

Geothermal Technologies Program

U.S. DEPARTMENT OF
ENERGY | Energy Efficiency &
Renewable Energy



International
Partnership for
Geothermal
Technology



IEA **GEOHERMAL ENERGY**

International Partnership for
Geothermal Technology (IPGT & IEA-GIA)

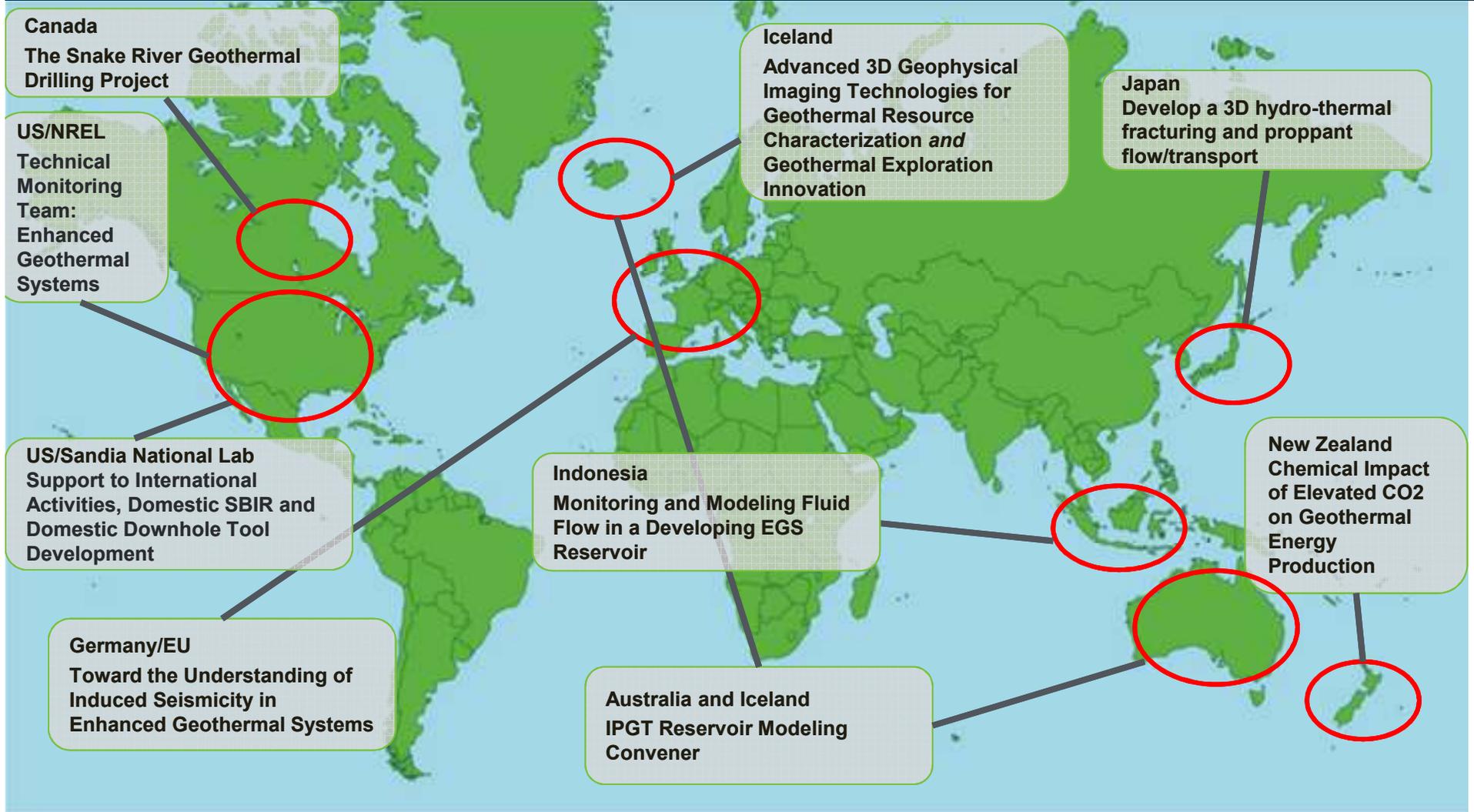
Jay Nathwani

May 7, 2012

GTP 2012 Peer Review

Current International Collaborations

The DOE is currently funding meaningful international collaborations through competitive funding solicitations and with national laboratories – examples are shown below



