MEASUREMENT AND VERIFICATION PLAN

EAST IRONDEQUOIT CENTRAL SCHOOL DISTRICT
EASTRIDGE HIGH SCHOOL

DISTRIBUTED GENERATION/COMBINED COOLING, HEATING, AND POWER (DG/CCHP) SYSTEM

SEPTEMBER 28, 2010

SUBMITTED TO:

NEW YORK STATE ENERGY RESEARCH AND DEVELOPMENT AUTHORITY
17 COLUMBIA CIRCLE
ALBANY, NY 12203-6399

SUBMITTED BY:

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Owner: East Irondequoit Central School District
Engineer: Clark Patterson Lee
Site: Eastridge High School
2350 East Ridge Road
Rochester, NY 14622

Project Overview

Clark Patterson Lee is the architect/engineer for the East Irondequoit CSD 2009 Generations project (The Project). This project involves renovations and additions to several District schools, including Eastridge High School. Currently, Eastridge is a 202,888 s.f. grade 9-12 high school with a student population of approximately 1,000.

The Project involves the demolition of an existing natatorium and gymnasium, and the construction of a new natatorium, gymnasium, fitness center, locker rooms, and classrooms, for a total school size of 240,888 s.f.

The site is currently supplied with electric and gas service from Rochester Gas & Electric Corp. Without supplemental (non-utility) power, the size of the new addition would require a utility service upgrade to accommodate the increased electric demand.

System Description

The proposed co-generation (co-gen) system is a combined cooling, heat, and power (CCHP) system using five (5) 65kW microturbines. The basis-of-design system is the UTC Power Pure Comfort Solution Model 325M CARB. (The CARB suffix indicates the "low emissions" option). The electricity generated by the co-gen system will supplement the existing utility provided electrical power, and also be used for emergency power. The waste heat from the microturbine exhaust is captured to power an absorption chiller that provides heating and cooling capacity to specific building HVAC and plumbing systems.

- The heating potential of the absorption chiller will be one component of the overall heating system, and also provides domestic and pool water heating. The heating capacity of the absorption chiller is supplemented by a high-efficiency condensing boiler and a steam-to-hot water heat exchanger.
- The cooling potential of the absorption chiller is the sole cooling source for the facility.
- The system controls will allow cooling to take priority over heating.

In the absence of the CCHP system, The Project would require greater boiler capacity, an electric chiller, an electrical service upgrade, and a separate emergency power system. The boiler system is being replaced as part of The Project, but the new boiler system will have less capacity than if the CCHP system was not included in the design.

The advantages to the CCHP system are to provide on-site power generation in parallel with the utility power, and heating and cooling potential, without the need to increase the capacities of the existing building systems.

The operation of the individual microturbines is based on the building thermal loads. The microturbines will be operated in a thermal load-following manner.

Equipment Description

Prime Mover		UTC Power Pure Comfort Solution Model 325M CARB (5) 65kW Microturbines 325 kW Gross Power Output (power mode only) 310 kW Net Power Output (power mode only) 3,825 MBH LHV Natural Gas Consumption
Absorption Chiller		
59 deg. F Ambient Temp.	Cooling	182 Tons (cooling priority)
	Heating	1,306 MBH
Facility		Eastridge High School Grades 9-12 Approx. 1,000 student population 240,888 s.f. 1,200 Amp, 277/480 Volt utility electric service 4" NPS high-pressure utility natural gas service On-site power production will parallel utility service On-site power will be used for emergency power One electric meter and one gas meter

Data Collection and Monitoring

All system data will be monitored and logged into a comprehensive Andover building management system. All log files will be recorded in 15 minute intervals as required by NYSERDA. The information will be automatically transferred via an ASCII file to a designated secure FTP site after each 24-hour period.

The following devices and instruments will be used to collect the project data:

ID	Control Point	Units	Manufacturer	Model No.
W1	Microturbine Net Power Output	kWh	Veris	H8043-0800-4
W2	Utility Power	kWh	Utility Company	Auxiliary Pulse Output
T1	HHW Supply Temp.	F	Greystone	TE200CGS020
T2	HHW Return Temp.	F	Greystone	TE200CGS020
F1	HHW Flow Rate	gpm	Yokogawa	AFX100 4" Mag Meter
T3	CHW Supply Temp.	F	Greystone	TE200CGS020
T4	CHW Return Temp.	F	Greystone	TE200CGS020
F2	CHW Flow Rate	gpm	Yokogawa	AFX100 6" Mag Meter
F3	Natural Gas Flow Rate	cu. ft.	FCI	ST51-3F12FM00
T5	Microturbine Exh. Temp.	F	Kele	TT111H-0800
DV	Diverter Valve Position	%	Carrier	From data interface
T6	Ambient Temperature	F	Greystone	TE200ADGS016

