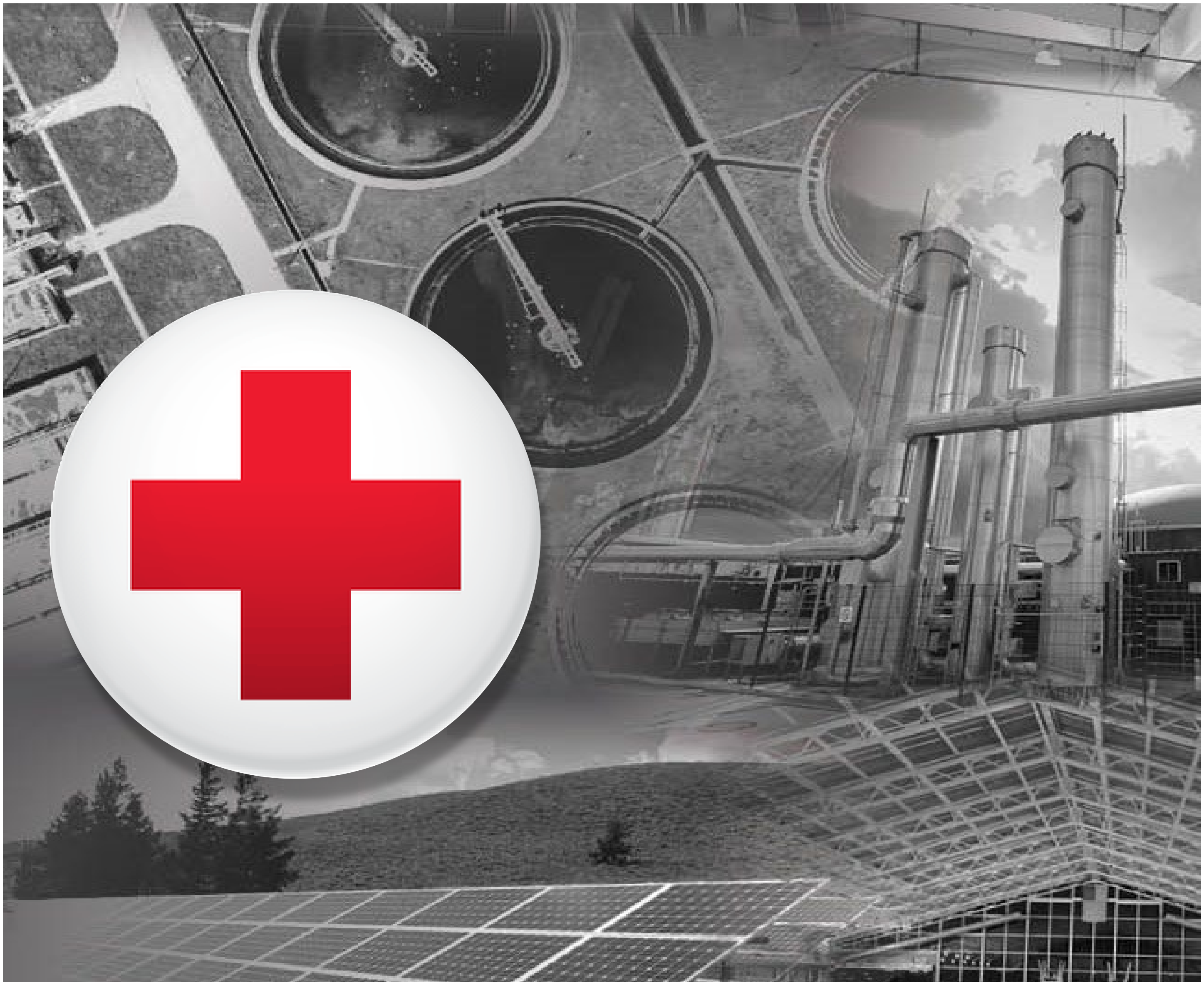

Pomona, CA Site Sustainability Report

American National Red Cross

December 2022

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Executive Summary

Entegrity performed a sustainability assessment of the American National Red Cross facility at 100 Red Cross Cr. in Pomona, CA. The assessment involved a review of the buildings' layout and operating procedures, utility data, air quality, waste stream, and infrastructure components such as the building envelope, lighting systems, domestic water heating and plumbing fixtures, mechanical equipment, and controls. Entegrity also investigated the potential for on-site generation and electric vehicle charging. A site visit on October 25th through October 27th with a return visit on December 6th, 2022, and a review of facility documentation and utility data provided by Red Cross operations staff facilitated the assessment.

The assessment was intended to comprehensively benchmark the sites' sustainability, identify the costs and potential savings of measures to improve the facility's sustainability over time, and outlay a capital plan to address upcoming infrastructure components nearing the end of their useful life. This report details the findings of the sustainability assessment at the American National Red Cross site in Pomona, California.

Figure 1 - American National Red Cross – Pomona, CA

Recommended Projects Overview

The costs and savings opportunities for the recommended energy conservation measures (ECMs) and facility improvement measures (FIMs) described in this report are summarized in the table below. Specific detail on each measure, including its associated costs, savings, and special considerations, is provided in the respective measure's infrastructure category section in this report.

Recommendations Summary

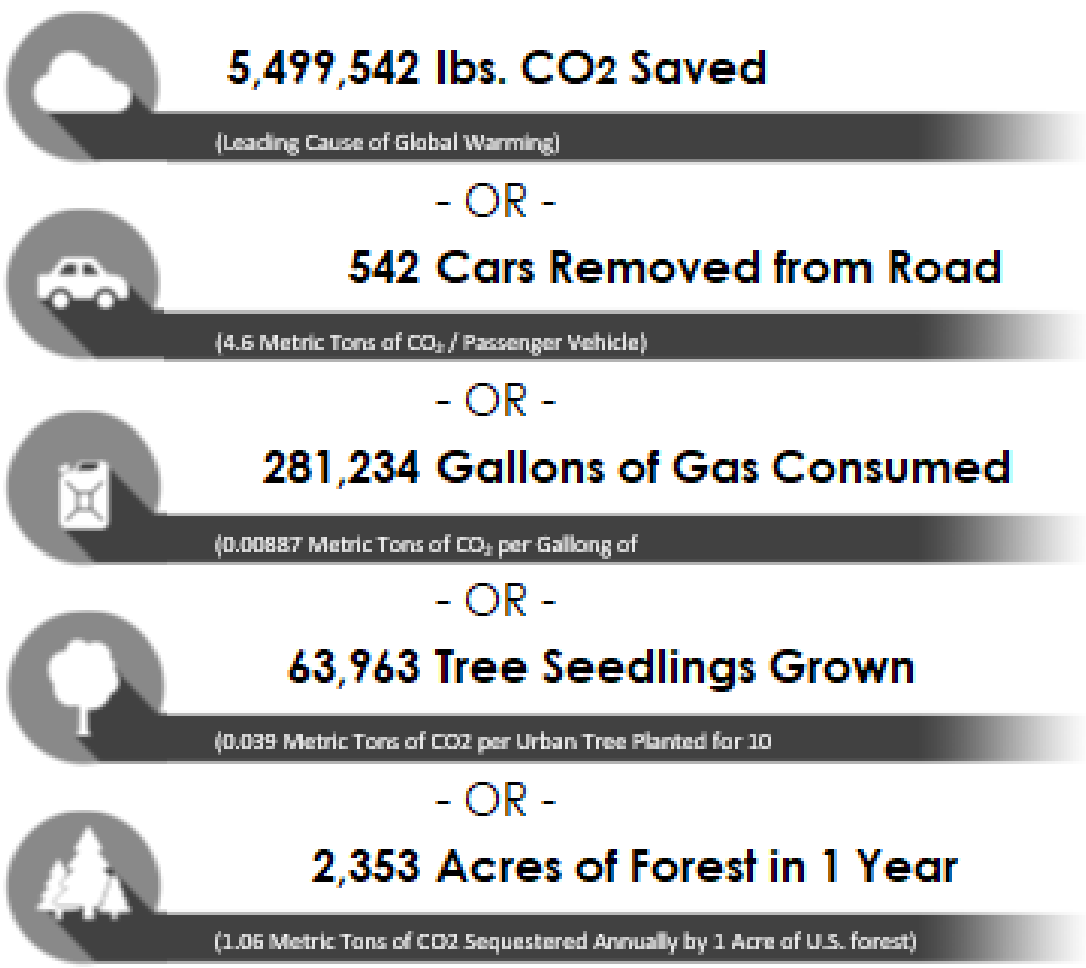
Table 1 – Measures Costs & Savings

Infrastructure Category	Measure	Priority	Cost ($)	Savings ($)	Simple Payback (yr)	lbs. CO2 Saved
Refrigeration	Refrigeration Replacement	High	Not Included	Not Included	-	-
Mechanical	Replace AHU 1	High	$ 1,825,000	$ 7,100	257	107,012
Mechanical	Replace AHU 4	High	$ 561,000	$ 2,700	208	40,695
Mechanical	Replace AHU 5	High	$ 751,000	$ 3,300	228	49,738
Mechanical	Replace AHU 8	High	$ 782,000	$ 3,300	237	49,738
Controls	Upgrade to new BAS	High	$ 117,000	$ 58,500	2	881,718
Controls	RCx on Dampers, Actuators, and Valves, & TAB	High	$ 111,000	$ 53,200	2	801,835
Mechanical	Re-pipe Return to Chillers for better water distribution	High	$ 89,000	$ 26,600	3	400,918
Lighting	Exterior Lighting	High	$ 86,000	$ 13,300	6	200,459
Controls	Setup/Setback for 2nd Floor	High	$ 90,000	$ 13,300	7	200,459
Mechanical	Replace All IDF and MDF systems except for Unit 2	High	$ 184,000	$ 10,700	17	161,271
Mechanical	RCx on VAV Boxes	High	$ 204,000	$ 5,400	38	81,389
Controls	Repair/Replace VFDs on pumping Systems and AHUs	High	$ 351,000	$ 18,600	19	280,341
Water	Repair Water Softener System	High	$ 106,000	$ -	No Payback	0
Envelope	Roof replacement	High	$ 7,769,000	$ 1,700	4570	25,623
Water	Water Bottle Filling Stations	Low	$ 25,000	$ -	No Payback	0
Water	Efficient Water Fixtures	Low	$ 237,000	$ 2,200	108	33,159
Mechanical	Replace AHU 2	Low	$ 1,825,000	$ 7,100	257	107,012

Infrastructure Category	Measure	Priority	Cost ($)	Savings ($)	Simple Payback (yr)	lbs. CO2 Saved
Mechanical	Replace AHU 9	Low	$ 782,000	$ 3,900	201	58,781
Envelope	New Loading Dock Door Curtains	Low	$ 104,254	$ 210	496	3,167
Envelope	Solar Shades	Low	$ 390,952	$ 420	930	6,333
Water	Xeriscaping	Medium	$ 1,173,000	$ 10,100	116	152,228
Controls	Add updated Chiller Control Sequences	Medium	$ 83,000	$ 26,600	3	400,918
Mechanical	Replace AHU 3	Medium	$ 1,825,000	$ 7,100	257	107,012
Mechanical	Replace boilers with condensing boilers	Medium	$ 1,012,000	$ 26,600	38	400,918
Mechanical	Replace AHU 7	Medium	$ 834,000	$ 3,900	214	58,781
Lighting	Lighting Occupancy Sensors	Medium	$ 150,000	$ 37,200	4	560,682
Lighting	Convert Type A LED to Type B	Medium	$ 78,000	$ 13,300	6	200,459
Mechanical	Install heat-pump chiller to serve HW/CHW loads	Medium	$ 616,000	$ 13,300	46	200,459
Lighting	Daylighting Controls and window blinds in the Lobby/Stair/ south exposure areas.	Medium	$ 319,000	$ 5,400	59	81,389
Mechanical	Replace AHU 4A	Medium	$ 561,000	$ 2,700	208	40,695
Mechanical	Replace AHU 6	Medium	$ 751,000	$ 3,300	228	49,738
Envelope	Insulate Roof Expansion Joint and Areas with removed equipment.	Medium	$ 5,487	$ 252	22	3,800
Solar	Roof Mounted Solar PV	Medium	$ 835,000	$ 46,000	18	615,697
TOTAL	**-**	**ALL**	**$ 24,632,693**	**$427,282**	**58**	**5,499,542**
TOTAL	**-**	**High**	**$ 13,026,000**	**$217,700**	**60**	**2,802,012**

Annual Environmental Impact

Reducing energy use is the quickest, most cost-effective way to reduce the emission of greenhouse gases that accompany the generation of electricity from fossil fuels. The volume of CO_2 saved for each measure is shown in Table 1 above if all the measures above were included, is an equivalent of **5,499,542 pounds of CO_2** emitted into the atmosphere could be reduced each year. A savings of 3,112,198 kWh of electricity and 4,457 MMBTU of natural gas per year from the above measures is equivalent to:



Reference: https://www.epa.gov/energy/greenhouse-gas-equivalencies-calculator

Implementation Strategy

It is recommended that the recommendations be implemented based on the priorities associated with each measure in Table 1 – Measures Costs & Savings, above in general; however, some measures with higher paybacks may need to be done before lower payback items for functionality. Each measure can be individually implemented over time, or incorporated into a larger, comprehensive project to optimize the building's performance on a shorter time horizon. The Capital Planning section of this report can help guide the timing of major capital improvement projects.

Generally, the "High Priority" individual measures and applicable adders may be implemented in the following sequence below to maximize facility utility and operations performance. Medium and lower priority measure are excluded from the following sequence.

1. Refrigeration Upgrades
    a. Although, savings and costs have not been assessed, refrigeration seemed to be the largest mechanical priority during the time of the audit.
2. Mechanical Upgrades
    a. Replace AHU 1, AHU 4, AHU 5, and AHU 8 while scavenging parts for the AHUs that are like each of the aforementioned AHUs. For example, AHU 1 parts will be used to retrofit AHU 3. AHU 3 will be replaced as a later date and AHU 2 will be retrofitted with AHU 3 parts.
    b. Replacements of split systems. Only one split system has been replaced and the remainder are at the end of their useful life.
    c. Retro-commission existing mixing boxes (approximately 149 boxes).
    d. Re-pipe return to chillers for better water distribution.
    e. Replace boilers with condensing boilers.
    f. Install heat-pump chiller to serve heating water and chilled water loads.
3. Lighting Upgrades
    a. Retrofit existing exterior fixtures lamps with LED bulbs.
    b. Install interior occupancy sensors in the main facility and warehouse.
    c. Daylighting controls in the lobby.
4. Controls
    a. Upgrade to new BAS
    b. Retro-commission all dampers, actuators and valves and perform a complete TAB.
    c. Employ setup and setback temperatures for unoccupied spaces on the 2nd floor.
    d. Repair/Replace VFDs on pumping systems and AHUs.
    e. Add updated chiller control sequences.
5. Solar Upgrades
    a. Roof-mounted solar photovoltaic system.

Savings Measurement & Verification

Measurement and verification (M&V) is the process of validating savings figures are being met once an energy savings measure has been implemented. For all proposed energy conservation measures (ECMs) that include savings, Entegrity has recommended one of the four measurement & verification options published by the International Performance Measurement & Verification Protocol (IPMVP). These options are selected according to the nature of the guaranteed savings, the interaction of the ECM with other ECMs on the same utility meter, and the cost of measuring the ECM as compared with the ECM's annual savings.

Each energy conservation measure's M&V strategy is detailed in the measure's recommendation costs and savings section. During a M&V process, savings will be compared against the annual baselines established in the Utility Analysis section Table 7 – Baseline Consumption & Cost. Below is a summary of each IPMVP M&V Option.

Table 2 - IPMVP Measurement & Verification (M&V) Options

Option	Description
A: Retrofit Isolation, Partial Measurement	Savings are determined by partial field measurement of the energy use of the system(s) to which an ECM was applied, separate from the energy use of the rest of the facility. Measurements may be either short-term or continuous. Partial measurement means that some but not all parameter(s) may be stipulated if the total impact of possible stipulation error(s) is not significant to the resultant savings.
B: Retrofit Isolation, Full Measurement	Savings are determined by field measurement of the energy use of the systems to which the ECM was applied, separate from the energy use of the rest of the facility. Short-term or continuous measurements are taken throughout the post-retrofit period. Meters are typically in place throughout the post-retrofit period to track variations in energy use.
C: Whole Building Analysis	Savings are determined by measuring energy use at the whole facility level. Short-term or continuous measurements are taken throughout the post-retrofit period. Analysis of whole facility utility meter or sub-meter data using techniques from simple comparison to regression analysis. Multifaceted energy management program affecting many systems in a building. Energy use is measured by the gas and electric utility meters for a twelve-month base year period and throughout the post-retrofit period.
D: Calibrated Simulation Model	Savings are determined through simulation of the energy use of components or the whole facility. Simulation routines must be demonstrated to adequately model actual energy performance measured in the facility. This option usually requires considerable skill in calibrated simulation.