Technology Areas of Focus

Technology Area	Country
Exploration	Iceland
Imaging Fluid Flow	Indonesia
Supercritical CO ₂ /Reservoir Rock Chemical Interactions	New Zealand
Stimulation Prediction Models	Japan
Fracture Characterization	Iceland
Induced Seismicity	Germany/EU
New Combination of Technologies	Canada

Toward the Understanding of Induced Seismicity in Enhanced Geothermal Systems

- Array Information Technology (Prime Awardee) with partners including Helmholtz Centre Potsdam German Research Centre for Geosciences and data sharing with 11 EU countries

Total Award (ARRA)	\$1,164,143
Cost Share	\$290,473
Total Project Cost	\$1,454,616

Project Objectives: Develop a combination of techniques to evaluate the relationship between enhanced geothermal operations and the induced stress changes throughout the reservoir and surrounding country rock that lead to earthquakes of $M > 3$. The project also seeks to formulate a way to estimate the largest possible ground shaking and associated seismic hazard



Project Benefits:

- A detailed hazard analysis study!

Peer Reviewed in 2011

Monitoring and Modeling Fluid Flow in a Developing EGS Reservoir

- Massachusetts Institute of Technology

Total Award (FY2008)	\$226,002
Cost Share	\$450,000
Total Project Cost	\$676,002

Project Objectives: use Chevron's data from Gunung Salak field combined with a THM model to predict stress and permeability changes and during EGS development

Project Benefits:

- A resulting comparison of waveforms to determine proximity of events & better constrain inter-event distance using collapsing

