Rome Site - Data Integrator Notes

Rome Memorial Hospital (RMH) is planning to install a partial distributed generation, combined heat and power (DG-CHP) system. RMH plans to design, build and operate a nominal 260kW micro-turbine based Combined Heat and Power (CHP) plant to supplement its thermal and electrical loads. The plant will be located in the Hospital's 'Old Boiler Room'. The proposed system is sized/arranged to operate at peak thermal and electrical performance and at full capacity 24hrs/day, 365days/year.

Data Point Details

Pasco will collect and transfer 15-minute data to CDH each night by email. The data sent is listed in Table 4 and is sent at a regular time each night as a time-stamped CSV file.

All data on the website is presented in Eastern Standard Time.

DG/CHP Generator Output (total kWh)
The Generator Output comes from the data channel called WG_ACC. The power is given as an accumulator. The difference between readings is set as the amount for each interval and the 15-minute data is then summed to hourly data.

DG/CHP Generator Output Demand (peak kW)
The Generator Output Demand comes from the data channel called WG_KW. The power is given as a rate, which has the maximum value taken across each hour.

DG/CHP Generator Gas Input (cubic feet)
The Generator Gas Input comes from the data channel called FG_ACC. The gas data is given as an accumulator. The difference between readings is set as the amount for each interval and the 15-minute data is then summed to hourly data.

Total Facility Purchased Energy (total kWh)
The Total Facility Purchased Energy comes from the data channel called WT_ACC. The power is given as an accumulator. The difference between readings is set as the amount for each interval and the 15-minute data is then summed to hourly data.

Total Facility Purchased Demand (peak kW)
The Total Facility Purchased Demand comes from the data channel called WT_KW. The power is given as a rate, which has the maximum value taken across each hour.

Other Facility Gas Use (cubic feet)
The Other Facility Gas Use comes from the data channel called FT_ACC. The gas data is given as an accumulator. The difference between readings is set as the amount for each interval and the 15-minute data is then summed to hourly data. This gas use is connected to boilers, kitchen equipment, laundry, and the microturbines.

Unused Heat Recovery (total MBtu/h)
No data

Useful Heat Recovery (total MBtu/h)
The useful heat recovery comes from the data channel called QHW_ACC. This heat transfer data is given as an accumulator. The difference between readings is set as the amount for each interval and the 15-minute data is then summed to hourly data.

After July 19th, the data for useful heat recovery is calculated from Q1 through Q4 due to an issue with the accumulator.

Status/Runtime of DG/CHP Generator (hrs)
This is determined based on the value of WG1_KW through WG4_KW. If the power is greater than 25 kW for an interval, the status is increased by 1. The status is then averaged across an hour.

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 927 btu/cf. The expected efficiency should range from 30–45%.

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 927 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 > 20 and FGE<=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 1-minute data before it is converted to hourly data. If any of the 1-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	80 kWh	0 kWh
DG/CHP Generator Output Demand	Maximum	300kW	0 kW
DG/CHP Generator Gas Use	Average	1200 cf	0 cf
Total Facility Purchased Energy	Sum	400 kW	0 kW
Total Facility Purchased Demand	Maximum	1600 kW	0 kW
Other Facility Gas Use	Sum	5000 cf	0 cf
Unused Heat Recovery	Average	-	-
Useful Heat Recovery	Average	1600 MBtu	0 MBtu
Ambient Temperature	Average	120°F	-30°F

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

Table. 4 File Headings

CDH_ID	File Headers
WT_KW	Utility Electric Demand
WT_ACC	Utility Electric Consumption
FT_ACC	Utility Gas Consumption
FG_ACC	Turbine Gas Consumption
FG_CF	Turbine Gas Demand
WG1_KW	Turbine-1 Power Output
WG2_KW	Turbine-2 Power Output
WG3_KW	Turbine-3 Power Output
WG4_KW	Turbine-4 Power Output
Q1	Turbine-1 BTU Output
Q2	Turbine-2 BTU Output
Q3	Turbine-3 BTU Output
Q4	Turbine-4 BTU Output
RT1	Turbine-1 Run Hours
RT2	Turbine-2 Run Hours
RT3	Turbine-3 Run Hours
RT4	Turbine-4 Run Hours
QHW_ACC	Net Thermal BTU Total
FHW	Net Termal Flow
THWS	Net Thermal HWS Temp
THWR	Net Thermal HWR Temp
WG_KW	Net Power Demand
WG_ACC	Net Power Consumption

Site Notes:

7/13/2011:
The data has been posted on the website.

7/29/11:
The accumulator for useful heat recovery is reading significantly higher than the system is rated for. Until the issue is resolved the calculation will be using the heat output from each turbine before the storage tank.

1/10/2012:
The accumulators for net useful heat recovery and net power generation are empty. Useful heat recovery is already using the output from the four turbines and power generation has now been changed to use the sum of the four turbines. The total power generation between the four turbines is multiplied by a factor of .95 to match the previous accumulator data (Parasitic power).