One of the goals of the State of New Jersey is to enhance energy efficiency through on-site power generation with recovery and productive use of waste heat, and to reduce existing and new demands to the electric power grid by providing financial incentives for Combined Heat & Power (CHP) installations.

For more information:

NJ BPU
www.state.nj.us/bpu/

NJ Clean Energy Program
www.njcleanenergy.com/

NJ CHP
www.njchp.rutgers.edu

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THE STATE UNIVERSITY OF NEW JERSEY
RUTGERS CAES
CENTER FOR ADVANCED ENERGY SYSTEMS

CASE STUDY: Downsizing of CHP unit to satisfy current heating load

Summary

Project Name	Downsizing of CHP unit to satisfy current heating load
Brief Summary	The plant had a 38 MW gas turbine operating in a combined cycle to satisfy its plant thermal load. The plant had downsized and consequently decommissioned its CHP system. Our goal was to determine the optimum operation scenario for their utility plant such that the plant's energy needs were satisfied.
Project status	CAES visited the plant multiple times in the summer of 2006. In December of 2006 a report was provided for the plant outlining four operation scenarios that would satisfy their thermal load.
Remarks	Key topics that are of focus in this case study included: detailed examination of electric rate structures, value of existing CHP systems, optimizing boiler life, detailed analysis of thermal (steam) and electric loads, quantification of steam losses, full analysis of implementing a new gas turbine and boilers in conjunction with back pressure steam turbines.

Brief Explanation

Downsizing of CHP unit to satisfy current heating load:

The manufacturing plant in Belvidere, NJ was the largest producer of vitamin C in the world. In order to satisfy the massive thermal and electric loads, the facility had implemented a 38 MW GE gas turbine operating in conjunction with a back pressure steam turbine in a combined cycle operation. The majority of the plant's thermal needs were for steam. In 2002, production of vitamin C was moved overseas. Consequently the plants thermal and electric loads dropped significantly enough such that operating the gas turbine was no longer feasible from a financial or technical standpoint due to the low efficiencies associated with low loading of a gas turbine.
CAES was asked to examine and study the current electric and thermal load of the plant and develop a strategy for the plant to meet its loads. After understanding and analyzing the existing loads at the facility, CAES immediately determined that at no point would it be possible to run the existing gas turbine to satisfy the plant's loads or as a spinning reserve for the area. CAES looked at resale values for the gas turbine along with the feasibility of implementing a new gas turbine sized for the existing loads. CAES selected an appropriate turbine and determined, among other things, the implementation cost, savings, payback, and spark spread for the new system.

In being thorough, CAES also examined the possibilities of running boilers in combination with back pressure steam turbines (BPST). CAES looked at running the existing boiler with the existing BPST. It was determined that the steam load at the plant would not be enough to run the existing BPST. CAES next looked at using the old BPST with a new boiler, using the old boiler with a new BPST and using a new BPST and a new boiler. After sizing the systems and getting quotations, CAES determined the demand and usage savings on electricity, the annual savings and the simple payback. CAES used multiple operating pressures in each scenario in order to show the effect of CHP system sizing.

The report sent to the plant personnel included all the detailed calculations mentioned above as well as information on PJM, vendors for the CHP systems, and detailed electric and steam loads profiles.