Harbec Plastics Data Integrator Notes

The CHP system at Harbec Plastics consists of 25 microturbines and a wind turbine. The microturbines are used primarily for base load and ran according to the amount of heat recovery that is necessary to offset chiller and boiler loads. The wind turbine has a maximum output of 250 kW. The data from Harbec Plastics is available from an Automated Logic Controller (ALC) webpage configured by Northern Development.

Data Point Details

The data for this site can be viewed through a web browser on graphical trends through the ALC system. The data can then be downloaded into text files. Out of the total number of data points available, only a small portion have trend data going back to the beginning of the system. The data points have different time stamps and they are organized into a 15-minute database by averaging, totalizing or taking the peak of the data within the preceding 15-minutes in the CDH database.

The data for this site is presented into databases. The first database represents facility and microturbine data. The second set represents wind turbine. When viewing the data, the databases are combined except if the option to "Plot Data by Monitoring Unit" is selected. The utility rate calculations and standardized reports use the combined database. The databases are separated because the site has two CHP fuel sources (natural gas for the microturbines and air for the wind turbine)

Details for Harbec Plastics Microturbines

DG/CHP Generator Output (total kWh)
The data for Generator Output comes from a 5-minute sample of the generator power output. The label for this data point is "TURBINE KW" in the downloaded data file from the ALC system. The data is converted to energy per interval (in kWh) and then summed into hourly data.

DG/CHP Generator Output Demand (peak kW)
The data for Generator Output comes from a 5-minute sample of the generator power output. The label for this data point is "TURBINE KW" in the downloaded data file from the ALC system. The maximum for a given hour is assigned to the hourly database.

DG/CHP Generator Gas Input (cubic feet)
The data for Generator Gas Input comes from a 5-minute for the gas flow through the Rochester Gas & Electric meter serving the turbines. The label for this data point is "GAS CFM" in the downloaded data file from the ALC system. The data is converted to energy data (in cubic feet) and is then summed into hourly data.

Total Facility Purchased Energy (total kWh)
The data for Facility Purchased Energy comes from a 5-minute sample of the utility import demand from the Rochester Gas & Electric meter. The label for this data point is "RGE KW" in

the downloaded data file from the ALC system. The data is converted to energy per interval (in kWh) and then summed into hourly data.

Total Facility Purchased Demand (peak kW)
The data for Facility Purchased Demand comes from a 5-minute sample of the utility import demand from the Rochester Gas & Electric meter. The label for this data point is "RGE KW" in the downloaded data file from the ALC system. The maximum for a given hour is assigned to the hourly database.

Other Facility Gas Use (cubic feet)
There is no suitable data available for this data point from the ALC system.

Total Facility Energy (total kWh) and Total Facility Demand (peak kW)
These two data points are the sum of the DG/CHP Generator Output and Total Facility Purchased data points.

Unused Heat Recovery (total MBtu/h)
There is no suitable data available for this data point from the ALC system.

Useful Heat Recovery (total MBtu/h)
The Useful Heat Recovery comes from a 5-minute sample of the turbine power output, turbine gas use and chp efficiency. The label for these data points are "TURBINE KW", "GAS CFM" and "TURBINE PLANT EFFICIENCY" in the downloaded data file from the ALC system. The heat recovery is calculated by assuming a higher heating value for natural gas of 1,030 Btu/cubic feet for natural gas. The turbine gas use is converted to Btus and multiplied by the turbine plant efficiency as a decimal. This yields the utilized heat content from the gas input. The power output of the turbine is converted to equivalent energy in Btus (3,413 Btus/kWh) and subtracted from the utilitized heat content, leaving the useful heat recovery. This 5-minute energy data is then summed into hourly data.

Status/Runtime of DG/CHP Generator (hrs)
The turbine status is estimated by taking the generator output and dividing by 25 kW for a fully on turbine. The result is then rounded down for the number of turbines fully on for that generator power reading. The number of turbines operating is then averaged for the interval into hourly data.

Ambient Temperature (avg °F)
The Ambient Temperature comes from a 10-minute sample for outdoor temperature. The label for this data point is "OAT Sensor" in the downloaded data file from the ALC system. The 10-minute sample temperatures are averaged into hourly data for the online database.

Total CHP Efficiency (%)
The Total CHP Efficiency comes from a 5-minute sample for the instantaneous CHP efficiency of the microturbine plant. The label for this data point is "TURBINE PLANT EFFICIENCY" in the downloaded data file from the ALC system. The 5-minute samples are averaged into hourly data for the online database.

Electrical Efficiency (%)
The Electrical Efficiency is calculated from the online hourly database as the DG/CHP Generator Output, converted from kWh to MBtus, divided by the DG/CHP Generator Gas Input. The gas input is converted to MBtus using the Lower Heating Value (LHV) of the fuel which is 0.930 MBtu/cubic foot (Natural Gas).

