Technical Report 2

Building and Plant
Energy & Emissions Analysis

The Salvation Army Ray & Joan Kroc Corps Community Center of Salem Oregon

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Table of Contents

Executive Summary

For the following report, thorough building load and energy use calculations were performed on the Kroc Center in Salem, Oregon. The information for the building loads was taken from the construction documents and building specifications. Because of the variety of spaces within the Kroc Center, the heating and loading calculations had to be performed on a room by room basis. This approach ensured an accurate model. The information for the energy costs was determined using an energy analysis report performed by the mechanical engineer. That report provided utility rates as well as their energy analysis on the building which provided a good source of comparison.

The building heating and cooling calculations were performed in TRACE. Detailed information was given on building materials, lighting loads, and glazing areas. Occupancy, equipment loading, and scheduling had to be derived from other sources. Weather data was taken from ASHRAE information embedded into trace. The design temperatures were chosen to meet the demands 99.6% of the time. The calculated required cooling load was only 11% lower than the scheduled cooling load. That difference is most likely a matter of safety factors and slightly different assumptions. The heating load, however, was 51% lower than the scheduled heating loads. A key factor that could account for much of this difference is the design temperature for the winter months. The winter design temperature seemed very high. Lowering that temperature would increase the heating load to a value much closer to the scheduled amount. Overall the building performed well, the design temperature seems to be the only major difference between the calculated values and the scheduled values.

The energy use and operating costs that were calculated were much lower than the projected operating costs that were provided in the energy analysis report performed by GLUMAC. The main reason for the difference lies on the lower heating load calculated in the first part of this report. According to the calculated energy costs, the heating energy accounts for 45% of the total energy cost in the building; despite the fact that it is only half of the scheduled amount. If the calculated heating load was equal to the scheduled load, the energy costs would be very similar. Detailed breakdowns of the energy use are provided in the report.

Building Summary

The Salvation Army Ray & Joan Kroc Corps Community Center of Salem Oregon was a new construction project located in Salem, Oregon. The Kroc Center is a one story, ninety-two thousand square foot facility located on a ten and a half acre campus. The building has a number of large, energy-intensive spaces including a full-size gymnasium, a competition pool, a leisure pool, a large chapel, a commercial size kitchen, and rooms to host community events. The Kroc Center also contains several offices, classrooms, small recreation rooms, and support spaces for the larger areas. The Kroc Center is surrounded by large athletic fields which are owned by the Salvation Army. The different building features enable the Kroc Center to be used by children, teens, families and adults from the community.

The Kroc Center was funded entirely by the Salvation Army. The Salvation Army allotted $35.5 million to build the Kroc Center, but the total cost of construction was slightly less then that at approximately $33.3 million. The Salvation Army also donated a matching $35.5 million endowment to operate the building.

Mechanical System Summary

The Kroc Center uses a variety of mechanical equipment to condition its many different spaces. All of the heating, cooling and ventilation loads are supplied by air handlers scattered across the roof of the building. The two pools are conditioned by very large, individual air handling units. The kitchen, community spaces, and most of the classrooms are conditioned by an individual packaged rooftop unit. Two rooftop units are used to condition the gymnasium space. Other packaged rooftop units are spread out across the roof and service smaller spaces around the community center. Two fan coil units are used to condition the platform of the chapel and the backstage spaces. Also the Kroc Center has two make-up air units; one above the kitchen, and one above the restrooms and storage areas on the south side of the competition pool. All of the ventilation for the entire building is supplied through the above equipment. Also, there is a mechanical room by the leisure pool that supplies domestic hot water for the entire building and hot water for the two pools.

Design Load Estimation

Block Load Summary

The Kroc Center contains a variety of different spaces and the only way to achieve some level of accuracy on the load calculation is to perform the calculations on a room by room basis. Trane TRACE 700 was used to perform the calculations and the results will be discussed throughout this report.

