MONITORING AND DATA COLLECTION FOR DISTRIBUTED GENERATION/ COMBINED HEAT AND POWER (DG/CHP) SYSTEMS

AT ALLIED FROZEN FOODS BROCKPORT, NEW YORK.

SYSTEM OVERVIEW

The power generation shall be delivered via 2 - Caterpillar model G-3516B, 1300 kW, synchronous-parallel, natural gas fired generators. Power may be exported to the grid depending on economics.

System is configured for following types of operation:

- Grid parallel with no import
- Grid parallel with export to sell power
- Generators off with full import
- Grid isolated with full generator power
- Black-start capability using only onsite power

The generators have three primary forms of heat rejection which are capable of being recovered for use elsewhere in the facilities. The turbo after-cooler (after-cooler) water, cooling jacket (jacket) water, and generator combustion exhaust (flue gas). Generator after-cooler water will be used for floor heating in the freezers. Currently the floor heat is provided by hot gas bypass from the electric driven ammonia compressors. Generator cooling jacket water will be used to heat office and warehouse space. Currently this heat is provided by natural gas fired rooftop units, unit heaters, and boilers. The flue gas will be used as the heat source in an aqueous ammonia absorber. The absorber has the capability of producing very low temperatures, in this case -30°F. This low temperature will be used to displace part of the refrigeration load in the cold storage building, displacing electrical compressor load.

POWER GENERATING EQUIPMENT

As discussed above, the primary lineup will be comprised of two (2) 1,300 kW generators. The units, furnished by Caterpillar, will generate electricity at 4,160 Volts, using natural gas as the fuel source.

HEAT RECOVERY SYSTEM AND DISPLACED EQUIPMENT

The current in floor heating is done by using hot gas from the present ammonia refrigeration system. The new system will use waste heat from the Distributed Generation/Combined heat and Power system at the facility. The 4 Owens Road building

presently has a combination of electric and gas heating system that will be displaced by the absorption chiller low temperature water waste heat.

The Absorption chiller system has a cooling capacity of 150 tons tied into the existing ammonia system to condense 10°F ammonia vapor.

FACILITY LOAD DETAILS

Allied Food Services provides frozen food storage and warehousing services for a variety of customers. The three AFS facilities provide for approximately 9.8 million cubic feet of frozen storage area. In addition there is 600,000 square feet of heated storage areas.

Currently the electrical demand varies seasonally from 1,450 kW to 1,660 kW and usage varies seasonally from 600,000 kWH to 900,000 kWH. Electrical load for the facility is primarily from refrigeration compressors plus some miscellaneous lighting and equipment. Presently electrical service is provided by Niagara Mohawk with 3 separate services, one at each building. The new configuration will consolidate the service to one location. The present service rate for electric is SC-7 and gas service rate of SC01 industrial.

COMBINED CYCLE POWER GENERATION
SYSTEM EFFICIENCY M & V METHODOLOGY

This section shall describe the Measurement and Verification Methodology for demonstrating cogeneration system efficiency on an overall annual basis.

Introduction

The costs and saving associated with this installation include the following:

- Cost for primary fuel for the combined cycle equipment. Unit of measure is natural gas Therms
- Cost savings for electrical energy produced by the combined cycle equipment. Units of measure are electric kiloWatt hours (kWh).
- Cost savings for the electrical demand being met by the cogeneration equipment. Units of measure are electric kiloWatt (kW).
- Cost savings for thermal energy recovered from the cogeneration plant, and used in building systems. Units of measure are natural gas Therms.

The combined cycle power plant consists of two combined cycle generators with associated mechanical, electrical, and digital control gear. Mechanical gear includes pumping, piping, valves, heat exchangers, fuel supply hardware, flow meters, chilled water, heat rejection, exhaust, and ventilation equipment. Electrical equipment includes controls, switch gear, power quality monitoring equipment, transformers, and electric metering. Measurement and Verification equipment shall interface with this equipment to obtain data relevant to system efficiency and performance.

COMBINED CYCLE POWER GENERATION INSIGHTS

The parameters that are needed to understand the operating conditions of the combined cycle power plant are the energy inputs and energy outputs. The energy input to the system is in the form of the fuel used to fire the internal combustion engine. For this application, natural gas is used. The energy outputs include electrical energy measured in Watts and totaled as Watt-hours, recovered thermal energy, and non-recovered thermal energy. The general flow of energy in and out of the cogeneration unit for this application is shown in the following chart. Actual energy quantities may differ from those shown in the illustration.

The Data Collection has been incorporated into the DDC central automation and control system. The control point identification summary is as follows:

Date/Time	Outside Air Temp	**Generation** Fuel Input	**Electrical** Generator Output	**Thermal** Low Temp Water Utilization	**Thermal** High Temp Water Utilization		Stack Gas Utilization	Total Plant Efficiency
				300 State St.	4 Owens Rd.	Chiller	Chiller	
	(°F)	(Btu)	(kVA)	(Btu)	(Btu)	(Btu)	(Btu)	(%)

Point Descriptions	**Actual Point Names**
Date Time	$DateTime
Outside Air Temperature F	Outside_Air_Temp
Plant Total Gas Flow BTU	Plant_Total_Gas_Flow_BTU
Plant Total Generator KVA	Plant_Total_Generator_KVA
300 Start St Low Temp Water Heat Recovery BTU	300_State_St_LTW_Heat_Recov_BTU
4 Owens Rd High Temp Water Heat Recovery BTU	4_Owens_Rd_HTW_Heat_Recov_BTU
Chiller1 High Temp Water Heat Recovery BTU	Chiller1_HTW_Heat_Recov_BTU
Chiller1 Stack Gas Heat Recovery BTU	Chiller1_StackGas_Heat_Recov_BTU
Plant Total Efficiency	Plant_Total_Efficiency

Energy Balance
Caterpillar G-3516BLE