

宜蘭清水地熱儲集層數值模型與生產模擬研究

Study on Numerical Model for Geothermal Reservoir and Production Simulation in Chingshui, Yilan

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摘 要

於 1981-1993 年運轉的宜蘭清水 3MWe 地熱電廠因產能衰減導致不敷成本而停止運轉。本文旨在建立清水地熱儲集層數值模型，用以探討該區產能衰減原因。本研究建立的清水地熱儲集層數值模型，考量地熱流體含二氧化碳成分，經由參數調節和數值計算，自然狀態溫度模擬結果與井測溫度擬合良好。進而以自然狀態模型為基礎，建立 1981-1993 年生產井歷史開採的模型，然後進行模擬變數、變壓及定壓等 3 種方案開採。其中，變數和變壓開採方案雖與歷史開採流量吻合，卻與實際開採壓力條件差異較大；定壓方案為假設結垢造成井周圍滲透率隨時間變化，經歷史開採流量模擬可獲得與實際流量相近的擬合結果，而推估結垢為導致滲透率下降造成歷史開採流量異常降低的原因。

關鍵詞：清水地熱、儲集層數值模型、二氧化碳。

Abstract

A 3MWe geothermal power plant at Chingshui geothermal field was built in 1981 and was decommissioned in 1993 due to continued declines in well production. The purpose of this study is aimed to build reservoir numerical models to investigate the reservoir fluid flow process at Chingshui, Yilan. Computer simulation technique was undertaken for assessing and predicting the reservoir response to future development. The numerical model was calibrated by adjusting inflow rate until a good match obtained with the natural state condition. Moreover, inclusion of CO₂ in the geothermal system as observed in the field has shown further improvement in the simulation results. Based on the natural state model obtained, we further built production model to simulate the production history from 1981 to 1993 through three production scenarios- variant flow production, variant pressure production and constant pressure production. Based on constant pressure scenario, we further adjusted permeability surrounding wellbores varying with time to simulate declining production caused by carbonate scaling. The calibrated model shows good match with historic data for the constant pressure scenario. In future, the model will be attempted to combine geochemistry reaction in order to yield optimal production schemes with controlled management of the scaling problem.

Key words: Chingshui geothermal field, Reservoir numerical model, CO₂.

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