

HVAC and Energy Life Cycle Cost Report

30 Year Life Cycle Cost
for the

Sonoma County Adult Detention Behavioral Health Unit

Santa Rosa, California



Prepared by Kitchell

For

Sonoma County

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Job No. 6082C2

FINAL REPORT



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I. ANALYSIS

A. Purpose

The Purpose of the Sonoma County Energy Model Analysis was to determine the 30-year Life Cycle Cost for the new Sonoma County Adult Detention Behavioral Health Unit.

B. Modeling System

The energy model analysis was performed using the TRANE TRACE 700 Energy Modeling Software in conjunction with ASHRAE 90.1 and ASHRAE 62.1 **modeling standards.**

C. Assumptions

The following design assumptions were made for the proposed Schematic Design Energy Model analysis and are intended to show the life cycle cost under the following conditions. Actual life cycle cost model may differ depending on final design, equipment system selections, facility operations, and utility costs at the time of construction and operation.

Weather Data (Based on ASHRAE Fundamental Handbook Standards):

City: Santa Rosa, California

Summer Design Conditions (Dry Bulb/Wet Bulb): 95°F/67°F

Winter Design Conditions (Dry Bulb): 29°F

Interior Design Conditions:

All spaces assume a 75°F summer and 70°F winter design set point.

Utility Rates: Based on PG&E Rates

Electricity On Peak (Jan-Dec.):

On Peak Demand: \$25.53/kw

On Peak Consumption: \$0.131860/kwh

Electricity (Jan-Dec.):

Off Peak Demand: \$5.00/kw

Off Peak Consumption: \$0.071170/kwh

Gas On Peak: \$0.71/therm

Gas Off Peak: \$0.53/therm

Water: \$1.85/1000 gallons

Waste: \$2.02/1000 gallons

D. Summary

The Schematic Design Energy Model was created to simulate the operating condition for the proposed Sonoma County Adult Detention Behavioral Health Unit with the purpose of developing a 30-year life cycle cost analysis.

The Sonoma County Adult Detention Behavioral Health Unit consist of a 36,383 square foot Administration Support and Housing facility. The facility will be served by a Variable Refrigerant Flow (VRF) Heat Pump system with dedicated make-up air units for thermal control and ventilation.

The results of the Energy Model indicate that the total annual utility cost will be \$336,299. The total maintenance and major repairs cost over the 30-year life of the building will be \$9,467,045. All utilities assume a 3% inflation cost. The total cost of the utilities, maintenance, and major repairs over the 30-year life of the building will be \$23,240,498.

Utility	Annual Cost (\$)
Electric	164,454
Gas	57,933
Water	64,176
Sewer	49,736
Total	336,299

Figure 1. Sonoma County Adult Detention Behavioral Health Unit Utility Annual Cost

Maintenance Item	Replacement Year	Estimated Replacement Cost (\$)
HVAC Equipment	15-30	\$ 799,061.00
Roofing	15 - 30	\$ 1,259,408.89
Plumbing Boilers & Accessories	15 - 30	\$ 61,308.00
Plumbing Fixtures	15 - 30	\$ 433,584.00
Water Management System	15 - 30	\$ 51,770.00
Transformers	15 - 30	\$ 16,042.00
Panelboards	15-30	\$ 45,314.00
Switchboards	15-30	\$ 78,912.00
Lights	15-30	\$ 514,219.00
Fire Alarm Control Panel	15-30	\$ 156,725.00
Security and Communication	15-30	\$ 1,422,128.00
Temporary Power and Lighting	15-30	\$ 36,463.00
Total		4,874,935

Figure 2. Sonoma County Adult Detention Behavioral Health Unit Maintenance Replacement Cost

Sonoma County Adult Detention Behavioral Health Unit
Estimated Energy Model Analysis

