

Sunny Knoll ADG Site - Data Integrator Notes

Sunny Knoll Dairy Farm's ADG system includes one reciprocating, biogas, engine that serve the electrical needs for the farm located in Perry, NY.

One 230 kW Caterpillar G379 engine / generator serves the farm. The genset is located in a building, adjacent to the digester. All the recovered heat is captured in the form of hot water and used for digester and space heating.

Data Point Details

Data is logged at ***15-minute*** intervals by a Campbell Scientific C10 data logger. The data is 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 data point labeled Generator Power Output in the Campbell log file. The kWh / interval data is summed into hourly data.

DG/CHP Generator Output Demand (peak kW)

The Generator Output Demand is from the same data point as above, Generator Power Output. Instead of summing the data, the highest kWh value per interval is multiplied by the number of intervals per hour to calculate the peak demand for the hour.

DG/CHP Generator Gas Input (cubic feet)

The data for Generator Gas Input comes from the data point Engine Gas Use in the Campbell log file. This interval flow data is summed into hourly data.

Total Facility Purchased Energy (total kWh)

The data for Total Facility Purchased Energy comes from the difference between the data points Main Meter power Import and Main Meter Power Export from the Campbell log file. The calculated value is then summed into hourly data.

Total Facility Purchased Demand (peak kW)

The data for Total Facility Purchased Energy is calculated the same as above; from the difference between the data points Main Meter power Import and Main Meter Power Export from the Campbell log file. The highest kWh value per interval is multiplied by the number of intervals per hour to calculate the peak hourly demand.

Other Facility Gas Use (cubic feet)

Other facility gas use represents the gas being flared. The data for Other Facility Gas Use comes from the data point Flare Gas Flowrate in the Campbell log file. The flow data is summed into hourly data.

Unused Heat Recovery (total MBtu/h)

The data for Unused Heat Recovery comes from the data point Radiator Heating Load from the Campbell log file. The interval data is summed into hourly data.

Useful Heat Recovery (total MBtu/h)

The data for Useful Heat Recovery comes from the sum of the data points Load Circuit Heating Load and Digester Heating Load. The calculated data is then summed into hourly data.

Status/Runtime of DG/CHP Generator (hrs)

The generators are defined as being fully on over an interval if the generator output is greater than 5 kW / interval (the fully-loaded capacity is 57.5 kW / interval). The status is given a value of 0.25 if the generator output is above 5 kW. The status data is then summed into hourly data for the online database.

Ambient Temperature (avg °F)

The Ambient temperature comes from the Dansville Airport weather station. The data are downloaded from www.wunderground.com.

Electrical Efficiency (%)

The Electrical Efficiency is calculated by dividing Generator Output (WG) in BTU's by Generator Gas Input (FGE) in BTU's. The energy density of biogas used is 600 BTU/cf. The expected efficiency should range from 20%-30%.

Total CHP Efficiency (%)

Same as electrical efficiency

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
None Applied	-	-

Notes: FG – DG/CHP Generator Gas Use
WG – DG/CHP Generator Output

Range Checks

These checks are applied to the interval data before it is converted to hourly data. If any of the 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	250 kWh/hr	0 kWh/hr
DG/CHP Generator Output Demand	Maximum	250 kW	0 kW
DG/CHP Generator Gas Use	Sum	8,500 scf/hr	0 scf/hr
Total Facility Purchased Energy	Sum	200 kWh/hr	0 kWh/hr
Total Facility Purchased Demand	Maximum	200 kW	200 kW
Other Facility Gas Use	Sum	8,500 kWh/hr	0 kWh/hr
Unused Heat Recovery	Sum	5,100 Mbtu/hr	0 Mbtu/hr
Useful Heat Recovery	Sum	2,500 Mbtu/hr	0 Mbtu/hr
Ambient Temperature	Average	130°F	-30°F

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