San Francisco Department of the Environment

LEEDv4 Cost Case Study

Sunset Rec Center & North Beach Branch Library

Draft 1 | October 31, 2016

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This report takes into account the particular instructions and requirements of our client.

It is not intended for and should not be relied upon by any third party and no responsibility is undertaken to any third party.

Job number Job number

This report is a cooperative venture of Arup and Saylor Consulting authorized by San Francisco Department of The Environment

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1 Executive Summary

The City of San Francisco first established green building requirements for city buildings in 1999. In 2004 LEED Silver certification became the required standard for municipal new construction and major renovation projects. In 2011 this standard was raised to LEED Gold certification to ensure municipal requirements remained at least as stringent as the San Francisco Green Building Code requirements that apply to all new construction over 25,000 square feet city-wide. San Francisco's Municipal Green Building Ordinance has always intended to lead by example, staying one step ahead of California's codes in green building design for municipal projects. With the expiration of LEED v3 for new projects on October 31, 2016, and the 2016 California Building Code going in effect on January 1, 2017, the proposed amendment to Chapter 7 of the Environment Code recognizes these code updates and adopts LEED v4 Gold certification as the municipal standard for new construction and major renovation projects over 10,000 square feet. San Francisco currently owns and operates 50 LEED certified projects totaling nearly 7 million square feet.

The City's LEED 2009 Gold requirement effectively covered all the requirements of 2016 Energy Code and CALGreen. 2016 Energy and CALGreen codes, however, are not as high a standard as LEEDv4 Gold, and do not represent the same leadership position that the City took when it initially required LEED Gold

This report compiled by Arup and Saylor Consulting compares two recent City and County of San Francisco projects that achieved LEED 2009 Gold certification (as required by the SF Environment Code, Chapter 7), to what it would take for those projects to be certified at LEEDv4 Gold. Our upgrade analysis first accounts for and excludes the costs associated with meeting current state and local codes notably California Energy Code Title 24 2016 Part 6 (Energy Code) and Part 11 (CalGreen). The two projects are the North Beach Branch Library, which was a ground-up new construction project, and the Sunset Recreation Center, which was a major renovation.

The North Beach Library additional cost for LEEDv4 Gold would have been about $71,000 – 0.8% of the $9,198,650 total project cost -- primarily for additional soft costs related to team meetings, product research, and lighting design. For Sunset Rec Center, the additional cost would have been more like $255,000 – 2.6% of the $9,717,916 total project cost. The LEEDv4 improvements in that case would have been primarily for HVAC system improvements, landscaping, and soft costs. The energy improvements would have a simple payback period around 15 years. Sunset Rec Center would also have required a larger PV system at an additional cost of $230,000 (another 3% of project cost).

This study brings up a tendency for costs per square foot for renovation projects to be higher than for new construction, especially when existing buildings contain historic elements and/or asbestos, lead-based paint, or other hazardous materials, or when older buildings have accumulated a legacy of deferred maintenance. However, the value of preserving the City's cultural heritage and neighborhood

character is well established and worth paying for, as is improving the experience of visiting public facilities such as libraries and recreation centers. LEED requirements do not tend to change the basic cost differential between new-build and renovation projects.

While the process of LEED certification has a cost, it helps to deliver better and more consistent quality. The additional soft costs in LEEDv4 go towards activities that integrate the teams designing city projects, allowing them the time to find more sustainable design solutions without increasing construction costs. LEED v4 projects also tend to have a higher level of commissioning (quality control and testing) than required by California Energy Code and CalGreen Building Code. Lastly, current Environment Code contains a waiver provision for LEED requirements when project-specific factors make LEED compliance infeasible.

2 Title-24 & CALGreen Impact

LEEDv4 is coming to the fore at the same time that the State of California's Energy Code and Green Building Code (often referred to as "Title 24 Part 6 and Part 11 have been tightened. Some green building and energy-efficiency measures that were not required when North Beach Library and Sunset Rec Center were permitted would apply to similar projects built today even if LEEDv4 were not required. However, today's code requirements would not have changed the design of either North Beach Library or Sunset Rec Center. Building the same buildings today to current codes would not cost more, because code requirements for energy-efficient systems, building commissioning (energy efficiency testing), water efficient plumbing fixtures, low-VOC materials, etc. were met as part of the LEED 2009 process.

