Pepsi Co. – College Point, NY

Data Integrator Initial Data Summary

Data Description

Beginning on March 1, 2007, Consolidated Edison Solutions began sending CDH Energy data for the Pepsi Co. plant located in College Point, NY. The data is uploaded to CDH every 15 minutes and contains information for generator power output, facility power import, gas use, feedwater flow and steam heating load. This documents summarizes the data being collected and the remaining questions.

DG/CHP Integrated Data System Channels

Two distinct engine generator systems can be identified from the data; the first set has engines 1 and 2 while the second set has engines 3 and 4. Each system consists of two engine generators and heat recovery to steam. The electrical generation and gas consumption of the generators are in separate data channels. The steam heat recovery is available in a single generator per generator set.

Table 1 shows the processed data channels from rawdata used in the DG/CHP Integrated Data System for engines 1 and 2. Table 2 shows the processed data channels from rawdata used in the DG/CHP Integrated Data System for engines 3 and 4. The facility purchased energy/demand will be assigned to engines 1 and 2 and zeroes will be used for engines 3 and 4; these channels are only valuable on a full facility basis by summing the two databases.

Table 1. Data Integrator Database Mapping for Generators 1 and 2

Integrated Data System Channel	Units of Measure	Raw Data Row Description [Label][1]	Raw Data Units	Raw Data Mult.[4]	Calculation Formula
DG/CHP Generator Output	kWh/int	Eng1Net-kWh [WG1], Eng2Net-kWh [WG2]	kWh	1.0	= (WG1 + WG2)
DG/CHP Generator Output Demand	kW	Eng1Net-kWh [WG1], Eng2Net-kWh [WG2]	kWh	1.0	= (WG1 + WG2)* (60 min/hour ÷15 min/int)
DG/CHP Generator Gas Input	cuft/int	Engine1Gas [FG1], Engine2Gas [FG2]	ccf	100	= FG1 + FG2
Total Facility Purchased Energy[2]	kWh/int	ElMtr-Totalizer [WT]	kWh	2.0	= WT
Total Facility Purchased Demand[2]	kW	ElMtr-Totalizer [WT]	kWh	2.0	= WT * (60 min/hour ÷15 min/int)
Other Facility Gas Use[2]	cuft/int	FirmGas [FTF]	ccf	100	= FTF
Total Facility Energy	kWh/int	Calculated			
Total Facility Demand	kW	Calculated			
Useful Heat Recovery	MBtu/int	HWB1Steam [QH12]	Btu	100,000	= QH12 /1000
Unused Heat Recovery[5]	MBtu/int	N/A			
Status/Runtime of DG/CHP Generator	Hours	Calculated			
Ambient Temperature[3]	°F	N/A	°F		
Total CHP Efficiency	% LHV	Calculated	N/A		
Electrical Efficiency	% LHV	Calculated	N/A		

[1] – The Raw Data Row Description listed is from the Coned Solutions AST files, the label, in square brackets, is assigned by CDH Energy and used for reference in the calculation formula.

[2] – All Facility Purchased Energy and Demand is assigned to the first database. This data is only examined on a full facility basis.

[3] – Hourly Temperature from wunderground.com for the JFK airport in Brooklyn, NY has been used for the ambient temperature

[4] – Raw Data Multipliers are specified by Coned Solutions and are applied to the rawdata before using the calculation formula.

