



# MISSION BAY ARENA & ENTERTAINMENT COMPLEX



## 100% SD RECONCILIATION

MAY 8<sup>TH</sup>, 2015



SECTION 10  
**SUSTAINABILITY**



## NARRATIVE OUTLINE

### Sustainable Design

- Scope of Work
- Technical Premises and Criteria for Design
- Energy and Climate Analyses
  - Climate Analysis
  - Event Center Energy Analysis
  - Office Tower(s) Energy Analysis
- Campus Sustainable Approach
- Event Center Sustainable Approach
- Office Tower(s) Sustainable Approach
- Alternative Strategies
  - Solar PV System
  - Educational Opportunities
- Tenant Lease LEED Guidelines
- Appendices

## 10 – SUSTAINABLE DESIGN

### 10.1 – SCOPE OF WORK

- LEED® certification criteria, at a minimum level of LEED Gold.
- Pursuit of a sustainable and high performing facility, within the project budget and schedule.
- Innovative technologies, nature based systems, renewable energy systems, and highly efficient HVAC options are being investigated for the facilities.
- Integrated energy analyses are being utilized for these facilities. The 100% **Reconciled SD** Sustainability Narrative builds on the concept phase analysis, 25%, 50% and 75% Narratives, and integrates detailed energy analyses into this phase of the project.
- High performance facility operations, including lowered operational waste, educational experiences for the community and staff, pedestrian and bicycle-friendly transportation options, and sustainable food sourcing will be considered as the project moves forward.
- The project will use a Campus approach for LEED certification. This approach treats the entire site as a shared campus, allowing several LEED credits to be pre-approved under a Campus site application and then referenced by each individual or group of buildings located on the site. The Event Center will pursue LEED for New Construction certification, while the Office Towers will each pursue a LEED for Core and Shell certification as individual projects.

### 10.2 – TECHNICAL PREMISES AND CRITERIA FOR DESIGN

- US Green Building Council- Leadership in Energy and Environmental Design (LEED®) Gold Certification
- 2013 Green Building Code
- 2013 California Energy Code
- 2013 San Francisco Green Building Code Amendments

## 10.3 – ENERGY AND CLIMATE ANALYSES

### 10.3.1 - Overview

The SD energy analysis for the Event Center and Mixed-Use Development at Mission Bay Blocks 29-32 in San Francisco, CA shows the major design considerations, assumptions, and results of the climate and energy analyses. Placeholders are utilized in this analysis for pending project details or metrics to be confirmed with the Owner.

The SD analysis serves to:

- Establish energy targets and goals in line with the owner's expectations.
- Compare energy targets and goals to the current design energy model results.
- Review the buildings' usage and energy consumption patterns in order to identify future modeling adjustments and building-specific Energy Conservation Measures (ECMs).
- Investigate the local climate in order to identify driving factors for energy consumption as well as climate-specific ECMs.
- Evaluate the energy and cost savings potential of various Load Reduction measures and ECMs.

### 10.3.2 - Primary Project Energy Goals

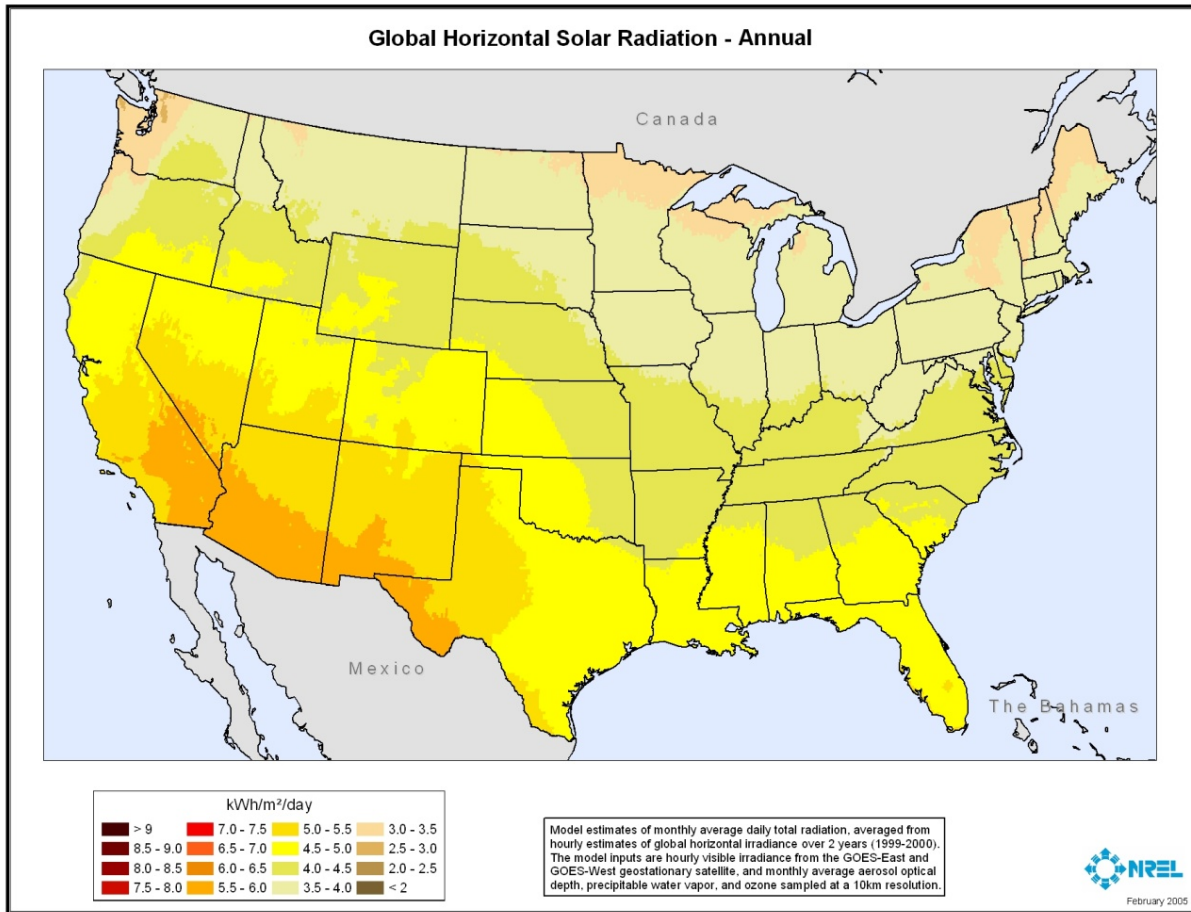
The primary energy-related goal of the project is to reach the highest level of performance within the building program and budget. San Francisco code requires that all new construction projects achieve Gold level certification under the 2009 LEED for New Construction Rating System on selected buildings. Additionally, San Francisco requires a minimum 15% reduction in energy costs when compared to a Baseline building as defined by ASHRAE 90.1-2007, Appendix G as well as show Title 24, Part 6, 2013 Compliance.

### 10.3.3 - Renewable Energy Analysis

This facility may include some amount of renewable energy production, most likely solar photovoltaic panels. As an educational opportunity, other renewable energy sources could be pursued, though solar power will likely provide the most beneficial economics for the facility. Previous analyses have indicated that wind, wave, and tidal sources would not be efficient producers of energy at this site. The following details the feasibility of a solar energy source.

### 10.3.4 - Solar

Figure 1 shows that the site is located in an area with notable solar radiation. At latitude 37.62° N, solar technologies are viable and can be economically desirable depending on scale and incentives. Annual solar resources may be approximately 542 kBtu/ft<sup>2</sup>-yr, an above average figure on a global scale of 254 to 697 Btu/ft<sup>2</sup>-yr. In order to pursue minimum 1% of annual energy usage from solar photovoltaic sources, roughly 126 kW of energy would need to be produced on site for the Event Center and roughly 49 kW for the office / mixed use facilities.



**Figure 1. Annual Global Horizontal Solar Radiation**

### 10.3.5 - Economics

The California state average electrical and natural gas rates, as published by the DOE Energy Information Administration, were used to evaluate utility costs for the purposes of determining the relative performance of the building options analyzed.

Electricity: \$0.1457 / kW-hr

Natural Gas: \$0.781 / therm

Actual Utility Rate Structures to be determined with input from the Owner.

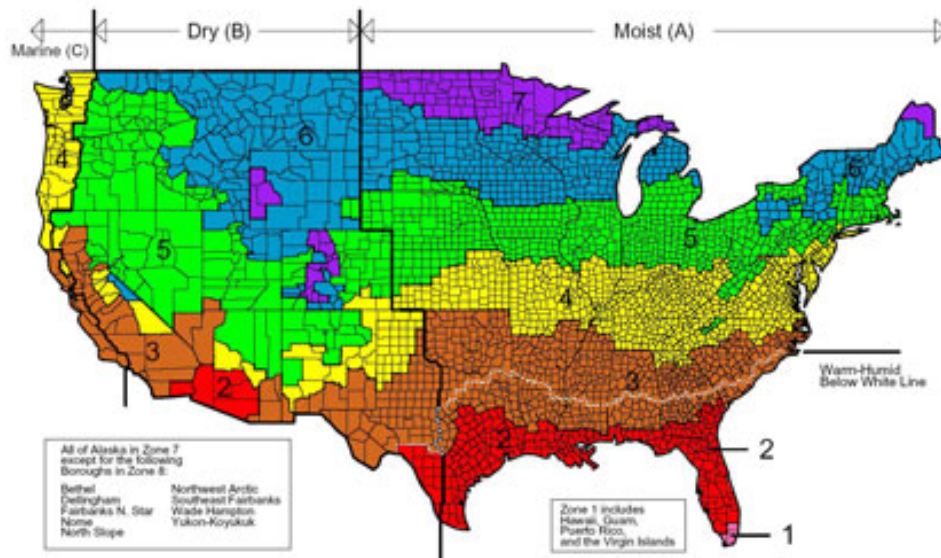


### 10.3.6 - Climate Analysis

#### 10.3.6.1 - Weather & Climate Zone

The selection of climate data complies with ASHRAE 90.1-2007, Appendix G. Weather data used in the energy analysis was based on 8760 hour Typical Meteorological Year (TMY3) data from the San Francisco, CA, International Airport, which is proximate and climatically similar to the project site. In compliance with Appendix G, sizing of equipment in the Baseline design model was based on 99.6% heating design temperatures and 1% cooling design temperatures per the ASHRAE Fundamentals Handbook.

A map of the United States showing climate zone locations is provided in Figure 2.

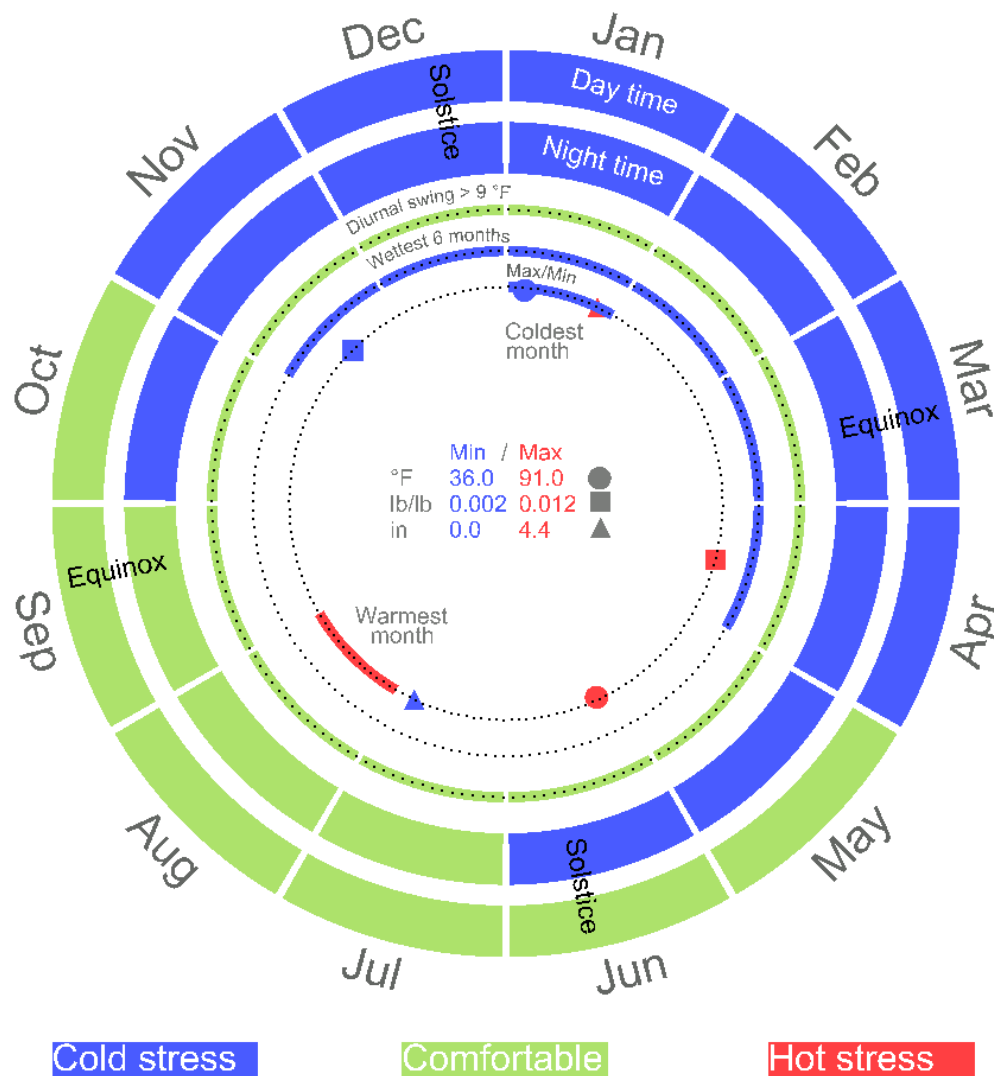


**Figure 2. Climate Zones for U.S. Locations from Figure B-1 of ASHRAE 90.1-2007**

Title 24, 2013 assigns San Francisco as Climate Zone 3 and per ASHRAE 90.1-2007, the project is located in Climate Zone 3C – “Warm-Marine” – due to the number cooling degree days (CDD50°F) less than or equal to 4500 and the number of heating degree days (HDD65°F) less than or equal to 3600. The classification of “Marine” is also applied because the location meets the following four criteria:

1. Coldest month average temperature between 27°F and 65°F
2. Warmest month average less than 72°F
3. At least four months with average temperatures over 50°F
4. Dry season in summer. The month with the heaviest precipitation in the cold season has at least three times as much precipitation as the month with the least precipitation in the rest of the year. The cold season is October through March in the Northern Hemisphere.

Weather data used in the energy analysis was based on 8760-hour Typical Meteorological Year (TMY3) data from the San Francisco International Airport weather station, which is proximate and climatically similar to the project site. What follows is an analysis of this weather station data with Figure 3 through Figure 5 providing a graphical summary of the site's climate and weather.

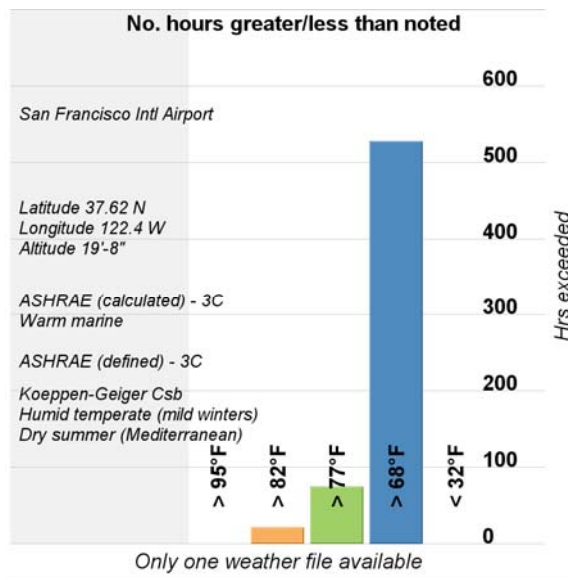


**Figure 3. Summary of Climate Metrics**

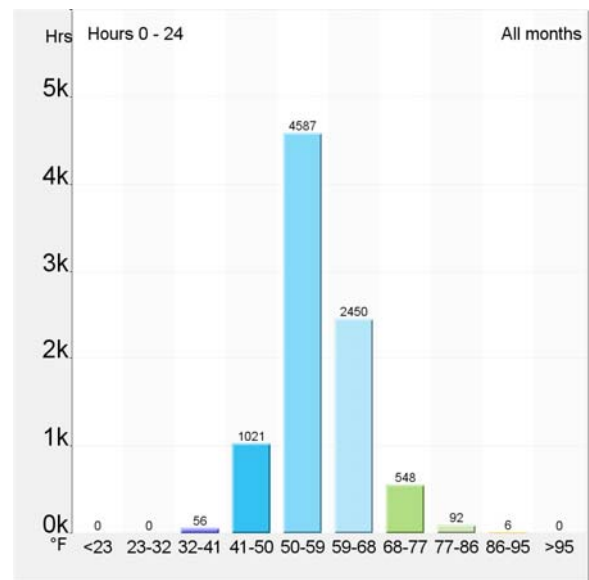
The outer two circles show that the weather throughout the year is fairly evenly distributed with 3012 HDD65 and 2585 CDD50. The term “Cold stress” refers to the need for heating, while “Hot stress” refers to the need for mechanical cooling, and “Comfortable” means temperatures are within the comfort range according to ASHRAE Standard 55 and require no additional cooling or heating. Based on the results of the shading analysis shown in Figure 6 and Figure 7, plus the

large amount of “Cold stress” months shown above it, can be concluded that the building is in a slightly heating-dominant climate. Therefore, climate-specific design strategies will focus more on passive solar heating and high efficiency heating systems. Additionally, due to the overall temperate climate, natural ventilation and free cooling will be taken advantage of as much as possible.

Figure 4. Climate and Weather, shows the number of hours per year that exceed certain temperature ranges typical for this location. Figure 5. Summary of Annual Temperature Distributions, shows the number of hours more specifically based on certain temperature ranges.



**Figure 4. Climate and Weather**



**Figure 5. Summary of Annual Temperature Distributions**

### 10.3.6.2 - Passive Design Strategies – Shading Analysis

Due to the cooler climate, the design should maximize solar heat gain in winter to reduce heating energy (Figure 6 and Figure 7). A detailed shading optimization calculation and iteration was developed using the following sun shading charts in an attempt to show the length of shade, if any, would best make use of solar heat gain in the winter and prevent it in the summer. However, based on final optimization results, shading is not strongly beneficial for any orientation in this location.



