City of San Diego Valencia Park-Malcolm X Branch Library

ASHRAE Level II Audit Report

August 2017

Prepared for

California Energy Commission

Prepared by

Center for Sustainable Energy

Center for Sustainable Energy®

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Abbreviations and Acronyms

ASHRAE	American Society of Heating, Refrigerating and Air-Conditioning Engineers
Btu	British thermal unit
Btu/hr	Btu per hour
CBECS	Commercial Buildings Energy Consumption Survey
CEC	California Energy Commission
CFL	Compact flourescent lamp
CFM	Cubic feet per minute
CSE	Center for Sustainable Energy
EER	Energy efficiency ratio
EUI	Energy use intensity
EUL	End of useful life
HPS	High pressure sodium
HQI	Hydrargyrum quartz iodide
HVAC	Heating ventilation and air conditioning
IDSM	Integrated demand-side management
kBtu	Thousand british thermal units
kWh	Killowatt hour
LED	Light emitting diode
MMBtu	Million british thermal units
NBI	New Buildings Institute
SDG&E	San Diego Gas and Electric
SEER	Seasonal energy efficiency ratio
TE	Thermal efficiency
VAV	Variable air volume
VPL	Valencia Park-Malcolm X Branch Library
ZNE	Zero net energy

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I. Executive Summary

Introduction

The Center for Sustainable Energy (CSE) conducted an American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) Level II audit for the City of San Diego's Valencia Park-Malcolm X Branch Library & Performing Arts Center (VPL or VPL facility). CSE conducted this audit as part of an Electric Program Investment Charge demonstration agreement (EPC-15-085[1]) developed in partnership with the City of San Diego Environmental Services Department and funded by the California Energy Commission (Energy Commission). The purpose of this agreement is to conduct energy consumption baselines, identify and deploy energy conservation measures (ECMs) and integrate demand-side energy management solutions that, when combined with on-site renewable energy generation, achieve site zero net energy (ZNE) at three City of San Diego public libraries,[2] including the PLH facility. To help achieve the ZNE goal, CSE is identifying relevant ECMs to deploy at the facility and then installing a number of energy efficiency measures (EEMs) identified in Section III of this report, in addition to others that will be evaluated in the "ECM design" stage of this project. The City of San Diego is also installing solar photovoltaics (PV) at each library facility and may add energy storage and electric vehicle charging stations depending on available funding. Following the installation of energy efficiency and solar PV measures, CSE will measure and verify the facility's real-time energy consumption and renewable energy generation for 12 months to determine if ZNE is achieved. The Executive Summary provides an overview of CSE's findings, with further details provided throughout the report.

Importance of Zero Net Energy

California has set aggressive goals for increasing energy efficiency in existing buildings and for achieving ZNE targets for new and existing buildings. Specific to this project, the state requires all new nonresidential construction to be ZNE and 50% of existing commercial buildings to be retrofitted to ZNE by 2030. Local governments have large and diverse nonresidential building portfolios and are in a unique position to implement ZNE demonstration projects and integrated demand-side management (IDSM) solutions in commercial buildings.

Cost-effective ZNE that utilizes energy efficiency and IDSM needs further demonstration and analysis to determine market viability and long-term sustainable energy savings. Integrating energy efficiency, solar photovoltaics (PV) and energy storage to achieve ZNE in existing buildings requires further testing in real-world applications, as do financing mechanisms and revenue models that allow local governments to cost-effectively achieve ZNE goals in municipal building portfolios.

[1] EPC-15-085: *The City of San Diego Public Library Zero Net Energy and Integrated Demand-Side Management Demonstration Project,* www.energycenter.org/sdzn3.
[2] Point Loma-Hervey Branch, Serra Mesa-Kearny Mesa Branch and Valencia-Malcolm X Branch.

CSE is aligning it's ZNE goals for this project with the Energy Commission's "Zero-Net-Energy Code Building" [3] definition:

> A Zero-Net-Energy Code Building is one where the net amount of energy produced by on-site renewable energy resources is equal to the value of the energy consumed annually by the building, at the level of a single "project" seeking development entitlements and building code permits, measured using the Energy Commission's Time Dependent Valuation metric. . . . A zero-net-energy code building meets an energy use intensity value designated in the Building Energy Efficiency Standards by building type and climate zone that reflect best practices for highly efficient buildings.

Using this definition and applying it to innovative upgrades to existing municipal facilities, this project will demonstrate to the Energy Commission, the City of San Diego, other public agencies, policymakers and relevant industry stakeholders the application of multi-technology integration efforts that maximize cost and energy savings. Further, it will serve to build political and community motivation for similar projects across municipal and commercial building portfolios.

Audit Findings Summary

On January 12, 2017, CSE conducted a comprehensive walk-through of the VPL facility to document existing appliances, equipment, fixtures, energy efficiency features and overall building characteristics to establish the VPL's existing conditions.

Following the on-site assessment, CSE developed a preliminary energy consumption profile, which included analyzing 12-months of the VPL facility's electric and natural gas utility data, accessing the facility's ENERGY STAR Portfolio Manager® profile and energy use intensity (EUI) score. This consumption analysis reveals that **the VPL facility consumes approximately 1,160,825 kBtu of energy annually consisting of more than 285,794 kWh/yr. in electricity and approximately 186 MMBtu/yr. in natural gas.**

Figure 1 shows that **electricity accounts for about 90% of VPL's energy consumption**. Electricity is consumed primarily for lighting and HVAC, peaking during the summer months to meet an increased air conditioning demand. The VPL facility consumes natural gas for both space and hot water heating, with the annual peak generally occurring in the winter months when the demand for space heating is greatest.

After evaluating the January 2017 walk-through data and conducting a preliminary energy assessment of historical utility consumption data, CSE identified high-level opportunities to improve the efficiency of the VPL facility's equipment, building/equipment operation systems and the overall comfort of occupants. After analyzing these opportunities in more detail,

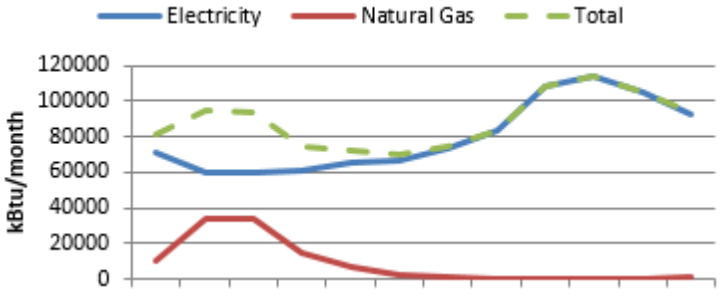


Figure 1: Valencia Park-Malcolm X Branch 2015 – 2016 Energy Consumption

[3] California Energy Commission. 2013. *2013 Integrated Energy Policy Report*. Publication Number: CEC-100-2013-001-CMF.

CSE recommends the following targeted EEMs based on potential energy savings for the VPL facility equipment and fixtures.

