NUMERICAL SIMULATION OF THE WASABIZAWA GEOTHERMAL FIELD, AKITA PREFECTURE, JAPAN

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Key Words:
Initial state, well test, forecasting, deliverability, make-up well

ABSTRACT

A numerical simulation model of the Wasabizawa field was developed based on the conceptual model developed by Dowa Mining Company. The model covers a total area of 70 km2 and extends vertically from an elevation of 700m above sea level to 1,600m below sea level. The model has 2,185 grid blocks in 9 layers. The boundary conditions and distributions of horizontal and vertical permeabilities were arrived at by trial-and-error matching of the initial temperature and pressure distributions within the field. All other hydraulic and thermal properties of the field were known from exploration, drilling, well testing and core-analysis results.

Observed and calculated temperature and pressure distributions were well-matched, confirming the validity of the conceptual model and providing the first stage of calibration of the numerical model. This effort yielded credible estimates of the locations and rates of fluid recharge and discharge in the initial state. In the second stage of calibration, long-term well test data and downhole pressure records from observation wells were matched by trial-and-error. In addition, the wellbore characteristics were calibrated against available data using wellbore simulation. This well test matching effort yielded excellent results, further confirming the model's validity and refining its calibration.

Forecasting shows that the field can easily sustain a power generation level of 30 MW with eight production and eight injection wells. Assuming that the productivity of new wells to be drilled lies between that observed in wells WZ-7 and WZ-9 (the two currently available production wells), a make-up well would be needed after 5.4 years, followed by one every six years. If the new wells were assumed to be closer in productivity to the more productive existing well, only one make-up well was needed at year 25 to maintain the required steam rate for a 30 MW plant. For a generation level of 40 MW, a total of 10 production and 10 injection wells are needed initially and one make-up well would be needed every 2.5 to 3 years.

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