[PS]Sedheat - Research Community Initiative on Geothermal Energy of Sedimentary Basins*

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Abstract

We are assembling an international team on the cyberinfrastructure needs for research, education and knowledge transfer as part of the SedHeat initiative. SedHeat is a community-based initiative on the science and engineering challenges of the geothermal potential of sedimentary basins, sponsored by NSF. SedHeat includes academic and industry participants, with a strong emphasis on education, diversity and career pathways and on shared cyberinfrastructure and data (see www.sedheat.org).

Issues associated with acquisition, curation, access and use of data underpin all activities. For example, we need to provide seamless linkages of data to analysis and visualization tools, in particular high-level modeling programs and required computational resources. When dealing with industry partnerships, proprietary data must be handled carefully, so to moratorium data from both industry and academic researchers. We also must better utilize these research-level data within the education enterprise to train and attract our next generation of geoscientists and geoengineers.

Data discovery and sharing among multiple data sites is a persistent issue. The notion of the "semantic web" has sparked continued debate because of the stated need for ontologies and single-definition vocabularies. Whereas intellectually attractive, after 11 years of effort it has failed to reach its goals because of an overly restrictive framework. A hybrid approach is now evolving that utilizes some tools of the semantic web but recognizes the investment in current data sites and the different needs of the various user communities. This approach also recognizes that much "knowledge" (the ultimate outcome of cyberinfrastructure) is wrapped up in differences among vocabularies, languages and concepts and that forcing singularity decreases the knowledge value of data and their resulting data products. This approach makes data sharing more difficult, but not impossible, and importantly opens up the system for broader participation and collaboration.

SEDHEAT – RESEARCH COMMUNITY INITIATIVE ON GEOTHERMAL ENERGY OF SEDIMENTARY BASINS

- ABSTRACT -

SedHeat: Addressing the Science and Engineering Challenges for Unlocking the Geothermal Potential of Sedimentary Basins

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SedHeat is a community-based initiative that will address the science and engineering research challenges for realizing the geothermal potential of sedimentary basins. This interdisciplinary effort is sponsored by the National Science Foundation, includes academic and industry participants, and has a strong emphasis on education, diversity and career pathways, and will create pathways to shared cyberinfrastructure and data.

The ability to translate the geothermal potential of sedimentary basins into productive use lies in the application of basic science and engineering research. Effective use also lies in reducing the economic risk of geothermal exploration and development which inhibits attracting financial investors to this energy sector. In addition, it is also important to provide federal and state decision makers and agencies with the information they require to make sound decisions about geothermal energy. Thus, the long-term vision is to integrate NSF-sponsored research, education and cyberinfrastructure to build a partnership among researchers, industry, and state and federal agencies to insure that geothermal energy can meet its potential as a major and sustainable contributor to our nation's energy grid.

The first workshop for this initiative was held November 7-9 at the Energy Geosciences Institute, University of Utah. The overall initial goal was to define the scope of research needed for this under-studied portion of the renewable energy portfolio and to provide a road map for how NSF's community, through fundamental research, facilities development, data sharing and cyberinfrastructure, and education, can help make the vast geothermal potential of sedimentary basins a significant part of the nation's renewable energy portfolio. The interdisciplinary nature and the breadth and depth of research needed means that the development of the roadmap will be an iterative process, thus other workshops will be held on more focused topics. The SedHeat.org web site serves as a central communication point for the initiative.

WORKSHOP SPONSORS

Society of Exploration Geophysicists
The international society of applied geophysics

