Another Comment

Additional Considerations for an Updated "Cogeneration Bluprint"

R.C. (Dick) Vetterick
TRC Energy, Inc.

What a difference a few years make! When this article was written, in late 1981, it was "illegal" to burn natural gas for power generation. That came about due to the energy crises of the mid 1970's when the Northern regions of the country were freezing in the winter because there wasn't enough natural gas in the pipelines to heat the homes. Industries were either switching to oil, or shutting down to conserve nature's most accommodating fuel.

As mentioned in the referenced article, if industry and institutional establishments were considering cogeneration in 1982 they were required to request an exemption to the "Fuel Use Act." Today, natural gas is the fuel of choice for power generation, and certainly for cogeneration.

This is for environmental reasons, but also because of available resources, and ease of operation and maintenance. While current day prices have spiked due to delivery capacity and poor planning, future prices will likely remain stable as a result of the current drilling and pipeline construction programs.

Relative to the referenced article, it is important to have a "Blueprint" that doesn't lock in specific operating conditions. When people think of cogeneration, most think of a secondary energy use riding piggyback on a primary energy use.

However, only under unique operating conditions does the primary and secondary energy use match in terms of capacity requirements over a long period of operating conditions. Frequently the secondary energy use must suffer through periods of inadequate supply or an oversupply. If the oversupply isn't "wasted" then the primary energy use must be curtailed or overloaded to make the cogen conditions match.

"REAL" VS. "PLANNED"

Several cogen operations have had to shut down because the "real" operating conditions did not match the "planned" operating conditions, and the "real" operating conditions have a way of changing from year to year, or decade to decade. There were cogeneration-combined cycle units (with a dependent industrial load on the back end) that were forced to shut down in the mid 1990's because the electricity generated in the topping cycle could not compete with the 1/2 cent hydroelectric power available in the Northwest.

But now, with watershed levels far below normal, and power prices high, the cogeneration unit may be running purely as a combined cycle unit and the industrial load may very well have gone away in the interim.

If a "Cogeneration Blueprint" is designed properly, the cogeneration facilities must be capable of being "biased" to match *real* day-to-day and season-to-season operating conditions. For example, most cogeneration applications come about by an industrial or institutional organization realizing that their operation could be thermodynamically more efficient if they utilized a gas turbine exhaust to supply the heat for their thermal load. So they decide to study the situation and see how to size the turbine generator.

The first thing that jumps out is that the industrial/institutional load is not constant throughout the year, AND the gas turbine efficiency drops off sharply with a decrease in load. Other data that drops out is that the Gas Turbine in simple cycle operates at approximately 30 % to 34% efficiency (at full load) and a typical boiler operates in the 75 to 80% efficiency range with a reliable and efficient turn down of approximately 3 to 1. The options may be as follows:

1) Size the GT to supply the heat input to the boiler required to meet the *minimum* consistent load expected throughout the year. Supplementally fire the boiler to meet the steaming requirements of the industrial/institutional load. In this layout the Turbine Generator can run "flat out" at its best efficiency point, or shut down

depending upon the electrical demand. In this layout the combined cycle efficiency will be in the 85% to 87% range throughout the year.

2) Size the GT to supply the heat input to the boiler to meet the *full load* conditions of the boiler and to maximize the electrical output. During periods of partial steaming conditions, vent the steam or condense it to waste the heat. In this arrangement the combined cycle efficiency will be somewhere between that of the boiler and that of the GT, depending upon the average load conditions of the industrial/institutional installation. This is likely to be in the 40% to 55% range.

My recommendation is the first arrangement, to maximize the efficiency, and leave the bulk power generation up to the "pros." This will save capital, maximize profits, and keep the focus on your primary business. Other benefits that may very well accrue are improved environmental performance, improved reliability of your boiler operation, and reduced complexity of operations, and greater flexibility. One major benefit is that if that pesky turbine decides to trip off, just turn up your burners and keep your primary business in operation!

R.C. (Dick) Vetterick
TRC Energy, Inc.

Editor's Note: Dick Vetterick co-authored an article in *CCPJ*, Spring 2001 issue, "How to Improve Reliability in Cogeneration and Steam Systems." He is co-author with Patrick Whitten, P.E., M.E., of another article to appear in the Winter 2001 issue of *CCPJ*, entitled "Retrofit Package Boilers to Cogeneration… and PROFIT!"

Mr. Vetterick spent more than 40 years with the Babcock Wilcox Company, in field engineering and service management.