Year	Utilities	Major Maintenance	Major Replacement	Total
Year 1	\$ 336,298.77	\$ 112,123.00		\$ 448,421.77
Year 2	\$ 346,387.74	\$ 115,486.69		\$ 461,874.43
Year 3	\$ 353,315.49	\$ 117,796.42		\$ 471,111.92
Year 4	\$ 360,381.80	\$ 120,152.35		\$ 480,534.15
Year 5	\$ 367,589.44	\$ 122,555.40		\$ 490,144.84
Year 6	\$ 374,941.23	\$ 125,006.51		\$ 499,947.73
Year 7	\$ 382,440.05	\$ 127,506.64		\$ 509,946.69
Year 8	\$ 390,088.85	\$ 130,056.77		\$ 520,145.62
Year 9	\$ 397,890.63	\$ 132,657.91		\$ 530,548.53
Year 10	\$ 405,848.44	\$ 135,311.06		\$ 541,159.51
Year 11	\$ 413,965.41	\$ 138,017.28		\$ 551,982.70
Year 12	\$ 422,244.72	\$ 140,777.63		\$ 563,022.35
Year 13	\$ 430,689.61	\$ 143,593.18		\$ 574,282.80
Year 14	\$ 439,303.41	\$ 146,465.05		\$ 585,768.45
Year 15	\$ 448,089.47	\$ 149,394.35	\$ 1,345,723.00	\$ 1,943,206.82
Year 16	\$ 457,051.26	\$ 152,382.23		\$ 609,433.50
Year 17	\$ 466,192.29	\$ 155,429.88		\$ 621,622.17
Year 18	\$ 475,516.13	\$ 158,538.48		\$ 634,054.61
Year 19	\$ 485,026.46	\$ 161,709.25		\$ 646,735.70
Year 20	\$ 494,726.99	\$ 164,943.43	\$ 2,269,803.00	\$ 2,929,473.42
Year 21	\$ 504,621.53	\$ 168,242.30		\$ 672,863.83
Year 22	\$ 514,713.96	\$ 171,607.15		\$ 686,321.10
Year 23	\$ 525,008.24	\$ 175,039.29		\$ 700,047.52
Year 24	\$ 535,508.40	\$ 178,540.07		\$ 714,048.47
Year 25	\$ 546,218.57	\$ 182,110.88		\$ 728,329.44
Year 26	\$ 557,142.94	\$ 185,753.09		\$ 742,896.03
Year 27	\$ 568,285.80	\$ 189,468.16		\$ 757,753.95
Year 28	\$ 579,651.51	\$ 193,257.52		\$ 772,909.03
Year 29	\$ 591,244.54	\$ 197,122.67		\$ 788,367.21
Year 30	\$ 603,069.44	\$ 201,065.12	\$ 1,259,408.89	\$ 2,063,543.45
		Total		\$23,240,497.76

Figure 3. Sonoma County Adult Detention Behavioral Health Unit
30-Year Life Cycle Cost

E. Appendix A: Energy Model Analysis

MONTHLY UTILITY COSTS

By KITCHELL

Utility	----- Monthly Utility Costs -----												Total
	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	
Alternative 1													
Electric													
On-Pk Cons. (\$)	8,677	7,327	9,533	10,459	11,041	11,217	12,414	12,035	11,001	10,222	9,439	8,398	121,763
On-Pk Demand (\$)	3,355	2,615	2,746	3,098	3,677	4,325	4,970	4,722	4,218	3,169	3,240	2,556	42,691
Total (\$):	12,032	9,942	12,279	13,557	14,717	15,543	17,384	16,757	15,219	13,391	12,679	10,954	164,454
Monthly Total (\$):	12,032	9,942	12,279	13,557	14,717	15,543	17,384	16,757	15,219	13,391	12,679	10,954	164,454

Building Area = 23,594 ft²
 Utility Cost Per Area = 6.97 \$/ft²

Figure 4. Sonoma County Adult Detention Behavioral Health Unit Monthly Utility Costs

