

INNCOM SYSTEM MONITORING
MARRIOT HOTEL DOWNTOWN
PHILADELPHIA, PA

Report 9

July 2, 2012

CH2M HILL Project No. 421631



1. PURPOSE

The purpose of this report is to present observations of the Inncom system operation in ten (10) rooms at the Marriot Hotel Downtown in Philadelphia, PA. This report presents data from ten (10) snapshot periods:

- July 12, 2011
- August 12, 2011
- Sept 8, 2011
- Oct 6, 2011
- Nov 4, 2011
- Dec 5, 2011
- Jan 9, 2012
- Mar 19,2012
- May 8, 2012
- July 2, 2012

2. Executive Summary

The observed average energy savings between the managed and unmanaged rooms for electricity, heating and cooling is summarized in Table 1A. The energy savings for the current month are shown in Table 1B. Detailed results are shown in Table 2. The measurements are based on the observation of the energy delivered to the rooms.

SERVICE	Room Pair Delta (%)			Average Energy Savings
	Max	Min	Avg.	
ELECTRIC (KWH)	121.1	-7.8	35.6	\$ 2.70
COOLING (KWH)	73.1	1.1	22.3	\$15.81
HEATING (KWH)	284.8	-34.0	71.6	\$14.87

Table 1A

Room Pair	Energy Savings (Current Month)			
	Electricity	Cooling	Heating	Total
1061/1059	\$2.76	\$28.11	\$5.41	\$36.28
1068/1070	\$13.70	\$28.99	\$-6.83	\$35.87
1080/1082	\$3.14	\$2.42	\$23.06	\$28.62
1081/1079	\$3.64	\$15.53	\$3.00	\$22.17
1093/1091	\$-1.40	\$26.57	\$68.69	\$93.85

Table 1B

Notes:

1. Energy savings are based on the cost calculations in section 4.2.
2. The average energy savings is based on the difference in energy delivered to the managed and unmanaged rooms.
3. This is raw data therefore room occupancy has not been factored into these measurements. This assumes that the occupancy rates for the rooms being compared are approximately the same.
4. The cooling cost is based on the electricity cost to operate the chiller plant.
5. The heating cost is based on the natural gas cost to operate the heating plant.

3. BACKGROUND

Ten rooms have been selected for monitoring. These rooms are on the tenth floor, on opposite sides of the hotel. Five rooms have the energy management function enabled and are adjacent to the room without the energy function enabled.

Room Number with Energy Function	Room Number without Energy Function
1061	1059
1068	1070
1080	1082
1081	1079
1093	1091

The energy delivered to each room is measured by the E-Mon system. In each monitored room a BTU meter has been installed on the Chilled Water and Hot Water supply to the fan coil or air handling unit. The E-Mon system calculates the energy delivered by measuring the water inlet temperature, outlet temperature and flow to the unit.

The energy function monitors the room rental status and the occupancy using a door switch and motion detectors as follows:

- Rented Occupied temperature limits are set to +/- 1 degrees of setpoint
- Rented Unoccupied temperature limits are set to +/- 4 degrees of setpoint
- Unrented and unoccupied temperature limits are set to 50 °F to 90 °F
- When the room is rented it will take 10 min after the door is opened and closed and no movement is sensed for the room to go Unoccupied

4. OBSERVATIONS (July12, 2011 – July 2, 2012)

4.1. General

- Inncom has stated that the energy totals have the same starting basis.

4.2. Cost Calculations

Based on factors supplied by Marriott, the cost associated with energy use has been included in this report. The energy cost has been calculated using equations for Cooling, Heating and Electrical energy.

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Marriott Factors:

- Chiller Plant (including chillers, pumps and towers) – 1.7 kW/ton
- Electricity (fully loaded rate including demand charge) - \$0.091/kWh
- Hot Water Boiler Plant – 75% efficient
- Gas - \$1.83/CCF

Cooling Cost:

1 ton of Cooling = approx 12,000 BTU

1 BTU = 3412.142 kW-hr

Cooling delivered kW-hr * 3412.142 = Cooling BTUs delivered-hr *(Convert kW-hr to BTU-Hr)*
Cooling BTUs delivered/hr /12,000 = Tons of Cooling delivered/hr *(Convert BTU-hr to Ton-hr)*
Tons of Cooling delivered/hr * 1.7 kW/ton= KW of cooling/hr *(Convert Ton/hr to kWhr)*
KW of cooling/hr * \$0.091/kWhr = \$ Cooling *(Convert kWh to cost in dollars)*

Heating Cost:

A cubic foot of natural gas on the average gives off 1,000 BTU.

