

# 利用單一裂隙熱能開採循環系統試算加強型地熱案場之發電規模

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## 摘要

地熱潛能與地熱產能的聯繫上須仰賴工程與技術的結合與應用，適當的工程設計將可提升產能達到最佳化。由於將地熱能量自地底開發至地表進行地熱發電所能發出的功率，中間需經過很多能源轉換損耗或是有部分地熱潛能因種種因素無法被開發。

本研究採用 Tester 等人在 1979 年發展的單一裂隙熱能開採循環系統作為乾熱岩(HDR)增強型地熱系統(EGS)之計算方式，並以 Han 等人於 2019 年提出的一注兩產之增強型地熱開發井概念，估算建置一個 5MWe 之 EGS 地熱電廠所需要的條件。假設營運條件為 20 年能控制在地層溫降 20% 以內，設定環境參數為發電時間 20 年，熱電轉換效率 6%，起始儲層溫度 250°C，注入井及生產井距離 200 公尺，計算結果需要約 1 立方公里體積的乾熱岩，需要 30 條裂隙，裂隙間距為 97.62 公尺，在儲層內需 2830.98 公尺，總共需要 3,660,000 平方公尺的裂隙面積。另外本研究亦針對不同溫度之發電機組效率進行統整比較。

**關鍵字：** 增強型地熱系統、乾熱岩、地熱發電。

# **Geothermal Power Estimation with a Single Fracture Circle Model in Enhanced Geothermal Systems**

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## **Abstract**

The connection between geothermal potential and geothermal production capacity depends on the combination and application of engineering and technology. Proper engineering design will optimize production capacity. Because the power that can be generated by geothermal fluid from the reservoir to the surface. In the up process, geothermal fluid requires lots of energy conversion and loss or some of the geothermal potential cannot be converted due to various factors.

This study adopts the single fracture cycle system developed by Tester et al. in 1979 as the calculation method for enhanced geothermal system (EGS) of hot dry rock (HDR) and uses the one injection and two production methods proposed by Han et al. in 2019. Using the enhanced geothermal development well concept as a calculation scenario, it is estimated what conditions are required to complete the construction of a 5MWe EGS geothermal power plant. It is assumed that the operating conditions can be controlled within 20% of the formation temperature drop in 20 years, the environmental parameters are set to a power generation time of 20 years. The thermoelectric conversion efficiency of 6%, an initial reservoir temperature of 250°C, and a distance of 200 meters between the injection well and the production well. The calculation results require a volume of about 1 cubic kilometer of hot dry rock. Each fracture spacing is 97.62 meters, and 2830.98 meters are required in the reservoir, resulting in a total fracture area of 3,660,000 square meters. In addition, this study also conducts a comprehensive comparison of the efficiency of generating units at different temperatures.

**Keywords:** Enhanced geothermal system(EGS), Hot Dry Rock (HDR), Geothermal power generation.