

THE GEYSERS PIPELINE PROJECT

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ABSTRACT

A unique public/private partnership of local, state, federal and corporate stakeholders are constructing the world's first wastewater-to-electricity system at The Geysers. A rare example of a genuinely "sustainable" energy system, three Lake County communities will recycle their treated wastewater effluent through the southeast portion of The Geysers steamfield to produce approximately 625,000 MWh annually from six existing geothermal power plants. In effect, the communities' effluent will produce enough power to indefinitely sustain their electric needs, along with enough extra power for thousands of other California consumers. Because of the project's unique sponsorship, function and environmental impacts, its implementation has required: 1) preparation of a consolidated state environmental impact report (EIR) and federal environmental impact statement (EIS), and seven related environmental agreements and management plans; 2) acquisition of 25 local, state, and federal permits; 3) negotiation of six federal and state financial assistance agreements; 4) negotiation of six participant agreements on construction, operation and financing of the project, and 5) acquisition of 163 easements from private land owners for pipeline construction access and ongoing maintenance. The project's success in efficiently and economically completing these requirements is a model for geothermal innovation and partnering throughout the Pacific Rim and elsewhere internationally.

PROJECT ORIGINS

Like many areas in California, growth in Lake County has strained its public infrastructure, including County-operated wastewater systems. In the 1980s, the Lake County Sanitation District (LACOSAN), which provides sewer service to the communities of Clearlake, Lower Lake, and Middletown, found its wastewater systems deficient in terms of both treatment quality and disposal capacity. These deficiencies prompted the state to order LACOSAN to upgrade its treatment process and find a means of disposing of larger quantities of effluent. Finding environmentally-acceptable and affordable solutions for these requirements was not easy, and LACOSAN spent several years evaluating alternative treatment and disposal options, including agricultural irrigation, created wetlands, and ultimately geothermal injection.

At the same time in the late 1980s, the region's geothermal power industry began to experience productivity declines in The Geysers steamfield. Power plant steam usage was exceeding the steamfield's natural recharge rate and steam production was falling dramatically. The geothermal heat source remained constant; but, injection of additional water was needed to convey the geothermal heat to steam production wells. With the support of the California Energy Commission and Geysers operators, a joint Lake and Sonoma County survey was conducted of potential injection water sources available in The Geysers region, including surface waters, groundwater, and municipal wastewater. This study concluded that surface and groundwater supplies were already over committed; but, the wastewater effluent could satisfy two critical needs at once--first, as an environmentally-superior wastewater disposal method, and second, as a continuous supply of steamfield recharge water that could help mitigate Geysers productivity declines.

DEVELOPMENT PROCESS

Once the project concept emerged, a group of key stakeholders convened to investigate its feasibility and pursue project development. The core group included LACOSAN, the Northern California Power Agency (NCPA), Calpine Corporation, Unocal Corporation, and Pacific Gas & Electric Company (PG&E). The group pursued four simultaneous tracks of project development during 1991-96:

- Technical. A series of geothermal reservoir analyses and pipeline engineering studies examined reservoir impacts from effluent injection and multiple pipeline alignments and operating strategies. The results of these studies were then cost estimated and subjected to a series of life-cycle economic analyses. Together with the environmental track described below, this process iterated to a final design concept and working cost estimate;
- Environmental. Along with reservoir and pipeline technical studies, preliminary environmental surveys were performed to build a database and identify possible design and construction conflicts with environmental resources. An explicit strategy from the outset was emphasis on early identification of environmental issues,

quick preparation of documentation for objective evaluation of those issues, and design coordination to then avoid significant sensitivities before they could become impediments or controversies. The environmental track concluded with the preparation of the project EIR/EIS;

- Legal. Over the course of the technical and environmental reviews, the stakeholders also negotiated an initial agreement-in-principle for overall project development, and then detailed construction, operating, and related financing and water supply agreements, and
- Financial. The group members were also engaged at the same time in securing their individual construction cost shares and raising construction funds from public agencies with allied program goals.

As finally designed, the project consists of a 29-mile, 20-inch diameter pipeline that will carry 7.8 million gallons per day of treated wastewater effluent and Clear Lake make-up water to The Geysers for injection at existing wells operated by NCPA, Calpine and Unocal. Figure 1 summarizes the

