Willet Dairy - Data Integrator Notes

The digester system at the farm was designed by DVO Anaerobic Digesters. The power plant equipment will be provided by Martin Machinery while the gas conditioning equipment will be supplied by DVO Anaerobic Digesters. Gas and power metering are planned to be provided by Gen-Tec and Sage Metering Inc. The site will operate one 1,000 kW synchronous engine-generator with gas conditioning equipment, piping and controls installed in a designated building next to the digester. All the electrical loads at the farm have been consolidated into a single 3-phase, 277/480 volt electrical service in order to accommodate the interconnection of the generator system. The electrical system includes controls to synchronize the generator to the grid as well as a protective relay and controls to automatically isolate the units from the utility grid in the event of a utility power outage. The generator will be connected to the NYSEG distribution network through a two meter system - one outgoing and one incoming. A 1,000 kW, diesel generator will be connected to the farm electrical system through a 2,000 A disconnect/transfer switch for use during power outages.

Data Point Details

The Carbon Catcher monitoring system is based around a Red Lion data logger. All data is collected as 15 minute data and converted to hourly data.

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. This is an accumulator for the gross generator output. The difference between consecutive intervals is used to determine the output per interval. The kWh/ interval data is then converted to kW data.

DG/CHP Generator Output Demand (peak kW)
The Generator Output Demand comes from the data channel called WG_acc. These channels are averaged across each 15-minute period to determine the demand. The maximum value for each hour is then taken.

DG/CHP Generator Gas Input (cubic feet)
The Generator Gas Input comes from the data channel called FGE_acc. This is an accumulator for the gas used by the engine. The difference between consecutive intervals is used to determine the gas use per interval, and is then converted to hourly gas use.

Total Facility Purchased Energy (total kWh)
No data

Total Facility Purchased Demand (peak kW)
No data

Other Facility Gas Use (cubic feet)
Flared biogas comes from the data channel called FGF_acc, and biogas used by the boiler is stored in the data channel called FGB_acc. These two values are accumulators. The difference between consecutive intervals is used to determine the gas use per interval, and is then converted to hourly gas use. The two hourly gas rates are then added together to calculate the total other facility gas use.

Unused Heat Recovery (total MBtu/h)
No data.

Useful Heat Recovery (total MBtu/h)
No data.

Status/Runtime of DG/CHP Generator (hrs)
The channels labeled as SG_d holds the generator status. It is calculated from the generators instantaneous output WG. If the generator is above 30 kW for a 15 minute interval SG_d receives a 1. The SG_d values are then averaged over each hour.

Ambient Temperature (avg °F)
The Ambient temperature comes from the Weather Underground using the ITH airport as a reference location. 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 580 btu/cf. The expected efficiency should range from 25–35%.

Total CHP Efficiency (%)
No data.

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 > 30 and FGE<=100	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	1100 kWh	-1 kWh
DG/CHP Generator Output Demand	Maximum	1100 kW	-5 kW
DG/CHP Generator Gas Use	Sum	18000 cf	0 cf
Total Facility Purchased Energy	Sum	-	-
Total Facility Purchased Demand	Maximum	-	-
Other Facility Gas Use	Sum	18000 cf	0 cf
Unused Heat Recovery	Average	-	-
Useful Heat Recovery	Average	-	-
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: