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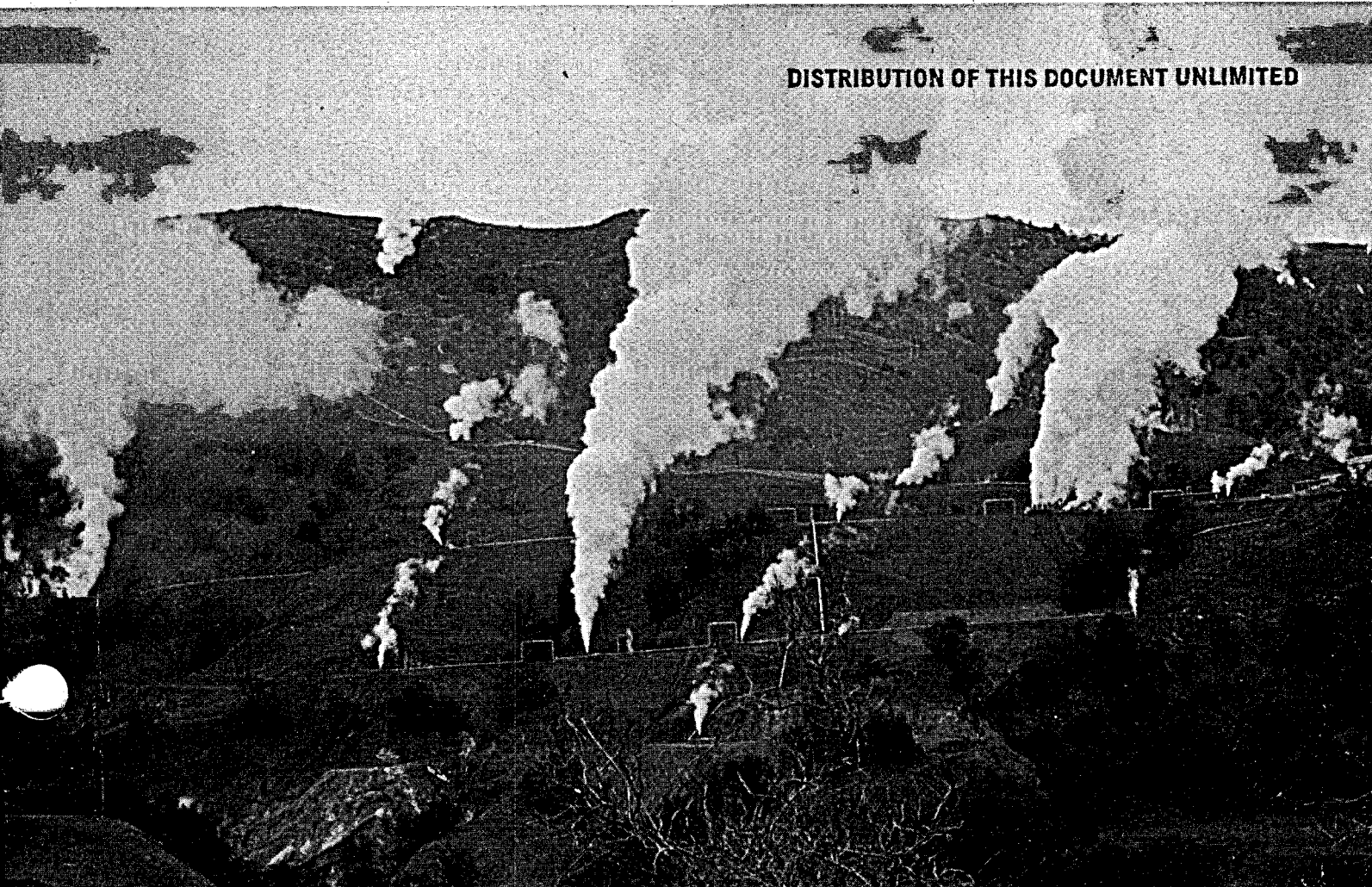
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## UTILITY COMPANY VIEWS OF GEOTHERMAL DEVELOPMENT

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The statement will emphasize views of geothermal development from a utility company standpoint. The impediments associated with such developments as required reliability and identification of risks will be discussed. The utility industry historically is not a risk-taking industry. Support of rapid geothermal development by the utility industry requires identification and elimination of risks or absorption of the risks by other agencies. Suggestions as to the identification and minimization of risks will be made.

### I. INTRODUCTION

In most geothermal development projects, electric power generation utilizing the geothermal resource is considered an electric utility; this utility will be involved in the project as the ultimate purchaser of electrical energy or, more likely, the purchaser of the geothermal fluids which will be utilized in the utility owned and operated generating plant.

A utility may choose to participate in a project in the early exploration stages or wait until this phase is done by others and join a project at the time the reservoir capacity has been established. In both cases the utility will need certain criteria established prior to committing to the purchase of electrical energy from a generating plant or the construction of a generating plant utilizing a given resource. There are four major areas of concern on which a utility must have facts to actively develop a geothermal resource. These four areas are :

- (1) The need to have established reliability.
- (2) The need to have assurance of reservoir capacity.
- (3) The need to have assurance that the economics of a geothermal development are comparable to the utility's other alternatives.
- (4) The need to integrate a geothermal development program into existing power generation expansion plans.

Each of these areas will be discussed separately in the following.