Heating delivered kW-hr * 3412.142 = Heating BTUs delivered-hr *(Convert kW-hr to BTU-Hr)*
Heating BTUs delivered /1000 = CF of gas required *(Convert Btu/Hr to CF of Gas)*
CF of gas required / .75 = CF Gas *(Gas Conversion Efficiency)*
CF Gas / 100 = CCF Gas *(Convert CF gas to CCF Gas)*
CCF Gas * \$1.83/CCF = \$ Heating *(Convert CCF gas to cost in dollars)*

Electric Cost:

Energy Delivered kWh * \$0.091 = \$ Electric *(Convert kWh to cost in dollars)*

4.3. Energy Meter Summary Data

The Table 2 shows the data values observed from the energy meter. The difference calculated is the percentage difference in energy delivered between the managed and unmanaged rooms.

- Rooms highlighted utilize the Inncom energy function
- Data is as reported on the Energy Meter trends provided on the Inncom system

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Date\Room	Energy Delivered kW-Hr		Room Pair Delta	Percent Diff	Cost	Cooling Delivered kW-Hr		Room Pair Delta	Percent Diff	Cost	Heating Delivered kW-Hr		Room Pair Delta	Percent Diff	Cost
	1061	1059	kW-Hr	%	\$	1061	1059	kW-Hr	%	\$	1061	1059	kW-Hr	%	\$
12-Jul-11	34.2	44.3	10.1	29.5	0.92	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
12-Aug-11	46.9	64.1	17.2	36.7	1.57	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
8-Sep-11	56.3	73.6	17.3	30.7	1.57	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
6-Oct-11	64.1	81.8	17.7	27.6	1.61	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
4-Nov-11	71.4	88.6	17.2	24.1	1.57	1327	1707	380.0	28.6	16.72	233.0	240.0	7.0	3.0	0.58
5-Dec-11	79.6	94.5	14.9	18.7	1.36	1457	1775	318.0	21.8	13.99	269.0	269.0	0.0	0.0	0.0
9-Jan 2012	81.0	103.9	22.9	28.3	2.08	1470	1811	341.0	23.2	15.00	328.0	274.0	-54.0	-16.5	-4.50
19-Mar-2012	89.5	110.2	20.7	23.1	1.88	1572	1944	372.0	23.7	16.36	426	436	10.0	2.3	0.83
8-May-2012	99.5	121.1	21.6	21.7	1.97	1723	2171	448.0	26.0	19.71	485	523	38.0	7.8	3.16
2-July-2012	112.5	142.8	30.3	26.9	2.76	2030	2669	639	31.5	28.11	495	560	65	13.1	5.41
	1068	1070	kW-Hr	%	\$	1068	1070	kW-Hr	%	\$	1068	1070	kW-Hr	%	\$
12-Jul-11	48.3	95.2	46.9	97.10	4.27	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
12-Aug-11	59.0	102.3	43.3	73.39	3.94	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
8-Sep-11	64.5	109.3	44.8	69.46	4.08	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
6-Oct-11	73.2	123.3	50.1	68.4	4.56	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
4-Nov-11	77.5	151.2	73.7	95.1	6.71	1196	1269	73.0	6.1	3.21	104.0	130.0	26.0	25.0	2.16
5-Dec-11	82.3	163.1	80.8	98.2	7.35	1259	1362	103.0	8.2	4.53	129.0	135.0	6.0	4.7	0.50
9-Jan 2012	83.7	174.6	90.9	108.6	8.27	1278	1497	219	17.1	9.63	151.0	143.0	-8.0	-5.3	-0.67
19-Mar-2012	93.1	202.2	109.1	117.2	9.93	1469	1689	220.0	15.0	9.68	246.0	163.0	-83.0	-33.7	-6.91
8-May-2012	108.2	223.3	115.1	106.4	10.47	1757	1986	229.0	13.0	10.07	256	169	-87.0	-34	-7.24
2-July-2012	124.4	275	150.6	121.1	13.70	2103	2762	659	31.3	28.99	261	179	-82.0	-31.4	-6.83

