SEDHEAT:

Addressing the science and engineering challenges for unlocking the geothermal potential of sedimentary basins

John Holbrook, *Texas Christian University*

Walter Snyder, *Boise State University*

David Blackwell, *SMU*

Joseph Moore, *University of Utah*

Derek Elsworth *Penn State*

Herbert Einstein, *MIT*

Karin Block, *CUNY*

C.O. Tim Killeen

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GEES = Geosciences Focus

- Sustainable Energy Pathways

with new and understand risks and stressors associated w

sequestration

C.O. Tim Killeen

“What are the basic science and engineering questions that need

Question #1

[redacted]

T = 150C

Geothermal System Resource Base

T = 150C

Data from SMU

Category of Resource	Thermal Energy, in Exajoules (1EJ = 10^{18} J)	Reference
Conduction-dominated EGS		
Sedimentary rock formations	100,000	MIT, 2006
Crystalline basement rock formate.7p1os1(8)]TJ 0 Tc 0 6 598.92 0 Td3,3 (100,000)T67 0.57 0 Td [(M)-1(I)23(T)1(,		

Category of Resource	Thermal Energy, in Exajoules (1EJ = 10^{18} J)	Reference
Conduction-dominated EGS		
Sedimentary rock formations	100,000	MIT, 2006
Crystalline basement rock formations	13,300,000	MIT, 2006
Supercritical Volcanic Systems	74100 excludes Yellowstone NP, Hawaii	USGS Circular 726 and
Hydrothermal	2,400 – 9,600	USGS Circular 726 and
Coproduced (oil field) fluids	0,0944 – 0,4510	McKenna, et al. (2005)
Geopressured systems	71,000 – 170,000 (includes methane)	USGS Circular 72

Hydrothermal (Convective) Systems

Small Resource

Approx. 100% of Current Production

Caprock

Fluid

Heat Source

C.O. Joe Moore

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http://www.bing.com/images/search?q=oil+drilling&qpvt=oil+drilling&FORM=IQFRML#x0y6408

Sedimentary Basins

Heat Volume and Matrix Permeability

Question #3

What are the questions?

How does heat move within sedimentary basins at large scales and how does this impact the renewability of the resource?

How is heat stored and released on the local and

Topics

The Native Basin

Fluid flow

What are the fundamental sedimentary processes that control the filling of sedimentary basins across all scales, and how do they impact permeability, connectivity, and heterogeneity of deep-basin flow paths?

What are the digenetic processes that operate in deep sedimentary basins and how do they augment or deduct permeability as they evolve?

What controls the natural processes whereby fractures form and evolve within basin sediments,

Topics

Engineering

Drilling

What new or improved well technologies can make drilling and developing large boreholes possible and practical at very high temperatures?

Can numerical decision models be generated that effectively predict geothermal operational risk?

C.O Rick Allis

Topics

Engineering

Reservoir

What new techniques can be defined that permit us to predict, control, and monitor stimulated fracture systems in deep, hot, and heterogeneous media?

How can we effectively monitor the evolution of fractures, heat regime, and stress conditions induced by geothermal extraction?

What are the relationships and thresholds between modified fluid pressures and induced seismicity?

Topics

Topics

Cyberinfrastructure

Topics

Education

What short-term and long-term efforts will prove most effective toward tempering workforce shortages expected of an emerging geothermal industry?

What efforts would prove most effective at raising the current low profile of geothermal energy in the mind of the public and policy makers?

What are the positive and negative feedbacks tied to relationships between the geothermal and oil and gas industries as it relates to perceptions, workforce development, and educational infrastructure?

What are the most effective forms of cyberinfrastructure that may be used to promote sharing of data and education materials in order to foster more offerings of geothermal curricula?

What are the best vehicles for fostering cross-disciplinary education and scholarship between engineering and science disciplines?

What are the best processes for building an educational and workforce pipeline from K-12, though undergraduate, to graduate, to professional in the geothermal sciences, and how can we best assure that women and minorities are not leaked from this system?

Question #4

The Next Steps?

-NSF Research Coordination Network (RCN)

Build a research community for geothermal energy from sedimentary basins

-What Do We Do?

Workshops

GSA Penrose: Predicting and Detecting Natural and Induced Flow Paths for Geothermal Fluids in Deep Sedimentary Basins

Student opportunites

Lab visits, etc.

Education

Short courses, Web Materials

Sponsorship

Web page

WWW.SedHeat.org

Contact me

John.holbrook@TCU.EDU

C.O. Joe Moore