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POTENTIAL GEOTHERMAL RESOURCES OF THE UNITED STATES GULF COAST

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The energy crisis has focused national attention on the need to become self-sufficient in energy. One partial solution to the energy crisis is accelerated development of geothermal energy for electric power generation. Geothermal energy is presently a small but viable contributor to the United States' energy supply. However, the geothermal resource must be developed rapidly if it is to contribute significantly to this nation's urgent energy needs.

In addition to known areas of geothermal resources in the western United States, a unique form of potential energy exists in geopressured aquifers underlying the United States Gulf Coast. Due to a unique combination of factors involving the accumulation and compaction of great quantities of sands and muds in the U. S. Gulf Coast area, overpressured aquifers, usually referred to as geopressured zones, have been created. The waters in these zones possess abnormally high temperatures. The principal geothermal zones are long, linear, high-volume aquifers extending from Laredo, Texas to the Mississippi border. They occur in successive parallel bands southward into the Gulf of Mexico. The top of the zone begins at depths of about 8,000 feet to 10,000 feet, and temperatures as high as 520° F have been recorded in Matagorda County, Texas. These abnormally pressurized geothermal zones have usually been considered a nuisance while drilling for petroleum. Future research may prove that they are more widespread than petroleum and perhaps as valuable. The very high temperature waters are essentially fresh water, with salinities as low as 1,000 parts per million. Upon reaching atmospheric conditions, a portion of the water will flash to steam, which may be used to generate electric power. Greater thermodynamic efficiencies may be achieved by the use of binary systems for power generation and also for heating and refrigeration purposes. Furthermore, observations have indicated that Gulf Coast geothermal waters contain significant quantities of natural gas in solution. This natural gas will also be released at surface conditions and can be separated from the other fluids and added to our present supply of this valuable fuel. Laboratory studies indicate that approximately 40 cubic feet of natural gas may be dissolved in each barrel of water. This means that production of every 50,000 barrels of geothermal water will release two million cubic feet of natural gas. In addition, after extraction of heat from the geothermal fluids, the comparatively fresh water may be of sufficient quality to be used for irrigation or consumption in the relatively arid areas of the Valley in South Texas. Preliminary calculations

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indicate that the major Gulf Coast geothermal sands have the capability of producing at least 22,000 MW (megawatts) of power for 50 years along coastal Texas. Studies in Louisiana have indicated a potential of at least 7,500 MW for a comparable time. Independent studies in progress by United States Geological Survey scientists suggest that reserves for the generation of electricity may be twice this figure.

Although actual costs of geothermal energy in the Gulf Coast cannot be determined at this time, it is noteworthy that the cost of operation of every geothermal facility to date has been less than that of other available fuels, aside from petroleum. The Atomic Energy Commission estimates costs of hot rock systems at 6.3 mills per kilowatt-hour, compared to 11.8 mill/kw-hr for nuclear generation. Most present geothermal costs are between 4 and 9 mill/kw-hr.

Environmental protection must be carefully considered when suggesting substitutes for petroleum. Based upon present knowledge, it is believed that production of hot fluids along the Gulf Coast will contain no minerals or noxious gases. The problem of subsidence may occur due to withdrawal of large volumes of fluids, although there is no assurance that this will happen. Studies of deep geopressured reservoirs which produce gas in South Louisiana show replenishment of reservoir fluids due to the influx of additional water from the shales adjacent to the sands in some cases, and no subsidence has been noted. However, the only way to determine if this problem may exist is to perform a field test and reservoir study. There are, of course, methods of counteracting the problem of subsidence. Water can be reinjected into oil and gas reservoirs which are often present at shallow depths. Injection into partially depleted petroleum reservoirs may provide additional recoveries by these secondary and tertiary methods. Another potential solution to the problem of subsidence is to drill for geothermal reservoirs a short distance offshore in coastal waters. In this way, the geothermal waters can be utilized for other purposes, after heat is extracted, or returned to the Gulf.

The impact of the production of electric power on the environment can only be understood by analyzing the entire fuel cycle beginning with mining, processing, transportation, and ending with disposal of spent wastes. When viewed in this light, the environmental impact of geothermal generation appears minor compared with either coal or nuclear generation. The environmental impact of geothermal power is restricted to the generating site. Various sites in California are both aesthetically and environmentally attractive.

Geothermal energy appears to represent a "here and now" energy source which, with rapid development, may partially fulfill our energy requirements. Present technology is sufficiently advanced to explore for, drill, and develop geothermal fields. Costs are usually less than those encountered for power generation using other petroleum substitutes or alternatives. Environmental effects are also less troublesome than those reported using alternative power sources. The U.S. Gulf Coast contains areas of known and suspected major reserves of geothermal energy. Intensive research and development can lead to rapid utilization of this resource.