Primary Monitoring Objectives

No.	Objective	Data Required
1	Quantify the variation of DG/CCHP system power output, gas consumption, and efficiency over a wide range of annual operating conditions	W1, F3, T6
2	Quantify external parasitic loads	The only parasitic loads are the microturbine gas packs. The net power output of the microturbines (W1) includes the parasitic load reduction.
3	Quantify the daily, weekly, monthly, and annual variation of utility power so that actual utility costs can be determined.	W2
4	Determine the thermal loads supplied to the facility from the CCHP system. Quantify the variation of these loads with ambient conditions and operating schedules.	T1, T2, T3, T4, F1, F2, T6
5	Quantify the amount of available thermal energy that is unused by the CCHP system.	DV, T1, T2, T3, T4, F1, F2, T6, W1

The electrical output of the microturbines shall be measured with an H 8043-0800-4 Veris Kilowatt Hour Meter.

The net microturbine power output will include the parasitic gas pack load reduction. The natural gas input to the turbines shall be measured by a single FCI ST51-3F12FM00 mass flow meter.

The thermal output of the absorption chiller will be determined from the flow and temperature difference of both the heating hot water and chilled water systems. The system will operate to generate chilled water as the priority mode. The data logger will integrate these readings every ten seconds to determine the thermal output.

The position of the diverter valve (damper) will be monitored through a data interface to the CCHP Microprocessor Control System and evaluated against the overall microturbine power output and thermal output. This will help in quantifying the unused thermal energy by comparing these results vs. durations when the diverter valve is 100% closed to the atmosphere.

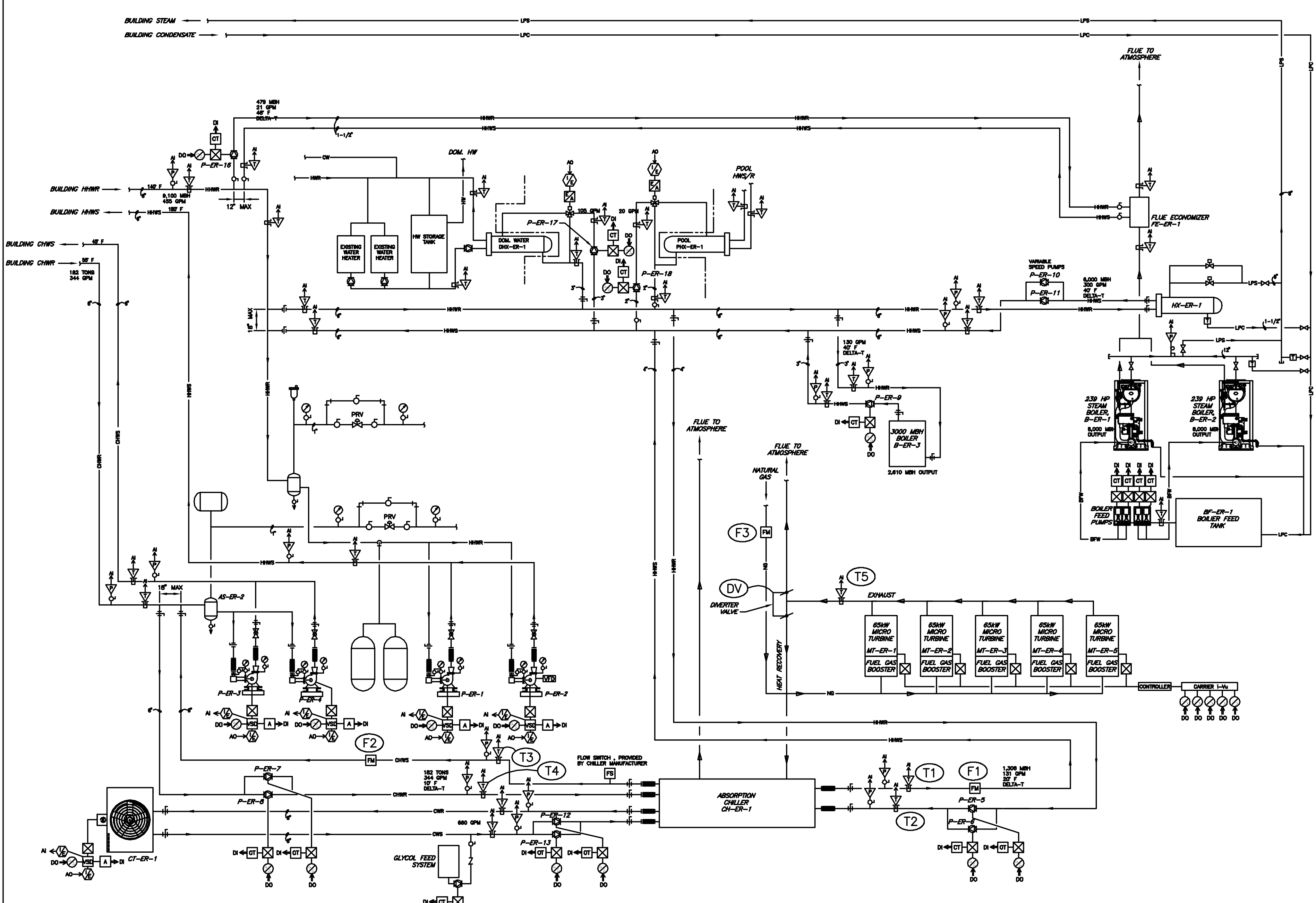
The total output of the chiller system will be measured, along with the condenser water temperature entering the absorption chiller, to confirm that the COP and capacity of the chiller is consistent with the manufacturer's performance specifications.

