ALLIANT ENERGY CENTER

ENERGY LOSS THRU DOOR OPENING

GIVEN CONDITIONS

FROM 2001 ASHRAE HANDBOOK OF FUNDAMENTALS, PAGE. 26.11,
Eqn. 30, ENERGY FLOW DUE TO THERMAL FORCES:
$Q = 60*C_D*A*\sqrt{(2*g*H_{NPL}*(T_i-T_o)/T_i)}$
WHERE $C_D = ABS(T_i-T_o)*0.0025 + 0.4$
(IN Eqn. 30, IF $T_o > T_i$, SUBSTITUTE $(T_o-T_i)/T_o$)

g =	32.2	ft/sec^2
A =	224	ft^2
$H_{\_NPL}$ =	10	ft
$T_{i(WINTER)}$ =	68	^oF
$T_{i(SUMMER)}$ =	75	^oF
ENTHALPY @ 75 ^oF & 50% RH =	28.1	BTU/#$_M$

CALCULATIONS ASSUME THAT THE DOOR IS OPENED MAINLY BETWEEN 8 AM AND 4 PM, 2 Day/Wk, FOR APPROXIMATELY 696 HOURS PER YEAR.
THE CALCULATIONS ALSO ASSUME NO SAVINGS BETWEEN 5O ^oF AND 60 ^oF DUE TO ECONOMIZER OPERATION. THE CALCULATION PROCESS FIRST DETERMINES FROM BIN DATA THE NUMBER OF HOURS IN EACH 5 DEGREE BIN. THEN HEATING AND COOLING ENERGY IS CALCULATED.

HOURS ADJUSTMENT / GENERAL CALCULATIONS / HEATING CALCULATION / AIR CONDITIONING CALCULATION

BIN TEMP., ^oF			ADJUSTED HOURS, 2 Days/Wk 8am - 4pm	ADJUSTED TO 374 HOURS	C_D	Q, CFM		MBH	MBH/YR	COINCIDENT ENTHAPLY, 8am - 4 pm	MBH	MBH/YR
97.5												
92.5			9	5	0.44	73,109	4			40.3	4,014	18,109
87.5			30	15	0.43	60,048	3			37.9	2,648	39,826
82.5			56	28	0.42	45,164	2			34.3	1,260	35,376
77.5			73	37	0.41	25,297	1			31.5	387	14,165
72.5			73	37	0.41	25,297	1			29.2	125	4,583
67.5			64	32	0.42	45,164	2			25.7	488	15,650
62.5			56	28	0.43	60,048	3			22.5	1,513	42,481
57.5			46	*	ECONOMIZER OPERATION			ECONOMIZER OPERATION		ECONOMIZER OPERATION		
52.5			41	*								
47.5			44	22	0.45	84,505	4	1,871	41,269			
42.5			46	23	0.46	96,859	5	2,668	61,515			
37.5			60	30	0.48	108,786	6	3,583	107,786			
32.5			69	35	0.49	120,445	6	4,618	159,737			
27.5			57	29	0.50	131,938	7	5,771	164,907			
22.5			38	19	0.51	143,333	7	7,043	134,177			
17.5			25	13	0.53	154,677	8	8,436	105,729			
12.5			19	10	0.54	166,005	8	9,950	94,778			
7.5			13	7	0.55	177,343	9	11,588	75,518			
2.5			8	4	0.56	188,710	10	13,349	53,538			
-2.5			4	2	0.58	200,121	10	15,237	30,555			
-7.5			2	1	0.59	211,589	11	17,253	17,298			
-12.5			0	0	0.60	223,121	11	19,398	0			
-17.5			0	0	0.61	234,727	12	21,675	0			
-22.5			0	0	0.63	246,411	13	24,084	0			
			833	374					1,046,809			170,190

* HOURS NOT INCLUDED DUE TO ECONOMIZER OPERATION

@ 80% EFFICIENCY = **13,085 THERMS**
$0.65 Therm Rate
$8,439.90

@ 12,000 BTUs/TON & 0.8 kW/TON = **11,346 kWh**
$0.14 kWh Rate
$1,531.71

BIN HRS Madison, WI 2 Days/Wk 8am - 4 pm

Deg	BIN HR
97	6
92	9
87	30
82	56
77	73
72	73
67	64
62	56
57	46
52	41
47	44
42	46
37	60
32	69
27	57
22	38
17	25
12	19
7	13
2	8
-3	4
-8	2
-13	0
-18	0
-23	0
-28	0
	839

$9,971.61 Combined Annual Savings

$83,500.00 Project Cost

8.37 Payback Period