

**ROLAND**  
**ENGINEERING SERVICES**

**Chiller Performance Evaluation & Analysis**

**Horizon Building Tampa Bay, Florida**

**For Highwoods Properties**

# Chiller Performance Evaluation & Analysis Summary

Performance Evaluation June - August 2011

## **What we did:**

We connected data acquisition equipment to key functions of the chiller at the Horizon Building using HOBO U30 loggers. Specifically ambient temperatures, water flow, chiller water temperatures in and out, along with power consumption (Kw/ton.)

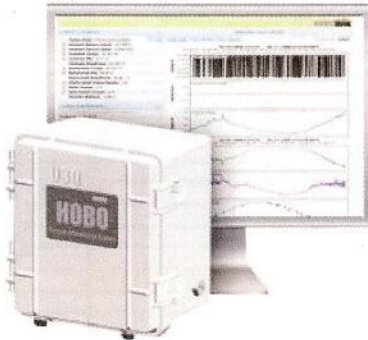
## **What we collected:**

The data was recorded 24/7 over a period of 40 days; June 30 through August 8, 2011. Calculations were made from the raw data to produce values for work (tons of cooling) and efficiency (Kw/ton). The calculated data sheet shows values for each logging interval of 15 minutes. The logging interval value is the average of the value for each minute during that interval. The calculated data sheets do not contain system "off" periods.

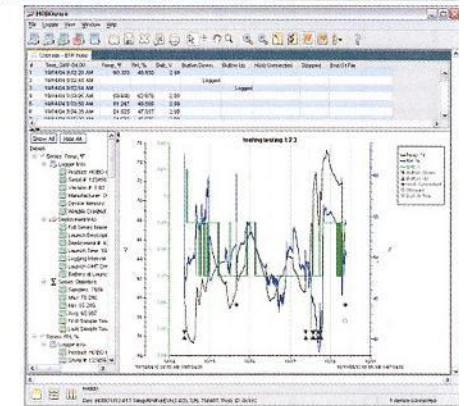
## **Summary:**

The "Before" data is reflective of a healthy air cooled chiller with efficiency values that resemble the manufacturer's values. Very soon after the Cold-Plus™ was added to the system, the efficiency numbers improved at all ambient temperatures.





## Project Details



**Location:** Tampa, Florida

**Equipment:** McQuay 120 Ton Air Cooled Chiller  
Model: AGZ120BSS27-ER11

**Purpose:**

- Establish Baseline Performance
- Install Cold-Plus™
- Measure Post Installation Performance
- Determine Percentage of Performance Improvement





This is an example of the data collected by the loggers to give us a good baseline of operation for the McQuay 120 ton chiller. The first graph is from the baseline period and the second graph is from the period after installation of Cold-Plus™.

**Before Cold-Plus™**

Data Acquisition Time	KW	Evap Water In Temp	Evap Water Out Temp	Ambient Temp	Sun Temp	CHW Delta T	(250 G/H) Water Flow Lbs/Hour	Work BTU/Hr	Work Tons	Efficiency Kw/Ton	EER	COP
7/27/2011 14:45	38.00	47.19	44.08	82.17	75.51	3.11	124,995	388,734	32.39	1.17	10.23	3.00
7/27/2011 15:00	38.20	47.28	44.17	84.00	75.72	3.11	124,995	388,734	32.39	1.18	10.18	2.98
7/27/2011 15:15	37.80	47.25	44.13	83.82	75.72	3.12	124,995	389,984	32.50	1.16	10.32	3.02
7/27/2011 15:30	33.80	48.36	45.48	82.09	75.94	2.88	124,995	359,986	30.00	1.13	10.65	3.12
7/27/2011 15:45	38.20	47.37	44.26	82.98	76.24	3.11	124,995	388,734	32.39	1.18	10.18	2.98
7/27/2011 16:00	37.80	47.10	43.99	82.89	76.68	3.11	124,995	388,734	32.39	1.17	10.28	3.01
7/27/2011 16:15	38.20	46.98	43.95	83.55	77.59	3.03	124,995	378,735	31.56	1.21	9.91	2.90
7/27/2011 16:30	38.80	47.19	44.17	85.08	78.82	3.02	124,995	377,485	31.46	1.23	9.73	2.85
7/27/2011 16:45	39.70	47.43	44.40	87.03	80.13	3.03	124,995	378,735	31.56	1.26	9.54	2.80
7/27/2011 17:00	39.70	47.88	44.85	87.85	80.85	3.03	124,995	378,735	31.56	1.26	9.54	2.80
7/27/2011 17:15	41.40	48.15	45.09	88.07	82.09	3.06	124,995	382,485	31.87	1.30	9.24	2.71
7/27/2011 17:30	38.20	47.52	44.44	87.71	82.80	3.08	124,995	384,985	32.08	1.19	10.08	2.95
7/27/2011 17:45	37.10	47.28	44.26	86.76	83.52	3.02	124,995	377,485	31.46	1.18	10.17	2.98
7/27/2011 18:00	36.30	48.09	45.30	86.25	84.63	2.79	124,995	348,736	29.06	1.25	9.61	2.81
7/27/2011 18:15	33.50	48.99	46.40	85.98	85.12	2.59	124,995	323,737	26.98	1.24	9.66	2.83
7/27/2011 18:30	34.40	49.57	46.92	85.48	85.86	2.65	124,995	331,237	27.60	1.25	9.63	2.82
7/27/2011 18:45	32.70	49.60	46.98	84.15	85.98	2.62	124,995	327,487	27.29	1.20	10.01	2.93
7/27/2011 19:00	33.80	49.60	46.92	83.55	87.85	2.68	124,995	334,987	27.92	1.21	9.91	2.90
Data Acquisition Time	KW	Evap Water In Temp	Evap Water Out Temp	Ambient Temp	Sun Temp	CHW Delta T	Water Flow Lbs/Hour	Work BTU/Hr	Work Tons	Efficiency Kw/Ton	EER	COP
<b>Average</b>	<b>39.87</b>	<b>48.31</b>	<b>45.11</b>	<b>86.99</b>	<b>85.71</b>	<b>3.20</b>	<b>124,995</b>	<b>400,110</b>	<b>33.34</b>	<b>1.19</b>	<b>10.10</b>	<b>2.96</b>

