Title

Preface

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Publication Date

2016-09-01

DOI

10.1016/j.geothermics.2016.04.001

Peer reviewed

Geothermics

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High-temperature geothermal resources are often the manifestations of cooling magmatic intrusions, and are vertically zoned. Beneath the low-permeability cap and the hydrothermal circulation volume, there exists a zone of limited permeability where water does not circulate freely. At present, almost all of the commercial production of geothermal energy is derived from the relatively shallow (usually < 2–3 km) hydrothermal zone (i.e. zone where water can flow freely). Reliance on hydrothermal resources is dictated by currently available technology and by cost considerations.

Hydrothermal systems constitute only a small fraction of the thermal energy contained in earth's crust at currently accessible depths (less than about 5 km). As a matter of fact, most of the thermal energy is contained in geothermal formations with limited permeability and/or fluid content. Starting in 1970s, several countries have supported research and development programs to develop EGS (Engineered or Enhanced Geothermal Systems) technology appropriate for the exploitation of the latter type of geothermal systems. Development of cost-effective EGS technology to mine heat will have a profound impact on the geothermal industry. First, the life of existing geothermal systems would be greatly extended, making better use of existing power plants and other surface facilities. Secondly, the technology would be also applicable to other areas including those previously considered candidates for Hot Dry Rock (HDR) development.

This special issue of Geothermics is intended to present a review of the current state-of-the-art in EGS technology. About half of the papers (Ayling et al., Benato and Taron, Benato et al., Blocher et al., Cladouhos et al., Fang et al., Garcia et al., Kelkar et al., Rutqvist et al.) describe results of large-scale field experiments. Tsuchiya et al. consider a granite porphyry system as an analog for a supercritical EGS. Exploration methodology for EGS systems is covered by Iovenitti et al. Novel theoretical and experimental methods for assessing the impact of coupled processes in EGS and for geological/geomechanical characterization of the systems are the subjects of papers by Ghassemi and Tao, Ghergut et al., Karmarkar et al., and Wang et al. These

developments serve to illustrate significant progress in the approach to EGS development and in understanding of reservoir dynamics.

Despite the impressive progress made during the past decade or two, it is apparent that significant additional work will be needed to commercialize the EGS technology. The brief review paper by Malcolm Grant makes it clear that we have yet to create EGS reservoirs with commercially adequate productivity and recovery factor. Major challenges in reservoir creation and control remain to be resolved. Hopefully, continued R&D over the next few years will enable us to realize the full potential of Enhanced Geothermal Systems.