THE GEOLOGICAL SOCIETY OF AMERICA®

SEPM Society for Sedimentary Geology

ARMA american rock mechanics association

Geothermal Resources Council GRC

GEA GEOTHERMAL ENERGY ASSOCIATION

NSF

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WORKSHOP SNIPPETS

Multi-disciplinary Opportunities for Geothermal Energy - the NSF Perspective
Tim Killeen (Assistant Director, Geosciences Directorate, NSF)(via Webinar link)
Break
Introduction and Overview of Geothermal Resources
David Blackwell (Southern Methodist University Geothermal Program)
Chasing the Geothermal Elephants in Sedimentary Basins
Rick Allis (Utah State Geologist, Utah Geological Survey)
Geothermal Energy and Public Policy
Allyson Anderson (U.S. Senate Energy Committee)
Lunch – Marriott (Ballroom 3)
Breakout 1 Topic: SEDIMENTARY BASIN ARCHITECTURE AND THERMAL REGIMES
Topic leader & Keynote: *John Holbrook (Texas Christian University)*
Breakout 1 - Sedimentary Basin Architecture & Thermal Regimes
Breakout 1 - Report & Discussion Period

WHAT IS HAPPENIGN NOW?
- RESEARCH COORDINATION NETWORK -

1. Proposal pending with NSF to establish an RCN

2. RCN will serve as a central coordination point for SedHeat activities.

3. SedHeat cyberinfrastructure activities will spin off to the International Geothermal Data Federation.

4. Future proposal to NSF for a "Sustainability Research Network" to provide funding for targeted SedHeat community research.
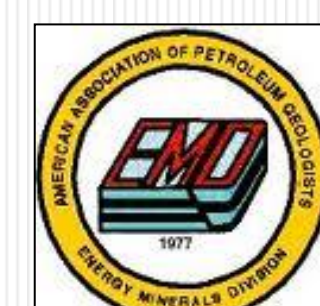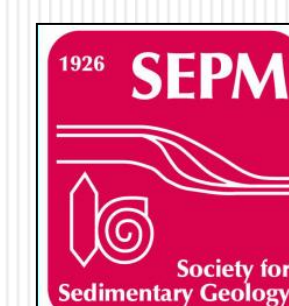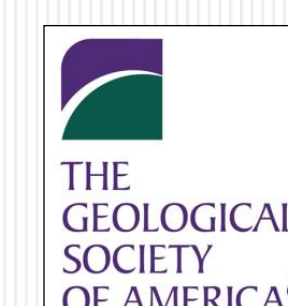
HOW DID THIS OPPORTUNITY HAPPEN?

1. Informal & then formal discussions with NSF about possibilities of science & engineering research focused on geothermal of sedimentary basins

2. Workshop proposal – quickly funded by 3 directorates

3. Luck – NSF needs to become involved in research that is more relevant to national needs.

Also converges with U.S. NSF's push on:

1. Education, diversity and the workforce

2. Cyberinfrastructure

MORE INFORMATION

Website: **www.SedHeat.org**

Contact : John Holbrook

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Or any of the steering committee members (names listed on the abstract).

CYBERINFRASTRUCTURE FOR GEOTHERMAL ENERGY
- THE BRIDGE BUILDER -

GEOTHERMAL CYBERINFRASTRUCTURE

PURPOSE

To build a better way to capture and transfer knowledge and technology among researchers, industry, and educators to assist in bringing more geothermal energy online. Cyberinfrastructure, and its more focused geoinformatics, can provide those bridges.

Cyberinfrastructure (CI)

An all-encompassing term for the infrastructure, computer science, information technologies, software and data that support and/or themselves areas of research.

Geoinformatics (GI)

Can simply be viewed as "cyberinfrastructure for the geosciences".

CHALLENGES

User indifference
- "I don't really care . . . ."
- "I don't have the time . . . ."
- "It's not my job . . . . "

You can ask users up front what they want, but the answers are typically ambiguous if they don't really care.

Interdisciplinary teams:
- Collaboration among geoscience, engineering, and education communities (and their subcommunities)
- Industry-academia collaboration
- User community + IT teams are difficult to build (not just an IT problem (see below).

Funding and sustainability:
- Funding agencies sometimes try to drive and manage what must be community built and managed systems.
- Holding communities together as their interest wanes
- Long-term baseline funding - who should feel responsible? Who should be responsible?

