Burrstone Energy Center, LLC, St. Lukes Hospital, Home, and Utica College Data Integrator Notes

The Burrstone Energy Center's cogeneration plant includes four engine-generators that serve the electrical services for three separate facilities near Burrstone Road in Utica, NY:

- Utica College,
- St Lukes Hospital,
- St. Lukes Home.

One 1100 kW engine serves the college, two 1100 kW units serve the hospital, and a 334 kW engine serves the home. All four engines are located in a new facility near the hospital's boiler house. Each engine includes a heat recovery steam generator (HRSG) as well as heat exchangers to transfer heat from the engine jacket water to meet hot water loads in the hospital. Steam from the HRSG offsets boiler steam loads, including summertime loads for a steam-driven absorption chiller (a new steam-fired chiller was recently installed). Engine jacket water heat is used to offset service hot water loads in the hospital facility as well as drive a newly installed hot-water driven 100 ton absorption chiller in Area 7. Dump radiators reject excess heat to ambient when the return water temperature entering the engine HX is too high.

Data Point Details

The data required has been made available at www.becchp.com. See table 4 for a list of data points. This server uses the Niagara Ax/Obix Framework, which is supplied by Tridium. Data are logged at 15-minute intervals and are averaged or totaled for that period.

The timestamp in the raw data files is in Eastern Standard Time. All graphical figures on the website are presented in Eastern Standard Time. Presenting data in Standard Time throughout the year is common practice for graphical time series plotting because it eliminates skipping an hour in April and duplicating an hour in October.

DG/CHP Generator Output (total kWh)
The data for Generator Output comes from the channels WCOL_GEN, WHSP_GEN, and WHOM_GEN (kW). This power data is converted into kWh and summed across each hour.

DG/CHP Generator Output Demand (peak kW)
The Generator Output Demand comes from the channels WCOL_GEN, WHSP_GEN, and WHOM_GEN (kW). The highest value from the 15-minute data during an hour is used for the Output Demand in the online database.

DG/CHP Generator Gas Input (cubic feet)
The data for Generator Gas Input comes from the channel FG (cf/h). The data is averaged into hourly data for the online database.

Total Facility Purchased Energy (total kWh)
The data for Facility Purchased Energy comes from the channels WCOL, WHSP1, WHSP2, and WHOM (kW). These channels are converted to kWh and summed across each hour.

Total Facility Purchased Demand (peak kW)
The data for Facility Purchased Demand comes from the channels WCOL, WHSP1, WHSP2, and WHOM (kW). The channels are added together for each 15 minute interval and the maximum value is used for each hour.

Other Facility Gas Use (cubic feet)
There is no data available for this point.

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)
The Unused Heat Recovery comes from the channels QRW and QDS (MBtu). They represent the rejected heat recovery from hot water and steam respectively. The channels are summed across each hour.

Useful Heat Recovery (total MBtu)
The Useful Heat Recovery comes from the channels FSCG (lb/h), FW (gpm), TL, and TE (F). FSCG is converted to MBtu/h using 1.0194 Mbtu/lb. The heat transfer on the hot water side is calculated:

$.5 * FW * (TL - TE) = Q$ (Mbtu/h)

Both channels are converted to Mbtu and summed across each hour.

Status/Runtime of DG/CHP Generator (hrs)
The 3 1100 kW generators are defined as being fully on for a 15-minute interval if the generator output is greater than 400 kW for the period (the fully-loaded capacity is 1100 kW). The smaller generator uses 100 kW as a set point. The status for each 15 minute interval is increased by .25 for each unit that is active. The 15-minute data is then summed into hourly data for the online database.

Ambient Temperature (avg °F)
The data for Ambient Temperature comes from the channel TAO. The data point obtained represents the average temperature for each day. The temperature reading is spread across the day as hourly data.

Total CHP Efficiency (%)
The Total CHP Efficiency is calculated from the online hourly database as the sum of the Useful Heat Recovery and 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).

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).

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".

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 Arrow Linen

Evaluated Point	Criteria	Result
FG	WG > 100 and FG <=0	DQ Level for FG set to 2
QHR	WG > 100 and QHR <=0	DQ Level for QHR set to 2

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

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 3. Range Checks for Burrstone

Data Point	Hourly Data Method	Upper Range Check	Lower Range Check
DG/CHP Generator Output	Sum	1250 kWh	-98 kWh
DG/CHP Generator Output Demand	Maximum	5000 kW	-98 kW
DG/CHP Generator Gas Use	Average	50000 cubic feet/hour	-98 cubic feet
Total Facility Purchased Energy	Sum	1500 kWh	-600 kWh
Total Facility Purchased Demand	Maximum	6000 kW	-600 kW
Other Facility Gas Use	Sum	N/A	N/A
Unused Heat Recovery	Sum	40000 MBtu	-98 MBtu
Useful Heat Recovery	Sum	40000 MBtu	-98 MBtu
Status/Runtime of DG/CHP Generator	Sum	1 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 fully to the ASERTTI Long-Term Monitoring Protocol. All required performance parameters are provided. The data is averaged and summed into 15-minute intervals as per the protocol. In addition, most of the optional parameters are available at this site.