Measure Number	Measure Description	Peak Demand Savings (kW)	Electricity Savings (kWh)	Gas/Fuel Savings (therms)
EEM-1	Install Occupancy Sensors (LTNG-1)	0	6,931	0
EEM-2	Replace Indoor and Outdoor Lighting Fixtures with LED Equivalents (LTNG-2,3,4,5)	17.4	54,863	0
TOTAL		**17.4**	**61,793**	**0**

Table 1: Potential Energy Savings from Recommended Energy Efficiency Measures

Measure Number	Total Cost Savings	Measure Cost	Potential Utility Incentive	Measure Life (yr.)	Net Measure Cost	Investment Rate of Return	Net Present Value	Simple Payback (yr.)
EEM-1	$18,267	$121,440	$11,120	8	$110,320	7%	$12,664	6.0
EEM-2	$20,657	$135,970	$12,740	11-16	$123,230	15%	$112,924	6.0
TOTAL	**$38,923**	**$257,410**	**$23,860**	**8-16**	**$233,550**	**12%**	**$125,588**	**6.0**

Table 2: Potential Cost Savings from Recommended Energy Efficiency Measures

When combined, these measures would reduce the library's electricity consumption by about 21.6% and bring the EUI down from 41.1 to approximately 33.0 kBtu/ft^2.

II. Existing Site Conditions

The Valencia Park-Malcolm X Branch Library (VPL or VPL facility), located at 5148 Market Street, is a branch of the San Diego Public Library System serving the Valencia Park neighborhood and surrounding communities. The library is in the southeast region of the City off SR-94 and I-15, see Figures 2 and 3. This region sits in California's Climate Zone 7. The facility receives both electricity and gas service from San Diego Gas and Electric (SDG&E) with one meter for each utility service.

Figure 2: Valencia Park-Malcolm X Library – Google Maps Regional View

Figure 3: Valencia Park-Malcolm X Library Site Map – Google Maps Satellite View

The 26,328-square-foot facility was constructed in 1995 and serves over 25,000 visitors each month. The library staff includes 13 employees and occupies study and seminar rooms, a staff workroom and a multipurpose room for hosting large groups and community events. The library also includes a newly renovated Teen Tech Center that features a recording studio and computer lab. The building is open to the public during the following hours:

- Monday, Thursday-Saturday: 9:30 a.m.–6:00 p.m.
- Tuesday & Wednesday: 11:30 a.m.–8:00 p.m.
- Sunday: 12:30–5:00 p.m.

Description of Existing Building Systems

Building and Equipment Schedules

- Occupancy Schedule – Thirteen full-time employees arrive 30 minutes prior to library opening and leave at closing; approximately 25,000 visitors per month occupy the library for varying lengths of time. Custodial staff perform janitorial duties five days per week and typically leave within one hour of library closure.

- Lighting Schedule – Same as Occupancy Schedule; minimal lighting during unoccupied hours for security purposes.

- Outdoor Lighting Schedule – Roughly 5:30 p.m. – 7:00 a.m. (set by a timer).

- HVAC Schedule – Coincides with library operating hours, and on a timer. Thermostat temperature settings can only be adjusted locally by two-degree Fahrenheit; master temperature settings are controlled remotely by Building Services.

Building Envelope

- Roof – VPL's traditional roof (non-flat) consists of metal roofing with non-weathering copper finish with R-19 rigid insulation. Flat roofing consists of four-ply, built-up roofing with skid-resistant asphalt plank walkways installed for areas requiring maintenance access.

- Walls – The exterior walls are primarily constructed of poured concrete covered in a 2" cement plaster, finished with exterior paint.

- Windows – Fixed smoke-tint, single-pane glass windows with glazing in aluminum frames.

Indoor Lighting

- Stacks and Seminar Rooms – Interior lighting in the book stack areas and seminar rooms consists of suspended 1' x 4' two-or-three lamp F32T8 fluorescent uplight fixtures and 8" in diameter recessed can lights with twin-tube fluorescent bulbs. Most suspended fixtures consist of perforated metal diffusers that direct the majority of light upwards. The lighting in each space is controlled by manual switches with some seminar rooms including occupancy controls. A main light switch controls much of the public space fixtures and is manually operated by library staff upon entering and exiting the premises each day.

- Multipurpose Room – Interior lighting in the multipurpose room includes an array of 8" in diameter recessed fluorescent can lighting for general space lighting, along with a projector and stage track lighting. Each form of lighting throughout the room is controlled via separate wall-mounted manual switches. Upon inspection, this space appeared noticeably dark and staff mentioned complaints of lack of illumination in this area. After further examination, a large percentage of the bulbs in this room were burnt out and in need of replacement. All lighting in this space is controlled by manual switches with no occupancy controls except for in the adjacent storage closets. Employees and visitors are encouraged to turn off lights in unoccupied spaces.

- Entrances and Atrium – The lobbies are illuminated with a variety of track lighting and recessed can lighting featuring U-bent fluorescent bulbs. The main entrances face east and south and include large floor-to-ceiling doors and windows allowing natural light to flood the space. Additionally, the library features an 18-foot in diameter atrium near the east entrance separated from the outside by floor-to-ceiling windows, allowing natural daylighting to enter the atrium throughout the day, which is great for reducing lighting demands. Lights in these spaces are manually operated by a single wall switch by library staff upon entering and exiting the premises each day.

- Teen Tech Center (TTC) – The newly renovated (2016) TTC occupies the west branch of the library and is primarily illuminated by an array of LED suspended can lighting fixtures. The TTC also includes a separate computer lab space that is illuminated by wall accent lights and suspended 4' indirect F32T8 fluorescent uplight fixtures, similar to the suspended fixtures in the main library stacks. These lights are controlled by occupancy sensors and appear to be properly detecting occupancy in each space.

Outdoor Lighting

- Parking – pole lights – (20) 180 W High Pressure Sodium (HPS) down lights

- Landscape/Building Accent Lighting – (10) 250 W HPS flood lights

- Building Exterior Entry – (2) 35 W HPS wall packs

- Building Exterior Walkway – (2) 70 W ground flush-mounted HQI metal halide lights

Mechanical Systems

- Heating, Ventilation & Air Conditioning (HVAC) Systems – There are a total of ten space heating and cooling systems at the facility. The HVAC systems that serve the main library space are packaged systems located on a gated mechanical mezzanine located on the north side of the site outside of the building. Three Carrier Model 48HC packaged HVAC units (tag: AC-6 through 8) sit outside on a concrete pad and provide both heating (natural gas) and cooling (electricity) throughout the year. Units AC-6 through 8 appear to be of 2014 vintage. These units work in conjunction with three relief fans that are interconnected with each Carrier unit's exhaust duct system to balance pressure differentials within the VPL facility's interior conditioned space. This equipment appears to be in good condition and working properly. However, a simple visual inspection revealed these outdoor units may not be properly secured to the foundation, as the cable restraints are not physically connected to the units. These units are controlled by a set of locked digital thermostats with minimal control over temperature set points. A phone call must be made to Building Services to request a temperature change of 1-2°F up or down from 72°F.

  The multipurpose room (in the northeast section of VPL) features its own dedicated rooftop air handling unit (tag: AH-1) served by a 24-ton, ground-mounted, air-cooled chiller (tag: CH-1) located outside of the building. The multipurpose room is heated via a 216 MMBtu/hr inline duct heater (tag: DH-1) with a modulating gas valve, located along the supply duct of AH-1. This unit is controlled locally by two dedicated thermostats (tag: AH-1) which are both located in the multipurpose room.

  All conditioned space outside of the multipurpose room is served by two packaged rooftop units (tags: AC-1 and AC-3 with a VAV system; AC-2, 4, 5, 9 &10) featuring natural gas-supplied heat and electrical cooling. In addition, a single 2-ton Carrier ductless split system, (tag: AC-11) Model 38GVC - used only for cooling - includes a condenser located on the roof (west) above the TTC. This unit provides cooling to the TTC server room.

