy Conservation Measure	Incentive Level ($/kWh)
Lighting Upgrades (Interior and Exterior)	$0.15
Lighting Controls	$0.10
HVAC Measures	$0.25

Los Angeles DWP Solar Incentive

The LADWP has a solar incentive program, although funds are not assured until project application is received and approved.

Energy Conservation Measure	Incentive Level ($/Watt ac)
Solar PV Installations (Non-profit / Govt. Rate)	$1.15

Southern California Gas Company

The Southern California Gas Company has a general program to incentivize the conservation of natural gas.

Energy Conservation Measure	Incentive Level ($/therm)
Various EEMs	$1.00

These incentives are not guaranteed. For the purpose of the economic analysis, $0.10 per kWh saved annually was used for all measures.

© 2015 OpTerra Energy Services

8. Performance Assurance Plan

Measurement & Verification of Savings

Measurement and Verification (M&V) is the process of using measurement to reliably determine energy or utility use reductions or "savings" achieved by implemented energy conservation measures. Savings are determined by comparing measured use before and after implementation of a project and making appropriate adjustments for changes in conditions.

M&V, When Completed Using Solid Engineering Protocols can:

- Increase energy savings over the life of the project
- Allow for Energy Use Predictions for budgeting and other financial purposes
- Capture Potential Usage Increases quickly to allow for corrections
- Improve engineering design and facility operations and maintenance

Proposition 39 M&V requirements:

The requirements of the Proposition 39 energy savings reporting is spelled out in the rules and regulations of the Proposition 39: California Clean Energy Jobs Act – 2015, Energy Expenditure Handbook latest update June 2015. This regulation requires that an annual progress status report is submitted for each approved energy expenditure plan to the Energy Commission, until all eligible energy measures within an energy expenditure plan are completed. In addition, a final report is required to be submitted 12 – 15 months after the completion of all energy measures in an energy expenditure plan. The Energy Commission is currently developing an online reporting process that has not yet been completed.

OpTerra's 5 Year M&V Program:

OpTerra's intention of M&V for this IGA is to not only provide the benefits above and comply with Proposition 39 but to also to comply with the International Performance Measurement and Verification Protocol (IPMVP) for 5 years after construction. This protocol is recognized by the National Association of Energy Service Companies (NAESCO) as the standard guideline of how savings resulting from energy conservation projects should be measured.

The IPMVP defines four broad options for measurement and verification of energy savings. Each option is applicable to specific situations, and oftentimes, more than one option is possible. Multiple options are often implemented on a single project. The categories of the IPMVP are as follows:

Option	Title	Description
Option A	Partially Measured Retrofit Isolation	This option allows for the energy savings to be calculated using a sampling of field measurements combined with stipulated parameters. The savings, once calculated, are usually stipulated to for the life of the project. Ongoing actual measurements may or may not be used in this verification technique depending on whether the predicted savings and/or volatility of the measures implemented warrant the expenditure on additional field measurements. A possible application for using this option would be for lighting efficiency improvements whose performance may be relatively stable and not interdependent with other measures. The savings for the lighting upgrade would be quantified by measuring before and after power consumption for a representative sample of lighting circuits and by stipulating or agreeing to the hours of operation of each circuit.
Option B	Retrofit Isolation	Designed for projects where long-term continuous measurement of performance is desired and warranted. Under Option B, individual loads are continuously monitored to

© 2015 OpTerra Energy Services

Option	Title	Description
		determine performance; and this measured performance is compared with a baseline to determine savings. A possible application for Option B measurement would be for the installation of a solar area. In this case the energy savings boundary is the entire array and the baseline is zero. Energy usage of the area would be negative, as the array is producing energy and adding it to the grid or for use by the facility. Total monthly savings would be equal to the energy produced that month and measured through utility grade meters on an on-going basis. For measures other than solar PV, this type of measurement can be expensive and complex, but may be implemented as an alternative to Option C to ensure the long-term success of the energy efficiency measures
Option C	Whole Building	Option C verification techniques measure savings by comparing the post-retrofit overall energy use in a building or facility with pre-retrofit energy baselines. Implicit in this measurement option is the necessity of identifying and accounting for the effects of changes to the facilities during the measurement period that are beyond the scope of the measures installed. The impact of building additions, changes in operating hours, remodeling projects, etc., that are implemented by the customer during the measurement period must have their energy impact accounted for if the true savings from the energy efficiency measures is to be assessed. This process can be time consuming and expensive in facilities that are very dynamic. However, there are many benefits to an Option C measurement. When significant interactions between energy consuming systems and energy efficiency measures are present, and for assessing savings for measures that are not easily measured directly, Option C may be the only viable method. Option C savings calculations also most closely emulate the bills from the utility company, and the calculations are easy to understand and explain
Other	Stipulated Savings	While not directly defined as an IPMVP option, the protocol recognizes that there are instances when measurement and verification of the savings is not warranted. In cases where the cost of measurement is too high as compared to the savings, where the parameters preclude accurate measurements, or where the confidence of the savings projections is high, the Client and OpTerra ES may agree to stipulate to those projected savings for the term of the project without any additional measurement and verification of the savings.

Often overlooked is the necessity of identifying the M&V plan simultaneously with the project development. In some cases, it is necessary to drop or ignore a portion of savings associated with a specific retrofit for the simple reason that that portion is unreasonably expensive to measure. Implementation of a verification plan for the diverse types of EEMs typically involved in a performance guarantee usually requires a combination of methods to successfully measure savings. Even for a given EEM, verification categories may be crossed by combining a stipulated and an end-use measurement component into the savings calculation. Factors that guide the selection of an M&V method for each EEM include:

- Cost of measurement vs. savings
- Timing of measure installation
- Likelihood of future EEMs
- Degree of sub-metering within the facility
- Likelihood of sustainable savings from the measures
- Complexity of EEMs to be installed
- Level of interaction between EEMs
- Dynamics of the facility's energy baselines
- Likelihood of future construction

© 2015 OpTerra Energy Services

Due to the variables and dynamics that are unique to each program an individual measurement and verification plan must be developed for each situation. While the specifics may vary, the general method employed will always follow one of the methods outlined in the IPMVP.

Prop 39 Measurement & Verification 5 Year Program

The table below represents a proposed M&V approach which balances M&V cost with the value of savings associated with each component. OpTerra will provide the Alliance with an annual report of the following:

5 Year Measurement & Verification Method per Energy Measure

EEM No.	EEM Descriptions	Savings Component	M&V Method
001.00	Light Upgrade (LED)	Electricity, (kWh)	Option A
002.00	Renewable Energy Solar Photovoltaic Panels	Electricity, (kWh)	Option B
003.00	Central Plant Variable Speed Pumping	Electricity, (kWh)	Stipulated
004.00	High Efficiency Transformer Upgrade	Electricity, (kWh)	Option A

Prop 39 Measurement & Verification Deliverable

In order to meet the requirements of Proposition 39 OpTerra will provide an annual progress status report that will be submitted for each approved energy expenditure plan to the Energy Commission, until all eligible energy measures within an energy expenditure plan are completed. In addition, OpTerra will provide an a final report to be submitted 12 – 15 months after the completion of all energy measures in an energy expenditure plan. OpTerra will using the Energy Commission's online reporting process once it has been developed and released.

© 2015 OpTerra Energy Services