Table 2

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	1080	1082	kW-Hr	%	\$	1080	1082	kW-Hr	%	\$	1080	1082	kW-Hr	%	\$
12-Jul-11	60.3	82.5	22.2	36.8	2.02	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
12-Aug-11	74.0	101.2	27.2	36.8	2.48	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
8-Sep-11	82.5	109.9	27.4	33.2	2.49	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
6-Oct-11	90.9	117.2	26.3	28.9	2.39	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
4-Nov-11	95.7	127.4	31.7	33.1	2.88	1423	1463	40.0	2.8	1.76	92.0	354.0	262.0	284.8	21.81
5-Dec-11	104.2	140.9	36.7	35.2	3.34	1491	1562	71.0	4.8	3.12	130.0	384.0	254.0	195.4	21.15
9-Jan-2012	111.7	144.5	32.8	29.4	2.98	1551	1580	29.0	1.9	1.28	173.0	506.0	333.0	192.5	27.72
19-Mar-2012	130.8	158.1	27.3	20.9	2.48	1696	1720	24	1.4	1.06	335.0	655.0	320.0	95.5	26.64
8-May-2012	145.8	187.2	41.4	28.4	3.77	1904	2058	154.0	8.1	6.77	394	672	278.0	70.6	23.15
2-July-2012	183.2	217.7	34.5	18.8	3.14	2512	2567	55	2.2	2.42	401	678	277	69.1	23.06

Table 2 (cont)

Date\Room	Energy Delivered kW-Hr		Room Pair Delta	Percent Diff	Cost	Cooling Delivered kW-Hr		Room Pair Delta	Percent Diff	Cost	Heating Delivered kW-Hr		Room Pair Delta	Percent Diff	Cost
	1081	1079	kW-Hr	%	\$	1081	1079	kW-Hr	%	\$	1081	1079	kW-Hr	%	\$
12-Jul-11	50.4	50.4	0.0	0	0.00	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
12-Aug-11	64.3	59.3	-5.0	-7.8	-0.46	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
8-Sep-11	72.6	69.2	-3.4	-4.7	-0.31	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
6-Oct-11	80.0	78.6	-1.4	-1.8	-0.13	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
4-Nov-11	85.1	85.7	0.6	0.7	0.05	1763	1782	19.0	1.1	0.84	118.0	164.0	46.0	39.0	3.83
5-Dec-11	91.4	91.0	-0.4	-0.4	-0.04	1804	1878	74.0	4.1	3.26	133.0	187.0	54.0	40.6	4.50
9-Jan-2012	92.4	93.1	0.7	.06	0.8	1815	1902	87.0	4.8	3.83	165.0	192.0	27.0	16.4	2.25
19-Mar-2012	107.6	116.7	9.1	8.5	.83	1925	2161	236.0	12.3	10.38	246.0	268.0	22.0	8.9	1.83
8-May-2012	118.8	144.4	25.6	21.5	2.33	2146	2453	307.0	14.3	13.50	259	299	40.0	15.4	3.33
2-July-2012	139.4	179.4	40	28.7	3.64	2593	2946	353	13.6	15.53	271	307	36	13.3	3.00
	1093	1091	kW-Hr	%	\$	1093	1091	kW-Hr	%	\$	1093	1091	kW-Hr	%	\$
12-Jul-11	39.3	61.9	22.6	57.5	2.06	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
12-Aug-11	47.9	82.9	35.0	73.1	3.19	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
8-Sep-11	65.1	88.4	23.3	35.8	2.12	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
6-Oct-11	82.1	96.5	14.4	17.5	1.31	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
4-Nov-11	92.6	104.5	11.9	12.9	1.08	1188	2056	868.0	73.1	38.18	245.0	535.0	290.0	118.4	24.14
5-Dec-11	98.7	109.9	11.2	11.3	1.02	1327	2182	855.0	64.4	37.61	259.0	598.0	339.0	130.9	28.22
9-Jan-2012	108.9	115.5	6.6	6.1	0.60	1368	2367	999.0	73.0	43.94	262.0	817.0	555.0	211.8	46.21
19-Mar-2012	134.0	135.7	1.7	1.3	0.15	1535	2575	1040.0	67.8	45.75	321.0	1070	749.0	233.3	62.36
8-May-2012	152.1	155.1	3.0	2.0	0.27	1837	2805	968.0	52.7	42.58	339.0	1151	812.0	239.5	67.60
2-July-2012	199.7	184.3	-15.4	-7.7	-1.40	2676	3280	604	22.6	26.57	346.0	1171	825	238.4	68.69

Table 2 (cont).