- Hot Water System – A single Pacemaker Model 92-40F1 natural gas water heater, located in a closet adjacent to the men's restroom in the atrium, provides hot water needs to VPL's restroom facilities. This 38 MBH, 40-gallon unit, is 2010 vintage and serves all the hot water needs for the building.

Electrical Systems

- Transformers – A 12-kV SDG&E service line enters the site near the service drive on 51st Street to the northwest of VPL and passes through an SDG&E transformer, where service is stepped down to 480 V before entering the library electrical room. The electrical room is located on the north side of VPL below an HVAC mezzanine, where 480 V power supplies a main switchboard and distributes power throughout the library. A single circuit on the main switchboard sends power to a 225-kVA Challenger DT-3 transformer, also located in the electrical room, where power is stepped down to 120 V to serve a Distribution Board DP-1. This panel serves 120 V power to most the lighting and plug loads throughout VPL.

Energy Profile

The VPL facility consumes around 1,160,825 kBtu of energy annually consisting of more than 285,794 kWh/yr. in electricity and approximately 105 MMBtu/yr. in natural gas. Figure 4 shows that electricity accounts for about 90% of VPL's energy consumption, peaking in the summer months. Electricity is consumed primarily for lighting and HVAC, with the peak generally occurring in the summer months to meet an increased air conditioning load. The library consumes natural gas for both space and hot water heating, with the annual peak generally occurring in the winter months when the demand for space heating is greatest.

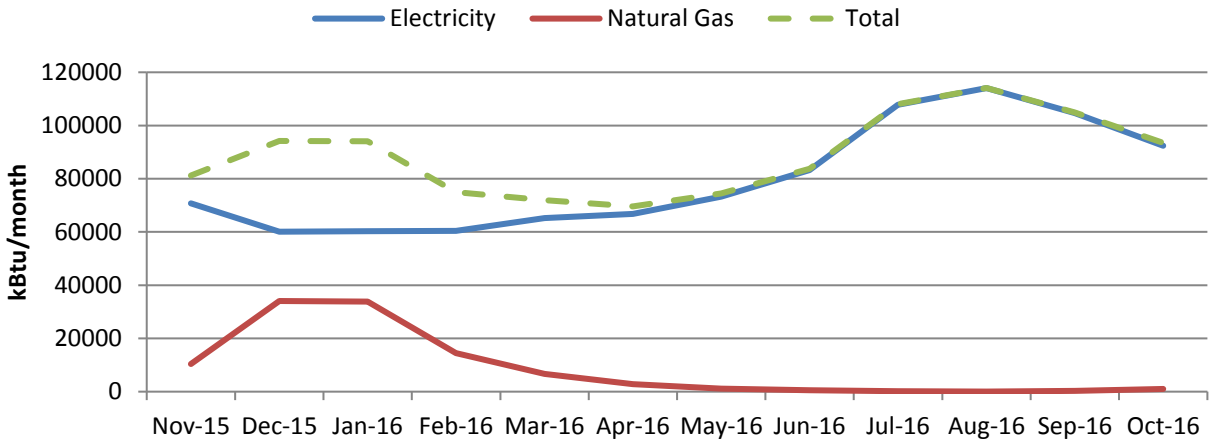
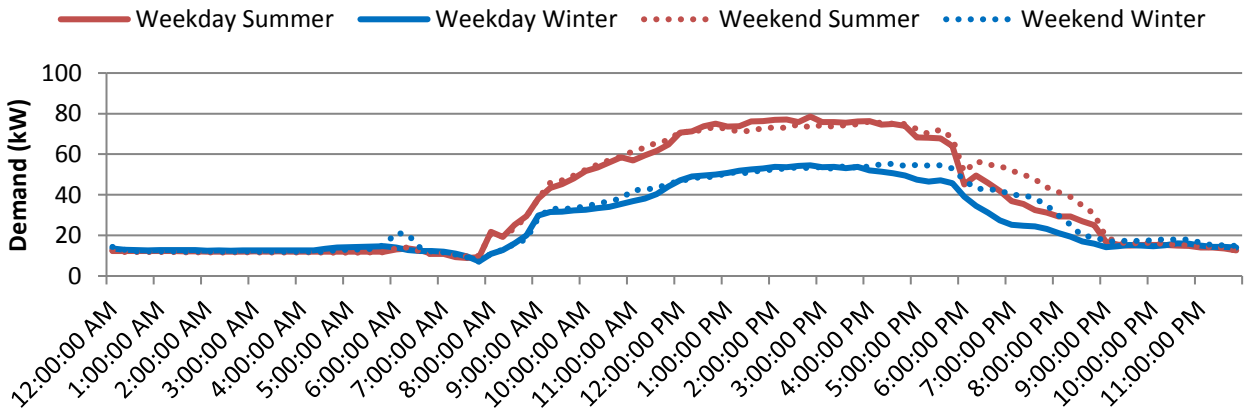


Figure 4: Valencia Park-Malcolm X Library Energy Consumption Profile (kBtu/month)

Using 15-minute interval utility data over the course of a year, Figure 5 illustrates how the VPL facility's electricity and natural gas use varies by season, weekday versus weekend and by time of day. For electricity, the weekday load profiles take an average of all weekday profiles separated into summer months (May-October) and winter months (November-April). The weekend load profiles take the average of the all weekend days throughout the year separated into summer and winter categories.

Figure 5 also illustrates the average electric load is significantly greater (approximately 30%) in the summer months when compared to the winter months for building cooling needs mentioned earlier.



The overnight 12 kW baseload (unoccupied) is mainly attributed to security and parking lot lighting. The morning load spikes around 8:00-9:00 a.m., coinciding with library staff arrivals HVAC schedules. Opportunities to reduce the unoccupied electric load include upgrading emergency lighting and exterior lighting fixtures with lower wattage lamps. Additionally, building energy management software, along with on-site renewable energy generation and energy storage, can smooth these spikes and reduce peak periods of consumption.

The VPL facility is enrolled in SDG&E's AL-TOU commercial tariff that charges customers for electric and natural gas consumed, as well as transmission and distribution costs. Table 3 outlines 12 months of the PLH facility's electricity and natural gas usage (November 2015–October 2016). The City paid an average annual blended rate of $0.260/kWh for electricity and an average blended rate of $8.81/MMBtu ($0.88/therm) for natural gas at VPL.

Utility	SDG&E Meter	Tariff	Energy Consumption	Annual Energy Costs	Avg. Cost per Unit
Natural Gas	1423938	GN-3	1,857 therms/yr.	$1,636	$0.881/therm
Electricity	6693453	AL-TOU	285,794 kWh/yr.	$74,342	$0.260/kWh
Totals				$75,978	

Table 3: Valencia Park-Malcolm X Library Utility Service Data and Historical Energy Consumption

Table 4 represents monthly electricity consumption using 15-minute interval data and the time-of-use (TOU) tariff through which VPL receives service. The consumption and coincident demand that occurs during each TOU period as well as the noncoincident (max, during any TOU) monthly demand. The purpose of analyzing when energy is used is to assess the value of energy saved through various EEM recommendations. A unit of energy saved during on-peak periods is worth more than a unit saved during semi- or off-peak periods. CSE's recommended lighting and HVAC EEMs account for TOU pricing when calculating anticipated savings.

