Ultraflex - Data Integrator Notes

Ultra-Flex is an industrial printing facility located in Brooklyn. The CHP system at Ultra-Flex includes three (3) 100-kW InVerde Engine Units from Tecogen that use permanent magnet generators with 480 VAC inverters to provide power output. The engines are capable of providing 125 kW peak and 100 kW continuous. The inverters, oil coolers, and associated electronics have their own small cooling loop and dry cooler (FLC-2). A heat rejection loop from the engine jacket and exhaust heat exchanger is the primary source of thermal output.

Data Point Details

The ALC control system will be used transfer 5-minute or 15-minute data to CDH each night by email. The ALC system will be setup to email the data listed in Table 1 at a regular time each night as a time-stamped CSV file. The file should include the previous few days of data (e.g., 3-4 days).

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

DG/CHP Generator Output (total kWh)
The Generator Output is calculated from the raw data channel, "CGDP Power (kW)", by dividing the kW reading by 4 (number of intervals/hour). 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 raw data channel labeled "CGDP Power (kW)". 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 raw data channel labeled "Engines Gas Use (cu ft/hr)". This 15-minute interval data is averaged into hourly data.

Total Facility Purchased Energy (total kWh)
The Total Facility Purchased Energy is calculated from the raw data channel, "MDP Power (kW)", by dividing the kW reading by 4 (number of intervals/hour). The 15-minute interval energy data is summed into hourly data.

Total Facility Purchased Demand (peak kW)
The Total Facility Purchased Energy from the raw data channel labeled "MDP Power (kW)". 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 raw data channels "Engines CGWR Temp", "Engines Inlet Temp", and "Engines Flow (gpm)" in the raw data file. This 15-minute data is then averaged into hourly data

Useful Heat Recovery (total MBtu)
The Useful heat Recovery is calculated from the raw data channels "Main CGW Flow (gpm)", "Main CGWS Temp", "Main CGWR Temp" in the raw data file. This 15-minute data is averaged into hourly data.

Status/Runtime of DG/CHP Generator (hrs)
The system of generators is defined as being fully on for a 15-minute interval if the generator output is greater than 50 kW (the fully-loaded capacity is 300 kW). The status is given a value of 1 if the generator system has an output greater than 50 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 channel "OA Temp" in the raw data file. 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 905 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 905 btu/cf and the expected efficiency should range 60-90%

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	125 kWh	0 kWh
DG/CHP Generator Output Demand	Maximum	500 kW	0 kW
DG/CHP Generator Gas Use	Average	1250 cf	0 cf
Total Facility Purchased Energy	Sum	250 kWh	0 kWh
Total Facility Purchased Demand	Maximum	1000 kW	0 kW
Other Facility Gas Use	Sum	-	-
Unused Heat Recovery	Average	750 MBtu	0 MBtu
Useful Heat Recovery	Average	3000 MBtu	0 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.

6/23/11:
Sensors at the site have been verified. The glycol concentration in the water has been tested and the multiplier used to calculate heat recovery has been adjusted to reflect this.