MONTHLY ENERGY CONSUMPTION

By KITCHELL

Utility	----- Monthly Energy Consumption -----												Total
	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	
Alternative: 1													
ADBHU													
Electric													
On-Pk Cons. (kWh)	65,805	55,569	72,296	79,319	83,731	85,069	94,147	91,275	83,428	77,522	71,580	63,686	923,427
On-Pk Demand (kW)	131	102	108	121	144	169	195	185	165	124	127	100	195
Energy Consumption						Environmental Impact Analysis							
Building	133,579 Btu/(ft2-year)					CO2	No Data Available						
Source	400,776 Btu/(ft2-year)					SO2	No Data Available						
						NOX	No Data Available						
Floor Area	23,594 ft ²												

Figure 5. Sonoma County Adult Detention Behavioral Health Unit Monthly Energy Consumption

System Checksums

By KITCHELL

SINGLE HOUSING QUAD - 1										Variable Refrigerant Flow											
COOLING COIL PEAK				CLG SPACE PEAK				HEATING COIL PEAK				TEMPERATURES									
Peaked at Time: Mo/Hr: 7 / 16				Mo/Hr: 7 / 15				Mo/Hr: Heating Design													
Outside Air: OADB/WB/HR: 94 / 67 / 55				OADB: 95				OADB: 29													
Space		Plenum		Net Total		Percent		Space		Coil Peak		Percent									
Sens. + Lat.		Sens. + Lat		Btu/h		Of Total		Sensible		Space Sens		Tot Sens Of Total									
Btu/h		Btu/h		Btu/h		(%)		Btu/h		Btu/h		(%)									
Envelope Loads																					
Skylite Solar		0		42,233		43		44,449		46		Envelope Loads		0		0		0.00			
Skylite Cond		2,404		2,404		2		0		0		Skylite Cond		0		-6,206		3.13			
Roof Cond		0		14,093		14		0		0		Roof Cond		0		-20,531		10.37			
Glass Solar		2,872		2,872		3		3,607		4		Glass Solar		0		0		0.00			
Glass/Door Cond		983		983		1		909		1		Glass/Door Cond		-2,790		-2,790		1.41			
Wall Cond		5,821		1,643		7,464		8		5,875		6		Wall Cond		-22,950		-29,522		14.91	
Partition/Door		0		0		0		0		0		0		Partition/Door		0		0		0.00	
Floor		0		0		0		0		0		0		Floor		0		0		0.00	
Adjacent Floor		0		0		0		0		0		0		Adjacent Floor		0		0		0.00	
Infiltration		9,401		9,401		10		10,933		11		Infiltration		-23,971		-23,971		12.11			
Sub Total ==>		61,311		18,141		79,451		81		65,771		68		Sub Total ==>		-49,711		-83,021		41.93	
Internal Loads																					
Lights		15,964		3,991		19,955		20		15,964		17		Lights		15,964		19,955		-10.08	
People		20,900		0		20,900		21		11,000		11		People		11,000		11,000		-5.56	
Misc		0		0		0		0		0		0		Misc		0		0		0.00	
Sub Total ==>		36,864		3,991		40,855		42		26,964		28		Sub Total ==>		26,964		30,955		-15.63	
Ceiling Load		4,142		-4,142		0		0		3,848		4		Ceiling Load		-5,625		0		0.00	
Ventilation Load		0		-22,230		-22,230		-23		0		0		Ventilation Load		0		0		0.00	
Adj Air Trans Heat		0		0		0		0		0		0		Adj Air Trans Heat		0		0		0.00	