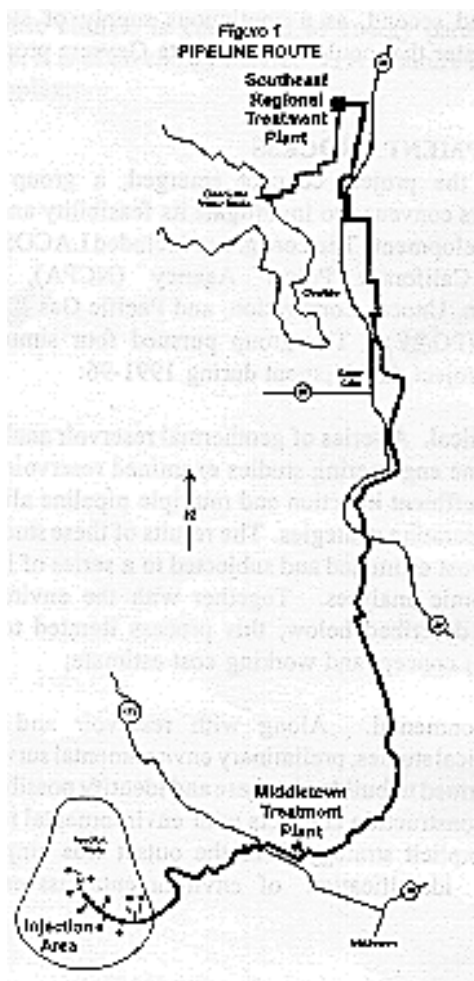


Figure 1.

29-mile route from Clear Lake to The Geysers. Make-up lake water will be used to take maximum advantage of pipeline capacity during the early years of the pipeline's life; as effluent flows increase over time with population growth, make-up lake water quantities will be reduced proportionately. To move the effluent and lake water, the pipeline will use six pump stations totaling 7,370 hp, including a 1,600 ft final lift from the Bear Canyon operator and entrance up to the injection area in the southeast Geysers. Depending on steam recovery rates for the injected effluent, the project is expected to create up to 70 MW of generating capacity at six existing power plants operated by NCPA and PG&E, or as much as 625,000 MWh annually.

The project's total construction cost is \$45 million, including \$8 million in wastewater treatment plant improvements. Construction costs are being shared by the core group of participants, known as the Joint Operating Committee (JOC), with additional funding from the California Energy Commission, California Water Resources Control Board, U.S. Department of Energy, U.S. Department of Commerce, U.S. Department of the Interior, and the U.S. Environmental Protection Agency. Approximately 40% of the construction costs are industry-funded, 20% are County funded, and the remaining 40% is divided equally between economic development and energy resource funds from the federal and state agencies. Additionally, the industry participants are investing several million dollars in secondary pipelines terminus to injection wells in the steamfield.

The project's annual operating costs are estimated at approximately \$1.5 to 2 million. The JOC members have signed a 25-year operating agreement wherein LACOSAN will operate the pipeline as far as the Middletown area, after which it will be industry-operated to its terminus in the steamfield. LACOSAN will pay an annual O&M cost share equivalent to its normal disposal costs, with the industry participants paying the remaining O&M costs based on the quantity of effluent they each receive at their wellheads.

PERMITS AND AGREEMENTS

A major aspect of the project from the outset was its institutional complexity, and the need to reach legal and administrative agreement with numerous public and private stakeholders representing a myriad of environmental, regulatory, operator, and property interests. Table 1 summarizes the project's five major categories of institutional requirements, and the specific permits and other items that were completed, negotiated, and/or acquired during 1991-96.

Initially, considerable effort was devoted to negotiating agreement among the JOC members to pursue project development. This was embodied in a 1991 agreement-in-principle that set out the project's basic goals and committed stakeholders to consensus decision making. Extensive effort also went into negotiating federal geothermal royalty reduction agreements that allow lower industry royalty payments in exchange for larger industry construction cost shares, plus a longer overall term of payments as a result of the effluent-extended reservoir life. A critical agreement also had to be negotiated with adjacent Yolo County for a portion of

Table 1
INSTITUTIONAL REQUIREMENTS

General Agreements

- Preliminary Agreement-in-Principle
- Joint Construction
- Joint Operation
- Clearlake Water Acquisition
- Federal Royalty Reduction
- Geothermal Operator-to-Operator

Funding Agreements

- California Energy Commission (multiple)
- California Water Resources Control Board
- U.S. Department of Energy (multiple)
- U.S. Department of Commerce
- U.S. Environmental Protection Agency

Environmental Documents

- Lead Agency Memorandum of Understanding
- County Certification
- BLM Record of Decision
- DOE Record of Decision
- EPA Record of Decision
- County Mitigation/Operating Plan
- BLM Special Stipulations/Right-of-Way Agreement

Private Right-of-Way

- Temporary Construction Easements
- Permanent Maintenance Easements

Permits

- Federal/State Cultural Resources Programmatic Agreement
- Federal/State Cultural Resources Memorandum of Understanding
- Federal/State Cultural Resource Clearance (multiple)
- State Fish and Game Stream Crossings/Alteration Agreement
- State Fish and Game Lake Intake Alteration Agreement
- State Highway Encroachment
- State Stormwater Pollution Prevention (multiple)
- State Wastewater Treatment Plant Waste Discharge Modification
- State Waste Discharge Modification for Industry Operators (multiple)
- County Air District Authority to Construct/Permit to Operate
- County Road Encroachment
- County Grading
- County Building
- County Lakebed Encroachment
- County Lakebed Variance
- County Lakebed Management Lease
- Municipal Street Encroachment

their water rights to Clear Lake for the make-up water needed during the project's early years when effluent flows will be relatively small in relation to pipeline capacity. Another set of agreements and special legislation were arranged for financial assistance provided by state and federal agencies.