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3 North Beach Branch Library

Table 1 below shows a LEEDv4 scorecard prepared for the North Beach Branch Library. As a high-performing LEED 2009 Gold project, we estimate that the project as designed would have earned 54 points in LEEDv4 – close to retaining its Gold rating (minimum 60 points). We identified an additional 7 credits worth up to 9 possible points that could have been achieved with relatively minor design changes.

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Table 1- North Beach Library LEEDv4 Scorecard

North Beach Branch Library LEEDv4 Comparison

LEED v4 for NEW CONSTRUCTION

LEED PROJECT SCORECARD

POINTS YES	POINTS MAYBE	POINTS NO			MAX PTS	
0	1	0	**Integrative Process (IP)**			
0	1	0	IP 1	Integrative Process	1	D
13	0	3	**Location and Transportation (LT)**			
0	0	0	LT 1	LEED for Neighborhood Development Location	16	D
1	0	0	LT 2	Sensitive Land Protection	1	D
0	0	2	LT 3	High Priority Site	2	D
5	0	0	LT 4	Surrounding Density and Diverse Uses	5	D
5	0	0	LT 5	Access to Quality Transit	5	D
1	0	0	LT 6	Bicycle Facilities	1	D
1	0	0	LT 7	Reduced Parking Footprint	1	D
0	0	1	LT 8	Green Vehicles	1	D
3	1	6	**Sustainable Sites (SS)**			
R			SS PrRq 1	Construction Activity Pollution Prevention		C
0	1	0	SS 1	Site Assessment	1	D
0	0	2	SS 2	Site Development -Protect or Restore Habitat	2	D
0	0	1	SS 3	Open Space	1	D
0	0	3	SS 4	Rainwater Management	3	D
2	0	0	SS 5	Heat Island Reduction	2	D
1	0	0	SS 6	Light Pollution Reduction	1	D
5	0	6	**Water Efficiency (WE)**			0
R			WE PrRq 1	Outdoor Water Use Reduction		D
R			WE PrRq 2	Indoor Water Use Reduction		D
R			WE PrRq 3	Building-Level Water Metering		D
2	0	0	WE 1	Outdoor Water Use Reduction	2	D
3	0	3	WE 2	Indoor Water Use Reduction	6	D
0	0	2	WE 3	Cooling Tower Water Use	2	D
0	0	1	WE 4	Water Metering	1	D
12	4	14	**Energy and Atmosphere (EA)**			
R			EA PrRq 1	Fundamental Commissioning and Verification		C
R			EA PrRq 2	Minimum Energy Performance		D
R			EA PrRq 3	Building-Level Energy Metering		D
R			EA PrRq 4	Fundamental Refrigerant Management		D
0	3	3	EA 1	Enhanced Commissioning	6	C
12	0	6	EA 2	Optimize Energy Performance	18	D
0	1	0	EA 3	Advanced Energy Metering	1	D
0	0	2	EA 4	Demand Response	2	C
2	0	1	EA 5	Renewable Energy Production	3	D
1	0	0	EA 6	Enhanced Refrigerant Management	1	D
0	0	2	EA 7	Green Power and Carbon Offsets	2	C