Facility Description

For the assessment of the American National Red Cross facility in Pomona, CA, Entegrity considered the facility's use and age, occupancy and operating schedule, and utility use and cost profiles, as well as maintenance staff feedback from on-site interviews. Analyzing these parameters enables Entegrity to compare the Pomona facility's metrics to other Red Cross facilities and facilities outside of Red Cross' portfolio that have similar construction and operating profiles.

The Pomona, CA site is a biomedical facility that is responsible for facilitating blood and plasma lab work, storage, and delivery. The Pomona Facility has lab space, refrigerated and unconditioned storage areas, a loading dock, and other spaces that service medical operations on the first floor. The second floor is primarily made up of office space, conference rooms, and classrooms. The roof screen wall contains most of the air-side HVAC equipment that conditions the building. The space type distribution at the Pomona facility is 65% Office Space, 20% Lab Space, and 15% Warehouse space.

Figure 2 - Red Cross Pomona, CA Facility Site Map

General information on the facility's area and age, uses, and occupancy details are provided in the tables below.

Table 3 – Facility Area, Age, and Primary Use

Facility	Gross Floor Area (sqft)	Year Constructed	Primary Use
Pomona Facility (B11254)	230,000	2005	Blood Processing & Warehouse

Table 4 – Typical Occupancy Load

Facility	Regular Occupants		Visitors		
	Average Daily Full-Time Count	Average Daily Part Time Count	Days per Week with Visitors	Daily Visitor Count	Average Duration of Visit
Pomona Facility (B11254)	82-205	N/A	7	40	1.25 hours

Table 5 – Weekly Hours of Operation

Facility	Weekly Operating Hours (Total number of hours)	Weekday Operating Schedule	Weekend Operating Schedule
Pomona Facility (B11254)	168 hours	24/7	24/7

Utility Analysis

Utility Baseline

The utility providers for the Red Cross Pomona facility were determined from historical billing data and information provided by facility operations staff. Utility providers for the facility are documented in the table below.

Table 6 – Utility Providers

Utility	Utility Provider
Electric	SoCal Edison
Natural Gas	SoCal Gas
Water	Cal Poly

Historical utility data analyzed through this assessment includes historically billed consumption, demand, costs, and utility rate structures from 2019 to current date. Red Cross Pomona annual utility consumption and cost data is summarized in the table below. The baseline period for this data is the twelve-month period spanning July 2021 through June 2022.

Table 7 – Baseline Consumption & Cost

Utility	Annual Consumption	Consumption Units	Annual Cost ($)
Electric	6,894,600	kWh	$1,020,858
Natural Gas	9,873	MMBtu	$155,692
Water	12,650	kGal	$84,037
TOTALS	**-**	**-**	**$1,260,587**

Energy and Cost Trends

The figures below present utility data in various formats that help in visualizing patterns over time. These figures all show trends in consumption, demand, and cost for the facility.

The monthly cost figure below shows that during a typical year, utility costs are highest between May and June – and during this period costs are driven by electric utility use. Natural gas use increases in winter times, while water costs and consumption remain relatively flat month over month.

Figure 3 - Monthly Utility Costs by Utility Type

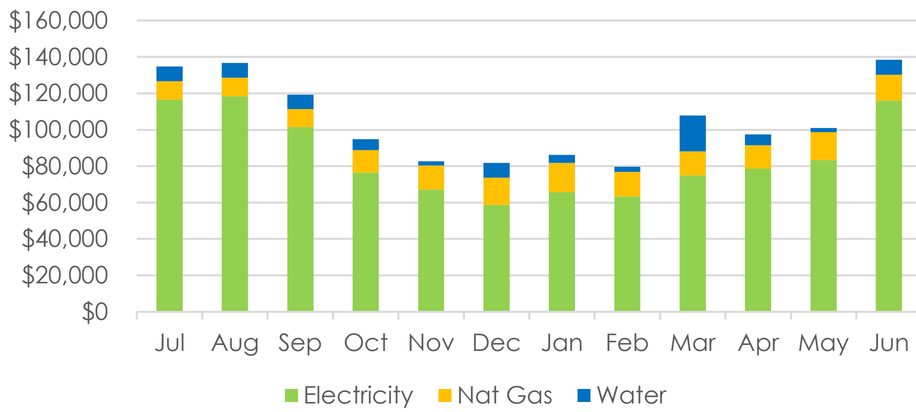
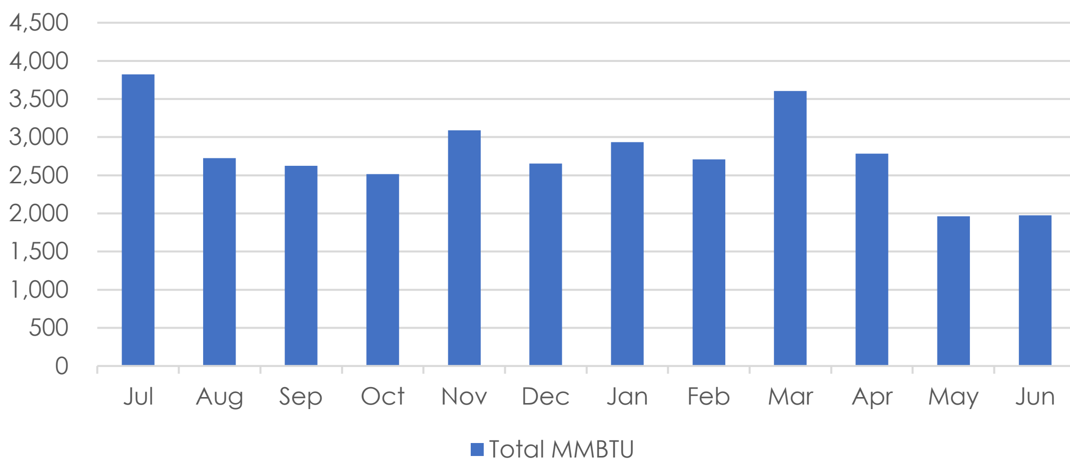
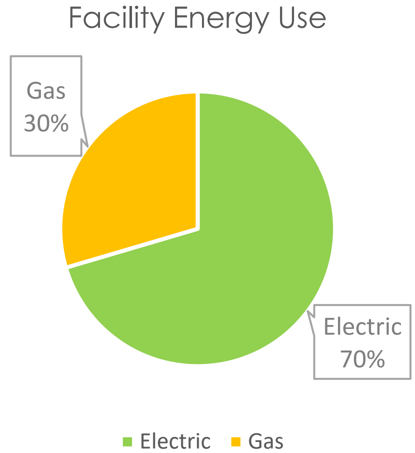


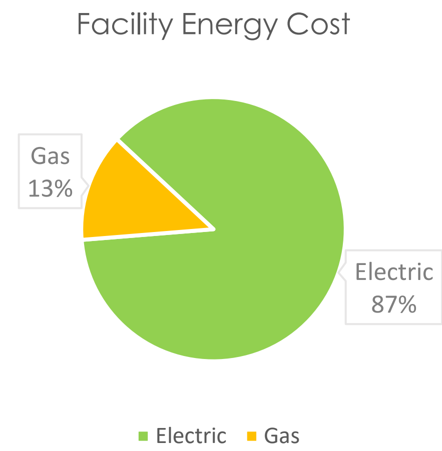
Figure 4 – Monthly Total Energy Consumption (MMBtu)



The graphs below summarize facility energy by use and cost. Energy use and cost is broken out by utility and compared to the total consumption and spend. The analysis shows that, while natural gas heating energy makes up approximately 30% of the facility energy usage, it represents approximately 13% of the annual energy cost. This shows that for the Red Cross Pomona facility, electric energy is significantly more cost demanding than natural gas, and electric energy waste should be the primary target for utility cost savings.

Figure 5 – Energy Use vs. Energy Costs





Electrical data in the figures below shows a trend of slightly decreasing utility consumption over time, while costs over time increase slightly. Typically, the monthly peak demand for the building would reveal any substantial seasonal variations that typically present themselves when a large portion of the peak demand is attributed to building heating and cooling loads, which are lower in the spring and fall seasons. This information has not been analyzed.

Figure 6 – Monthly Electrical Consumption Trend (kWh)

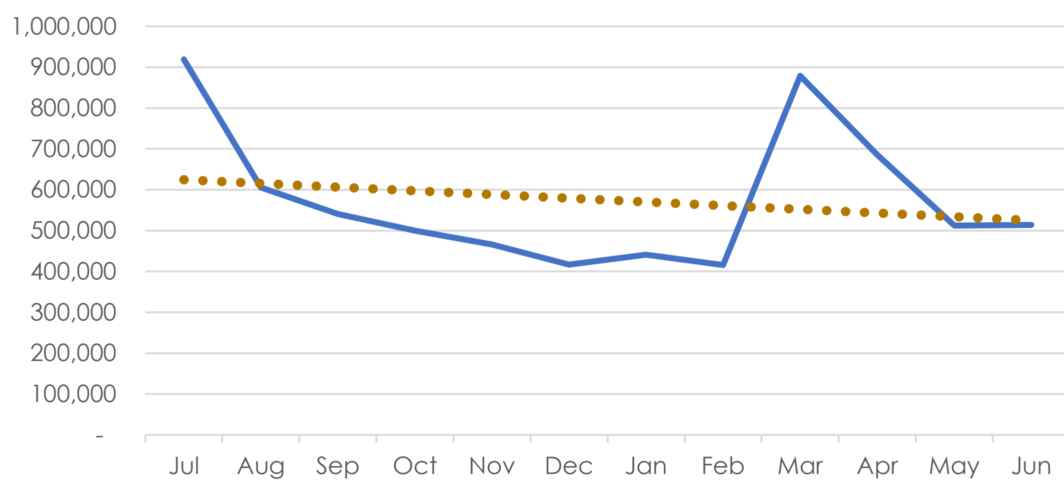
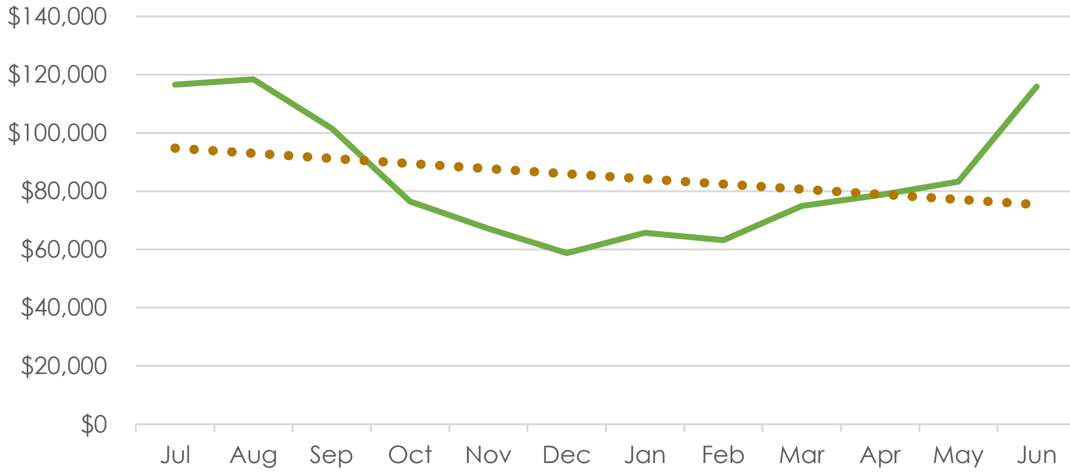


Figure 7 – Monthly Electrical Cost Trend ($)



Analysis of natural gas data shows a strong correlation with temperature. Use and costs are highest in the winter months, indicating that the primary driver for natural gas consumption is HVAC heating. Considering all monthly data, the facility's energy consumption has been remained trending down slightly (Average use of 944 MMBTU per month in 2021 and 702 per month in 2022), while costs have increased over this same period.

Figure 8 – Monthly Natural Gas Consumption Trend (MMBtu)

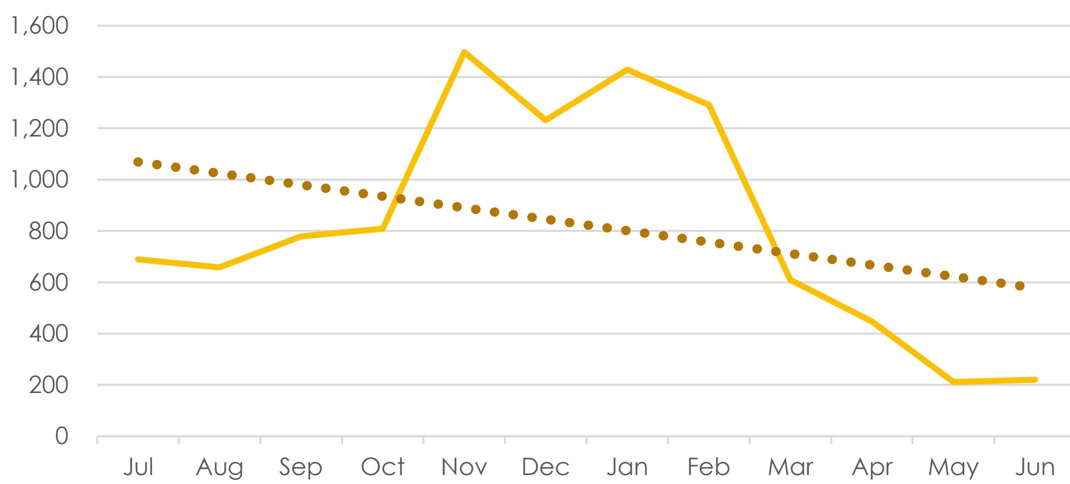
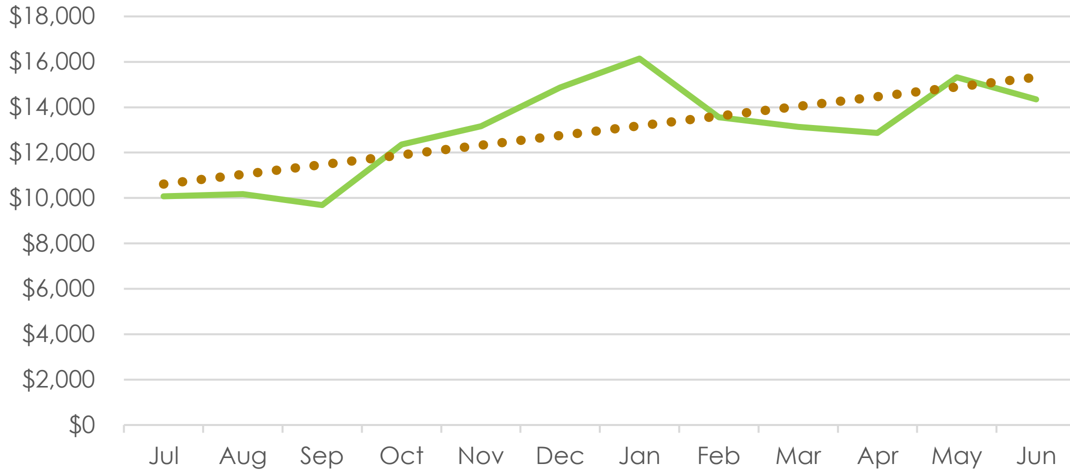


Figure 9 – Monthly Natural Gas Cost Trend ($)



Water and sewer consumption and costs show a slight decrease in costs and usage over time. Overall, water is a small part (7%) of the utility makeup of the total utility costs at the Pomona facility.