Figure 1 is a graphic display of the energy meter data for Electricity Delivered

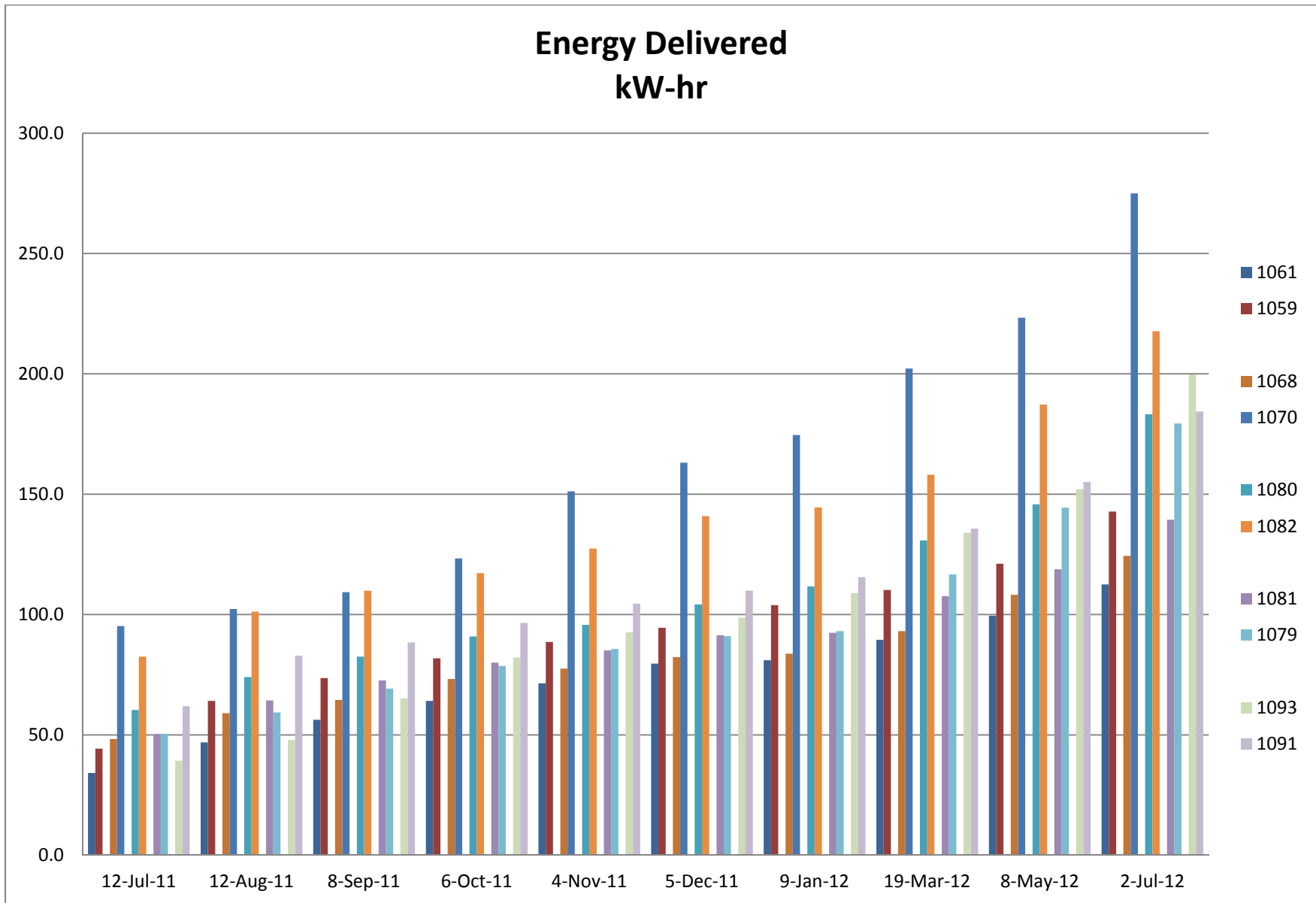


Figure 1