## WHY IMPORTANT FOR GEOTHERMAL?

The problem:
- Need to bring multiple 200mw projects online for geothermal to become an important part of the renewable energy portfolio.
- We are not as smart as we think we are; we don't understand deep sedimentary basins well enough to just go out and find and develop those large geothermal resources.
- Relative high up front exploration and development costs and payout only over the long-term.
- Attractive to small and mid-sized companies but they don't have internal capital to carry all the risk.
- Less attractive to large petroleum companies because size and length of payout.
- Catch 22: have to reduce risk and increase certainty, in particular for deep sedimentary basin geothermal, but limited resources to do so.

Community cyberinfrastructure can help:
- Data and the models and case studies based on these data are critical for a better understanding of these sedimentary geothermal systems.
- Global system for sharing open, public data and software tools can help the small and mid-sized companies become more competitive in the geothermal market.

IMPORTANCE OF DATA STEWARDSHIP

Numerous publications, reports, workshops, etc. to educate the broader community on the importance of data stewardship. All federal agencies, and those they fund, are being required to provide nonproprietary data to recognized, public data systems.
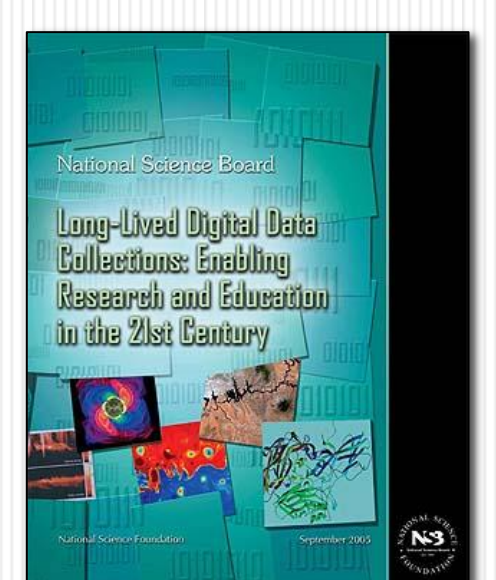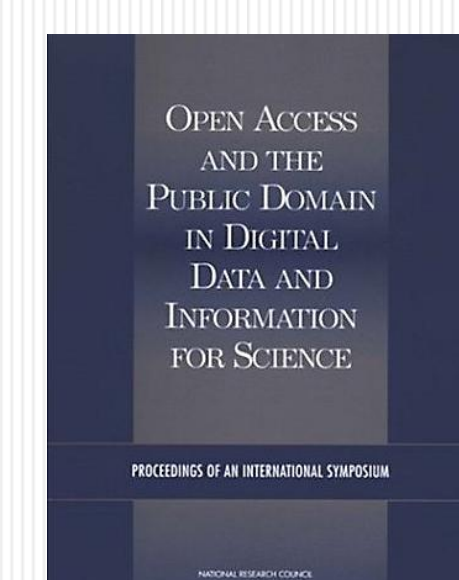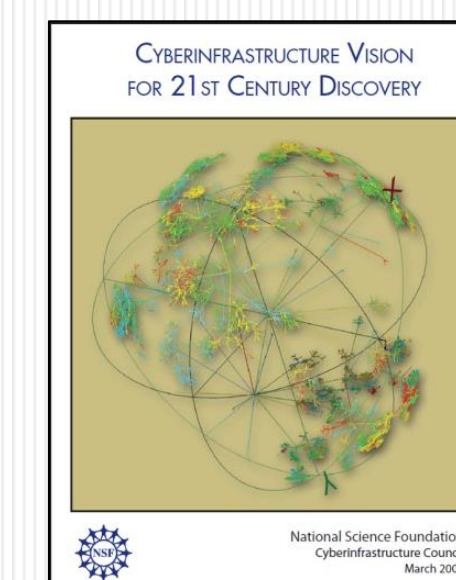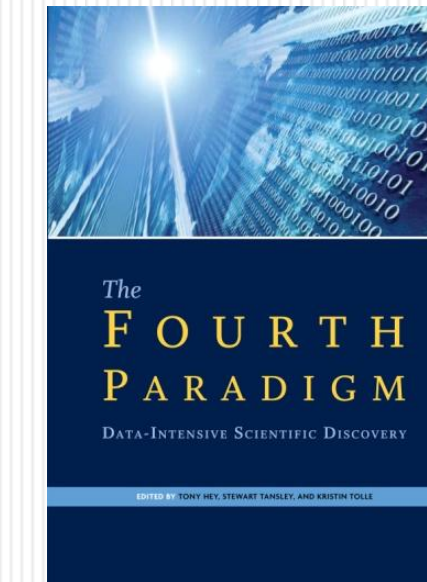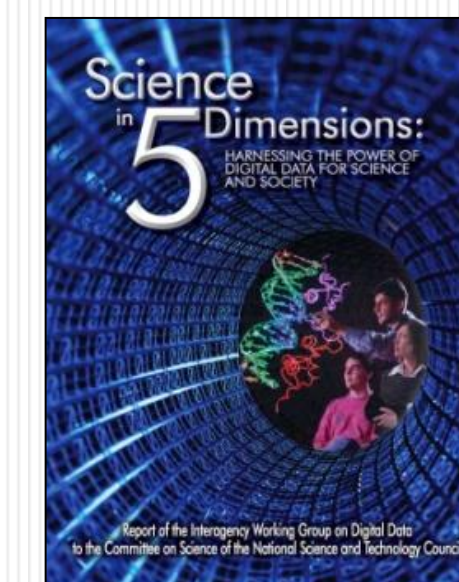
LESSONS & PROGRESS