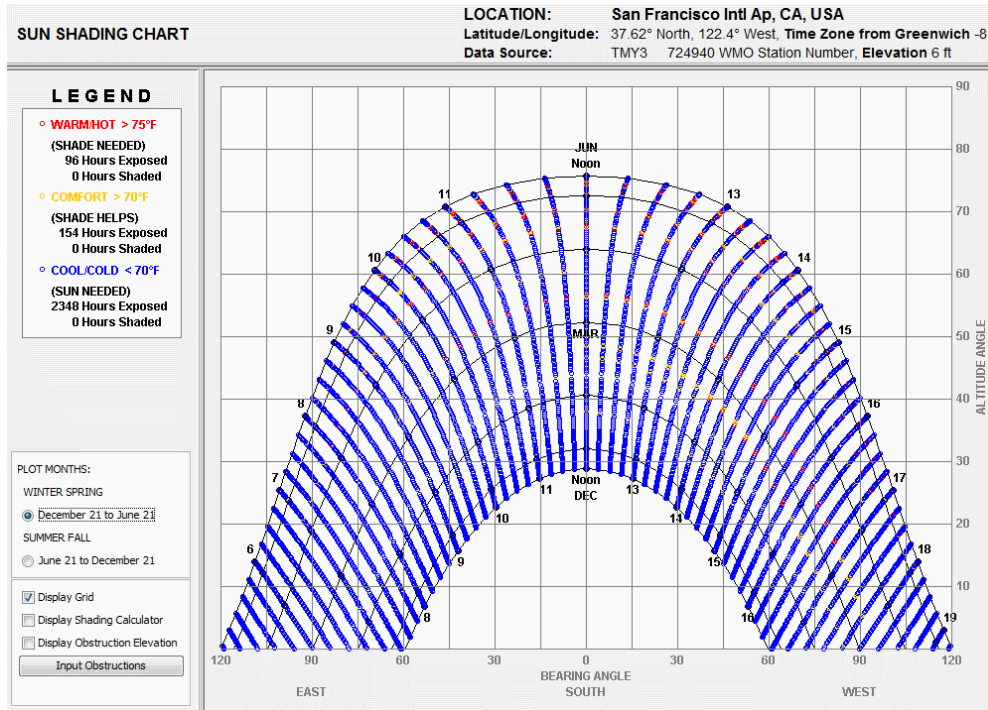


Figure 6. Sun Shading Chart – December through June

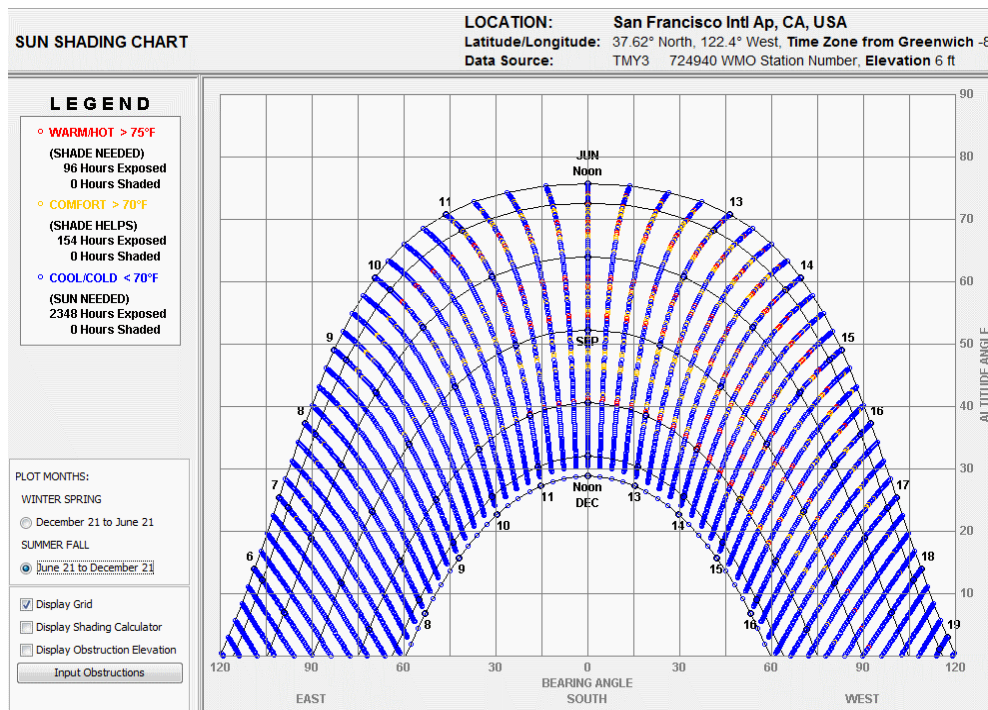


Figure 7. Sun Shading Chart – June through December

### 10.3.6.3 - Passive Design Strategies – Psychrometric Analysis

A psychrometric analysis of the hourly weather data suggests several climate-specific passive design strategies can be utilized to reduce the heating and cooling loads on the building. These are represented in Figure 8, with the number of applicable hours provided next to each strategy. Note that these strategies are preliminary estimates and are only to be used to help guide the process of developing low-energy design strategies.

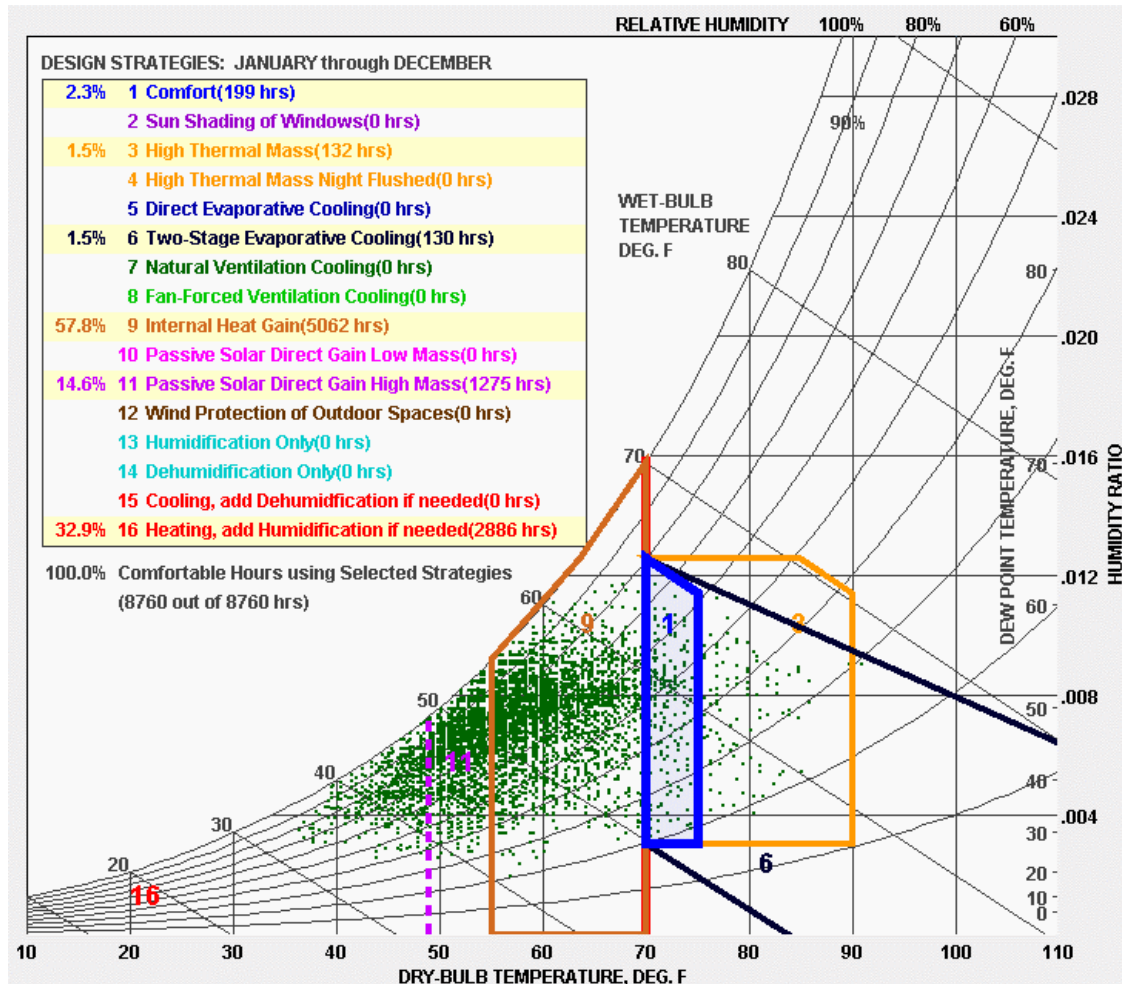


Figure 8. Potential Passive Design Strategies

Figure 8 shows all the weather data points plotted on a psychrometric chart. Based on the strategies implemented, the green plot points indicate compliance with comfort levels according to the California Energy Code. The legend lists each of the design strategies with a percentage and a number of hours, which represent the amount of time throughout the year that the strategy will be beneficial to maintaining comfort levels.

Based on the above psychrometric analysis the following are viable passive design strategies that likely to be included in the final design, where the number below corresponds to the numbered design strategy highlighted above:

1. Comfort – the occupants of a space are thermally comfortable without any design changes or heating/air conditioning of any kind for 2.3% (199 hrs) of the year
3. High Thermal Mass – this area outlined on the chart indicates that using high thermal mass on the interior would be a beneficial natural cooling design strategy for 1.5% (132 hrs) of the year
  - This strategy counts on the thermal storage and time lag and damping effects of the mass. Thus high daily outdoor temperature swings will become low indoor temperature swings.
6. Two-Stage Evaporative Cooling – this area outlined on the chart indicates that using two-stage evaporative cooling would be a beneficial natural cooling design strategy for 1.5% (130 hrs) of the year
  - The first stage uses water to cool the outside of a heat exchanger through which incoming air is drawn into the second stage where it is cooled by direct evaporation.
9. Internal Heat Gains – this area outlined on the chart represents a rough estimate of the amount of heat that is added to a building by internal loads such as lights, people, and equipment, which provide natural heating for 57.8% (5062 hrs) of the year
  - This strategy is very dependent on the building type, design, occupancy, and schedules. This Balance Point Temperature is the outdoor air temperature at which internal loads alone will keep the building in the comfort zone. Well designed, well insulated buildings have much lower balance point temperatures, thus use much less heating energy. Some building types (like homes and warehouses) have relatively low internal loads and need more supplemental heating, so the Balance Point might be 60°F. Other buildings with large internal loads (like factories) need almost no additional heating, and so might have a Balance Point near 20°F.
11. Passive Solar Direct Gain High Mass – this boundary line indicates that if the building has the right amount of sun-facing glass, then passive solar heating can raise internal temperatures naturally for 14.6% (1275 hrs) of the year
  - If this is a high mass building the amount of glass can be much greater without the danger that solar gain might over heat the space. The internal mass in contact with the internal air will store up this solar heat gain and then give it back later when it is needed.
16. Heating, add Humidification if needed – this area represents the 32.9% (2886 hrs) of the year when none of the other strategies can provide comfort conditions and so some form of heating is required, for example as provided by a furnace, boiler, heat pump, or resistance heaters

The following energy conservation measures (ECMs) will be optimized for the final project design based on the psychrometric study in Figure 8:

- Allow heat gain from equipment, lights, and occupants to reduce heating needs
- High performance, low-E glazing should be provided on each façade, but while tinted glass should be used on east and west sides, clearer glass should be used to facilitate passive solar gain on south side.
- Lower indoor temperature setpoints to the far end of the comfort ranges to reduce heating energy and allow for unoccupied temperature setback controls
- High efficiency heating systems should prove to be cost effective in this climate
- Extra insulation might prove cost effective, and will increase occupant comfort by keeping indoor temperatures more uniform
- On warm days ceiling fans or indoor air motion can make it seem cooler by at least 5 degrees F thus less air conditioning is needed

### 10.3.7 – Event Center Energy Analysis

#### 10.3.7.1 - Event Center Energy Target – LEED EAc1 Points

- The 2009 LEED for New Construction rating system requires that any project seeking certification must demonstrate a 10% energy cost savings relative to a code-compliant building defined by ASHRAE 90.1-2007, Appendix G. After meeting the energy efficiency prerequisite, LEED awards points under Energy and Atmosphere Credit 1 (EAc1) as shown in the Table below. However, San Francisco energy code requires a minimum 15% reduction as well as show Title 24, Part 6, 2013 Compliance. The main energy target of the Event Center is to achieve 24-34% energy cost savings, equivalent to 7-12 LEED EAc1 points. Based on the current design, the energy model shows an energy cost savings (performance rating) of 25.88% relative to a Baseline building design per ASHRAE 90.1-2007, Appendix G. This is equivalent to 7 LEED EAc1 points, as shown in Table 1 below.

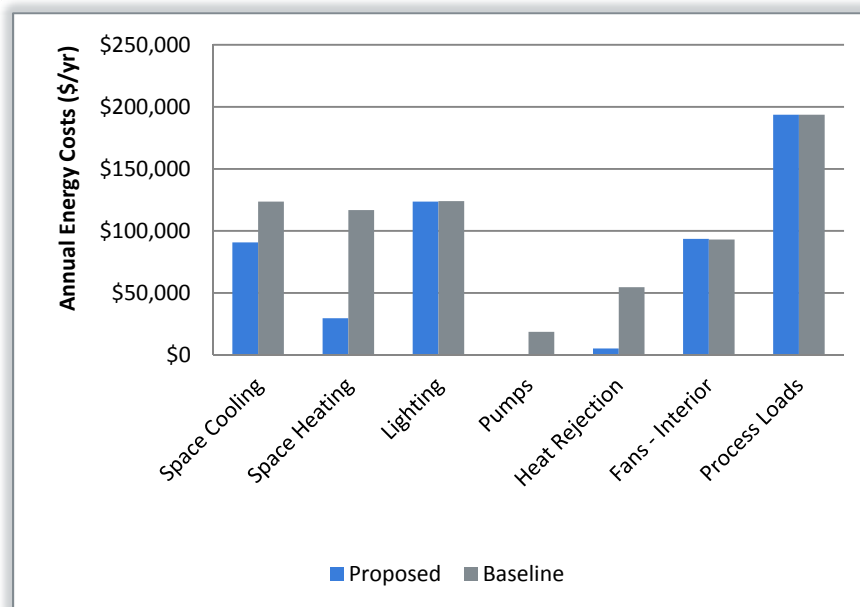
**Table 1. 2009 LEED-NC EAc1 Point Scale**

Points Awarded	% Energy Cost Savings
1	12%
2	14%
3	16%
4	18%
5	20%
6	22%
7	24%
8	26%
9	28%
10	30%
11	32%
12	34%

} Event Center Project Target

13	36%
14	38%
15	40%
16	42%
17	44%
18	46%
19	48%

A comparison of the Proposed and Baseline Designs is provided in Figure 9 below.

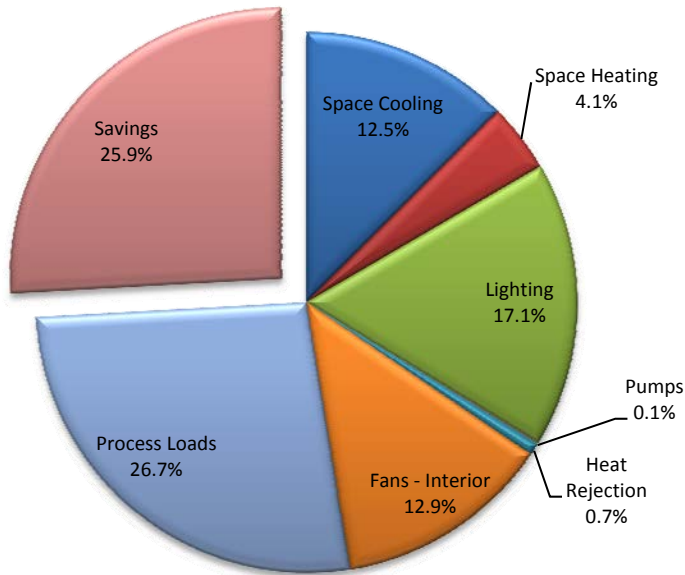


**Figure 9. Comparison of Energy Costs by End Use**

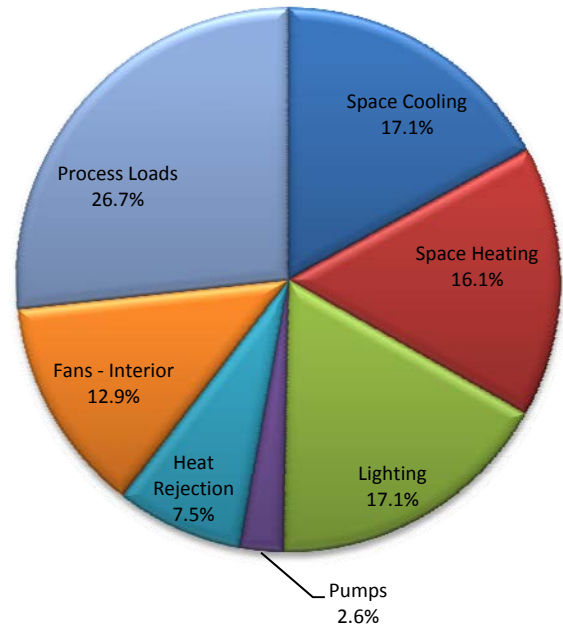
#### 10.3.7.2 - Energy Consumption Breakdown

Figure 10 and Figure 11 illustrate the breakdown in energy by end use in the Proposed and Baseline building designs. A detailed spreadsheet containing pertinent inputs to the energy model is located at the end of the event center energy model report section.





**Figure 10. Percentage of Cost by End Use in Proposed Design**



**Figure 11. Percentage of Cost by End Use in Baseline Design**

For this project process loads make up a significant portion of the overall energy usage "pie." The process load energy usage category consists of the following according to percentage of total process load energy consumption.

1. Plug Loads (50.05%) – these are estimates from COMNET on a building-area average of 0.79 W/sf based on Court Sports Arena usage. This is the most unpredictable of all process load usages and this estimate is the best guess at actual usage. It includes computers, printers, copiers, projectors, etc.
2. Refrigeration (20.72%) – this includes estimated loads for all coolers, freezers, and all equipment associated with ice events
3. Natural Gas Cooking Equipment (18.84%)
4. Electrical Cooking Equipment (6.97%)
5. Elevators/Escalators (3.43%)
6. Process Lighting (TBD) – this is all lighting that is excluded from the interior lighting power, but will still contribute to energy usage throughout the year. One source of process lighting for this project is the exit signs.
7. Event and Sports Lighting (TBD) - this is the other source of process lighting for the project and it will be provided for the final energy model run and LEED Submission

Note that without the process load energy the overall energy cost savings for the event center is 35.3%. Therefore, it is recommended that priority be placed on reducing event center process loads and providing accurate schedules for all process equipment types so that the model will more accurately reflect anticipated usage.

### 10.3.7.3 - Facility Description – Building Use Schedules

Fractional utilization schedules for occupants, lights, and equipment and other loads were specified for the building. The building was divided into two categories: Event Center and Office. The Warrior's Offices, Arena Operations, and Warrior's Team Offices are categorized as Office and are taken from the ASHRAE 90.1-2007 User's Manual. The schedules are shown in Figure 12 and Figure 13 and go year-round. These schedules will be finalized based on owner input.