Figure 2 is a graphic display of the energy meter data for Cooling Delivered

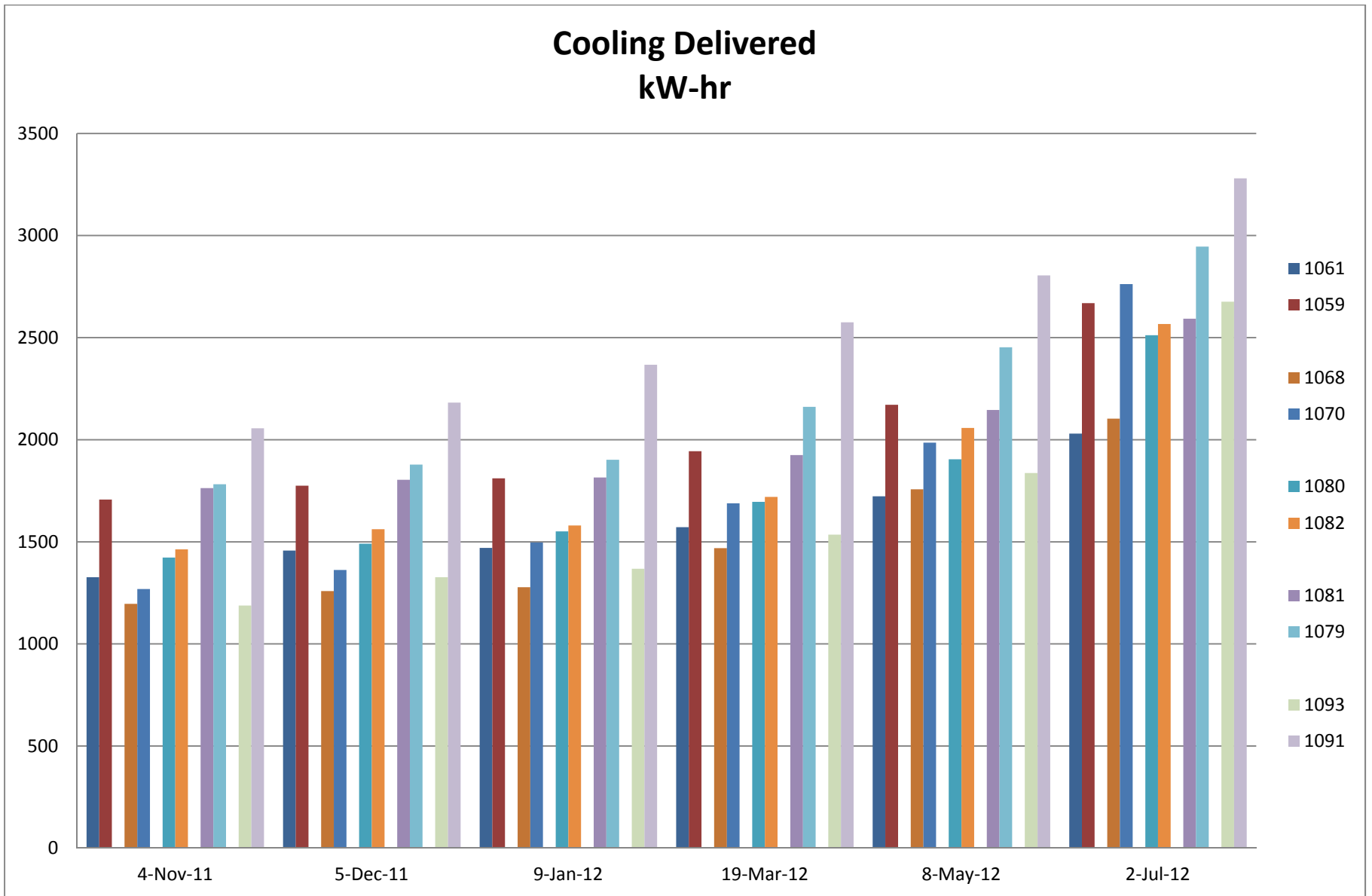


Figure 2

