One Penn Plaza - Data Integrator Notes

A Peak Coincident Distributed Generation (PCDG) system is being installed at One Penn Plaza in New York. The system is being installed by Endurant Energy, LLC on behalf of the building owner, Vornado Realty Trust. The system includes three Caterpillar engine-driven generators that are being installed on the 12th floor setback. The engines will each provide 2055 kW into power bus that feeds a bank of five power converters (AC-DC-AC inverters). The power converters feed the 5 separate 480 VAC electrical services within the building (Switchboards B to F).

Data Point Details

The Emerson DeltaV DCS has been installed by Control Associates. The DeltaV system has been programmed to record the requested data values. These data points are automatically averaged and logged to a file at 15-minute intervals. Each 15-minute record is time and date stamped. The file is row-oriented ASCII, text, or comma separated values (CSV) file with sufficient resolution to accurately represent each reading. Once per day the file is automatically transferred to CDH Energy (the NYSERDA web site contractor) via Secure FTP to the CDH data server.

The DeltaV system has provisions to save the daily data files locally for up to several hundred days.

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

DG/CHP Generator Output (total kWh)
The Generator Output comes from the three channels, which record the power output for each generator. These channels are converted to kWh, summed, and multiplied by .95 to account for parasitic losses. This 15-minute interval energy data is summed into hourly data.

DG/CHP Generator Output Demand (peak kW)
The Generator Output Demand comes from the three channels, which record the power output for each generator. These channels are summed and multiplied by .95 to account for parasitic losses. The maximum for each hourly period is used as the demand from the generator.

DG/CHP Generator Gas Input (cubic feet)
The data for Generator Gas Input comes from the three channels, which record gas flow for each generator. The gas flow is provided in units of cf/m, this is converted to cf/h. This 15-minute interval data is averaged into hourly data.

Total Facility Purchased Energy (total kWh)
The Total Facility Purchased Energy comes from the five channels, which monitor the power import for the building. These channels are converted to kWh and summed. The 15-minute interval energy data is summed into hourly data.

Total Facility Purchased Demand (peak kW)
The Total Facility Purchased Energy comes from the the five channels, which monitor the power import for the building. These channels are summed. The maximum for each hourly period is used as the demand from the generator.

Other Facility Gas Use (cubic feet)
No data

Unused Heat Recovery (total MBtu)
The Unused Heat recovery is calculated from the flow and temperatures across the condenser. This 15-minute data is then averaged into hourly data

Useful Heat Recovery (total MBtu)
The Useful heat Recovery is calculated using the flows and temperatures across the heating water loop, the condensate preheating loop, and the steam flow from the HRSGs. This 15-minute data is averaged into hourly data.

Status/Runtime of DG/CHP Generator (hrs)
Each generator is defined as being fully on for a 15-minute interval if the generator output is greater than 500 kW (the fully-loaded capacity is 2055 kW). The status is given a value of +1 for each generator that has an output greater than 500 kW. The 15-minute data is then averaged into hourly data for the online database.

Ambient Temperature (avg °F)
The Ambient temperature comes from the Weather Underground. The 15-minute data is averaged into hourly data.

Electrical Efficiency (%)
The Electrical Efficiency is calculated by dividing Generator Output (WG) in BTU's by Generator Gas Input (FGE) in BTU's. The lower heating value of natural gas used is 918.9 btu/cf. The expected efficiency should range from 25%-35%.

Total CHP Efficiency (%)
The Total CHP Efficiency is calculated by dividing the Generator Output and Useful Heat Recovery by the Generator Gas Input. The lower heating value of natural gas used is 918.9 btu/cf and the expected efficiency should range 55-80%

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 any of the interval data points fails the relational check, the data for the entire hour is marked as failed.

Table 2. Relational Checks

Evaluated Point	Criteria	Result
FG	WG_KW > 25 and FG<=0	DQ Level for FG set to 2

Notes: FG – DG/CHP Generator Gas Use
WG – DG/CHP Generator Output

Range Checks

These checks are applied to the 15-minute data before it is converted to hourly data. If any of the 15-minute data points fails the range check, the data for the entire hour is marked as failed.

Table 3. Range Checks

Data Point	Hourly Data Method	Upper Range Check	Lower Range Check
DG/CHP Generator Output	Sum	1800 kWh	-20 kWh
DG/CHP Generator Output Demand	Maximum	7200 kW	-20 kW
DG/CHP Generator Gas Use	Average	90000 cf	0 cf
Total Facility Purchased Energy	Sum	3000 kWh	0 kWh
Total Facility Purchased Demand	Maximum	12000 kW	0 kW
Other Facility Gas Use	Sum	-	-
Unused Heat Recovery	Average	50000 MBtu	-20 MBtu
Useful Heat Recovery	Average	50000 MBtu	-20 MBtu
Ambient Temperature	Average	130°F	-30°F

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

Site Notes:

1/6/11:
The data has been posted on the website.

7/27/11:
Data transfer has been restored and back data (4/4/2011 – 7/14/11) is now posted on the website.
Adjusted range checks for useful heat, dumped heat and facility import.