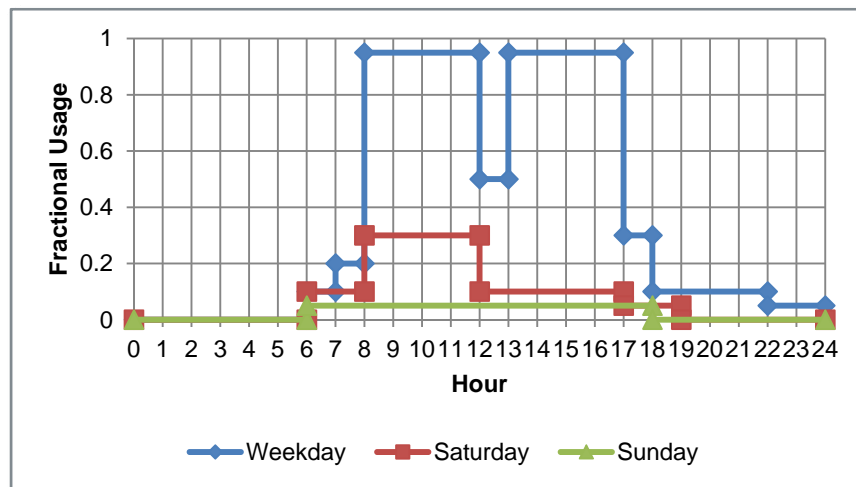


Figure 12. Office Occupancy Schedule

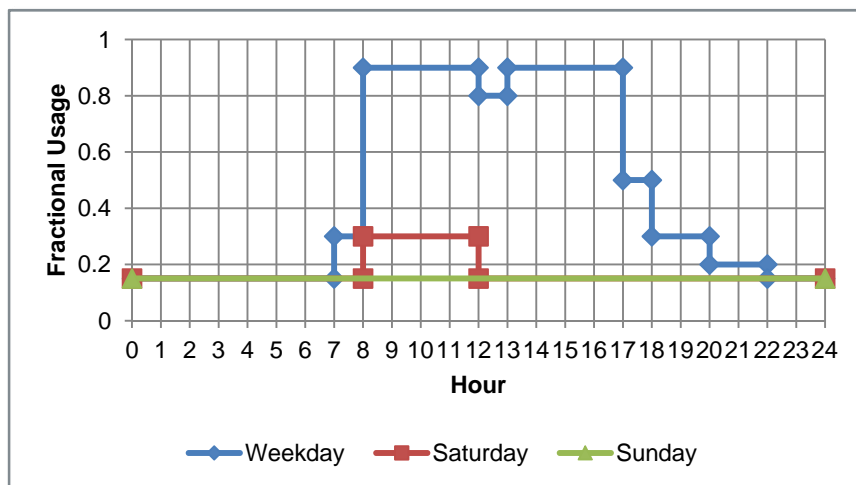
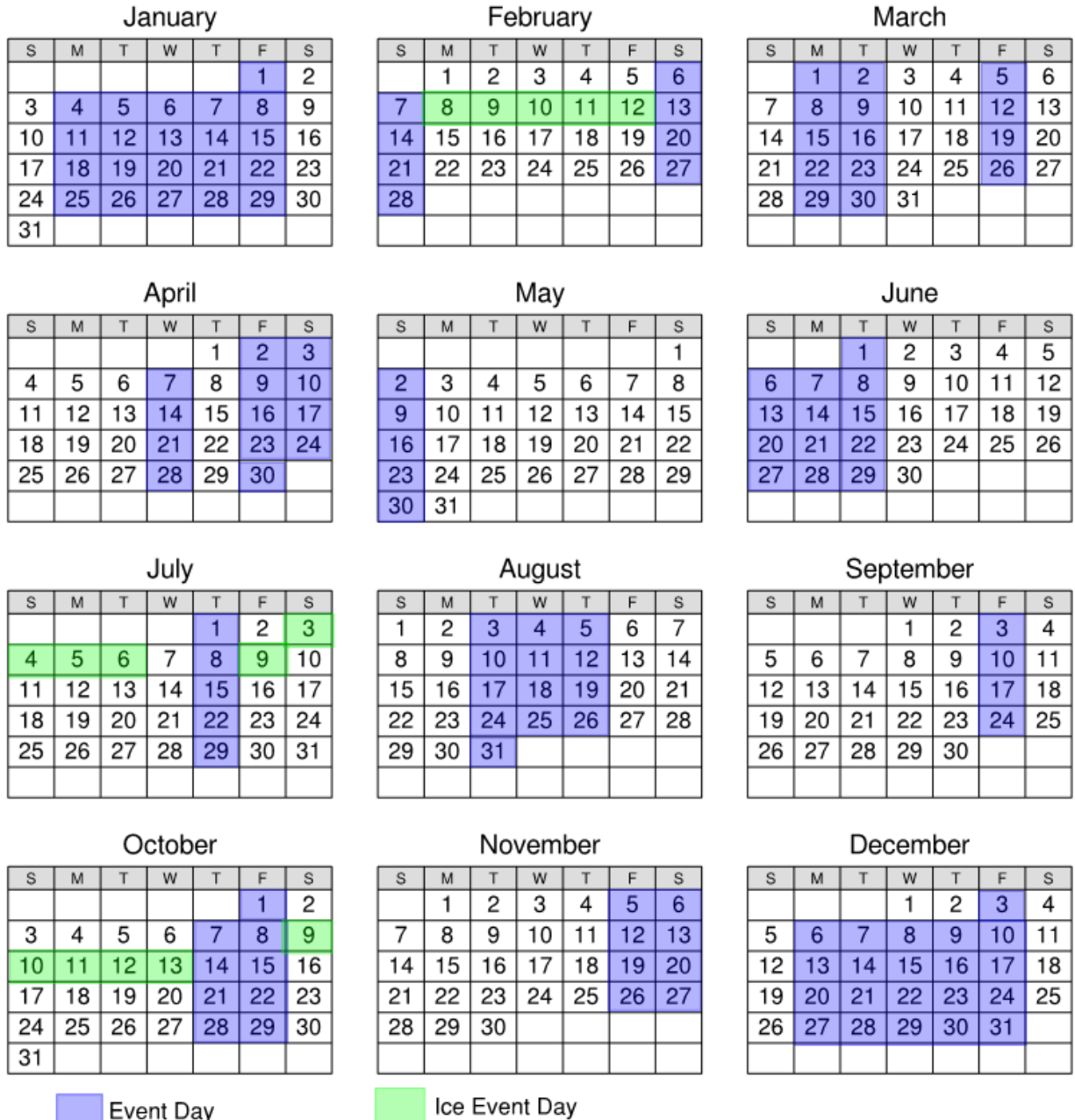
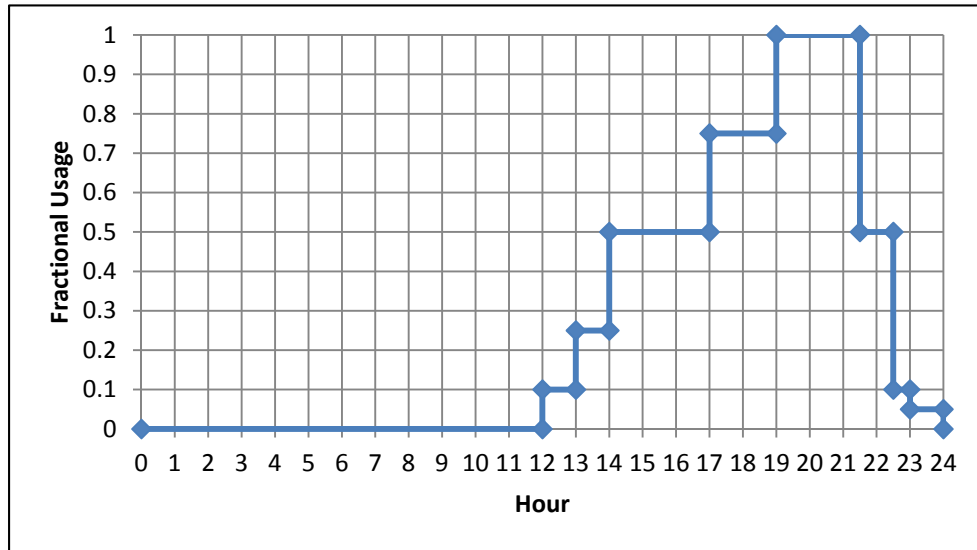


Figure 13. Office Lighting and Equipment Schedule

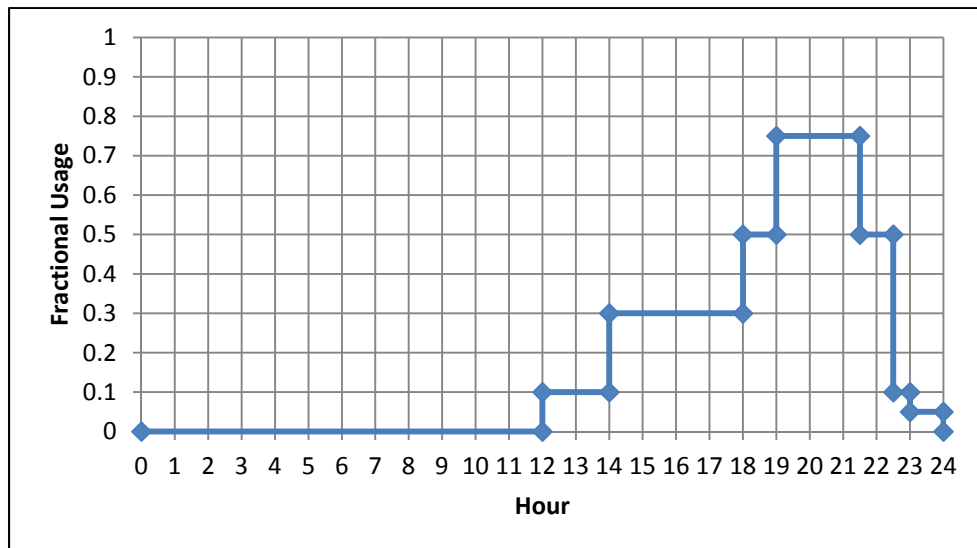
The annual schedule for the Event Center was divided up between Ice Events, regular Events, and non Event days as shown in the calendar below. An estimated 135 events and 15 ice events were modeled in a simplified allotment as shown based on input from the mechanical engineer.



All non-event days were considered unoccupied and all internal loads were modeled at zero and the HVAC was cycled only to meet load. The internal load utilization schedules for both Ice Event and regular Events are shown in Figure 14 and Figure 15 below. These schedules are based on a modified “Assembly” usage category as found in the ASHRAE 90.1-2007 User’s Manual and will be finalized based on owner input.



**Figure 14. Event center Event Day Internal Load Schedule**



**Figure 15. Event center Ice Event Day Internal Load Schedule**

#### 10.3.7.4 - Facility Description – Internal Loads & Indoor Design Conditions

ASHRAE 90.1 defines the allowed lighting power density per space type or building type. Other assumptions for occupant and process loads were assumed based on information in the ASHRAE 90.1 User's Manual and COMNet. A summary of internal loads and assumed indoor design conditions typical of building space types is provided in Table 2. These values will be further refined as the design progresses.

**Table 2. Event Center Internal Loads and Indoor Design Summary**

Space Type	Owner		Electrical Engineer		
	Occupant Density (sf/person)	HVAC Operations Schedule	Illuminance (foot-candles)	Lighting Power Density (W/sf)	Equipment Power Density (W/sf)
BOH/Storage	0	"Assembly" Schedule M-F 8 AM-10 PM Sat-Sun 8 AM-10 PM	10	0.8	0.27
Seating Bowl/Suites/Media/Press	11.33		5	0.4	1.01
Concourse/Circulation	0		10	0.5	0.78
Lounge/Club	100		10	1.4	1.53
Locker/Other Sport Rooms	10		40	0.6	0.83
Technical (MEP)	0		10	1.5	0.2
Food & Beverage	100		20	1.2	1.56
Offices/Admin	275		30	1.1	0.8
Toilets	0		15	0.9	0.41
Sponsor/Retail	300		20	1.7	0.5
Court Sports Area/Ice Floor/Retractable	11.33		50	2.3	0.79
Vertical Circulation	0		5	0.6	0.78

#### 10.3.7.5 - Facility Description – Baseline and Proposed Modeling Inputs

<b>Project Name:</b>	Event Center at Mission Bay Blocks 29-32
<b>City, State:</b>	San Francisco, California
<b>Climate Zone:</b>	3C
<b>Heating Source:</b>	Natural Gas
<b>Energy Standard:</b>	ASHRAE 90.1-2007, App. G
<b>Energy Simulation Program:</b>	IES <VE>

Model Input Parameter	Proposed Design per SD plans and narratives	Baseline Design per ASHRAE 90.1-2007 Appendix G
<b>Building Envelope (Construction Assemblies)</b>		
Roofs (Description, Insulation R-value, Overall U-value, Reflectivity)	Insulation entirely above deck, R-20 c.i.; U-0.048, reflectivity-0.30 (SRI<82)	
Walls - Above Grade (Description, Insulation R-value, Overall U-value)	Steel-framed with R-13 cavity and R-3.8 continuous insulation with a U-factor of 0.084	
Walls - Above Grade - Semiheated (Description, Insulation R-value, Overall U-value)	Steel-framed with R-13 cavity insulation with a U-factor of 0.124	



Walls - Below Grade (Description, Insulation R-value, Overall C-factor)	8" medium weight concrete block with solid grouted cores and no insulation with a C-factor of 1.140	
Exposed Floors (Description, Insulation R-value, Overall U-value)	Steel-joist with R-19 insulation with a U-factor of 0.052	
Slab-On-Grade Floors (Description, Insulation R-value, Overall F-value)	Unheated 6" concrete slabs with no insulation with an F-factor of 0.730	
Fenestration and Shading		
Vertical fenestration Area (% of Wall area) N/S/E/W	Overall 46% 53 / 26 / 45 / 58%	Overall 40% maximum 46 / 23 / 39 / 50%
Vertical Glazing Description, U-factor, SHGC, VLT	Curtainwall/Storefront; Assembly U-0.434, SHGC-0.283, VLT-0.415	Metal framing (curtainwall/storefront); Assembly U-0.60, SHGC-0.25, VLT-0.76
HVAC (Air-side)		
Primary HVAC Type	Single zone VAV DX units with hot water heating and Indirect/Direct Evaporative Coolers (IDDEC)	System 7 – Packaged VAV with Reheat (one per floor, with exceptions below)
Other HVAC Type	Dedicated Outside Air Unit with IDDEC providing ventilation to Variable Refrigerant Volume fan coil units serving suites, food prep, retail, media, etc.  CRAC units serving MEP only spaces  Packaged VAV DX units with Hot Water reheat and IDDEC serving Warrior's Offices, Arena Ops, and Warrior's Team Offices	System 3 – Packaged Single Zone AC, Exception (b) used since schedules and occupancy for Warrior's Offices, Warrior's Team Offices, and Arena Ops differ from rest of event center  System 3 – Packaged Single Zone AC, Exception (b) used for bowl area and concourses as peak loads differ from remainder of building
Total Cooling Capacity	Auto-sized	115% system coil capacity as auto-sized
Unitary Cooling Capacity Ranges	< 65 MBH, 65-135 MBH, 135-240 MBH, 240-760 MBH, >760 MBH (as determined by load)	> 760 MBH and 240-760 MBH
Unitary Cooling Efficiency	13.0 SEER, 11.0 EER/11.2 IEER, 10.8 EER/11.0 IEER, 9.8 EER/9.9 IEER, and 9.5 EER/9.6 IEER, respectively	9.5 EER/9.6 IEER and 9.8 EER/9.9 IEER
Total Heating Capacity	Auto-sized	125% system coil capacity as auto-sized
Unitary Heating Capacity Ranges	TBD	As auto-sized
Unitary Heating Efficiency	TBD	80%

Fan System Operation	Fans operate continuously whenever spaces are occupied and cycle to meet loads when unoccupied	Fans operate continuously whenever spaces are occupied and cycle to meet loads when unoccupied; Variable speed for System 7, Constant Volume for Systems 3
Outdoor Air Design Min Ventilation	As per the 75% SD mechanical schedules, applied on a cfm/sf average per air handling unit	Same as Proposed
HVAC Air-side Economizer Cycle	None	75°F dry bulb economizer
Design Airflow Rates (Conditioned Space)	Auto-sized	- 0.4 cfm/sf minimum airflow setpoints for all terminal units - All airflows allowed to auto-size
Total System Fan Power (Conditioned)	362.03 kW (estimated from auto-sized loads, airflows, and static pressures)	206.28 kW (estimated from auto-sized loads, airflows, and static pressures)
Total Supply Fan Power	326.79 kW	153.35 kW
Total Return / Relief Fan Power	35.24 kW	52.93 kW
Total Exhaust Fan Power (tied to AHUs)	TBD	TBD
Demand Control Ventilation	- DCV will be designed to meet requirements - Spaces to be modeled in future iterations - Ventilation is modeled as zero during unoccupied hours	- DCV required within the breathing zone for all densely occupied spaces greater than 500 sq. ft. - Spaces required TBD - Ventilation is modeled as zero during unoccupied hours
Supply Air Temperature Reset Parameters	None	For System 7 – SATR of 5°F under minimum cooling conditions
<b>Lighting</b>		
Interior Lighting Power Calc Method	Space-by-Space Method as described above	
Interior Lighting Power Density (Average)	0.81 W/sf	
Automatic Lighting Controls	Occupancy sensors in conference/meeting rooms and employee break rooms as required.	
Exterior Lighting Power	Tradable – 8.55 kW (estimate) Nontradable – TBD	Tradable – 8.55 kW (estimate) Nontradable – TBD 5% Allowance – 0.4275 kW
	Total – 8.55 kW (estimate)	Total – 8.98 kW (estimate)
<b>Miscellaneous</b>		
Receptacle equipment	Per COMNET Building Area Method as described above, 0.79 W/sf	
Interior Process Lighting	TBD: Exit and sports/event lighting	

HVAC (Water-side)		
Number of Chillers	All AHUs DX with the exception of the low temperature cooling coils required for ice events. Ice event chiller to be modeled as process load.	2 water-cooled centrifugal chillers
Chiller Capacity (Per Chiller)		362 tons each
Chiller Efficiency		6.1 COP (6.4 IPLV)
Chiller Water Loop Supply Temperature		44°F
Chilled Water (CHW) Loop Delta-T		12°F
CHW Loop Temp Reset Parameters		44°F at 80°F and above; 54°F at 60°F and below; and ramped linearly between 44°F and 54°F between 80°F and 60°F
CHW Loop Configuration		Primary-Secondary
Number of Primary CHW Pumps		2
Primary CHW Pump Power		11 W/gpm
Primary CHW Pump Flow		723.7 gpm per chiller
Primary CHW Pump Speed Control		Constant flow-each primary pump interlocked with associated chiller
Number of Secondary CHW Pumps		1
Secondary CHW Pump Power		11 W/gpm
Secondary CHW Pump Flow		1,447.45 gpm
Secondary CHW Pump Control		Variable speed
Number of Cooling Towers	Supplemental cooling tower and common heat rejection loop to be modeled externally through worksheets and calculations and not directly modeled in the energy simulation program.	One
Cooling Tower Fan Power		39.49 kW (19.5 W/gpm)
Cooling Tower Fan Control		Two-speed axial fan
Condenser Water (CW) Leaving Temp		85°F
CW Loop Delta-T		10°F
CW Loop Temp Reset Parameters		70°F leaving water where weather permits, floating up to leaving water temperature at design conditions
Number of CW Pumps		2
CW Pump Power		19 W/gpm
CW Pump Flow		2,024.9 gpm total
CW Pump Control		Riding the pump curve
Number and Type of Boilers	7 condensing boilers	2 equally-sized natural draft hot water boilers
Total Boiler Capacity	6 boilers at 300 MBH, 1 boiler at 200 MBH	7,371.36 kBtu/h (3,685.68 kBtu/h per boiler)
Boiler Efficiency	95%	80%
Hot Water (HHW) Supply Temp	140°F	180°F
HHW Delta-T	40°F	50°F

HHW Temp Reset Parameters	None	180°F at 20°F and below; 150°F at 50°F and above; and ramped linearly between 180°F and 150°F between 20°F and 50°F
HHW Loop Configuration	Primary-only	
Number of Primary HHW Pumps	1	
Primary HHW Pump Power	19 W/gpm	
Primary HHW Pump Flow	176.29 gpm	294.75 gpm
Primary HHW Pump Control	Variable speed	

#### 10.3.7.6 – Load Reduction Measures – Event Center

Before analyzing energy-efficient HVAC and load handling strategies, it is often cost-effective to investigate envelope-related load reduction strategies. These passive, low maintenance strategies are a priority since they can contribute to smaller, less expensive HVAC equipment, thus increasing the cost-effectiveness of a whole-building solution. As a result, a number of envelope-related load reduction strategies were analyzed to identify those building parameters that have the largest impact on energy consumption. Based on the results shown in Table 3 and

Table 4, we recommend prioritized investment be made in the following building parameters:

- Windows – U-0.33 assembly (U-0.24 center-of-glass)
- Walls – R-13 + R-10 c.i.
- High Albedo Roof – SRI greater than 82