Figure 10 – Monthly Water Consumption Trend (kGal)

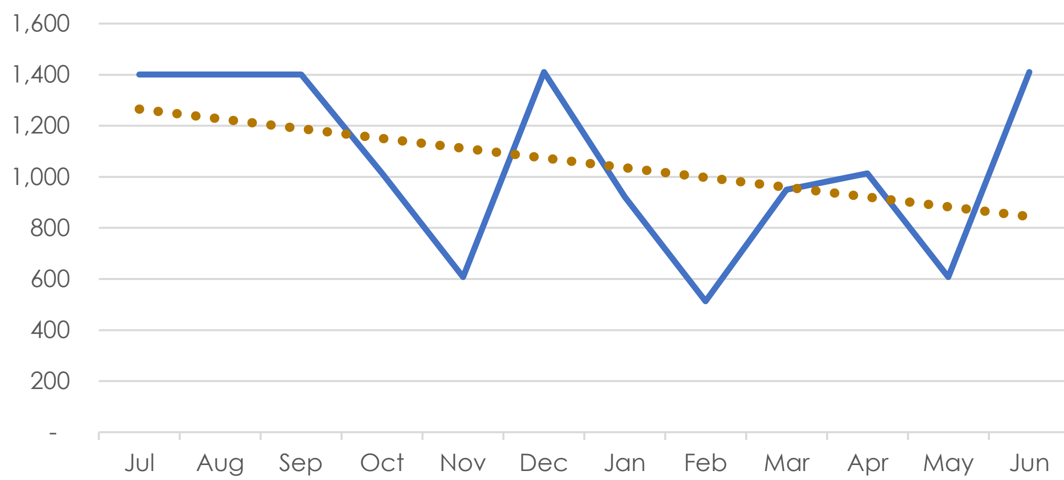
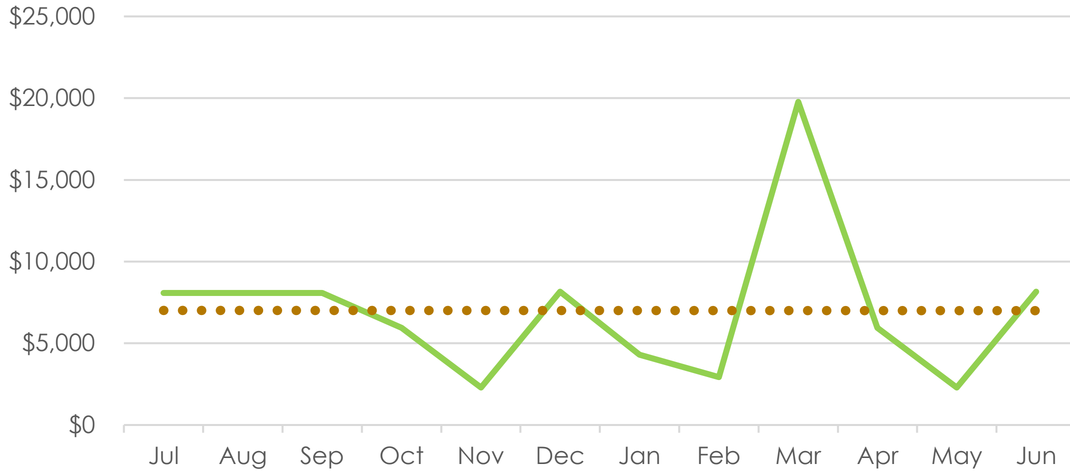


Figure 11 – Monthly Water Cost Trend ($)



Utility Performance Metrics

Benchmarking is the practice of comparing the measured performance of a facility or campus to itself, its peers, or established norms. Benchmarking serves as a mechanism to measure energy performance of a building over time, relative to historic performance or other, similar buildings. Entegrity has benchmarked the Red Cross facility in Pomona using energy and cost metrics.

Energy use intensity (EUI) is one metric investigated in our utility analysis. EUI is a value used to quickly compare a building's annual energy use, measured in energy consumption per square foot (kBTU/sqft). The lower the building's EUI, the better its energy performance. This metric is utilized by the Department of Energy and their Commercial Building Energy Consumption Survey (CBECS) to help establish benchmarks for many different building types. EUI can also be used to set energy targets for new and existing buildings. Because it is based solely on consumption and building area, utility cost differences between compared facilities are not a factor.

The Red Cross Pomona facility has an energy use intensity (EUI) of 163.3 kBTU/sqft. CBECS groups benchmarking metrics into 75 building types. The characteristics of the Red Cross facility in Pomona has various space types that include office space, lab space, and both refrigerated and conditioned warehouse space. The national weighted median comparative EUI of deducted from the space types and their representative areas sums to 89.6 kBTU/sqft. Achieving this average EUI would result in a 45% reduction in energy use at the Pomona facility. As noted, the refrigeration equipment, though not quantified, is believed to be a large part of the energy consumption issue at this facility. It should be noted that the Pomona Red Cross facility has 24/7 operations and houses significant medical and refrigeration equipment. A detailed model and load analysis would be a more accurate method of energy use and savings; however, the benchmarking method used should give general guidance for upgrades.

Table 8 - Energy Use Intensity (EUI) Targets

Space Type	kBTU / ft^2
Office	51.2
Lab	115.3
Warehouse	22.7
Pomona	163.3
Target/Weighted Median	89.6

Other important metrics used to understand a building's utility costs and savings opportunities are the utility cost index (UCI), which represent the total annual cost per building square foot, and energy cost index (ECI), which represents total annual energy utility cost per square foot. The utility costs and the square footage for the Red Cross Pomona facility represent a utility cost index (UCI) of $5.48/sqft for electricity, natural gas, and water utilities, while the energy cost index (ECI) calculates to be $5.12/sqft for electricity and natural gas utilities alone.

Cost indexing considers the impact of local utility rates in addition to all of the existing conditions that affect energy and water use intensity, such as building age, occupancy, system designs, and climate. Analyzing cost indexes across a portfolio of facilities demonstrates how local utility rate structures impact operating costs for buildings with similar energy requirements. While energy cost and energy use generally go hand-in-hand, some measures, such as utility rate correction, can reduce energy costs without impacting energy use.

Energy Star Benchmarking

Energy Star is a program developed by the Environmental Protection Agency (EPA) which provides credible and unbiased energy information related to both energy and water consuming products and building performance.

One of Energy Star's most used tools is Energy Star Portfolio Manager which allows building owners to track energy and water use while also entering the specific property use details, such as gross square footage, number of workers, and occupied hours. Once all the use details and the energy consumption for the building have been entered the tool will calculate a 1-100 Energy Star score. A score of 1 indicates for every 100 similar building types throughout the United States, this building has the worst energy performance. A score of 50 indicates the building matches the median energy performance, and a score of 100 indicates the building is performing better than all buildings in its peer group. Since the facility is not a standard use facility, Energy Star scores are not a good indicator of performance relative to other buildings in Energy Star, but may be used to compare against other Red Cross facilities. A score for this facility was not achievable due to its large amount of unoccupied office space.

Energy Star Portfolio Manager is becoming more relevant as several cities are developing or have already adopted legislation requiring commercial building owners to track their energy and water usage using this tool. Additionally, government agencies, such as the USDA, are mandated to only lease space from an Energy Star Certified building, which achieves a score of 75 or above. Energy Star has become the industry standard for striving towards and achieving energy efficiency.

Entegrity entered the Red Cross facility in Pomona into the Energy Star's Portfolio Manager in the Office Building peer group for benchmarking. The Office facility type requires an accurate account of Gross Floor Area, Weekly Operating Hours, Number of Workers on Main Shift, Number of Computers, and Percent That Can Be Cooled. Additionally, Portfolio Manager requires an office building to separate both parking lot floor area and any vacant space in the building. Entegrity worked with the Red Cross facility operators and used the site assessment to determine all Portfolio Manager property use details described in the table below.

Table 9 - Portfolio Manager Property Use Details

Category	Variable	Value
Office	Gross Floor Area (sqft)	150,400
	Weekly Operating Hours	50
	Workers on Main Shift	100
	Number of Computers	100
	Conditioned Area (%)	100%
Laboratory	Gross Floor Area (sqft)	46,500
	Weekly Operating Hours	168
	Workers on Main Shift	82
	Number of Computers	30
Non-Refrigerated Warehouse	Gross Floor Area (sqft)	31,500
	Weekly Operating Hours	168
	Workers on Main Shift	23

	Cold Storage (%)	0%
	Conditioned Area (%)	100%
Refrigerated Warehouse	Gross Floor Area (sqft)	1,600
	Weekly Operating Hours	168
	Workers on Main Shift	23
	Cold Storage (%)	100%
	Conditioned Area (%)	100%

Available Utility Incentive Programs

Utility companies often provide incentives for projects that reduce energy consumption or demand. Incentives may be given by utilities as rebates for installing energy efficient equipment such as LED light fixtures or condensing gas-fired furnace. Utilities sometimes provide custom rebates for more complex measures and validate savings using pre- and post-measurement or other verification methods.

The site's utility providers and rebate programs are documented in the table below.

Table 10 – Utility Incentive Programs

Utility Provider	Incentive Available	Incentive Programs	Program Administrators
SoCal Edison	YES	Illuminate California	TRC
SoCal Gas	YES	Energy Efficiency Rebates for Business (EERB)	SoCal Gas

Some of the recommendations Entegrity has provided to improve the sustainability for the Red Cross site in Pomona, CA are incentivized by the site's utility providers. Incentive estimates for each measure are provided in the table below.

Table 11 – Incentivized Measured

Infrastructure Category	Measure	Impacted Utilities	Incentive Available	Incentive Program	Incentive Rate
Gas	Boilers, Water Heaters	Gas	Up to $500,000 per site, and up to $1,000,000 per customer, per year.	Energy Efficiency Rebates for Business (EERB)	$0.05-$8.00/ kBtuh
Lighting	Type B and Type C LED T8 Tubes and high and low bay luminaires	Electric	Varies	Illuminate California	$1.05-$13.25/bulb

Arc Performance Score

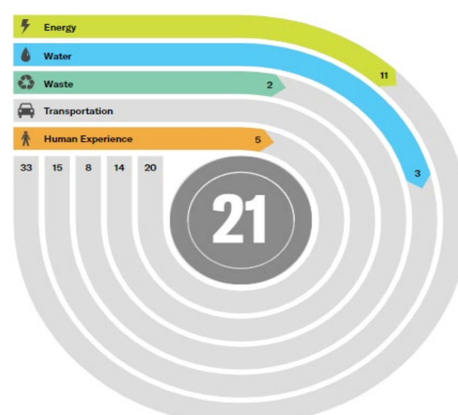
Arc is an online platform that benchmarks the operational performance of buildings by analyzing data across five categories: energy, water, waste, transportation, and human experience. The Arc Performance Score is generated by entering building performance data into the platform and comparing that building performance data to baseline data in Arc. The building achieves a score from 0 – 100 with a higher score reflecting better performance. For more information on the methodology of the scoring see the [Arc Performance Score Core Concepts document]. For the American National Red Cross facilities, the transportation performance category is not in scope, which results in a score of zero for this category. The occupant satisfaction component of the human experience performance category is not in scope, which results in a partial score for this category. Because all categories are not included, the overall Arc Performance Score is low for the building. It would be more beneficial to review each category score to compare performance to the local and global averages as well as across the Red Cross portfolio of buildings. An analysis of each category is included below.

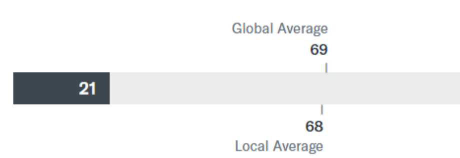
Facility Arc Performance

Metric Scores

- **33** Energy
- **22** Water
- **25** Waste
- **0** Transportation (not in scope)
- **26** Human Experience (partially in scope)

Arc Performance Score (Weighted Metric Scores)

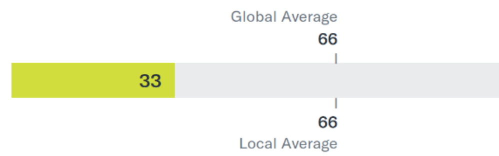


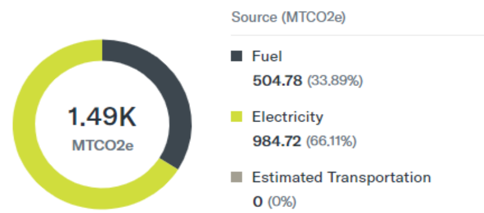


The overall Arc Performance Score is calculated by combining the weighted scores of each performance category. Each category has its own metric weight determined by the LEED v4.1 rating system. Energy's metric weight is 33%, water is 15%, waste is 8%, and human experience is 20%. For the Pomona facility, its overall Arc Performance Score is 21/100. The figure above shows the Pomona facility's score compared to the local and global averages for similar buildings. To maintain the Arc score over time each category must be updated at minimum yearly and ideally monthly for energy and water data.

Energy Performance

33 33/100

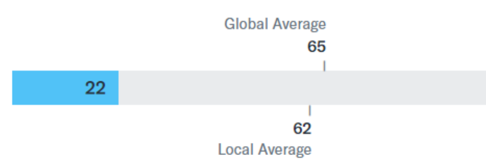




The energy performance score is calculated by converting the most recent 365 days of energy consumption data from ENERGY STAR Portfolio Manager into its carbon dioxide equivalent emissions using local emissions factors. Source energy and greenhouse gas emissions data is compared to Arc's baseline. An energy performance score of 100 requires the measured performance of a building to be near net zero energy and net zero carbon. The weighted energy performance score is calculated by multiplying the metric score of 33 by the category's metric weight of 33%. Pomona's weighted energy performance score is 11, as shown in the Arc Performance graphic. The line bar above shows how the Pomona facility's energy score compares to the local and global averages for similar buildings. The donut chart shows the Pomona facility's greenhouse gas emissions from natural gas and electricity.

Water Performance

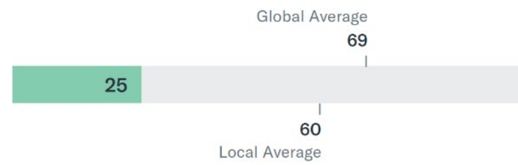
22 22/100



The water performance score is calculated by the most recent 365 days of water consumption data from ENERGY STAR Portfolio Manager. Potable water consumption data for a building is compared to Arc's baseline. A water performance score of 100 requires low potable water use per occupant. The weighted water performance score is calculated by multiplying the metric score of 22 by the category's metric weight of 15%. Pomona's weighted water performance score is 3, as shown in the Arc Performance graphic. The bar chart above shows how the Pomona facility's water score compares to the local and global averages for similar buildings.

Waste Performance

25 25/100



The waste performance score is calculated from the results of a one-day waste audit that tracks the total waste generated and the amount of waste diverted. Waste generation and waste diversion data for a building is compared to Arc's reference set. A waste performance score of 100 requires low waste generation and high waste diversion. The weighted waste performance score is calculated by multiplying the metric score of 25 by the category's metric weight of 8%. Pomona's weighted waste performance score is 2, as shown in the Arc Performance graphic. The bar chart shows how the Pomona facility's waste score compares to the local and global averages for similar buildings. Of the waste measured, Pomona recycled or otherwise diverted 33% by weight of the material from going to the landfill.

Existing Recycling Process

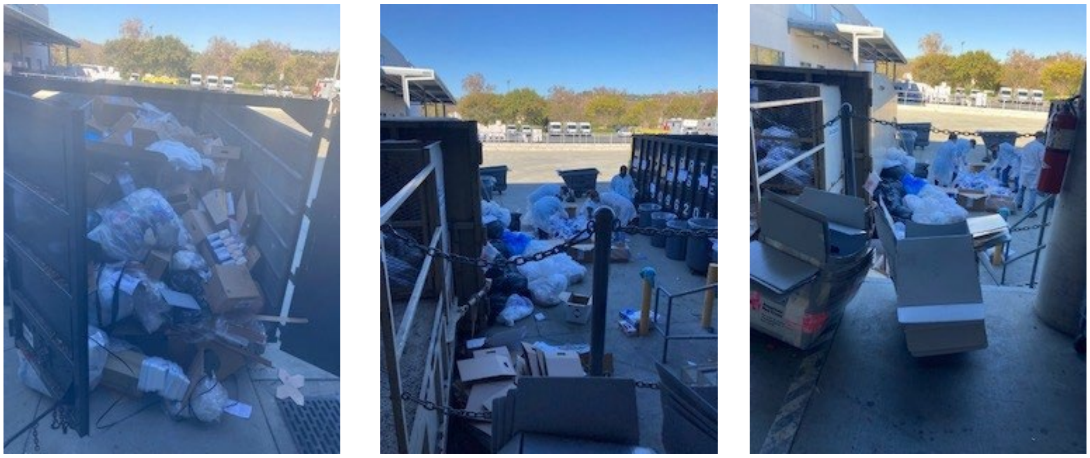
The Pomona facility provides outside containers for waste and cardboard recycling through the haulers Burrtec Waste Inc. and Epax Systems Inc.

Figure 12 – Existing Facility Recycling

Waste Audit Process

Red Cross staff placed all waste and recycling from the previous day in a centralized location for a one-day waste audit. The waste was sorted into two categories: trash and cardboard. The waste audit team comprised entirely of Red Cross employees. All trash and cardboard were initially weighed and manually logged.

Figure 13 – Waste Audit Setup



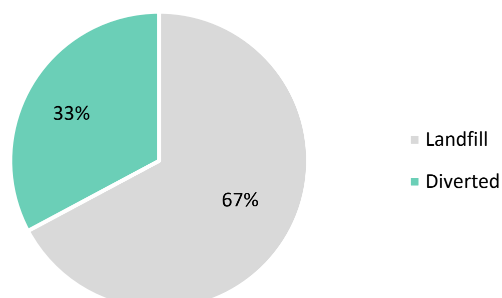
Waste Audit Outcome

The initial weights of trash and cardboard were 811 lbs. and 396 lbs. respectively for a total of 1,207 lbs. of waste generated and 396 lbs. of waste diverted. Figure 14 shows the percentage of waste sent to the landfill was 67% and the percentage of waste diverted was 33%.