Occupancy Load Summary

Room occupancies were not given in the design documents; fortunately ASHRAE provides an average occupancy density ratio in ASHRAE Standard 62.1. These occupancy values provided the basis for the occupancy loads that were inputted into TRACE, but sometimes ASHRAE's values were too general and needed to be tweaked for certain spaces. Also, ASHRAE did not have occupancy densities for all the necessary room types so some had to be determined using the designer's best judgment. This ambiguity in the occupancies could lead to differences in the building loads, but they would not produce significant differences.

Lighting Load Summary

Lighting density calculations were previously performed as part of Technical Assignment 1. The overall lighting density was divided by the five sections of the building and these weighted lighting densities were applied to the major spaces in each building section. The smaller and unoccupied spaces throughout the entire building were all given a lighting density of 1 W/ft^2 for simplicity in the model. Table 1 provides the lighting density breakdown per building section.

Lighting Load Summary					
Area	A	B	C	D	E
Watts	16894	29095	18958	20216	19835
Area	16960	10485	24770	21235	18185
W/SF	1.00	2.77	0.77	0.95	1.09

TABLE 1 – Lighting Load Summary

Building Envelope Summary

Wall and roof construction details were provided in the construction documents, and they were assembled in TRACE using its database of materials. The detail in the roof and wall assemblies allowed a very accurate model to be created.

Schedule Summary

The building schedule was based on the Kroc Center's current operating hours that are listed on its website. The design condition was based on the day of the week with the longest period of operation.

Performance Summary

Building load calculations were performed on the entire building and were separated by the mechanical systems that condition them. The results were compiled into Table 2 which clearly show how the results compare to the designed values. The percent difference represents how much smaller the calculated values are compared to the schedule values.

System Comparison						
Unit	Calculated		Scheduled		Percent Difference	
	Heating	Cooling	Heating	Cooling	Heating	Cooling
AHU-1	516.4	422.1	922	802.8	44%	47%
AHU-2	379.6	591.2	737	609.6	48%	3%
FCU-1	99.7	159	46.1	63.1	-8%	-26%
FCU-2			46.1	63.1		
RTU-1	454.2	702.5	697	763	35%	8%
RTU-2	91.3	182.7	284	208	68%	12%
RTU-3	102.7	217.5	410	240	75%	9%
RTU-4	18.8	27.9	284	192	93%	85%
RTU-5	309	476.9	284	202	46%	-18%
RTU-6			284	202		
RTU-7	76.3	182.2	104	60	27%	-204%
RTU-8	117.6	226.1	324	265	64%	15%
RTU-9	28.2	46.9	120	79	77%	41%
RTU-10	140.6	202.3	202	119	30%	-70%
Totals	2334.4	3437.3	4744.2	3868.6	51%	11%

TABLE 2 – Building Load Comparison

To simplify the model, FCU-1 and FCU-2 were combined and modeled as one unit since they condition the same space. The same was done with RTU-5 and RTU-6.

The total cooling load for the building is very close to the scheduled load, but the heating load is drastically smaller. The cooling load accuracy fluctuates between zones but the total load is pretty accurate. Once a building is in operation the supplied cooling load will not stay in one zone, but will drift into the other zones till the whole building reaches equilibrium. That is why it is important to look at the building as a whole, and the number calculated is very close to the scheduled value. The ten percent difference can probably be attributed to safety factors and different assumptions.

The total heating load is significantly lower than the scheduled load, and nearly every system is more than twenty percent smaller. Probably the largest factor in this difference is the design day temperature in the winter. For this report, ASHRAE weather data was used and their design day temperature for heating was over twenty degrees. Oregon is located in the northern part of our country, so that number appears high. The design team probably chose a design temperature closer to zero; such a change would make a dramatic difference in the heating load.

In summary, the calculated cooling load is very close to the scheduled value, so it does not need changed. The calculated heating load is too different from the scheduled load and needs to be addressed in the future. Because the cooling loads are so close, it would appear that the model is accurate; but a difference in the winter design temperature would explain why only the heating load is different. Lowering the design temperature will cause the calculated results to more closely match the original mechanical design.