**Table 3. Summary of Load Reduction Strategies**

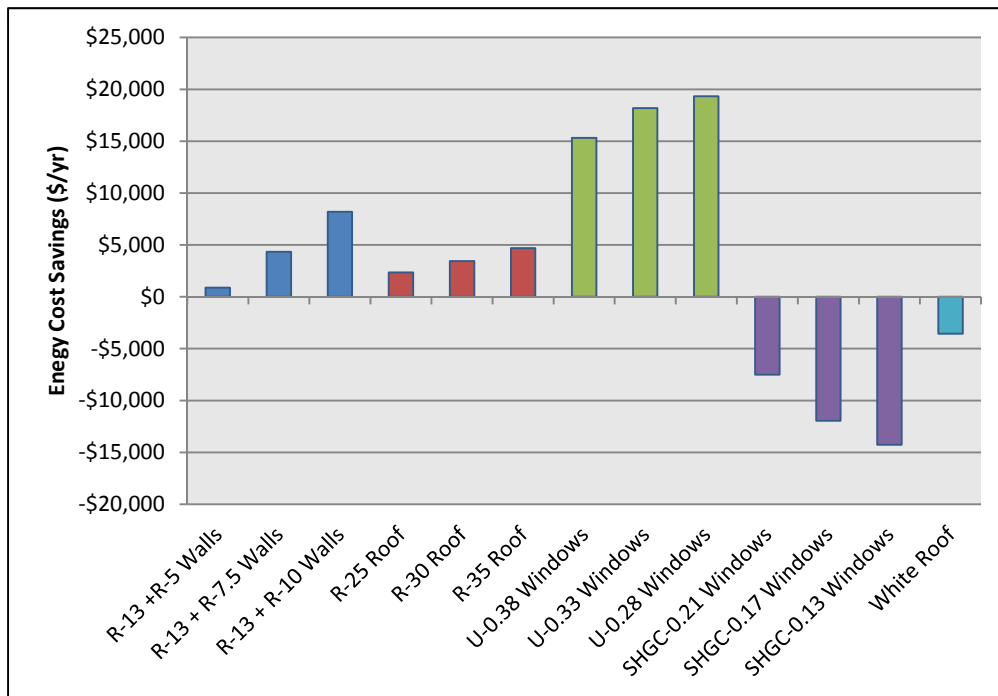
LR	Description	Energy Usage (kBtu/yr)	Energy Costs (\$/yr)	Cumulative Savings to Proposed (\$/yr)	% Energy Cost Savings over Baseline	Potential LEED EAc1 Points
	Baseline Design per ASHRAE 90.1, App. G	30,014,577	\$724,491			-
	Proposed Design per SD Documents	16,426,193	\$536,992	-	25.9%	7
1-1	R-13 + R-5 Walls	16,375,828	\$536,110	\$883	26.0%	8
1-2	R-13 + R-7.5 Walls	16,191,914	\$532,651	\$4,342	26.5%	8
1-3	R-13 + R-10 Walls	16,007,359	\$528,804	\$8,189	27.0%	8
2-1	R-25 Roof	16,311,204	\$534,641	\$2,351	26.2%	8
2-2	R-30 Roof	16,234,740	\$533,543	\$3,449	26.4%	8
2-3	R-35 Roof	16,185,287	\$532,296	\$4,696	26.5%	8
3-1	U-0.38 Windows	15,594,961	\$521,666	\$15,326	28.0%	9
3-2	U-0.33 Windows	15,442,862	\$518,806	\$18,187	28.4%	9
3-3	U-0.28 Windows	15,390,967	\$517,662	\$19,330	28.5%	9
4-1	SHGC-0.21 Windows	16,848,998	\$544,499	-\$7,507	24.8%	7
4-2	SHGC-0.17 Windows	17,096,998	\$548,942	-\$11,949	24.2%	7
4-3	SHGC-0.13 Windows	17,240,388	\$551,263	-\$14,270	23.9%	6
5-1	White Roof	16,640,444	\$540,550	-\$3,557	25.4%	7

**Table 4. Cost Impact of Load Reduction Strategies**

LR	Description	Envelope Cost Change (\$)	Cooling		Heating		Net Construction Cost Change (\$)	Energy Cost Savings (\$/yr)	Simple Payback Period (yrs)
			Load Change (tons)	Mech Equip Cost Change (\$)	Load Change (MBH)	Mech Equip Cost Change (\$)			
1-1	R-13 +R-5 Walls	\$41,970	0.51	\$7,005	-58.0	-\$11,899	\$37,076	\$883	42.0
1-2	R-13 + R-7.5 Walls	\$118,574	1.65	\$22,545	-157.0	-\$32,187	\$108,932	\$4,342	25.1
1-3	R-13 + R-10 Walls	\$185,400	2.17	\$29,686	-126.6	-\$25,955	\$189,130	\$8,189	23.1
2-1	R-25 Roof	\$178,884	-6.15	-\$83,988	-83.8	-\$17,177	\$77,719	\$2,351	33.1
2-2	R-30 Roof	\$366,147	1.73	\$23,688	-256.5	-\$52,586	\$337,250	\$3,449	97.8
2-3	R-35 Roof	\$561,788	1.54	\$21,034	-219.9	-\$45,085	\$537,736	\$4,696	114.5
5-1	White Roof	Negligible	-11.04	-\$150,918	4.1	\$841	-\$150,077	-\$3,557	Immediate

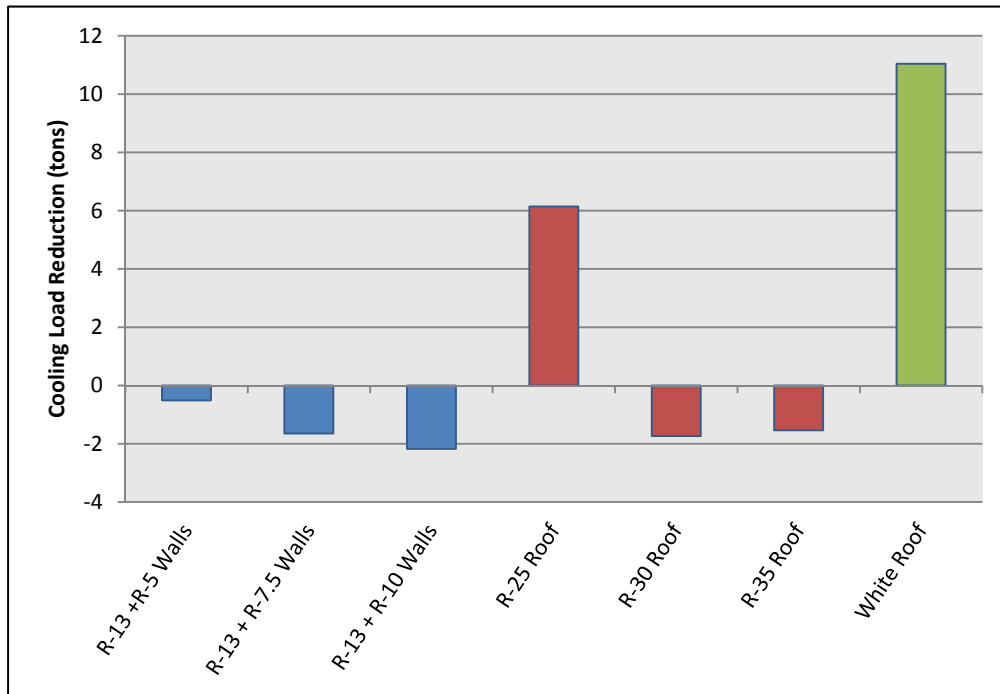
Note 1 - Envelope construction cost determined through RS Means

Note 2 - Cooling and heating equipment costs determined by Clark Construction and Mortenson Construction

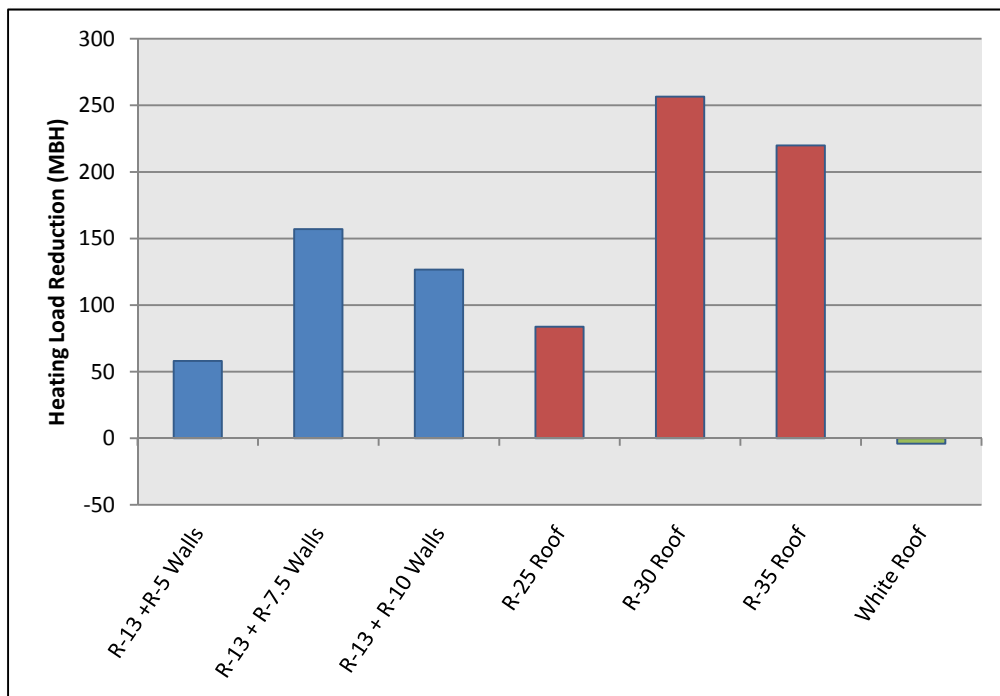


**Figure 16. Energy Cost Savings of Load Reduction Measures**





**Figure 17. Cooling Load Reductions due to Load Reduction Measures**



**Figure 18. Heating Load Reductions due to Load Reduction Measures**

#### *Improved Window Assembly U-values*

The Proposed Building is assumed to have windows with a center of glass U-value of 0.296 and an overall assembly U-value of U-0.434. By contrast, the Baseline design includes glazings having a whole-window assembly U-value of U-0.60 and a solar heat gain coefficient of SHGC-0.25. This strategy involves using various combinations of Low-E, argon-filled, and/or triple-paned glazings in a thermally broken window frame to reduce heat transfer. For the purpose of this analysis, Viracon glass and Kawneer 1600UT System 2 curtainwall framing was assumed as the basis of design. Table 5 lists potential glazing alternatives, showing the Center-of-Glass U-values, as well as the Window Assembly U-values.

**Table 5. Potential Glazing Alternatives**

Viracon		U-values	
Description	Product	Center-of-Glass	Window-Assembly
Low-E on #2, Air-filled	VE1-2M on Clear	0.29	0.38
Low-E on #2, Argon-filled	VE1-2M on Clear	0.24	0.33
Triple-pane, Low-E on #2, Argon-filled	VE1-2M on Clear	0.18	0.28

#### *Improved Window Assembly SHGC-values*

The Proposed Building is assumed to have windows with a solar heat gain coefficients (SHGC) of 0.283 as its basis of design. By contrast, the Baseline Building includes windows with solar heat gain coefficients (SHGCs) of 0.25 at all orientations. This strategy involves using tinted, fritted, or reflective glass types with reduced center-of-glass SHGC values. This lowering of the SHGC is meant to reduce solar heat gain to the space, thereby reducing cooling needed. However, a balance must be struck in climates with moderately cold winters, as a higher SHGC can help to reduce heating costs in the winter. For the purpose of this analysis, Viracon's website was referenced to identify feasible SHGC alternatives, with the following alternatives tested in the energy model:

- 1) SHGC-0.21
- 2) SHGC-0.17
- 3) SHGC-0.13

#### *Increased Roof Insulation*

The Baseline design includes a light-weight roof assembly with continuous R-20 insulation entirely above deck, resulting in a roof assembly U-value of U-0.048. This strategy involves adding increasing amounts of insulation to the entire roof, resulting in the following roof alternatives:

- 1) R-25 continuous insulation (c.i.) – U-0.039
- 2) R-30 continuous insulation (c.i.) – U-0.032
- 3) R-35 continuous insulation (c.i.) – U-0.028

#### *Increased Wall Insulation*

The Baseline design includes steel-framed walls with R-13 batt between studs on 16" centers and R-3.8 continuous insulation (c.i.), resulting in a wall assembly U-value of U-0.084. This strategy involves adding increasing levels of continuous rigid insulation to the wall assembly. The batt insulation is optional, so long as an additional inch of continuous insulation is added in its absence. The resulting wall alternatives analyzed were as follows:

- 1) R-13 batt + R-5 c.i. – U-0.077
- 2) R-13 batt + R-7.5 c.i. – U-0.064
- 3) R-13 batt + R-10 c.i. – U-0.055

#### *High-Albedo, Cool Roof*

The Baseline design includes a dark-colored roof modeled with a long-term reflectance of 0.3. This strategy investigates the use of a high-albedo, white-colored roof with either a reflectance of greater than 0.70 and an emittance greater than 0.75 or a minimum SRI of 82. In this case, the roof of the Proposed design can be modeled with a long-term reflectance of 0.45.

The following are potential ECMs that will be modeled and reported in future iterations of the energy modeling reports for the event center based on potential impacts to design.

#### Mechanical

- Under-floor air distribution versus the current design of VAV terminal units for administration and office areas on Level 100-Mezzanine
- Optimization of the mechanical equipment control sequences

#### Lighting

- Daylight harvesting options and optimization to be determined
- High efficiency sports and event lighting as compared to standard design practices

### 10.3.8 - Office Tower(s) Energy Analysis

#### 10.3.8.1 - Energy Targets - LEED EAc1 Points

- The 2009 LEED for Core & Shell rating system requires that any project seeking certification must demonstrate a 10% energy cost savings relative to a code-compliant **Baseline** building defined by ASHRAE 90.1-2007, Appendix G. After meeting the energy efficiency prerequisite, LEED awards points under Energy and Atmosphere Credit 1 (EAc1) as shown in the Table below. However, San Francisco energy code requires a minimum 15% reduction as well as 2013 show Title 24, Part 6, 2013-Compliance. The main energy target of the Office Towers is to achieve 24-34% energy cost savings, equivalent to 9-14 LEED EAc1 points. Based on the current design, the energy model shows an energy cost savings (performance rating) of 39.129.2% relative to an **ASHRAE 90.1** -Baseline building design per ASHRAE 90.1 2007, Appendix G. **Using the Alternate Compliance Path for LEED-CS project**, this is equivalent to 16 19 LEED-EAc1 points, as shown in Table 6 below.

Table 6. 2009 LEED-CS EAc1 Point Scale

Percent of New Construction:		100.0%
Percent of Energy Cost Influenced or Directly Controlled by CS Owner/Developer:		45.7%
Points	Standard Compliance Path Savings as a Percent of Core & Shell Building Load	Alternative Compliance Path - Revised Point thresholds based on Percent of Energy Cost influenced by Developer and Percent New Construction versus Major Renovation
	New	
Prereq	10.0%	6.1%
3	12.0%	9.7%
4	14.0%	11.0%
5	16.0%	12.2%
6	18.0%	13.4%
7	20.0%	14.6%
8	22.0%	15.8%
9	24.0%	17.1%
10	26.0%	18.3%
11	28.0%	19.5%
12	30.0%	20.7%
13	32.0%	21.9%
14	34.0%	23.2%
15	36.0%	24.4%
16	38.0%	25.6%
17	40.0%	26.8%
18	42.0%	28.0%

19	44.0%	29.2%
20	46.0%	30.5%
21	48.0%	31.7%

A comparison of the Proposed and Baseline Designs is provided in Figure 19, Figure 20, and Figure 21 below.

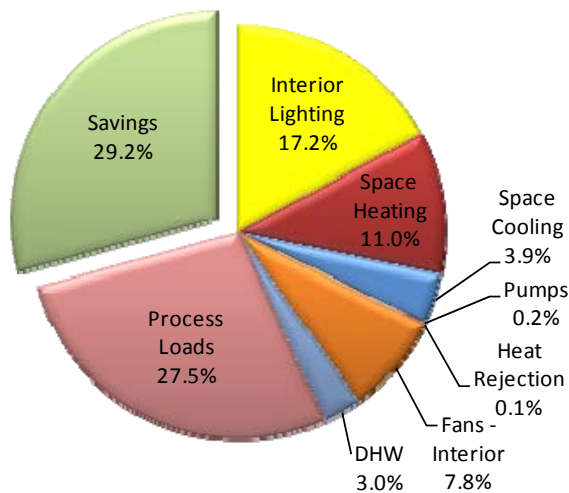


Figure 19. Proposed Design Energy Costs by End Use

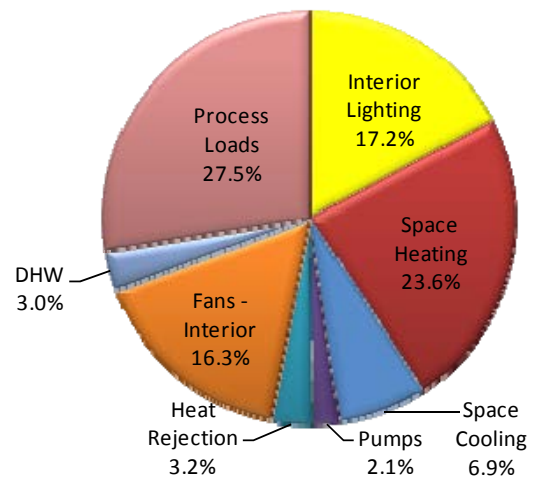
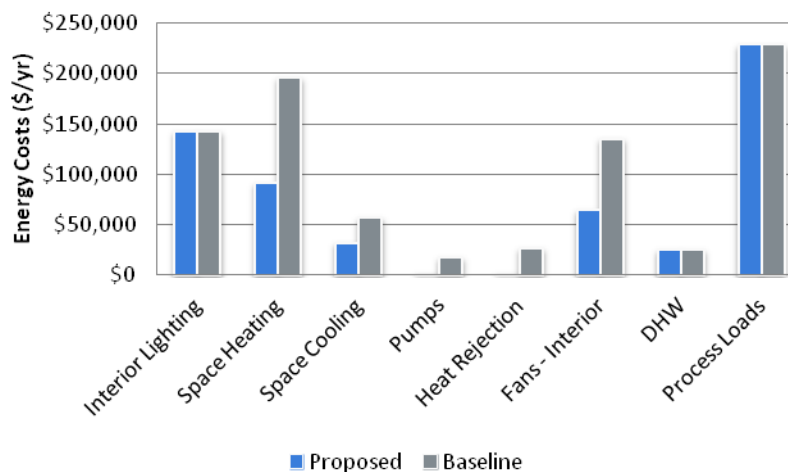


Figure 20. Baseline Design Energy Costs by End Use





**Figure 21. Comparison of Baseline and Proposed Designs**

### 10.3.8.2 - Energy Targets - ENERGY STAR

The ENERGY STAR performance rating system, on a scale of 1-100, compares a building's energy performance to similar buildings nationwide. A score of 50 represents median energy performance, while a score of 75 means that the building performs better than 75 percent of all similar buildings nationwide – and may be eligible for ENERGY STAR certification. Figure 22 below demonstrates the ENERGY STAR scoring system and the project target.

Site Energy Use Intensity (EUI) is the annual amount of all energy consumed on-site, as reported on the utility bills, divided by the facility gross floor area. Source EUI, by contrast, reflects the total amount of raw fuel required to operate the facility. Source energy includes losses that take place during generation, transmission, and distribution of the energy. While Site EUI is more frequently referenced with discussing facility energy efficiency, Source EUI is utilized by ENERGY STAR Portfolio Manager to calculate a performance rating. For this reason, Source EUI is referenced in order to provide a consistent benchmark as the design progresses.

