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GEOHERMAL PLANNING: A TALE OF TWO COUNTIES

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ABSTRACT

This paper examines the diverse settings, community concerns and planning procedures pertaining to geothermal development in Imperial and Lake Counties. The Imperial County planning process has predictably emphasized protection of its agricultural base. With fewer environmental problems, more comprehensive advance planning and fewer agencies, geothermal development has generally proceeded smoothly except when agricultural or recreational interests are threatened. Lake County development reflects the area's greater environmental sensitivity, conflicting land uses and fast growth. However, increased revenues and advanced environmental mitigation practices have accompanied development.

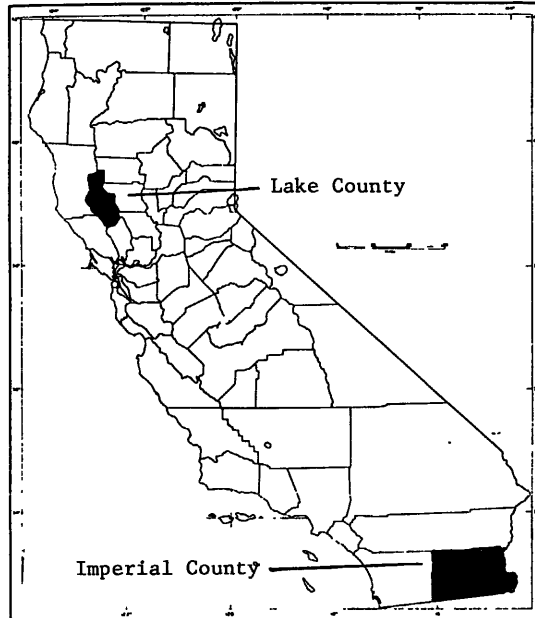
INTRODUCTION

Geothermal development activities span the state of California from level farmlands and parched deserts near Mexico to northern mountains, forests and meadows. In recent years most development has occurred in the "Geysers" region to the north and the Imperial Valley to the south. This paper examines the diverse settings, major community concerns and planning procedures pertaining to geothermal development in Imperial and Lake Counties.

LOCAL SETTINGS

The Imperial Valley is located approximately 80 miles east of San Diego, extending northward from the Mexican border to the Salton Sea. The valley is best known for its 475,000 acres of irrigated farmlands and warm climate. The valley usually ranks among the top five counties in the nation in agricultural production. The county has 95,000 inhabitants. Although agribusiness produced revenues exceeding \$757 million in 1980, 1981 joint tax returns indicated the second lowest per capita income in the state. In addition, unemployment reached 26% in the spring of 1982. Between 1970 and 1980 the population growth rate was 2.4% per year.

The Imperial Valley also contains nearly one third of the nation's known hot water geothermal resources. Six Known Geothermal Resource Areas (KGRAs) are now considered to be economically viable and may be capable of producing 4,000 MW of electrical



power sometime around the year 2010. Approximately 220 deep exploratory/production wells have been permitted, of which 120 have been drilled with 35 wells currently active. Mud drilling is used during exploration. Reservoir temperatures range from around 350°F to 644°F. High salinity levels, ranging up to 325,000 ppm, have in many of the hottest resource areas required the careful development and testing of elaborate control measures to prevent the "plugging" of geothermal equipment. At present, two 10 MW demonstration power plants are operational, with a third plant almost completed. The City of El Centro has drilled a geothermal well for direct use in the heating and cooling of the Community Center as well as other potential applications. Many other direct use studies involving agricultural processing have been and are being conducted.

Lake County is located 80 miles northeast of San Francisco and is best known for its recreational opportunities, large retirement population and walnut and pear orchards. The topography and vegetation are diverse, with coastal mountains, small

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farms, agricultural valleys, and lakes and creeks hosting a variety of forest, chaparral and riparian plant communities. The region's many lakes and mountain resorts are popular tourist attractions, resulting in a summer population roughly three times as large as its year round population of 40,000. The county is currently one of the fastest growing areas in the state. Between 1970 and 1980 the annual average growth rate was in excess of 8%. Most of this growth is attributable to in-migration, many coming to retire or resettle away from more urbanized areas. However, local economic conditions which featured 16% unemployment in Spring 1982, and the state's lowest 1981 joint per capita income are expected to, according to the Lake County General Plan, reduce the area's explosive growth rate to a high five to six percent per year.

