

## Japan Beyond-Brittle Project: a proposal of engineered geothermal power generation in ductile zones

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Current geothermal power generation from engineered geothermal system (EGS) technologies has two bottle-necks in practical use: one is losses of injected water and the other is risk of induced seismicity. The losses of injected water reach 50-70 % in such active tectonic regions as Japan. The risk of induced seismicity gives serious impacts in particularly less seismic regions such as Basel, Switzerland. To resolve these two bottle-necks, we propose a new power generation method which is EGS technologies in ductile zones. If we could create a confined brittle zone in ductile zones by hydraulic cooling, the envelopment of ductile zones would significantly mitigate the losses of injected water and risk of induced seismicity. This method could dramatically expand exploitable thermal-conduction resources beyond brittle zones. This method does not use any natural hydrothermal convection systems and would be ultimately compatible with numerous hot springs in Japan. Ductile zones have already been confirmed at an economically accessible depth in the Kakkonda geothermal field. Drilling targets of this method are a broad high-temperature thermal structure so that risk of failure of drilling could be far reduced. The ICDP-JBBP Workshop was planned to delineate possible methods creating a confined brittle zone in ductile zones in Sendai during 12-16 March 2013. We shall brief the results of the Workshop at the time of presentation.

Keywords: engineered geothermal system, losses of injected water, risk of induced seismicity, brittle zone, ductile zone