Using inputs based on the current gross floor area and occupancy, ENERGY STAR Portfolio Manager indicates that a median Office building has a Source EUI of 229.5 kBtu/sf/yr. The design target for the Office buildings is an Energy Star Score of 75, which equates to a target Source EUI of 169.7 kBtu/sf/yr. Based on the current SD design, the Proposed building design is demonstrating a Source EUI of ~~106.7~~ **132.5** kBtu/sf, equivalent to an ENERGY STAR score of ~~94~~ **88**.

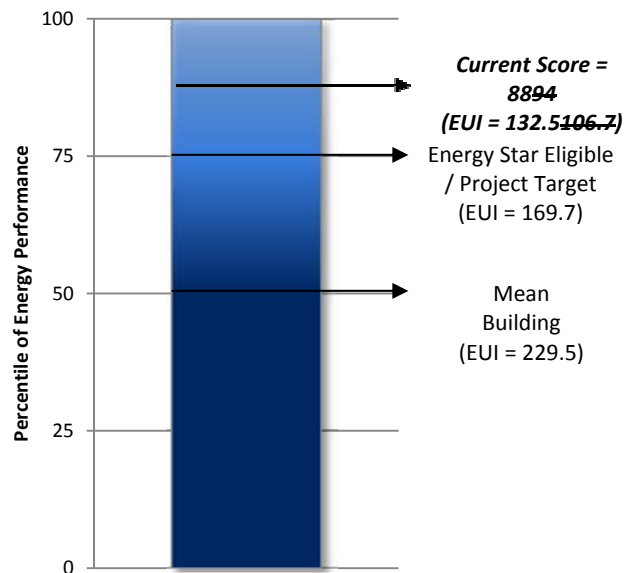


Figure 22. ENERGY STAR Scale (Corresponding Source EUIs Shown)

### 10.3.8.3 - Facility Description - Building Use Schedules

Fractional utilization schedules for occupants, lights, equipment and other loads were specified for the buildings. The schedules currently used for the Office Buildings are based on the "Office" usage categories found in the ASHRAE 90.1-2007 User's Manual and are shown in Figure 23 through Figure 25. These schedules include modifications to account for typical after-hours usage of lighting and office equipment.

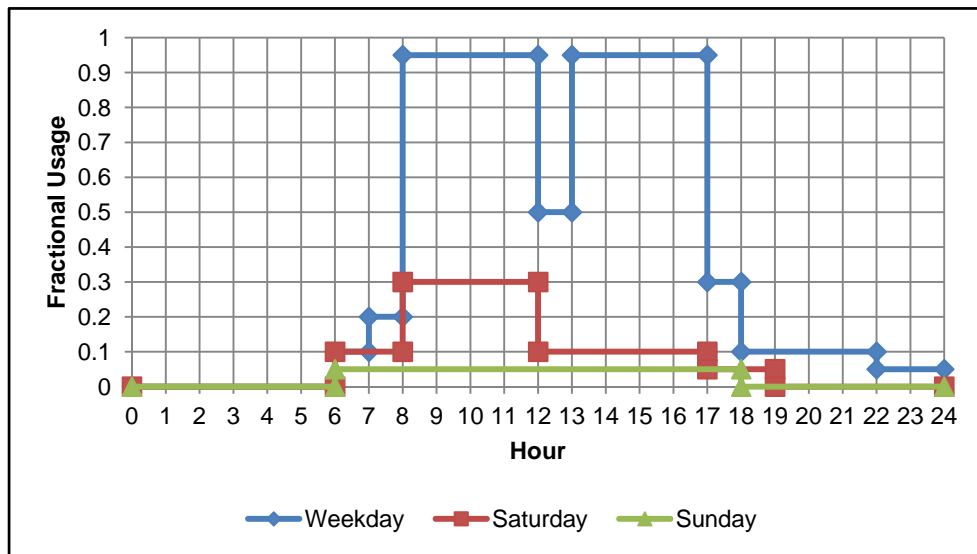


Figure 23. Office Occupancy Schedule

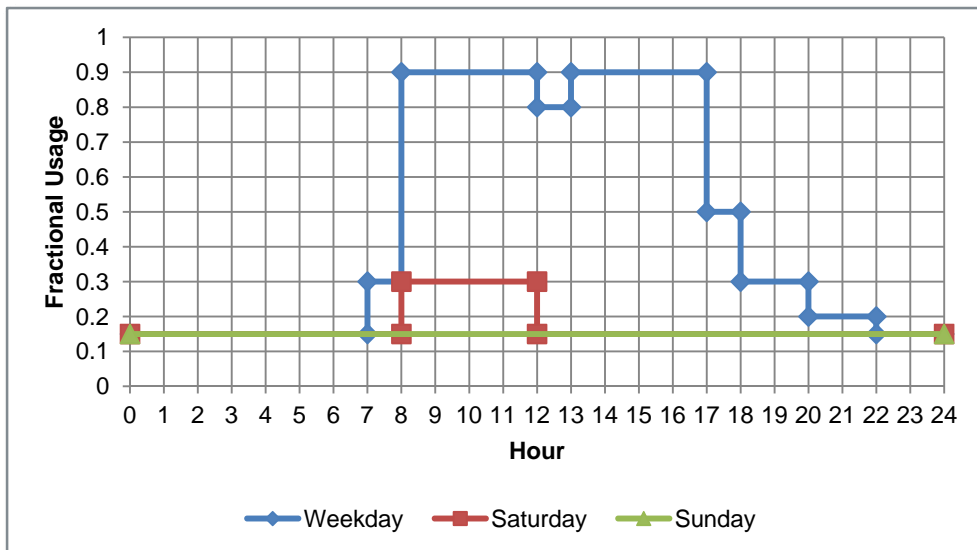
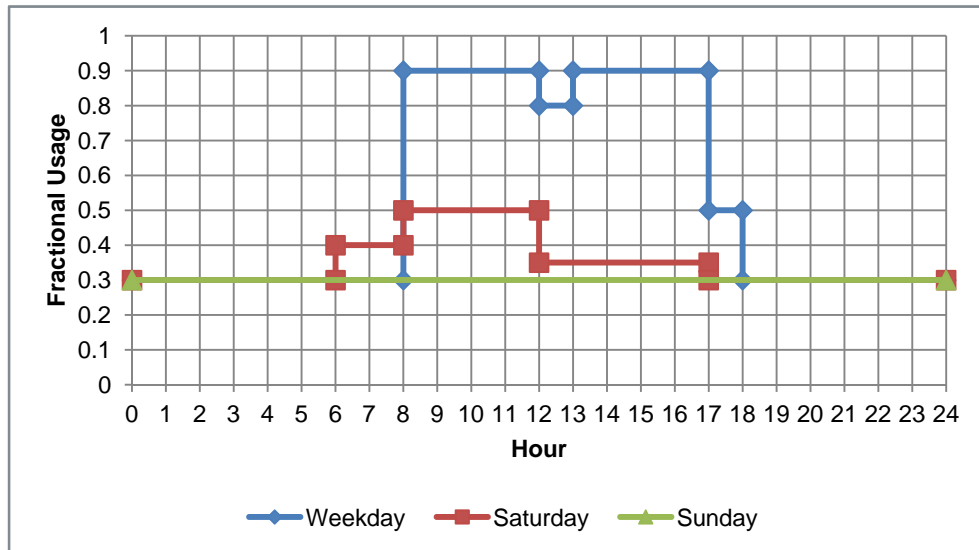


Figure 24. Office Lighting Utilization Schedule



**Figure 25. Office Equipment Utilization Schedule**

#### 10.3.8.4 - Facility Description - Internal Loads & Indoor Design Conditions

ASHRAE 90.1 defines the allowed lighting power density per space type or building type. Other assumptions for occupant and process loads were assumed based on information in the ASHRAE 90.1 User's Manual and COMNet. A summary of internal loads and assumed indoor design conditions typical of office building space types is provided in Table 7. These values will be further refined as the design progresses.

**Table 7. Office Internal Loads and Indoor Design Summary**

Space Type	Owner		Electrical Engineer		Mechanical Designer		
	Occupant Density (sf/person)	HVAC Operations Schedule	Lighting Power Density (W/sf)	Plug Load Density (W/sf)	Thermal Comfort (ASHRAE 55-2004)		
					Summer		Winter
					Temperature	Humidity	
Office	100	"Office" Schedule: M-F 6AM-10PM	1.0	1.0	74	60	70

### 10.3.8.5 - Facility Description - Baseline and Proposed Modeling Inputs

**Project Name:** Golden State Warriors - Office Buildings

**City, State:** San Francisco, CA

**Climate Zone:** 3C

**Heating Source:** Electricity

**Energy Standard:** ASHRAE 90.1-2007, App. G

**Energy Simulation Program:** IES <VE>

Summary of Energy Model Inputs		
Model Input Parameter / Energy Efficiency Measure	Proposed Case per SD plans and narratives	Baseline Case per ASHRAE 90.1-2007 Appendix G
Building Envelope (Construction Assemblies)		
Roofs	Insulation entirely above deck - R-20 c.i.; U-0.048	
Roof SRI	Roof reflectance to 0.3 (absorptivity=0.7)	
Walls - Above Grade	Steel-framed, R-13 + R-3.8 c.i.; U-0.084	
Exposed Floors	Steel-joist floor with R-19 insulation; U-0.052	
Slab-On-Grade Floors	Unheated, no insulation, F-0.730	
Infiltration Rates	0.4 cfm/sf of surface area when tested to 75 Pa per ASTM E779-10	
Fenestration and Shading		
Vertical fenestration Area (% of Wall area)	69%40%	40%
Vertical Glazing Description	Metal Framing (curtainwall/storefront)	
Vertical Glazing U-factor	0.434 (Window-Assembly)	0.60 (Window-Assembly)
Vertical Glazing SHGC	0.31283 (Window-Assembly)	0.25 (Window-Assembly)
HVAC (Air-side)		
Primary HVAC Type	- Office -- (2) Rooftop (3) AHUs in Penthouse w/ IDEC units, supplemental DX Cooling, and electric heating serve Air Column Units on each floor which pressurize UFAD system; heating with with series, fan-powered electric reheat air terminal units - Lobby - (1) Penthouse VAV AHU w/ IDEC, Supplemental DX cooling and electric heating - Retail - CV DOAS with IDEC, supplemental DX cooling, and electric preheat coils provide room-neutral air to spaces; Single-zone, constant volume VRF heat recovery type heat pumps serve space loads	System #8 - VAV Air handling units, CHW cooling, and electric reheat in fan-powered VAV boxes; One System per floor
Unitary Cooling Efficiency	IDEC DX - 12 EER / 12.2 IEER VRF - 9.3 EER / 10.4 IEER	n/a
Unitary Heating Efficiency	Electric Resistance - 100% VRF Heating - 3.2 COP	Electric Resistance - 100%
Fan System Operation	Fans operate continuously whenever spaces are occupied and cycle to meet loads when unoccupied	

Outdoor Air Design Min Ventilation	100% OA, with minimum set to be that required by ASHRAE 62.1-2007	As required by ASHRAE 62.1-2007
HVAC Air-side Economizer Cycle	None	Fixed Dry-bulb Economizers
Economizer High-Limit Shutoff	n/a	75 F
Design Airflow Rates (Conditioned Space)	- Offices - UFAD Airflow based on 60-65 F supply air - Lobby/Retail - Overhead air distribution based on 54 F supply air	Based on 20 deg F difference between room temperature and supply temperature; - Indoor Design Conditions: 74 F Summer, 70 F Winter - Minimum primary airflow rate of 30% of peak, 50% zone-level recirculation
Total System Fan Power (Conditioned)	194 kW	202 kW
6.5.3.1.1B Pressure Drop Adjusmtents	n/a	0.9" for MERV 13 filters, 0.5" for ducted exhaust, 0.5" for exhaust filtration; 0.15" for sound attenuators
Zone Terminal Boxes Fan Power	0.35 W/cfm	
Exhaust Air Energy Recovery	IEC includes heat pipe and claims 30 F reduction in cooling temperature (~147% sensible effectiveness) and 50% recovery of exhaust heat	Not Required
Demand Control Ventilation	- CO2-based DCV used to reset system ventilation during off peak occupancy (maintain 500-700 ppm above OA CO2 levels) - Ventilation is modeled as zero during unoccupied hours	- DCV required in densely occupied spaces greater than 500 sq. ft. - Ventilation is modeled as zero during unoccupied hours
Supply Air Temperature Reset Parameters	Reset up to 5 deg F based on zone demand	
Other	EPAct-compliant fan motors	
HVAC (Water-side)		
Number of Chillers	N/A	2
Chiller Part-Load Controls	N/A	Chillers cycle with load
Chiller Capacity (Per Chiller)	N/A	< 800 tons
Chiller Efficiency	N/A	6.1 COP
Chilled Water Loop Supply Temperature	N/A	44 F
Chilled Water (CHW) Loop Delta-T	N/A	56 F
CHW Loop Temp Reset Parameters	N/A	44 F LWT above 80 F OAT, 54 F LWT below 60 F OAT, LWT ramps linearly between 44 and 54 F as OAT varies between 80 and 60 F
CHW Loop Configuration	N/A	Constant Primary, Variable Secondary
Number of Primary CHW Pumps	N/A	1
Primary CHW Pump Power	N/A	11 W/gpm
Primary CHW Pump Flow	N/A	2 gpm/ton
Primary CHW Pump Speed Control	N/A	Constant Speed
Secondary CHW Pump Power	N/A	11 W/gpm
Secondary CHW Pump Flow	N/A	2 gpm/ton



Secondary CHW Pump Speed Control	N/A	Variable Speed
Number of Cooling Towers / Fluid Coolers	N/A	1 per chiller
Cooling Tower Fan Power	N/A	38.2 gpm/hr
Cooling Tower Fan Control	N/A	2-speed
Condenser Water Leaving Temperature	N/A	85 F
Condenser Water (CW) Loop Delta-T	N/A	10 F
CW Loop Temp Reset Parameters	N/A	Maintain 70 F CT LWT as conditions allow, floating up to design LWT of 85 F
CW Loop Configuration	N/A	Constant Primary
Number of CW Pumps	N/A	1
CW Pump Power	N/A	19 W/gpm
CW Pump Speed Control	N/A	Constant Speed
Other	EPAct-compliant pump motors	
Service Water Heating		
SHW Equipment Type	Electric Storage	
Equipment Efficiency	100%	
Temperature Controls	Automatic time switch or aquastat to shut off circulation pumps during unoccupied periods	
SHW Peak Demand	396 gal/hr	
Lighting		
Automatic Lighting Shutoff Method	Time Switch turns off interiors lights during nights/weekends	
Interior Lighting Power Calc Method	Building-Area Method	
Interior Lighting Power Density (Average)	Office - 1.0 W/sf	
Automatic Interior Space Shutoff Control in Required Spaces (Section 9.4.1.2)	Occupancy Sensor or dual-scene control as required in Conference rooms, Classrooms, and Breakrooms	
Automatic Exterior Lighting Control	Exterior Lighting Controlled by photocell and/or time switch	
Miscellaneous		
Receptacle equipment	1.0 W/sf	
Escalators and Elevators	6 geared traction elevators, VVVF non-regen drives, 3500 lbs, 350 fpm, 11 stops	
Occupant Density	100275 sf/person	

#### 10.3.8.6 – Load Reduction Measures – Offices

Before analyzing energy-efficient HVAC and load handling strategies, it is often cost-effective to investigate envelope-related load reduction strategies. These passive, low maintenance strategies are a priority since they can contribute to smaller, less expensive HVAC equipment, thus increasing the cost-effectiveness of a whole-building solution. As a result, a number of envelope-related load reduction strategies were analyzed to identify those building parameters that have the largest impact on energy consumption. The results are shown in the tables and figures below.

Based on these results, we recommend prioritized investment be made in the following building parameters:

- Windows – U-0.29 Center-of-glass
- Windows – SHGC-0.21
- Roof – R-25
- Walls – R-13 + R-10 c.i. (Or continuous R-15 with no stud-cavity insulation)

- High-albedo, White Roof

**Table 8. Summary of Load Reduction Strategies**

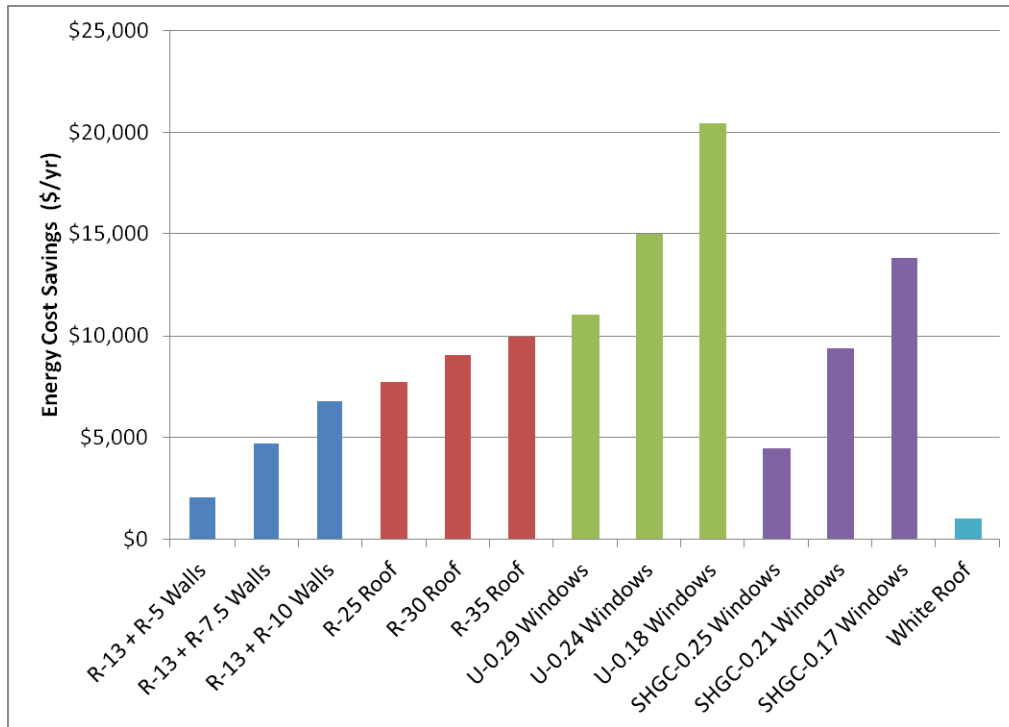
LR	Description	Energy Costs (\$/yr)	Savings to Proposed (\$/yr)	% Energy Cost Savings to Baseline	LEED EAc1 Points	Energy Usage (kBtu/yr)	Source EUI (kBtu/sf/yr)	% Reduction in EUI from median	Energy Star Score (1-100)
-	Baseline Design per ASHRAE 90.1-2007	\$831,114	-	-	-	19,468,721	181.9	21%	-
-	Proposed Design per SD Documents	\$588,073	-	29.2%	19	13,775,524	128.7	44%	88
1-1	R-13 + R-5 Walls	\$586,032	\$2,041	29.5%	19	13,727,710	128.3	44%	88
1-2	R-13 + R-7.5 Walls	\$583,385	\$4,688	29.8%	19	13,665,700	127.7	44%	88
1-3	R-13 + R-10 Walls	\$581,303	\$6,770	30.1%	19	13,616,942	127.3	45%	88
2-1	R-25 Roof	\$580,368	\$7,705	30.2%	19	13,595,035	127.1	45%	88
2-2	R-30 Roof	\$579,026	\$9,047	30.3%	19	13,563,598	126.8	45%	89
2-3	R-35 Roof	\$578,117	\$9,956	30.4%	19	13,542,299	126.6	45%	89
3-1	U-0.29 Windows	\$577,023	\$11,050	30.6%	20	13,516,680	126.3	45%	89
3-2	U-0.24 Windows	\$573,058	\$15,015	31.0%	20	13,423,804	125.5	45%	89
3-3	U-0.18 Windows	\$567,634	\$20,439	31.7%	21	13,296,736	124.3	46%	89
4-1	SHGC-0.25 Windows	\$583,637	\$4,436	29.8%	19	13,671,605	127.8	44%	88
4-2	SHGC-0.21 Windows	\$578,668	\$9,405	30.4%	19	13,555,209	126.7	45%	89
4-3	SHGC-0.17 Windows	\$574,275	\$13,798	30.9%	20	13,452,306	125.7	45%	89
5-1	White Roof	\$587,064	\$1,009	29.4%	19	13,751,888	128.5	44%	88