Design Phase Credit
Construction Phase Credit

POINTS YES	POINTS MAYBE	POINTS NO			MAX PTS
5	0	8	**Materials & Resources (MR)**		
R			MR PrRq 1	Storage & Collection of Recyclables	
R			MR PrRq 2	C&D Waste Management Planning	
0	0	5	MR 1	Building Life-Cycle Impact Reduction	5
1	0	1	MR 2	Building Product Disclosure & Optimization - EPDs	2
1	0	1	MR 3	BPDO - Sourcing of Raw Materials	2
1	0	1	MR 4	BPDO - Material Ingredients	2
2	0	0	MR 5	Construction and Demolition Waste Management	2
7	3	6	**Environmental Quality (EQ)**		
R			EQ PrRq 1	Minimum IAQ Performance	
R			EQ PrRq 2	Environmental Tobacco Smoke (ETS) Control	
1	0	1	EQ 1	Enhanced IAQ Strategies	2
2	1	0	EQ 2	Low-Emitting Materials	3
1	0	0	EQ 3	Construction IAQ Management Plan	1
1	0	1	EQ 4	IAQ Assessment	2
0	0	1	EQ 5	Thermal Comfort	1
1	1	0	EQ 6	Interior Lighting	2
0	0	3	EQ 7	Daylight	3
1	0	0	EQ 8	Quality Views	1
0	1	0	EQ 9	Acoustic Performance	1
5	0	1	**Innovation (IN)**		
1	0	0	ID 1.1	0	1
1	0	0	ID 1.2	0	1
1	0	0	ID 1.3	0	1
1	0	0	ID 1.4	0	1
0	0	1	ID 1.5	0	1
1	0	0	ID 2	LEED AP	1
3	0	1	**Regional Priority (RP)**		94133
1	0	-	EA 2	Optimize Energy Performance, Threshold: 10	1
1	0	-	LT 5	Access to Quality Transit, Threshold: 5	1
0	0	-	MR 1	Building Life-Cycle Impact Reduction, Threshold: 3	1
1	0	-	MR 3	Building Product Disclosure & Optimization - Sourci	1
0	0	-	SS 4	Rainwater Management, Threshold: 3	*
0	0	-	WE 2	Indoor Water Use Reduction, Threshold: 4	*
YES	MAYBE	NO			
56	9	45		TOTAL POSSIBLE POINTS	110

LEGEND
- Regional Priority Credit
- LEED V4 Credis Required by the San Francisco Green Building Code (SFGBC)
- R Required Prerequiste, must be achieved

LEED Certified = 40-49, Silver = 50-59, Gold = 60-79, Platinum = 80 points and above

Saylor Consulting estimated the cost of the 5 credits considered most likely based on Arup's San Francisco project design experience, then added standard markups for general conditions, contingency, bonding, overhead and profit. The per-credit cost (before markups) is included in Table 2 below. The total North Beach Library additional cost for LEEDv4 was estimated at $71,000 – 0.8% of the $9,198,650 total project cost (including approved change orders) -- primarily for additional soft costs related to team meetings, product research, and lighting design. We believe that SFPUC provided the PV system for this project outside of the DPW project budget and change order process, which is not feasible for all projects.

The Saylor report contains details on totals with markups.

Table 2 - Additions needed for LEEDv4

Code	Credit	Add'l points	Design changes to earn additional LEED points	Cost per Saylor
Credits studied for cost				
IP 1	**Integrative Process** 1. ENERGY SYSTEMS and 2. WATER SYSTEM - Perform a preliminary "simple box" energy model & water budget before the completion of schematic design - Document how the above analysis informed design and building form.	1	Additional pre-design meeting & analysis: 32 hours estimated of professional time (this team probably did some of this)	$4,800
SS 1	**Site Assessment** Survey/assess all of: · Topography · Hydrology · Climate · Vegetation · Soils · Human use · Human health. Describe how these features influenced the project design.	1	Additional pre-design meeting & analysis: 24 hours estimated of professional time (this team probably did some of this)	$3,600
EA 1	**Enhanced Commissioning** OPTION 1.1: ENHANCED COMMISSIONING (3 pts) In addition to EAp1CxA must: · Review contractor submittals. · Perform additional verification. · Review building operations 10 months after substantial completion. · Develop an on-going commissioning plan. · Update the OPR and BOD	3	Additional time for Commissioning Agent to develop on-going commissioning plan and provide more verification than under LEED 2009. 40 hours of professional time estimated	$8,000
EQ 2	**Low-Emitting Materials** OPTION 1. PRODUCT CATEGORY METHOD 2* categories = 1 pt 4* categories = 2 pts 5* categories = 3 pts. - Paints & coatings: 90% Gen'l Emissions & 100% VOCs - Adhesives & sealants: 90% Gen'l Emissions & 100% VOCs - Flooring: 100% Gen'l Emissions, FloorScore or NSF-332 - Composite wood: 100% CARB ULEF rating or NAUF - Ceilings, walls, insulation: 100% General Emissions * Furniture: 90% Furniture Emissions and	1	Additional time to specify materials (architect) and prepare more detailed submittals (contractor) and review submittals (architect) for all 5 categories. 50 hours for architect and 25 hours for GC estimated	$14,000