[5] – There is no data available for this channel from the Coned Solution data

Table 2. Data Integrator Database Mapping for Generators 3 and 4

Integrated Data System Channel	Units of Measure	Raw Data Row Description [Label][1]	Raw Data Units	Raw Data Mult.[4]	Calculation Formula
DG/CHP Generator Output	kWh/int	Eng3Net-kWh [WG3], Eng4Net-kWh [WG4]	kWh	1.0	= (WG3+ WG4)
DG/CHP Generator Output Demand	kW	Eng3Net-kWh [WG3], Eng4Net-kWh [WG4]	kWh	1.0	= (WG3 + WG4) * (60 min/hour ÷15 min/int)
DG/CHP Generator Gas Input	cuft/int	Engine3Gas [FG3], Engine4Gas [FG4]	ccf	100	= FG3 + FG4
Total Facility Purchased Energy[2]	kWh/int	N/A	kWh	2.0	= 0
Total Facility Purchased Demand[2]	kW	N/A	kWh	2.0	= 0
Other Facility Gas Use[2]	cuft/int	N/A	ccf	100	= 0
Total Facility Energy	kWh/int	Calculated			
Total Facility Demand	kW	Calculated			
Useful Heat Recovery	MBtu/int	HWB2 Steam [QH34]	Btu	100,000	= QH34 / 1000
Unused Heat Recovery[5]	MBtu/int	N/A			
Status/Runtime of DG/CHP Generator	Hours	Calculated			
Ambient Temperature[3]	°F	N/A	°F		
Total CHP Efficiency	% LHV	Calculated	N/A		
Electrical Efficiency	% LHV	Calculated	N/A		

[1] – The Raw Data Row Description listed is from the Coned Solutions AST files, the label, in square brackets, is assigned by CDH Energy and used for reference in the calculation formula.

[2] – All Facility Purchased Energy and Demand is assigned to the first database. This data is only examined on a full facility basis.

[3] – Hourly Temperature from wunderground.com for the JFK airport in Brooklyn, NY has been used for the ambient temperature

[4] – Raw Data Multipliers are specified by Coned Solutions and are applied to the rawdata before using the calculation formula.

[5] – There is no data available for this channel from the Coned Solution data

Data Verification

Figure 1 shows a time series and shade plot of generator 1 output. A shade plot has the date along the x-axis and the time of the day along the y-axis. The relative power for each period is shown with shades of gray. Darker shades indicate greater power output while light gray corresponds to minimum power. White indicates periods of no data.

Generator 1 had higher peak outputs in the initial data collection and in the past month than from mid-April through early September. Normal operating patterns seem to be five or six days a week with occasional periods of being shutdown during the week for a few hours. The peak output was 392 kW in March.

