GeothermEx, Inc.

3260 BLUME DRIVE, SUITE 220
RICHMOND, CALIFORNIA 94806 USA

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EDUARDO E. GRANADOS

PRESENT POSITION

Senior Vice President, Drilling Services

EXPERTISE

Mr. Granados has been active in geothermal exploration, drilling and well testing continuously since 1975. His specialties are:

- drilling engineering
- design of high temperature geothermal wells for flash flow
- design of low temperature geothermal wells for pump flow
- instrumentation, design and supervision of geothermal well tests
- specification and design of instrumentation for production wells
- analysis of geothermal well-test data for reservoir assessment
- supervision of drilling and workover of geothermal wells
- design and supervision of construction for civil works (roads, pipelines, drill pads, sumps)
- preparation of drilling specifications and bid documents
- permitting and coordination with government regulatory agencies

EDUCATION

M.S. in Petroleum Engineering, Stanford University, 1983

Diploma, Geothermal Institute, University of Pisa (Italy), 1975

B.S. in Civil Engineering, University of Costa Rica, 1973

Fluent in Spanish and Italian; reads and speaks French

EXPERIENCE

GeothermEx, Inc., 1984-present

Mr. Granados has worked in the United States, Portugal, Indonesia, Japan, Republic of Georgia, Papua New Guinea, Mexico, Guatemala, El Salvador, Nicaragua, Costa Rica, and

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Panama on multiple aspects of geothermal well drilling, testing, data analysis and the construction of surface facilities. Examples of his work include:

- Well design, preparation of bid documents, bid evaluation, drilling contractor selection, drilling procurement, drilling supervision and management of logistics for multi-well drilling programs in the Azores Islands (Sao Miguel and Terceira), Portugal, 1998 – present.
- Coordination of drilling, well repair and field operations at the Miravalles geothermal field, Costa Rica, 1994 - present.
- Design and specification of well workover and field-wide well testing operations at the Zugdidi-Tsaishi geothermal field, Republic of Georgia, 1997 - 1998.
- Design of deep (10,000+ feet), high temperature, directional steam wells, some with forked completions, at the Aidlin geothermal project in The Geysers; daily monitoring of drilling operations, 1992 - 1997.
- Drilling engineering services for the design and workover of high-temperature (600°F+) wells in the Puna geothermal field, 2002 - present.
- Design of deep injection wells (7,000+ feet) at the Bradys geothermal project, daily monitoring of drilling operations, 1992 - 1994.
- Preparation of technical specifications for bidding drilling services at the Dieng geothermal field, Indonesia, 1994 - 1995.
- Design and specification, daily monitoring of drilling operations for directional wells at the Dieng geothermal field, Indonesia, 1994 - 1995.
- Design and specification for drilling directional wells at the Wayang Windu geothermal field, Indonesia, 1995 - 1997.
- Planning and managing of field operations for repair and control of blow-out situations in uncontrolled wells in a field in northern Japan, 1992.
- Design of deep directional production wells and daily monitoring of drilling operations in the Chipilapa geothermal field, El Salvador, 1991 - 1992.
- Coordination of a scientific group for the preparation a manual for geothermal development ("Guidelines for Geothermal Development in the Latin American Countries"). For the Latin-American Organization for Energy Development (OLADE), Ecuador, 1992 - 1993.
- Design and field supervision of drilling and workover operations for several extremely high-temperature, highly gassy, anomalously pressured geothermal production wells (average depth 8,000 feet), Akita, Japan, 1989 - present.

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- Review of drilling results, design and supervision of injection testing of geothermal research wells in the Puna Geothermal District, Hawaii, 1989 - 1995.
- Review of geothermal well drilling programs for Ormat Energy Systems, Inc., private developers in the Puna District, Hawaii, 1989 -1995.
- Design of well tests and assessment of drilling and logging results at Zunil geothermal field, Guatemala, 1988 -1994.
- Review of exploration and development drilling for high-temperature geothermal resources in El Salvador, 1990 - 1994.
- Design and supervision of well workover operations to upgrade existing wells for pump installation at Empire (San Emidio) and Steamboat, Nevada. 1985-1987.
- Design of large-diameter injection wells, supervision of geothermal drilling and logging and design/supervision of long-term injection testing at an open-pit gold mine located on an active geothermal system at Lihir Island, Papua New Guinea, 1986 - 1988.
- Design and drilling supervision of 25 temperature gradient and exploration holes (20 cored, 5 rotary drilled) for geothermal field assessment at Lihir Island, Papua New Guinea, 1988 - 1990.
- Design of pumped wells, downhole pump installation, and supervision of drilling and testing of geothermal wells at Empire (San Emidio), Steamboat and Soda Lake, Nevada, and East Mesa, California, 1985 - 1988.
- Design and specification of scale and corrosion control field equipment at Asal geothermal field, Djibouti, 1989.
- Assessment of well damage and management of re-logging and testing operations at Uenotai geothermal field, Japan, 1988 - 1989.
- Design and supervision of well testing operations for the Scientific Deep Hole in Salton Sea, Imperial Valley, California, 1987.
- Design of large-diameter geothermal wells, design and supervision of long-term well testing, planning and design of a wellhead maintenance program at the Coso Hot Springs geothermal field, California, 1985 - 1987.
- Design and permitting of deep, directional steam wells in The Geysers geothermal field, California. For Geothermal Energy Partners, Ltd., Northern California Power Agency and California Department of Water Resources, 1984 - 1997.

