Case Study
State of California Department of Industrial Relations (DIR)

Location: San Luis Obispo, CA
Architect: Fraser Seiple Architects
Services: Energy Modeling, Daylight Design, LEED Energy Credits
LEED-NC 2.2 - Gold

Overview

The DIR building is a 9,000 SF office space for the State of California. The structure is laid out with optimum orientation and proportions for daylighting and solar control. Green features include solar shading devices, high performance glazing, reclaimed water, cool roofing and paving, FSC certified wood products, solar photovoltaic panels, and multiple daylighting strategies. An innovative system of wind towers above the roof uses negative air pressure from the consistent prevailing winds to drive a passive ventilation system.

Energy

The building was modeled using EnergyPro Version 4.415 compliant with California's Title 24 -2005 Energy Efficiency Standards. The proposed design is approximately 26% better than the Standard. Most of the improvement is due to reduced cooling loads and reduced electrical lighting use.

The improvement in cooling loads is due largely to three main factors: improved building envelope, high EER equipment, and the use of integrated fixed temperature economizers set to run during all occupied hours with a temperature limit of 74 deg F. The Baseline building is modeled with a cooling budget of approximately 32,700 kWh. Of this budget, about 5,000 kWh savings can be attributed to the improved envelope, another 10,200 to the high EER equipment, and an additional 8,400 through the use of the integrated economizers. Of the envelope features the most notable are the increase in insulation and the use of high performance glass: PPG Solarban60 (3) Cabaria. Seven single zoned direct expansion (dx)

units were specified with high efficiency ratings. A typical Title 24-code compliant building would typically have units that are 1/3 less energy efficient than the units specified and would not have economizers due to the smaller size of the units (less than 75 kBtu). In combination, the proposed building shows a substantial improvement in cooling load from the Title 24 baseline budget of 32,732 kWh to the proposed 9,169 kWh.

Lighting

The improvement in interior electrical lighting use can be attributed to two factors: the use of energy efficient fixtures and lamps and the use of photo and occupancy sensors. Natural daylight is brought into the building through the use of sun tubes for top lighting and clerestories for side lighting. Extensive lighting controls have been specified to reduce the use of electrical light during the daylight hours. The Title 24 code allows a lighting power density (LPD) of 1.2 W/SF, but the average LPD for the project was 0.91 resulting in nearly a 20% reduction is predicted energy use. The Baseline budget for interior lights was approximately 31,500 kWh and the Proposed 25,400 kWh.

Electricity

	Annual Site Energy Use (from UTIL-1 Step 3)		Annual Energy Use Costs (Virtual Rate from ECON-1 or Current Elect Rates)			
	Standard T24 (kWh)	Proposed (kWh)	Standard/Baseline Energy Cost	Proposed Building Energy Cost	Cost Savings	
Exterior Lights	10335	6324	$ 1,633	$ 999	$ 634	
Interior Lights	31543	25435	$ 4,984	$ 4,019	$ 965	
Space Heating	0	0	$ -	$ -	$ -	
Space Cooling	32732	9169	$ 5,172	$ 1,449	$ 3,723	
Indoor Fans	23126	19492	$ 3,654	$ 3,080	$ 574	
Heat Rejection	0	0	$ -	$ -	$ -	
Pumps	0	0	$ -	$ -	$ -	
DHW	0	0	$ -	$ -	$ -	
Receptacle	36738	36738	$ 5,805	$ 5,805	$ -	
Process	3494	3494	$ 552	$ 552	$ -	
	137968	100652	**$ 21,799**	**$ 15,903**	$ 5,896	**Totals**
	127633	94328	Totals w/o Ext Light			

Natural Gas

	Annual Site Energy Use (from UTIL-1 Step 3)		Annual Energy Use Costs (Virtual Rate from ECON-1 or Current Gas Rates)			
	Standard T24 (Therms)	Proposed (Therms)	Standard/Baseline Energy Cost	Proposed Building Energy Cost	Energy Savings	
Exterior Lights	0	0	$ -	$ -	$ -	
Interior Lights	0		$ -	$ -	$ -	
Space Heating	185	171	$ 149	$ 138	$ 11	
Space Cooling	0		$ -	$ -	$ -	
Indoor Fans	0		$ -	$ -	$ -	
Heat Rejection	0		$ -	$ -	$ -	
Pumps	0		$ -	$ -	$ -	
DHW	442	413	$ 357	$ 334	$ 23	
Receptacle	0		$ -	$ -	$ -	
Process	0		$ -	$ -	$ -	
	627	584	**$ 507**	**$ 472**	$ 35	**Totals**
	627	584	Totals w/o Ext lights			

Total Annual Energy Savings	**$**	**5,931**
Total Annual Energy Cost of Proposed	**$**	**16,375**
Total Annual Energy Cost of BaseLine	**$**	**22,305**
% Savings		27%

Exterior Light worksht

	Cost=	Allowed/ Installed Watt	x	Full Load Hours of Operation	x	1/1000= kWh/year	x	**Virtual Rate of electricity**	Total Use kWh
Proposed	$ 999	1575		4015				0.158	6324
Standard	$ 1,633	2574		4015				0.158	10335

Full Load Hours of Operation:	365 days	*	5 to 5 =12 hrs 7 to 5 = 10 hrs ~ 11 hrs/day	(=)	4015	

% Process Worksht =

Virtual Rate of Gas (therm)

0.808