Annual Energy Consumption and Operating Costs

Energy Consumption

A detailed energy analysis was performed by the mechanical engineer, GLUMAC International, using eQuest. This report contains the electric and natural gas rates for the Salem area. The Kroc Center has three boilers that supply hot water to the air handler coils as well as condition the two large pools. The boilers were assumed to run at eighty percent efficiency. The gas company, Northwest Natural Gas, charges a flat rate of $1.2923 / therm. The local electric company, Salem Electric, has a varying rate which is detailed in Table 3 and Table 4.

Consumption Charge ($/kwh)	
First 3,000 kwh	$0.0748
Next 17,000 kwh	$0.0610
Over 20,000 kwh	$0.0464

TABLE 3 – Consumption Charges

Demand Charge ($/kw)	
First 50kW	$0.00
Over 50 kW	$6.11

TABLE 4 – Demand Charges

Using TRACE, the electrical consumption, electrical demand, and gas usage for the Kroc Center were determined on a month by month basis. Taking the utility rates mentioned above, the energy use was determined and assembled into Table 5 which shows the detailed cost breakdown. Actual utility bills for the Kroc Center were not available at the time of this report, but the energy analysis report performed by the mechanical engineer provided something reliable to compare the calculated results to.

The total energy cost value from Table 5 includes the building loads, but does not account for the energy required to heat the two pools. The energy analysis report performed by GLUMAC states that the total energy needed to heat the pools for an entire year was 1,060 MBtus. This load converts into 13,250 therms of natural gas, which adds an additional $17,123 to the annual energy cost. The total energy cost including heating the pools is $141,404, which is significantly under GLUMAC's estimate of $191,208. The lower building loads that were found in the first part of this report would account for a large portion of the difference in the total energy calculations.

Energy Costs by Month and Type						
	EC (kwh)	ED (kw)	Gas (therms)	EC ($)	ED ($)	Gas ($)
January	80609	179	5930	$ 4,085	$ 788	$ 7,663
February	72895	183	4662	$ 3,727	$ 813	$ 6,025
March	82440	188	4418	$ 4,170	$ 843	$ 5,709
April	83299	220	2932	$ 4,209	$ 1,039	$ 3,789
May	104332	406	816	$ 5,185	$ 2,175	$ 1,055
June	119639	452	308	$ 5,896	$ 2,456	$ 398
July	152246	510	154	$ 7,409	$ 2,811	$ 199
August	145815	549	216	$ 7,110	$ 3,049	$ 279
September	115558	416	465	$ 5,706	$ 2,236	$ 601
October	94798	286	2064	$ 4,743	$ 1,442	$ 2,667
November	78229	180	5395	$ 3,974	$ 794	$ 6,972
December	78647	176	7352	$ 3,994	$ 770	$ 9,501
			Costs:	$ 60,206	$ 19,216	$ 44,858
			Total Energy Cost:	$ 124,281		

TABLE 5 – Energy Costs by Month

The energy cost for the Kroc Center was broken down into five major categories: Heating, Cooling, Lighting, Receptacles, and Pool energy use. When it is broken down like this, one can see that the energy costs for the Kroc Center are dominated by the heating and lighting loads. These two loads provide the biggest areas for potential energy savings. The lighting is high because of exterior lighting and the light intensive chapel, but the lighting was designed for aesthetics not energy savings. The heating load is surprisingly high, given how much lower it was than the scheduled load. The large expanses of glass, especially around the two pools are responsible for a large portion of the heating energy loss in the building. The cost breakdown based on energy use is shown in Table 6.

Energy Costs per Use			
Element	Cost	$/SF	% of Total
Lighting	$ 34,093	$ 0.37	24%
Heating	$ 63,267	$ 0.69	45%
Cooling	$ 16,910	$ 0.18	12%
Receptacles	$ 5,116	$ 0.06	4%
Pool	$ 17,123	-	12%

TABLE 6 – Energy Cost by Use

System Emission Rates

The Kroc Center was built in Salem, Oregon, which is located in the Western Interconnection electric grid. The grid determines the average amount of pollution required to produce 1 kwh of electricity in a given portion of the country. Using the information found in the file titled RegGridemissionfactors2007.pdf that was provided by the AE department, it was determined how much pollution is released in order to meet the electrical demands of the Kroc Center in any given year. The numbers are tallied in Table 7 below.

