VIP Country Club Data Integrator Notes

This site is a health and fitness club located in the New York City suburb of New Rochelle. The site has three 60 kW UTC/Capstone microturbines that provides heat recovery for domestic hot water, space heating and space cooling. For cooling, heat is recovered from the microturbines to three water-fired chillers. Data for this site is collected by Connected Energy and provided to CDH Energy.

Data Point Details

The data at this site is provided by Connected Energy in the form of comma-separated value (CSV) files. There is one file for each day containing 15-minute timestep data for 92 data points. One data file is uploaded on a nightly basis containing the previous days data. From these 15-minute values, the hourly database is formed. It is unclear whether the 15-minute data is sampled or averaged across the interval. The details for each individual data point are outlined below.

The timestamp in the raw data files is in Eastern Local Time. This means it obeys the Standard to Daylight savings times rules for the Eastern timezone. For display purposes, we convert the timestamp from Local Time to Eastern Standard Time for all graphical figures on the website. This means that during the Daylight Savings Time period from the first Sunday in April until the last Sunday in October the monitored data plots, CSV output and standardized PDF reports are in Eastern Standard Time and do not obey Daylight Savings time rules. Presenting data in Standard Time throughout the year is common practice for graphical time series plotting because it eliminates skipping an hour in April and duplicating an hour in October.

DG/CHP Generator Output (total kWh)

The data for Generator Output comes from a 15-minute average for the total microturbine demand on the controller for the master microturbine. MTG-1 is the master microturbine while MTG-2 and MTG-3 are the slaves; as the master MTG-1 reports total power for all connected microturbines. The column of origin for this data point is labeled “MTG-1 Power, All Phases” in the data files received from Connected Energy. After March 28, the “MTG-1 Power, All Phases” value reports only the power for the first microturbine and the total power channel records the total power produced by all three microturbines. The column of origin for this data point is now labeled “MTG Power, All MTGs” in the data files received from Connected Energy. This 15-minute interval demand data is converted to energy and then summed into hourly data.

DG/CHP Generator Output Demand (peak kW)

The data for Generator Output comes from a 15-minute average for the total microturbine demand on the controller for the master microturbine. MTG-1 is the master microturbine while MTG-2 and MTG-3 are the slaves; as the master MTG-1 reports total power for all connected microturbines. The column of origin for this data point is labeled “MTG-1 Power, All Phases” in the data files received from Connected Energy. After March 28, the “MTG-1 Power, All Phases” value reports only the power for the first microturbine and the total power channel records the total power produced by all three microturbines. The column of origin for this data

point is now labeled “MTG Power, All MTGs” in the data files received from Connected Energy. The maximum for a given hour is assigned to the hourly database.

DG/CHP Generator Gas Input (cubic feet)
The data for Generator Gas Input comes from an accumulator sampled every 15-minutes for total gas use. The column of origin for this data point is labeled “Cumul. Site Gas Use, pulse” in the data files received from Connected Energy. The difference between consecutive records is assigned as the turbine gas use for that interval. This 15-minute interval gas data is then summed into hourly data.

Total Facility Purchased Energy (total kWh)
The data for Facility Purchased Energy comes from the 15-minute average for total turbine power and total building power. The columns of origin for this data point are labeled “Total Building Power” and “MTG Power, All MTGs “ in the data files received from Connected Energy. The difference between the building power and the turbine power is assigned as the purchased demand for that interval. This 15-minute demand data is converted to energy and then summed into hourly data.

Total Facility Purchased Demand (peak kW)
The data for Facility Purchased Demandcomes from the 15-minute average for total turbine power and total building power. The columns of origin for this data point are labeled “Total Building Power” and “MTG Power, All MTGs “ in the data files received from Connected Energy. The difference between the building power and the turbine power is assigned as the purchased demand for that interval. The maximum for a given hour is assigned as the Total Facility Purchased Demand in the hourly data.

Other Facility Gas Use (cubic feet)
There is no data available for this point from the Connected Energy data.

Total Facility Energy (total kWh) and Total Facility Demand (peak kW)
These two data points are the sum of the DG/CHP Generator Output and Total Facility Purchased data points.

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

Useful Heat Recovery (total MBtu/h)
The Useful Heat Recovery comes from an average sampled every 15-minutes for the generator heat recovery rate. The column of origin for this data point is labeled “Total Heat Recovery, kBTU” in the data files received from Connected Energy. The heat recovery rate is converted to energy and then summed into hourly data.

Status/Runtime of DG/CHP Generator (hrs)
The turbines are defined as being fully on for a 15-minute interval if the turbine power is greater than 45 kW for the period (the fully-loaded capacity is 60 kW each). The status is given a value

of 0.25 if the generator output is above 45 kW and the generator output is divided by 45 kW if it is below. The 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 Westchester Airport (Airport Code HPN) 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 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" or 1 for "Data Exists".

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 15-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. Columns from “Heat Exch Flow - Cumul pulse” through “Total Building Power” represent one piece of equipment that contains accumulator information.. Columns from “Total CHP Efficiency” through “MTG-3 Number of Starts” represent data for the Engine Controller and contain data for the Generator Output and Generator Output Demand. When there is a failure to obtain new data, the data set repeats the old value. We can identify this bad data through a relational check for repeating data on the two pieces of equipment separately. We are using a threshold of 95% repeating values because some values reset to zero during the repeating periods.

Table 2. Relational Checks for VIP Country Club

Evaluated Point	Criteria	Result
FG	WG > 0 and FG <= 0	DQ Level for FG set to 2
WG, WT, WT_KW	> 95% of columns "Heat Exch Flow - Cumul pulse" through "Total Building Power" repeat previous data record	DQ Level for WG, WT, WT_KW set to 1
WG, WG_KW, SG	> 95% of columns "Total CHP Efficiency" through "MTG-3 Number of Starts" repeat previous data record	DQ Level for WG, WG_KW, SG set to 1
WG, WG_KW, FG, WT, WT_KW, QHR, SG	> 95% of all columns repeat previous data record	DQ Level for WG, WG_KW, FG, WT, WT_KW, QHR, SG set to 1

Notes: FG – DG/CHP Generator Gas Use
WG – DG/CHP Generator Output
WG_KW – DG/CHP Generator Demand
WT – Total Facility Purchased Energy
WT_KW – Total Facility Purchased Demand
QHR – Useful Heat Recovery
SG – Status/Runtime of DG/CHP Generator

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 VIP Country Club

Data Point	Hourly Data Method	Upper Range Check	Lower Range Check
DG/CHP Generator Output	Sum	50 kWh	0 kWh
DG/CHP Generator Output Demand	Maximum	200 kW	0 kW
DG/CHP Generator Gas Use	Sum	3,700 cubic feet	0 cubic feet
Total Facility Purchased Energy	Sum	50 kWh	0 kWh
Total Facility Purchased Demand	Maximum	200 kW	0 kW
Other Facility Gas Use	Sum	N/A	N/A
Unused Heat Recovery	Sum	N/A	N/A
Useful Heat Recovery	Sum	1,500 MBtu	0 MBtu
Status/Runtime of DG/CHP Generator	Sum	0.75 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 to the ASERTTI Long-Term Monitoring Protocol with the following exception: the thermal heat utilized is not measured separately from the thermal heat recovered. Other than that exception, the data provided by Connected Energy has all the required performance parameters. Data is provided in 15-minute intervals satisfying the protocol. In addition, this site also has most of the optional performance parameters.

Monitoring Notes

January 25, 2006

CDH begins receiving daily file uploads from Connected Energy for this site.