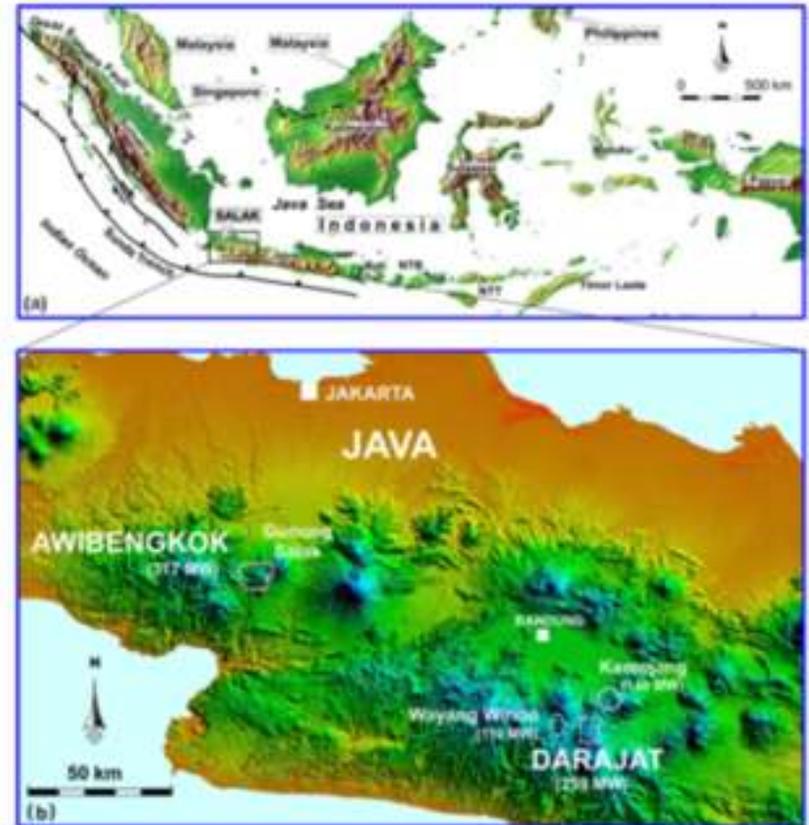


Figure from *J. Stimac et al. / Geothermics 37 (2008) 300–331*

Peer Reviewed in 2011

Develop a 3D hydro-thermal fracturing and proppant flow/transport

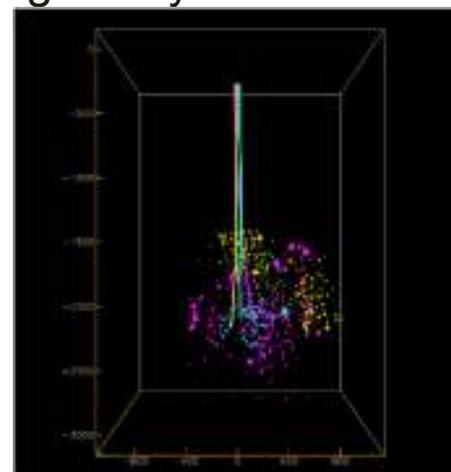
- Colorado School of Mines (Prime Awardee) validating 3D hydro-thermal fracturing simulator with data from Ogachi and Hijori

Total Award	\$1,191,893
Cost Share	\$441,600
Total Project Cost	\$1,633,493

Project Objectives: to develop and validate an advanced computer model for planning and design of stimulation techniques to create engineered reservoirs

Project Benefits:

- Develop a true 3D hydro-thermal fracturing and proppant flow/transport simulator
- Perform laboratory scale model tests of hydraulic fracturing and proppant flow/transport using a polyaxial loading device
- Perform discrete element/particulate modeling of proppant transport in hydraulic fractures
- Test and validate the 3D hydro-thermal fracturing simulator
- Develop a plan to commercialize the 3D fracturing and proppant flow/transport simulator



Hijori EGS Test Site

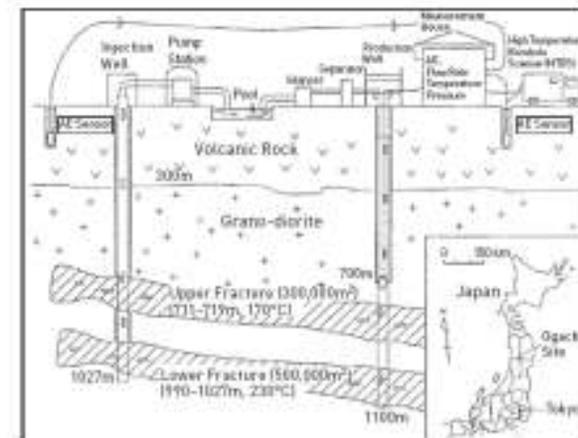


Figure 4.11 Illustration of the Ogachi HDR experiment (Kitano et al., 2006).

Joint Seismic-Electromagnetics Inversion for Iceland Geothermal Systems

- Lawrence Berkeley National Laboratory (Prime Awardee), ISOR (Iceland GeoSurvey) and Reykjavic University

Funding

\$3.0 M (co-funded by GEORG)

Project Objectives: to improve our ability to predict the location of fluids and fractures in high temperature geothermal systems through innovative joint geophysical imaging technologies

Project Benefits:

- The development of joint geophysical imaging technologies to better characterize fluids and fractures



Krafla Geothermal Field, Iceland (Photo credit: ThinkGeoEnergy)

For more information on *these projects* and *all other Geothermal Technology Program funded projects*, please visit our project database:
geothermal.energy.gov/projects

Thank you.

jay.nathwani@ee.doe.gov

1-202-586-9410