Pollutants from Electricity			
Pollutant	lb/kwh Elec	kwh	lb
CO2e	1.31E+00	1208507	1.58E+06
CO2	1.22E+00	1208507	1.47E+06
CH4	3.51E-03	1208507	4.24E+03
N2O	2.97E-05	1208507	3.59E+01
NOx	1.95E-03	1208507	2.36E+03
SOx	6.82E-03	1208507	8.24E+03
CO	5.46E-04	1208507	6.60E+02
TNMOC	6.45E-05	1208507	7.79E+01
Lead	8.95E-08	1208507	1.08E-01
Mercury	1.86E-08	1208507	2.25E-02
PM10	6.99E-05	1208507	8.45E+01
Solid Waste	1.39E-01	1208507	1.68E+05

TABLE 7 – Electrical Emissions

The Kroc Center also uses three natural gas boilers to heat the water used in the pools and by the air handlers. The natural gas is burned on site, so the emission factors were taken from Table 8 of the pdf file mentioned above. The emission results are shown in Table 8 below.

Pollutants from Natural Gas			
Pollutant	lb / 1000 ft3	1000 ft3	lb / gas
CO2e	1.23E+02	37906	4.66E+06
CO2	1.22E+02	37906	4.62E+06
CH4	2.50E-03	37906	9.48E+01
N2O	2.50E-03	37906	9.48E+01
NOx	1.11E-01	37906	4.21E+03
SOx	6.32E-04	37906	2.40E+01
CO	9.33E-02	37906	3.54E+03
TNMOC	6.13E-03	37906	2.32E+02
Lead	5.00E-07	37906	1.90E-02
Mercury	2.60E-07	37906	9.86E-03
PM10	8.40E-03	37906	3.18E+02

TABLE 8 – Natural Gas Emissions

Energy Consumption and Operating Cost Summary

The annual energy cost that was calculated in this report was about $50,000 less than the cost calculated by the mechanical designers. There are a number of factors that could be responsible for at least part of that discrepancy. One, the building loads that were calculated, especially the heating loads were significantly under the scheduled loads. The drastically reduced heating load still accounted for forty-five percent of the total energy use in the building. If the calculated heating load was closer to the scheduled load, the energy cost would be much higher. Another possible source of the error is equipment loads. For the kitchen and fitness area, energy use estimates were made on a W/SF basis. A detailed list of the equipment in each of these rooms would provide a much more accurate plug load which would affect the energy costs of the building. Since the operating cost is lower than the designed cost and the building heating load is lower than the designed load, we can tell that the energy cost analysis is accurate given its input values.

References

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Deru, M. & Torcellini, P. Source Energy and Emission Factors for Energy Use in Buildings. National Renewable Energy Laboratory. June 2007

Final Report. Salem Kroc Center Recreational Building LEED Energy Analysis. GLUMAC International. 9 Jan. 2009.

Construction Documents and Project Specifications for The Salvation Army Ray & Joan Kroc Corps Community Center of Salem Oregon. Courtesy of BRS Architecture.

