

## ***Price Chopper Site - Data Integrator Notes***

The PureCell 400 fuel cell is installed behind the supermarket. The fuel cell (FC) has separate electrical feeds for parallel operation with the utility or to provide backup power when isolated from the grid. The fuel cell is able to provide 400 kW of electrical power and up to 1.7 million Btu/h of heat. If fully utilized, the full cell can obtain a thermal efficiency near 90%.

### **Data Point Details**

The monitoring system is based around the Obvius AcquiSuite data logger. The layout of the EMS and the connections with other network components of the Fuel Cell system are shown in **Error! Reference source not found.** A Babel Buster gateway device reads MODBUS data from the PPC and Shark power meters and makes that data available to the Obvius data logger. All data is collected as 1 minute data and converted to hourly data.

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 WFCCUM. This is an accumulator for the generator output. The difference between consecutive intervals is used to determine the output for each hour.

#### DG/CHP Generator Output Demand (peak kW)

The Generator Output Demand comes from the data channel called WFC. This channel is averaged across each 15-minute period to determine the demand. The maximum value for each hour is then taken.

#### DG/CHP Generator Gas Input (cubic feet)

The data for Generator Gas input comes from the data channel labeled FG. This channel provides the fuel flow rate in kg/hour and is converted into standard cubic feet and averaged to determine the quantity of fuel used for each hour.

#### Total Facility Purchased Energy (total kWh)

The Total Facility Purchased Energy comes from the data channel labeled WT\_WREC\_POS. This is an accumulator for the facility import. The difference between consecutive intervals is used to determine the import amount for each hour.

#### Total Facility Purchased Demand (peak kW)

The Total Facility Purchased Demand comes from the data channel labeled WT\_WDREC. This channel is averaged across each 15-minute period to determine the demand. The maximum value for each hour is then taken.

#### Other Facility Gas Use (cubic feet)

No data

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### Unused Heat Recovery (total MBtu/h)

The flow rate, supply temperature, and return temperature of the cooling water loop, (FCW,TCWS,TCWR), are used to determine the amount of heat which is rejected from the system. This is determined as a rate which is averaged across the hour.

### Useful Heat Recovery (total MBtu/h)

The flow rate, supply temperature, and return temperature of the high and low grade water loop, (FH,THS,THR and FL,TL,TLR), are used to determine the amount of heat which is rejected from the system. This is determined as a rate which is averaged across the hour.

### Status/Runtime of DG/CHP Generator (hrs)

The channel labeled as RTIME provides the generator status. This is an accumulator for the generator status. The difference between consecutive intervals is used to determine the status for each hour.

### Ambient Temperature (avg °F)

The Ambient temperature comes from the Weather Underground using the ALB airport as a reference location. 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 30%-40%.

### 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**

<b>Data Quality Levels</b>	<b>Description</b>	<b>Definition</b>
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**

<b>Evaluated Point</b>	<b>Criteria</b>	<b>Result</b>
FG	WG > 25 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**

<b>Data Point</b>	<b>Hourly Data Method</b>	<b>Upper Range Check</b>	<b>Lower Range Check</b>
DG/CHP Generator Output	Sum	125 kWh	0 kWh
DG/CHP Generator Output Demand	Maximum	500 kW	0 kW
DG/CHP Generator Gas Use	Sum	90 cf	0 cf
Total Facility Purchased Energy	Sum	400 kWh	0 kWh
Total Facility Purchased Demand	Maximum	2000 kW	0 kW
Other Facility Gas Use	Sum	-	-
Unused Heat Recovery	Average	3000 Mbtu	0 MBtu
Useful Heat Recovery	Average	3000 MBtu	0 MBtu
Ambient Temperature	Average	130°F	-30°F

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

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**Site Notes:**

5/11/10:

The data has been posted on the website.

3/18/2011:

Modified the range for Generator gas use on 5/14/10.