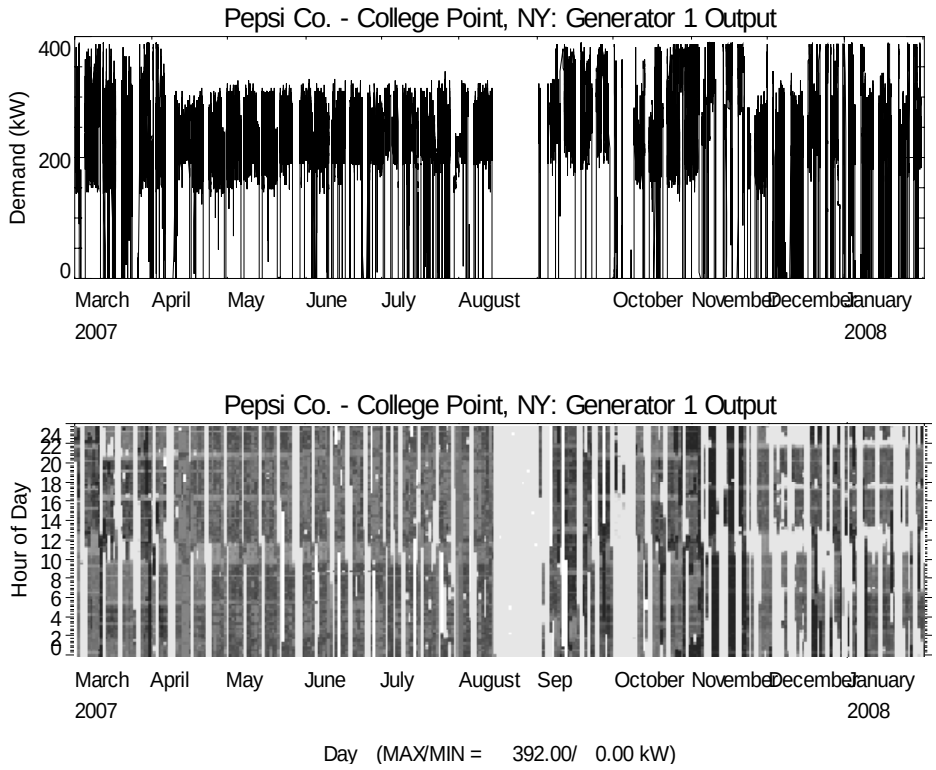

Figure 1. Generator 1 Output Time Series and Shade Plot

Figure 2 shows the shade plot and times series for generator 2 Output. The peak output for this generator was 392 kW. The data shows increased output after October 6th.

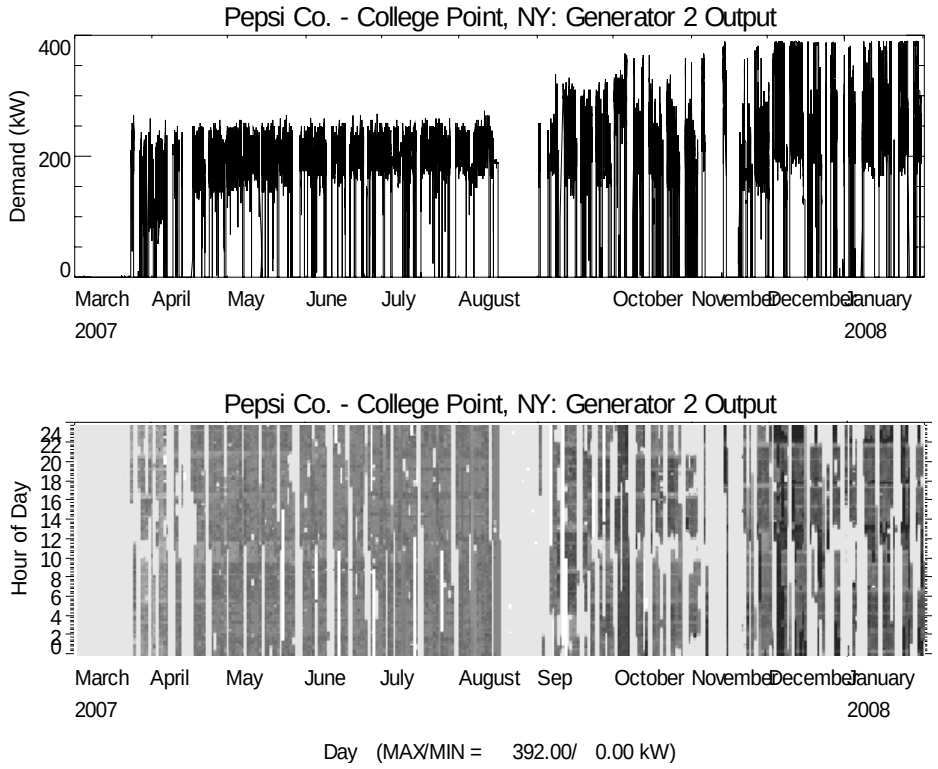

Figure 2. Generator 2 Output Time Series and Shade Plot

Figure 3 shows the shade and time series plots for generator 3 Output. The peak output for this generator was 392 kW. Similar to the other engines, output was higher in March and September than from April through August. There was a period in August where data was not collected from 9am through 1am for a period of several weeks. The output was higher in December and January than from September through November.

