
JAMES W. LOVEKIN

PRESENT POSITION

Manager of Field Operations

EXPERTISE

Mr. Lovekin has been actively involved in geothermal reservoir engineering and field management since 1985. His specialties include:

- Planning and execution of geothermal well tests
- Assessment of geothermal reserves and sustainable reservoir capacity
- Interpretation of well logs, pressure transient tests, tracer tests, and geochemical trends
- Design and supervision of well workovers
- Prevention of scale in geothermal wells and surface facilities
- Selection of optimal injection strategies for geothermal fields
- Forecasting reservoir performance and estimating make-up drilling requirements
- Budgeting and cost control for drilling and for monitoring reservoir performance

EDUCATION

Engineer's Degree in Petroleum Engineering, Stanford University, 1987

B.S. in Geological Engineering, University of Nevada, Reno, 1980

B.A. in American Studies, Amherst College, Amherst, Massachusetts, 1977

Fluent in French; speaks and reads Spanish; and reads Russian

Mr. Lovekin is a Registered Professional Engineer in Petroleum Engineering in the State of California (Certificate Number 1594)

EXPERIENCE

Manager of Field Operations, GeothermEx, Inc., 1996 - present

As GeothermEx's Manager of Field Operations, Mr. Lovekin is responsible for:

- planning field development
- assessing well capacities
- monitoring reservoir performance

- preparing and reviewing field operating budgets; and
- evaluating drilling budgets

Mr. Lovekin has undertaken these types of analyses at numerous geothermal fields in the United States, Indonesia, the Philippines, Kenya, and Central America.

Selected projects include:

- Project manager for resource assessment and performance forecasting for the Roosevelt Hot Springs geothermal field. For PacifiCorp, 2013 - 2015.
- Project Manager for all GeothermEx projects undertaken for Ormat. Includes work on resource assessment, reservoir management and optimization, injection management, due diligence for project financing, and specialized analyses to resolve specific operational issues. 2012 - present.
- Provision of technical analysis of geothermal development issues in Hawaii. For the Department of Land and Natural Resources of the State of Hawaii, 2012 – present.
- Resource assessment, well test analysis, lenders' resource consultant services, and advice on development strategy for greenfield development prospects in Indonesia. For a private client, 2012 to present.
- Assessment of business opportunities and recommendations for expansion of geothermal portfolio of a major U.S. electrical utility. For Black & Veatch Corporation, 2009 – 2010.
- Project Manager for resource assessment, well-test analysis, and due-diligence reporting for financing of the Hudson Ranch geothermal project in the Salton Sea. For EnergySource LLC, 2008-present.
- Evaluation of resource adequacy and business plans for geothermal projects in Nevada, in support of evaluations by regional electrical utility for formulation of power purchase agreements. For NV Energy, 2008 – 2011.
- Analysis of business plan, budget and revenue projections, and resource viability for the acquisition and expansion of the Stillwater geothermal project, Nevada. For Leucadia Corporation, 2001 – 2002.
- Development of ASTM standard definitions for geothermal reserves (1997-1998) and steam quality (2000-2001) as Chair of the Technical Standards Committee of the Geothermal Resources Council.
- Assessment of power generation forecasts and of project financial projections for three geothermal projects operated by Calpine Corporation at The Geysers (Aidlin, Bear

Canyon, and West Ford Flat), in support of refinancing. For CIT Group/Newcourt Capital, 2000-2001.

- Analysis of the geothermal potential of the State of Hawaii, including economic evaluation of options for alternative uses of geothermal energy. For the Department of Business, Economic Development and Tourism of the State of Hawaii, 1999-2000.
- Assessment of sustainable capacity for electrical generation and mineral extraction at new plants in the Salton Sea geothermal field, including assessment of specialized operational requirements and analysis of budgets for drilling, operations and maintenance. For CalEnergy Company, 1999.
- Pre-feasibility studies for development of six geothermal projects in the Philippines. For US Geothermal Industries Corporation (USGIC) on behalf of US Department of Energy, 1998-1999.
- Evaluation and review of project economics, including assessment of drilling requirements and budgetary constraints, in four major Indonesian geothermal projects (Dieng, Patuha, Wayang Windu and Bali) totaling more than 300 MW. For Credit Suisse First Boston, 1996-1998.