The runtimes of all equipment will be monitored and logged by the Building Management System.

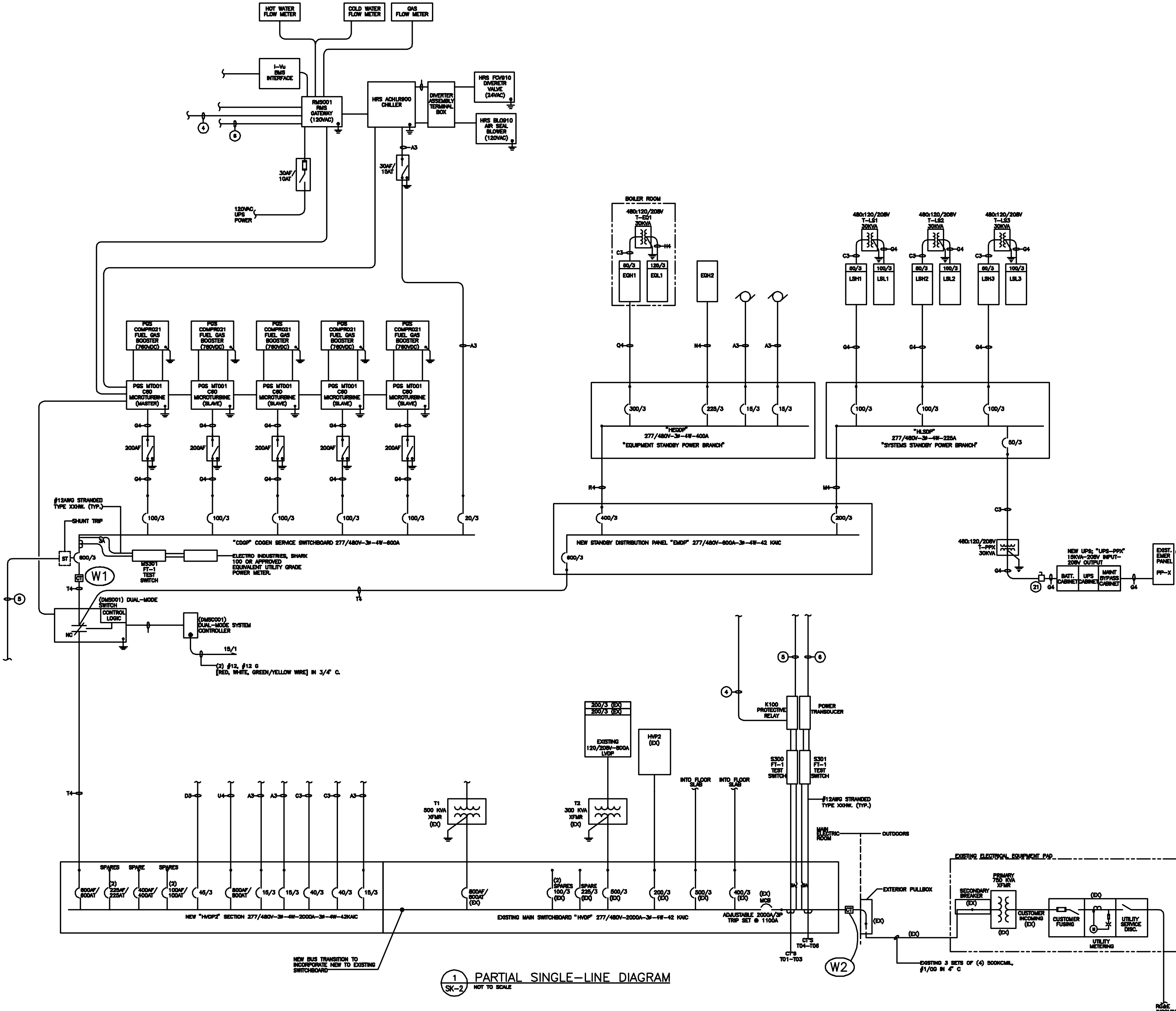
The data shall be transmitted periodically as directed to the Performance Analysis Contractor for their evaluation and reporting.

Attachments

Sketch 1/SK-1 — CCHP Controls Schematic
Sketch 1/SK-2 — Partial Single-Line Diagram



1 SK-1 CCHP CONTROLS SCHEMATIC
NOT TO SCALE



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SK-2
PARTIAL SINGLE-LINE DIAGRAM
NOT TO SCALE