Dehumid. Ov Sizing		0		0		0		0		0		0		Ov/Undr Sizing		0		0		0.00	
Ov/Undr Sizing		0		-14,284		-14,284		-15		0		0		Exhaust Heat		14,405		-7,28		-159.595	
Exhaust Heat		0		13,700		14		0		0		0		OA Preheat Diff.		-743		0.38		80.60	
Sup. Fan Heat		0		0		0		0		0		0		RA Preheat Diff.		0		0		0.00	
Ret. Fan Heat		0		0		0		0		0		0		Additional Reheat		0		0		0.00	
Duct Heat Pkup		0		0		0		0		0		0		Underflr Sup Ht Pkup		0		0		0.00	
Underflr Sup Ht Pkup		0		0		0		0		0		0		Supply Air Leakage		0		0		0.00	
Supply Air Leakage		0		0		0		0		0		0		Sub Total ==>		-28,372		-197,999		100.00	
Grand Total ==>		102,317		-18,526		97,492		100.00		96,583		100.00		Grand Total ==>		-28,372		-197,999		100.00	
COOLING COIL SELECTION																					
Total Capacity		Sens Cap.		Coil Airflow		Enter DB/WB/HR		Leave DB/WB/HR													
ton		MBh		cfm		°F °F gr/lb		°F °F gr/lb													
Main Clg		8.1 97.5		91.8		5,780 77.5 61.7 57.7		60.6 55.4 57.7													
Aux Clg		0.0 0.0		0.0		0 0.0 0.0 0.0		0.0 0.0 0.0													
Opt Vent		8.1 96.9		97.3		3,512 95.0 66.9 54.6		70.0 58.3 54.6													
Total		16.2 194.4																			
AREAS																					
Gross Total		Glass																			
Floor		5,205																			
Part		0																			
Int Door		0																			
ExFlr		0																			
Roof		5,205 565 11																			
Wall		6,598 139 2																			
Ext Door		132 0 0																			
HEATING COIL SELECTION																					
Capacity		Coil Airflow		Ent		Lvg															
MBh		cfm		°F		°F															
Main Htg		-39.2		5,731		67.0 73.1															
Aux Htg		0.0		0		0.0 0.0															
Preheat		0.0		0		0.0 0.0															
Humidif		0.0		0		0.0 0.0															
Opt Vent		-159.6		3,512		29.0 70.0															
Total		-198.8																			
AIRFLOWS																					
Cooling		Heating																			
Diffuser		5,780 5,731																			
Terminal		5,780 5,731																			
Main Fan		5,780 5,731																			
Sec Fan		0 0																			
Nom Vent		3,512 2,668																			
AHU Vent		3,512 2,668																			
Infil		538 538																			
MinStop/Rh		578 578																			
Return		9,830 8,937																			
Exhaust		4,050 3,206																			
Rm Exh		0 0																			
Auxiliary		0 0																			
Leakage Dwn		0 0																			
Leakage Ups		0 0																			
ENGINEERING CKS																					
Cooling		Heating																			
% OA		60.8 46.6																			
cfm/ft²		1.11 1.10																			
cfm/ton		356.74																			
ft²/ton		321.27																			
Btu/hr-ft²		37.35 -38.20																			
No. People		59																			