CalEnergy Company, Inc., Ridgecrest, California, 1987 - 1996

As Director of Geothermal Resources (1991 - 1996), Mr. Lovekin:

- Managed reservoir engineering, geology, and drilling activities for CalEnergy's operating geothermal fields in the United States, including Coso (270 MW), Salton Sea (326 MW), Roosevelt Hot Springs (25 MW), and Desert Peak (9 MW).
- Supervised resource-related aspects of exploration, drilling, and field assessment for CalEnergy's geothermal projects under development, including Newberry Crater, Oregon; Glass Mountain (Medicine Lake), California; Dieng, Indonesia; and Patuha, Indonesia.
- Coordinated a program of relocating injection at Coso by drilling in-field wells to improve pressure support in the reservoir.
- Successfully negotiated an agreement between different partnership interests and royalty holders at Coso to permit exchanges of steam between lease areas, to provide greater flexibility in utilizing available steam and to minimize the drilling of make-up wells.

As District Reservoir Engineer of the Coso Geothermal Field (1987-1991), Mr. Lovekin:

- Directed reservoir engineering at the Coso Geothermal Field in Inyo County, California, during its first four years of commercial operations.

- Conducted flow tests of approximately 50 productive wells at Coso.
- Established a reservoir monitoring program incorporating flow rate measurements, pressure and temperature surveys, geochemical sampling, and tracer studies.
- Made forecasts of make-up drilling requirements and participated in the site selection for new wells.
- Prepared reserve estimates and performed economic evaluations of Coso and other geothermal properties being considered for acquisition.

Production Engineer, Chevron USA, Inc., Ventura County, California, Summer 1986

- Estimated reserves for the Pliocene Gas Pool in the West Montalvo Field in Ventura County, California, and recommended a plan of depletion.

Engineering Assistant, Unocal Geothermal, Santa Rosa, California, Summer 1985

- Performed pressure transient analysis and assisted in the construction of the annual isobaric map of The Geysers Geothermal Field.

Petroleum Engineer, Amoco Production Company, New Mexico and Texas, 1980 - 1984

- Worked with oil and gas fields in the Permian and Delaware basins, with the Bravo Dome Carbon Dioxide Gas Field in northeastern New Mexico, and with offshore oil operations in the Gulf of Suez.
- Evaluated water flooding projects for expansion, designed well simulations, analyzed well logs and pressure transient data, and estimated reserves.

Geologist, Amax Exploration, Inc., Colorado, Summer 1980

- Performed field work on a project to assess the geothermal potential of the Rio Grande Rift area of New Mexico.
- Measured geothermal gradient in water wells and took water samples from wells and hot springs.
- Wrote descriptions of surface geology at sample locations.

MEMBERSHIPS AND ASSOCIATIONS

Geothermal Resources Council (Member of the Board of Directors, 1993 – present)