Appendix A - Building Statistics

Section A

	Room	Area	Room Ht	Wall Area	Width	Wall Type	Glass Type	Roof Type	Exposure
Community Room A	101	1100	20	450.0	22.5	45	AG	3	All East
Community Room B	102	1400	20	566.6	28.3	45	AH	3	East
Community Room C	103	1110	20	450.0	22.5	45	AG	3	East
Storage	104	115	20	640.0	32.0	43		1	26.5' East, 5.5' South
Classroom	105	550	10.5	112.9	10.8	43	AB	1	All South
Classroom	106	570	10.5	0.0	0.0			1	
Storage	107	110	20	0.0	0.0			1	
Hall	108	1335	9	54.0	6.0	43		1	East
Storage	109	28	10	55.0	5.5	43		1	East
Storage	110	28	10	0.0	0.0			1	
Storage	111	28	10	0.0	0.0			1	
Storage	112	28	10	0.0	0.0			1	
Storage	113	28	10	0.0	0.0			1	
Storage	114	38	10	0.0	0.0			1	
Restroom	115	405	10	130.0	13.0	43		1	East
JC	116	50	10	0.0	0.0			1	
Restroom	117	55	10	0.0	0.0			1	
Restroom	118	400	10	130.0	13.0	43		1	East
Classroom	119	580	10	193.3	19.3	44	B	1	West
Storage	120	110	9	0.0	0.0			1	
Storage	121	110	10	75.0	7.5	44		1	West
Library (Classroom)	122	575	10	205.0	20.5	44	B	1	West
Computer Lab	123	575	10	190.0	19.0	44	B	1	West
Storage	124	105	9	0.0	0.0			1	
Storage	125	105	9	0.0	0.0			1	
Storage	126	105	9	69.0	7.7	44		1	West
Arts (Classroom)	127	570	10	275.0	27.5	45	B	1	22.5' West, 5' North
Hall	128	1215	9	0.0	0.0			1	
Classroom	129	560	10	272.5	27.3	45	B	1	22.25' West, 5' South
Storage	130	100	9	0.0	0.0			1	
Childhood Ed. Cen	131	965	15	1188.8	79.3	43	B,B,AM	1	9.25' South, 47' West, 23' North
Lobby	132	140	10	0.0	0.0			1	
Office	133	135	10	0.0	0.0			1	
JC	134	30	10	0.0	0.0			1	
Storage	135	50	10	0.0	0.0			1	
Storage	136	50	10	0.0	0.0			1	
Storage	137	230	20	0.0	0.0			1	
Restroom	138	45	10	0.0	0.0			1	
Restroom	139	35	10	0.0	0.0			1	
Laundry	140	45	10	85.0	8.5	43		1	North
Electrical (Storage	141	95	20	180.0	9.0	43		1	North
Hall	142	270	9	67.5	7.5	43		1	North
Storage	143	475	20	0.0	0.0			1	
Restroom	144	55	10	76.7	7.7	43		1	North
Office	145	105	9	114.0	12.7	43	AD	1	North
Kitchen	146	1525	11.5	882.6	76.8	43	AK	1	37.25' North, 39.5' East
Lobby	147	85	10	105.0	10.5	45	AF?	1	West

Section B

	Room	Area	Room Ht	Wall Area	Perimeter	Wall Type	Glass Type	Roof Type	Exposure
Chapel	101	2650	17	1100.75	64.75	40		7	46' SE, 18.75' NE
Storage	102	200	9	0	0			1	
Storage	103	65	9	0	0			1	
Lobby	104	90	12	156	13	43	AF	1	East
Lobby	105	3655	20	715	35.75	43	AR,AR,E	1	17.25' East, 18.5' West
Lobby	106	300	10	275	27.5	?	F,F.2	1	23' West, 4.5' North
Adult Lounge	107	605	10	482.5	48.25	44	B,D	1	31' SW, 17.25' W
Office	108	115	10	125	12.5	44	D	1	W
Storage	109	110	10	0	0			1	
Teen Room	110	570	14	217	15.5	44	D	1	W
Office	111	110	9	0	0			1	
Storage	112	110	9	69.03	7.67	44		1	W
Control Booth	113	75	10	0	0			1	
Control Room	114	170	20	0	0			1	
Electrical	115	80	20	0	0			1	
Storage	116	215	20	250	12.5	43		1	E
Office	117	130	9	177.03	19.67	39		5	9' W, 10.67' N
Storage	118	200	11	156.75	14.25	39		5	N
Platform	119	1485	30	1250.1	41.67	39		5	E
Storage	120	260	24	828	34.5	39		5	15.25' E, 19.25'S
Green Room	121	130	11	198	18	39		5	12.5' S, 5.5' W
Hall	122	90	11	207.13	18.83	54		5	3.33' W, 7' N, 8.5' E
Storage	123	20	11	190.74	17.34	54		5	3.67' N, 10' W, 3.67' S