Figure 6. Sonoma County Adult Detention Behavioral Health Unit Quadrant 1 Load Calculations

System Checksums

By KITCHELL

SINGLE HOUSING QUAD - 2										Variable Refrigerant Flow							
COOLING COIL PEAK				CLG SPACE PEAK				HEATING COIL PEAK				TEMPERATURES					
Peaked at Time: Mo/Hr: 7 / 16				Mo/Hr: 7 / 15				Mo/Hr: Heating Design									
Outside Air: OADB/WB/HR: 94 / 67 / 55				OADB: 95				OADB: 29									
		Space Sens. + Lat.	Plenum Sens. + Lat	Net Total	Percent Of Total			Space Sensible	Percent Of Total			Space Peak Space Sens	Coil Peak Tot Sens	Percent Of Total			
		Btu/h	Btu/h	Btu/h	(%)			Btu/h	(%)			Btu/h	Btu/h	(%)			
Envelope Loads																	
Skylite Solar		42,233	0	42,233	43	44,449		46	Skylite Solar		0	0	0.00				
Skylite Cond		0	2,404	2,404	2	0		0	Skylite Cond		0	-6,206	3.13				
Roof Cond		0	14,093	14,093	14	0		0	Roof Cond		0	-20,531	10.37				
Glass Solar		2,872	0	2,872	3	3,607		4	Glass Solar		0	0	0.00				
Glass/Door Cond		983	0	983	1	909		1	Glass/Door Cond		-2,790	-2,790	1.41				
Wall Cond		5,821	1,643	7,464	8	5,875		6	Wall Cond		-22,950	-29,522	14.91				
Partition/Door		0	0	0	0	0		0	Partition/Door		0	0	0.00				
Floor		0	0	0	0	0		0	Floor		0	0	0.00				
Adjacent Floor		0	0	0	0	0		0	Adjacent Floor		0	0	0.00				
Infiltration		9,401	0	9,401	10	10,933		11	Infiltration		-23,971	-23,971	12.11				
Sub Total ==>		61,311	18,141	79,451	81	65,771		68	Sub Total ==>		-49,711	-83,021	41.93				
Internal Loads																	
Lights		15,964	3,991	19,955	20	15,964		17	Lights		15,964	19,955	-10.08				
People		20,900	0	20,900	21	11,000		11	People		11,000	11,000	-5.56				
Misc		0	0	0	0	0		0	Misc		0	0	0.00				
Sub Total ==>		36,864	3,991	40,855	42	26,964		28	Sub Total ==>		26,964	30,955	-15.63				
Ceiling Load		4,142	-4,142	0	0	3,848		4	Ceiling Load		-5,625	0	0.00				
Ventilation Load		0	-22,230	-22,230	-23	0		0	Ventilation Load		0	0	0.00				
Adj Air Trans Heat		0	0	0	0	0		0	Adj Air Trans Heat		0	0	0.00				
Dehumid. Ov Sizing		0	0	0	0	0		0	Ov/Undr Sizing		0	0	0.00				
Ov/Undr Sizing		0	0	0	0	0		0	Exhaust Heat		0	14,405	-7.28				
Exhaust Heat		0	-14,284	-14,284	-15	0		0	OA Preheat Diff.		-159,595	80.60					
Sup. Fan Heat		0	0	13,700	14	0		0	RA Preheat Diff.		-743	0.38					
Ret. Fan Heat		0	0	0	0	0		0	Additional Reheat		0	0	0.00				
Duct Heat Pkup		0	0	0	0	0		0	Underflr Sup Ht Pkup		0	0	0.00				
Underflr Sup Ht Pkup		0	0	0	0	0		0	Supply Air Leakage		0	0	0.00				
Supply Air Leakage		0	0	0	0	0		0	Sub Total ==>		-28,372	-197,999	100.00				
Grand Total ==>		102,317	-18,526	97,492	100.00	96,583		100.00	Grand Total ==>		-28,372	-197,999	100.00				

AIRFLOWS																
		Cooling	Heating													
Diffuser		5,780	5,731													
Terminal		5,780	5,731													
Main Fan		5,780	5,731													
Sec Fan		0	0													
Nom Vent		3,512	2,668													
AHU Vent		3,512	2,668													
Infil		538	538													
MinStop/Rh		578	578													
Return		9,830	8,937													
Exhaust		4,050	3,206													
Rm Exh		0	0													
Auxiliary		0	0													
Leakage Dwn		0	0													
Leakage Ups		0	0													

ENGINEERING CKS																
		Cooling	Heating													
% OA		60.8	46.6													
cfm/ft²		1.11	1.10													
cfm/ton		356.74	321.27													
ft²/ton		321.27	37.35													
Btu/hr-ft²		37.35	-38.20													
No. People		59														

