V.I.P. Country Club CHP Facility

Microturbine CHP with Space Heating and Cooling

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V.I.P. Country Club CHP Facility

Project Objectives

- Design and install a CHP system for a medium sized business that achieves an overall efficiency of 70% to 80% which significantly exceeds the efficiency of current electric power plants (approximately 33%)
- Reduce the total cost of Natural Gas and Electricity Bills
- Achieve a 5 year payback period
- Improve the reliability and quality of electric power for the customer
- Design and install computer control system (customer perception) for automated operation

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Electric Power Generation

- Three 60 KW Capstone Microturbines
- Natural Gas Fired (804,000 BTU/hr per Microturbine)
- Efficiency = 28 ± 2%
- Features:

  Grid Parallel

  Compliance with UL 1741 (Inverters, Converters and Controllers for use in Independent Power Systems)

  Stand Alone (with Automatic Transition from Grid Parallel Mode)

  Load Following

  Auto-Startup and Auto-Shutdown

  Remote Monitoring and Control through Modem and Serial Port

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Capstone Microturbines and Copeland Natural Gas Compressors

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Heat Recovery

- Three custom designed Stainless Steel Heat Recovery Units
- Heat Recovered from Exhaust Gas is used to generate Hot Water
- Provides Building Heating and the Thermal Energy Required to Operate Three 20 Ton Lithium Bromide Absorption Chillers for Building Cooling
- Generates 1,070,000 BTU/hr
- Maximum Water Outlet Temperature = 210 Deg F (measured)
- Programmable Heat Exchanger Bypass Door

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Three Heat Recovery Units

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Chilled Water Production

- Three Yazaki 20 Ton Hot Water Fired Lithium Bromide Absorption Chillers
- 48 Deg F Chilled Water is produced from Hot Water generated by Heat Recovery Units
- Three Water Circuits:

  Heat Medium Water must be kept above 152 Deg F (7½ HP Pump)

  Chilled Water must be kept above 38 Deg F (7½ HP Pump)

  Cooling Tower Water must be kept above 75 Deg F (10 HP Pump)
- Chiller Control System provides Run/Stop Signal to Pump VFD
- Electric Power required for pump operation = 23 KW (approximately)

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Three 20 Ton Yazaki Absorption Chillers

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CHP Control System

- Controls all CHP subsystems (microturbines, heat recovery unit, absorption chillers and pumps)
- Retrofit standard Desktop Computer with Data Acquisition and Control Boards
- Agilent VeePro Software with Graphical User Interface (GUI)
- Thermocouples for Water and Exhaust Gas Temp Measurement
- Transducers for Pump Discharge Pressure Measurement
- Variable Frequency Drives for Pump Control
- Electrically Actuated Valves for seasonal changes (Honeywell)
- Receives Run/Stop signal from Master Microturbine
- Receives Grid Connect/Stand Alone signal from Capstone Dual Mode Controller (DMC)

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Relay Protection

- Capstone Microturbines have UL Listed Protective Features for Voltage, Frequency, and Current
- The electric grid area managed by Consolidated Edison of New York requires compliance with Relay Protection described in Specification EO-2115
- Required Equipment includes:

  Intertie Breaker

  General Relay Protection for Voltage, Frequency and Current

  Three-Phase Reverse Power Protection

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600 Amp Capstone DMC Equipped Shunt Trip Intertie Breaker

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ABB Alpha Plus Power Meter and Protective Relay Control Panel

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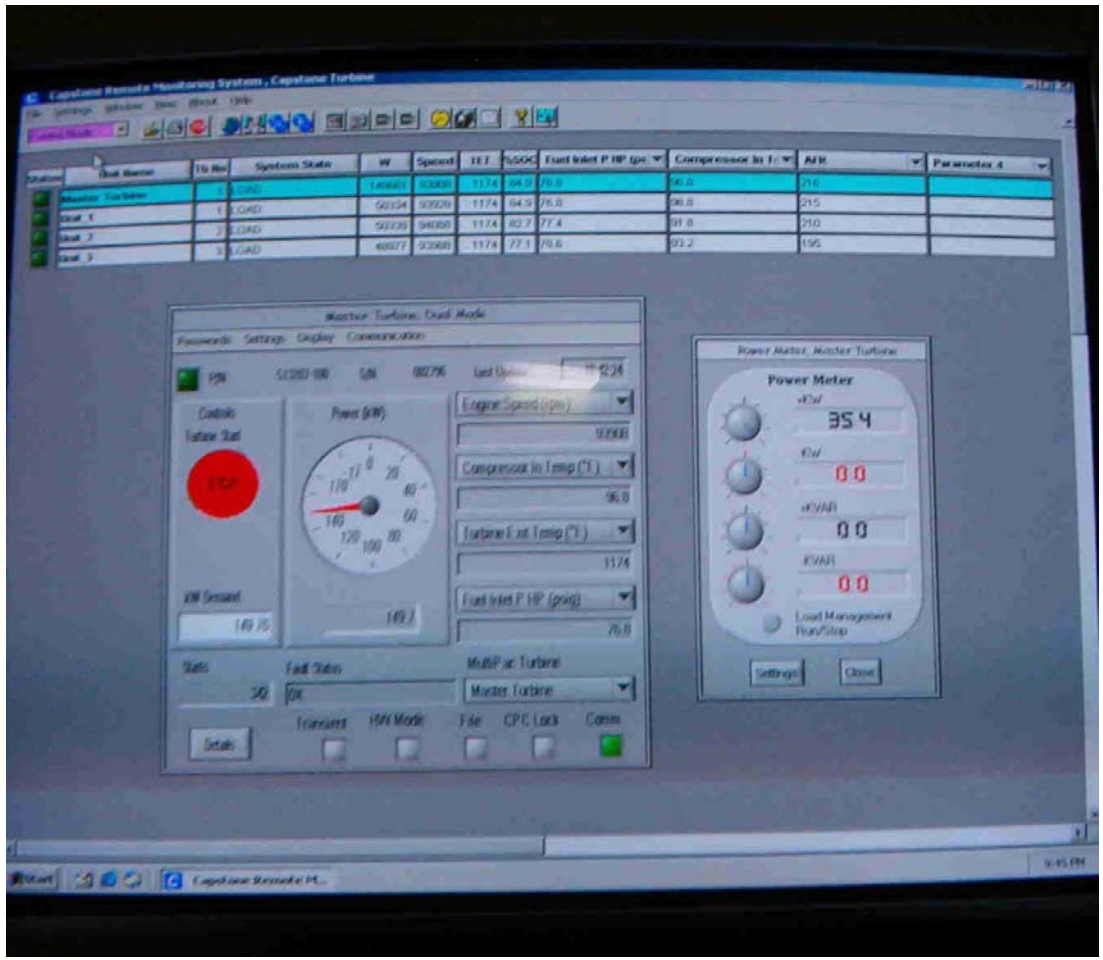
Capstone Remote Monitoring Software (Display Shows 143 KW)



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Results and Projections

- CHP System efficiencies are approximately 70% during Heating and Cooling Seasons
- Projections and initial system performance indicate that the Demand Change during the Cooling Season will be reduced by approximately 250 KW
- Backup Electric Power is available (very important for this facility)
- Power Quality improvement? Difficult to determine thus far
- Payback Period is projected to be approximately 5 years (this value includes 50% co-funding provided by NYSERDA
- In general, the “hands-off” capability provided by the control system appears to be satisfied