Section C

	Room	Area	Room Ht	Wall Area	Perimeter	Wall Type	Glass Type	Roof Type	Exposure
Gymnasium	101	9180	33	2277	69	34	X,W,V(13)	5	57' E, 12' S
Storage	102	810	20	1173.2	58.66	30		1	31.33' E, 27.33' S
Aerobics	103	1270	13	546	42	32	B,B	1	S
Storage	104	180	20	626.8	31.34	30		1	8.67' S, 22.67' W
Storage	105	100	10	96.7	9.67	30		1	S
Supervisor	106	70	28	0	0			5	
Fitness	107	3215	28	1442	51.5	38	U,U.1	5	15.75' SE, 35.75' SW
Hall	108	2560	28	462	16.5	38		1	8' W, 8.5' SW
Control Desk	109	335	20	0	0			1	
Laundry Room	110	155	9	0	0			1	
Work Room	111	245	9	0	0			1	
Meeting Room	112	80	9	0	0			1	
Computer Room	113	210	20	0	0			1	
Count Room	114	55	9	0	0			1	
Childcare	115	495	15	262.5	17.5	45	AE	1	NE
Storage	116	65	9	0	0			1	
Restroom	117	70	9	0	0			1	
Office	118	105	9	108	12	45	AC	1	NE
Hall	119	1040	10	0	0			1	
HR	120	165	9	0	0			1	
Finance	121	375	9	0	0			1	
Storage	122	70	20	0	0			1	
Conference Room	123	330	10	0	0			1	
Electrical	124	85	20	0	0			1	
Open Offices	125	530	9	306	34	45	AC,AD(3)	1	NE
Storage	129	40	10	0	0			1	
Storage	130	40	10	55	5.5	45		1	NE
Office	131	195	9	114.75	12.75	45	AB	1	NE
Open Offices	132	305	9	306	34	45	B,B	1	16' NE, 18' E
Office	133	195	9	144	16	45	B	1	E
Storage	134	30	10	45	4.5	45		1	E
Storage	135	30	10	45	4.5	45		1	E
Storage	136	45	10	0	0			1	
Office	137	190	9	141.03	15.67	45	B	1	E
Office	138	135	9	101.25	11.25	45	AB	1	E
JC	139	45	10	85	8.5	45		1	E
Restroom	140	50	10	0	0			1	
Break Room	141	235	9	288	32	45	B,Y	1	13.67' E, 18.33' S

Section D

	Room	Area	Room Ht	Wall Area	Perimeter	Wall Type	Glass Type	Roof Type	Exposure
Climbing Wall	101	405	20	513.4	25.67	31	G,G.1	10	NW
Storage	102	135	20	578.4	28.92	31		1n	8.67' NW, 20.25' NE
Party Room	103	455	10	0				1n	
Storage	104	80	10	0				1n	
Party Room	105	455	11	0				1n	
Storage	106	80	10	0				1n	
Restroom	107	215	8	0				1n	
Restroom	108	205	8	0				1n	
Locker Room	109	1265	11	0				1n	
Restroom	110	115	9	0				1n	
Restroom	116	200	9	0				1n	
Restroom	120	65	10	0				1n	
JC	126	40	10	0				1n	
Guard Room	127	170	9	0				1n	
Office	128	115	9	0				1n	
Office	129	115	9	0				1n	
Storage	130	835	14	161	11.5	30		1	SE
Electrical	131	260	14	525	37.5	30		1	26.5' SE, 11' SW
Mainenance	132	390	14	130.62	9.33	30		1	SW
Sprinkler	133	100	14	217	15.5	30		1	SW
Mechanical	134	435	14	560	40	30		1	13.5' SW, 26.5' NW
Supply Room	135	300	14	336	24	30		1	NW
Office	136	110	14	0				1	
Leisure Pool	137	9870	36	5526	153.5	35n	H,S,S.1,T,R,Q	10n	63.5' NE, 74' SW, 16' SI

