Seapark East - Data Integrator Notes

Seapark East's cogeneration plant includes two engine-generators that serve the electrical needs for this large apartment building located in Brooklyn, NY.

Two 75 kW Tecogen engines are located on the second floor in the parking garage, adjacent to the apartment building.

Data Point Details

Data is logged at 1-minute intervals by an Acquisuite datalogger. The data is aggregated into hourly data and uploaded to the web site.

The timestamp in the raw data files is in Eastern Standard Time. All data on the website are presented in Eastern Standard Time.

DG/CHP Generator Output (total kWh)
The data for Generator Output is calculated by adding data points WE1 and WE2, then subtracting WP, after they are calculated from the accumulators in the AcquiSuite log file. The difference between consecutive records is calculated to determine the energy use during the interval. This 1-minute interval data is then summed into hourly data.

DG/CHP Generator Output Demand (peak kW)
The Generator Output Demand is calculated by adding data points WE1 and WE2 and subtracting WP, the same as above. The difference between consecutive records is calculated to determine the energy use during the interval. Instead of summing the kWh data, the highest kWh per interval value is multiplied by 60 in order to calculate the peak demand for the hour.

DG/CHP Generator Gas Input (cubic feet)
The data for Generator Gas Input comes the accumulator records for FG in the AcquiSuite log file. The difference between consecutive records is calculated to determine the gas use during the interval. The 1-minute data is then summed into hourly data for the online database.

Total Facility Purchased Energy (total kWh)
This data will be taken from the Con Ed DMS website when the data is available.

Total Facility Purchased Demand (peak kW)
This data will be taken from the Con Ed DMS website when the data is available.

Other Facility Gas Use (cubic feet)
No data

Total Facility Energy (total kWh) and Total Facility Demand (peak kW)
No data.

Unused Heat Recovery (total MBtu/h)
No data

Useful Heat Recovery (MBtu/h)
The Useful Heat Recovery comes from 1-minute data for the data points FW, THS and THR from the AcquiSuite log file, and is calculated as such:

$$Q=500*FW*(THS-THR)/1000$$

The 1-minute data is then averaged into hourly data for the online database.

Status/Runtime of DG/CHP Generator (hrs)
The generators are defined as being fully on for a 1-minute interval if the generator output is greater than 10 kW for the period (the fully-loaded capacity is 150 kW). The status is given a value of 1/60 if the generator output is above 10 kW. The 1-minute data is then summed into hourly data for the online database.

Ambient Temperature (avg °F)
The data for Ambient Temperature comes from hourly data for John F. Kennedy (JFK) airport from http://www.wunderground.com/

Electrical Efficiency (%)
The Electrical Efficiency is calculated by dividing the Generator Output (WE1+WE2-WP) in BTU's by Generator Gas Input (FG) in BTU's. The energy density of natural gas used is 930 BTU/cf. The expected efficiency should range from 20%-30%.

Total CHP Efficiency (%)
The Total CHP Efficiency is calculated similarly to electrical efficiency above except the Useful Heat Recovery (Q) and the Generator Output (WE1+WE2-WP) are summed before dividing by the Gas Input (FG) in BTU's.

Data Quality Checks

The Data Quality Checks consist of three levels of verification:

- the data exist (flag=1),
- the data pass range checks (flag=2)
- the data pass relational checks (flag=3).

The methodology for applying the data quality begins by creating a contiguous database. We initially assume all data are good (flag=3) and then work backwards to identify data that does not meet Relational and/or Range Checking.

The next step is to apply the relational checks. Relational checks attempt to identify data values which conflict with other data in the data set. For instance, data received indicating a DG/CHP

Generator output when the gas use is zero is suspect. For data failing a relational check, the data quality level is set to 2 for "Data Passes Range Checks".

The last step is evaluating the range checks. The range checks consist of reasonable high and low values based on facility and DG/CHP Generator information. Data that falls outside the defined range for the database value has its data quality level set to 1 for "Data Exists."

It is necessary to work backwards when applying data quality checks to insure that data gets set to the lowest applicable data quality level. It is possible for data to pass the relational check and fail the range check and such data will be set to a data quality level of 1 for "Data Exists."

Table 1. Data Quality Definitions

Data Quality Levels	Description	Definition
3	Passes Relational Checking	This data passes Range Checks and Relational Checks. This is the highest quality data in the data set.
2	Passes Range Checks	This data passes the Range Checks but is uncorroborated by Relational Checks with other values.
1	Data Exists	This data does not pass Range Checks. This data is found to be suspect based on the facility and/or CHP equipment sizing.
0	Data Does Not Exist	This data is a placeholder for maintaining a contiguous database only.

Details on the Range and Relational Checks are found below.

Relational Checks

These checks are applied to the interval data before it is converted to hourly data. If 25% or less of the data fails the range check, the failed data is excluded and the remaining data is used for the hour. If more than 25% of the 1-minute data points fails the range check, the data for the entire hour is marked as failed and the hour is calculated normally.

Table 2. Relational Checks

Evaluated Point	Criteria	Result
FG	WG > 5 and FG <3	DQ Level for FG set to 2

Notes: FG – DG/CHP Generator Gas Use
WG – DG/CHP Generator Output
QHR– DG/CHP Useful Recovered Heat

Range Checks

These checks are applied to the 1-minute data before it is converted to hourly data. If 25% or less of the data fails the range check, the failed data is excluded and the remaining data is used for the hour. If more than 25% of the 1-minute data points fails the range check, the data for the

entire hour is marked as failed and the hour is calculated normally. Note that range checks for one minute data (and especially accumulators) are set to allow a large amount of variance.

Table 3. Range Checks

Data Point	Hourly Data Method	Upper Range Check	Lower Range Check
DG/CHP Generator Output	Sum	10 kWh	-3 kWh
DG/CHP Generator Output Demand	Maximum	180 kW	-100 kW
DG/CHP Generator Gas Use	Sum	150 cubic feet/hour	0 cubic feet
Total Facility Purchased Energy	Sum	-	-
Total Facility Purchased Demand	Maximum	-	-
Other Facility Gas Use	-	-	-
Unused Heat Recovery	-	-	-
Useful Heat Recovery	Sum	2100 MBtu	-150 MBtu
Status/Runtime of DG/CHP Generator	Sum	1 hrs	0 hrs
Ambient Temperature	Average	130°F	-30°F

Notes: Data failing the Range Check has the data quality level set to 1 for “Data Exists”

Monitoring Notes:
11/10/2010:
Now collecting power data in kWh instead of Wh

4/5/2010:
Switched from collecting 5 minute data to collecting 1 minute data to aide in debugging several issues.

4/7/2010:
Pulse counts from the fuel meter were not being counted properly, adjusted the closed resistance threshold for pulse readings on the data logger from 1000 to 2500. Switched temperature sensors from RTDs to Thermistors

6/14/2010:
Changed the output of for the temperature sensors to ohms for debugging purposes.

6/16/2010:
Installed new veris 10k type 2 Curve on the obvius datalogger. Output has been returned to degrees F.

9/30/2010:
Updated all documentation.

3/28/2011:
Updated the airport to John F. Kennedy (which is closer to the site) for ambient temperature data collection.