Onondaga Metropolitan Wastewater Treatment Facility - Data Integrator Notes

The OC Department of Water Environment Protection's ADG system includes one reciprocating, biogas, engine that serve the electrical needs for the facility located in Syracuse, NY.

One 350 kW Caterpillar engine / generator serves the facility. 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 to heat the digester.

Data Point Details

Data is logged at ***1-minute*** intervals by Onondaga Metro's own SCADA system. 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 are presented in Eastern Standard Time.

DG/CHP Generator Output (total kWh)
The Generator Output comes from the data point labeled Total_kWh in the SCADA log file. The difference between consecutive records is calculated to determine the energy use during the interval. This energy data is then summed into hourly data.

DG/CHP Generator Output Demand (peak kW)
The Generator Output Demand is from the same data point as above, Total_kWh. The difference between consecutive records is calculated to determine the energy use during the interval. Instead of summing the kWh 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 points TotalGasFlow and biogas_valve in the SCADA log file. The difference between consecutive records of TotalGasFlow is calculated to determine the gas flow during the interval. The biogas_valve value will be 1 when the valve is open, and 0 when it is closed. Multiplying the valve status by TotalGasFlow it can be determines how much biogas is flowing to the engine. This flow data is then summed into hourly data.

Total Facility Purchased Energy (total kWh)
No data

Total Facility Purchased Demand (peak kW)
No data

Other Facility Gas Use (cubic feet)
Other facility gas use represents natural gas being consumed by the engine. The data for Generator Gas Input comes from the data points TotalGasFlow and ng_valve in the SCADA log

file. The difference between consecutive records of TotalGasFlow is calculated to determine the gas flow during the interval. The ng_valve value will be 1 when the valve is open, and 0 when it is closed. Multiplying the valve status by TotalGasFlow determines how much natural gas is flowing to the engine. This flow data is then summed into hourly data.

Unused Heat Recovery (total MBtu/h)
No data

Useful Heat Recovery (total MBtu/h)
No 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 10 kW / interval (the fully-loaded capacity is 87.5 kW / interval). The status is given a value of 0.25 if the generator output is above 10 kW. The data is then summed into hourly data for the online database.

Ambient Temperature (avg °F)
The Ambient temperature comes from the Syracuse Airport weather station. The data is 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 exists (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 > 3 and FGE<100	DQ Level for FG set to 2
FT	Biogas_valve = 1 and NG_valve = 1	DQ Level for FT set to 2

Notes: FG – DG/CHP Generator Gas Use
WG – DG/CHP Generator Output
Biogas_valve – open / closed status (0,1)
NG_valve – open / closed status (0,1)

Range Checks

These checks are applied to the data before it is converted to hourly data. If any of the interval 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	455 kWh/h	0 kWh/h
DG/CHP Generator Output Demand	Maximum	455 kW	0 kW
DG/CHP Generator Gas Use	Sum	11,500 cf/hr	0 cf/hr
Total Facility Purchased Energy	Sum	-	-
Total Facility Purchased Demand	Maximum	-	-
Other Facility Gas Use	Sum	11,500 cf/hr	0 cf/hr
Unused Heat Recovery	Sum	-	-
Useful Heat Recovery	Sum	-	-
Generator Status	Sum	1 hr	0 hr
Ambient Temperature	Average	130°F	-30°F

Notes:

1. Data failing the Range Check has the data quality level set to 1 for “Data Exists”
2. Range checks are applied to interval data
3. This table contains values from *range_checks.pro*