Table 12 – Waste Audit Data

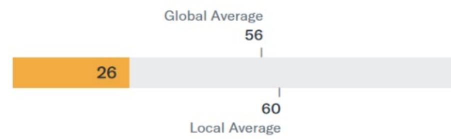
Measure		Weight (lbs)
Landfill	Trash	811
Diverted	Cardboard	396
Total Waste Generated		1207
Total Landfill		811
Total Diverted		396
Landfill (%)		**67%**
Diverted (%)		**33%**

Figure 14 – Waste Improvement



Human Experience Performance

26 26/100



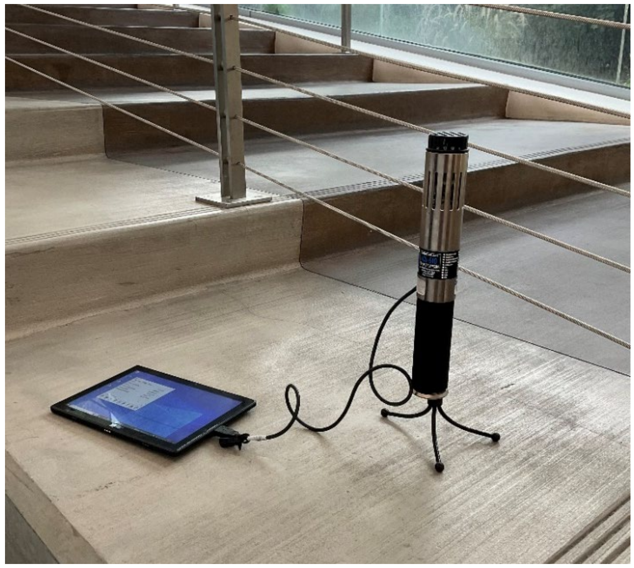
The human experience performance score is based on an occupant satisfaction survey and air quality testing results. Occupant satisfaction survey's is not in the scope of this project. Entegrity measured indoor air quality through carbon dioxide (CO2) and total volatile organic compounds (TVOC) concentrations. Ideally the CO2 scores are below 660 ppm and TVOC scores are below 200 µg/m³ which will lead to a higher overall Arc score. The weighted human experience performance score calculated by multiplying the metric score of 26 by the category's metric weight of 20%. Pomona's weighted human experience performance score is 5, as shown in the Arc Performance graphic. The bar chart shows how the Pomona facility's human experience score compares to the local and global averages for similar buildings.

Indoor Air Quality (IAQ)

As a part of Entegrity's sustainability assessment, indoor air quality (IAQ) testing was performed in accordance with the EPA Compendium of Methods for the Determination of Air Pollutants in Indoor Air and in accordance with Arc requirements for IAQ. IAQ testing for Arc requires measurement of occupied areas TVOCs and CO2.

Indoor air quality testing for the Red Cross facility in Pomona was conducted by taking a test sample in locations representative of each major occupied space type. The space types analyzed for the facility included a donor center, manufacturing room, cafeteria, stairwell, two cubicles, three hallways, warehouse, label storage, and a lab. The locations for testing were selected to sample representative air contaminants in occupiable areas. Test samples were taken in the breathing zone, between 3 and 6 feet above the floor. All samples were taken with the HVAC system operating in as-found, existing conditions – during normal facility operating hours in the occupied facility.

Figure 15 - Typical IAQ Testing Setup



Indoor air quality performance makes up half of the total points available in the human experience Arc score, with TVOC and CO_2 each contributing 25% to the human experience score. The outdoor baseline averages for TVOC and CO_2 were 0.00 µg/m³ and 373.389 ppm. The table below shows the readings from each individual location as well as the average score across all zones.

Table 13 – Indoor Air Quality Measurements

Test Locations	TVOC Measurement (µg/m³)	TVOC Target (µg/m³)	CO2 Measurement (ppm)	CO2 Target (ppm)
Donor Center	407.63	500	447.00	1000
Manufacturing	741.57		576.7	
Cafeteria	255.32		475.1	
Stairwell	116.125		503.25	
Cubicle F03	95.611		479.05	
Cubicle K11	32.8125		491.25	
Hallway	0.625		457.5	
Conference Room 305	0.8		433	
Hallway by Conference Room 305	10.64		446.8	
Warehouse	171.38		432.60	
Label Storage	173		436.35	
Hallway	0.00		432.6	
Lab	51.315		543.2	
Average Score	158.22		473.42	

Both TVOC and CO_2 measurements are impacted by the space HVAC ventilation rates at the time of measurement. CO_2 measurements are specifically impacted by the recent and time-of-measurement space occupancy, while TVOC may be impacted by cleaning chemicals and cleaning schedules, space finishes and furnishings such as paint and carpet selections, and other sources of air contamination.

Recommendations

Table 14 - Arc Performance Score Recommendations

Performance Category	Recommendation
Energy	Implement some or all of the energy savings measures identified elsewhere in the report.
Water	Implement some or all of the water savings measures identified elsewhere in the report.
Waste	In the waste audit, Red Cross made note of 473 lbs of waste that could be recycled if additional recycling procedures were established: 1. Mixed paper – 52 lbs 2. Glass – 4 lbs 3. Aluminum cans – 2 lbs 4. Plastics – 73 lbs 5. Food waste – 14 lbs 6. Metals – 3 lbs 7. Plastic bags – 238 lbs 8. Blood product bags – 87 lbs The implementation of plastic recycling would increase the diversion percentage from 33% to 39%.
IAQ	TVOC measurements were elevated in most areas tested, with the manufacturing area above the target limit. This points to interior containment sources being brought into the building. 1. Confirm filtration media is in place for all outdoor air systems. Ensure proper ventilation rates and schedules for the manufacturing area. 2. Reviewing existing cleaning products and protocol and as available, switch to Green Seal certified cleaning products. Green Seal certifies products with reduced human health an environmental impacts and meets ISO 14020/14024 and Global Ecolabelling Network's Internationally Coordinated Ecolabelling System standards. Increase indoor air quantity in spaces where cleaning products must be used often. 3. Look for any sources of interior air contamination like air fresheners, "plug in's", candles and similar and remove those from the building. 4. Educate staff about individuals impacts on Indoor Air Quality.

Refrigeration Equipment

The refrigeration equipment was not included in the cost and savings evaluation of this report; however, it was identified as a significant contributor of wasted energy at this facility. It was noted that refrigeration seems to have been added in certain areas, and changed or replaced in other areas.

Not only do the changes in the refrigeration equipment and placement of that equipment not match the original building design load, the shading system installed to reduce energy consumption of those systems is damaging the roof membrane. Refrigeration equipment is also responsible for wasted water, as water is being sprayed onto air-cooled condenser coils to improve equipment efficiency. Replacement and ongoing maintenance of refrigeration equipment, the shading structure, and the water spray systems create a large operational cost at this facility.

Existing Equipment

The Red Cross facility in has a mixture of coolers, freezers, and blast freezers used throughout the facility. In the photos below, the use of water to cool air coils has been a strategy to aid refrigeration systems on extremely hot days. A load study may need to be conducted that considers the updated loads present in the facility due to refrigeration equipment changes since the building was originally opened. Changes and addition of equipment, as well as malfunctioning refrigeration, appear to contribute to the need for additional space cooling via portable air-conditioning systems.

During the sustainability assessment, Entegrity did not document the refrigeration equipment since a separate refrigeration assessment was said to be in process.

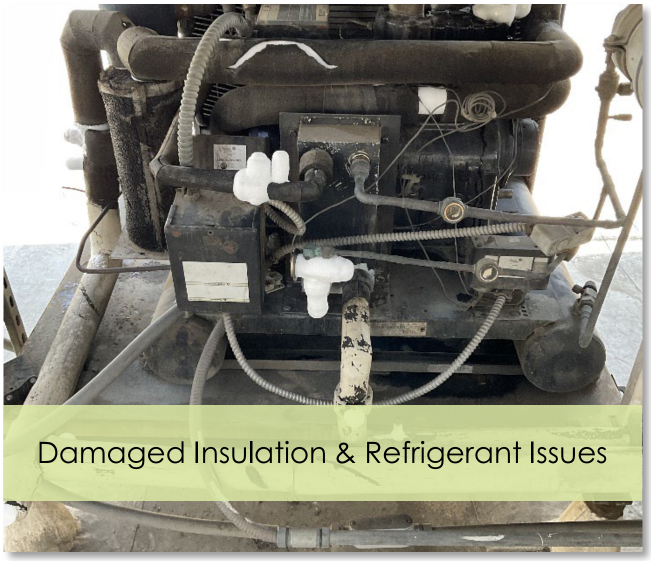
Photos of existing equipment documented during the assessment are provided for reference below.

Water Sprayer for Air Cooled Coil

Calcification on Coil

Shading Structures

Damage to Roof Membrane from Shade Structure



Damaged Insulation & Refrigerant Issues

Blast Freezers

Lighting

Typically, lighting energy represents 25-35% of a facility's electrical energy consumption. Light-emitting diode (LED) lamps and fixtures can reduce the lighting demand by up to 80% over other lighting technologies, and LEDs lamp life is typically 100-200% higher than other lamp types. Upgrading older, inefficient lighting technologies to LED lamps and fixtures where they don't currently exist is among the most cost-effective options building owners have to reduce facility operating costs from both a utility and maintenance cost perspective. Coupling LED advantages with lighting control strategies such as occupancy sensing for interior areas and daylight sensing for exterior fixtures can generate significant lighting energy savings.

Interior Fixtures & Controls

The primary lighting technology at the Pomona, CA Red Cross facility is LED. Exterior lightning was excluded in the previous LED upgrade and needs to be upgraded to LED. Most interior troffer light fixtures use LED technology, as well as recessed can lighting fixtures. Existing interior lighting controls are point-of-use, manual switches. No occupancy controls were documented for the lighting systems on site. Particularly on the Second floor, where occupancy is low, occupancy sensors could be a good savings strategy.

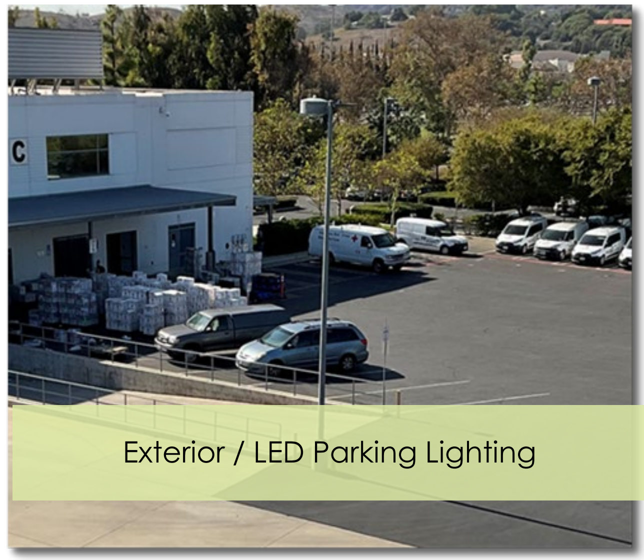
Stock / T8 Lamps

Interior / LED Troffer

Exterior Fixtures & Controls

The exterior fixtures were excluded from the prior lighting audit and existing ground mounted metal halides remain and could be update to LED fixtures. Exterior lighting appears to be controlled via photocell controls.


Exterior / Fluorescent Can Fixtures


Exterior / LED Parking Lighting


Exterior / Bollard and Accent Lighting


Exterior / LED Parking Lighting

Observed Issues & Recommendations

LED technology has been implemented in the interior and the majority of the exterior of the Pomona Red Cross facility. Converting the full building to LED technology and updating controls represents a cost-efficient opportunity for reducing energy use.

1. Exterior Lighting Fluorescent Fixtures – Complete the LED retrofit to include the remaining exterior fixtures.

2. Interior Lighting Occupancy Controls - Update interior lighting controls to include occupancy sensors in corridors, restrooms, and utility rooms.

3. Interior Lighting Controls - and installing a daylight sensor or lunar calendar schedule to the lobby lighting will maximize utility savings from implementing a lighting project. Blinds were also added to this measure, but a more detailed analysis of lighting controls only would likely render improved results.

Recommendation Costs & Savings

Recommendations for lighting at the Pomona, CA Red Cross facility are summarized in the table below.

Table 15 – Lighting Recommendation Costs & Savings

Measure	Priority	Cost ($)	Savings ($)	Simple Payback (yr)
Exterior Lighting	High	$86,000	$13,300	6
Lighting Occupancy Sensors	Medium	$150,000	$37,200	4
Daylighting Controls and window blinds in the Lobby/Stair/ south exposure areas.	Medium	$319,000	$5,400	59
Convert Type A LED to Type B	Low	$78,000	$13,300	6
TOTAL		**$633,000**	**$69,200**	**9**

Incentive or rebate program applicability for the recommendations above are documented in the Utility Analysis, Available Utility Incentive Programs section of this report.

The recommended measurement and verification (M&V) approach for validating savings realized from implementing recommended projects above is the International Performance Measurement and Verification Protocol Option A. In the case that these recommendations are implemented concurrently with other energy conservation measures, other M&V options may be more suitable to capture the interactive effects between energy-using systems, such as Option C or D.

Water

Water is a resource that all building owners depend on for sanitation, food preparation, irrigation, sustenance, and other needs. In most cases, water is provided to the building owner by a single entity which bills the owner monthly for the use of both water and sewage infrastructure. While typically less expensive than electricity and gas utilities over the course of a year, water costs can add up.

Flow & Flush Fixtures

At the Red Cross facility in Pomona, there is single men's and women's restrooms on each floor. Restroom flow fixtures were observed to be 2.2 gallons per minute, while water closets were unlabeled, but expected to have a 1.6 gallon per flush rating (GPF). These fixtures are in line with current building code flow and flush rates.

Three drinking water fountains were documented at the facility. These fountains were original to the building's construction.

Domestic Hot Water Heating

Water also impacts energy use. At Red Cross Pomona, domestic water heating is accomplished with electric heat, supplied by an electric tank type water heaters located in the ceiling of restrooms.

Mens RR / 2.2 GPM Aerator

Mens RR / 1.6 GPF Water Closet

Irrigation and Landscaping

Water also impacts landscape maintenance. At Red Cross Pomona, reclaimed water is used to water non-native species of plants. Also, the timeclock currently operates on a manual schedule. During the audit, over watering was observed with water flowing into the parking lot. It was also noted that trees have died and been replaced due to excessive watering or poor root systems.

Exterior / Irrigation Controls


Exterior / Landscaping

Ice Capture

Large volumes of ice waste fill the north loading dock areas daily. Some ideas for using this ice for pre-cooling for various systems has been discussed. This would be a non-standard measure and required a more detailed analysis to determine feasibility.

Ice Waste - Potential for Ice Capture

Observed Issues & Recommendations

At Red Cross Pomona, the total fixture quantity is low, and existing flow and flush rates could only be marginally improved with new fixtures or retrofits such as installing new flush valves or sink aerators. Water closet flush rates of 1.28 GPF, urinals of 1.0 GPF, and lavatory faucet flow rates of 0.5 GPM are available. As a result, water fixture upgrades do not represent a significant water utility cost savings opportunity.

Water heating energy savings could be expected from updating existing domestic water heating tanks to instantaneous or a heat-pump system. However, due to a low demand for domestic hot water at the facility, Entegrity recommends replacing the existing tanks with instantaneous water heaters when the existing equipment is due for replacement.

Newer, more efficient drinking water fountains are now available, and those with integrated water-bottle filling stations can provide building occupants an easier avenue to staying hydrated.

1. Repair or Replacement of the Water Softener– this equipment has systemic affects throughout the facility's water infrastructure. With this system not functioning, the water fixture valves, sinks, and mechanical systems are more susceptible to scaling and damage. This has been a known issue of the facility staff.

2. Xeriscaping – by updated to rock gardens and native species that thrive in this desert type climate, significant water savings and maintenance savings can be achieved. A

deeper dive into the maintenance savings for this measure would need to be completed internally by Red Cross to discover the total saving benefit.

3. Drinking Fountain Upgrades – install new drinking fountains with integral water-bottle filling stations in place of existing water fountains original to the building construction

4. Efficient Water Fixtures – water efficiency upgrades to ultra-low flow fixtures are available at this facility.

Recommendation Costs & Savings

Recommendations for water at the Pomona, CA Red Cross facility are summarized in the table below.

Table 16 – Water Recommendation Costs & Savings

Measure	Priority	Cost ($)	Savings ($)	Simple Payback (yr)
Repair Water Softener System	High	$106,000	$0	No Payback
Xeriscaping	Medium	$1,173,000	$10,100	116
Water Bottle Filling Stations	Low	$25,000	$0	No Payback
Efficient Water Fixtures	Low	$237,000	$2,200	108
TOTAL		**$1,541,000**	**$12,300**	**125**

Incentive or rebate program applicability for the recommendations above are documented in the Utility Analysis, Available Utility Incentive Programs section of this report.

The recommended measurement and verification (M&V) approach for validating savings realized from implementing recommended projects above is the International Performance Measurement and Verification Protocol Option A. In the case that these recommendations are implemented concurrently with other energy conservation measures, other M&V options may be more suitable to capture the interactive effects between energy-using systems, such as Option C or D.

Building Envelope

Components of a building's envelope include its walls, floors, roofs, doors, windows, and fenestrations, and each component has a significant impact on facility energy efficiency. A review of building envelope assemblies is important as poorly performing envelope components can increase infiltration of hot or cold air, increasing energy costs year-round. Trapped heat and moisture in envelope assemblies can negatively affect building indoor air quality and the longevity of building components.

Construction Types

Entegrity evaluated the condition of the envelope during our site visit. The primary building envelope components of the building are detailed below.

Table 17 – Envelope Constructions

Exterior Walls	Roof	Floor	Windows	Exterior Doors
Precast Concrete and Metal Cladding	Thermoplastic Polyolefin (TPO)	Slab on Grade	Double Pane, Aluminum Framed, Single Pane Lobby Glass	Aluminum Framed Storefront, Hollow Metal

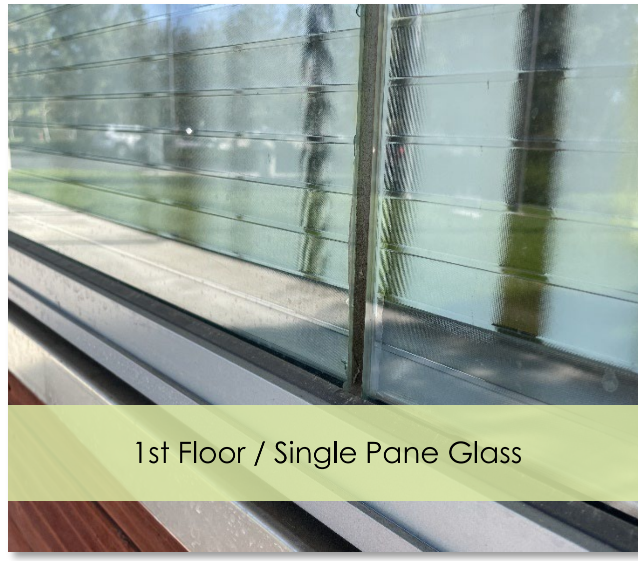
Loading dock bay doors and double doors were also documented during the facility site visit. These doors remain open during periods of loading or unloading delivery packages incoming from remote donation sites or outgoing to local hospitals or other medical facilities.

Roof / Thermoplastic Polyolefin (TPO) System

Lobby Stairs / Storefront Windows

Skylight / Lab Ceiling

Exterior/ Precast Panels



1st Floor / Single Pane Glass

Thermography

As part of the envelope investigation, a thermographic inspection was completed following the ASTM Standard C 1060-90 Standard Practice for Thermographic Inspection of Insulation Installations in Envelope Cavities of Frame Buildings. The entire building was inspected for problem areas on the exterior using infrared technology. The thermographic inspection was performed early in the morning as the sun was rising, thus eliminating solar radiation on the exterior of the building. Temperatures between the inside and outside of the building exceeded the required 18-degree temperature difference, and no precipitation had fallen on the building in the 24 hours prior to the inspection. Testing results were gathered via infrared photographs and still photographs. Please note that the day and time stamp shown on these photos is not correct. These photos were taken at approximately 7 am on October 26, 2022.

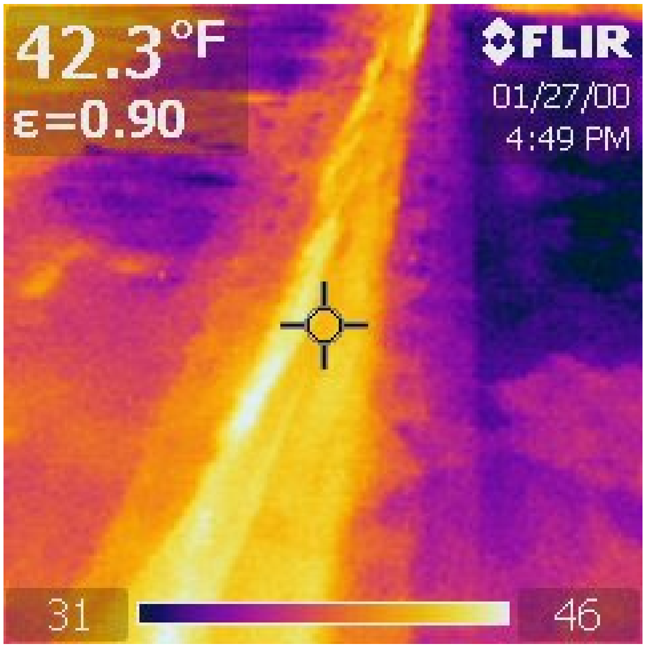
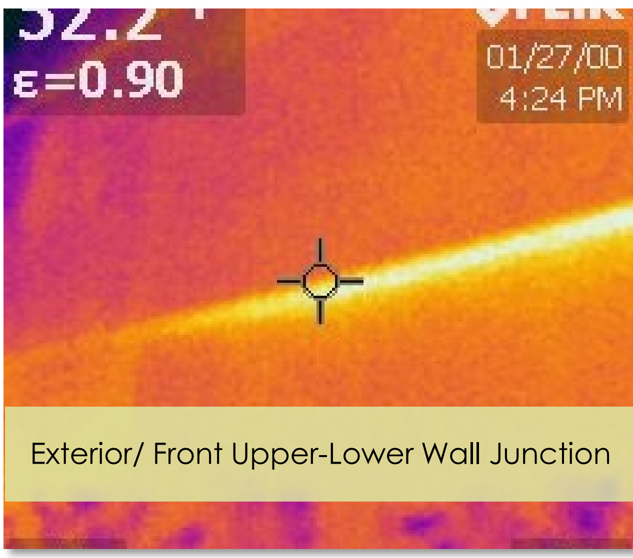
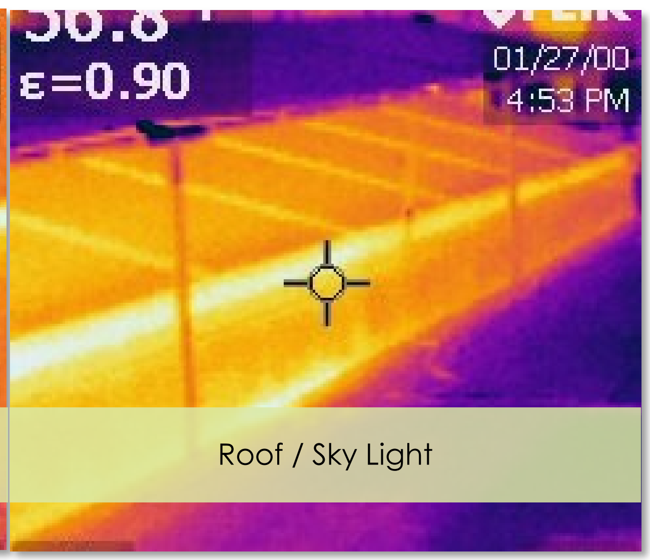


Figure 16 – Pomona Roof Expansion Joint

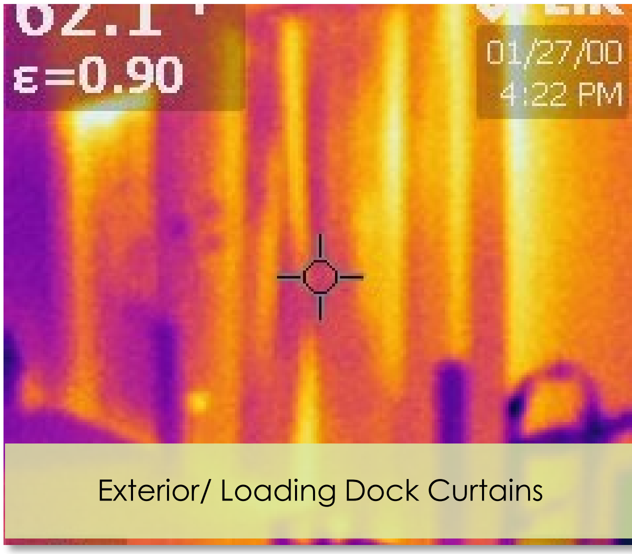
At the time of thermography testing, no building envelope insulation deficiencies were readily apparent. Thermography testing did not reveal any envelope defects that require remedial action.



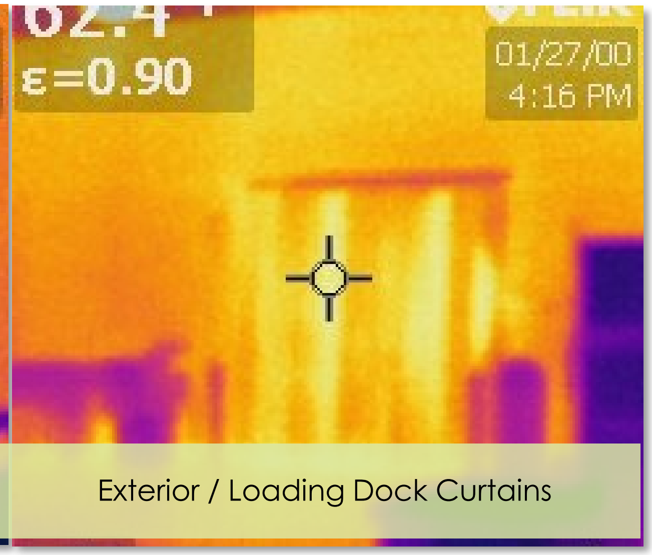
Exterior/ Front Upper-Lower Wall Junction



Roof / Sky Light



Exterior/ Loading Dock Curtains



Exterior / Loading Dock Curtains

Observed Issues & Recommendations

During envelope assessments, Entegrity inspects building components and investigates potential air or water leakage points including roof leaks, missing door sweeps, window construction gaps or other insulation or envelope component shortfalls.

Overall, the envelope at Red Cross Pomona appeared to be in good condition with only one issue noted - the roof expansion joint shows substantial heat migration. This area could be sealed for minimal costs.

1. New Roof – A new roof is planned for the facility soon. Savings potential for this measure have been excluded from this report since the specification is unknown.

2. Insulate Roof Expansion Joint and Areas with Removed Equipment – Apply insulation, backing and polyurethane sealant to seal and insulate the roof expansion joint below the roof deck.

Recommendation Costs & Savings

Incentive or rebate program applicability for the recommendations above are documented in the Utility Analysis, Available Utility Incentive Programs section of this report.

The recommended measurement and verification (M&V) approach for validating savings realized from implementing recommended projects above is the International Performance Measurement and Verification Protocol Option A. In the case that these recommendations are implemented concurrently with other energy conservation measures, other M&V options may be more suitable to capture the interactive effects between energy-using systems, such as Option C or D.

HVAC Equipment & Controls

HVAC equipment replacement and ongoing maintenance is often one of the largest operational costs facility owners manage. Heating, cooling, and ventilation requirements typical make up 50-70% of a building's total energy use. When buildings have more stringent requirements for ventilation, temperature variation, and humidity, energy demands can quickly escalate.

Existing Equipment

The Red Cross facility in Pomona is heated and cooled in four main areas – the labs, donor center, warehouse, and administration. The design of the facility affords the ability to maintain a steady replacement strategy by replacing one piece of equipment and scavenging its parts for maintenance of other equipment on site. The main Air Handling Units (AHUs) will need replacements and modifications in the short term; however, this can be done in a manner that will prevent large swings in capital expense from year to year. Details of the system arrangements for each of the main sections of the building is outlined below. The building is heated by 3-Ajax Forced Draft Boilers and cooled by 4-Daikin Air Cooled Chillers. Details of the system arrangements for each of the main sections of the building is outlined below.

1. <u>Lab AHUs</u> – The Lab rooms on the first floor are served ventilation air and cooling from 3 variable air volume air handling units (AHU-1-3) located on the roof. The air handling units have a hydronic cooling coil, and chilled water is provided by three air-cooled chillers located on the ground. Electronic 3-way valves control water flow to the chill water coils. Each of these units have electric steam humidifiers. Heating is provided by electric reheat in terminal equipment in each zone. These units are economizer capable; however, the actuators were nonfunctional and/or disconnected. Units are set to control operating rooms at 55 – 60 degrees and a relative humidity of approximately 45%. The humidity requirements at such a low supply air temperature indicate a very high cooling demand from the air handling unit to remove moisture from the air, as well as high reheat load from the electric heating terminal equipment in each zone.

2. <u>Donor Center AHU</u> – AHU 4 serves the Donor Center. This is a variable air volume unit. The unit has setpoints of 62 degrees and humidity of 45%. This unit is also located on the roof with the other AHUs. Like the other AHUs, this unit is original to the building, but the supply air fans has been replaced. The cooling coils on this units are showing signs of their age. Electronic 3-way valves control water flow to the chilled water coils.

3. Warehouse AHUs – The Warehouse is served by AHUs 5 and 6. These are the only constant volume AHUs in the building. Cooling and ventilation air is provided by the chillers mentioned above. These units, original to the construction of the building, function as the lab AHUs. These units do not have humidifiers and are controlled to a higher supply air setpoint of 65 degrees and relative humidity setpoint of 40%. Zone control is achieved by terminal boxes with hot water reheat. Each zone has a local thermostat integrated with the building automation system.

4. Administration AHUs – AHUs 7-9 serve the administration areas. These units function as the warehouse units mentioned above, but these units are variable air volume. The supply air setpoint is set to 64 degrees and there is no humidity setpoint. The outside air damper actuators were disconnected on these units, so economizer mode is not functional.

5. Chiller System – The chiller system includes 4-air cooled chillers. There is a primary-secondary pumping system with 10-horsepower primary pumps. These pumps do not have variable frequency drives and are not capable of varying flow rates. The secondary chilled water pumps are 50-horsepower with variable frequency drives. Water flow to each chiller is balanced with balancing valves. A reverse return piping arrangement would allow more balanced and better flow distribution to the chillers. Some of the drives on this equipment need replacement or repair.

6. Boiler System – Three Ajax forced-draft boilers and a primary-secondary variable volume hot water pumping system serve the building with heating water. The primary pumping system is variable volume, and the secondary pumping system has a season setback temperature of 155 degrees in May through October from 170 degrees in November through April. The drives on this system need repair and/or replacement.

7. Terminal Equipment – The facility contains approximately 150 VAV boxes. These terminal units are original to the construction of the building and could be brought back to original operating specifications with retro-commissioning, test and balance, as well and sensor calibration in some areas.

8. Split Systems – Split systems serve the various IT spaces. These are heat pump units that are contain R-22 and are original to the construction of the building. These units need replacement as they have a reached the end of their expected life and only one condensing unit was noted to have been replaced.

Table 18 – Existing Space Conditioning & Ventilation Approach

HVAC Component	Existing Conditions Summary
Primary Cooling Method	Air-Cooled Chillers, Variable Volume Secondary Chilled Water Loop
Primary Heating Method	Gas Fire, Forced Draft Boilers, Constant Volume Primary Heating Water Loop Secondary Variable Volume VAV Terminals
Air Distribution & Ventilation	Air Handling Units (AHUs) with ventilation and ducted return air, AHUs provide cold air to variable volume mixing box terminal equipment with reheat, Terminal reheat the air temperature for zone conditioning

During the sustainability assessment, Entegrity documented each major piece of equipment described above while on site. Details of the existing equipment are provided in the table below.