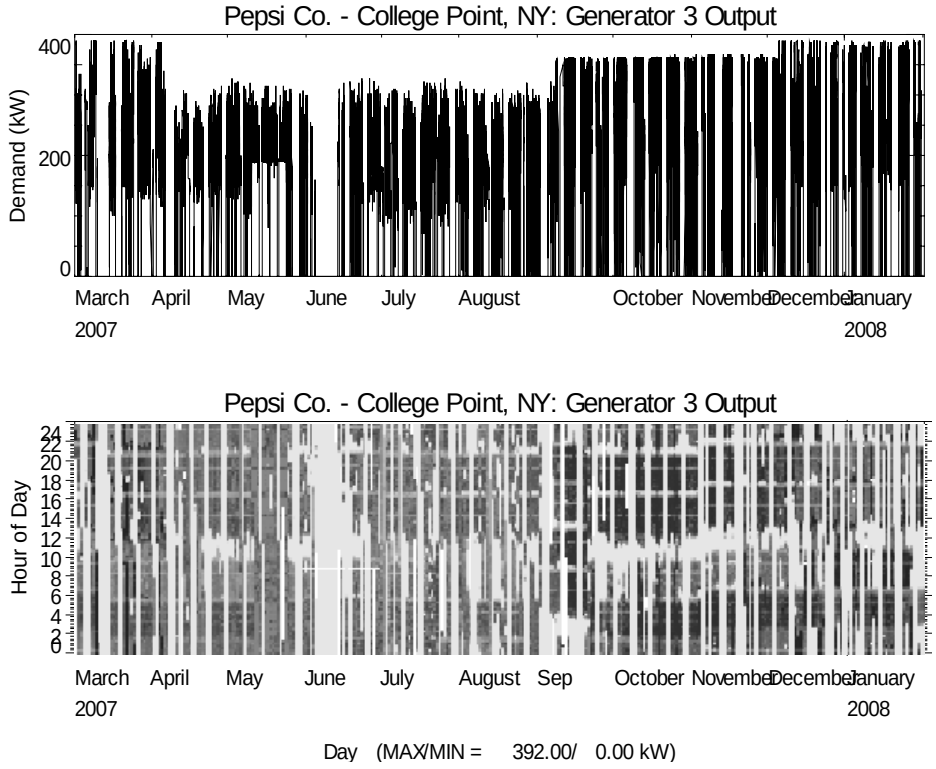

Figure 3. Generator 3 Output Time Series and Shade Plot

Figure 4 show the shade and time series plots for generator 4 Output. The peak output for this generator was 332 kW. Similar to generator 3, there was a period in August where data was not collected from 9am through 1am for a period of several weeks.