International Geothermal Association

Society of Petroleum Engineers

American Association of Petroleum Geologists

Association of Engineering Geologists

PUBLICATIONS

- Chabora, E.R., Lovekin, J.L., Spielman, P., and Krieger, Z., "Resource Performance at Ormat's Tuscarora Geothermal Project, Nevada USA," Proceedings, World Geothermal Congress, 2005, 8 pages, 2015.
- Orenstein, R., Delwiche, B., and Lovekin, J.L., "The Don A. Campbell Geothermal Project – Development of a Low-Temperature Resource," Proceedings, World Geothermal Congress, 2005, 6 pages, 2015.
- Lovekin, J. W., and Pletka, R., "Geothermal Assessment as Part of California's Renewable Energy Transmission Initiative (RETI)," Geothermal Resources Council, Transactions, Vol. 33, pp. 1,013-1,018, 2009.
- Lovekin, J. W., Sanyal, S. K., Sener, A. C., Tiangco, T., and Gutiérrez-Santana, P., "Potential improvements to existing geothermal facilities in California," Geothermal Resources Council, Transactions, Vol. 30, pp. 885-890, 2006.
- Lovekin, J. W., Henneberger, R. C., and Sanyal, S. K., "Energy reserves and costs of geothermal resources in Hawaii," Geothermal Resources Council, Transactions, Vol. 30, pp. 891-895, 2006.
- Sanyal, S. K., Klein, C. W., Lovekin, J. W., and Henneberger, R. C., "National assessment of U.S. geothermal resources – a perspective," Geothermal Resources Council, Transactions, Vol. 28, pp. 355-362, 2004.
- Klein, C. W., Lovekin, J. W., and Sanyal, S. K., "New geothermal site identification and qualification." Consultant report for California Energy Commission, Publication No. P500-04-051, April 2004. Report and accompanying PIER Geothermal Database available on the web at: http://www.energy.ca.gov/pier/final_project_reports/500-04-051.html.
- Sabin, A. E., Unruh, J. R., Walker, J. D., Monastero, F. W., Lovekin, J. W., Robertson-Tait, A., Ross, H., Sorensen, M., Leong, R., Holte, C. T., Amos, C., and Blackwell, D., "Geothermal energy resource assessment on military lands," Proceedings of the Twenty-ninth Workshop on Geothermal Reservoir Engineering, Stanford Geothermal Program, pp. 42-51, 2004.
- Sanyal, S. K., Lovekin, J. W., Henneberger, R. C., Robertson-Tait, A., Brown, P. J., Morris, C. L., Schochet, D., "Injection testing for an enhanced geothermal system project at Desert Peak, Nevada," Geothermal Resources Council, Transactions, Vol. 27, pp. 885-891, 2003.
- Butler, S. J., Sanyal, S. K., Robertson-Tait, A., Lovekin, J. W., and Benoit, D., "A case history of numerical modeling of a fault-controlled geothermal system at Beowawe, Nevada,"

Proceedings of the Twenty-sixth Workshop on Geothermal Reservoir Engineering,
Stanford Geothermal Program, pp. 35-40, 2001.

Robertson-Tait, A. and Lovekin, J. W., "Potential sites and experiments for enhanced
geothermal systems in the western United States," Geothermal Resources Council
Transactions, Vol. 24, pp. 169-174, 2000.

Sanyal, S. K., Robertson-Tait, A., Klein, C. W., Butler, S. J., Lovekin, J. W., Brown, P. J.,
Sudarman, S., and Sulaiman, S., "Assessment of steam supply for the expansion of
generation capacity from 140 to 200 MW, Kamojang Geothermal Field, West Java,
Indonesia," Geothermal Resources Council Transactions, Vol. 24, pp. 571-578, 2000.

Lovekin, J. W., "The economics of sustainable geothermal development," Geothermal
Resource Council Transactions, Vol. 24, pp. 113-118, 2000.

Lovekin, J. W., "Sustainable geothermal power: the life cycle of a geothermal field,"
Geothermal Resource Council Transactions, Vol. 22, pp. 515-519, 1998.

Hirtz, P., and Lovekin, J. W., "Tracer dilution measurements for two-phase geothermal
production: comparative testing and operating experience," Geothermal Resource
Council Transactions, Vol.19, pp. 563-568, 1995.

Hirtz, P., Lovekin, J. W., Copp, J. F., Buck, C., and Adams, M.C., "Enthalpy and mass flowrate
measurements for two-phase geothermal production by tracer dilution techniques,"
Proceedings of the Eighteenth Workshop on Geothermal Reservoir Engineering,
Stanford Geothermal Program, pp. 17-27, 1993.

Lovekin, J. W., "Control of calcium carbonate scale using concentric tubing at Coso
geothermal field," Geothermal Resource Council Transactions, Vol.14, Part 2, pp.
1611-1617, 1990.

Lovekin, J. W., "Correlation of rig test and James tube tests in the Coso geothermal field,"
Proceedings of the Fifteenth Workshop on Geothermal Reservoir Engineering,
Stanford Geothermal Program, pp. 167-172, 1990.

Lovekin, J. W., and Horne, R. N., "Optimization of injection scheduling in geothermal fields,"
Geothermal Resources Council Transactions, Vol.11, pp. 607-614, 1987.

CITIZENSHIP

USA