## *New York Presbyterian Hospital Site - Data Integrator Notes*

New York Presbyterian Hospital consists of a 7.5 MW cogeneration plant connected to the high-tension service distribution system. The system consists of a gas turbine generator, duct burner and heat recovery steam generator. The generator is a Taurus 70-T10301S St., natural gas fuel turbine generator from Solar Gas Turbines.

## Data Point Details

Norgen Consulting Group logs data at 15-minute intervals. 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.

DG/CHP Generator Output (total kWh)
The Generator Output comes from the columns labeled "Generator Output KWH" and "Parasitic Load KWH" in the data files from Norgen. The generator output minus the parasitic load is displayed as the total generator output. This 15-minute interval energy data is summed into hourly data.

DG/CHP Generator Output Demand (peak kW)
The Generator Output Demand comes from the columns labeled "Generator Output KWH" and "Parasitic Load KWH" in the data files from Norgen. The generator output minus the parasitic load is displayed as the total generator output. The generator output is then multiplied by the data interval to determine the demand. The maximum for each hourly period is used as the demand from the generator.

DG/CHP Generator Gas Input (cubic feet)
The data for Generator Gas Input comes from the data point "Gas to Turbine Therms" in the data files from Norgen. This data is provided in therms for each 15-minute interval. It is converted into standard cubic feet of gas using the higher heating value and summed into hourly data. This data does not include the fuel used by the duct burners.

Total Facility Purchased Energy (total kWh)
TheTotal Facility Purchased Energy comes from the column labeled "Utility Supplied Power KWH" in the data files from Norgen. This 15-minute interval energy data is summed into hourly data.

Total Facility Purchased Demand (peak kW)
The Total Facility Purchased Demand comes from the column labeled ""Utility Supplied Power KWH" in the data files from Norgen. The Total Facility Energy is then multiplied by the data interval to determine the demand. The maximum for each hourly period is used as the demand from the generator.

Other Facility Gas Use (cubic feet)
No data

Unused Heat Recovery (total MBtu/h)
No data

Useful Heat Recovery (total MBtu/h)
The Useful heat Recovery is obtained from the columns of data labeled "Steam from HRSG Kbtu" in the files obtained from Norgen. These points are provided in units of kbtu. This 15-minute data is summed into hourly data. Steam can be produced from both exhaust heat recovery and the duct fired burner (but duct burner fuel is not measured)

Status/Runtime of DG/CHP Generator (hrs)
The generator is defined as being fully on for a 15-minute interval if the generator output is greater than 200 kWh / interval (the fully-loaded capacity is 1875 kWh / interval). The status is given a value of 0.25 if the generator output is above 200 kWh. The 15-minute data is then summed into hourly data for the online database.

Ambient Temperature (avg °F)
The Ambient temperature comes from the column of data labeled "Ambient Temperature DegF" in the files from Norgen. 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 930 btu/cf. The expected efficiency should range from 20%-30%.

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 930 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 > 200 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 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**

| Data Point | Hourly Data Method | Upper Range Check | Lower Range Check |
|---|---|---|---|
| DG/CHP Generator Output | Sum | 1875 kWh | -50 kWh |
| DG/CHP Generator Output Demand | Maximum | 7500 kW | -50 kW |
| DG/CHP Generator Gas Use | Sum | 250000 cf | 0 cf |
| Total Facility Purchased Energy | Sum | 2750 kWh | 0 kWh |
| Total Facility Purchased Demand | Maximum | 11000 kW | 0 kW |
| Other Facility Gas Use | Sum | - | - |
| Unused Heat Recovery | Sum | - | - |
| Useful Heat Recovery | Sum | 20000 kbtu | 0 kbtu |
| Ambient Temperature | Average | 130°F | -30°F |

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

## Site Notes:

12/14/09:
The data has been posted on the website.

3/12/2011

Previously, we had mistakenly included the "Air Cooling Kbtu" in the Useful Heat Recovery. The useful heat recovery now only includes the Steam from the HRSG

The gas was formerly assumed to be in BTU based on lower heating value. We have now changed it to be based on higher heating value.