COOLING COIL SELECTION										AREAS				HEATING COIL SELECTION								
		Total Capacity			Sens Cap.	Coil Airflow	Enter DB/WB/HR		Leave DB/WB/HR		Gross Total	Glass			Capacity	Coil Airflow	Ent	Lvg				
		ton	MBh	MBh	cfm	°F	°F	gr/lb	°F	°F	gr/lb	ft²	(%)			MBh	cfm	°F	°F			
Main Clg		8.1	97.5	91.8	5,780	77.5	61.7	57.7	60.6	55.4	57.7	Floor		5,205	Main Htg		-39.2	5,731	67.0	73.1		
Aux Clg		0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	Part		0	Aux Htg		0.0	0	0.0	0.0		
Opt Vent		8.1	96.9	97.3	3,512	95.0	66.9	54.6	70.0	58.3	54.6	Int Door		0	Preheat		0.0	0	0.0	0.0		
		0	0	0	0	0.0	0.0	0.0	0.0	0.0	0.0	ExFr		0	Humidif		0.0	0	0.0	0.0		
		0	0	0	0	0.0	0.0	0.0	0.0	0.0	0.0	Roof		5,205	565	11	Opt Vent		-159.6	3,512	29.0	70.0
		0	0	0	0	0.0	0.0	0.0	0.0	0.0	0.0	Wall		6,598	139	2	Total		-198.8			
		0	0	0	0	0.0	0.0	0.0	0.0	0.0	0.0	Ext Door		132	0	0						
Total		16.2	194.4																			

Figure 7. Sonoma County Adult Detention Behavioral Health Unit Quadrant 2 Load Calculations

System Checksums

By KITCHELL

SINGLE HOUSING QUAD - 3										Variable Refrigerant Flow												
COOLING COIL PEAK				CLG SPACE PEAK				HEATING COIL PEAK				TEMPERATURES										
Peaked at Time:		Mo/Hr: 7 / 16		Mo/Hr: 7 / 15		Mo/Hr: Heating Design																
Outside Air:		OADB/WB/HR: 94 / 67 / 55		OADB: 95		OADB: 29																
Space Sens. + Lat.	Plenum Sens. + Lat.	Net Total	Percent Of Total	Space Sensible	Percent Of Total	Space Peak	Coil Peak	Space Sens	Coil Peak	Percent												
Btu/h	Btu/h	Btu/h	(%)	Btu/h	(%)	Btu/h	Btu/h	Btu/h	Btu/h	(%)												
Envelope Loads												AIRFLOWS										
SkyLite Solar	42,233	0	42,233	43	44,449	46	0	0	0.00		TEMPERATURES											
SkyLite Cond	0	2,404	2,404	2	0	0	-6,206	3.13			Cooling		Heating									
Roof Cond	0	14,093	14,093	14	0	0	-20,531	10.37			SADB	60.6	73.1									
Glass Solar	2,872	0	2,872	3	3,607	4	0	0.00			Ra Plenum	78.3	65.8									
Glass/Door Cond	983	0	983	1	909	1	-2,790	1.41			Return	75.3	67.1									
Wall Cond	5,821	1,643	7,464	8	5,875	6	-22,950	14.91			Ret/OA	75.3	67.0									