Details for Harbec Plastics Wind Turbine

DG/CHP Generator Output (total kWh)
The data for Generator Output comes from a 5-minute sample of the wind turbine output. The label for this data point is "WIND KW" in the downloaded data file from the ALC system. The data is converted to energy per interval (in kWh) and then summed into hourly data.

DG/CHP Generator Output Demand (peak kW)
The data for Generator Output comes from a 5-minute sample of the wind turbine output. The label for this data point is "WIND KW" in the downloaded data file from the ALC system. The maximum for a given hour is assigned to the hourly database.

DG/CHP Generator Gas Input (cubic feet)
There is no suitable data available for this data point from the ALC system.

Total Facility Purchased Energy (total kWh)
This data is included in the Harbec Plastics Microturbine database.

Total Facility Purchased Demand (peak kW)
This data is included in the Harbec Plastics Microturbine database.

Other Facility Gas Use (cubic feet)
There is no suitable data available for this data point from the ALC system.

Total Facility Energy (total kWh) and Total Facility Demand (peak kW)
These two data points are the sum of the DG/CHP Generator Output and Total Facility Purchased data points.

Unused Heat Recovery (total MBtu/h)
There is no suitable data available for this data point from the ALC system.

Useful Heat Recovery (total MBtu/h)
There is no suitable data available for this data point from the ALC system.

Status/Runtime of DG/CHP Generator (hrs)
The wind turbine varies the power output with the speed of the wind. The wind turbine is defined as operating if the power output is greater than 1 kW. When the power output exceeds 1 kW, a value of 0.25 is assigned for the wind turbine status and it is set to 0 otherwise. This status data is then summed into hourly data.

Ambient Temperature (avg °F)
The Ambient Temperature comes from a 10-minute sample for outdoor temperature. The label for this data point is "OAT Sensor" in the downloaded data file from the ALC system. The 10-minute sample temperatures are averaged into hourly data for the online database.

Total CHP Efficiency (%)
There is no suitable data available for this data point from the ALC system.

Electrical Efficiency (%)
There is no suitable data available for this data point from the ALC system.

Data Quality Checks

The Data Quality Checks consist of three levels of verification: does the data exist, does the data pass reasonable range checking and does the data pass relational checks. The methodology for applying the data quality begins by creating a contiguous database. This is necessary to maintain compatibility between the many sites on the server. Next, the data received for this site is fit into the database, in this case we are using 15-minute data. For any period where there is data, the data quality level is set to 3 for "Passes Relational Checks". We 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 which is uncorroborated by the rest of 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" or 1 for "Data Exists".

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 15-minute data before it is converted to hourly data. If any of the 15-minute data points fails the relational check, the data for the entire hour is marked as failed.

Table 2. Relational Checks for Harbec Plastics Microturbines

Evaluated Point	Criteria	Result
FG	WG > 0 and FG <= 0	DQ Level for FG set to 2

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

Table 3. Relational Checks for Harbec Plastics Microturbines

None

Range Checks

These checks are applied to the 15-minute data before it is converted to hourly data. If any of the 15-minute data points fails the range check, the data for the entire hour is marked as failed.

Table 4. Range Checks for Harbec Plastics Microturbines

Data Point	Hourly Data Method	Upper Range Check	Lower Range Check
DG/CHP Generator Output	Sum	150 kWh	0 kWh
DG/CHP Generator Output Demand	Maximum	600 kW	0 kW
DG/CHP Generator Gas Use	Sum	1,200 cubic feet	0 cubic feet
Total Facility Purchased Energy	Sum	150 kWh	-50 kWh
Total Facility Purchased Demand	Maximum	600 kW	-200 kW
Other Facility Gas Use	Sum	N/A	N/A
Unused Heat Recovery	Sum	N/A	N/A
Useful Heat Recovery	Sum	400 MBtu	0 MBtu
Status/Runtime of DG/CHP Generator	Sum	6.25 hrs	0 hrs
Ambient Temperature	Average	130°F	-30°F

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

Table 5. Range Checks for Harbec Plastics Wind Turbines

Data Point	Hourly Data Method	Upper Range Check	Lower Range Check
DG/CHP Generator Output	Sum	75 kWh	0 kWh
DG/CHP Generator Output Demand	Maximum	300 kW	0 kW
DG/CHP Generator Gas Use	Sum	N/A	N/A
Total Facility Purchased Energy	Sum	N/A	N/A
Total Facility Purchased Demand	Maximum	N/A	N/A
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	0.25 hrs	0 hrs
Ambient Temperature	Average	130°F	-30°F

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

ASERTTI Protocol Adherence

This site adheres partially to the ASERTTI Long-Term Monitoring Protocol. Data is provided in 15-minute intervals satisfying the protocol. The thermal energy recovered is not being reported directly and the inlet air temperature is not provided in the data. The only optional data received from the ALC system is the ambient temperature. There are many more data points available than are being used by the Data Integrator system.

Monitoring Notes

August 17, 2006

Data is downloaded from the ALC system for the first time. The data stretches back to October 2005.