**Table 9. Cost Impact of Load Reduction Strategies**

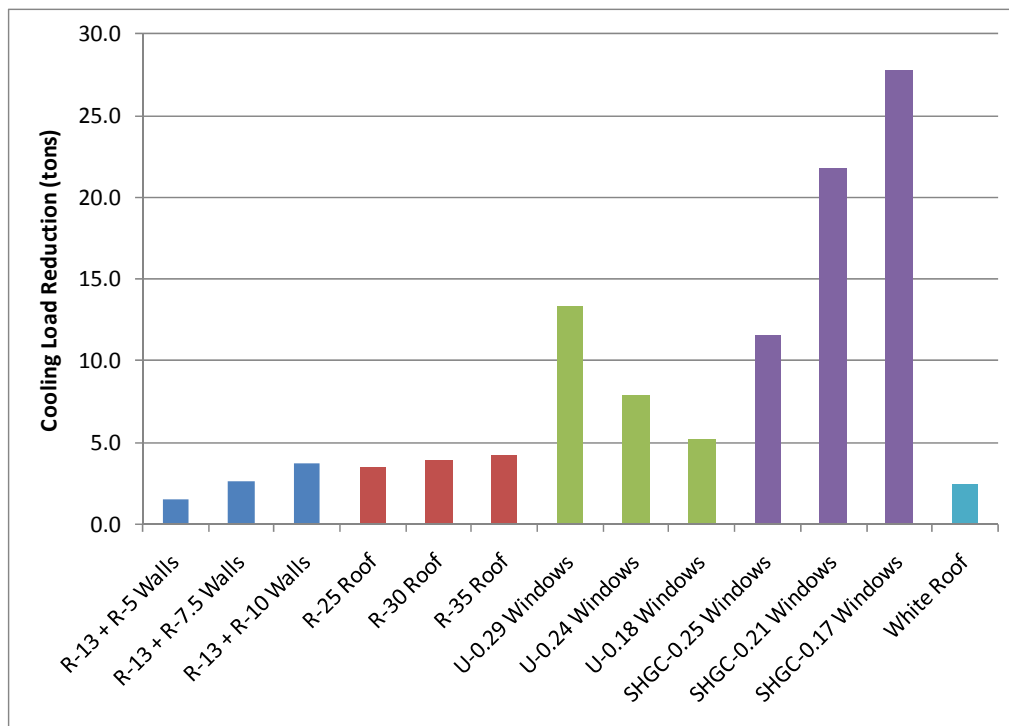
LR	Description	Envelope Cost Change (\$)	Cooling		Heating		Net Construction Cost Change (\$)	Energy Cost Savings (\$/yr)	Simple Payback Period (yrs)
			Load Change (tons)	Mech Equip Cost Change (\$)	Load Change (kW)	Mech Equip Cost Change (\$)			
1-1	R-13 + R-5 Walls	\$13,071	-1.5	-\$13,486	-5.1	-\$3,569	-\$3,983	\$2,041	Immediate
1-2	R-13 + R-7.5 Walls	\$36,930	-2.6	-\$22,990	-10.2	-\$7,165	\$6,776	\$4,688	1.4
1-3	R-13 + R-10 Walls	\$57,743	-3.7	-\$32,667	-21.7	-\$15,164	\$9,912	\$6,770	1.5
2-1	R-25 Roof	\$39,387	-3.5	-\$30,535	0.8	\$533	\$9,385	\$7,705	1.2
2-2	R-30 Roof	\$80,620	-3.9	-\$34,520	-5.6	-\$3,925	\$42,174	\$9,047	4.7
2-3	R-35 Roof	\$123,697	-4.2	-\$36,994	-9.2	-\$6,424	\$80,278	\$9,956	8.1
5-1	White Roof	\$0	-2.4	-\$21,501	1.2	\$832	-\$20,669	\$1,009	Immediate

Note 1 - Envelope construction cost determined through RS Means

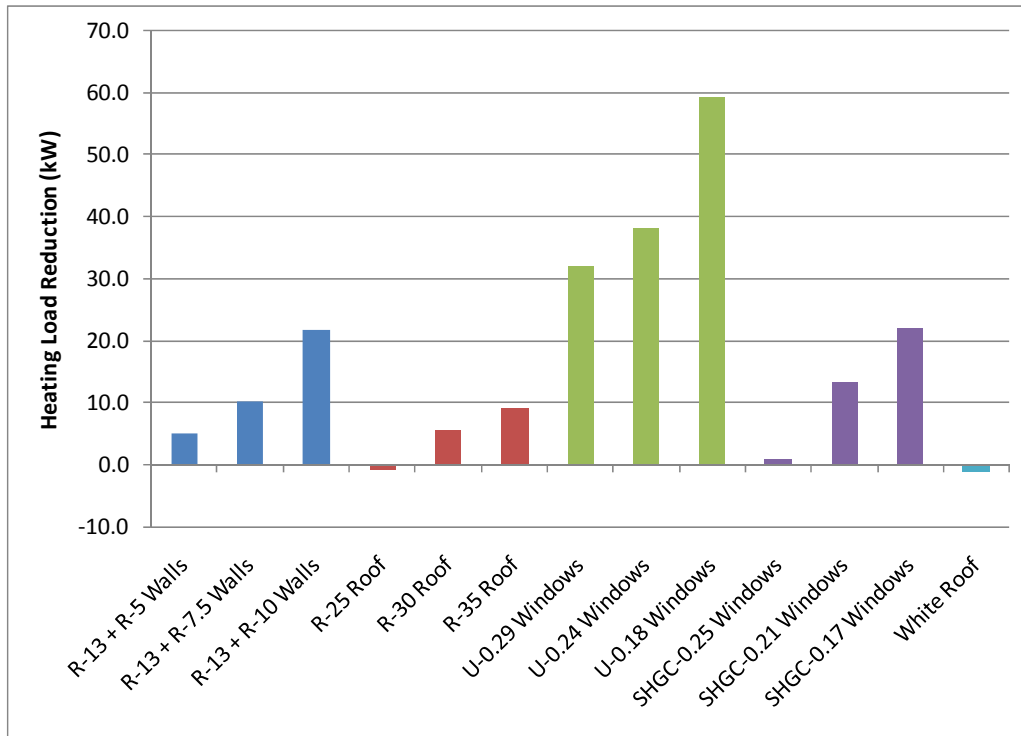
Note 2 - Cooling and heating equipment costs determined by Clark Construction and Mortenson Construction



**Figure 26. Energy Cost Savings of Load Reduction Measures**



**Figure 27. Cooling Load Reductions due to Load Reduction Measures**



**Figure 28. Heating Load Reductions due to Load Reduction Measures**

#### *Improved Window Assembly U-values*

The Proposed Building is assumed to have windows with an overall assembly U-value of U-0.43. By contrast, the Baseline design includes glazings having a whole-window assembly U-value of U-0.60 and a solar heat gain coefficient of SHGC-0.25. This strategy involves using various combinations of Low-E, argon-filled, and/or triple-paned glazings in a thermally broken window frame to reduce heat transfer. For the purpose of this analysis, Viracon glass and Kawneer 1600UT System 2 curtainwall framing was assumed as the basis of design. Table 10 lists potential glazing alternatives, showing the Center-of-Glass U-values, as well as the corresponding Window Assembly U-values.

**Table 10. Potential Glazing Alternatives**

Viracon		U-values	
Description	Product	Center-of-Glass	Window-Assembly
Low-E on #2, Air-filled	VE1-2M on Clear	0.29	0.38
Low-E on #2, Argon-filled	VE1-2M on Clear	0.24	0.33
Triple-pane, Low-E on #2, Argon-filled	VE1-2M on Clear	0.18	0.28

#### *Improved Window Assembly SHGC-values*

The Proposed Building is assumed to have windows with a solar heat gain coefficients (SHGC) of 0.283 as its basis of design. By contrast, the Baseline Building includes windows with a SHGC of 0.25 at all orientations. This strategy involves using tinted, fritted, or reflective glass types with reduced center-of-glass SHGC values. This lowering of the SHGC is meant to reduce solar heat gain to the space, thereby reducing cooling needed. However, a balance must be struck in climates with moderately cold winters, as a higher SHGC can help to reduce heating costs in the winter. For the purpose of this analysis, Viracon's website was referenced to identify feasible SHGC alternatives, with the following alternatives tested in the energy model:

- 1) SHGC-0.25
- 2) SHGC-0.21
- 3) SHGC-0.17

#### *Increased Roof Insulation*

The Baseline design includes a light-weight roof assembly with continuous R-20 insulation entirely above deck, resulting in a roof assembly U-value of U-0.048. This strategy involves adding increasing amounts of insulation to the entire roof, resulting in the following roof alternatives:

- 1) R-25 continuous insulation (c.i.) – U-0.039
- 2) R-30 continuous insulation (c.i.) – U-0.032
- 3) R-35 continuous insulation (c.i.) – U-0.028

#### *Increased Wall Insulation*

The Baseline design includes steel-framed walls with R-13 batt between studs on 16" centers and R-3.8 continuous insulation (c.i.), resulting in a wall assembly U-value of U-0.084. This strategy involves adding increasing levels of continuous rigid insulation to the wall assembly. The batt insulation is optional, so long as an additional inch of continuous insulation is added in its absence. The resulting wall alternatives analyzed were as follows:

- 1) R-13 batt + R-5 c.i. – U-0.077
- 2) R-13 batt + R-7.5 c.i. – U-0.064
- 3) R-13 batt + R-10 c.i. – U-0.055

#### *High-Albedo, Cool Roof*

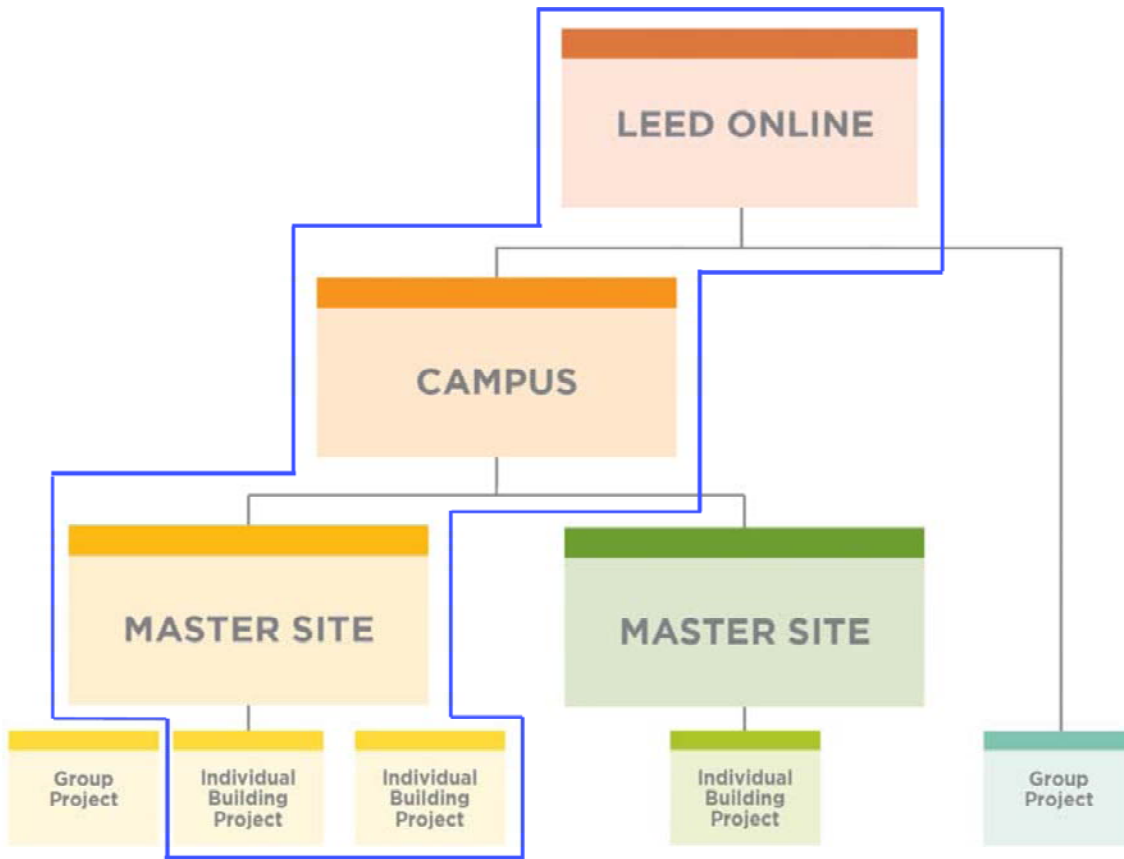
The Baseline design includes a dark-colored roof modeled with a long-term reflectance of 0.3. This strategy investigates the use of a high-albedo, white-colored roof with either a reflectance of greater than 0.70 and an emittance greater than 0.75 or a minimum SRI of 82. In this case, the roof of the Proposed design can be modeled with a long-term reflectance of 0.45.

## 10.4 – CAMPUS SUSTAINABLE APPROACH

### 10.4.1 - Process Overview

- The LEED Campus Approach streamlines the LEED certification process for larger and more complex projects. Multiple building projects that share a site, and are under the control of the same owner, developer, or property management, fall into the criteria of the campus program. Under the Campus Approach, several LEED credits and prerequisites may be reviewed and pre-approved. Once earned, these credits may be claimed by all LEED projects for that campus, though the Campus is not eligible for LEED certification itself. The US Green Building Council (USGBC) defines a campus credit as one that can be attempted for most or all projects within a LEED campus boundary because of shared site features and uniformity in project or management traits.
- As highlighted in Figure 29, the Campus project will consist of a Master Site with several individual building projects. The Office/Mixed-Use Development will be utilizing LEED Core and Shell. The North Tower and South Tower, inclusive of the Gatehouse, will pursue LEED individually, earning two separate LEED Gold certifications. The Event Center, inclusive of the Arena, Markethall and Bayfront Terrace, will use LEED for New Construction. Campuses with multiple segregated sites can register multiple LEED Master Sites to create groups of buildings within the campus. For this project the terms Master Site and Campus represent the same single entity within the LEED certification process. Therefore, from this point on the project will be referred to as the “Campus.”





**Figure 29. LEED Online Campus Application**

#### 10.4.2 - Project Registration

- The Campus project is registered on LEED-Online, and the Event Center and Office/Mixed-Use facilities will be registered early in the design phase once final building configurations are finalized. These projects will be registered through the Campus LEED website as the Event Center and Mixed-Use Development at Mission Bay Blocks 29-32. Project team access to these LEED projects will be available via LEED-Online once registration is complete.

#### 10.4.3 - Campus LEED Detailed Scorecard

- The following page is a detailed list of all Campus credits along with design and construction criteria for the Mission Bay site.



## LEED 2009 Campus Application Scorecard

Golden State Warriors - Campus Credits  
5/8/2015

CS 23	NC 22	Sustainable Sites			25	<b>Schematic Design Notes:</b> Project should not impact any of the prohibited land use types for this credit. This site is not considered a wetland or habitat and far enough from bay to meet minimum distance from water. The project is located close to numerous conveniences. A Phase I assessment was performed, and the site is a remediated brownfield. A certificate of remediation or other documentation will need to be tracked down in the future. Public transportation (at least two bus lines) is available to the site. Office Towers: LEED requires 3% of average building occupants to have bike racks. Based on the combined office tower occupancy, 92 bike spaces will be necessary for LEED compliance. Current design, based on the major phase commitments, allocates 186 bike racks to these buildings. The combined office tower FTE count is 2411, requiring 13 (0.5%) total showers to be available to mixed use employees (within 200 feet of the building where they work). Event Center: Peak event center occupancy would require 1850 bicycle parking spaces. Current design provides access to 300 permanent valet bike racks with an additional temporary corral capacity of 100 for event visitors. Though the number of racks does not meet 5% of total peak, it will cover FTE's plus a percentage of peak transients per LEED Interpretation 5082. SSR will discuss this approach with the USGBC after the project is registered. Based on 660 FTEs, 4 showers will be needed for full-time event center employees. Current design provides 42 showers within the event center with FTE employees having access to a minimum of 4 showers. Campus: San Francisco code requires short-term bike parking for 5% of visitor parking capacity within 200 feet (SF code) of visitor's entrance, and long-term bike parking for 5% of tenant parking capacity that are covered, lockable, and permanently anchored. Considering 1,002 on site parking spots total based on current design goals, assuming most stringent code requirement of all parking serving visitors, 51 bike racks are required to be located within 200 feet of any visitor entrance. According to the Event Center and Office Tower estimates, a total of 486 permanent bike racks and 100 temporary bike corral spaces will be required to be installed throughout the campus to meet compliance. These numbers may change as design progresses. Designate 5% (~51 spaces) of parking spaces for low-emitting / fuel efficient vehicles (FEV) OR designate 3% (~31 spaces) of parking spaces for vehicle charging stations (VCS). The approach for this project will be to use a combination of both options, referencing LEED Interpretation 10410, 19 VCS (equivalent to 31 preferred spaces) and 20 FEV spaces for a total equivalent of 51 preferred parking spaces contributing to this credit. Current design provides 30 VCS and 21 FEV spaces. Should cost impact prevent the project from achieving a minimum of 18 VCS parking spaces, then 51 FEV spaces will be pursued for LEED instead and any number of VCS installed would be above and beyond LEED requirements. SF Code requires at least 8% (~81 spaces) to be any combination of low-emitting, fuel-efficiency, carpool/van pool spaces, which shall be achieved through SSc4.3 & SSc4.4. SF Code requires specific painting on parking spaces instead of signage.
1	1	d	Credit 1	Site Selection	1	
5	5	d	Credit 2	Development Density and Community Connectivity	5	
1	1	d	Credit 3	Brownfield Redevelopment	1	
6	6	d	Credit 4.1	Alternative Transportation—Public Transportation Access	6	
2	1	d	Credit 4.2	Alternative Transportation—Bicycle Storage and Changing Rooms	2 CS / 1 NC	
3	3	d	Credit 4.3	Alternative Transportation—Low-Emitting and Fuel-Efficient Vehicles	3	

#### Sustainable Sites Continued

2	2	d Credit 4.4	Alternative Transportation—Parking Capacity	2	Designate 5% (~51 spaces) of parking spaces for carpool vehicles. SF Code requires at least 8% (~81 spaces) to be any combination of low-emitting, fuel-efficiency, carpool/van pool spaces, which shall be achieved through SSc4.3 & SSc4.4. SF Code requires specific painting on parking spaces instead of signage.
1	1	d Credit 5.2	Site Development—Maximize Open Space	1	25% requirement may already be in compliance. Pedestrian oriented hardscape and/or landscape can be included as open space.
1	1	d Credit 6.2	Stormwater Design—Quality Control	1	Provisions for this credit are required by San Francisco (SF) code, and will be specified by the civil engineer. Several schemes are being discussed for stormwater treatment basins. These basins could be anywhere on the site, and must be sized properly. Pumping of stormwater to treatment areas may be required depending on grade and location of the basins.
1	1	c Credit 7.1	Heat Island Effect—Non-roof	1	Site hardscape / paving materials will need to be concrete or otherwise of a light / reflective color. Color and configuration will be determined by the design team.