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	*add one more category needed for points. Furniture must comply if installed within building prior to occupancy.			
EQ 6	**Interior Lighting** OPTION 2. LIGHTING QUALITY (1 pt) - Do 4:A. Reduce fixture glare: luminance <2,500 cd/m2B. High CRI ≥ 80 or higher for entire project. C. Long life: rated life (L70) ≥ 24,000 hrs 75% of load.D. Reduce overhead glare. Direct-only ≤ 25% load.E. High reflectance: 85% ceilings, 60% walls, 25% floors, ≥ 90% regularly occupied area.F. Furniture reflectance: 45% work surfaces, 50% movable partitions, if furniture is included in the scope of work.G. Reduce wall contrast. wall:: work plane illuminance ≤ 1:10 min. 75% of the regularly occupied area; plus E or F.H. Reduce ceiling contrast. ceiling: work surface illuminance ≤ 1:10 min. 75% of the regularly occupied area; plus E or F.See LEED reference guide for strategy details.	1	Additional time from lighting designer for design and documentation. (Assume LED fixtures would be part of Title-24 compliance at no extra cost; surface reflectance and contrast can be done within existing painting cost.) 40 estimated hours	$26,100
	Total	**7**		
Credits not studied				
EA 3	**Advanced Energy Metering** Install advanced energy meters for uses ≥10% total annual consumption · Electricity meters for both consumption and demand. · Network for data collection · Hourly recording, etc.	1	Add a metering system (e.g. E-MON or Square D) with separate metering of: lighting, fan power, cooling power. Include local computer to store and display energy trend data with internet connection. Service contract may also be needed.	-
EQ 9	**Acoustic Performance** see Credit reference and LEED reference guide for detailed criteria ALL OPTIONS: For all occupied spaces, meet all as applicable: · HVAC Background Noise - ASHRAE Handbook, Chapter 48, Table 1 & 6 · Sound Transmission - STCC per LEED reference guide · Reverberation time - per LEED reference guide · Sound Reinforcement and Masking criteria (if used) - per LEED reference guide etc.	1	Additional time from acoustical consultant plus potential changes to façade, windows, roof, and HVAC equipment that cannot be estimated in this study.	-

Based on our review of the project's LEED documents, North Beach Library would have met 2016 California Energy Code ("Title 24") and CALGreen without additional changes. Again, this is more typical of new buildings than renovation projects.

4 Sunset Recreation Center

Table 3 below shows a LEEDv4 scorecard prepared for the Sunset Recreation Center. As a renovation of an older building, we estimated that the project as designed would have earned 45 points in LEEDv4 – a mid-range Silver rating. We identified an additional 10 credits worth up to 18 possible points that could be added to achieve a v4 Gold Rating.

