

NUMERICAL MODELING OF THE MIRAVALLES GEOTHERMAL FIELD, COSTA RICA

Pham, M.¹, Sanyal, S.K.¹, Granados, E.E.¹, Mainieri, A.², and Gonzáles, C.²

¹GeothermEx, Inc., 5221 Central Avenue, Suite 201, Richmond, California 94804 USA

²Instituto Costarricense de Electricidad, Sabana Norte, Piso 8, Dept. Estudios Geotérmicos, San José, Costa Rica

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ABSTRACT

Miravalles geothermal field has about 150 MW installed plant capacity being supplied by 24 active wells; more than 45 production/injection wells have been drilled to date in this field. A three-dimensional, finite-differences, numerical simulation model of the field was developed based on a conceptual model derived from extensive geological, geophysical and geochemical exploration data and results of drilling and testing of wells. The model was then calibrated by matching the initial state by trial and error.

The model covers an area of 108 square km and consists of 6 layers of non-uniform thickness, with about 2,000 gridblocks in total. To further calibrate the model, detailed production and injection data from the wells were input into the model and the observed reservoir pressure histories were matched by trial and error. Production enthalpy data were available but were not particularly useful for matching, since the data showed little change during the three-year history. Historical geochemical data trends obtained from the production wells were used to constrain the model.

The calibrated numerical model, complemented by wellbore simulation, was then used to forecast reservoir behavior and individual well performance under a wide variety of production and injection schemes. These schemes included several expansion scenarios and the results were used in planning the production well drilling schedule for the purpose of maintaining the steam supply. Additionally, from these forecasts, an optimum production and injection strategy was developed; specifically, more infield injection was found to be necessary to ensure longevity of steam production.

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