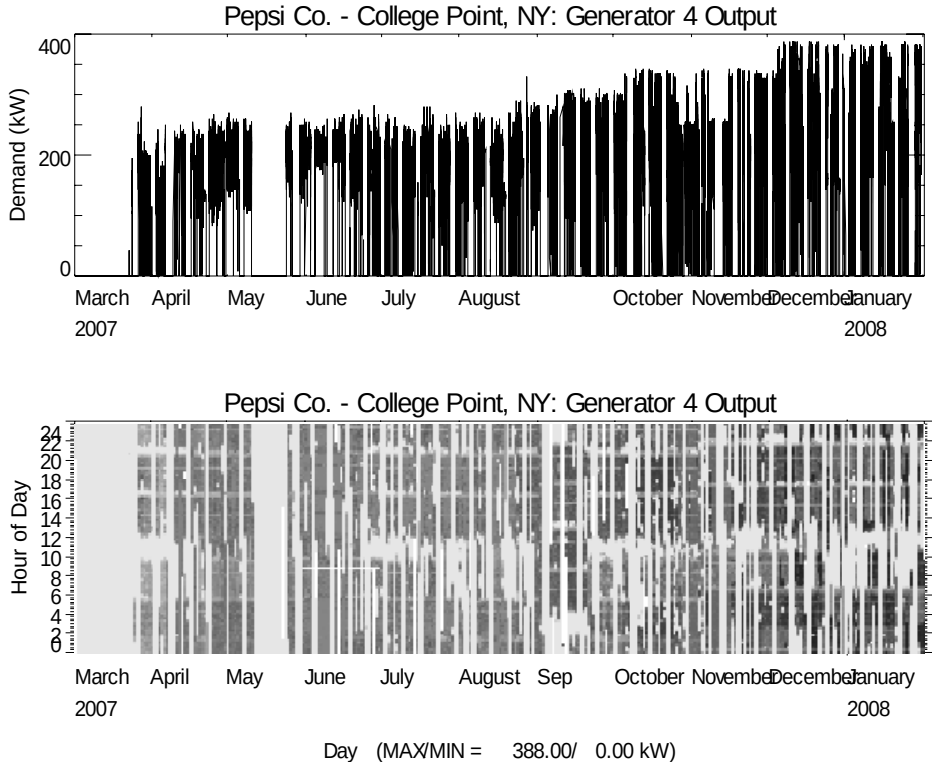

Figure 4. Generator 4 Output Time Series and Shade Plot

Generator Fuel Use Patterns

Gas use data is being reported for each of the generators individually. Gas Use for generator 1 is much lower in the period before April 6 than after because of an apparent scaling change. According to the gas use, both generators did not operate significantly from a period in mid-August through early September, which is also confirmed by the power data. There was period in December where the data for Generator 2 Fuel Input was zero (the generator power indicated operation) probably due to a data collection error.

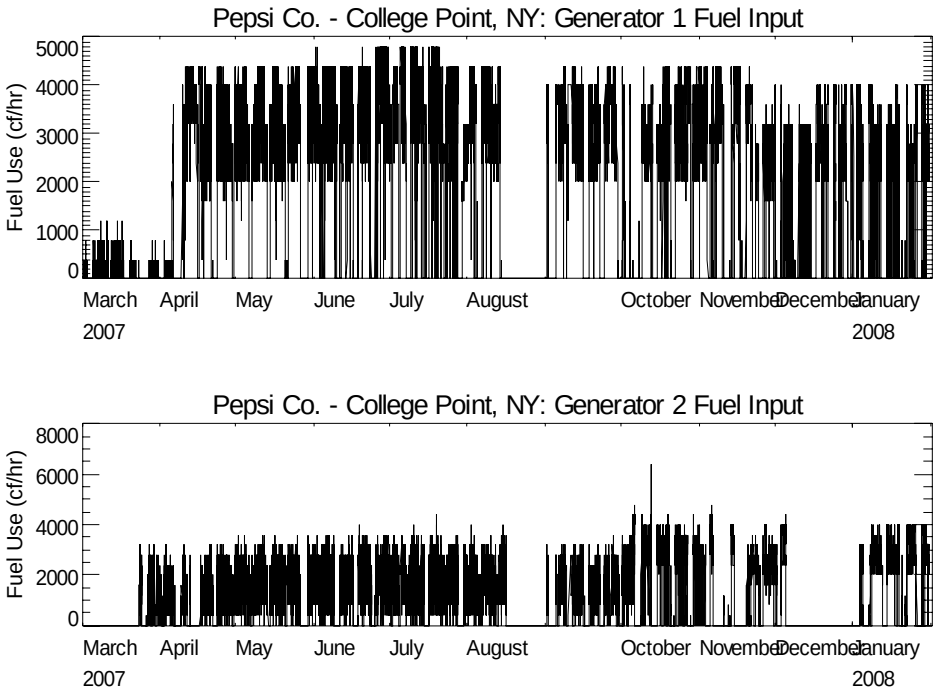

Figure 5. Gas Use Data for Generators 1 and 2

Figure 6 shows the gas use for Generator 3 and 4. Gas Use for Generator 3 is much lower in the period before April 6 than after because of an apparent scaling change. There is one period of high gas consumption for both generators in March, this is probably due to a data collection error and will be masked by data quality checks with the generator power.