Partition/Door	0	0	0	0	0	0	0	0.00			Fn MtrTD	0.2	0.0									
Floor	0	0	0	0	0	0	0	0.00			Fn BldTD	0.5	0.0									
Adjacent Floor	0	0	0	0	0	0	0	0.00			Fn Frict	1.4	0.0									
Infiltration	9,401	0	9,401	10	10,933	11	-23,971	12.11			ENGINEERING CKS											
Sub Total ==>	61,311	18,141	79,451	81	65,771	68	-49,711	41.93			% OA	60.8	46.6									
Internal Loads												Diffuser		5,780		5,731						
Lights	15,964	3,991	19,955	20	15,964	17	15,964	19,955	-10.08		Terminal	5,780	5,731									
People	20,900	0	20,900	21	11,000	11	11,000	11,000	-5.56		Main Fan	5,780	5,731									
Misc	0	0	0	0	0	0	0	0.00			Sec Fan	0	0									
Sub Total ==>	36,864	3,991	40,855	42	26,964	28	26,964	30,955	-15.63		Nom Vent	3,512	2,668									
Ceiling Load												AHU Vent		3,512		2,668						
Ventilation Load	4,142	-4,142	0	0	3,848	4	-5,625	0	0.00		Infil	538	538									
Adj Air Trans Heat	0	-22,230	-22,230	-23	0	0	0	0	0.00		Min Stop/Rh	578	578									
Dehumid. Ov Sizing	0	0	0	0	0	0	0	0.00			Return	9,830	8,937									
Ov/Undr Sizing	0	0	0	0	0	0	0	0.00			Exhaust	4,050	3,206									
Exhaust Heat	0	-14,284	-14,284	-15	0	0	14,405	-7.28			Rm Exh	0	0									
Sup. Fan Heat	0	0	13,700	14	0	0	-159,595	80.60			Auxiliary	0	0									
Ret. Fan Heat	0	0	0	0	0	0	-743	0.38			Leakage Dwn	0	0									
Duct Heat Pkup	0	0	0	0	0	0	0	0.00			Leakage Ups	0	0									
Underflr Sup Ht Pkup	0	0	0	0	0	0	0	0.00			COOLING COIL SELECTION											
Supply Air Leakage	0	0	0	0	0	0	0	0.00			Total Capacity	ton	MBh									
Sub Total ==>	102,317	-18,526	97,492	100.00	96,583	100.00	-28,372	-197,999	100.00		Sens Cap.	MBh	Coil Airflow	cfm	Enter DB/WB/HR	°F	°F	gr/lb	Leave DB/WB/HR	°F	°F	gr/lb
Grand Total ==>												Main Htg		-39.2		5,731		67.0		73.1		
Grand Total ==>												Aux Htg		0.0		0		0.0		0.0		
Grand Total ==>												Preheat		0.0		0		0.0		0.0		
Grand Total ==>												Humidif		0.0		0		0.0		0.0		
Grand Total ==>												Opt Vent		-159.6		3,512		29.0		70.0		
Grand Total ==>												Total		-198.8								