Table 3 - Sunset Recreation Center LEEDv4 Scorecard

####				LEED PROJECT SCORECARD		
						Design Phase Credit D
POINTS						Construction Phase Credit C
0	1	0	Integrative Process (IP)			
YES	MAYBE	NO			MAX PTS	
0	1	0	IP 1	Integrative Process	1	D
7	0	9	Location and Transportation (LT)			
0	0	0	LT 1	LEED for Neighborhood Development Location	16	D
1	0	0	LT 2	Sensitive Land Protection	1	D
0	0	2	LT 3	High Priority Site	2	D
2	0	3	LT 4	Surrounding Density and Diverse Uses	5	D
3	0	2	LT 5	Access to Quality Transit	5	D
0	0	1	LT 6	Bicycle Facilities	1	D
1	0	0	LT 7	Reduced Parking Footprint	1	D
0	0	1	LT 8	Green Vehicles	1	D
4	5	1	Sustainable Sites (SS)			
R			SS PrRq 1	Construction Activity Pollution Prevention		C
0	1	0	SS 1	Site Assessment	1	D
0	1	1	SS 2	Site Development -Protect or Restore Habitat	2	D
1	0	0	SS 3	Open Space	1	D
0	3	0	SS 4	Rainwater Management	3	D
2	0	0	SS 5	Heat Island Reduction	2	D
1	0	0	SS 6	Light Pollution Reduction	1	D
4	1	6	Water Efficiency (WE)			0
R			WE PrRq 1	Outdoor Water Use Reduction		D
R			WE PrRq 2	Indoor Water Use Reduction		D
R			WE PrRq 3	Building-Level Water Metering		D
0	0	2	WE 1	Outdoor Water Use Reduction	2	D
4	0	2	WE 2	Indoor Water Use Reduction	6	D
0	0	2	WE 3	Cooling Tower Water Use	2	D
0	1	0	WE 4	Water Metering	1	D
6	6	18	Energy and Atmosphere (EA)			
R			EA PrRq 1	Fundamental Commissioning and Verification		C
R			EA PrRq 2	Minimum Energy Performance		D
R			EA PrRq 3	Building-Level Energy Metering		D
R			EA PrRq 4	Fundamental Refrigerant Management		D
3	0	3	EA 1	Enhanced Commissioning	6	C
3	5	10	EA 2	Optimize Energy Performance	18	D
0	1	0	EA 3	Advanced Energy Metering	1	D
0	0	2	EA 4	Demand Response	2	C
0	2	1	EA 5	Renewable Energy Production	3	D
1	0	0	EA 6	Enhanced Refrigerant Management	1	D
0	0	2	EA 7	Green Power and Carbon Offsets	2	C

POINTS					
8	0	5	Materials & Resources (MR)		
YES	MAYBE	NO			MAX PTS
R			MR PrRq 1	Storage & Collection of Recyclables	C
R			MR PrRq 2	C&D Waste Management Planning	D
3	0	2	MR 1	Building Life-Cycle Impact Reduction	5 C
1	0	1	MR 2	Building Product Disclosure & Optimization - EPDs	2 C
1	0	1	MR 3	BPDO - Sourcing of Raw Materials	2 C
1	0	1	MR 4	BPDO - Material Ingredients	2 C
2	0	0	MR 5	Construction and Demolition Waste Management	2 C
6	2	8	Environmental Quality (EQ)		
R			EQ PrRq 1	Minimum IAQ Performance	
R			EQ PrRq 2	Environmental Tobacco Smoke (ETS) Control	
1	0	1	EQ 1	Enhanced IAQ Strategies	2 D
2	1	0	EQ 2	Low-Emitting Materials	3 C
1	0	0	EQ 3	Construction IAQ Management Plan	1 C
1	0	1	EQ 4	IAQ Assessment	2 C
0	0	1	EQ 5	Thermal Comfort	1 D
1	1	0	EQ 6	Interior Lighting	2 D
0	0	3	EQ 7	Daylight	3 D
0	0	1	EQ 8	Quality Views	1 D
0	0	1	EQ 9	Acoustic Performance	1 D
6	0	0	Innovation (IN)		
1	0	0	ID 1.1	0	1
1	0	0	ID 1.2	0	1
1	0	0	ID 1.3	0	1
1	0	0	ID 1.4	0	1
1	0	0	ID 1.5	0	1
1	0	0	ID 2	LEED AP	1
3	1	0	Regional Priority (RP)		0
0	0	-	EA 2	Optimize Energy Performance, Threshold: 10	1
0	0	-	LT 5	Access to Quality Transit, Threshold: 5	1
1	0	-	MR 1	Building Life-Cycle Impact Reduction, Threshold: 3	1
1	0	-	MR 3	Building Product Disclosure & Optimization - Sourci	1
0	1	-	SS 4	Rainwater Management, Threshold: 3	*
1	0	-	WE 2	Indoor Water Use Reduction, Threshold: 4	*
YES	MAYBE	NO			
45	18	47		TOTAL POSSIBLE POINTS	110

LEGEND

	Regional Priority Credit
	LEED V4 Credis Required by the San Francisco Green Building Code (SFGBC)
R	Required Prerequiste, must be achieved

LEED Certified = 40-49, Silver = 50-59, Gold = 60-79, Platinum = 80 points and above

Saylor Consulting estimated the cost of the 9 most likely credits, then added standard markups for general conditions, contingency, bonding, overhead and profit. The per-credit cost (before markups) is included in Table 4 below. The additional LEED costs are estimated at $255,000 -- 2.6% of the $9,717,916 total project cost, including approved change orders -- plus another $230,000 for a larger PV system, which could have been financed outside the project cost (for instance from SFPUC as per North Beach Library). See the Saylor report for totals with markups.