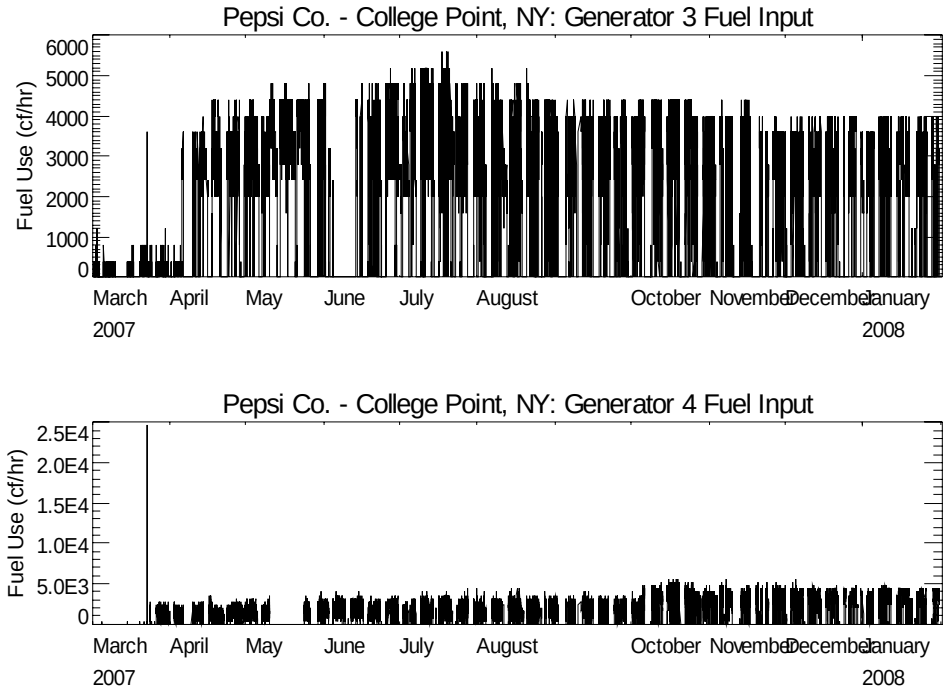

Figure 6. Gas Use Data for Generators 3 and 4

Steam Loads

Steam data is being collected for the two systems. The steam output for generators 1 and 2 is represented by the channel HWB1. The steam output for generators 3 and 4 is represented by HWB2. All of the data reported so far for System 1 is zero. There is steam data for system 2 but non-zero steam loads have been observed during periods of no Generator Output for either Generator 3 or 4. There is an apparent change in the steam output in September, representing either a change in the multiplier or decreased steam production.

