

COMBINING TOTAL ENERGY AND ENERGY INDUSTRIAL
CENTER CONCEPTS TO INCREASE UTILIZATION
EFFICIENCY OF GEOTHERMAL ENERGY

B. P. Bayliss
Lloyd Corporation and Magma Energy, Incorporated
Los Angeles, California

Integrating energy production and energy consumption to produce a total energy system within an energy industrial center would result in more power production from a given energy source and less pollution of the environment. Strong governmental support would be required for the crash drilling program necessary to implement these concepts. Cooperation among the federal agencies, power producers, and private industry would be essential in avoiding redundant and fruitless projects, and in exploiting most efficiently our geothermal resources.

I. INTRODUCTION

The United States and indeed the World is in deep trouble these days on a number of fronts. In the forefront is the projected gap between energy supply and consumption. This is a frightful gap to behold and one which holds the seeds of a demoralizing and humiliating decline in mankind's vaunted "ever onward and upward" climb towards its ultimate star of destiny.

It is required that advances be made on two fronts — first we must increase our energy output some orders of magnitude by augmenting known means and creating new means of supplying additional energy.

A second imperative is to utilize, in the most efficient way, that geothermal energy which is made available for power generation.

II. NEAR-SITE ENERGY CONSUMPTION

The very organization responsible for this Conference, The National Science Foundation, also sponsors an Industrial Center Study, managed by Dow. It concerns itself with, among other things, two fundamental considerations of energy utilization efficiency. First is the advantage of physical placement of the industrial consumer of electricity (chemical plants for example) close to the origin of production (a geothermal plant for example). Second is the utilization of exhaust steam from turbines for industrial process use. Under this system, industrial boilers are eliminated and the needs for cooling towers, condensers or cooling ponds to dispose of heat is reduced.

Of course, these economies have another inherent advantage: — with more power being produced from a given energy source, less environmental pollution will result!

The author applauds NSF authorization and sponsorship of this study, originally submitted to it by Governor Milliken's Michigan Special Commission on Energy.

III. TOTAL ENERGY CONCEPT

To carry the foregoing Energy Industrial Center Study one step further, the author believes the Total Energy system concept could be applied here. Mr. Fred Dubin, head of a New York consultant firm states in his article "Total Energy Systems and the Environment";

"Integrating systems may become an important factor in conserving the nations natural resources. Spectacular savings in energy can result from this concept. In this "systems" approach conversion of fuels (including geothermal fluids) to electric power is only one segment of the system. The transmission and distribution systems and the utilization of "thermal waste" are important factors. Design of end-use facilities, marriage of sewage treatment plants with solid waste disposal systems, integrating lighting systems with heating and cooling systems, design of exhaust-air systems and fresh air intake systems to permit energy transfer to take place, are only a few examples of the "Total Energy approach. "

Total Energy has been called an energy-recovery system using the waste heat from the generation of electricity. Of course, it is more than this. A total resource system certainly offers significant opportunities for conservation of energy and does require the coordinated effort and understanding of all disciplines. Revising rigidly inflexible municipal codes for example, to permit use of new methods and systems without sacrificing safety, is badly needed.

It is believed that Federal and State studies to implement the Total Energy concept would be money and time well spent. It is easy to visualize how the Geothermal Energy Industry could participate in and benefit from such a basic concept.

Still on the broad subject of energy efficiency the question is posed: Can Federal programs aid in the research of means to increase cycle efficiency (heat rate) in geothermal power plants and implement usage of resulting improvements with the steam utility companies? Is there any possible way to beneficially increase the enthalpy of the natural steam entering the plant for a net increase in kW output of the plant or is this an impossibility like perpetual motion or bootstrap lifting?

IV. GOVERNMENTAL ASSISTANCE

The author read with a great deal of interest Dr. John D. Ridge's idea that he presented at USGS symposium during the recent dedication of its National Center at Reston, Va. He proposes a cross-country checkerboarding of the conterminous U.S. with 7500 wells on 20 mile centers, each 15,000 feet deep, to "uncover \$750 billion of recoverable raw materials at a project cost of \$3 billion." The entire oil industry drills annually in this country about 25,000 to 30,000 wells for oil and gas at an average depth of just under 5,000 feet. But they do it selectively. The author has been involved in deep oil well drilling for 20 years and even though the drilling program that Dr. Ridge advances is manifestly impractical, the idea behind his idea is quite pertinent and practical. He is an advocate of direct field exploration. As a recommendation change the depth to 2500 feet; the spacing between wells to one mile; be selective as to the areas approved for checkerboarding — generous, but selective —; and his idea could then be considered as an intelligent, direct-type of practical exploratory action having an honest chance of paying handsome dividends.