Table 19 – Existing HVAC Equipment

ID	Equipment	Serves	Make	Model	Year	Capacity
CHW-1	Air Cooled Screw Compressor Chiller	Main Building	Daikin	AWS240CDPEWNN-ER10	2015	240 Tons
CHW-2	Air Cooled Screw Compressor Chiller	Main Building	Daikin	AWS240CDPEWNN-ER10	2015	240 Tons
CHW-3	Air Cooled Screw Compressor Chiller	Main Building	Daikin	AWS240CDPEWNN-ER10	2015	240 Tons
B-1	Forced Draft Boiler	Main Building	AJAX	WFG-2000-LN	2000	1640MBH
B-2	Forced Draft Boiler	Main Building	AJAX	WFG-2000-LN	2000	1640MBH
B-3	Forced Draft Boiler	Main Building	AJAX	WFG-2000-LN	2000	1640MBH
AHU-1	AHU - VAV	Main Building	McQuay	Unknown	2002	70,000 CFM
AHU-2	AHU - VAV	Main Building	McQuay	Unknown	2002	70,000 CFM

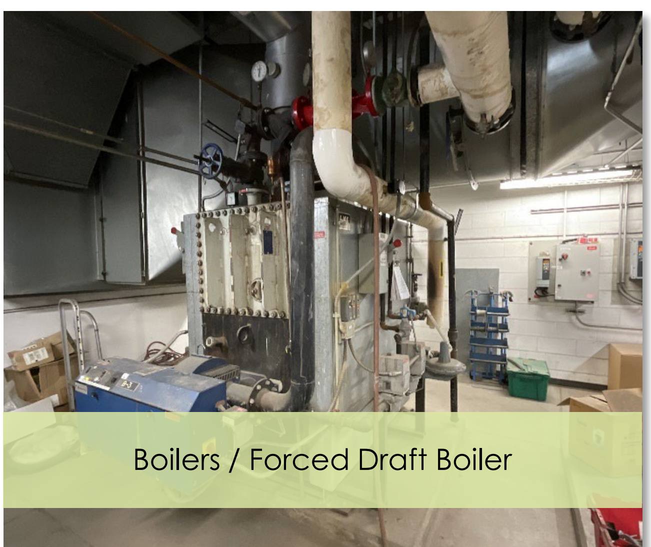
ID	Equipment	Serves	Make	Model	Year	Capacity
AHU-3	AHU - VAV	Main Building	McQuay	Unknown	2002	70,000 CFM
AHU-4	AHU - VAV	Main Building	McQuay	Unknown	2002	21,500 CFM
AHU-4A	AHU - VAV	Main Building	McQuay	Unknown	2002	21,500 CFM
AHU-5	AHU - SZ	Main Building	McQuay	Unknown	2002	28,800 CFM
AHU-6	AHU - SZ	Main Building	McQuay	Unknown	2002	30,000 CFM
AHU-7	AHU - VAV	Main Building	McQuay	Unknown	2002	30,000 CFM
AHU-8	AHU - VAV	Main Building	McQuay	Unknown	2002	32,000 CFM
AHU-9	AHU - VAV	Main Building	McQuay	Unknown	2002	30,000 CFM
VAV-AHU 1, 2, 3	VAV Box – HW RH	Zone 1-QTY 49	KRUEGER	LMHS	2002	800 CFM
VAV-AHU 4	VAV Box – HW RH	Zone 2 – QTY 19	KRUEGER	LMHS	2002	420 CFM
VAV-AHU 5,6	VAV Box – HW RH	Zone 3 – QTY 15	KRUEGER	LMHS	2002	420 CFM
VAV-AHU 7	VAV Box – HW RH	Zone 4 – QTY 31	KRUEGER	LMHS	2002	420 CFM
VAV-AHU 8	VAV Box – HW RH	Zone 5 – QTY 35	KRUEGER	LMHS	2002	420 CFM
SS-1	Split System 1	Room 317	Trane	TTBO24C100A2	2004	2 Ton
SS-2	Split System 2	Room 348	Trane	4TTR4025L1000BA	2022	2 Ton
SS-3	Split System 3	Room 401	Trane	TTBO24C100A2	2004	2 Ton
SS-4	Split System 4	Room 439	Trane	TTB024C100A2	2004	2 Ton
SS-5	Split System 5	Room 368	Trane	2TTA0060A4000AA	2004	5 Ton
SS-6	Split System 6	Room 127	Trane	2TTA0048A4000AA	2004	4 Ton

ID	Equipment	Serves	Make	Model	Year	Capacity
SS-7	Split System 7	Room 152	Trane	2TTA0060A4000AA	2004	5 Ton
SS-8	Split System 8	Room 153	Trane	2TTA0048A4000AA	2004	4 Ton

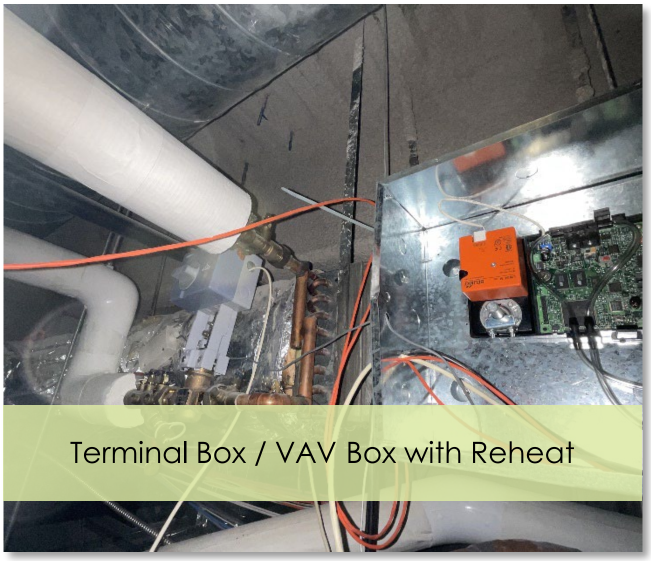
The AHU air flow rates above are assumed values based on the facility square footage. Photos of existing equipment documented during the assessment are provided for reference below.


Chiller 1 / Air Cooled Chiller

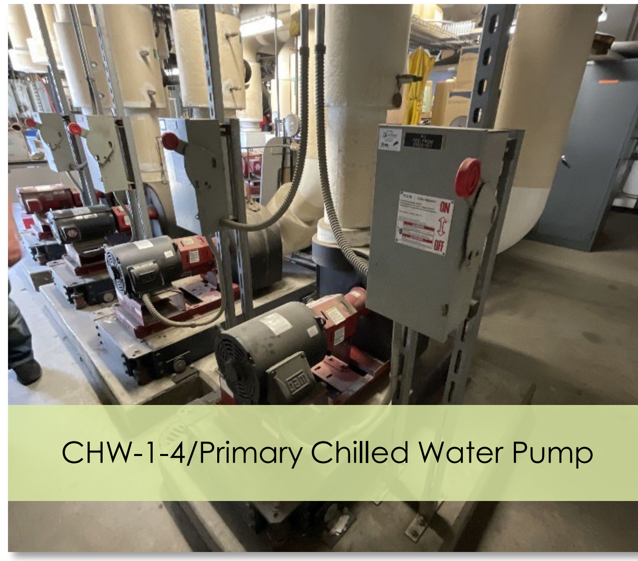
Chiller 2 / Air Cooled Chiller


Boilers / Forced Draft Boiler

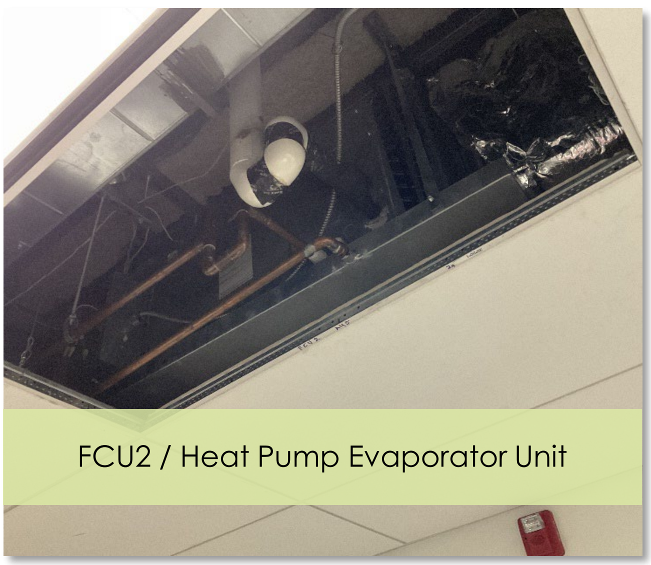

AHU-1/ Air Handling Unit



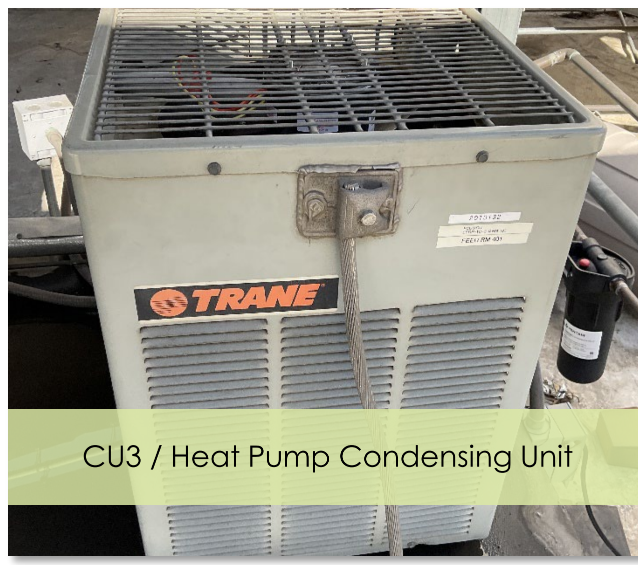
Terminal Box / VAV Box with Reheat



CHW-1-4/Primary Chilled Water Pump



FCU2 / Heat Pump Evaporator Unit

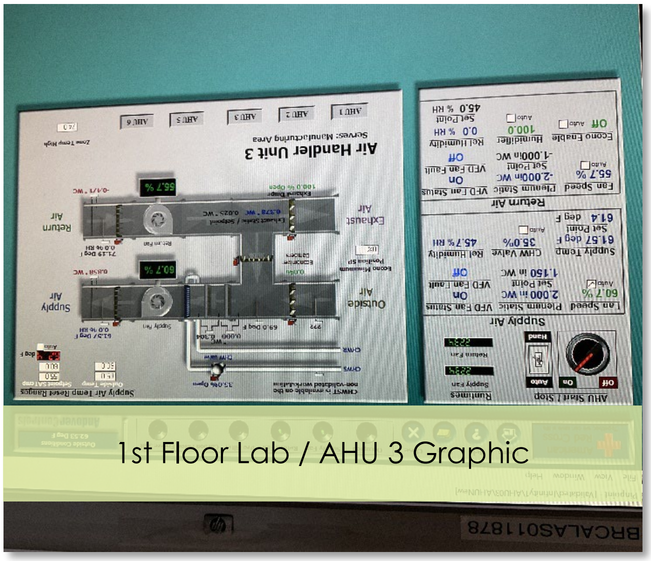


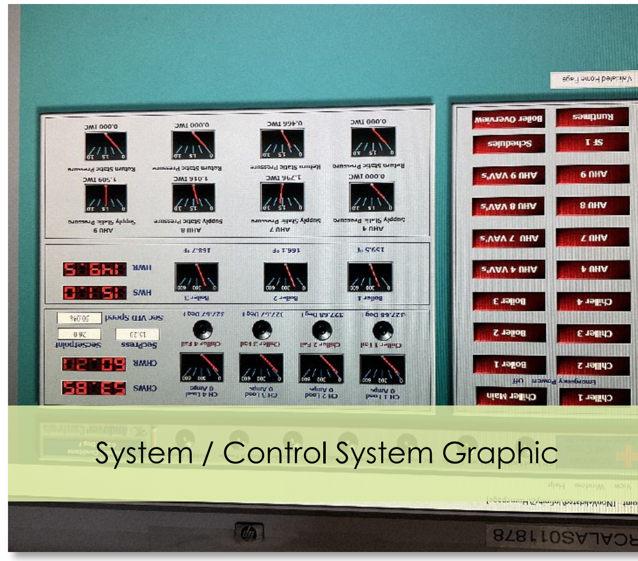
CU3 / Heat Pump Condensing Unit

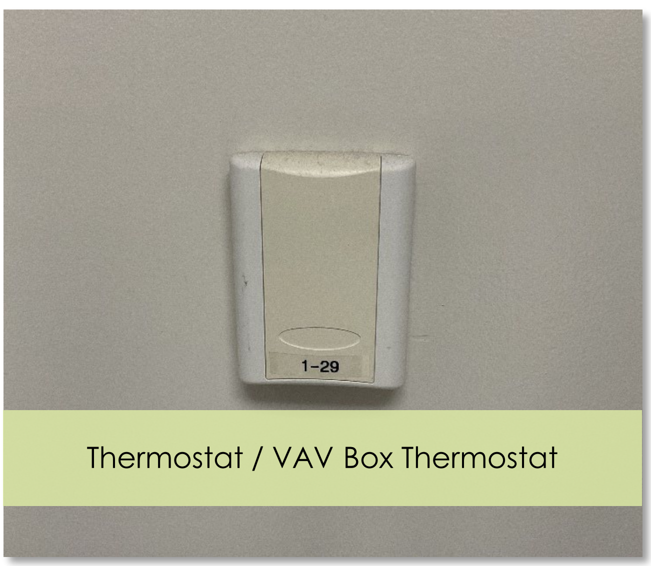
Existing Controls

HVAC control plays a large roll in how maintenance staff diagnose and address occupant comfort problems. Because HVAC setpoint controls determine the runtime for a piece of equipment, optimizing controls for reduced energy use also extends the life of equipment.

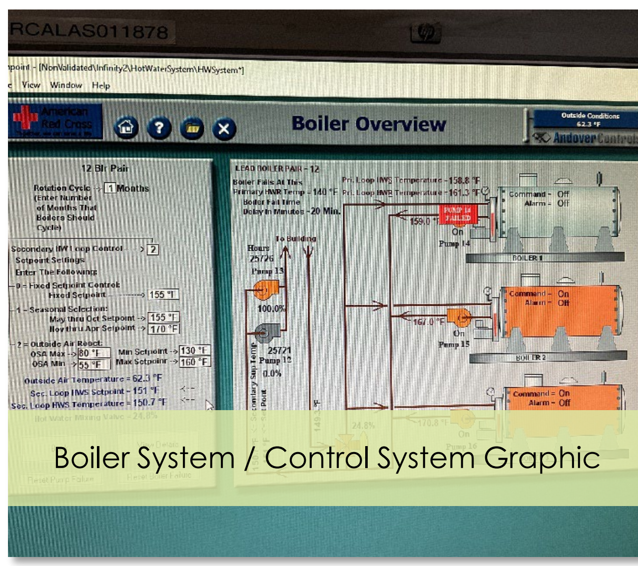
The Red Cross Pomona facility controls and monitors equipment with an Andover Continuum building automation system (BAS). Terminal VAV mixing boxes' can turn down to 30% of their maximum airflow with approximately a 27-to-50-degree temperature increase via hot water reheat coils. With exception AHUs 5 and 6, air handling units all have variable frequency drives. The chiller is controlled by the automation system as are the boilers with the ability to take advantage of outside air temperature setpoint reset. Existing controls do not take advantage of economizer setting, a control strategy well-suited for this local climate, because many of the dampers and actuators are disconnected and not functioning.


1st Floor Lab / AHU 3 Graphic


System / Control System Graphic



Thermostat / VAV Box Thermostat



Boiler System / Control System Graphic

Observed Issues & Recommendations

Opportunities exist for energy conservation measures for HVAC equipment and controls detailed below. The priorities for items 1-3 below were established based on the observed condition of each Air Handling Unit.

1. Lab AHUs 1, 2 and 3 - Equipment cleaning component replacements seem to be the priority for these units. Entegrity believes and systematic approach can be taken that will allow for a gradual replacement of these AHUs. The idea would be to replace AHU-1 immediately, scavenge its parts for AHU-3 and tune up AHU-3. AHU-3 would need replacement and its parts could be scavenged for maintaining AHU-2. When AHU-2 needs replacement, its parts can be scavenged for maintaining AHU-1 to compete and restart the maintenance cycle.

2. Warehouse AHUs 5, and 6 – As with the lab AHUs, equipment cleaning component replacements seem to be the priority for these units. The same systematic approach mentioned above can be taken that will allow for a gradual replacement of these AHUs. AHU-5 would need to be replaced immediately and its parts scavenged to address component degradation AHU-6. AHU-6 would need replacement later, and its parts could be scavenged for maintaining AHU-5 to compete and restart the maintenance cycle.

3. Administration Area AHUs 7, 8, and 9 – Again, the same systematic approach can be taken that will allow for a gradual replacement of these AHUs. The idea would be to replace AHU-8 immediately, scavenge its parts to tune-up AHU-7. AHU-7 would need replacement and its parts could be scavenged for maintaining AHU-9. When AHU-9 needs replacement, its parts can be scavenged for maintaining AHU-7 to compete and restart the maintenance cycle.

4. Terminal Equipment with Hot Water Reheat - Equipment cleaning: Terminal boxes with Hot Water reheat allow for zone temperature control. The terminal boxes are above the ceiling grid throughout the building. Entegrity documented the condition of a terminal boxes that that did not seem to match the temperature setpoint. Commissioning of the existing VAV boxes is recommended.

5. Replace All Split Systems with Exception of Split System 2 – Existing split system, with exception of system 2 which was replace in 2022, are 18 years old. Expected life spans of this type of equipment are 15-17 years so this equipment has already exceeded expected useful life. These systems will likely begin to fail frequently and will soon need to be replaced.

