ERSD Fuel Cell Long Term Monitoring Plan.

Overview

The East Rochester School District CHP (Combined Heat and Power) System consists of one 200 KW phosphoric acid fuel cell (PAFC) manufactured by UTC Power Corporation. The system provides for synchronous parallel operation and is capable of providing backup power if utility grid power is lost. Waste heat is recovered and used to support domestic hot water and the hot water heating system.

System Schematic

Drawing # M2.1 Power Module Flow Diagram
Simplified and modified to include electrical components.

Power generating Equipment

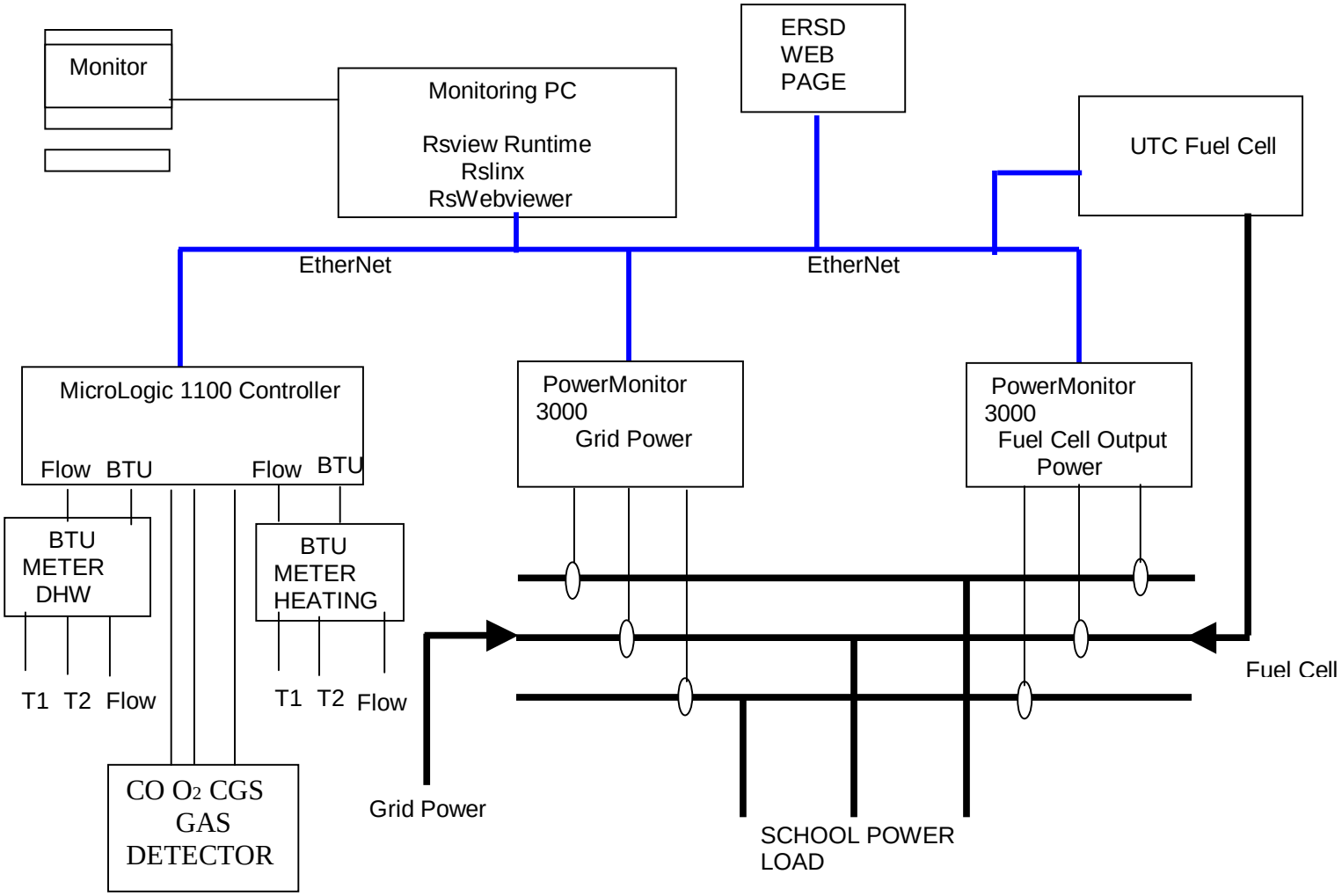
A. General performance Characteristics
    1. Rated capacity 200KW/235KVA
    2. Steady state operating range 0 to 200 KW
    3. Voltage and frequency 480/277, 60 Hz, 3 phase, 3 or 4 wire
    4. Fuel consumption, Natural gas: 2050scft/hr
    5. Efficiency on LHV basis shall be at least:
        a. 37% Electrical
        b. 50% Thermal
        c. 86% Total
    6. Typical emissions levels, based on Factory Testing(15%O2,Dry) are:
        a. NOx < 1ppmv
        b. SOx < 1ppmv
        c. Particles < 1ppmv
        d. COx < 2ppmv
        e. Non-Methane Hydrocarbons < 1ppmv
        f. Smoke = 0.0ppmv
    7. Total Noise shall be less than 60 dba at a distance of 30 feet in open space
    8. Thermal capacity:
        a. Up to 925000 Btu/hr @ 140 F (at rated power)
        b. High heat option: up to 475,000 Btu/hr @250 F and up to 450,000 Btu/hr @ 140 F (at rated power)