Table 4. CDH and TBS point names.

CDH ID	TBS Server ID
TAO	Local Outside Dry Bulb
FG1	CG-1 Gas Flow F-2
FG2	CG-2 Gas Flow F-3
FG3	CG-3 Gas Flow F-4
FG4	CG-4 Gas Flow F-5
FG	Cog Plant Gas Flow F-1
FGB	Boiler Plant Hourly Gas Usage
FW1	CG-1 Water Flow H-1
FW2	CG-2 Water Flow H-2
FW3	CG-3 Water Flow H-3
FW4	CG-4 Water Flow H-4
FW	Cog Plant Water Flow H-5
FW7	Area 7 H-6 Flow
FS1	CG-1 Steam Flow S-1
FS2	CG-2 Steam Flow S-2
FS3	CG-3 Steam Flow S-3
FS4	CG-4 Steam Flow S-4
FSCG	Steam Condenser Steam Flow S-5
FST	Boiler Steam S-6
PS	Boiler Steam SP-2
TH1	CG-1 Sec ENT Temp TE-106
TH2	CG-2 Sec ENT Temp TE-206
TH3	CG-3 Sec ENT Temp TE-306
TH4	CG-4 Sec ENT Temp TE-406
TL1	CG-1 Sec LVG Temp TE-107
TL2	CG-2 Sec LVG Temp TE-207
TL3	CG-3 Sec LVG Temp TE-307
TL4	CG-4 Sec LVG Temp TE-407
TE1	CG-1 Loop ENT Temp TE-113B
TE2	CG-2 Loop ENT Temp TE-213B
TE3	CG-3 Loop ENT Temp TE-313B
TE4	CG-4 Loop ENT Temp TE-413B
TL	Cog Plant Loop Lvg Temp TE-601
TE	Cog Plant Loop Ent Temp TE-602
TL7	Area 7 TE-619 A7 LVG Loop Temp
TE7	Area 7 TE-618 A7 ENT Loop Temp
WCOL	College Utility Demand Total
WCOL_im	College Utility kWH Import
WCOL_ex	College Utility kWH Export
WCOL_gen	College Genset Demand Total
WCOL_gen_ex	College Genset kWH Export
WCG1	College CG-1 Total kW
WCG1_cum	College CG-1 kWH Produced

CDH ID	TBS Server ID
WHSP1	Hosp Util 1 Demand Total
WHSP1_im	Hosp Util 1 kWH Import
WHSP1_ex	Hosp Util 1 kWH Export
WHSP2	Hosp Util 2 Demand Total
WHSP2_ex	Hosp Util 2 kWH Export
WHSP2_im	Hosp Util 2 kWH Import
WHSP_gen	Hospital Genset Demand Total
WHSP_gen_ex	Hospital Genset kWH Export
WCG2	Hospital CG-2 Total kW
WCG2_cum	Hospital CG-2 kWH Produced
WCG3	Hospital CG-3 Total kW
WCG3_cum	Hospital CG-3 kWH Produced
WHOM	Home Utility Demand Total
WHOM_im	Home Utility kWH Import
WHOM_ex	Home Utility kWH Export
WHOM_gen	Home Genset Demand Total
WHOM_gen_ex	Home Genset kWH Export
WCG4_cum	Home CG-4 kWH Produced
WCG4	Home CG-4 Total kW
QDW1	CG-1 HW Heat Rej 15 Min
QDW2	CG-2 HW Heat Rej 15 Min
QDW3	CG-3 HW Heat Rej 15 Min
QDW4	CG-4 HW Heat Rej 15 Min
QRW1	CG-1 HW Heat Prod 15 Min
QRW2	CG-2 HW Heat Prod 15 Min
QRW3	CG-3 HW Heat Prod 15 Min
QRW4	CG-4 HW Heat Prod 15 Min
QUW1	CG-1 HW Heat Add 15 Min
QUW2	CG-2 HW Heat Add 15 Min
QUW3	CG-3 HW Heat Add 15 Min
QUW4	CG-4 HW Heat Add 15 Min
QRS1	CG-1 Steam Heat Add 15 Min
QRS2	CG-2 Steam Heat Add 15 Min
QRS3	CG-3 Steam Heat Add 15 Min
QRS4	CG-4 Steam Heat Add 15 Min
QUW	Cog Plant HW Heat Add 15 Min
QRW	Cog Plant HW Heat Rej 15 Min
QUS	Cog Plant Steam Heat Add 15 Min
QDS	Cog Plant Steam Heat Rej 15 Min
QUT	Cog Plant Total Heat Add 15 Min

Monitoring Notes

8/10/2011

The three Burrstone sites were originally posted as separate facilities. They have now been combined into one facility. The checks and points used to supply data for this facility are different than the points used on the original three sites. Some points are now obtained from meters that take readings based on the combined output of all four generators rather than each individually. The power readings are used for Generator Output and Total Facility Purchased Energy due to issues with the data provided by the accumulators for those points.