SUNY Buffalo Data Integrator Notes

The SUNY Buffalo Combined Heat and Power (CHP) system consists of two Capstone 60kW microturbines with integrated heat exchangers. The heat recovered from the turbines is used to heat a pool in the alumni arena. The CHP data at this site is collected by Gerster Trane Energy Services and provided to CDH Energy.

Data Point Details

The data at this site is collected by a Nexus EIG Meter. The data is collected on a 15-minute interval and saved into an MS Access Database. It is unclear whether the non-accumulator channels represent averages or samples.

DG/CHP Generator Output (total kWh)
Data for this point comes from an accumulator for the combined generator power produced. The Data ID for this point is "22412" in the Access database. The accumulator data is in units of Watt-hours and is converted to kWh by dividing by 1000. This 15-minute energy data is summed into hourly data for the online database.

DG/CHP Generator Output Demand (peak kW)
Data for this point comes from a channel for the generator demand produced on the feeds from both turbines. The Data ID for this point is "21025" in the Access database. The demand data is in units of Watts and is converted to kW by dividing by 1000. The peak value from the 15-minute data is assigned for the hourly online database.

DG/CHP Generator Gas Use (total cubic feet)
Data for this point comes from an accumulator for microturbine gas use. The Data ID for this point is "26402" in the Access database. The 15-minute data is summed into hourly data for the online database.

Total Facility Purchased Energy (total kWh) and Demand (peak kW)
There is no data for these points available from the Access database.

Other Facility Gas Use (total cubic feet)
There is no data for this point available from the Access database.

Total Facility Energy (total kWh) and Total Facility Demand (peak kW)
Due to the lack of Facility Purchased Energy/Demand data, these data points cannot be calculated at this site.

Unused Heat Recovery (total MBtu/h)
There is no data for this point available from the Access database.

Unused Heat Recovery (total MBtu/h)
The Useful Heat Recovery is recorded by an accumulator in units of Watt-hours. The Data ID for this point is "26403" in the Access database. The heat recovery data is multiplied by

0.003413 to convert from Watt-hours to MBtus. The interval energy data is then summed into hourly data.

Status/Runtime of DG/CHP Generator (total hrs)
A turbine is defined as being fully on for a 15-minute interval if the turbine output is greater than 40 kW for the period (the fully-loaded capacity is 60 kW). The status is given a value of 0.5 if the combined generator output is above 80 kW. The status is given a value of 0.25 if the combined generator output is between 40 kW and 60 kW. The generator output is divided by 40 kW if the combined generator output is between 80 kW and 60 kW or less than 40 kW for fractional runtime and then divided by 4 to convert from hours to minutes. This 15-minute data is then summed into hourly data for the online database.

Ambient Temperature (avg °F)
The Ambient Temperature comes from hourly sampled conditions at the Buffalo Airport (Airport Code BUF) available at http://www.wunderground.com. The hourly data from the weather underground (which is often recorded at irregular time intervals) is assigned to the closest hour for the Ambient Temperature in the online database.

Total CHP Efficiency (%)
The Total CHP Efficiency is calculated from the online hourly database as the sum of the Useful Heat Recovery and the DG/CHP Generator Output, converted from kWh to MBtus, divided by the DG/CHP Generator Gas Input. The gas input is converted to MBtus using the Lower Heating Value (LHV) of the fuel which is 0.930 MBtu/cubic foot (Natural Gas).

Electrical Efficiency (%)
The Electrical Efficiency is calculated from the online hourly database as the DG/CHP Generator Output, converted from kWh to MBtus, divided by the DG/CHP Generator Gas Input. The gas input is converted to MBtus using the Lower Heating Value (LHV) of the fuel which is 0.930 MBtu/cubic foot (Natural Gas).

Data Quality Checks

The Data Quality Checks consist of three levels of verification: does the data exist, does the data pass reasonable range checking and does the data pass relational checks. The methodology for applying the data quality checks begins by creating a contiguous database. This is necessary to maintain compatibility between the many sites on the server. Next, the data received for this site is fit into the database, in this case we are using 15-minute data. For any period where there is data, the data quality level is set to 3 for “Passes Relational Checks”. We 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 which is uncorroborated by the rest of 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 5-minute data before it is converted to hourly data. If any of the 15-minute data points fails the relational check, the data for the entire hour is marked as failed.

Table 2. Relational Checks for SUNY Buffalo

Evaluated Point	Criteria	Result
FG	WG > 0 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 for SUNY Buffalo

Data Point	Hourly Data Method	Upper Range Check	Lower Range Check
DG/CHP Generator Output	Sum	11 kWh	0 kWh
DG/CHP Generator Output Demand	Maximum	125 kW	0 kW
DG/CHP Generator Gas Use	Sum	500 cubic feet	0 cubic feet
Total Facility Purchased Energy	Sum	N/A	N/A
Total Facility Purchased Demand	Maximum	N/A	N/A
Other Facility Gas Use	Sum	500 cubic feet	0 cubic feet
Unused Heat Recovery	Sum	450 MBtu	0 MBtu
Useful Heat Recovery	Sum	450 MBtu	0 MBtu
Status/Runtime of DG/CHP Generator	Sum	0.166 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"

ASERTTI Protocol Adherence

This site adheres partially to the ASERTTI Long-Term Monitoring Protocol. There is no data to for the thermal energy recovered from the microturbines: there is only data for the heat utilized. There is also no data for inlet air temperature, although ambient temperature from a nearby has been used instead. Some of the optional parameters for power quality are available at this site

Monitoring Notes

March 24, 2006

Gerster Trane provided CDH Energy with an Access database containing data from December 11, 2002 to August 11, 2004.