#### Water Efficiency 4

2	2	d Credit 1	Water Efficient Landscaping	2 to 4	<p>To achieve two (2) points for 50% irrigation water reduction, the project will need to utilize native/adapted plants and an efficient irrigation system. SF code requires weather-based with rain sensor or soil moisture-based controllers for the irrigation system as well as sub meters for irrigation systems that serve areas between 1,000-5,000 square feet.</p> <p>Since irrigation is required on site and water reuse will not be pursued due to the cost impact, Option 2 for four (4) points is no longer available to us for this project.</p>
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#### Materials and Resources 2

Y	Y	d Prereq 1	Storage and Collection of Recyclables		Per SF Code, the facilities will need recycling bins throughout, and a recycling storage room or dumpster by the loading dock.
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#### Indoor Environmental Quality 4

Y	Y	d Prereq 2	Environmental Tobacco Smoke (ETS) Control		The facility will be non-smoking, and the site will be non-smoking based on local requirements.
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## 10.5 – EVENT CENTER SUSTAINABLE APPROACH

### 10.5.1 - Narrative

- The 100% **Reconciled** SD analysis identifies approximately sixty-eight-six (~~6866~~) LEED® points that are available either within the current design or with minor modifications for the Event Center project. These credits are identified on the provided LEED® Credit Checklist under the “Yes” column. An additional ~~seven-nine~~ (**79**) points identified under the “Maybe” column may be possible, pending further research and potentially higher investment. Credits under the “No” column were designated as such based on a higher associated cost or inapplicability to this project.
- With sixty (60) points required for LEED® Gold certification, this project is well positioned to achieve the minimum certification goal. A buffer of five to six (5-6) points above the desired certification threshold is recommended.
- With the Arena, Bayfront Terrace and Markethall being contiguous spaces these facilities will all be included as part of the Event Center’s LEED application.

### 10.5.2 - Measurement & Verification

- LEED EA credit 5 Measurement and Verification is intended to provide for the ongoing accountability of building energy consumption over time. Through the use of utility invoices, building automation system (BAS) data logging, permanently installed sub-metering, and spot measurements, the facility will measure the actual utility usage of the building for each energy end use for at least 12 months post-occupancy. The method of metering will be primarily through the use of building meters and sub-meters. These meters will record the electrical and natural gas loads as indicated below and in the final M&V plan. These meters are intended to validate the anticipated energy savings indicated in LEED EAc1. See Electrical Narrative (Section 4) for more details on the networked metering system.

**Table 9. Event Center M&V Preliminary Energy End Uses**

Fuel Type	Category	Sub Category	Equipment
Electricity	Lighting	Interior Lighting	
		Exterior Lighting	
	HVAC Equipment	Packaged HVAC Equipment	Variable Refrigerant Flow (VRF) Units
			AHUs, ERVs, DAUs
			CRAC Units, Split Systems
		Fans	Kitchen & Grease Exhaust Fans
			Process Ventilation Fans
			VRF Indoor FCUs
			AHU Supply Fans
			Exhaust Fans
		Heat Rejection	Cooling Towers
		HVAC Pumps	Heat Rejection Loop Recirc Pumps
			Heating Hot Water Pumps
			Radiant Heating Pumps
			Condenser Water Pumps
	Plug/Process Loads	Receptacle Loads	
		Event Center Event Lighting	
		Low Temp Chillers & associated Pumps	
		Ice Slab Chiller(s) & associated Pumps	
		Elevators/Escalators	
		Food Service Equipment	
		Food Service Refrigeration Equipment	
	Service Water Heating	Domestic Water Heaters	
		Domestic Water Pumps	
Natural Gas	Space Heating	Boilers	
	Service Water Heating	Domestic Water Heaters	
	Plug/Process Loads	Food Service Equipment	

### 10.5.3 - Event Center LEED Detailed Scorecard

- The following scorecard details the credit by credit approach for the Event Center project, along with design and construction notes based upon the current design for the facility.





## LEED 2009 for New Construction and Major Renovations

Golden State Warriors Event Center - LEED Gold Credit Strategy Scorecard  
5/8/2015

22 1 3

### Sustainable Sites

Possible Points:

26

Y ? N d/C

Y		
1		
5		
1		
6		
1		
3		
2		
		1
1		
		1
1		
	1	
1		
		1

- C Prereq 1 Construction Activity Pollution Prevention
- d Credit 1 Site Selection
- d Credit 2 Development Density and Community Connectivity
- d Credit 3 Brownfield Redevelopment
- d Credit 4.1 Alternative Transportation—Public Transportation Access
- d Credit 4.2 Alternative Transportation—Bicycle Storage and Changing Rooms
- d Credit 4.3 Alternative Transportation—Low-Emitting and Fuel-Efficient Vehicles
- d Credit 4.4 Alternative Transportation—Parking Capacity
- C Credit 5.1 Site Development—Protect or Restore Habitat
- d Credit 5.2 Site Development—Maximize Open Space
- d Credit 6.1 Stormwater Design—Quantity Control
- d Credit 6.2 Stormwater Design—Quality Control
- C Credit 7.1 Heat Island Effect—Non-roof
- d Credit 7.2 Heat Island Effect—Roof
- d Credit 8 Light Pollution Reduction

1  
5  
1  
6  
1  
3  
2  
1  
1  
1  
1  
1  
1

#### Design/Construction Coordination and Cost Notes:

Provisions for this prerequisite are required by NPDES / SF code, and will be specified by the civil engineer. Requirements for prevention of wind erosion should be included, per recent USGBC comments.

CAMPUS CREDIT

CAMPUS CREDIT

CAMPUS CREDIT

CAMPUS CREDIT

CAMPUS CREDIT

CAMPUS CREDIT

Compliance will be verified again after final landscape plans are available but due to the limited areas with vegetation this credit is not likely to be achieved.

CAMPUS CREDIT

Stormwater retention would be required, this credit is not cost feasible for the project.

CAMPUS CREDIT

CAMPUS CREDIT

Credit will be achieved by a combination of green roofs and reflective roof surfaces. Depending on aesthetic preference low-e roofing is available in white, tan, and gray.

SF code requires compliance with Title 24, Part 6, Section 147 so that the site lighting design will need to be more efficient than the code baseline. However, due to this credit's requirements for light trespass this credit will not be feasible based on the compactness of the site.

5 0 5

### Water Efficiency

Possible Points:

10

Y ? N

Y		
2		2
		2
3		1

- d Prereq 1 Water Use Reduction—20% Reduction
- d Credit 1 Water Efficient Landscaping
  - ☐ No Potable Water Use or Irrigation
- d Credit 2 Innovative Wastewater Technologies
- d Credit 3 Water Use Reduction
  - ☐ Reduce by 40%

2 to 4  
4  
2  
2 to 4  
4

#### Design/Construction Coordination and Cost Notes:

Facility will utilize auto-sensor restroom lavatories, pint flush (0.125 gpf) urinals, 1.28 gpf water closets, 1.5 gpm break room sinks, and 1.5 gpm showerheads (depending on where the shower is located).

CAMPUS CREDIT

Water reuse for irrigation was determined not feasible. Previously, this credit required a \$500,000.00 premium.

A graywater system will not be pursued at the new site. The city graywater system will not be available until 2020+. The event center will need to be plumbed with purple pipe.

In order to achieve these three (3) points for 35% water efficiency of building fixtures, the facility will utilize the fixtures described above for WE Prerequisite 1. Minimum 30% reduction required by SF code.

40% water use reduction is not likely for the project, it would require graywater reuse for flush fixtures.



14	7	14	Energy and Atmosphere	Possible Points:	35	
Y	?	N				
Y			C Prereq 1 Fundamental Commissioning of Building Energy Systems			<b>Design/Construction Coordination and Cost Notes:</b>
Y			d Prereq 2 Minimum Energy Performance			Provisions for this credit are required by SF code, and will be specified by the CxA.
Y			d Prereq 3 Fundamental Refrigerant Management			The facility will utilize an efficient mechanical and electrical design to achieve this prerequisite, more detail is described below under EA Credit 1- Optimize Energy Performance.
7	5	7	d Credit 1 Optimize Energy Performance	1 to 19		This prerequisite will not be an issue to achieve because the building will have all new equipment.
		7	d Credit 2 On-Site Renewable Energy	1 to 7		A minimum of 15% efficiency over 90.1-2007 is required for the project, if RECs are purchased (25% if RECs are not purchased). The design will use strategies to achieve this credit and a minimum of 24% efficiency over the ASHRAE 90.1-2007 baseline with the potential to achieve up to 34% reduction. The level of savings and number of points for EA Credit 1 will be refined as the design progresses.
2			C Credit 3 Enhanced Commissioning	2		Due to budget and structure constraints, as well as conflicts with sponsor logos, solar PV will no longer be pursued for the arena project.
	2		d Credit 4 Enhanced Refrigerant Management	2		Provisions for this credit are required by SF code, and will be specified by the CxA. Independent Cx commissioning services will be included under consultant contract.
3			C Credit 5 Measurement and Verification	3		This credit would be difficult to achieve with the VRF system. The credit will be contingent on the pounds of refrigerant per ton of cooling in the building's HVAC systems. This credit is not a cost item, but will just be determined based on the final submittal data for the cooling units.
2			C Credit 6 Green Power	2		In order to pursue this credit, the building systems will be metered per major load category: lighting, plug loads, HVAC fans, pumps, heat rejection, heating, and the kitchen and data centers will be segregated. The Building Automation System will be set up to trend, save, and report this information (potentially in a dashboard format).
						Purchasing RECs lowers the energy efficiency requirement for the project. Based on the current design and energy model of the event center, RECs would cost roughly \$7,000 for two points, plus an innovation point. Purchasing RECs meets another of the options for SF code requirements. REC quotes will be updated to reflect the final energy model. REC cost per MWh is known to fluctuate, therefore final purchase price will be dependent on the current rate at time of purchase during construction.
6	1	7	Materials and Resources	Possible Points:	14	
Y	?	N				
Y			d Prereq 1 Storage and Collection of Recyclables			<b>Design/Construction Coordination and Cost Notes:</b>
		3	C Credit 1.1 Building Reuse—Maintain Existing Walls, Floors, and Roof	1 to 3		CAMPUS CREDIT
		1	C Credit 1.2 Building Reuse—Maintain 50% of Interior Non-Structural Elements	1		N/A
2			C Credit 2 Construction Waste Management	1 to 2		N/A
		2	C Credit 3 Materials Reuse	1 to 2		Construction waste recyclers should be utilized to obtain a minimum 75% rate of diversion from the landfill for construction materials to meet SF code requirements.
2			C Credit 4 Recycled Content - 20%	1 to 2		Though concrete piles will be crushed and re-used, cost will likely not be high enough to achieve this credit, but will contribute to MRc2 achievement.
1	1		C Credit 5 Regional Materials	1 to 2		The specifications for this project should include details for using construction materials with recycled content.
		1	C Credit 6 Rapidly Renewable Materials	1		The specifications for this project should include details for using construction materials with regional content.
1			C Credit 7 Certified Wood	1		The 20% additional Maybe point is dependent on the sourcing of the concrete during construction.
						The facility may not include the types of materials that would be considered rapidly renewable (bamboo, cork, cotton, etc).
						Utilizing FSC certified wood products for doors and casework, to have 50% of the wood materials represented by FSC materials, has an incremental cost but is typically not a large add to the project budget.

12	0	3	Indoor Environmental Quality		Possible Points:	15	
Y	?	N					
Y			d	Prereq 1	Minimum Indoor Air Quality Performance		
Y			d	Prereq 2	Environmental Tobacco Smoke (ETS) Control		
1			d	Credit 1	Outdoor Air Delivery Monitoring	1	
1			d	Credit 2	Increased Ventilation	1	
1			C	Credit 3.1	Construction IAQ Management Plan—During Construction	1	
1			C	Credit 3.2	Construction IAQ Management Plan—Before Occupancy	1	
1			C	Credit 4.1	Low-Emitting Materials—Adhesives and Sealants	1	
1			C	Credit 4.2	Low-Emitting Materials—Paints and Coatings	1	
1			C	Credit 4.3	Low-Emitting Materials—Flooring Systems	1	
1			C	Credit 4.4	Low-Emitting Materials—Composite Wood and Agrifiber Products	1	
1			d	Credit 5	Indoor Chemical and Pollutant Source Control	1	
1			d	Credit 6.1	Controllability of Systems—Lighting	1	
		1	d	Credit 6.2	Controllability of Systems—Thermal Comfort	1	
1			d	Credit 7.1	Thermal Comfort—Design	1	
1			d	Credit 7.2	Thermal Comfort—Verification	1	
		1	d	Credit 8.1	Daylight and Views—Daylight	1	
		1	d	Credit 8.2	Daylight and Views—Views	1	
							<b>Design/Construction Coordination and Cost Notes:</b> This design requirements for this prerequisite are required by code. <b>CAMPUS CREDIT</b> To achieve this credit, mechanical system will include airflow monitoring at outside air units (per standard design practice) and CO2 monitoring in densely occupied spaces. 30% increased ventilation is likely because of evaporative cooling system implemented by mechanical design. A best practice construction IAQ management plan will be developed and implemented to help protect HVAC systems and absorptive materials from moisture or debris contamination, as well as to prevent high VOC product usage in the facility. This is mandated through SF code. Option 1 - Pre-occupancy flush out consists of providing 14,000 cubic feet of outdoor air, per square foot of floor area, into the space after construction is complete and finishes are installed. The amount of time this could take may conflict with the project schedule. The flush out usually takes anywhere from 1 week to 1 month, depending on final HVAC design airflows. Due to the size of sports facilities, scheduling conflicts typically occur. To avoid any conflicts, Option 2 – Air Testing is expected to be pursued instead. Air testing consists of sampling the project space post construction and prior to occupancy to confirm that maximum concentrations of contaminants (i.e. formaldehyde, carbon monoxide, or volatile organic compound (VOCs)) are not exceeded. Per SF code, low-VOC adhesives will be included in the specifications, there is typically not a cost add for these products based on current market availability. Per SF code, low-VOC paints/coatings will be included in the specifications, there is typically not a cost add for these products based on current market availability. Per SF code, CRI certified carpets will need to be utilized, as well as FloorScore certified manufactured hard flooring products. There may be some incremental cost for these products, but typically not significant. SF code requires urea formaldehyde-free composite wood products and laminating adhesives. Additionally, all products in this category must meet California Air Resources Board Air Toxics Control Measure for Composite Wood (17 CCR 93120 et seq.), by or before the dates specified in those sections The HVAC units will need to utilize MERV 13 filtration on the ventilation air and MERV 8 filters on the return (SF code), facility will need minimum 10' walk-off mats or systems at entrances, and copy machines will need to be in dedicated rooms with self-closing doors. This credit requires design and layout coordination, but typically not a large construction cost. Clubs, conference rooms, and multi-occupant areas will need dimmable or dual stage lighting, and 90% of individual use areas (offices, ticket booths, etc) will need controllable lighting. This building will likely have a lighting control system, so this credit may have some incremental cost but likely not notable. Clubs, conference rooms, and multi-occupant areas will need to have thermostats, as well as 50% of individual use areas (ticket booths, offices, etc). This is close to standard design, but could require additional zoning. Facility will be designed for thermal comfort with temperature, humidity, and air-speed. A thermal comfort survey will need to be implemented within 6-18 months of building occupancy. Daylighting will not be feasible for most interior spaces. Daylighting will not be feasible for most interior spaces.

<div>600</div>			Innovation in Design		Possible Points:	6	
Y	?	N					
1			C	Credit 1.1	Innovation in Design: Green Building Education	1	<div>Design/Construction Coordination and Cost Notes:</div> <div>Facility can achieve this credit by having a comprehensive green building education program, including signage, website information, and potentially a kiosk or dashboard.</div> <div>Facility can utilize a green cleaning program that emphasizes nonharmful chemicals, and equipment that is less impactful to operations staff (noise, vibration, ergonomics). This will require coordination with operations staff / facility manager.</div> <div>The project could achieve exemplary performance in recycled material content or site open space.</div> <div>The project can achieve exemplary performance in Measurement and Verification, based on EA c5 scope and monthly reporting of utility bills.</div> <div>Achievement of exemplary performance in green power should be a reasonable cost, additional information is included in the attached narrative.</div> <div>The project will have several LEED professionals and a team facilitating the sustainability process.</div>
1			C	Credit 1.2	Innovation in Design: Green Housekeeping	1	
1			C	Credit 1.3	Exemplary Performance: MRc4 or SS5.2	1	
1			C	Credit 1.4	Exemplary Performance: M&V	1	
1			C	Credit 1.5	Exemplary Performance: Green Power	1	
1			C	Credit 2	LEED Accredited Professional	1	
<div>103</div>			Regional Priority - San Francisco		Possible Points:	4	
Y	?	N					
1			d	Credit 1.1	Regional Priority:SS5.2- Open Space	1	<div>Design/Construction Coordination and Cost Notes:</div> <div>A regional priority credit in open space should be feasible for the 30% open space anticipated for the project.</div> <div>40% water use reduction is not likely for the project, it would require graywater reuse for flush fixtures.</div> <div>Onsite renewable energy will not be pursued for the arena.</div> <div>A regional priority credit in innovative wastewater technology will also require the water re-use system for flush fixtures.</div>
		1	d	Credit 1.2	Regional Priority: WEc3- Water Efficiency	1	
		1	d	Credit 1.3	Regional Priority: EAc2 (1%)- Onsite Renewable Energy	1	
		1	d	Credit 1.4	Regional Priority: WEc2- Innovative Wastewater Technology	1	
<div>66935</div>			Total		Possible Points:	110	
Certified 40 to 49 points Silver 50 to 59 points Gold 60 to 79 points Platinum 80 to 110							



## 10.6 – OFFICE TOWER(S) / MIXED USE SUSTAINABLE APPROACH

### 10.6.1 - Narrative

- The 100% **Reconciled** SD analysis identifies sixty-six ~~seven~~ **(66)** LEED® points that are available either based on current design or with minor modifications, similar to the Event Center project. These credits are identified on the provided LEED® Credit Checklist under the “Yes” column. An additional ~~sixteen~~ **twenty** ~~(16)~~ **(20)** points identified under the “Maybe” column may be possible, pending further research and potentially higher investment. Credits under the “No” column were designated as such based on a higher associated cost or inapplicability to this project.
- With sixty (60) points required for LEED® Gold certification, this project is well positioned to achieve the minimum certification goal. As with the Event Center project, a buffer of five to six (5-6) points above the desired certification threshold is recommended.

### 10.6.2 - Measurement & Verification

- LEED EA credit 5 Measurement and Verification is intended to provide for the ongoing accountability of building energy consumption over time. Through the use of utility invoices, building automation system (BAS) data logging, permanently installed sub-metering, and spot measurements, the facility will measure the actual utility usage of the building for each energy end use for at least 12 months post-occupancy. The method of metering will be primarily through the use of building meters and sub-meters. These meters will record the electrical and natural gas loads as indicated below and in the final M&V plan. These meters are intended to validate the anticipated energy savings indicated in LEED EAc1. See Electrical Narrative (Section 4) for more details on the networked metering system.

**Table 12. Office Buildings M&V Preliminary Energy End Uses**

Fuel Type	Category	Sub Category	Equipment
Electricity	Lighting	Interior Lighting	
		Exterior Lighting	
	HVAC Equipment	Packaged HVAC Equipment	AHUs
			Packaged and Split DX Equipment
			VRF Outdoor Units
		Space Heating	Rooftop AHU Heating Coils
			UFAD Terminal Unit Heating Coils & Fans
			Pedestal-type Radiant Heaters
		Fans	AHU Supply Fans
			Toilet/General Exhaust Fans
			VRF Fan Coil Units
	Process Loads	Receptacle Loads	
		Elevators/Escalators	
	Service Water Heating	Common Area Domestic Water Heaters	
		Tenant Area Domestic Water Heaters	

#### 10.6.3 – Office / Mixed-Use LEED Detailed Scorecard

- The following pages are a detailed list of all Mixed-Use credits along with design and construction notes based upon the current design for the project.



