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Appendix B: Chiller Manufacturer L.C.C. Calculations

PENNSTATE

Carrier FC =	$353,256			
j	Assume MCj's (1% increase by year)	UCj Carrier	d	(UCj+MCj)/(1+d)^j
1	11500	162,224	0.12	155,111
2	11615	162,224	0.12	138,583
3	11731.15	162,224	0.12	123,818
4	11848.4615	162,224	0.12	110,626
5	11966.94612	162,224	0.12	98,841
6	12086.61558	162,224	0.12	88,311
7	12207.48173	162,224	0.12	78,904
8	12329.55655	162,224	0.12	70,499
9	12452.85211	162,224	0.12	62,990
10	12577.38064	162,224	0.12	56,281
11	12703.15444	162,224	0.12	50,287
12	12830.18599	162,224	0.12	44,932
13	12958.48785	162,224	0.12	40,147
14	13088.07272	162,224	0.12	35,872
15	13218.95345	162,224	0.12	32,053
16	13351.14299	162,224	0.12	28,640
17	13484.65442	162,224	0.12	25,591
18	13619.50096	162,224	0.12	22,867
19	13755.69597	162,224	0.12	20,432
20	13893.25293	162,224	0.12	18,258
21	14032.18546	162,224	0.12	16,314
22	14172.50731	162,224	0.12	14,578
23	14314.23239	162,224	0.12	13,026
24	14457.37471	162,224	0.12	11,640
25	14601.94846	162,224	0.12	10,401
26	14747.96794	162,224	0.12	9,295
27	14895.44762	162,224	0.12	8,306
28	15044.4021	162,224	0.12	7,422
29	15194.84612	162,224	0.12	6,632
30	15346.79458	162,224	0.12	5,927
			Total:	$1,406,586	plus first cost = $1,759,842

McQuay-1 FC =	$388,240			
j	Assume MCj's (1% increase by year)	UCj McQuay-1	d	(UCj+MCj)/(1+d)^j
1	11500	163,495	0.12	156,246
2	11615	163,495	0.12	139,597
3	11731.15	163,495	0.12	124,723
4	11848.4615	163,495	0.12	111,434
5	11966.94612	163,495	0.12	99,562
6	12086.61558	163,495	0.12	88,955
7	12207.48173	163,495	0.12	79,479
8	12329.55655	163,495	0.12	71,013
9	12452.85211	163,495	0.12	63,449
10	12577.38064	163,495	0.12	56,691
11	12703.15444	163,495	0.12	50,653
12	12830.18599	163,495	0.12	45,258
13	12958.48785	163,495	0.12	40,439
14	13088.07272	163,495	0.12	36,132
15	13218.95345	163,495	0.12	32,285
16	13351.14299	163,495	0.12	28,847
17	13484.65442	163,495	0.12	25,776
18	13619.50096	163,495	0.12	23,032
19	13755.69597	163,495	0.12	20,580
20	13893.25293	163,495	0.12	18,389
21	14032.18546	163,495	0.12	16,432
22	14172.50731	163,495	0.12	14,683
23	14314.23239	163,495	0.12	13,120
24	14457.37471	163,495	0.12	11,724
25	14601.94846	163,495	0.12	10,476
26	14747.96794	163,495	0.12	9,361
27	14895.44762	163,495	0.12	8,365
28	15044.4021	163,495	0.12	7,475
29	15194.84612	163,495	0.12	6,680
30	15346.79458	163,495	0.12	5,969
			Total:	$1,416,824	plus first cost = $1,805,064

McQuay-2 FC =	$313,500			
j	Assume MCj's (1% increase by year)	UCj McQuay-2	d	(UCj+MCj)/(1+d)^j
1	8000	153,761	0.12	144,429
2	8080	153,761	0.12	129,019
3	8160.8	153,761	0.12	115,253
4	8242.408	153,761	0.12	102,956
5	8324.83208	153,761	0.12	91,972
6	8408.080401	153,761	0.12	82,160
7	8492.161205	153,761	0.12	73,395
8	8577.082817	153,761	0.12	65,566
9	8662.853645	153,761	0.12	58,572
10	8749.482181	153,761	0.12	52,324
11	8836.977003	153,761	0.12	46,743
12	8925.346773	153,761	0.12	41,758

j			d	
13	9014.600241	153,761	0.12	37,304
14	9104.746243	153,761	0.12	33,326
15	9195.793706	153,761	0.12	29,772
16	9287.751643	153,761	0.12	26,597
17	9380.629159	153,761	0.12	23,761
18	9474.435451	153,761	0.12	21,227
19	9569.179805	153,761	0.12	18,964
20	9664.871604	153,761	0.12	16,942
21	9761.52032	153,761	0.12	15,136
22	9859.135523	153,761	0.12	13,522
23	9957.726878	153,761	0.12	12,080
24	10057.30415	153,761	0.12	10,793
25	10157.87719	153,761	0.12	9,642
26	10259.45596	153,761	0.12	8,614
27	10362.05052	153,761	0.12	7,696
28	10465.67102	153,761	0.12	6,876
29	10570.32774	153,761	0.12	6,143
30	10676.03101	153,761	0.12	5,489
			Total:	$1,308,029	plus first cost = $1,621,529