A large portion of Lake County lies within one of four KGRAs. However, most geothermal development activities are occurring in the vapor-dominated, 350°-475°F "Geysers" field, located in the Mayacama Mountains near the Sonoma County boundary. Both mud and air drilling are used during exploration. At present, Lake County hosts one operational geothermal power plant--PG&E's Unit 13--which at 135 MW is the world's largest. In addition, Occidental Petroleum Company and the State Department of Water Resources are currently constructing power plants whose combined output will add another 135 MW of electrical generation.

The entire Geysers geothermal field currently produces around 906 MW of electrical power per year--with most of this production occurring in nearby Sonoma County. Projections for the Geysers area indicate roughly 2000 MW of power on line by 1990. Most of this projected development will occur in or adjacent to Lake County. Approximately 150 deep geothermal wells have active permits. Direct use applications are currently limited to a few privately owner warm water spas and individual water wells, although other options such as space and pool heating and agricultural applications are being examined.

COMMUNITY CONCERNS

Protection of the agricultural economy remains the paramount interest in Imperial County. Consequently, water consumption, subsidence prevention and the placement of transmission lines are among the most controversial issues facing geothermal developers. Subsidence prevention is a critical concern because of the region's extensive gravity flow irrigation systems. Other important local concerns include minimizing loss of agricultural lands, air quality impacts including potential damage to crops, protection of surface water quality and increased seismicity.

In the Salton Sea area, substantial opposition to geothermal development has been voiced when the possibility of off-shore drilling has raised local concerns regarding a potential loss of recreational amenities, increased water pollution and a proliferation of transmission lines. Diversion of surface waters for use as geothermal make-up water may fur-

ther contribute to the sea's already high salinity levels which may soon rise to levels (40,000 ppm) capable of interfering with fish reproduction. Additionally, geothermal expansion may impact the extensive waterfowl associated with the area's wildlife refuges, primarily through habitat loss, noise and collisions with transmission lines. As the Salton Sea rises, threatening further inundation of surrounding agricultural and residential areas, local apprehension regarding geothermal induced subsidence also continues to rise.

However, county wide support for geothermal development is widespread as demonstrated in a 1977 University of California survey where 90% of the county respondents were in favor of it. The expectations that development would increase jobs, attract business and provide less costly power were cited as major reasons for favorable responses. Even in the Salton Sea area, a planning department questionnaire distributed at a 1981 Niland town meeting indicated that 90% were in favor of geothermal development in the Imperial Valley (versus only 48% approval of off-shore drilling in the Sea itself). Another factor contributing to favorable local attitudes is the extensive agricultural character of the valley, where the presence of large tractors, crop dusters and feedlot odors are normal daily occurrences. In general, the agricultural areas are flat, heavily impacted, sparsely populated and have a developed road system. Consequently, many environmental issues such as increased noise, dust, odor and traffic have not yet emerged as major concerns. Geothermal leases provide a source of supplemental income to the farmer and have thus far not seriously interfered with agricultural operations.

In Lake County, geothermal development frequently occurs in pristine, scenic areas in relatively close proximity to resort communities, recreation facilities and mountain retreats. Well pad and access road construction require considerable grading and removal of natural vegetation. As in the Imperial Valley, water is a major issue. Landslides, erosion and sedimentation are widespread concerns with potential impacts to the region's many creeks, which supply drinking water and are used for fishing and swimming. Diesel, sump fluids and other materials have accidentally entered area creeks on several occasions. Development near the community of Anderson Springs, which currently receives 70% of its domestic water from Gunning Creek, is of particular concern. Fast growing Lake County is largely dependent upon creeks and ground water for its water needs. In the long run, competition for water may prove to be the major issue. Many creeks in surrounding areas are continuously "harvested" for the sand and gravel needed to accommodate geothermal expansion.