## LEED 2009 for Core and Shell Development

Golden State Warriors Office Towers - LEED Gold Credit Strategy Scorecard  
5/8/2015

24 1 3

### Sustainable Sites

Possible Points: 28

Y	?	N	d/C
Y			
1			
5			
1			
6			
2			
3			
2			
		1	
1			
		1	
1			
	1		
1			
		1	
1			

- C Prereq 1 Construction Activity Pollution Prevention
- d Credit 1 Site Selection
- d Credit 2 Development Density and Community Connectivity
- d Credit 3 Brownfield Redevelopment
- d Credit 4.1 Alternative Transportation—Public Transportation Access
- d Credit 4.2 Alternative Transportation—Bicycle Storage and Changing Rooms
- d Credit 4.3 Alternative Transportation—Low-Emitting and Fuel-Efficient Vehicles
- d Credit 4.4 Alternative Transportation—Parking Capacity
- C Credit 5.1 Site Development—Protect or Restore Habitat
- d Credit 5.2 Site Development—Maximize Open Space
- d Credit 6.1 Stormwater Design—Quantity Control
- d Credit 6.2 Stormwater Design—Quality Control
- C Credit 7.1 Heat Island Effect—Non-roof
- d Credit 7.2 Heat Island Effect—Roof
- d Credit 8 Light Pollution Reduction
- d Credit 9 Tenant Design and Construction Guidelines

#### Conceptual Design Notes:

- Provisions for this prerequisite are required by NPDES / SF code, and will be specified by the civil engineer.
- CAMPUS CREDIT
- CAMPUS CREDIT
- CAMPUS CREDIT
- CAMPUS CREDIT
- CAMPUS CREDIT
- CAMPUS CREDIT
- CAMPUS CREDIT
- Compliance will be verified again after final landscape plans are available but due to the limited areas with vegetation this credit is not likely to be achieved.
- CAMPUS CREDIT
- 4-5% to be allocated for treatment areas, i.e. vegetated swales and landscaping. Additional storage tank would be required. Determined not to be pursued due to cost premium.
- CAMPUS CREDIT
- CAMPUS CREDIT
- The facility will need to have a light colored roof. Depending on aesthetic preference low-e roofing is available in white, tan, and gray.
- SF code require compliance with Title 24, Part 6, Section 147 so that the site lighting design will need to be more efficient than the baseline. However, due to this credit's requirements for light trespass this credit will not be feasible based on the compactness of the site.
- Develop an illustrated document that provides tenants with design and construction information, specifically related to Commercial Interiors as well as how the Core and Shell project complies with achieved credits. Include sustainability goals and objectives as well as information on any credits requiring coordination between CS and CI.

5 1 4

### Water Efficiency

Possible Points: 10

Y	?	N	d/C
Y			
2		2	
		2	
3	1		

- d Prereq 1 Water Use Reduction—20% Reduction
- d Credit 1 Water Efficient Landscaping
  - ☐ No Potable Water Use or Irrigation
- d Credit 2 Innovative Wastewater Technologies
- d Credit 3 Water Use Reduction

#### Conceptual Design Notes:

- Facility will utilize auto-sensor restroom lavatories, pint flush (0.125 gpf) urinals, 1.28 gpf water closets, 1.5 gpm break room sinks, and 1.5 gpm showerheads (depending on where the shower is located).
- CAMPUS CREDIT
- Water reuse for irrigation was determined not feasible.
- A graywater system will not be pursued at the new site. The city graywater system will not be available until 2020+.
- In order to achieve these three (3) points for 35% water efficiency of building fixtures, the facility will utilize the fixtures described above for WE Prerequisite 1. Minimum 30% reduction required by SF code. 40% will be difficult to reach, but may be attainable.



17	11	9	Energy and Atmosphere		Possible Points:	35	<b>Conceptual Design Notes:</b> Provisions for this credit are required by SF code, and will be specified by the CxA. The facility will utilize an efficient mechanical and electrical design to achieve this prerequisite, more detail is described below under EA Credit 1- Optimize Energy Performance. This prerequisite will not be an issue to achieve because the building will have all new equipment. The design will use strategies to achieve this credit, targeting a minimum of 24% efficiency over the ASHRAE 90.1-2007 baseline with the potential to achieve a higher percent reduction. The point allotment for this scorecard is conservative in nature based on previous project experience when energy models are used. Although some level of solar PV may be installed on the office towers, the extent of the system will not likely be large enough to achieve LEED points for this credit. Provisions for this credit are required by SF code, and will be specified by the CxA. Independent Cx commissioning services will be included under consultant contract. This credit will be contingent on the pounds of refrigerant per ton of cooling in the building's HVAC systems, and will be determined after final equipment selections. In order to pursue this credit, the building systems will be metered per major load category: lighting, plug loads, HVAC fans, pumps, heat rejection, heating, and the kitchen and data centers will be segregated. The Building Automation System will be set up to trend, save, and report this information (potentially in a dashboard format). Based on initial tenant interest, it is unlikely that the office buildings will be multi-tenant, therefore tenant submetering will no longer be pursued. Based on the current design and energy model RECs would cost roughly \$3,000 for the office buildings. Purchasing RECs meets another of the options for SF code requirements. REC quotes will be updated to reflect the final energy model. REC cost per MWh is known to fluctuate, therefore final purchase price will be dependent on the current rate at time of purchase during construction.
Y	?	N					
Y			C Prereq 1	Fundamental Commissioning of Building Energy Systems			
Y			d Prereq 2	Minimum Energy Performance			
Y			d Prereq 3	Fundamental Refrigerant Management			
10	9	2	d Credit 1	Optimize Energy Performance	3 to 21		
		4	d Credit 2	On-Site Renewable Energy	4		
2			C Credit 3	Enhanced Commissioning	2		
	2		d Credit 4	Enhanced Refrigerant Management	2		
3			C Credit 5.1	Measurement and Verification-Base Building	3		
		3	C Credit 5.2	Measurement and Verification-Tenant Submetering	3		
2			C Credit 6	Green Power	2		

6	1	7	Materials and Resources		Possible Points:	14	<b>Conceptual Design Notes:</b> CAMPUS CREDIT N/A Construction waste recyclers should be utilized to obtain a minimum 75% rate of diversion from the landfill for construction materials to meet SF code requirements. N/A The specifications for this project should include details for using construction materials with recycled content. The specifications for this project should include details for using construction materials with regional content. The 20% additional Maybe point is dependent on the sourcing of the concrete during construction. Utilizing FSC certified wood products for doors and casework, to have 50% of the wood materials represented by FSC materials, has an incremental cost but is typically not a large add to the project budget.
Y	?	N					
Y			d Prereq 1	Storage and Collection of Recyclables			
		5	C Credit 1	Building Reuse—Maintain Existing Walls, Floors, and Roof	1 to 5		
2			C Credit 2	Construction Waste Management	1 to 2		
		2	C Credit 3	Materials Reuse	1 to 2		
2			C Credit 4	Recycled Content	1 to 2		
1	1		C Credit 5	Regional Materials	1 to 2		
1			C Credit 6	Certified Wood	1		

8	4	0	Indoor Environmental Quality	Possible Points:	15	Conceptual Design Notes:
Y	?	N				This design requirements for this prerequisite are required by code.
Y			d Prereq 1 Minimum Indoor Air Quality Performance			CAMPUS CREDIT
Y			d Prereq 2 Environmental Tobacco Smoke (ETS) Control			To achieve this credit, mechanical system will include airflow monitoring at outside air units (per standard design practice) and CO2 monitoring in densely occupied spaces.
1			d Credit 1 Outdoor Air Delivery Monitoring	1		30% increased ventilation may be feasible, but will be determined as mechanical design progresses.
1			d Credit 2 Increased Ventilation	1		A best practice construction IAQ management plan will be developed and implemented to help protect HVAC systems and absorptive materials from moisture or debris contamination, as well as to prevent high VOC product usage in the facility. This is mandated through SF code.
1			c Credit 3 Construction IAQ Management Plan—During Construction	1		Per SF code, low-VOC adhesives will be included in the specifications, there is typically not a cost add for these products based on current market availability.
1			c Credit 4.1 Low-Emitting Materials—Adhesives and Sealants	1		Per SF code, low-VOC paints/coatings will be included in the specifications, there is typically not a cost add for these products based on current market availability.
1			c Credit 4.2 Low-Emitting Materials—Paints and Coatings	1		Per SF code, CRI certified carpets will need to be utilized, as well as FloorScore certified manufactured hard flooring products. There may be some incremental cost for these products, but typically not significant.
1			c Credit 4.3 Low-Emitting Materials—Flooring Systems	1		SF code requires urea formaldehyde-free composite wood products and laminating adhesives. Additionally, all products in this category must meet California Air Resources Board Air Toxics Control Measure for Composite Wood (17 CCR 93120 et seq.), by or before the dates specified in those sections
1			c Credit 4.4 Low-Emitting Materials—Composite Wood and Agrifiber Products	1		The HVAC units will need to utilize MERV 13 filtration on the ventilation air and MERV 8 filters on the return (SF code), facility will need minimum 10' walk-off mats or systems at entrances, and copy machines will need to be in dedicated rooms with self-closing doors. This credit requires design and layout coordination, but typically not a large construction cost.
1			d Credit 5 Indoor Chemical and Pollutant Source Control	1		Provide individual comfort controls for 50% of building occupants to enable adjustments to meet individual needs or preferences. Must purchase and/or install the mechanical system or operable windows to meet the requirements of this CS credit.
1			d Credit 6 Controllability of Systems—Thermal Comfort	1		Facility will be designed for thermal comfort with temperature, humidity, and air-speed.
1			d Credit 7 Thermal Comfort—Design	1		Daylight and views to be reviewed once project drawings are issued.
1			d Credit 8.1 Daylight and Views—Daylight	1		Daylight and views to be reviewed once project drawings are issued.
1			d Credit 8.2 Daylight and Views—Views	1		

6	0	0	Innovation and Design Process	Possible Points:	6	Conceptual Design Notes:
Y	?	N				Facility can achieve this credit by having a comprehensive green building education program, including signage, website information, and potentially a kiosk or dashboard.
1			d/C Credit 1.1 Innovation in Design: Green Building Education	1		Facility can utilize a green cleaning program that emphasizes nonharmful chemicals, and equipment that is less impactful to operations staff (noise, vibration, ergonomics). This will require coordination with operations staff / facility manager.
1			d/C Credit 1.2 Innovation in Design: Green Housekeeping	1		The project could achieve exemplary performance in recycled material content.
1			d/C Credit 1.3 Exemplary Performance: MRc4 - Recycled Content	1		The project could achieve exemplary performance in maximize open space.
1			d/C Credit 1.4 Exemplary Performance: SSc5.2 - Maximize Open Space	1		Achievement of exemplary performance in green power should be a reasonable cost, quote to be requested.
1			d/C Credit 1.5 Exemplary Performance: EAc6 - Green Power	1		The project will have several LEED professionals, and a team facilitating the sustainability process.
1			d/C Credit 2 LEED Accredited Professional	1		

1	2	1	Regional Priority - Zip code 94158	Possible Points:	4	Conceptual Design Notes:
Y	?	N				A regional priority credit in open space should be feasible for the 30% open space anticipated for the project.
1			d/C Credit 1.1 Regional Priority: SSc5.2 - Site Development - Maximize Open Space	1		40% water use reduction is not likely for the project, but still an option, pending WEC3.
1			d/C Credit 1.2 Regional Priority: WEc3 - Water Use Reduction	1		Any on-site renewable energy installed will likely not meet LEED requirements to achieve LEED points.
1			d/C Credit 1.3 Regional Priority: EAc2 - On-site Renewable Energy	1		A regional priority credit for daylight may or may not be feasible, to be reviewed with project drawings.
1			d/C Credit 1.4 Regional Priority: EQc8.1 - Daylight and Views - Daylight	1		

67	20	24	Total	Possible Points:	110	
						Certified 40 to 49 points Silver 50 to 59 points Gold 60 to 79 points Platinum 80 to 110

## 10.7 – ALTERNATIVE STRATEGIES

### 10.7.1 - Solar Photovoltaic (PV) System

- Office Tower(s)  
The opportunity exists for a solar PV system to be installed on the office tower roofs; however, the extent of the system will likely not be large enough to achieve any LEED points for the on-site renewable energy credit.

### 10.7.2 - Educational Opportunities

- Campus Signage  
While signage options have yet to be discussed in detail, it is understood that technology is expected to be incorporated in some fashion.
- High Performance MEP Systems

## 10.8 - TENANT LEASE LEED GUIDELINES

The following credits being pursued by the Office Towers must be addressed in a Tenant Lease Agreement. LEED for Core and Shell requires certain credits to be specified in the tenant lease (shown in bold below). Additional credits will assist in the required LEED for Commercial Interiors certification as they will affect future building tenants.

- **SSc4.2: Bicycle Storage and Changing Rooms**
- **WEp1: Water Use Reduction**
- **WEc3: Water Use Reduction**
- **EAp2: Minimum Energy Performance**
- **EAp3: Fundamental Refrigerant Management**
- **EAc1: Optimize Energy Performance**
- EAc3: Enhanced Commissioning
- **EAc4: Enhanced Refrigerant Management**
- EAc5: Measurement and Verification
- **IEQp1: Minimum Indoor Air Quality Performance**
- **IEQp2: Environmental Tobacco Smoke Control**
- **IEQc1: Outdoor Air Delivery Monitoring**
- **IEQc2: Increased Ventilation**
- IEQc3: Construction Indoor Air Quality Management Plan
- **IEQc5: Indoor Chemical and Pollutant Source Control**
- **IEQc6: Controllability of Systems**
- IEQc7: Thermal Comfort
- IEQc8: Daylighting and Views

The Tenant Guidelines and/or Lease Agreements are typically drafted during the core and shell design phase. The document should be provided to future tenants during lease negotiations and must be provided prior to tenant design work.

## 10.9 – APPENDICES

### 10.9.2 - Bike Rack Counts

- This credit represents a sustainability goal that contains overlapping requirements from LEED and various codes. The final number of bike racks will be determined during the design process, with the maximum number being driven by LEED (which bases its requirements on facility occupancy counts). Appendix A shows a current detailed snapshot of the overlapping bicycle storage requirements. Showers must also be provided for FTEs in the Event Center and mixed-use buildings.

### 10.9.3 - Green Power Quote

- SSRCx will request updates to the green power quotes once more accurate information is available after final energy models have been completed. Appendix B shows green power estimates for the office towers based on current design. The estimated premium for the Office Towers is \$2,000. The estimated premium for the Event Center is \$7,000.



## APPENDIX A

**GSW MISSION BAY- CAMPUS BICYCLE STORAGE & SHOWER REQUIREMENTS**  
5.8.2015

	Arena LEED-NC Project	Office LEED-CS Projects	SF Code	D4D	Major Phase Commitment	SF Bike Coalition	Most Stringent Requirement	Design Stipulations	LEED Shower Requirements	Current Design	Design Stipulations
Arena	1128	n/a	Based on 1,002 total parking spaces serving the campus: 51 bike racks are required total.	51 bike racks on site with no location requirements	400 total	400 total including valet and corrals	400 total 300 valet spaces, 100 corral spaces	Outdoor bike racks (Class 2) to be permanently anchored and located within 200 <u>feet</u> of main entrances, readily visible to passers-by (per SF Code).	4	42	Employee showers to be located either in the building or within 200 <u>yards</u> of the respective building's main entrance and allocated to meet the minimum number of showers per building in this table.
Bayfront Terrace			300 valet spaces, and 100 corral spaces								
Market Hall			33 long-term (Class 1) spaces, in lockable enclosures with permanently anchored racks.								
North Office Tower (South Street)	n/a	50 total, 12 outdoor (Class 2)	186 total		108** secure off street spaces (Class 1) plus, ample on-street spaces (Class 2)	186 total 111 - Class 1 75 - Class 2	All remaining bike racks to be permanently achored in lockable enclosures located within 200 <u>yards</u> of any building's main entrance and allocated to meet the minimum number of racks per building in this table.	7	8		
South Office Tower (16th Street)	n/a	42 total, 6 outdoor (Class 2)	18 short-term (Class 2) racks to be permanently anchored and located within 200 feet of any visitor entrance, readily visible to passers-by.		111 Class 1 spaces, and 75 Class 2 spaces	Divided between office towers		6	8		
Gatehouse											

\*The approach to bicycle storage for the arena to meet the LEED requirements will follow LEED Interpretations 2494 and 5082 regarding permanent bike storage for FTEs and a portion of visitors (valet) with the remainder of visitor bicycle storage handled by a corral system

\*\*Request likely to increase based on our increased office sf.

SF Planning Class 1 refers to long-term, indoor racks, while SF Planning Class 2 refers to short-term, outdoor racks

## APPENDIX B





Lindsey Mazurski

The table below outlines the amount of Renewable Energy Certificates (RECs) needed in order to obtain the Green Power points in accordance with NC v2009 for the Golden State Warriors Event Center LEED project. We would provide Green-e Certified Renewable Energy Certificates for this LEED Certification. This quote assumes electricity usage of 3,434,209 kWh/year based on the information you have provided.

**NC v2009**

% Green Power	2-year Electricity Usage (MWh)	Cost Per MWh**	Total Cost* US\$
70% (2 EA Points and 1 ID Point)	4,808	\$1.26	\$6,058.08
35% (2 EA Points)	2,404	\$1.26	\$3,029.04

\* You do not need to add values to achieve 70%

\*\*REC price quote is valid from 14 days of issue

Please contact us with any questions regarding this quote. Please keep in mind that a REC is an investment in renewable energy generation and goes towards aiding in the development of the market for new generation. However, a REC should not necessarily be used for claims of carbon neutrality. This is due to the fact that a REC does not have to prove additionality, whereas a carbon offset must go through these additional rigors.

Sincerely,  
Scott Maloney



Lindsey Mazurski

The table below outlines the amount of Renewable Energy Certificates (RECs) needed in order to obtain the Green Power points in accordance with CS v2009 for the Golden State Warriors North Office Tower LEED project. We would provide Green-e Certified Renewable Energy Certificates for this LEED Certification. This quote assumes electricity usage of 3,347,654 kWh/year based on the information you have provided.

CS v2009

% Green Power	2-year Electricity Usage (MWh)	Cost Per MWh**	Total Cost* US\$
70% (2 EA Points and 1 ID Point)	704	\$1.26	\$887.04
35% (2 EA Points)	352	\$1.26	\$443.52

\* You do not need to add values to achieve 70%

\*\*REC price quote is valid from 14 days of issue

Please contact us with any questions regarding this quote. Please keep in mind that a REC is an investment in renewable energy generation and goes towards aiding in the development of the market for new generation. However, a REC should not necessarily be used for claims of carbon neutrality. This is due to the fact that a REC does not have to prove additionality, whereas a carbon offset must go through these additional rigors.

Sincerely,  
Scott Maloney



Lindsey Mazurski

The table below outlines the amount of Renewable Energy Certificates (RECs) needed in order to obtain the Green Power points in accordance with CS v2009 for the Golden State Warriors South Office Tower LEED project. We would provide Green-e Certified Renewable Energy Certificates for this LEED Certification. This quote assumes electricity usage of 3,011,561 kWh/year based on the information you have provided.

CS v2009

% Green Power	2-year Electricity Usage (MWh)	Cost Per MWh**	Total Cost* US\$
70% (2 EA Points and 1 ID Point)	634	\$1.26	\$798.84
35% (2 EA Points)	318	\$1.26	\$400.68

\* You do not need to add values to achieve 70%

\*\*REC price quote is valid from 14 days of issue

Please contact us with any questions regarding this quote. Please keep in mind that a REC is an investment in renewable energy generation and goes towards aiding in the development of the market for new generation. However, a REC should not necessarily be used for claims of carbon neutrality. This is due to the fact that a REC does not have to prove additionality, whereas a carbon offset must go through these additional rigors.

Sincerely,  
Scott Maloney