Twin Birch ADG Site - Data Integrator Notes

Twin Birch's cogeneration plant, which includes a set of new and a set of existing natural gas turbines, serves the electrical needs for the farm located in Skaneateles, NY. The new turbines and generators (50 kW contracted capacity) will receive production and capacity payments, while the existing (100 kW contracted capacity) will only receive maintenance incentives.

Four 30 kW Capstone micro-turbines makeup the existing set and two 30 kW Capstone micro-turbines make up the new set. The turbines are all located in the barn, adjacent to the digester building. All recovered heat is captured in the form of hot water and is used for digester heating.

Data Point Details

Data is logged at ***15-minute*** intervals by an Obvius AcquiSuite 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.

Twin Birch Existing Turbines

DG/CHP Generator Output (total kWh)
The Generator Output is calculated by subtracting data point M3 from M2. The difference between consecutive records is calculated for 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 calculated the same as above, by subtracting data point M3 from M2. Instead of accumulating the kWh data, the highest kWh / interval value is multiplied by the number of intervals per hour in order to calculate the peak hourly demand.

DG/CHP Generator Gas Input (cubic feet)
The Generator Gas Input is calculated by subtracting data point Sage 2 from Sage 1. This gas flow data is then summed into hourly data. This value represents total gas flow to both new and existing engines. There is no way to determine the flow to the new and existing turbines respectively

Total Facility Purchased Energy (total kWh)
No data

Total Facility Purchased Demand (peak kW)
No data

Other Facility Gas Use (cubic feet)
No data

Total Facility Energy (total kWh) and Total Facility Demand (peak kW)
No data

Unused Heat Recovery (total MBtu/h)
No data

Useful Heat Recovery (total MBtu/h)
No data

Status/Runtime of DG/CHP Generator (hrs)
A micro turbine is considered to be fully on over an interval if the generator output is greater than 5 kWh./ interval (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 interval data is then summed into hourly data for the online database. Since there are four engines the highest possible value is 4. This represents all generators were putting out above 5 kW per interval, for each for each interval during the hour.

Ambient Temperature (avg °F)
No data

Electrical Efficiency (%)
Calculated by dividing the Generator Output in BTU's by the Generator Gas Input in BTU's (biogas energy density of 600 btu/cf used). This calculated efficiency is lower than actual due to the fact that total gas flow is used (Existing and New turbine) while only the Existing Turbines power output is used.

* Combined Electrical Efficiency (WG new and WG existing) graph at end of document.

Total CHP Efficiency (%)
Same as electrical efficiency

Twin Birch New

DG/CHP Generator Output (total kWh)
The Generator Output comes from the data point M3. The difference between consecutive records is calculated for 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 comes from the same data point as above, M3. Instead of accumulating the kWh data, the highest kWh/ interval value is multiplied by the number of intervals per hour in order to calculate the peak hourly demand.

DG/CHP Generator Gas Input (cubic feet)
See Generator Gas Input for Twin Birch Existing above.

Total Facility Purchased Energy (total kWh)
No data

Total Facility Purchased Demand (peak kW)
No data
Other Facility Gas Use (cubic feet)
No data

Total Facility Energy (total kWh) and Total Facility Demand (peak kW)
No data

Unused Heat Recovery (total MBtu/h)
No data

Useful Heat Recovery (total MBtu/h)
No data

Status/Runtime of DG/CHP Generator (hrs)
A micro turbine is considered to be fully on over an interval if the generator output is greater than 5 kWh./ interval (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 interval data is then summed into hourly data for the online database. Since there are two micro-turbines the highest possible value is 2. This represents both generators were putting out above 5 kW per interval, for each for each interval during the hour.

Ambient Temperature (avg °F)
No data

Electrical Efficiency (%)
See Electrical Efficiency for Twin Birch Existing (above).

* Combined Electrical Efficiency (WG new and WG existing) graph at end of document.

Total CHP Efficiency (%)
See CHP Efficiency for Twin Birch Existing (above).

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.

Relational Checks

These checks are applied to the interval data before it is converted to hourly data. If any of the data points fails the relational check, the data for the entire hour is marked as failed.

Table 2. Relational Checks for Twin Birch Existing

Evaluated Point	Criteria	Result
FG	WG > 3 and FG <100	DQ Level for FG set to 2

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

Table 3. Relational Checks for Twin Birch New

Evaluated Point	Criteria	Result
N/A	-------	All points pass relational checks

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 4. Range Checks for Twin Birch Existing

Data Point	Hourly Data Method	Upper Range Check	Lower Range Check
DG/CHP Generator Output	Sum	165 kWh/hr	-5 kWh/hr
DG/CHP Generator Output Demand	Maximum	165 kW	-5 kW
DG/CHP Generator Gas Use	Sum	4,000 scf/hr	0 scf/hr
Total Facility Purchased Energy	Sum	-	-
Total Facility Purchased Demand	Maximum	-	-
Other Facility Gas Use	Sum	-	-
Unused Heat Recovery	Sum	-	-
Useful Heat Recovery	Sum	-	-
Status/Runtime of DG/CHP Generator	Sum	4 hr	0 hr
Ambient Temperature	Average	130°F	-30°F