Month	Total On-Peak (kWh)	Total Semi-Peak (kWh)	Total Off-Peak (kWh)	Max On-Peak Demand (kW)	Max Semi-Peak Demand (kW)	Max Off-Peak Demand (kW)	Max Demand (kW)
Jan	866	3,005	2,475	53.1	63.4	48	63.4
Feb	4,468	14,676	12,451	69.1	80	75.5	154.9
Mar	1,354	4,448	3,405	69.1	80	75.5	80
Apr	4,173	15,520	11,083	97.9	110.1	92.2	202.3
May	8,365	4,513	7,039	112	78.1	96	222.1
Jun	11,008	6,538	8,771	120.3	98.6	112.6	232.3
Jul	12,351	7,605	11,198	134.4	124.8	126.7	254.7
Aug	5,079	3,156	2,668	134.4	124.8	126.7	134.4

Sep	13,795	8,625	11,731	128	106.9	113.3	128
Oct	17,935	12,795	14,913	140.8	121.6	114.6	251.5
Nov	1,872	11,851	7,147	74.2	110.7	89	205.4
Dec	2,014	9,248	7,653	74.2	94.7	89	158.1
Total	**83,280**	**101,980**	**100,534**	**140.8**	**124.8**	**126.7**	**140.8**

Table 4: Valencia Park-Malcolm X Library Annual Electricity Consumption

Table 5 displays the monthly billing components based on the applicable TOU tariff and electricity usage in Table 4. Certain monthly charges are fixed and not based on electricity use, and are typically not factored into energy savings from conservations measures.

Month	Consumption Total Amount ($)	Demand Total Amount ($)	Other Total Amount ($)	Tax Total Amount ($)	Bill Total Amount ($)	Average of Blended Rate ($/kWh)
Jan	$534.28	$754.91	$78.56	$81.47	$1,449.22	0.228
Feb	$2,659.72	$3,823.86	$370.97	$408.22	$7,262.77	0.229
Mar	$819.48	$1,009.08	$101.33	$115.05	$2,044.94	0.222
Apr	$2,651.73	$4,629.78	$360.57	$450.93	$8,093.01	0.263
May	$1,991.59	$3,434.04	$225.74	$332.62	$5,983.99	0.299
Jun	$2,645.16	$3,643.48	$259.22	$386.37	$6,934.23	0.263
Jul	$3,103.80	$4,345.35	$295.35	$456.98	$8,201.48	0.266
Aug	$1,129.08	$1,499.72	$100.52	$161.03	$2,890.35	0.265
Sep	$3,427.78	$4,142.08	$305.51	$465.44	$8,340.81	0.244
Oct	$5,668.76	$7,017.12	$455.28	$773.50	$13,914.66	0.293
Nov	$1,794.58	$2,664.17	$226.89	$277.09	$4,962.73	0.239
Dec	$1,607.35	$2,198.28	$219.87	$238.35	$4,263.85	0.231
Total	**$28,033.31**	**$39,161.87**	**$2,999.81**	**$4,147.05**	**$74,342.04**	**0.256**

Table 5: Valencia Park-Malcolm X Library Annual Electric Bill Summary

Benchmarking

Benchmarking offers a quick way to compare buildings of similar types and function. Buildings are normalized by comparing the annual energy use (electricity and gas or other fuel) on a per-square-foot basis as energy use intensity (EUI). EUI information enables the development of a square footage index, which is then compared to similar buildings to identify the potential for greater energy and operational savings. CSE's calculated benchmarking results of the VPL facility are shown in Table 6, which account for 12 months of utility consumption data.

Electric (kBtu)	975,169
Natural Gas (kBtu)	185,656
Total (kBtu)	1,160,825
Site Area (ft^2)	26,328
Site EUI (kBtu/ ft^2)	**41.1**

Table 6: Valencia Park-Malcolm X Library Current Site Energy Consumption and EUI

Table 6 represents a traditional way to perform energy benchmarking, however, advanced tools, such as the Environmental Protection Agency's ENERGY STAR Portfolio Manager, simplify analysis for energy consumers and give them the ability to connect directly to their utility to track building performance and make comparisons to similar buildings of similar use, characteristics and climate zones nationwide. This data is provided by the Commercial Buildings Energy Consumption Survey (CBECS).[4]

Comparative Energy Use Intensity

Figure 6 compares the VPL's existing EUI to the other two libraries being evaluated by this project, to similar building types that have achieved a ZNE or Ultra-low Verified designation, and applicable CBECS data for similar building use types. The New Building Institue (NBI) maintains a list of *Public Assembly* buildings that have achieved ZNE and Ultra-low buildings including their energy consumption and EUI values. The nationwide averages for *Public Assembly* buildings use 2012 CBECS data to establish a typical EUI for similar building uses and climate zones.

When using the NBI data, it is important to compare to the *Base (Gross) Energy Use* value which accounts only for the building's consumption and not any additional energy offset provided by on-site renewable energy production. Base Energy Use displays the building's performance with existing equipment and controls. The Base Energy Use output ignores the variability of how much of an effect something like solar PV could have on a property's net consumption from the grid over the course of a year.

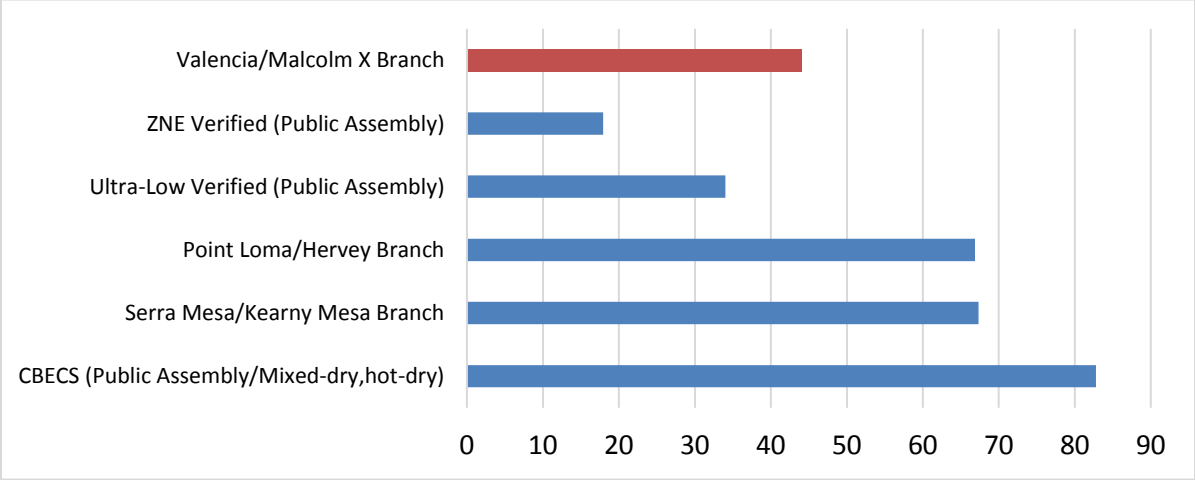


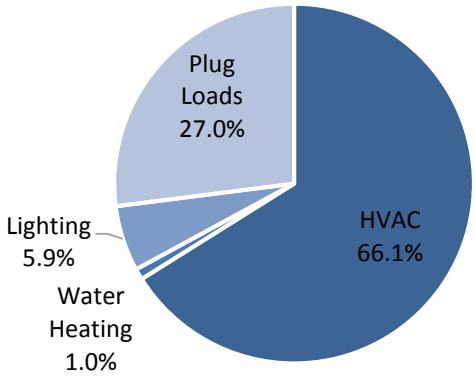
Figure 5: Valencia Park/Malcolm X Library Existing EUI Compared to Various Averages (kBtu/ft²)

VPL currently uses about 47% less energy on a square foot basis compared to similar facilities in the nation according to CBECS property type and climate zone data. Similarly, VPL also uses the least amount of energy on a square-foot basis than the other two libraries chosen for this study. Based on comparing VPL to ZNE or Ultra-Low Verified buildings it is obvious that many energy efficiency opportunities need to be deployed in order to reach ZNE or near-ZNE thresholds.