Instituto Costarricense de Electricidad (ICE), 1975 - 1984

- Design and supervision of drilling of nine deep geothermal wells (depths 3,600 to 7,500 feet) and 46 temperature-gradient holes (all cored; depths 100 to 1,600 feet)

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- Management of well-testing operations
- Design of civil works and camp facilities; construction management
- Design of well-logging and well-test operations
- Preparation of drilling specifications and bid documents; negotiation with drilling contractors; management of drilling budgets

MEMBERSHIPS

Society of Petroleum Engineers

Geothermal Resources Council

International Geothermal Association

SELECTED PUBLICATIONS

An Alternative and Modular Approach to Enhanced Geothermal Systems. Proceedings, World Geothermal Congress, 2005 (with Subir K. Sanyal, Steven J. Butler and Roland N. Horne).

Mitigation of Cyclic Production Behavior in a Geothermal Well at the Uenotai Geothermal Field, Akita Japan. Transactions, Geothermal Resources Council, 2002.

Updated Numerical Simulation Modeling of the Miravalles Geothermal Field, Costa Rica. Transactions, Geothermal Resources Council, 2002

Development of a Geothermal Master Plan for Nicaragua. Proceedings, World Geothermal Congress, 2000.

Numerical Modeling of the Miravalles Geothermal Field, Costa Rica. Proceedings, World Geothermal Congress, 2000.

Development of Injection Capacity for the Expansion of the Ribeira Grande Geothermal Power Project, São Miguel, Açores, Portugal. Proceedings, World Geothermal Congress, 2000.

Results of a Comprehensive Well Test Program to Assess the Zugdidi-Tsaishi geothermal Field, Republic of Georgia. Proceedings, World Geothermal Congress, 2000.

Analysis of Well Test Data from the High-Temperature Geothermal System of Amatitlán, Guatemala. Transactions, Geothermal Resources Council, Volume 20, 1996.

Injection-related problems encountered in geothermal projects and their mitigation: the U.S. experience. Proceedings, World Geothermal Congress, 1995.

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Modeling discharge requirements for deep geothermal wells at Cerro Prieto geothermal field, Mexico. Proceedings of the 19th Workshop on Geothermal Reservoir Engineering, Stanford Geothermal Program, January 1995.

Problems and solutions related to injection of geothermal fluids. Presented at the Workshop on Injection of Geothermal Fluids, Mexicali, Mexico, May 1993.

Numerical modeling of the initial state and matching of well test data from the Zunil geothermal field, Guatemala. Proceedings of the 16th Workshop on Geothermal Reservoir Engineering, Stanford Geothermal Program, January 1991.

An integrated test program for the definition of a high temperature geothermal reservoir. Transactions Geothermal Resources Council, Volume 14, 1990.

Long-term test program at Coso Hot Springs. Proceedings of the 12th Workshop on Geothermal Reservoir Engineering, Stanford Geothermal Program, January 1987.

Long-term testing of geothermal wells at LADWP's leases in the Coso Hot Springs KGRA. Proceedings, Tenth Annual Geothermal Conference Workshop (EPRI AP-5059-SR), February 1987.

Miravalles geothermal field, Costa Rica: technical report. Transactions, Geothermal Resources Council, Volume 9, 1985.

Scale deposits in geothermal wells at the Miravalles geothermal field, Costa Rica. Geothermics, Volume 14, No. 4, pp. 517-524, 1985.

Two-phase flow and scale deposits in thermal wellbores. Society of Petroleum Engineers, Long Beach, California, 1984.

Calcium carbonate deposition in geothermal wellbores. MSc. Thesis, Stanford University, 1983.

Informe de Factibilidad para el Proyecto Geotermico Miravalles, Area de Perforacion Profunda; Instituto Costarricense de Electricidad, 1980.

Informe de Pre-Factibilidad para el Proyecto Geotermico Miravalles; Instituto Costarricense de Electricidad, 1978.

Heat flow interpretation in the Miravalles geothermal field, Costa Rica. Transactions, Geothermal Resources Council, Volume 1, 1977.

Selection of construction materials for geothermal power plants. Post-graduate thesis for geothermal energy course, Pisa, Italy, 1975.

CITIZENSHIP

USA