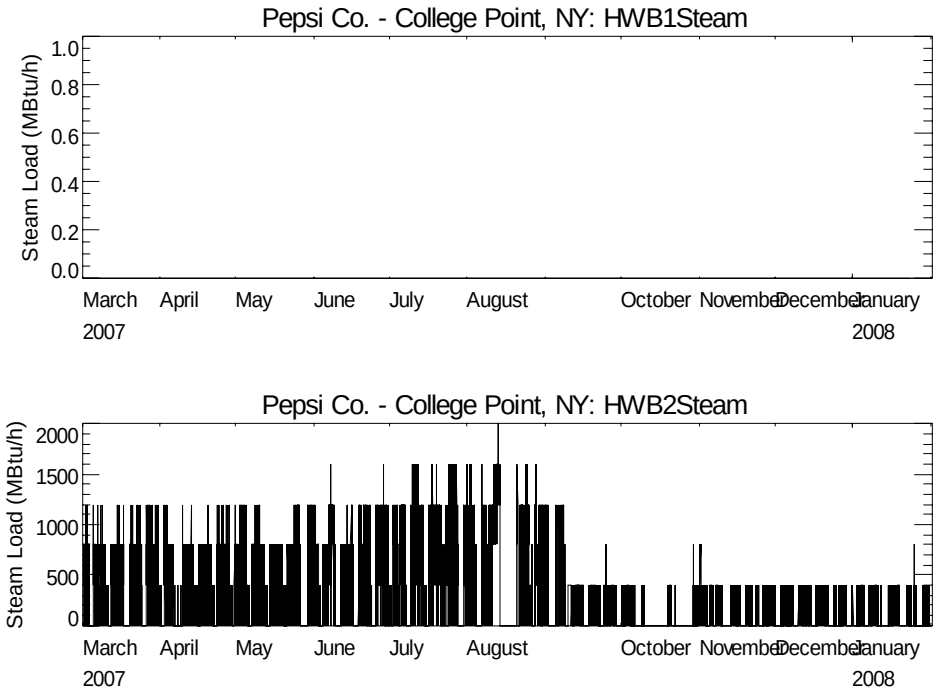

Figure 7. Plot of Steam Data Collected

Table 3 is a table of generator output, gas use and calculated generation efficiency on a monthly basis. From the table, the generator efficiencies for Generators 1 and 3 are impossibly high for March and April. This indicates a scaling change was made and the date was identified as April 6th. Generators 2 and 4 have a total generation efficiency that seems high before October 6th. After October 6th, all of the generation efficiencies are normal, with the exception of Generator 2 for a period when gas data was not reported (see Figure 5).

Table 3. Monthly Table of Generator Electrical Efficiencies

	Generator 1			Generator 2			Generator 3			Generator 4		
Date	Energy Produced (kWh)	Gas Consumed (CCF)	Generation Efficiency (% LHV)	Energy Produced (kWh)	Gas Consumed (cf)	Generation Efficiency (% LHV)	Energy Produced (kWh)	Gas Consumed (CCF)	Generation Efficiency (% LHV)	Energy Produced (kWh)	Gas Consumed (cf)	Generation Efficiency (% LHV)
Mar 2007	133,171	422	1158%	18,504	1,655	41%	102,880	326	1158%	15,522	1,486	38%
Apr 2007	121,250	14,061	32%	80,693	6,041	49%	94,053	9,653	36%	80,018	5,582	53%
May 2007	143,292	19,389	27%	121,312	9,732	46%	119,403	18,854	23%	59,079	4,491	48%
Jun 2007	124,580	19,200	24%	105,922	9,207	42%	55,175	8,931	23%	84,042	7,841	39%
Jul 2007	122,518	18,250	25%	120,085	10,202	43%	96,557	16,504	21%	77,236	7,478	38%
Aug 2007	61,985	8,670	26%	69,387	5,755	44%	93,920	14,293	24%	84,701	7,829	40%
Sep 2007	124,915	14,056	33%	86,233	5,821	54%	92,845	11,241	30%	76,801	6,390	44%
Oct 2007	107,331	12,711	31%	105,454	12,505	31%	126,267	14,887	31%	96,506	12,092	29%
Nov 2007	132,097	14,296	34%	62,137	7,098	32%	103,165	11,507	33%	96,088	12,288	29%
Dec 2007	91,953	9,683	35%	123,889	2,360	193%	106,244	11,332	34%	107,542	13,440	29%
Jan 2008	100,833	10,580	35%	112,420	11,161	37%	98,729	10,538	34%	93,969	11,672	30%
Total	1,263,925	141,318	33%	1,006,036	81,537	45%	1,089,238	128,066	31%	871,504	90,589	35%

Table 4 shows the CHP Efficiency for the two systems. The CHP efficiency for system 1 is simply the electrical efficiency by the calculation because the steam generation data from this system is always zero. For Generator 3 and 4, the CHP Efficiency is high in March and April due to gas scaling issues. The CHP Efficiency from May-January is 32-49%, a reasonable efficiency for a CHP system of this type.