Noise, dust and heavy truck traffic associated with geothermal development activities can be a source of considerable irritation to residents accustomed to the sounds of birds, running water and rustling leaves. Bleeding wells can damage surrounding vegetation and contribute to the

distinctive aroma associated with H₂S. Some agricultural interests are concerned that boron emissions may someday damage local crops. All of the aforementioned issues are exacerbated when development occurs on privately owned surface lands with federally (or otherwise) reserved mineral rights. Rare, native plants and a legacy of archaeological resources must be taken into account. Growth inducement, and commensurately expanding roads, water, sewage, hazardous waste and classroom facilities are raising important fiscal considerations.

While local controversies continue regarding some of the environmental consequences of geothermal development, it is important to note that only one well has ever been denied. An opinion poll conducted by the University of California in 1975 indicated that 68% of the respondents felt the county should "go ahead" with geothermal development. In today's economy, the development of local geothermal is often viewed as the brightest star in a largely dismal sky. County government is receiving increased revenues from geothermal facilities. For example, according to the Lake County Assessor's Office, 1971-72 geothermal property taxes represented only .03% of the total county property tax base. By 1981-82, geothermal property values accounted for \$2.7 million in taxes, more than 19% of the county's property tax base. In addition, over \$700,000 in "AB 1905" geothermal lease funds have been returned to Lake County during the past two years. Continued geothermal expansion is a locally accepted fact of life. Today's environmental controversies generally center around geothermal site planning, performance and enforcement standards.

PLANNING PROCEDURES

Geothermal activities in the Imperial Valley are governed by a variety of planning documents including the county's "Terms, Conditions, Standards and Application Procedures for Initial Geothermal Development", Geothermal Element, Transmission Corridor Element and a variety of studies and application procedures. Except for temperature observation holes, all geothermal development activities require a conditional use permit. A distinction is made, however, between exploration activities which can occur in any zone and production activities which require a geothermal overlay zone. This practice reduces paperwork at the initial exploration stage while recognizing that production activities represent a long term land use commitment which requires additional review. In addition, the Geothermal Element adopted in 1977 promotes the use of Master Environmental Impact Reports (MEIRs) for each anomaly. The MEIR addresses the cumulative effects of multiple installations and usually allows for a streamlined permit process requiring only site specific analysis in subsequent applications. The MEIR is typically written (at the developer's expense) when a major power plant or geothermal overlay zone expansion is proposed. The MEIR identifies environmentally sensitive areas and recommends mitigation for each anomaly.

The Geothermal Element provides overall policy directives which are then specifically addressed

in individual use permit conditions. For example, the element provides for the protection of agricultural water supplies and gravity flow irrigation systems by promoting the use of irrigation water only for demonstration power plants not exceeding a total of 75 MW in each anomaly for the first five years of operation. Subsidence monitoring networks are also promoted and participation in the network is generally required. The plan also promotes 100% reinjection of fluids back into the geothermal reservoir to protect against potential subsidence. In practice, reinjection requirements have varied from 80-98%. In accordance with general plan policy, wells are usually located in the corners of agricultural fields in order to minimize impacts to farming operations. The clustering of several wells per pad further reduces the loss of agricultural lands. Brine transmission pipelines are typically placed around the perimeter of agricultural fields. The Transmission Corridor Element addresses the location of electrical transmission corridors and substations in an effort to minimize interference with agricultural operations. Direct use applications are also briefly encouraged in the Geothermal Element.

Other county procedures also enable less comprehensive environmental documentation and faster permit processing if proposed exploration projects are located .5 miles from sensitive receptors such as residences, schools and wildlife refuges. However, the county's 1971 "Terms, Conditions and Performance Standards..." stipulates that wells only need to be a minimum of 300 feet from a residence, 50 feet from a public waterway, and 1,320 feet from a school. This document also requires a \$50,000 indemnity bond for each well or a \$150,000 blanket bond for all wells to indemnify the county for potential site repair or restoration costs. Other performance standards are also addressed.