The energy improvements listed below would have saved around $7,600 per year, giving a simple payback period around 15 years compared to the $109,900 cost for those measures. The larger PV system would produce $4,800 per year of

electricity, giving a simple payback period of 45 years without rebates or incentives; most PV systems rely on rebates, accelerated depreciation, and other incentives to achieve a much more favorable cost payback.

Table 4 - Additions needed for LEEDv4

Code	Credit	Add'l points	Design changes to earn additional LEED points	Cost per Saylor
Credits studied for cost				
IP 1	**Integrative Process** 1. ENERGY SYSTEMS and 2. WATER SYSTEM - Perform a preliminary "simple box" energy model & water budget before the completion of schematic design - Document how the above analysis informed design and building form.	1	Additional pre-design meeting & analysis: 40 hours estimated of professional time ~$5K	$ 6,000
SS 1	**Site Assessment** Survey/assess all of: · Topography · Hydrology · Climate · Vegetation · Soils · Human use · Human health. Describe how these features influenced the project design.	1	Additional pre-design meetings & analysis: 40 hours estimated of professional time ~$5K	$ 6,000
SS 2	**Site Development: Protect or Restore Habitat** OPTION 2. DONATION (1 pt) Give at least $0.40 per square foot for the total site area (including the building footprint) to a land trust or conservation organization within the same EPA Level III ecoregion or the project's state.	1	Site area approx. 152,000 sq ft --> donate $60,000 for 1 point.	$60,000

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SS 4	**Rainwater Management** OPTION 1. PERCENTILE EVENTS (2-3 pts)+ 1 reiognal priority point Manage on site (infiltrate, capture, reuse, etc) 100% of the runoff from the developed site using low-impact development (LID) and green infrastructure to best replicate natural site hydrology processes. Sending water offsite, e.g. to sewers or water bodies, does not comply. · 95th Percentile Event: 2 points · 98th Percentile Event: 3 points · 85th Percentile Event: 3 pts - only if 1.5 FAR within a 1/4 mile radius of the site.	4	alter site design to treat rainwater from roof, hardscape and lawn in bioswales, etc.	$ 30,000
WE 4	**Water Metering** Install permanent water meters for at least 2 of: · Irrigation, ≥ 80% of irrigated area. · Indoor plumbing fixtures >80% of fixtures (either directly or by deducting) · Domestic hot water, ≥ 80% of water heating capacity. · Boiler(s) ≥ 100,000 gallons or 500,000 BtuH · Reclaimed water (meter any makeup water) · Other process water ≥ 80% e.g. humidification systems, dishwashers, clothes washers, pools,	1	install (3) water meters for irrigation, kitchen, and restroom usage	$ 22,500
EA 2	**Optimize Energy Performance** Establish an energy performance target (kBTU/sqft-year) no later than the schematic design phase. AND OPTION 1. ENERGY MODELING (1–18 pts) Demonstrate a percentage improvement compared with the baseline.	5	improve building energy performance from 7% against ASHRAE-2010 to 20% better (by cost). The following measures should accomplish this: a) fan power is 43% of energy cost. Save approx 40% of fan power by switching system from constant volume AHUs to a smaller ducted DOAS system with Demand Controlled Ventilation and add ceiling Big Ass Fans for destratification in gymnasium. b) improve kitchen equipment to reduce process loads c) improve heating from 80% AFUE packaged units to 90% AFUE condensing boiler d) no cost - 2016 CEC would reduce outdoor lighting energy approx 20% from as-built design.	$ 109,900