Table 4. Monthly Table of Total CHP Efficiency

	Generator 1 and 2					Generator 3 and 4				
Date	Energy Produced (kWh)	Gas Consumed (CCF)	Steam Generated (MMBtu)	Generation Efficiency (% LHV)	Total CHP Efficiency (% LHV)	Energy Produced (kWh)	Gas Consumed (CCF)	Steam Generated (MMBtu)	Generation Efficiency (% LHV)	Total CHP Efficiency (% LHV)
Mar 2007	151,675	2,077	0.0	268%	268%	118,402	1,812	267.1	240%	398%
Apr 2007	201,943	20,102	0.0	37%	37%	174,071	15,235	239.1	42%	59%
May 2007	264,604	29,121	0.0	33%	33%	178,482	23,345	273.1	28%	41%
Jun 2007	230,502	28,407	0.0	30%	30%	139,217	16,772	285.4	30%	49%
Jul 2007	242,603	28,452	0.0	31%	31%	173,793	23,982	369.6	27%	43%
Aug 2007	131,372	14,425	0.0	33%	33%	178,621	22,122	337.7	30%	46%
Sep 2007	211,148	19,877	0.0	39%	39%	169,646	17,631	116.2	35%	42%
Oct 2007	212,785	25,216	0.0	31%	31%	222,773	26,979	42.3	30%	32%
Nov 2007	194,234	21,394	0.0	33%	33%	199,253	23,795	79.2	31%	34%
Dec 2007	215,842	12,043	0.0	66%	66%	213,786	24,772	65.2	32%	35%
Jan 2008	213,253	21,741	0.0	36%	36%	192,698	22,210	47.0	32%	34%
Total	2,269,961	222,855	0.0	37%	37%	1,960,742	218,655	2,121.9	33%	43%

Assumptions

1. HWB1 Steam is assumed to represent heat recovery for engines 1 and 2 while HWB2 is assumed to represent heat recovery for engines 3 and 4.

Summary Questions

Here is a summary of the questions from a review of the data set:

1. There is no steam data collected for HWB1. Is this a problem with the data channel or is the load actually zero?
2. Why are there periods of HWB2 Steam data when neither Generator 3 or 4 is operating?

Recommendations

All data problems, with the exception of the steam generation data, have been solved and the site is now loaded into the CHP database. Coned Solutions is working to solve the problems with the steam load data. Until the problems are resolved, this data will be masked from the online database.

Data Channel Summary

Table 5. Summary of Data Channels From Coned Solutions

Coned Solutions Data Channel	Units	File Prefix	Mult.	Min	Max	Avg
ElMtr-Totalizer	kWh	PepsiHWB-1	2	0	418	59.80
TotalCogenGas	cf	PepsiHWB-1	1,000	0	19,000	1,831.47
Engine1Gas	cf	PepsiHWB-1	100	0	1,200	447.68
Engine2Gas	cf	PepsiHWB-1	100	0	1,600	258.30
Eng1Net-kWh	kWh	PepsiHWB-1	1	0	98	40.04
Eng2Net-kWh	kWh	PepsiHWB-1	1	0	98	31.87
HWB1Fd-Wtr	gal	PepsiHWB-1	1	0	4	0.51
HWB1Steam	Btu	PepsiHWB-1	100,000	0	0	0.00
Engine3Gas	cf	PepsiHWB-2	100	0	1,400	407.22
Engine4Gas	cf	PepsiHWB-2	100	0	6,200	288.05
Eng3Net-kWh	kWH	PepsiHWB-2	1	0	98	34.63
Eng4Net-kWh	kWh	PepsiHWB-2	1	0	97	27.71
HWB2Fd-Wtr	Gal	PepsiHWB-2	1	0	0	0.00
HWB2Steam	Btu	PepsiHWB-2	100,000	0	500,000	67,494
IntrptGas	cf	PepsiHWB-2	1,000	0	26,000	1.65
FirmGas	cf	PepsiHWB-2	1,000	0	1,000	244.93