Joachim Site - Data Integrator Notes

St. Joachim and Anne is a nursing home and rehabilitation center located in on Coney Island. The CHP system includes three (3) 100-kW InVerde Engine Units from Tecogen that use permanent magnet generators with 480 VAC inverters to provide power output. The engines are capable of providing 125 kW peak and 100 kW continuous. The inverters, oil coolers, and associated electronics have their own small cooling loop and dry cooler (FLC/CT-1, 2, 3). A heat rejection loop from the engine jacket and exhaust heat exchanger is the primary source of thermal output.

Data Point Details

The ALC control system will be used transfer 15-minute data to CDH each night by email. The ALC system will be setup to email the data listed in Table 4 at a regular time each night as a time-stamped CSV file.

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 WT_KW. Presently the assumed channel based on the monitoring plan for generator power and utility import is reversed. This is resolved within the data processing. The power is given as a rate, which is converted to a 15-minute quantity and summed across each hour.

DG/CHP Generator Output Demand (peak kW)
The Generator Output comes from the data channel called WT_KW. Presently the assumed channel based on the monitoring plan for generator power and utility import is reversed. This is resolved within the data processing. The power is given as a rate, which has the maximum value taken across each hour.

DG/CHP Generator Gas Input (cubic feet)
The Generator Gas Input comes from the data channel called FG_H. This data is the hourly rate of gas flow. It is averaged across each hour.

Total Facility Purchased Energy (total kWh)
The Total Facility Purchased Energy comes from the data channel called WG_KW. Presently the assumed channel based on the monitoring plan for generator power and utility import is reversed. This is resolved within the data processing. The power is given as a rate, which is converted to a 15-minute quantity and summed across each hour.

Total Facility Purchased Demand (peak kW)
The Total Facility Purchased Demand comes from the data channel called WG_KW. Presently the assumed channel based on the monitoring plan for generator power and utility import is reversed. This is resolved within the data processing. The power is given as a rate, which has the maximum value taken across each hour.

Other Facility Gas Use (cubic feet)
No data

Unused Heat Recovery (total MBtu/h)
The flow rate, supply temperature, and return temperature of the cogen water loops (FM1,TCLR,TCLR2), are used to determine the amount of heat which is rejected from the system. This is determined as a rate and is averaged across the hour.

QD = k * FM1 * (TCLR – TCLR2)

k = .464

Useful Heat Recovery (total MBtu/h)
The flow rate, supply temperature, and return temperature of the cogen water loops (FM1, TCLS, TCLR), are used to determine the amount of heat which is recovered from the system. This is determined as a rate and is averaged across the hour.

QHR = k * FM1 * (TCLS – TCLR)

k = .464

Status/Runtime of DG/CHP Generator (hrs)
This is determined based on the value of WT_KW. If the power is greater than 75kW for an interval, the status is set to .25. The status is then summed across an hour.

Ambient Temperature (avg °F)
The Ambient temperature comes from the raw data file. 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 927 btu/cf. The expected efficiency should range from 30–45%.

Total CHP Efficiency (%)
The Total CHP Efficiency is calculated by dividing the Generator Output and Useful Heat Recovery by the Generator Gas Input. The lower heating value of natural gas used is 927 btu/cf and the expected efficiency should range 75–90%.

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 > 50 and FGE<=0	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	150 kWh	0 kWh
DG/CHP Generator Output Demand	Maximum	600 kW	0 kW
DG/CHP Generator Gas Use	Average	5000 cf	0 cf
Total Facility Purchased Energy	Sum	300 kW	0 kW
Total Facility Purchased Demand	Maximum	1200 kW	0 kW
Other Facility Gas Use	Sum	-	-
Unused Heat Recovery	Average	6000 Mbtu	0 MBtu
Useful Heat Recovery	Average	6000 MBtu	-500 MBtu
Ambient Temperature	Average	120°F	-30°F

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

Table. 4 File Headings

CDH ID	File Header Version 1	File Header Version 2	File Header Version 3
WT_ACC	MDP Energy (kWh)	MDP Energy (kWh)	MDP Energy (kWh)
WT_KW	MDP Power (kW)	MDP Power (kW)	MDP Power (kW)
WG_ACC	CGDP Power (kWh)	CGDP Power (kWh)	CGDP Power (kWh)
WG_KW	CGDP Power (kW)	CGDP Power (kW)	CGDP Power (kW)
WP_ACC	WP_ACC (kWh)	WP_ACC (kWh)	WP_ACC (kWh)
WP_KW	WP_KW Misc Cogen Loads (kW)	WP_KW Misc Cogen Loads (kW)	WP_KW Misc Cogen Loads (kW)
FG	Engines Gas Use	Engines Gas Use	Engines Gas Use
FG_H			Engine Gas Use Per Hour
FM1	Engines Flow (GPM)	Engines Flow (GPM)	Engines Flow (GPM)
TCLS	Engine Supply (CGWS Temp)	Engine Supply (TCLS Temp)	Engine Supply (TCLS Temp)
TCLR	Engine Return (CGWR Temp)	Engine Return (TCLR)	Engine Return (TCLR)
TCLR2			After Dump Temperature
FM3	Main CGP Flow	Main CGP Flow	Main CGP Flow
TM1	Main CGWS Temp	TM1 Main Loop Supply	TM1 Main Loop Supply
TM2		TM2 Main Loop After Chiller	TM2 Main Loop After Chiller
TM3		TM3 Main Loop Return	TM3 Main Loop Return
TAO	OA Temp	OA Temp	OA Temp
SP5	CGP-5 Speed	CGP-5 Speed	CGP-5 Speed
SP6	CGP-6 Hz	CGP-6 Hz	CGP-6 Hz
SF1		Dry Cooler Fan 1 Status	Dry Cooler Fan 1 Status
SF2		Dry Cooler Fan 2 Status	Dry Cooler Fan 2 Status
SF3		Dry Cooler 3 Fan Status	Dry Cooler 3 Fan Status
SF4		Dry Cooler 4 Fan Status	Dry Cooler 4 Fan Status
SF5		Dry Cooler 5 Fan Status	Dry Cooler 5 Fan Status
TER1		CG-1 Inlet Temperature	CG-1 Inlet Temperature
TER2		CG-2 Inlet Temperature	CG-2 Inlet Temperature
TER3		CG-3 Inlet Temperature	CG-3 Inlet Temperature
SP7		CGP-7 Status	CGP-7 Status
SP8		CGP-8 Status	CGP-8 Status
TBS		Boiler Water Supply Temperature	Boiler Water Supply Temperature
TBR		Boiler Water Return Temperature	Boiler Water Return Temperature
TES1			CG-1 Outlet Temperature
TES2			CG-2 Outlet Temperature
TES3			CG-3 Outlet Temperature
SVHW			Hot Water Bypass Valve
SVCH			Chiller Bypass Valve

Joachim

Site Notes:

6/29/2011:
Site verification was completed. See Addendum for details

7/5/2011:
The data has been posted on the website.