As to other assistance that Governmental agencies could render the private sector of the geothermal energy industry perhaps number one would be assistance in the environmental fight: As it now stands, compliance with full detailed environmental requirements has the effect of seriously delaying the contributions of geothermal to the energy shortage and of greatly increasing costs. Mr. Aidlin discusses this problem:

"To determine the extent of readily useable geothermal energy as quickly as possible I suggest the following:

- (1) Permit through 1975 the drilling of an exploratory well and not more than two confirmation wells in any area, without requiring compliance with full, detailed environmental requirements. It seems unrealistic that expensive, time consuming effort be devoted to environmental studies and reports before it is even known whether or not the resource will be found in economically useable quantity or kind.
- (2) If a useable geothermal energy resource is found, then the requirement for more detailed environmental studies may be made applicable, if the community deems that desirable.
- (3) If the developer is unable or unwilling to conform to appropriate environmental constraint for further development, he should be permitted to surrender or abandon the project and to write off as a loss two times the entire cost of the project. The reason for permitting the loss write off is to encourage the developer to take the risk of the initial geothermal well or wells to determine the presence of the resource rather than to spend his capital in other less risky pursuits.
- (4) The developer desiring to operate under this program should, of course, be required to disclose pertinent data to the appropriate governmental agency concerned with energy planning.

This program will require, strong government support to make available the casing, equipment, drilling rigs and other materials required for a crash drilling program.

It has the advantage of permitting rapid drilling of presently known promising areas, so that the energy planners will know what they can count on; and while it bypasses stringent, time-consuming environmental requirements on a temporary basis it does not supersede them. "

The appropriate federal agencies could also help stimulate development by incentives as set forth by Mr. Aidlin:

"For this program to produce greater results it will be necessary also that the Internal Revenue Service reverse its present policy which clearly discriminates against geothermal resources and unnecessarily and unreasonably impedes its development.

Additionally, the Bureau of Land Management will have to adopt policies which better accord to the wildcatter the fruits of his effort and risk. If an operator is willing to test an area at his expense but does not have enough land around it to make the investment economically sound, if the adjoining land is federal land, the BLM should make available a reasonable amount of its land for lease to the wildcatter, if his well develops a viable geothermal resource. "

To accelerate utilization of geothermal resources in generation of electric power, Mr. Aidlin suggests the following:

"In order to demonstrate the economic and mechanical viability of the binary cycle, electric generating system, which system is generally accepted as the only readily available and most likely to succeed, the Federal government, through one or more of its agencies, should guarantee loans for construction of two or more small capacity binary cycle plants - that is, from approximately 10 to 50 megawatts capacity - to generate and sell electricity on a commercial basis. The purpose would be to demonstrate to the utilities that such plants are economically and technologically sound. Such plants in commercial operation would provide the kind of operational and economic information that cannot be obtained in the laboratory.

If such plants operate profitably there will have been no cost to the government, and the technology will have been demonstrated. If they do not operate profitably, information will be gained which may correct errors or technological defects.

By guaranteeing such loans the government will have enabled the utility to proceed with power generation without first assuring itself of the life and extent of the resource reservoir beyond its ability under present technology to do. In other words, while we are developing better reservoir analysis and measuring techniques, we will be generating electric power for use. "

V. ENVIRONMENTAL CONSIDERATIONS

Although the final subject is admittedly somewhat critical in its nature, it is offered with no apology as the remarks are intended to be constructive and pertinent.

Bureaucratic programs, especially Federally funded ones, tend to become "ivory tower," unrealistic programs divorced from reality and from known technology. Since the funds don't belong to a specific individual or Corporation, they seem to belong to no one and are dissipated with little feeling of personal accountability. That's human nature I'm afraid.

Some programs are purposeless or their purpose is vague, obscure or misses the mark. Other extensive and expensive programs simply attempt to redo what has already been accomplished.

Once again Mr. Aidlin, in a letter to Dr. Dixie Lee Ray, Chairman of the U. S. A. E. C., states his thoughts this way;

"Frankly I believe that the program to develop and utilize geothermal energy has been complicated too much. It really is quite simple. What is involved is:

- (1) Exploration and development of geothermal resources. A number of areas have already been explored and discovered. There are adequate fluids in these areas to supply the needs for prototype plants.
- (2) The proof of technology which is immediately available before spending a great deal of money and attempting to develop advanced technology. In this connection there appears to be no technical question as to the viability of the binary cycle. Whether it is as efficient as some other variation can be determined at a later date. If we are to determine the extent of our energy self-sufficiency by the year 1985, it is important to utilize the tools at hand.
- (3) Obtaining a better knowledge of the resource itself. In this connection the drilling of a deep well at the Geysers, another in Imperial Valley, and another in the Gulf Coast area (the first two being proven areas) would certainly give us a tremendous amount of knowledge as to the character of the resource.
- (4) Facilitating the more rapid drilling of various promising areas to get an idea of how much of the resources can be depended upon immediately. This could be accomplished by financial assistance and also by removing the impediments which exist today in connection with the exploration operations. I have always considered it quite illogical to spend a great deal of time, effort and money worrying about environmental effects of the discovery of geothermal resources

in an area before the first well is drilled to determine whether or not the resource actually exists. It would seem to me that a simple program of permitting limited exploration, without the bureaucratic impediments, to determine the presence of the resource and then applying the environmental factors after the character of the resource is known is a much more sensible approach.

I truly believe that if we are to get the best out of the superb research talents of the federal agencies, it is necessary that the projects be scrutinized on a more practical basis before they are undertaken. It is also essential that the private sector be more closely involved and that to accomplish this, the applicable conditions for private involvement be framed so as to meet the legitimate needs and requirements of private industry. "

Perhaps our industry's slogan should be: "Our energy needs are great. The hour is late. All sectors should cooperate. "