Monitoring System

Detailed system performance data will be automatically collected at 15-minute intervals and logged locally for one day. At the end of the data collection cycle the data files will be automatically transferred through File Transfer Protocol (FTP) to the New York State Energy Research and Development Agency (NYSERDA) website maintained by CDH Energy for online analysis and report generation. The data will include natural gas consumption, fuel cell power output, facility power use (the combination of grid power use and fuel cell output), heat recovery rates for domestic hot water and Heating. The equipment used to capture this data will be:

1. Two Allen-Bradley Power Monitor 3000
    a. Grid Power
    b. Fuel Cell Output power
2. Two Niagara 7431 BTU Meters
    a. Domestic hot water
    b. Heating water
3. Allen-Bradley MicroLogic 1100 Programmable Logic Controller
4. Personal Computer With Rsview32 Fuel cell Application.
    a. Application program written by UTC for acquiring fuel cell data. Runtime license supplied by UTC.
    b. Modifications to UTC application program to include power and BTU meter data collection.(Modifications programmed by ATSI)
        1. Overview screen to show full system
        2. Data collection Screen
        3. Data Logging and FTP programming

Monitoring System Schematic



Data Collection System

The data collection system will consist of a computer running Allen Bradley RsView, programmed to collect the data from various instruments and the fuel cell via Ethernet IP. The RsView will also be programmed as a graphical user interface where screens representing the fuel cell and heat recovery process may be observed. Installing an additional program called RsWebviewer will enable access to the display screens through the East Rochester School Districts web site.

Data Point Details

The data is collected and presented to Connected Energy in the form of comma-separated value (CSV) files. There is one file for each day. Each file contains 15-minute timestamp intervals of required data points. The required data includes generator power output, fuel input, facility power use and heat recovery rates.

Generator Power Output (KW)

The power output will be measured using an Allen-Bradley 3000 power meter. The power meter will be connected to the output line of the fuel cell just prior to facility's main distribution panel. This will measure the fuel cell contribution to the total facility power usage. The meter data will be sampled every minute and then averaged for each 15-minute time period. The averaged readings will then be entered into the data-logging file.

Grid Power (KW)

The Rochester Gas and Electric grid will provide facility power demand in excess of what is supplied by the fuel cell. A second Allen-Bradley 3000 power meter will be connected to the incoming electric grid feed just prior to the facility's main distribution panel. The meter data will be sampled every minute and then averaged for each 15-minute time period. The averaged readings will then be entered into the data-logging file.

Total Fuel Consumed (Cu Ft)

The fuel cell natural gas usage will be extracted from the fuel cell control system at 15-minute intervals. The readings acquired from the fuel cell are cumulative values. The sampled data will be subtracted from the previous reading to give actual fuel consumed for the 15-minute time interval. This value will then be entered to the data-logging file.

Boiler Heat Recovery (BTU)

The useful heat recovered from the fuel cell by the facility's boiler heating system is measured with a Niagara 7431 BTU meter. This meter measures the difference in water temperature and flow through the supply and return lines of the heating system. The meter has a pulsed output fed into an Allen-Bradley micrologix 1100 PLC. The PLC collects the pulsed data and manipulates the data into a useful form for logging. The reading will be averaged over a 15-minute time interval and the averaged value will be entered into the data-logging file.

Domestic Hot Water Heat Recovery (BTU)

The useful heat recovered from the fuel cell by the facility's domestic hot water is measured with a Niagara 7431 BTU meter. This meter measures the difference in water temperature and flow through the supply and return lines of the DHW system. The meter has a pulsed output fed into an Allen-Bradley micrologix 1100 PLC. The PLC collects the pulsed data and manipulates the data into a useful form for logging. The reading will be averaged over a 15-minute time interval and the averaged value will be entered into the data-logging file.

Functionality

The main function of the data collection and monitoring is automatic data collection and transmission of required data to the New York State Energy Research and Development Agency (NYSERDA) website. The system will also have the capability of linking to the East Rochester School District web site where fuel cell status and operation can be displayed. The system provides expansion capabilities that will enable future monitoring needs to be added. An example of this expansion is to provide remote gas detection system readings to make sure the fuel cell room is safe to enter in case of a gas safety alarm. The system also provides educational opportunities to monitor fuel cell data and operation from the classroom and can be a process control-teaching tool.