Section E

	Room	Area	Room Ht	Wall Area	Perimeter	Wall Type	Glass Type	Roof Type	Exposure
Competition Pool	101	13220	34	5474	161	31	L,L,K,K	1n	31' NE, 110.5' NW, 19.5' SW
Pool Support	102	1635	20	970	48.5	31n		1n	SW
JC	103	55	20	0	0			1n	
Storage	104	700	20	470	23.5	31n		1n	SW
Restroom	105	275	10	102.5	10.25	31n		1n	SW
Restroom	106	50	10	0	0			1n	
Restroom	107	275	10	453.4	45.34	30n		1n	10.67' SW, 34.67' NW
Lobby	109	70	20	373.4	18.67	30n	AC,AF.1	1n	9' NW, 9.67' NE
Office	110	290	9	175.5	19.5	30n	B	1n	NE
Multi-Purpose	111	230	9	137.25	15.25	30n	B	1n	NE
Multi-Purpose	112	230	9	137.25	15.25	30n	B	1n	NE
Locker Room	113	210	9	157.5	17.5	30n		1n	NE
Locker Room	114	210	9	256.5	28.5	30n		1n	17.5' NE, 11' SE
Storage	115	20	20	0	0			1n	
JC	116	20	20	100	5	30n		1n	SE

Appendix B – Energy Reports

Monthly Energy Reports

MONTHLY ENERGY CONSUMPTION

By ACADEMIC

------ Monthly Energy Consumption ------

Utility	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Total
Alternative: 1	**Kroc Center**												
Electric													
On-Pk Cons. (kWh)	80,609	72,895	82,440	83,299	104,332	119,639	152,246	145,815	115,558	94,798	78,229	78,647	1,208,507
On-Pk Demand (kW)	179	183	188	220	406	452	510	549	416	286	180	176	549
Gas													
On-Pk Cons. (therms)	1,888	1,275	1,369	712	109	14	0	6	17	430	1,720	2,340	9,880
Off-Pk Cons. (therms)	4,042	3,387	3,049	2,220	707	294	154	210	448	1,634	3,675	5,012	24,829
On-Pk Demand (therms/hr)	10	9	8	6	2	0	0	0	1	4	10	13	13
Off-Pk Demand (therms/hr)	13	13	12	11	5	2	2	2	3	8	12	14	14

Energy Consumption		
Building	86,671	Btu/(ft2-year)
Source	186,423	Btu/(ft2-year)
Floor Area	87,636	ft2

Environmental Impact Analysis	
CO_2	1,014,354 lbm/year
SO_2	1,197 gm/year
NOX	1,175 gm/year

Project Name:
Dataset Name: Salem Kroc Center.trc

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Alternative - 1 Monthly Energy Consumption report Page 1 of 1

Total Energy Report

ENERGY CONSUMPTION SUMMARY
By ACADEMIC

	Elect Cons. (kWh)	Gas Cons. (kBtu)	% of Total Building Energy	Total Building Energy (kBtu/yr)	Total Source Energy* (kBtu/yr)
Alternative 1					
Primary heating					
Primary heating		3,470,886	45.7 %	3,470,886	3,962,198
Other Htg Accessories	20,609		0.9 %	70,340	211,041
Heating Subtotal	**20,609**	**3,470,886**	**46.6 %**	**3,541,226**	**4,173,239**
Primary cooling					
Cooling Compressor	306,586		13.8 %	1,046,378	3,139,449
Tower/Cond Fans	48,044		2.2 %	163,975	491,975
Condenser Pump			0.0 %	0	0
Other Clg Accessories	2,628		0.1 %	8,969	26,911
Cooling Subtotal....	**357,258**		**16.1 %**	**1,219,323**	**3,658,334**
Auxiliary					
Supply Fans			0.0 %	0	0
Pumps			0.0 %	0	0
Stand-alone Base Utilities			0.0 %	0	0
Aux Subtotal....			0.0 %	0	0
Lighting					
Lighting	727,572		32.7 %	2,483,203	7,450,355
Receptacle					
Receptacles	103,067		4.6 %	351,767	1,055,406
Cogeneration					
Cogeneration			0.0 %	0	0
Totals					
Totals**	**1,208,507**	**3,470,886**	**100.0 %**	**7,595,518**	**16,337,333**

* Note: Resource Utilization factors are included in the Total Source Energy value.
** Note: This report can display a maximum of 7 utilities. If additional utilities are used, they will be included in the total.

Project Name:
Dataset Name: Salem Kroc Center.trc

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Alternative - 1 Energy Consumption Summary report page 1