Figure 8. Sonoma County Adult Detention Behavioral Health Unit Quadrant 3 Load Calculations

System Checksums
By KITCHELL

VRF OFFICE SECTION										Variable Refrigerant Flow					
COOLING COIL PEAK				CLG SPACE PEAK				HEATING COIL PEAK				TEMPERATURES			
Peaked at Time:		Mo/Hr: 7 / 15		Mo/Hr: 7 / 15		Mo/Hr: Heating Design									
Outside Air:		OADB/WB/HR: 95 / 67 / 55		OADB: 95		OADB: 95		OADB: 29							
Space Sens. + Lat. Btu/h	Plenum Sens. + Lat. Btu/h	Net Total Btu/h	Percent Of Total (%)	Space Sensible Btu/h	Percent Of Total (%)	Space Peak Space Sens Btu/h	Coil Peak Tot Sens Btu/h	Percent Of Total (%)					Cooling	Heating	
Envelope Loads															
Skylite Solar	82,468	0	82,468	59	83,834	55	0	0.00	Skylite Solar	0	0	0.00	SADB	61.0	73.6
Skylite Cond	0	4,800	4,800	3	0	0	-11,411	4.26	Skylite Cond	0	-11,411	4.26	Ra Plenum	79.2	64.3
Roof Cond	0	18,477	18,477	13	0	0	-30,398	11.34	Roof Cond	0	-30,398	11.34	Return	76.0	66.3
Glass Solar	3,310	0	3,310	2	3,900	3	0	0.00	Glass Solar	0	0	0.00	Ret/OA	76.0	66.0
Glass/Door Cond	571	0	571	0	559	0	-1,941	0.72	Glass/Door Cond	-1,941	-1,941	0.72	Fn MtrTD	0.2	0.0
Wall Cond	6,094	1,660	7,754	6	6,593	4	-29,044	13.76	Wall Cond	-29,044	-36,889	13.76	Fn BldTD	0.5	0.0
Partition/Door	0	0	0	0	0	0	0	0.00	Partition/Door	0	0	0.00	Fn Fric	1.4	0.0
Floor	0	0	0	0	0	0	0	0.00	Floor	0	0	0.00			
Adjacent Floor	0	0	0	0	0	0	0	0.00	Adjacent Floor	0	0	0.00			
Infiltration	10,226	0	10,226	7	15,510	10	-35,659	13.30	Infiltration	-35,659	-35,659	13.30			
Sub Total ==>	102,670	24,937	127,607	91	110,396	72	-66,645	43.38	Sub Total ==>	-66,645	-116,298	43.38			
Internal Loads															
Lights	16,588	4,147	20,735	15	16,588	11	13,434	-6.26	Lights	13,434	16,793	-6.26			
People	36,320	0	36,320	26	19,000	12	10,200	-3.80	People	10,200	10,200	-3.80			
Misc	1,792	0	1,792	1	1,792	1	0	0.00	Misc	0	0	0.00			
Sub Total ==>	54,700	4,147	58,847	42	37,380	24	23,634	-10.07	Sub Total ==>	23,634	26,993	-10.07			
Ceiling Load															
Ventilation Load	5,583	-5,583	0	0	5,393	4	-9,510	0.00	Ceiling Load	-9,510	0	0.00			
Adj Air Trans Heat	0	-42,196	-42,196	-30	0	0	0	0.00	Ventilation Load	0	0	0.00			
Dehumid. Ov Sizing	0	0	0	0	0	0	0	0.00	Adj Air Trans Heat	0	0	0.00			
Ov/Undr Sizing	0	0	0	0	0	0	0	0.00	Ov/Undr Sizing	0	0	0.00			
Exhaust Heat	0	-23,571	-23,571	-17	0	0	33,011	-12.31	Exhaust Heat	0	33,011	-12.31			
Sup. Fan Heat	0	18,964	18,964	14	0	0	-211,786	79.00	OA Preheat Diff.	0	0	0.00			
Ret. Fan Heat	0	0	0	0	0	0	0	0.00	RA Preheat Diff.	0	0	0.00			
Duct Heat Pkup	0	0	0	0	0	0	0	0.00	Additional Reheat	0	0	0.00			
Underflr Sup Ht Pkup	0	0	0	0	0	0	0	0.00	Underflr Sup Ht Pkup	0	0	0.00			
Supply Air Leakage	0	0	0	0	0	0	0	0.00	Supply Air Leakage	0	0	0.00			
Grand Total ==>	162,953	-42,266	139,650	100.00	153,168	100.00	-52,520	100.00	Grand Total ==>	-52,520	-268,079	100.00			

COOLING COIL SELECTION									AREAS			HEATING COIL SELECTION					
Total Capacity ton	Capacity MBh	Sens Cap. MBh	Coil Airflow cfm	Enter DB/WB/HR °F °F	gr/lb	Leave DB/WB/HR °F °F	gr/lb		Gross Total	Glass ft² (%)	Capacity MBh	Coil Airflow cfm	Ent °F	Lvg °F			
Main Clg	12.1	145.0	145.0	8,000	78.1	62.8	61.7	61.0	Floor	7,979		-67.5	8,000	66.0	73.6		
Aux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	Part	0		0.0	0	0.0	0.0		
Opt Vent	10.7	128.6	129.1	4,661	95.0	66.9	54.6	70.0	Int Door	0		0.0	0	0.0	0.0		
Total	22.8	273.6							ExFlr	0		0.0	0	0.0	0.0		
									Roof	7,979	1,040	13	Humidif	0.0	0	0.0	
									Wall	8,266	143	2	Opt Vent	-211.8	4,661	29.0	70.0
									Ext Door	24	0	0	Total	-279.3			

Figure 9. Sonoma County Adult Detention Behavioral Health Unit Administration Load Calculations