[4] CBECS data, https://www.eia.gov/consumption/commercial/data/2012/c&e/pdf/c11.pdf.

End-use Breakdown

The following end-use breakdown was generated using electric and gas utility monthly data and CBECS building energy modeling data. These end-use consumption estimates utilize engineering models to account for energy being used by HVAC equipment, lighting, office equipment and other uses. These estimates are for a *Public Assembly* building within the range of 25,001–50,000 square feet in the Pacific Census region.



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Energy Consumption (kBtu) by End-Use

Figure 7 shows most of the VPL facility's energy consumption (66%) is attributed to HVAC loads, followed by plug loads (27%)[5]. It should be noted that this breakdown only shows past building consumption and could vary from how this site is operating in real-time. Future planned energy modeling and end-use monitoring of VPL will reveal the actual end-use breakout for comparison to CBECS national average estimation.

III. Energy Efficiency Measures

Resulting from this audit and analysis of VPL's energy consumption trends, CSE identified several energy efficiency measures (EEM's) to help reduce energy consumption in the VPL facility. By addressing each measure, the City creates an opportunity to increase energy efficiency, reducing both operating costs and the library's carbon footprint. The following section describes the details of each EEM recommended for consideration. A full equipment inventory for VPL is located in Appendix A.

Low-Cost/No-Cost Measures

Replace HVAC Thermostat Controls

HVAC controls are currently local wall-mounted digital thermostats placed throughout the library. This type of equipment has a useful life of 11 years, so may need replacement or upgrade. Further, building management technologies have improved significantly since the construction of this facility, and optimizing facility HVAC controls may provide additional energy savings. Currently SDG&E offers rebates which cover the full cost of programmable thermostats through their Business Energy Solutions Program[6].

Adjust Heating/Cooling Setpoints

Additional savings might be possible through the simple adjustment and standardization of heating and cooling setpoints. Figure 8 below shows the potential energy savings or energy waste for both the cooling and heating seasons based on where you set your thermostat. The percent of energy saved or

[5] Plug loads include printers, desktops, laptops, monitors, refrigerators, TVs, etc.
[6] SDG&E Business Energy Solutions Program, https://www.sdge.com/business/sdges-business-energy-solutions-program

lost is represented for each two degree change in the optimal setpoint of 78° F in summer and 68° F in winter.

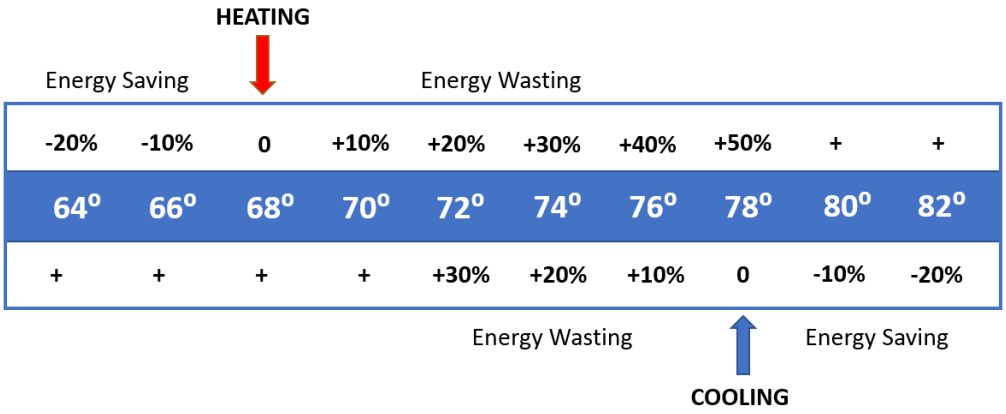

Figure 7: Energy Penalties and Benefits Resulting from Changes in Cooling and Heating Set points[7]

Repair Economizers

All the ten rooftop air conditioning units serving the VPL facility include economizer packages. As is often the case, economizers in aging rooftop packaged units often fail within 5-7 years if proper maintenance schedules are not upheld, but have a useful life up to 10 years. CSE was unable to verify proper economizer operation during the inspection. An economizer maintenance check is recommended to ensure proper operation to secure energy savings from free cooling. SDG&E currently offers incentives for commercial HVAC tune-ups and discounted maintenance packages through the Premium Efficiency Cooling program[8]. Incentive amounts are based upon the size of the systems and economizer options, however the program expires on December 31, 2017.

Automated Demand Response

SDG&E's Summer Saver Program[9] is a no-cost, energy-saving Demand Response program where customers enroll to have their HVAC units cycled during peak periods throughout summer (up to 60 hours during the months of May through October). In return, SDG&E provides an annual credit on customers SDG&E bill.

The air conditioning units run-times are reduced by a selected 30% or 50% cycling, compared to the hour before the conservation period. For 50% cycling this is half the run time. A 50% cycling enrollment would earn $7.50/ton and 30% cycling would earn $4.50/ton. **If VPL were to enroll all their units this would amount to approximately $477 per year for 30% cycling and $795 per year for 50% cycling.**

[7] National Energy Education Development Project (NEED). Saving Energy at Home and School. http://www.need.org/Files/curriculum/guides/BuildingScience.pdf, 2016-2017
[8] SDG&E Premium Efficiency Cooling Program, https://www.sdge.com/premium-efficiency-cooling
[9] SDG&E Summer Saver Program, https://www.sdge.com/business/demand-response/summer-saver-program

Capital Investment Measures

This section identifies measures requiring a moderate to significant upfront investment for the VPL facility. These measures often provide significant energy savings and attractive net-present values. CSE evaluated the following capital investment measures and plan to implement many of them during the project's construction phase.

Occupancy Sensors

Lighting is currently controlled via manual switches at VPL. Installing controls, such as occupancy sensors and/or daylight photosensors, can curtail energy consumption by ensuring lights are dimmed or turned off in areas with adequate sunlight infiltration or during unoccupied periods. Further, occupancy sensors and other lighting controls may be required by Title 24, Part 6. Table 7 below shows SDG&E's[10] estimated energy savings by space type from the installation of occupancy sensors. These savings estimates do not pertain to whole building energy reductions, instead they are associated with the percent of lighting hours that could be reduced in a particular building space by occupancy sensors. **For example, if VPL's breakroom has lighting controls up to 25% of lighting hours could be reduced.**

Space Type	% Savings	Space Type	% Savings	Space Type	% Savings
Assembly	45	**Industrial**	45	**Restroom**	45
Break Room	25	**Kitchen**	30	**Retail**	15
Classroom	30	**Library**	15	**Stair**	25
Computer Room	35	**Lobby**	25	**Storage**	45
Conference	35	**Lodging (Guest Rooms)**	45	**Technical Area**	35
Dining	35	**Open Office**	15	**Warehouses**	45
Gymnasium	35	**Private Office**	30	**Other**	15
Hallway	25	**Process**	45	**Parking Garage**	15
Hospital Room	45	**Public Assembly**	35	**-**	-

Table 7: Valencia Park-Malcolm X Branch Library Potential Energy Savings from Occupancy Sensors by Space Type

Tables 8 and 9 include CSE's calculated energy and costs savings that could be gained with the installation of occupancy sensors at VPL.

Measure Number	Measure Description	Peak Demand Savings (kW)	Electricity Savings (kWh)	Gas/Fuel Savings (therms)
LTNG-1	Install Occupancy Sensors	0	6,931	0

Table 8: Potential Energy Savings from Occupancy Sensors

[10] SDG&E Estimated Occupancy Sensor Energy Savings, https://www.sdge.com/sites/default/files/regulatory/SDG&E%202.0%20Energy%20Savings.pdf

Measure Number	Total Cost Savings	Measure Cost	Potential Utility Incentive	Measure Life (yr.)	Net Measure Cost	Investment Rate of Return	Net-Present Value	Simple Payback (yr.)
LTNG-1	$18,267	$121,440	$11,120	8	$110,320	7%	$12,664	6.0

Table 9: Potential Cost Savings from Occupancy Sensors

Replace Existing Fixtures with LED Equivalents

Currently, VPL has a lighting density factor of 1.58 watts per square foot (including only indoor lighting), which proves to be an area of significant opportunity. The most common lighting fixtures throughout VPL are 4-foot 32-watt linear fluorescent fixtures. There are 314 T8 fixtures across the entire branch, which is equivalent to about 787 individual lamps. CSE recommends replacing existing 32-Watt fluorescent fixtures with continuous dimming linear LEDs. While LED technologies generally have a greater initial cost and longer payback, they offer a greater net present value because of their longer effective useful life (EUL) and annual savings.

The life expectancy of a T8 lamp is 20,000- 24,000 hours. Given the lighting hours of the facility (~3,070 hours per year), this means that T8 lamps would start failing after 6.5 to 7.5 years. In contrast, linear LED fixtures have estimated useful lives of about 35,000- 50,000 hours, or about 11 to 16 years when operating at current lighting hours. Given current Title 24, Part 6 lighting requirements, LEDs have an advantage in achieving significantly lower wattage per square feet than fluorescent equivalents. Given the electric profile of VPL, reducing lamp wattage should also translate to peak demand and energy reductions. CSE analyzed replacing the various interior and exterior lighting fixtures to LED equivalent fixtures.[11] The results are in the Tables 10 and 11.

Measure Number	Measure Description	Peak Demand Savings (kW)	Electricity Savings (kWh)	Gas/Fuel Savings (therms)
LTNG-2	Replace Indoor T8 Fixtures with LED Equivalents	6.3	19,434	0
LTNG-3	Replace Indoor Compact Fluorescent Fixtures with LED Equivalents	3.9	12,020	0
LTNG-4	Replace Indoor Halogen and Incandescent Fixtures with LED Equivalents	6.3	19,235	0
LTNG-5	Replace Outdoor Compact Fluorescent, Metal Halide, and High Pressure Sodium Fixtures with LED Equivalents	0.9	4,174	0
LTNG-6	Replace HID Parking Lot Fixtures with LED Equivalents	1.1	5,109	0

Table 10: Potential Energy Savings by Installing LED Equivalent Fixtures

[11] Design Lighting Consortium Premium technical requirements for LED luminaires, https://www.designlights.org/solid-state-lighting/qualification-requirements/dlc-premium-requirements/.

Measure Number	Total Cost Savings	Measure Cost	Potential Utility Incentive	Measure Life (yr.)	Net Measure Cost	Investment Rate of Return	Net Present Value	Simple Payback (yr.)
LTNG-2	$7,317	$79,560	$7,800	16	$71,760	6%	$13,503	9.8
LTNG-3	$4,526	$30,840	$2,570	16	$28,270	14%	$24,467	6.2
LTNG-4	$7,242	$13,590	$920	16	$12,670	57%	$71,718	1.7
LTNG-5	$1,572	$11,980	$1,450	11	$10,530	9%	$3,237	6.7
LTNG-6	$1,924	$20,000	$0	11	$20,000	1%	-$3,149	10.4

Table 11: Potential Cost Savings by Installing LED Equivalent Fixtures

Based on the above results, VPL should look to replace interior lighting and exterior building lighting with LED equivalents. **Combined, these lighting measures (LTNG-2 through LTNG-5) would provide about $112,924 in net present value and a 6-year simple payback.**

HVAC Equipment Upgrade

The HVAC equipment serving VPL appears to be of 2014 vintage. Conversations with VPL staff and visual inspections of the equipment and associated ductwork reveal no obvious immediate need to replace existing equipment other than to increase energy efficiency. As the HVAC units operate up to or past their end of useful life (approximately 20 years), they may begin to incur excessive operations and maintenance issues. Tables 12 and 13 show that early retirement of the existing equipment does not make economic sense. However, when that time does come, replacing the existing units with high-efficiency models will provide significant energy savings compared to the minimum efficiency standard and help to move the VPL facility closer toward ZNE.

Measure Number	Measure Description	Peak Demand Savings (kW)	Electricity Savings (kWh)	Gas/Fuel Savings (therms)
HVAC-1	Replace AC-1 unit with 12.5 EER or greater	1.8	1,029	0
HVAC-2	Replace AC-2 unit with 12.5 EER or greater	1.8	675	0
HVAC-3	Replace AC-3 unit with 13 EER or greater	0.6	315	0
HVAC-4	Replace AC-4 unit with 13 EER or greater	0.7	404	0
HVAC-5	Replace AC-5 unit with 18 SEER or greater	0.4	231	0

HVAC-6	Replace AC-6 unit with 12.5 EER or greater	2.5	834	0
HVAC-7	Replace AC-7 unit with 12.5 EER or greater	2.5	834	0
HVAC-8	Replace AC-8 unit with 12.5 EER or greater	2.5	834	0
HVAC-9	Replace AC-9 unit with 18 SEER or greater	0.6	279	0
HVAC-10	Replace AC-10 unit with 18 SEER or greater	0.6	279	0
HVAC-11	Replace CH-1 and AH-1 with 11.5 EER or greater or Equivalent 11.5 EER Package Unit with economizer	4.2	5,363	0

Table 12: Valencia Park/Malcolm X Branch Library Potential Energy Savings from HVAC Equipment Upgrades

Measure Number	Total Cost Savings	Measure Cost	Potential Utility Incentive	Measure Life (yr.)	Net Measure Cost	Investment Rate of Return	Net Present Value	Simple Payback (yr.)
HVAC-1	$391	$17,856	$419	15	$17,437	-11%	-$13,090	>EUL
HVAC-2	$256	$17,856	$366	15	$17,490	-15%	-$14,639	>EUL
HVAC-3	$120	$14,356	$133	15	$14,223	-19%	-$12,889	>EUL
HVAC-4	$154	$16,465	$167	15	$16,297	-18%	-$14,585	>EUL
HVAC-5	$88	$5,195	$97	15	$5,098	-14%	-$4,120	>EUL
HVAC-6	$317	$23,797	$507	15	$23,291	-15%	-$19,766	>EUL
HVAC-7	$317	$23,797	$507	15	$23,291	-15%	-$19,766	>EUL
HVAC-8	$317	$23,797	$507	15	$23,291	-15%	-$19,766	>EUL
HVAC-9	$106	$5,486	$130	15	$5,356	-12%	-$4,178	>EUL
HVAC-10	$106	$5,486	$130	15	$5,356	-12%	-$4,178	>EUL
HVAC-11	$2,038	$30,415	$1,434	20	$28,981	3%	-$1,284	14.2

Table 13: Valencia Park/Malcolm X Branch Library Potential Cost Savings from HVAC Equipment Upgrades

IV. Conclusion

CSE recommends that the VPL facility upgrades all indoor and outdoor lighting to LED equivalent fixtures and adds occupancy control sensors. Both of these measures can be explored within the funding and scope of this project. When combined, the recommended measures below would reduce the library's electricity consumption by about 21.6% and reduce the EUI from 41.1 to approximately 33.0 kBtu/sqft.