Trane FC =	$399,060			
j	Assume MCj's (1% increase by year)	UCj Trane	d	(UCj+MCj)/(1+d)^j
1	11500	160,067	0.12	153,185
2	11615	160,067	0.12	136,864
3	11731.15	160,067	0.12	122,283
4	11848.4615	160,067	0.12	109,255
5	11966.94612	160,067	0.12	97,617
6	12086.61558	160,067	0.12	87,218
7	12207.48173	160,067	0.12	77,928
8	12329.55655	160,067	0.12	69,628
9	12452.85211	160,067	0.12	62,212
10	12577.38064	160,067	0.12	55,587
11	12703.15444	160,067	0.12	49,667
12	12830.18599	160,067	0.12	44,378
13	12958.48785	160,067	0.12	39,653
14	13088.07272	160,067	0.12	35,431
15	13218.95345	160,067	0.12	31,659
16	13351.14299	160,067	0.12	28,288
17	13484.65442	160,067	0.12	25,277
18	13619.50096	160,067	0.12	22,586
19	13755.69597	160,067	0.12	20,182
20	13893.25293	160,067	0.12	18,034
21	14032.18546	160,067	0.12	16,115
22	14172.50731	160,067	0.12	14,400
23	14314.23239	160,067	0.12	12,867
24	14457.37471	160,067	0.12	11,498
25	14601.94846	160,067	0.12	10,275
26	14747.96794	160,067	0.12	9,181
27	14895.44762	160,067	0.12	8,205
28	15044.4021	160,067	0.12	7,332
29	15194.84612	160,067	0.12	6,552
30	15346.79458	160,067	0.12	5,855
			Total:	$1,389,211	plus first cost = $1,788,271

York FC =	$318,240			
j	Assume MCj's (1% increase by year)	UCj York	d	(UCj+MCj)/(1+d)^j
1	11500	163,918	0.12	156,623
2	11615	163,918	0.12	139,934
3	11731.15	163,918	0.12	125,024
4	11848.4615	163,918	0.12	111,703
5	11966.94612	163,918	0.12	99,802
6	12086.61558	163,918	0.12	89,169
7	12207.48173	163,918	0.12	79,670
8	12329.55655	163,918	0.12	71,183
9	12452.85211	163,918	0.12	63,601
10	12577.38064	163,918	0.12	56,827
11	12703.15444	163,918	0.12	50,774
12	12830.18599	163,918	0.12	45,367
13	12958.48785	163,918	0.12	40,536
14	13088.07272	163,918	0.12	36,219
15	13218.95345	163,918	0.12	32,362
16	13351.14299	163,918	0.12	28,916
17	13484.65442	163,918	0.12	25,838
18	13619.50096	163,918	0.12	23,087
19	13755.69597	163,918	0.12	20,629
20	13893.25293	163,918	0.12	18,433
21	14032.18546	163,918	0.12	16,471
22	14172.50731	163,918	0.12	14,718
23	14314.23239	163,918	0.12	13,151
24	14457.37471	163,918	0.12	11,752
25	14601.94846	163,918	0.12	10,501
26	14747.96794	163,918	0.12	9,384
27	14895.44762	163,918	0.12	8,385
28	15044.4021	163,918	0.12	7,493
29	15194.84612	163,918	0.12	6,696
30	15346.79458	163,918	0.12	5,983
			Total:	$1,420,232	plus first cost = $1,738,472

LCC Cost Calculations (w electricity escalation factor):

LCC = FC + PWFe*UC + PWFm*MC
where,
PWFe = (((1+e')^N)-1)/(e'(1+e')^N)
e' = (d-e)/(1+e)
PWFm = (((1+m')^N)-1)/(m'(1+m')^N)
m' = (d-m)/(1+m)
N = # years of analysis/life of building in years (30)

Carrier FC =	$353,256							
MC	UC	d	e	m	e'	m'	PWFe	PWFm
11500	162,224	0.12	0.03	0.01	0.087	0.109	11	9
							LCC =	$2,160,246.92

McQuay-1 FC =	$388,240							
MC	UC	d	e	m	e'	m'	PWFe	PWFm
11500	163,495	0.12	0.03	0.01	0.087	0.109	11	9
							LCC =	$2,208,598.35

McQuay-2 FC =	$313,500							
MC	UC	d	e	m	e'	m'	PWFe	PWFm
8000	153,761	0.12	0.03	0.01	0.087	0.109	11	9
							LCC =	$2,000,792.83

Trane FC =	$399,060							
MC	UC	d	e	m	e'	m'	PWFe	PWFm
11500	160,067	0.12	0.03	0.01	0.087	0.109	11	9
							LCC =	$2,183,365.21

York FC =	$318,240							
MC	UC	d	e	m	e'	m'	PWFe	PWFm
11500	163,918	0.12	0.03	0.01	0.087	0.109	11	9
							LCC =	$2,143,047.14