**After Cold-Plus™**

Data Acquisition Time	KW	Evap Water In Temp	Evap Water Out Temp	Ambient Temp	Sun Temp	CHW Delta T	(250 G/H) Water Flow Lbs/Hour	Work BTU/Hr	Work Tons	Efficiency Kw/Ton	EER	COP
8/5/2011 17:45	35.39	49.15	45.72	84.27	102.42	3.43	124,995	428,733	35.73	0.99	12.11	3.55
8/5/2011 18:00	35.58	48.81	45.39	84.58	104.16	3.42	124,995	427,483	35.62	1.00	12.01	3.52
8/5/2011 18:15	35.91	48.81	45.45	85.86	103.39	3.36	124,995	419,983	35.00	1.03	11.70	3.43
8/5/2011 18:30	36.30	48.94	45.63	86.88	99.52	3.31	124,995	413,733	34.48	1.05	11.40	3.34
8/5/2011 18:45	36.49	49.06	45.72	87.80	107.71	3.34	124,995	417,483	34.79	1.05	11.44	3.35
8/5/2011 19:00	36.95	49.12	45.75	89.19	106.34	3.37	124,995	421,233	35.10	1.05	11.40	3.34
8/8/2011 6:00	24.35	48.31	45.81	85.17	83.91	2.50	124,995	312,488	26.04	0.94	12.83	3.76
8/8/2011 6:15	24.35	48.09	45.57	84.99	84.15	2.52	124,995	314,987	26.25	0.93	12.94	3.79
8/8/2011 6:30	24.35	47.91	45.39	84.85	83.91	2.52	124,995	314,987	26.25	0.93	12.94	3.79
8/8/2011 6:45	24.35	47.91	45.39	84.94	83.91	2.52	124,995	314,987	26.25	0.93	12.94	3.79
8/8/2011 7:00	24.35	48.15	45.63	85.08	83.91	2.52	124,995	314,987	26.25	0.93	12.94	3.79
8/8/2011 7:15	24.35	48.06	45.54	85.12	84.18	2.52	124,995	314,987	26.25	0.93	12.94	3.79
8/8/2011 7:30	24.35	48.06	45.54	85.30	84.24	2.52	124,995	314,987	26.25	0.93	12.94	3.79
8/8/2011 7:45	24.55	48.18	45.66	85.71	84.24	2.52	124,995	314,987	26.25	0.94	12.83	3.76
8/8/2011 8:00	24.55	48.58	46.08	86.31	84.27	2.50	124,995	312,488	26.04	0.94	12.73	3.73
Data Acquisition Time	KW	Evap Water In Temp	Evap Water Out Temp	Ambient Temp	Sun Temp	CHW Delta T	Water Flow Lbs/Hour	Work BTU/Hr	Work Tons	Efficiency Kw/Ton	EER	COP
<b>Average</b>	<b>33.16</b>	<b>49.43</b>	<b>46.41</b>	<b>88.40</b>	<b>88.56</b>	<b>3.02</b>	<b>124,995</b>	<b>377,283</b>	<b>31.44</b>	<b>1.05</b>	<b>11.54</b>	<b>3.38</b>

## Horizon Building McQuay Chiller Summary

### June Sample Data w/o Cold-Plus™

Temperatures	84	87	94
Kw/Ton	1.17	1.19	1.25
Kw/Ton	1.19	1.2	1.21
Kw/Ton	1.06	1.24	1.27
Kw/Ton	1.25	1.19	1.29
Average	<b>1.17</b>	<b>1.21</b>	<b>1.26</b>

### July Sample Data with Cold-Plus™

Temperatures	84	87	94
Kw/Ton	0.95	1.01	1.11
Kw/Ton	0.92	1.03	1.18
Kw/Ton	0.95	0.98	1.08
Kw/Ton	0.92	1	1.08
Average	<b>0.94</b>	<b>1.01</b>	<b>1.11</b>

### Improvement

<b>20%</b>	<b>17%</b>	<b>11%</b>
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The data clearly shows the efficiency improvement by using Cold-Plus™ as well as clearly demonstrating the efficiency loss from the condenser coil in this air cooled system.