Golub Headquaters - Data Integrator Notes

The CCHP system installed at the Golub Corporation's Headquarters' consists of a single PureComfort Model 195M system. This system has three 65kW microturbines and one exhaust-driven absorption chiller. The system utilizes an absorption chiller/heater to provide either hot or cold water for the building.

Data Point Details

A Carrier I- Vu Pro control system provides a log file for each day containing data logged at 15-minute intervals. The data is emailed to the CDH energy collection address where it is processed. The data is then 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 is presented in Eastern Standard Time.

DG/CHP Generator Output (total kWh)
The Generator Output comes from the Microturbine Power minus the parasitic power loads. The parasitic power loads are: "CT-1 Kw","CT-2 Kw", "CP-1 Status","PP-1 Status","PP-5 Status". The three statuses are multiplied against one time readings to obtain the parasitic load. The resulting power from this equation is converted to energy per interval. This 15-minute interval energy data is summed into hourly data.

WCWP1: Absorption Chiller Condenser Pump Power = 4.0 kW
WCHPP1: Absorption Chiller Chilled Water Pump Power = 1.9 kW
WHWPP5: Absorption Chiller Hot Water Pump Power = 0.5 kW

DG/CHP Generator Output Demand (peak kW)
The Generator Output Demand comes from the Microturbine Power minus the parasitic power loads. The parasitic power loads are: "CT-1 Kw","CT-2 Kw", "CP-1 Status","PP-1 Status","PP-5 Status". The three statuses are multiplied against one time readings to obtain the parasitic load. 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 data point "Microturbine Gas Usage" in the data files. This data is provided in standard cubic feet per hour for each 15-minute interval and is averaged into hourly data.

Total Facility Purchased Energy (total kWh)
The Total Facility Purchased Energy comes from the column labeled "Building Electrical Power" in the data files. This power data is converted into energy per interval. 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 column labeled "Building Electrical Power" in the data files. 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/h)
No data

Useful Heat Recovery (total MBtu/h)
The Useful heat Recovery is obtained by using the hot water and chilled water temperatures and flows to calculate the amount of heat used from each loop per interval. This 15-minute data is summed into hourly data.

Status/Runtime of DG/CHP Generator (hrs)
The generator is defined as being fully on for a 15-minute interval if the generator output is greater than 25 kW (the fully-loaded capacity is 180 kW / interval). The status is given a value of 1 if the generator output is above 25 kWh. 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 in the data file labeled OA Temp. 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 930 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 930 btu/cf and the expected efficiency should range 75-90%

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	60 kWh	0 kWh
DG/CHP Generator Output Demand	Maximum	200 kW	0 kW
DG/CHP Generator Gas Use	Sum	780 cf	0 cf
Total Facility Purchased Energy	Sum	210 kWh	0 kWh
Total Facility Purchased Demand	Maximum	800 kW	0 kW
Other Facility Gas Use	Sum	-	-
Unused Heat Recovery	Sum	-	-
Useful Heat Recovery	Sum	480 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:

8/31/10:
The data has been posted on the website.