Figure 3 is a graphic display of the energy meter data for Heating Delivered

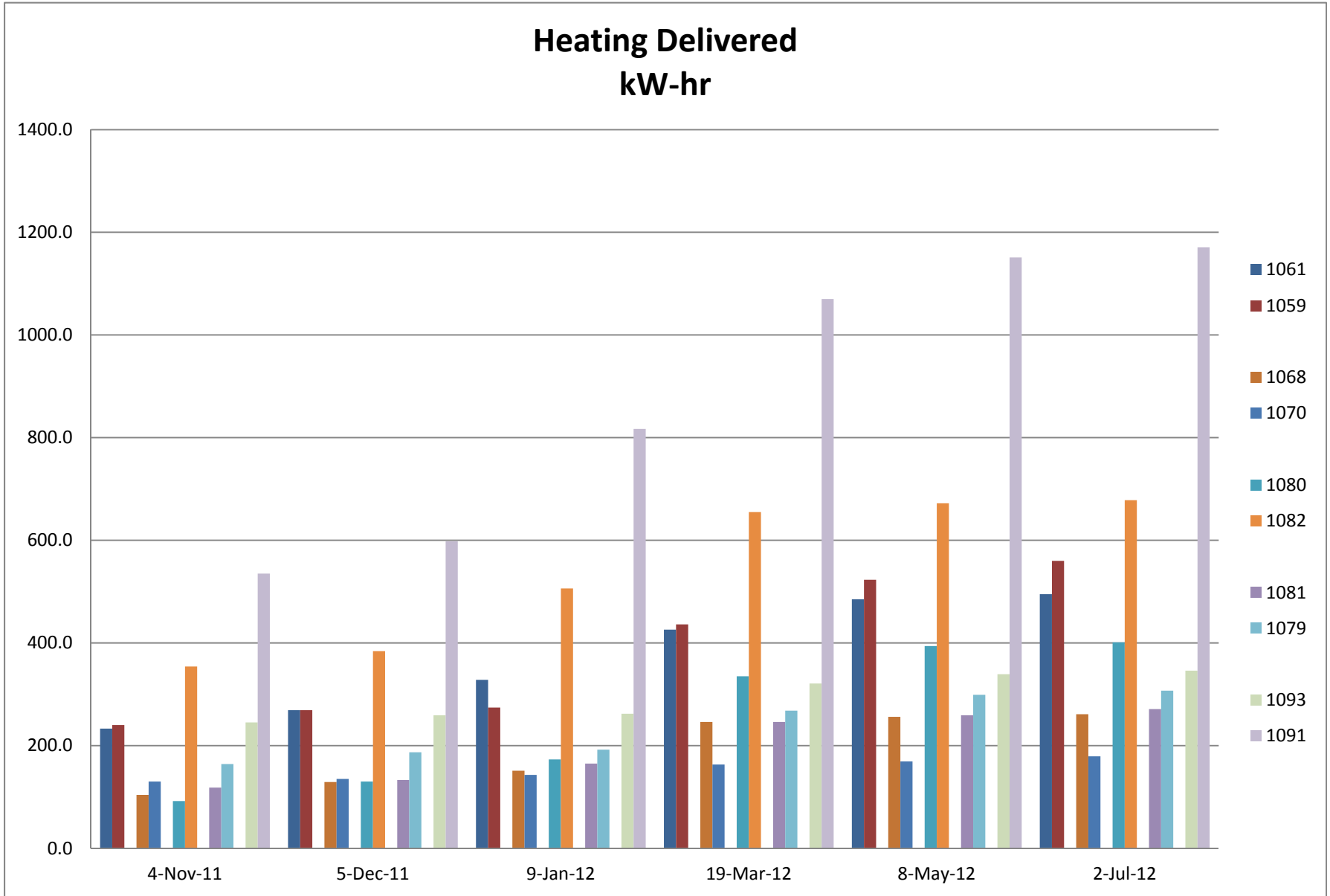


Figure 3