Notes:

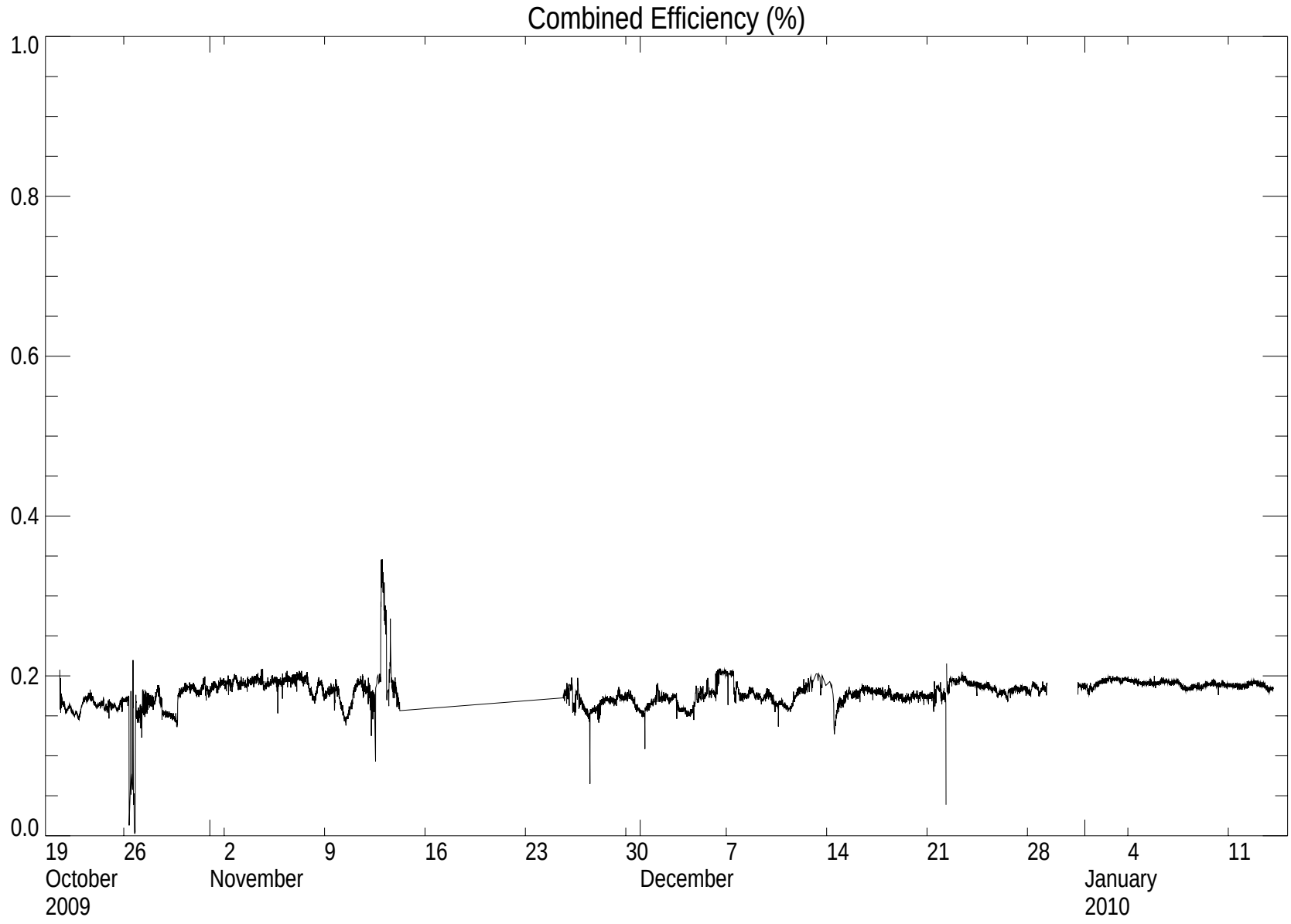
1. Data failing the Range Check has the data quality level set to 1 for “Data Exists”
2. Range checks are applied to interval data
3. This table contains the values from *range_checks.pro*

Table 5. Range Checks for Twin Birch New

Data Point	Hourly Data Method	Upper Range Check	Lower Range Check
DG/CHP Generator Output	Sum	10 kWh	-5 kWh
DG/CHP Generator Output Demand	Maximum	110 kW	-15 kW
DG/CHP Generator Gas Use	Sum	2,000 cf	0 cf
Total Facility Purchased Energy	Sum	60 kWh	0 kWh
Total Facility Purchased Demand	Maximum	2,000 kW	0 kW
Other Facility Gas Use	Sum	N/A	N/A
Unused Heat Recovery	Sum	N/A	N/A
Useful Heat Recovery	Sum	N/A	N/A
Status/Runtime of DG/CHP Generator	Sum	.25	0
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 the values from *range_checks.pro*


Combined Efficiency (%)
1.0
0.8
0.6
0.4
0.2
0.0
19
26
2
9
16
23
30
7
14
21
28
4
11
October
2009
November
December
January
2010