Measure Number	Measure Description	Peak Demand Savings (kW)	Electricity Savings (kWh)	Gas/Fuel Savings (therms)
EEM-1	Install Occupancy Sensors (LTNG-1)	0	6,931	0
EEM-2	Replace Indoor and Outdoor Lighting Fixtures with LED Equivalents (LTNG-2,3,4,5)	17.4	54,863	0
TOTAL		**17.4**	**61,793**	**0**

Table 14: Potential Energy Savings from Recommended Energy Efficiency Measures

Measure Number	Total Cost Savings	Measure Cost	Potential Utility Incentive	Measure Life (yr.)	Net Measure Cost	Investment Rate of Return	Net Present Value	Simple Payback (yr.)
EEM-1	$18,267	$121,440	$11,120	8	$110,320	7%	$12,664	6.0
EEM-2	$20,657	$135,970	$12,740	11-16	$123,230	15%	$112,924	6.0
TOTAL	**$38,923**	**$257,410**	**$23,860**	**8-16**	**$233,550**	**12%**	**$125,588**	**6.0**

Table 15: Potential Cost Savings from Recommended Energy Efficiency Measures

CSE recommends the City pursue these additional no- or low-cost energy conservation measures that further increased energy savings.

- Replace aged thermostats with new programable thermostats
- Adjust cooling and heating setpoints to find the most energy-efficient balance to maintain occupant comfort
- Investigate current economizer functionality and repair any broken equipment
- Enroll in an HVAC cycling demand response program

Finally, CSE recommends that the City evaluate the following larger capital investment measures as part of PLH's long-term maintenance or upgrade cycles in order to advance the library toward ZNE.

- Replace HVAC units that have reached the end of their useful life with high-efficiency units
- Install renewable generation technologies, such as solar and storage

- Replace gas-fired package units with all-electric, high-efficiency heat pumps

APPENDIX A: Valencia Park-Malcolm X Library Equipment Inventory

Indoor and Outdoor Lighting

Area	Space ID	Fixture Description	kW per Fixture	Fixture Qty.	Total Wattage
Interior	MP[12] Room	N: 8" Diameter Recessed Can Light	0.026	39	1,014
Interior		O: 4" Recessed Task Light	0.050	3	150
Interior		M: Track Projector Light	0.075	7	525
Interior		Stage Lighting	0.050	9	450
Interior	Fire Cabinet Room (MP Room)	G: 1x4 Surface Mt. Wraparound	0.064	2	128
Interior	MP Storage Room	D: 8" Diameter Recessed Downlight	0.026	3	78
Interior	MP Storage Room	G: 1x4 Surface Mt. Wraparound	0.064	2	128
Interior	MP Kitchen	G: 1x4 Surface Mt. Wraparound	0.064	2	128
Interior	MP Kitchen	F: 9" Open Recessed Can Light	0.052	9	468
Interior	MP Kitchen	O: 4" Recessed Task Light	0.050	3	150
Interior	Seminar "B" Room	B/B1: 1x4' Suspended Uplight	0.064	7	448
Interior	Seminar "B" Room	O: 4" Recessed Task Light	0.050	5	250
Interior	Seminar "A" Room	B/B1: 1x4' Suspended Uplight	0.064	7	448
Interior	Seminar "A" Room	O: 4" Recessed Task Light	0.050	5	250
Interior	Music Performance Room	B/B1: 1x4' Suspended Uplight	0.064	6	384
Interior	Main Entrance Lobby	M: Track Projector Light	0.075	21	1575
Interior	Main Entrance Lobby	D: 8" Diameter Recessed Downlight	0.026	5	130
Interior	Main Entrance Lobby	O: 4" Recessed Task Light	0.050	1	50
Interior	Main Entrance Lobby	I: 4" Recessed Task Light	0.020	21	420
Interior	Adult/YA Fiction	D: 8" Diameter Recessed Downlight	0.026	19	494
Interior	Adult/YA Fiction	A: 1x4' Suspended Uplight	0.096	31	2976
Interior	Online Reference	R: CFL Open Strip Light	0.040	86	3440
Interior	Adult/YA Nonfiction	A: 1x4' Suspended Uplight	0.096	32	3072
Interior	Adult/YA Nonfiction	D: 8" Diameter Recessed Downlight	0.026	9	234
Interior	Children's Area/Stacks	A: 1x4' Suspended Uplight	0.096	38	3648

[12] Multipurpose room

Interior	Children's Area/Stacks	F: 9" Open Recessed Can Light	0.052	4	208
Interior	Children's Area/Stacks	Z: 8" Wall-mounted Up/Down Cylinder Light	0.300	7	2100
Interior	Men's RR	L: 12" Diameter Drum Light	0.026	1	26
Interior	Women's RR	L: 12" Diameter Drum Light	0.026	1	26
Interior	South Lobby	F: 9" Open Recessed Can Light	0.052	9	468
Interior	South Lobby	D: 8" Diameter Recessed Downlight	0.026	4	104
Interior	Copy Room	B/B1: 1x4' Suspended Uplight	0.064	2	128
Interior	Typing Room	B/B1: 1x4' Suspended Uplight	0.064	4	256
Interior	Friends of the Library	B/B1: 1x4' Suspended Uplight	0.064	2	128
Interior	YA Group Study Room "A"	B/B1: 1x4' Suspended Uplight	0.064	3	192
Interior	YA Group Study Room "B"	B/B1: 1x4' Suspended Uplight	0.064	4	256
Interior	Telecom Room	G: 1x4 Surface Mt. Wraparound	0.064	1	64
Interior	Staff Room	B/B1: 1x4' Suspended Uplight	0.064	16	1024
Interior	Staff Room	W: Undercounter Task Light	0.032	6	192
Interior	Staff Room	D: 8" Diameter Recessed Downlight	0.026	4	104
Interior	Staff Restroom	L: 12" Diameter Drum Light	0.026	1	26
Interior	Staff Restroom	B/B1: 1x4' Suspended Uplight	0.064	4	256
Interior	Branch Manager Office	B/B1: 1x4' Suspended Uplight	0.064	3	192
Interior	Circulation Desk	B/B1: 1x4' Suspended Uplight	0.064	5	320
Interior	Circulation Desk	R: CFL Open Strip Light	0.040	13	520
Interior	Circulation Desk	K: Recessed 9" Wide Troffer	0.064	9	576
Interior	Circulation Desk	F: 9" Open Recessed Can Light	0.052	9	468
Interior	Children's Area	K: Recessed 9" Wide Troffer	0.064	9	576
Interior	South Lobby	K: Recessed 9" Wide Troffer	0.064	5	320
Interior	Diversity Area	K: Recessed 9" Wide Troffer	0.064	20	1280
Interior	Diversity Area	A: 1x4' Suspended Uplight	0.096	36	3456
Interior	Diversity Area	D: 8" Diameter Recessed Downlight	0.026	21	546
Interior	Atrium	F: 9" Open Recessed Can Light	0.052	11	572
Interior	Men's RR (Atrium)	D: 8" Diameter Recessed Downlight	0.026	4	104
Interior	Women's RR (Atrium)	D: 8" Diameter Recessed Downlight	0.026	4	104
Interior	YA Computer Room	B/B1: 1x4' Suspended Uplight	0.064	7	448
Interior	Multimedia Room	A: 1x4' Suspended Uplight	0.096	17	1632
Interior	Multimedia Room	M: Track Projector Light	0.075	10	750