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EA 3	**Advanced Energy Metering** Install advanced energy meters for uses ≥10% total annual consumption · Electricity meters for both consumption and demand. · Network for data collection · Hourly recording, etc.	1	Add a metering system (e.g. E-MON or Square D) with separate metering of: lighting, fan power, cooling power, gas consumption. Include local computer to store and display energy trend data with internet connection. Service contract may also be needed.	$ 9,300
EA 5	**Renewable Energy Production** Use renewable energy systems to offset building energy costs. Off-site energy systems allowed w/ ownership or 10-year lease, in same service area, retention of all RECs.	2	Increase PV system size (would fit on top of gym roof barrel vault). Produce $4800/yr of electricity (current system produces $668), so additional system is 7x as big as previous system.	Assumed $0
EQ 2	**Low-Emitting Materials** OPTION 1. PRODUCT CATEGORY METHOD 2* categories = 1 pt 4* categories = 2 pts 5* categories = 3 pts. - Paints & coatings: 90% Gen'l Emissions & 100% VOCs - Adhesives & sealants: 90% Gen'l Emissions & 100% VOCs - Flooring: 100% Gen'l Emissions, FloorScore or NSF-332 - Composite wood: 100% CARB ULEF rating or NAUF - Ceilings, walls, insulation: 100% General Emissions * Furniture: 90% Furniture Emissions and *add one more category needed for points. Furniture must comply if installed within building prior to occupancy.	1	Additional time to specify materials (architect) and prepare more detailed submittals (contractor) and review submittals (architect) for all 5 categories. 50 hours for architect and 25 hours for GC? Small premium on FF&E materials budget, estimated 1%	$ 34,375
Credits not studied				
EQ 6	**Interior Lighting** OPTION 2. LIGHTING QUALITY (1 pt) - Do 4: A. Reduce fixture glare: luminance <2,500 cd/m2 B. High CRI ≥ 80 or higher for entire project. C. Long life: rated life (L70) ≥ 24,000 hrs 75% of load. D. Reduce overhead glare. Direct-only ≤ 25% load. E. High reflectance: 85% ceilings, 60% walls, 25% floors, ≥ 90% regularly occupied area. F. Furniture reflectance: 45% work surfaces, 50% movable partitions, if furniture is included in the scope of work. G. Reduce wall contrast. wall: work plane illuminance ≤ 1:10 min. 75% of the regularly occupied area; plus E or F. H. Reduce ceiling contrast. ceiling: work surface illuminance ≤ 1:10 min. 75% of the regularly occupied area; plus E or F.	1	Additional time from lighting designer for design and documentation. (Assume LED fixtures would be part of Title-24 compliance at no extra cost; surface reflectance and contrast can be done within existing painting cost.) 40 (?) hours	

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Based on our review of the project's LEED documents, Sunset Recreation Center would have met 2016 California Energy Code ("Title 24") and CALGreen without additional changes. The as-built design did need substantial energy efficiency improvements to stay at a LEEDv4 Gold rating, however. Sunset Rec Center did not score as high in credit EAc1 Optimize Energy Performance as North Beach Library, nor does it have as many other features that already meet LEEDv4 standards. The energy features we thought would get the project enough LEED points were estimated to cost $109,900 (without markups); by saving an addition 13% of energy cost beyond what the building already achieved, this would save about $7,600 per year. This 14 ½ year payback period is much shorter than the roughly 65 years between when the building was first built and the recent substantial renovation.

We also estimated that the Sunset Rec Center would have needed a larger PV (solar photovoltaic power) system to generate energy on-site to retain a LEEDv4 Gold rating. The project as built included a very small PV system; we estimated that LEEDv4 would have required a system around 7 time the size. As noted above, there are a variety of methods of financing renewable power system because, unlike other efficiency measures, they generate valuable electricity. Saylor estimated the price of the PV system at $229,500 based on $4.5/W; if it produced around $4,800 worth of electricity per year it would have a simple payback period of 48 years. SFPUC states that PV costs may be somewhat higher than Saylor's estimate.
As is often the case, energy efficiency investments have a better return than renewable power installations, especially at a small scale.

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