6. Variable Frequency Drives for AHUs and Pumping Systems – The majority of the drives are original equipment and are reaching the end of their useful life. As AHUs are upgrade, it would be advantageous to upgrade the VFDs for their fans when they are replaced to match the new motor appropriately. Likewise, pumping motor drives are of the same age and in need of replacement.

7. Controls Systems - Entegrity recommends an overhaul of existing building controls to make use of new control strategies and allow facility management to easily view and control equipment status, including temperature, ventilation, and humidity setpoints for all building systems. The existing system is antiquated technology. Modern, web-enabled controls improve energy efficiency by reducing equipment runtimes – but can also dramatically improve equipment maintenance and management practices with equipment status visibility, problem diagnosis, and remote management improvements.

8. Reverse Return Piping of the Chiller Line to Chillers – Currently the flow to each chiller does not allow for balance water flow, meaning one chiller may receive adequate water flow while the other chillers are starved of water and not allowed to operate at their most efficient setting. Entegrity believes that repining of the return could allow for better chiller staging.

9. Install Heat Pump Chillers – The existing chillers have remaining life but when this equipment it up for replacement in the future, a heat recover chiller could increase system efficiency by providing simultaneous heating water for the VAV reheat coils while providing cooling to the building.

10. More aggressive setup/setback Temperatures for unoccupied Office Spaces – Much of the 2nd floor officed space is unoccupied. By moving occupancies to areas that could be more densely populated, remaining unoccupied areas can have their temperatures setback to saving energy and operational costs.

11. Controls Systems - Installing CO_2 sensors as part of a controls overhaul to enable demand control ventilation could minimize unnecessary treatment of outside air for building ventilation when the ventilation air is not needed. Demand control ventilation allows ventilation air to be dynamically provided in response to space occupancy by measuring the CO_2 in each zone.

12. Controls retro-commissioning (RCx) - As an alternative to a comprehensive controls upgrade, a deep-dive investigation and retro-commissioning of the existing Andover

controls system could be implemented to ensure that the most effective controls strategies and sequences are utilized by the existing control system.

Recommendation Costs & Savings

Recommendations for HVAC equipment and controls at the Pomona, CA Red Cross facility are summarized in the table below.

Table 20 – HVAC Recommendation Costs & Savings

Measure	Priority	Cost ($)	Savings ($)	Simple Payback (yr)
Replace AHU 1	High	$1,825,000	$7,100	257
Replace AHU 4	High	$561,000	$2,700	208
Replace AHU 5	High	$751,000	$3,300	228
Replace AHU 8	High	$782,000	$3,300	237
Upgrade to new BAS	High	$117,000	$58,500	2
RCx on Dampers, Actuators, and Valves, & TAB	High	$111,000	$53,200	2
Re-pipe Return to Chillers for better water distribution	High	$89,000	$26,600	3
Setup/Setback for 2nd Floor	High	$90,000	$13,300	7
Replace All IDF and MDF systems except for Unit 2	High	$184,000	$10,700	17
RCx on VAV Boxes	High	$204,000	$5,400	38
Repair/Replace VFDs on pumping Systems and AHUs	High	$351,000	$18,600	19
Replace AHU 2	Low	$1,825,000	$7,100	257
Replace AHU 9	Low	$782,000	$3,900	201
Add updated Chiller Control Sequences	Medium	$83,000	$26,600	3
Replace AHU 3	Medium	$1,825,000	$7,100	257
Replace boilers with condensing boilers	Medium	$1,012,000	$26,600	38
Replace AHU 7	Medium	$834,000	$3,900	214
Install heat-pump chiller to serve HW/CHW loads	Medium	$616,000	$13,300	46

Measure	Priority	Cost ($)	Savings ($)	Simple Payback (yr)
Replace AHU 4A	Medium	$561,000	$2,700	208
Replace AHU 6	Medium	$751,000	$3,300	228
TOTAL		**$13,354,000**	**$297,200**	**45**

Incentive or rebate program applicability for the recommendations above are documented in the Utility Analysis, Available Utility Incentive Programs section of this report.

The recommended measurement and verification (M&V) approach for validating savings realized from implementing recommended projects above is the International Performance Measurement and Verification Protocol Option C or D. In the case that these recommendations are implemented concurrently with other energy conservation measures, other M&V options may be more suitable to capture the interactive effects between energy-using systems, such as Option C or D.

Other Building Infrastructure & Operations

Entegrity's site assessment considered building infrastructure components, energy-using systems, and facility operational practices beyond lighting, water, envelope, an HVAC. Additional energy or operational considerations are documented below.

Telecommunications

Site staff indicated that Voice Over Internet Protocol (VOIP) is used for telecommunications services at the Red Cross Pomona facility. Verizon was determined to be the VOIP service provider for the site.

Entegrity has often revealed telecommunications billing cost savings opportunities by analyzing existing telecommunications requirements for VOIP services and comparing available service provider options to identify the most cost-effective solutions for each facility's needs. Typically, this type of upgrade has one of the lowest paybacks of all upgrades.

Medical Coolers and Freezers

Medical coolers and freezers were observed. They systems store product in the lab setting and in the warehouse setting. It appears that countless systems have been added since the facility came online.

Freezer / Blast Freezers

Other Equipment

Portable air conditioning systems. Entegrity observed several areas with additional cooling via portable air-conditioning systems. These systems take up floor space and add unneeded load to the electrical system. Often in lab spaces, the designer does not have all the information necessary to properly identify and plan for the space load. Conditions and space use can also change over time. It is recommended that an assessment of the biomedical and refrigeration equipment be performed, and updated heating and air conditioning loads be performed so that it can be determined if the existing HVAC equipment in the prior sections can be evaluated for proper sizing before replacements or further upgrades are made.

Lab/ Lab Hoods

Observed Issues & Recommendations

Opportunities exist for energy conservation or operational improvements detailed below.

1. VoIP Service Provider Change – Substantial savings could be obtained by changing service providers for Voice Over Internet Protocol services. Often the potential savings by utilizing are not passed on to the customer by the larger service providers when switching from land lines to VoIP. Open system options are available that can leverage more of the savings to the customer, rather than the service provider. Also, when these types of investigations take place, the larger providers will, at times, match the savings extended by open protocol providers.

2. Loading Dock Air Curtains – Existing loading air curtains are damaged and need repair and replacement. They have experience normal wear and tear and are not sealing as originally designed.

3. Lab Hoods – Proper Lab Hood air balancing can provide addition energy savings by looking at the hood's usage factor and the lab space as a whole. There are options for active sensing of air quality that enable the hoods only when needed as well as variable ventilation rates may be employed to reduce fan energy. A makeup air assessment would need to be performed to understand the viability of Lab Hood upgrades and if pressure-independent or individual exhausted duct air strategies are viable.

4. Ice Machine Heat Recovery – The Pomona site contains air cooled ice machines in various locations. These units are connected to 120-volt AC plugs and operate 24/7 per year. The ice is used for both packaging and biomedical use. The automated controls for ice production are designed to maintain a specific volume of ice in the bin. The unit also operates to maintain the proper temperature of the bin to reduce ice melting. Potable water comes in at about 70 degrees Fahrenheit. This water is then cooled using a compressor and refrigerant to create the ice. As this happens some ice in the bin melts and there is condensation on the compressor. This cold water is just above freezing then discharged and would normally flow straight down a drain. Options exist that use this discharged cold water to run through a coil around the incoming water lowering the temperature. This allows the ice machine to use less energy bringing the incoming water to freezing temperature and less water per cycle. It can be assumed the ice machines are only making ice 80% of the time. This is because while during the day it is constantly making ice to replace what is being used at night once it has refilled the storage bin it will stop. Because some ice will constantly melt and be replaced even without use the ice machine will still run some.

   With a refrigeration heat exchanger system installed, cold discharge water from an ice machine or refrigeration unit is exposed to incoming domestic water in a reservoir. This heat exchange can cool incoming water by more than 16%. This drop in temperature improves the efficiency of the ice machine by more than 18%. This creates energy savings by reducing the cooling load and cycle time of the ice machine or refrigeration unit.

5. Medical Walk-In Cooler and Freezer Upgrades – Various solutions for both heat rejection and controls have been considered for the walk-in coolers and freezers on the site. Heat rejection options that use chilled water or fluid cools have been explored but due to the locations and available space for additional equipment, it was deemed not practical.

A more realistic upgrade for freezer and cooler optimization is controls that would aid in automatic temperature tracking and logging of the temperature data. When an issue crops up and operating conditions need to be compared this data can be made available. Iced-up coils can reduce refrigeration performance, wasting energy and can reduce the life span of refrigeration components. Refrigeration controls can initiate a defrost cycle whenever iced coils are observed. Various versions of refrigeration system controls can turn off the system for a specified amount of time during deliveries, stocking/inventory, and other in-cooler work. Door heaters often run at full power all the time, regardless of if they're needed or not. Based on lab or warehouse temperature and interior humidity instead, control units can be installed that reduce door heater run times and energy use. Refrigeration controls can have alarms added that alert staff when high or low space temperatures, or compressor failures are sensed. Finally, these systems enable BAS integration and can allow for scheduling for freezers and coolers so that they can be turned off when not in use.

Recommendation Costs & Savings

Recommendations for other building Infrastructure & operational upgrades at the Pomona, CA Red Cross facility have not been estimated since more information would need to be garnered for a proper assessment of these potential measures.

Incentive or rebate program applicability for the recommendations above are documented in the Utility Analysis, Available Utility Incentive Programs section of this report.

The recommended measurement and verification (M&V) approach for validating savings realized from implementing recommended projects above is the International Performance Measurement and Verification Protocol Option D. In the case that these recommendations are implemented concurrently with other energy conservation measures, other M&V options may be more suitable to capture the interactive effects between energy-using systems, such as Option C or D.

On-Site Generation

Entegrity investigated the potential for on-site generation at each Red Cross facility, specifically focusing on the potential for cost-effective solar projects. Solar energy is an increasingly common energy conservation measure that has reached a competitive economy of scale. Further, current solar projects can be incentivized through the federal solar investment tax credit – which can knock off 30-60% of a solar project's cost.

Local Policy Allowances

The local policy allowances for the Pomona location are outlined below:

1. State-level policy
   a. Net-metering: Up to 2 MW
   b. Aggregate metering: Allowed for multiple meters on contiguous property under same ownership.
   c. Net Metering Rules are set to change as early as April 2023. These new policies will cut the value of exported energy to avoided cost.

2. Local utility policy
   a. Because the Pomona site is provided electrical power by the SoCal Edison, the local utility policy matches that of state-level policy outlined above.

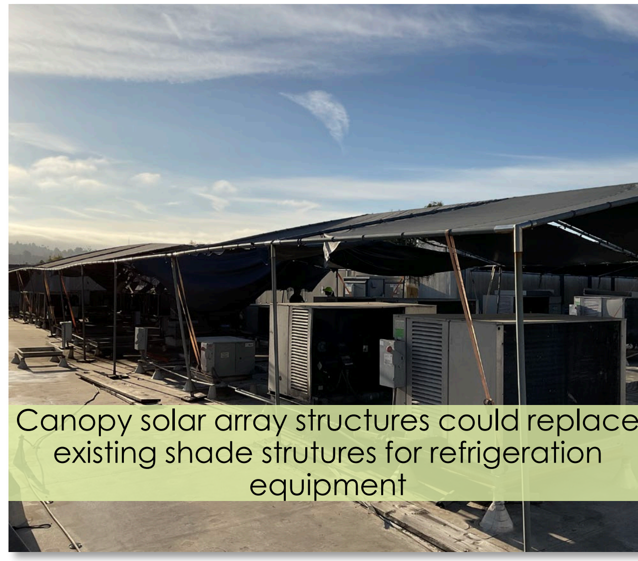
Generation Site Availability

A rooftop array is recommended for the Pomona Red Cross facility. The existing flat roof has ample area for rooftop solar, and because the roof is planned for a replacement project in the near-term, it is recommended that rooftop solar be installed after that project is complete. Special care should be taken to ensure new roof warranties are maintained if a solar project is implemented.

This roof also presents a separate opportunity for shading of existing refrigeration equipment using a canopy type array racking system. A second option could be developed for this type of system.

It should be noted that bi-facial solar panels can be installed on a reflective roof surface, and the roof can be considered by the federal government as a component of the solar system. As a result, a roofing project, when paired with a new rooftop solar array, can be eligible for the federal solar investment tax credit.

The flat roof is suitable for a rooftop array to be installed after replacement



Canopy solar array structures could replace existing shade strutures for refrigeration equipment

Utility Cost Savings Opportunity

The electrical utility meter at the Pomona location has sufficient load to install a solar array an achieve an economy of scale, measuring roughly 6,895 MWh of energy consumption per year.

The existing electrical utility rate is high, at approximately $0.10 per kilowatt-hour. As a result, the utility costs savings opportunity for the proposed rooftop solar array could be approximately $46,000. A rooftop solar project is recommended for greenhouse gas emissions reductions, when those efforts are prioritized by Red Cross.

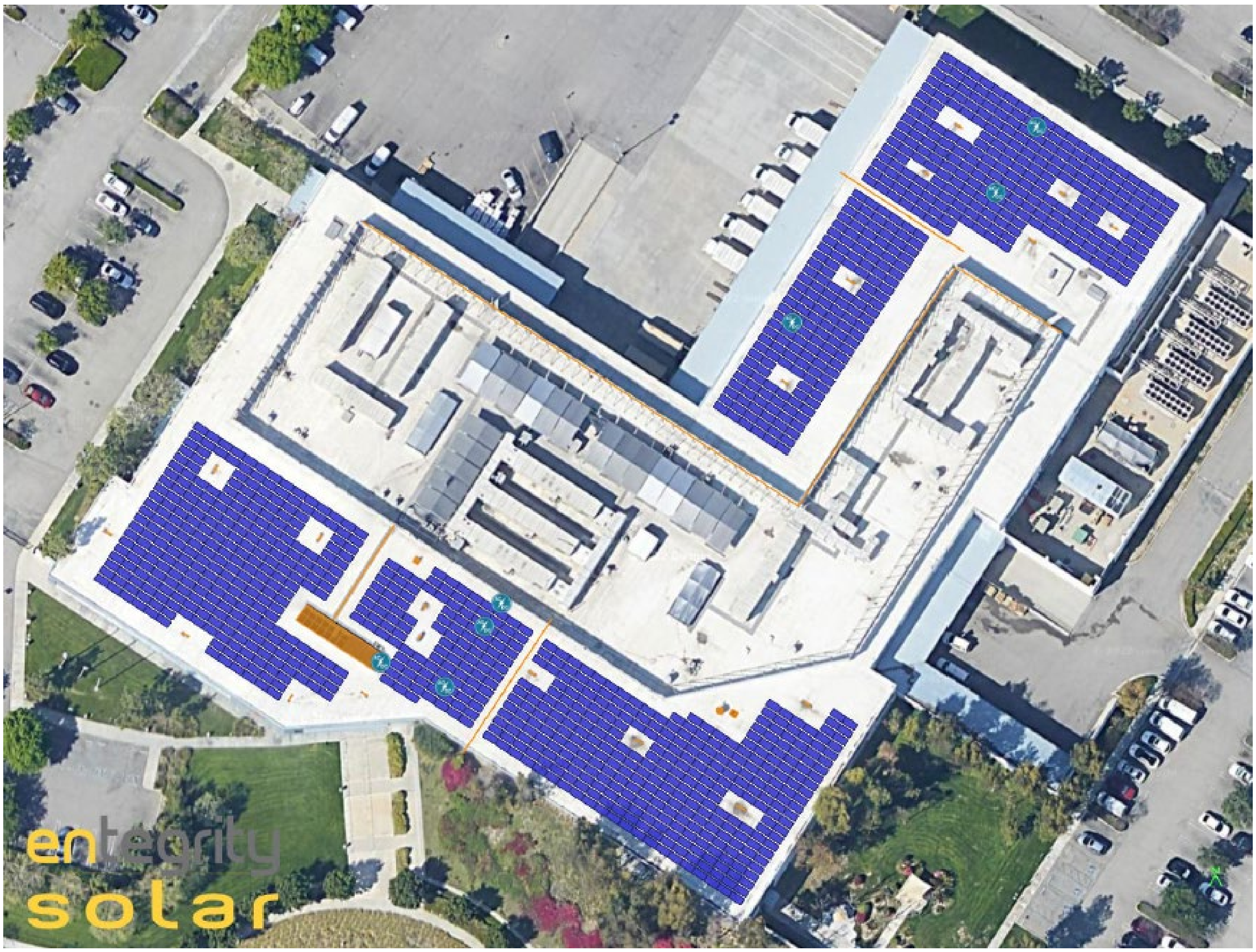
Observed Issues & Recommendations

Entegrity recommends a solar project to be implemented at Red Cross' discretion – which may be prioritized for carbon or carbon equivalent greenhouse gas emissions reductions or as a long-term hedge against increasing utility costs. The utility cost savings opportunity is high compared to other areas of the country due to the high cost of utility electric at the site. In California, power purchase agreements and shared renewable projects for solar arrays or other forms of on-site generation are allowed through the state of California's solar policy which makes it a great and cost-effective means of implementing a solar project.