In accordance with state law, Imperial County has been delegated "lead agency" status for processing geothermal exploration projects. This responsibility may be requested by local jurisdictions with comprehensive, adopted geothermal elements and equivalent processing procedures. While the county has not requested authorization to process geothermal power plants in excess of 50 MW from the California Energy Commission, the county is, in accordance with state law, processing all power plant applications under 50 MW. Coincidentally, no geothermal power plant application over 49 MW (net) generating capacity has been submitted in Imperial County. The county currently employs a full time geothermal planner as well as a coordinator located in the Public Works Department. Federal and state grant money has been widely used to finance a variety of geothermal planning studies, administration and staff.

The Lake County Geothermal Element was adopted in November, 1981. Three major policies are included in the document pertaining to:

1. the promotion of appropriate geothermal projects as a means of providing an alternative energy supply.
2. the protection of the natural environment

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- through proper mitigation of geothermal impacts.
- the promotion of direct use applications including space heating and cooling, spas, frost protection, aquaculture, food and resource processing.

The Geothermal Element is a concise document which promotes the revision of local regulations and performance standards if necessary to ensure adequate protection of public health and safety. However, a geothermal overlay zone is not mandated and geothermal activities may be conditionally permitted in any zone subject to use permit requirements. The element does promote buffer zones around streams, water quality monitoring and use of the best available control technologies. The element also addresses the need to review existing insurance and bond requirements, revegetation and road improvement provisions and other issues. The element calls for the maintenance of an up to date public information map of all geothermal activities and sufficient staffing to plan for the orderly expansion of geothermal development.

Other regulations are contained in the county's "Conditions, Procedures and Performance Standards for Geothermal Regulation", the County Code, and individual use permits. County "Conditions..." stipulates that well sites shall be at least 500 feet from a residence, 2640 feet from a school and in no case use more than five acres of arable land. Bonding requirements are currently \$5,000 for each well or \$25,000 for a blanket bond for up to five wells. In addition, no geothermal well can be permitted within one-half mile of a populated area (defined as ten or more dwelling units within a one-quarter mile area) or a recorded subdivision, without the written consent of 75% of the property owners. Site specific regulations, however, are largely the result of individual use permit conditions. These conditions have become relatively standardized and generally require well siting at least 500 feet from a perennial stream, noise emissions not exceeding Ldn 55dBA, submittal of erosion control, drainage and spill protection plans and a variety of other conditions depending on the scale and location of the project. Noise control technologies include lead vinyl noise barriers, enclosing diesel equipment, rock mufflers and other techniques. Air pollution control measures to limit the release of H₂S include abatement of bleeding wells, treatment with hydrogen peroxide, Stretford units, turbine bypasses and other technologies. At the field development stage, school fees based on classroom construction costs and an annual survey are becoming standard conditions.

The Lake County Geothermal Element was not written to qualify the county for increased regulatory responsibilities. Consequently, the State Division of Oil and Gas is the lead agency for environmental review purposes on exploratory wells, and the California Energy Commission is responsible for power plant siting. It should be noted, however, that all exploration and steam field development projects occurring on privately owned land surfaces do require county use permits. While county procedures do not require MEIRs, the California Energy Commission is conducting "cumulative impact studies" with current hearings addressing impacts to schools, roads, domestic water systems, power plant efficiency and transmission system planning. Until

being disbanded in late 1981, the GRIPS Commission, a four county joint powers agency, attempted to coordinate geothermal development studies in the Geysers area.

CONCLUSIONS

Vastly different topography, reservoir and land use features characterize geothermal development issues in Imperial and Lake Counties. Predictably, Imperial County planning procedures have emphasized the protection of its agricultural base. With fewer environmentally sensitive areas, more comprehensive advance planning, fewer regulatory agencies, most agricultural concerns addressed and only small demonstration plants currently on line, geothermal development activities have generally proceeded smoothly. However, this process has been severely stressed in the Salton Sea area and in instances where transmission lines and competition for water threaten agricultural interests.

On the other hand, Lake County development has reflected the area's pronounced environmental sensitivity, conflicting land uses and retirement/recreational character. These concerns have been exacerbated by limited water supplies, adverse impacts but not revenues from geothermal activities in Sonoma County, separate ownership of surface and mineral rights, less comprehensive advance planning, wider political fluctuations and fragmented regulatory responsibilities. Nevertheless, development has been accompanied by increased revenues and use of advanced environmental mitigation measures.

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