COGENERATION It May Not Be What You Think

by Ernest Bruss

"Cogeneration." When I say cogeneration, the person whom I am addressing becomes immobile, the eyes slowly get wider, the brow furrows, the jaw goes slack, their gaze becomes fixed and unfocused. Somehow, I get the feeling I have not communicated.

Not everyone reacts this way. Some people really know a lot about cogeneration. Some have heard the word, but most don't have the foggiest idea about what I am talking.

Remember 15 years ago? Energy was not a topic except when comparing your lack of it with your three year old's excess of it. We didn't even budget for our electric or gas bills. They were an insignificant part of our expenses. We could drive all week on a few dollars of gasoline.

Then came the Arab oil embargo, OPEC, shortages, price escalation, price control, the "realization" we were running out of fossil fuels, attempts at mandated conservation and consumption control, more shortages, more price escalation, more price control, massive oil and gas exploration, conservation beginning to take effect - not from legislation but from economics, gluts of oil and gas, gradual price decontrol, and a slowly stabilizing but very expensive field known generically as "energy."

So, what does that have to do with cogeneration? "Energy" impacts us where it hurts, in our pocketbooks. We are desperately looking for ways to soften that impact and cogeneration is one way that may help some people do just that.

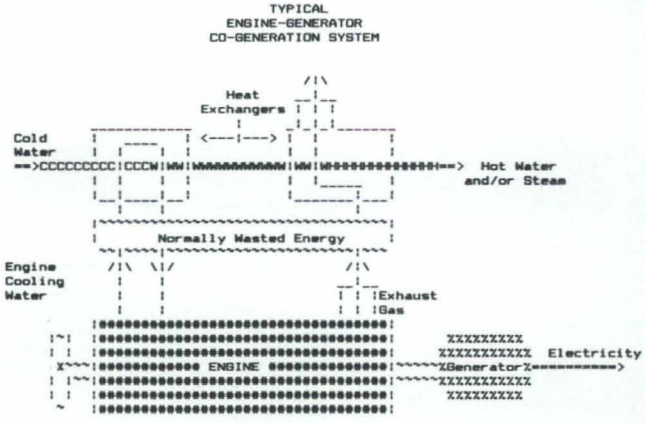
Cogeneration is defined as producing two or more useful energy forms from one energy source. For example, when you drive your automobile and operate your heater you are cogenerating. Gasoline is providing energy to turn the wheels to move the car and the heat from the engine is utilized to heat the car interior. Normally, we think of cogeneration in industrial or commercial applications where the two useful forms of energy are electricity and heat. Typically, and engine turns an electrical generator to produce electricity and the "waste" heat is captured to produce hot water or steam. The waste energy is that which goes out the exhaust stack to the atmosphere or is dissipated from the radiator to cool the engine. the "engine" actually may be a turbine, a boiler, or a reciprocating engine similar to what is in your automobile. There are almost an infinite number of variations of how cogeneration can be designed and applied depending upon the circumstances of each installation.

The attraction of cogeneration is efficiency. When a typical public utility power plant produces electricity, they deliver about 25 cents of electricity for every $1 that they spend for fuel. The other 75 cents is lost in the inefficiencies of the generating system, in the cooling processes, out the exhaust stack and in transmission losses. Electricity can be transported fairly efficiently over long distances, but heat cannot. With the advent of the large centralized generating station epitomized by coal fired and nuclear plants, which are usually located in remote locations, there is no place where the heat energy can be used.

With cogeneration, the electricity is produced on site where the waste energy from the exhaust stack and the radiator can be captured and utilized. Typically, with cogeneration, for every $1 that is spent on fuel, 75 cents is utilized as electricity or heat energy.

Cogeneration has been practiced since the earliest days of Thomas Edison and electric power. The initial electrical producers where industries which sold their excess electricity to their neighbors. As the demand for electricity began to increase, it became apparent that there needed to be an electric service that was reliable, inexpensive and available to everyone. As economics of scale lowered the cost of producing power in a central location and technical developments improved reliability, the electric utility began to emerge as an industry. Accordingly, on site generation gradually declined in importance.

As long as energy costs were low and fuels abundant, this system worked very well, but with the rapidly escalated price of fuels and the concern over shortages, it became apparent that we could not afford to waste 75 cents of every $1. Congress recognized this fact in 1978 and passed the Public Utilities Regulatory Policies Act, PURPA, which encourages the production of electricity through cogeneration as a conservation measure. The Act grants cogenerators who "qualify" (i.e., meet certain operational and safety



standards), the right to connect with the utility power grid, to contract with the utility for backup power at non-discriminatory rates and to sell any excess power back to the utility at their "avoided cost."

The implementation of this Act was left to the Federal Energy Regulatory Commission, FERC, who has, over the ensuing years since 1978, issued a number of guidelines and regulations concerning cogeneration. FERC, in turn, gave the responsibility of implementing and enforcing the Act to each of the state regulatory agencies (in New Mexico, this is the Public Service Commission).