In addition, the federal government's Inflation Reduction Act (IRA) does provide a significant incentive for solar projects. If a bi-facial rooftop solar installation was paired with a roof replacement and the roof was included as a component of the solar system, the project can become more economically appealing.

Below is shown a rooftop solar array at the Pomona facility. Figure 16 is a likely 520 kW AC ballasted only array that is modeled to generate 826.7 MWh per year, generating utility cost savings of approximately $46,000 annually.

Figure 16 – Potential Rooftop Solar Layout



A second option would present structural design challenges and is less likely, but it could aid in providing a dual function as shading for roof top refrigeration equipment.

Recommendation Costs & Savings

Recommendations for a solar project at Red Cross Tulsa are summarized in the table below.

Table 21 – Solar Generation Recommendation Costs & Savings

Measure	Priority	Cost ($)	Savings ($)	Simple Payback (yr)
Ballasted Only Rooftop Array	Low	*$835,000*	*$46,000*	*18*

Incentive or rebate program applicability for the recommendations above are documented in the Utility Analysis, Available Utility Incentive Programs section of this report.

The recommended measurement and verification (M&V) approach for validating savings realized from implementing recommended projects above is the International Performance Measurement and Verification Protocol Option A. In the case that these recommendations are implemented concurrently with other energy conservation measures, other M&V options may be more suitable to capture the interactive effects between energy-using systems, such as Option C.

Electric Vehicle (EV) Charging

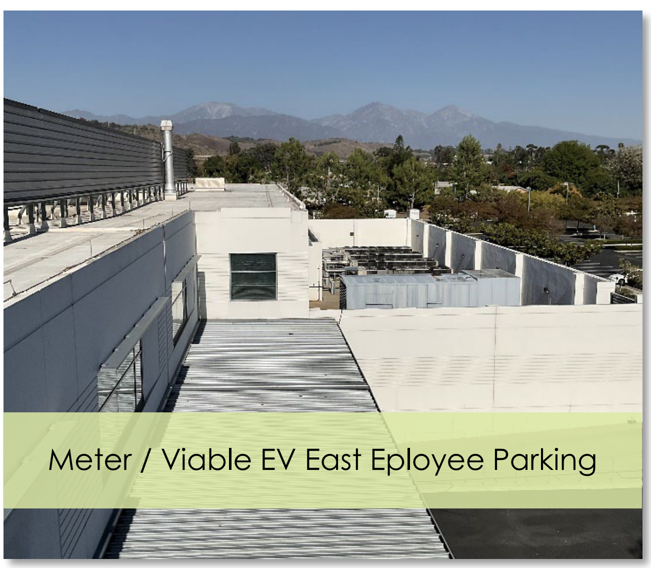
Entegrity investigated potential visitor, staff, and fleet charging locations for Red Cross parking areas. Electric vehicles are an increasingly common cost savings measure as they require significantly less maintenance than diesel or gas vehicles and utilize cheap electricity in place of increasingly expensive gas and diesel. Further, federal incentives for the transportation electrification have become popular, decreasing the costs of both the vehicles and charging equipment. Charging options, which vary by use case, are available as outlined below.

Infrastructure Requirements

Different charger options are available dependent upon customer preferences and vehicle types. Chargers can range from 12 kW AC to 75 kW DC. Fleet vans would utilize larger, DC chargers to accommodate those vehicles' larger batteries. Similarly, visitor parking would likely be DC chargers, allowing for a faster charge for visitors. To decrease upfront expenses, employee parking could be smaller, AC chargers as employee cars can be charged over a longer timeframe. Interconnection infrastructure requirements are dependent upon charger location: chargers can connect behind your main meter, utilizing your current transformer, or be connected directly into the utility lines, installing a new transformer and meter.

Charging Site Availability

1. Employee Parking: The Red Cross east employee vehicle parking areas are well-suited for an easy interconnection of high-voltage chargers as they are near the facility's main electrical meter, electrical transformer, and main building panel.
2. Fleet vehicles: The fleet parking lot is more distant to existing electrical infrastructure than east employee vehicle parking and does not represent an operational savings opportunity in the same way that electrification of the Red Cross transport fleet represents. For this reason, it may be considered a lower priority than fleet charging.
3. Visitor Parking: The visitor parking is very distant from existing electrical infrastructure required for high-voltage charging. To install quick chargers at this location, new electrical infrastructure would need to be installed, and a high cost of installation can be expected to service this lot. The visitor parking location is not recommended as a pilot EV charging project at the Tulsa location.


Meter / Viable EV East Eployee Parking


Excluded Area / Non-vialble EV Location

Operational Savings Opportunity

To accurately calculate savings produced by transferring to an electric fleet, Red Cross would need to analyze route distances and current maintenance costs. If Red Cross is interested in transferring to electric, Entegrity can analyze this information to determine project cost and savings opportunities. In general, by switching to electric, customers decrease maintenance expenses to less than half those of diesel and gas vehicles. Additionally, electricity costs prove to be significantly cheaper than diesel and gas.

Installing visitor and staff parking would not create direct cost savings; however, it would create conveniences for visitors and staff and could be touted in hiring efforts. Additionally, dependent upon the chargers installed, Red Cross could charge both visitors and staff for parking as a revenue generation opportunity.

Observed Issues & Recommendations

Due to the fleet parking's proximity to Red Cross's meter and transformer, infrastructure costs would be minimal, creating an ideal installation scenario. Route lengths in relation to battery capacity should be considered before implementing visitor parking charging stations as the interconnection requirements to the visitor parking location creating a high upfront cost associated with installing charging stations at this parking lot.

Recommendation Costs & Savings

Typical vehicle charging stations range from 12k AC to 75 kW DC in size and $13,000-$90,000 in cost. In addition to charger size, differentiators such as software, customer charge abilities, card scanning, and electrical interconnection, must be considered. These differentiators significantly influence both charger price and user experience. If Red Cross is interested in electric vehicle charging, options may be discussed in greater detail; however, without knowledge regarding customer preferences, it is difficult to determine project costs.

Similarly, savings generated from transferring to an electric fleet depend heavily on current vehicles in use, routes driven, and current maintenance costs. No savings are generated by installing visitor nor staff parking; however, revenue may be generated dependent upon if Red Cross chooses to charge car owners for charging, how much is charged, how often the chargers are used, and utility costs.

Although no costs and savings may be determined at this time, if Red Cross would like to move forward with an electric vehicle charging project, Entegrity will work with Red Cross to develop such cost and savings numbers.

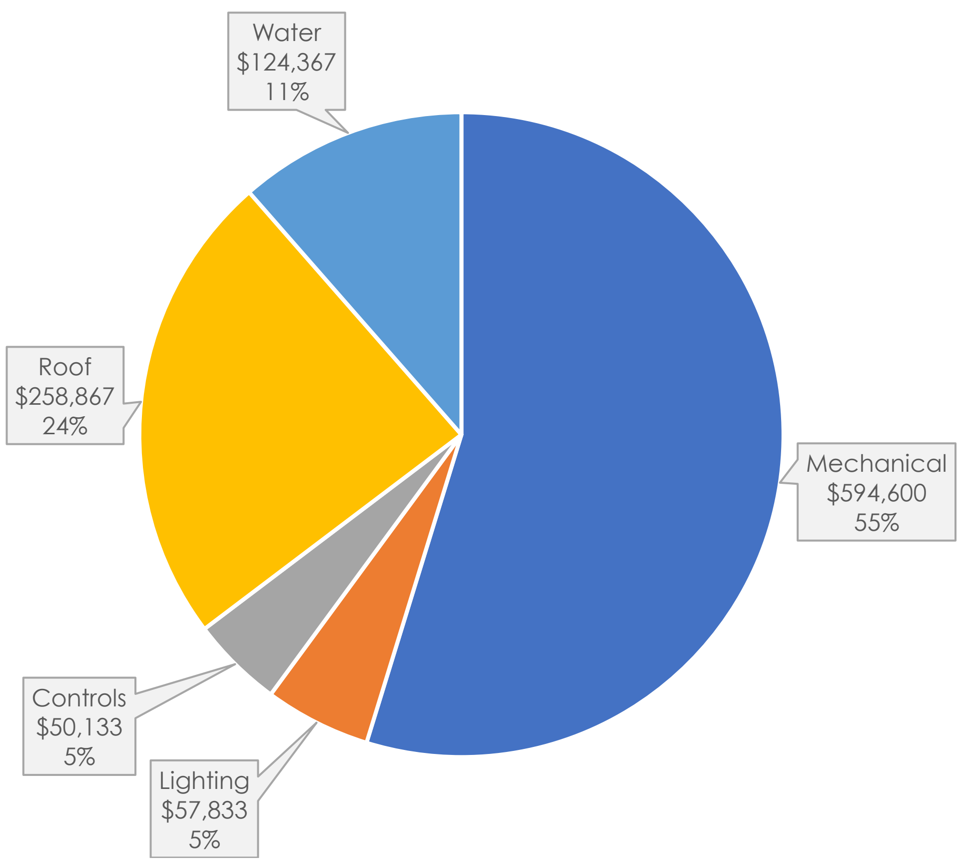
Capital Planning

Aside from utility expenses, upcoming capital costs associated with building infrastructure upkeep were also analyzed during Entegrity's sustainability assessment. This capital planning section demonstrates upcoming capital cost expectation by infrastructure category, provides a projection of when those operating costs will be incurred, and provides an annualized capital budget to consider implementing so that equipment and building components have funds available for upgrades when they are expected to be necessary. Not all assets are included in this capital plan, but the major assets and measure identified in the prior sections have been considered in this capital planning assessment.

Capital Planning Cost Categories

The capital plan presented includes the measures found and discussed in the assessment report above. The reserve budget allocation required to meet the need when the assets should require replacement is shown below in Figure 16.

Figure 16 – Capital Planning Cost Categories

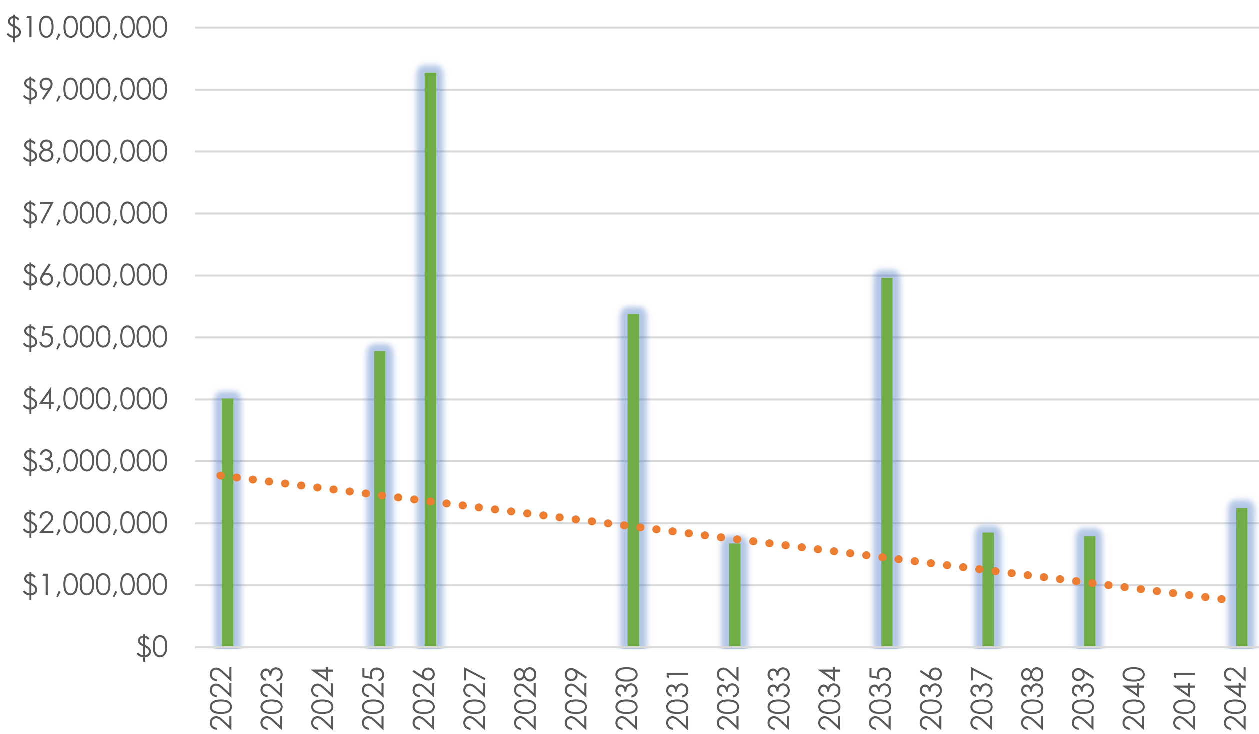


Capital Expense Projections

The graph below projects capital expense occurrences associated with the Red Cross Pomona facility upkeep over the next 20 years. Capital project costs are represented by green bars, while the annual capital reserve budget recommended to cover these costs is shown as the Orange dotted line, equivalent to $1,760,078. With the current plan it is projected that capital cost will decrease on average over time. Projected capital costs are detailed by facility asset category in the following Upcoming Capital Costs table below.

The below stacked bar chart indicates an immediate need of $4,012,324 of capital improvements and a roof replacement and partial lighting relamp in 2026 (Patching of this roof is an observed immediate need). The year 2035 represents the final replacement of the remaining original air handling equipment. Figure 17 aligns with the capital cost categories in the pie chart above / the asset categories in the table below.

Figure 17 – Capital Expense Projections



Capital Needs Detail

A line-by-line description of projected upcoming capital costs is provided in the table below. Where more than one replacement is required during the next 20 years, the second replacement is not shown.

Table 22 – Upcoming Capital Costs

Asset Category	Asset	Expected Useful Life, EUL (yr)	Remaining Useful Life, RUL (yr)	Expected Replacement Year (yr)	Expected Cost of Replacement, EV_R ($)
Water	Repair Water Softener System	15	0	2022	$106,000
Roof	Roof replacement	26	0	2022	$117,000
Controls	Upgrade to new BAS	17	0	2022	$111,000
Controls	RCx on Dampers, Actuators, and Valves, & TAB	17	0	2022	$86,000
Lighting	Exterior Lighting	17	0	2022	$90,000
Controls	Setup/Setback for 2nd Floor	17	0	2022	$184,000
Mechanical	Replace All IDF and MDF systems except for Unit 2	17	0	2022	$351,000
Mechanical	Replace AHU 1	20	0	2022	$1,173,000
Controls	Repair/Replace VFDs on pumping Systems and AHUs	17	0	2022	$83,000
Mechanical	Replace AHU 4	20	0	2022	$1,012,000
Mechanical	Replace AHU 5	20	0	2022	$150,000
Mechanical	RCx on VAV Boxes	20	0	2022	$319,000
Mechanical	Replace AHU 8	25	0	2022	$104,215
Water	Xeriscaping	10	3	2025	$1,824,000
Controls	Add updated Chiller Control Sequences	17	3	2025	$561,000
Water	Repair Water Softener System	15	3	2025	$751,000

Asset Category	Asset	Expected Useful Life, EUL (yr)	Remaining Useful Life, RUL (yr)	Expected Replacement Year (yr)	Expected Cost of Replacement, EV_R ($)
Controls	Upgrade to new BAS	17	3	2025	$204,000
Controls	RCx on Dampers, Actuators, and Valves, & TAB	17	3	2025	$89,000
Lighting	Exterior Lighting	17	3	2025	$615,000
Controls	Setup/Setback for 2nd Floor	17	3	2025	$78,000
Mechanical	Replace All IDF and MDF systems except for Unit 2	17	4	2026	$7,766,000
Controls	Repair/Replace VFDs on pumping Systems and AHUs	17	8	2030	$782,000
Water	Xeriscaping	10	8	2030	$1,824,000
Controls	Add updated Chiller Control Sequences	17	8	2030	$834,000
Mechanical	Replace boilers with condensing boilers	15	8	2030	$561,000
Lighting	Lighting Occupancy Sensors	13	13	2035	$751,000
Lighting	Daylighting Controls and window blinds in the Lobby/Stair/ south exposure areas.	13	13	2035	$1,824,000
Envelope	New Loading Dock Door Curtains	15	13	2035	$782,000
Mechanical	Replace AHU 1	20	13	2035	$5,485
Mechanical	Replace AHU 4	20	33	2055	$25,000
Mechanical	Replace AHU 5	20	33	2055	$237,000