In order to structure the project's environmental review, a memorandum of understanding was negotiated between the BLM, who administers federal geothermal leases held by Calpine and NCPA, and LACOSAN as the primary local sponsoring agency. BLM was designated as the lead agency for federal environmental review and LACOSAN was designated as the lead agency for state environmental review. Once underway, the EIR/EIS process focused on effluent injection-induced seismicity, possible groundwater contamination from effluent injection, sensitive plants impacts from pipeline construction, sensitive stream crossings by the pipeline, archaeologic site impacts, and Clear Lake water quality impacts. Analysis of these and other environmental issues revealed no significant adverse impacts that could not be adequately mitigated.

Following the preparation and certification of the EIR/EIS, records of decision were prepared for BLM, as well as DOE and EPA because of their funding roles. LACOSAN also prepared a detailed Mitigation, Monitoring and Operating Plan (MMOP) as required by state laws to insure that pipeline construction and operations comply with the mitigations

stipulated in the EIR/EIS, and that the project continues to function in an environmentally-acceptable manner over its operating life. A separate set of BLM environmental stipulations was also negotiated to ensure that pipeline construction and operations on federal lands are similarly compliant with the EIR/EIS. As an example of the project's attention to both environmental soundness and public involvement, one of the MMOP measures was establishment of a seismic monitoring advisory committee whose citizen and industry members will regularly examine seismic data for any indication of effluent-induced activity.

Permitting of the project was organized according to five segments, or reaches, of the pipeline. For each reach, a variety of local, state, and federal permits were required depending upon the urban or rural character of the reach and the presence or absence of sensitive environmental resources. Of the project's total 25 permits, the major ones included: federal and state archaeologic clearances, state fish and game authorizations for sensitive stream crossings and the Clear Lake intake, public highway and road encroachments, construction storm-water pollution prevention, and air quality management.

Finally, in addition to public right-of-way encroachments, easements had to be obtained from 163 private land owners over the 29-mile pipeline alignment for construction and ongoing maintenance access.

CHALLENGES AND ACCOMPLISHMENTS

Implementing the effluent pipeline project has been a major institutional challenge in several respects. First, as something that has never been attempted before, it automatically raised technical, legal, and regulatory concerns to above average heights. Second, it was jointly sponsored by public and private organizations that have historically often been adversarial; but, who found themselves benefitted by a partnership where they could work together toward mutually advantageous objectives. Finally, the complexity of a 29-mile linear facility crossing multiple jurisdictions and dozens of sensitive environmental sites significantly increased the scope and amount of environmental and regulatory scrutiny.

The project's strategy for dealing with these challenges included: 1) an inclusive "open door" policy that emphasized information sharing and collaborative planning among all interested parties; 2) involvement of agency permitting staff in early feasibility studies to insure their familiarity with the project, and solicit their input; 3) commissioning of special environmental studies to analyze specific options and questions as they arose, before they could become problematic to the project development process; 4) aggressive information outreach to citizens and civic groups, particularly environmental organizations, to insure their familiarity with the project; and 5) use of consensus decision making by the JOC members to insure that each step of the development process had the full commitment of all stakeholders. The project also emphasized the involvement of state and federal legislators whose districts were impacted by the project, insuring that they were aware of the problems the project was responding to, and the benefits expected if implemented as planned.

As a result of this strategy, the project's legal and institutional accomplishments to date include:

- An EIR/EIS completed and certified within 18 months and without any appeals,
- All permits acquired within 18 months without any agency imposition of extra project costs or any delays to the project's schedule,
- No appeals or other legal challenges to any of the permits or project agreements, and
- All legal, institutional, and environmental work completed within or under budget, in a total amount equivalent to approximately 3.5% of project construction costs.

CONCLUSION

The project's construction ground breaking took place on October 6, 1995. As of this writing, construction is underway on all of the pipeline reaches, with completion and start-up expected in August 1997.

In an age of dwindling resources, increasing competitive pressures, and bureaucracy, the Southwest Geysers Effluent Pipeline Project is a testament to the power of synergistic innovation and public/private partnering. In this case, the community liability of waste water is being converted into a sustainable geothermal energy asset. From a geothermal development perspective, the significance is not the uniqueness of the wastewater-to-electricity concept; but, rather the ability to implement geothermal projects more successfully where they can be linked to convergent community needs and partnerships. Comparable opportunities for innovation and collaboration exist throughout the Pacific Rim and elsewhere internationally.

ACKNOWLEDGMENTS

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