Interior	YA Multimedia Room	A: 1x4' Suspended Uplight	0.096	7	672
Interior	TTC[13] Main Room	TTC: 16W Suspended Can Light	0.016	20	320
Interior	TTC Computer Lab	TTC: 4' Lights Over Computers	0.018	34	598
Interior	TTC Computer Lab	TTC: Suspended 4' Linear Indirect Fluorescent	0.064	17	1088
Interior	TTC Lobby	TTC: Suspended 4' Linear Indirect Fluorescent	0.064	8	512
Interior	TTC Restroom	TTC: Restroom Light	0.042	1	42
Interior	TTC Recording Studio	TTC: Suspended 4' Linear Indirect Fluorescent	0.064	4	256
Interior	TTC Office	TTC: Suspended 4' Linear Indirect Fluorescent	0.064	2	128
Exterior	Outdoor: East Entrance	P: Parking Lot Area Pole Lights	0.180	17	3060
Exterior	Outdoor: South Entrance	U: Exterior Floodlight	0.250	10	2500
Exterior	Outdoor: South Entrance	T: Recessed Step Light	0.013	7	91
Exterior	Outdoor: South Entrance	P: Parking Lot Area Pole Lights	0.180	2	360
Exterior	Outdoor: South Entrance	S: Flush-mounted Uplights	0.070	2	140
Exterior	Outdoor: South Entrance	V: Outdoor Sign Light	0.032	2	64
Exterior	Outdoor: West of Bldg.	P: Parking Lot Area Pole Lights	0.180	1	180
Exterior	Outdoor: West of Bldg.	Q: 10.5" Diameter Wall Mntd Light	0.035	5	175
Exterior	Outdoor: North of Bldg.	Q: 10.5" Diameter Wall Mntd Light	0.035	11	385

Table 16: Valencia Park/Malcolm X Branch Library Existing Indoor and Outdoor Lighting Equipment –Site plan line-by-line

Split and Packaged AC Units

Unit ID	Manufacturer	Model	Vintage	Cooling Capacity (MBH)	Heating Capacity (MBH)	EER	SEER	TE	Notes
AC-1	Carrier	48TCDD14	2014	150	148	10.8	-	82%	Music/Seminar, TC=Standard Efficiency
AC-2	Carrier	48TCDD14	2014	150	148	10.8	-	82%	Multimedia
AC-3	Carrier	48HCDD08	2014	90	148	12	-	82%	Staff Area, HC=High Efficiency
AC-4	Carrier	48HCED11	2014	120	178	12	-	82%	Read San Diego
AC-5	Carrier	48HCLA05	2014	60	92	13	15.6	81%	Computer Lab
AC-6	Carrier	48TCDD17	2014	180	178	10.8	-	81%	Main Library
AC-7	Carrier	48TCDD17	2014	180	178	10.8	-	81%	Main Lib. West

[13] Teen Tech Center

AC-8	Carrier	48TCDD17	2014	180	178	10.8	-	81%	Main Lib. East
AC-9	Carrier	48HCLA06	2014	60	50	-	-	-	Lobby
AC-10	Carrier	48HCLA06	2014	60	92	12.45	15.2	81%	Lobby
AC-11	Carrier	38GVC024---3	2013	24	148	-	-	-	Teen Tech Center

Table 17: Valencia Park/Malcolm X Branch Library Existing Split and Packaged AC Units

Hot Water Heater

Unit ID	Manufacturer	Model	Vintage	Capacity (Gal)	EF	Notes
WH-1	RUUD-Pacemaker	P2-40F1	2010	40	0.59	Located in closet space off Men's RR

Table 18: Valencia Park/Malcolm X Branch Library Existing Hot Water Equipment

Other Mechanical

Unit ID	Description	Manufacturer	Model	Capacity	Unit	Voltage	Vintage
EF-1	AC-1 Relief Fan	Greenheck*	8FB-12-4	1300	CFM	115	NA
EF-2	Main Restrooms Fan	Greenheck*	BSQ-90-4	650	CFM	115	NA
EF-3	AC-6 Relief Fan	Greenheck*	BSQ-240-10	5315	CFM	460	NA
EF-4	AC-7 Relief Fan	Greenheck*	BSQ-240-10	5315	CFM	460	NA
EF-5	AC-8 Relief Fan	Greenheck*	BSQ-240-10	5315	CFM	460	NA
EF-6	Girls RR Read SD RR Fan	Greenheck*	CUBE-95	270	CFM	115	NA
AH-1	MP Room Air Handler	Carrier	39LB-18	7300	CFM	460	1995
DH-1	Duct Heater Serving AH-1	Reznor	HCRG-300	216	MBH	NA	1995
CH-1	MP Room Chiller	Carrier	30GT025-610	288	MBH	460	1995
NA	Whole Building Transformer	Challenger	DT-3	225	KVA	480D/208Y	NA

Table 19: Valencia Park/Malcolm X Branch Library Other Existing Mechanical Equipment

*CSE unable to verify during inspection due to missing nameplate on equipment

Plug Loads

Space ID	Qty.	Appliance	Notes
MP Kitchen	1	Whirlpool Refrigerator	
Main Entrance Lobby	1	Vizio 42" TV	
Adult/YA Fiction	2	Desktop w/Monitor	
Online Reference	11	Desktop w/Monitor	Model# 795.79302.901
Children's Area/Stacks	10	Desktop w/Monitor	Model# W8TXEWFYB03
Copy Room	1	Xerox WorkCentre 5845	Vizio E241VL 42" TV
Friends of the Library	1	Desktop w/Monitor	Desktop = 240W; LCD Display = 20W
Friends of the Library	1	HP Laserjet 3830	Desktop = 240W; LCD Display = 20W
Staff Room	3	Desktop w/ Monitor	Desktop = 240W; LCD Display = 20W
Staff Room	1	Whirlpool Refrigerator	Running Avg. = 1,150W; Standby = 290W; Low Power = 125W; Sleep (2 Min Idle) = 4W
Staff Room	1	Sharp Microwave	Desktop = 240W; LCD Display = 20W
Branch Manager Office	1	Desktop w/Monitor	Operational = 10W; Standby = 2.83W; Sleep = 1.17W
Circulation Desk	6	Desktop w/Monitor	Desktop = 240W; LCD Display = 20W
Circulation Desk	1	HP Laserjet P4015x	Model# ET8MTEXKQ02
YA Computer Room	15	Desktop w/Monitor	Model# R-4A92
Teen Tech Center Main Room	2	Sharp HDTV	Desktop = 240W; LCD Display = 20W
Teen Tech Center Main Room	5	Laptop	Desktop = 240W; LCD Display = 20W
Teen Tech Center Main Room	1	Desktop w/Monitor	-
TTC Computer Lab	1	HP Laserjet M452dn	Desktop = 240W; LCD Display = 20W
TTC Computer Lab	10	Desktop w/Monitor	Sharp LC 65" HDTV
TTC Computer Lab	10	Desktop w/Monitor	MacBook Pro - 61W each
TTC Computer Lab	2	Robo 3D Printers	Desktop = 240W; LCD Display = 20W
TTC Recording Studio	1	Desktop w/Monitor	Printing = 570W; Ready = 17.6W; Sleep = 5.4W; Off = 0.6W
TTC Office	2	Desktop w/Monitor	Desktop = 240W; LCD Display = 34.7W

Table 20: Valencia Park/Malcolm X Branch Library Existing Plug Loads