Immediately, there was a great rush into cogeneration in certain parts of the country. These occurred primarily in the Northeast, Southern California, and the Gulf Coast of Texas. Each of these areas had very high electrical rates and relatively low gas rates (relative to the electric rates).

New Mexico did not see a move toward cogeneration until the middle of 1984. At that time, electric demand rates jumped up for the medium sized consumer - commercial businesses, office buildings, light industry, etc. The higher electric bills caused an interest in cogeneration, but the

marketplace was unprepared to deal with an area of such complexity as cogeneration, and has taken until now to develop expertise to evaluate, design, manufacture, install and service cogeneration equipment.

Who can use cogeneration? It's not for everyone. Certain factors must be present in order to make it economically feasible:

1. The presence of high electrical cost.
2. A relatively cheap source of fuel, be it natural gas, diesel, or some alternative such as refuse, wood chips, digester gas, etc.
3. Equitable electrical buy back rates from the utility.
4. Reasonable interconnection and safety requirements to connect to the utility grid.
5. A high demand for thermal energy in some form that can be furnished by the cogeneration system.
6. The concurrence of the heat load with the electrical load.
7. A steady demand, both daily and seasonally, for electricity and heat.
8. The installation of the cogeneration system is not overly complex.

Most of these factors are now operating in New Mexico. Our electric rates are high. Our gas cost is relatively low. Electrical buy back rates by the utility at the present time are not reasonable, but this does not necessarily limit the possibility of a cogeneration project (it means that we usually have to look at only generating enough electrical power to displace the purchases from the utility rather than generating at a larger capacity and selling the extra electricity to the utility). Safety requirements are not unusually stringent with most of the utilities, but these are just now being clarified in the negotiations for the first commercial cogeneration systems to be interconnected. All of the other factors depend on the specific user and are determined on a case by case basis -usable thermal demand, concurrence of electrical and thermal load, and steady demand.

Typical installations, where we do find all the factors normally present, are in restaurants, food processing (such as canneries, dairies, meat packers, etc.), laundries, car washes, nursing homes, hospitals, apartment complexes and office buildings (with centralized heating and cooling plants), hotels and larger motels.

Easily determining who has potential for cogeneration and who does not, has been a problem. As a result, there have been a number of feasibility analysis models developed to determine whether cogeneration makes sense. They range from a one-page pencil and paper, no-charge analysis that is usually too simplistic, to a high priced, sophisticated computer program that most small commercial users are unwilling to purchase just to determine if they might have any cogeneration potential. Fortunately, there are programs that are sophisticated, that cost the customer little or nothing, and are sufficiently accurate to allow them to determine whether there is sufficient potential for savings to investigate further.

A word of caution is in order, beware of promoters who do a "quickie" analysis and promise incredible savings. These types of promoters will usually offer to install the equipment at no-charge and share the savings with you. You may not be out any initial expense, but with any equipment as complex and interrelated as to your existing electrical and heating/cooling systems as cogeneration systems are, you can be faced with some enormous headaches if the system does not work properly. There are legitimate, established firms in New Mexico who can provide the initial feasibility analysis, perform the subsequent engineering studies, design a proper system, assemble and fabricate all the components, provide complete installation, and maintain the equipment. You should also be certain that with whomever you deal, they have the capability to assist in negotiating contracts with the electric and the gas utility, and to properly design the system to file and obtain "qualifying facility" status with the Federal Energy Regulatory Commission so that you are protected by the PURPA laws.

Savings with cogeneration come from reducing the electrical bill, both in usage (kilowatt hour charges) and in demand (kilowatt charges). In addition, all the waste heat that is captured is essentially free and reduces the gas bill. These savings are offset by the cost of operating the cogeneration system, the cost of fuel and the cost for operation and maintenance. The net reduction in utility costs, electrical and gas, by using cogeneration typically ranges from 20% to 40%.

This stream of savings is usually enough to pay off a cogeneration installation in two to four years.

What about the future? Is cogeneration just a flash in the pan? Or, does this appear to be a viable long term development? The forces at work in the electric and gas utility markets would seem to indicate the cogeneration will have a long and healthy future. However, changes in regulatory or tax climates could make that market stronger or weaker.

In New Mexico, most of the areas serviced by the existing utilities have excess capacity which has been brought into service or is presently being brought into service. This capacity will have to be paid for by the rate payers. This will either come into the rate base in a large up-front amount creating "rate shock" or be pro-rated in over a period of time. In either case, it appears that there will be substantial rate increases.

There is presently a glut of natural gas both nationally and within the state of New Mexico. Gas prices in the last few months have actually been falling due to the renegotiated contracts the Gas Company has been obtaining from some of their suppliers. The president of the American Gas Association predicts that gas prices will, at most, track the cost of inflation between now and the year 2000 and he actually feels they will be less. Other industry experts are not quite so optimistic, but no one is predicting large gas price increases any time soon.

If electric rates increase and gas prices stay relatively stable, this means an increasing differential between the price of electricity and the price of gas. The greater the differential, the more economically feasible it becomes for firms to cut their utility bill by cogenerating.

It is my prediction that cogeneration is here to stay and that many New Mexico establishments will begin to cogenerate in the next few years.

E.B.