### II. RELIABILITY

The prime goal of an electrical utility is to provide reliable service to its customers. This goal is reflected throughout all of the equipment in the

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utility's system. The power production facilities must have an established reliability record to fit into the overall goal of the utility.

In considering a geothermal development the reliability of the equipment will be of utmost concern to the utility participant in the development. Reliability concepts will not be accepted by the utility industry solely from engineering feasibility studies. Operational field testing on all hardware associated with the process will be desired prior to commitment by the utility to a process to be incorporated into its overall electric generating plans.

In the case of dry steam, operation at The Geysers has demonstrated reliability and should additional dry steam fields be found demonstration would not be necessary. The reliability of equipment associated with the utilization of a pressurized hot water reservoir does need field demonstration for the utilities to seriously consider it in their overall generation plans.

### III. RESERVOIR CAPACITY

A utility will have to rely completely on the supplying reservoir for the "fuel supply" for a geothermal generating plant. Therefore, prior to expending any significant amount of funds on a geothermal project a utility will desire to have the risk associated with reservoir capacity defined and, if possible, eliminated.

In locations remote from the utility's area of service reservoir capacity will have a significant effect on the economics of a project. The greater the distance that a reservoir is from the point of usage of the electric power the larger the assured capacity will have to be to support the electrical transmission system. A general rule of thumb is that for every mile of transmission line required, two megawatts of reservoir capacity (for a 20 - 30 year period) will be necessary to support the construction of the transmission line.

Data developed in demonstrating reservoir capacity must withstand the independent review of competent firms in the reservoir assessment field.

### IV. ECONOMICS

For a utility to participate in a geothermal development project the overall cost of electrical energy from that project to the point of the utility's utilization of that energy must be competitive with the utility's other alternatives. In the long term geothermal energy must be competitive with coal and nuclear generation facilities. In the short term there may be the opportunity for geothermal power generation to displace fuel oil in existing fossil fuel burning plants. In this case the overall cost of the geothermal power need only be less than the cost of the fuel oil being used in a fossil fuel plant. It must be kept in mind that in order for a utility to take advantage of this type of displacement of fuel oil a sizeable financial investment will be required to install the generating facility if the utility itself is the owner of the power plant. With utility's vast requirement for capital this may require the developer to participate in the funding required for a geothermal plant to displace fuel oil in existing generating facilities.

## V. EXISTING EXPANSION PLANS

Most utilities have generation expansion plans that have facility commitments for various types of generation for the next ten years. Nuclear powered and coal-fired generating plants are the baseload type of energy that utility companies are planning for the future. Because of the long lead time requirements associated with these types of facilities significant financial commitments are being made today for generation facilities that will be on the line in the 80's. The lead time required to have a coal-fired plant on the line is approximately 7 to 8 years and a nuclear plant 9 to 10 years. Because of this the utilities do not have a great deal of flexibility to integrate into their expansion plans for the next 8 to 10 years any major emerging geothermal resource. This is the case if a geothermal project is looked at as one of supplying the capacity requirements for the expansion of the utility system. If the geothermal project can be considered as one that displaces existing fuel oil in plants presently on line the problem associated with integration into an expansion plan is not critical.

## VI. SUGGESTIONS ON GOVERNMENT PROGRAMS

It has been stated that the goal of the government programs is to accelerate the development of geothermal energy. Therefore, the areas that should be concentrated on are establishing reliability, reservoir capacity assurance, and economic feasibility. It has also been stated that the government desires not to operate within a vacuum but to participate in the acceleration of the geothermal program with industry.

The binary system of power generation appears to be a good selection for the utilization of the pressurized hot water reservoirs. A great deal of engineering has been done on this process and it appears that it will be economically feasible. What needs to be done now is to develop a field operating facility to establish the necessary reliability of the process to enable its use to be considered for various pressurized hot water reservoirs. Government should assist industry in bringing this to fruition as quickly as possible. The technical areas where research concentration is needed on the binary process is the pumping of the wells and the mitigation of the scaling and corrosion phenomena associated with the geothermal fluids.

For rapid development to occur on geothermal projects a high level of confidence in the reservoir capacity must be reached as quickly as possible. Present reservoir engineering techniques rely heavily on production of the field to establish trends which will enable projections to be made of reservoir capacity. Efforts should be concentrated on developing reservoir modeling techniques so that years of operation are not required to establish high levels of confidence in the reservoir capacity. This is an area that merits government participation with industry to aid in the acceleration of the geothermal program.

Many new concepts for power generation utilizing geothermal fluids have been proposed. These may improve the efficiency and economics of utilizing the geothermal resource, but are still in the high risk category. This should

be supported by government activity to assist in the long range program of improving the overall economics of geothermal energy.

As a general philosophy on the acceleration of commercial geothermal development, government participation can best aid acceleration by providing the preliminary funding of a commercial project while the activities associated with demonstrating reliability and reservoir capacity are proceeding. Normally a utility will not commit to a major development project until reliability and reservoir capacity have been demonstrated. This could take up to two years of operating time of a small scale test facility. If it is assumed that the reliability and reservoir capacity will be demonstrated, the initiation of environmental assessment work and engineering on the major development can be carried out in parallel with the small scale testing. With government assuming this risk in the early portion of the major project, the utility can take over the funding at the instant that the risks have been eliminated. As much as two years can be cut in the schedule for the major facility by this type of government participation.