Community education – a long process:
- "Build it and they will come" - does not work
- Major lesson: it is about people, institutions, culture and politics - the information technology is secondary (important, but secondary).
- Build a prototype to show what is possible can work, but a longer road.

Momentum:
- Increased awareness and appreciation of the importance of data stewardship and open access to data and software code.
- Growing consensus among those who produce and use data that sharing data and modeling software helps them do their jobs better.
- Industry-academia collaboration is increasing
- User community + IT teams are learning how to be productive

RESULTS

Several cyberinfrastructure activities that can contribute to an overall global approach to geothermal geoinformatics:

NSF-funded:
- CUAHSI-HIS re groundwater CI
- SESAR re International Geo Sample Number (IGSN)
- CoreWall re use of core viewing and management system
- Geoinformatics for Geochemistry (GfG) and EarthChem regarding how handle geochemical data
- Geothermal Data Exchange (GDEx) / GeoStrat re broad array of geological and geophysical data, surface and subsurface
- GSDNet – Geoscience Student Data Network
- EarthCube: NSF initiative to help build a common cyberinfrastructure approach across the geosciences.

DOE-funded:
- National Geothermal Data System (NGDS) (and its constituent nodes)

Unfunded (yet!), global community platform:
- International Geothermal Data Federation (IGDF)

INTERNATIONAL GEOTHERMAL DATA FEDERATION

- SYNOPSIS-

The International Geothermal Data Federation represents the initiation of a global interdisciplinary partnership for supporting the development of geothermal energy through the sharing of data and software code.

IGDF is an outgrowth of the SedHeat Initiative, and thus has a strong, but not exclusive focus on the geothermal energy of sedimentary basins.

The IGDF is only a few months old, and as soon as the management and governance provisions are in place, global membership will expand quickly.

Please contact one of the people below if you are interested in more information, membership, or supporting the effort.

- IGDF PURPOSE -

The purpose of the International Geothermal Data Federation to build a 'community of practice' for the sharing of data and software code, and for providing access to data derived from the full range of activities associated with geothermal energy, in particular that associated with sedimentary basins. The IGDF undertakes collaborative activities on:

- Use cases and user stories (to capture workflows)
- Vocabularies (including glossary of "community vocabulary"; dictionary, thesaurus)
- Content models
- Schemas - XML
- Ontologies
- Catalog development of a common catalog of public holdings
- Web services - targeted web services for suites of data and/or data products
- Software tools (GIS, visualization, statistical, numerical, and IT tools such as the parsing of legacy data from documents)
- Case studies
- Developing consistent mechanisms to provide citation credit for datasets publication

The IGDF will produce a series of recommendations based on thorough review of data and workflow needs posited against a background of existing standards, protocols, processes and procedures. This will be done through a series of community-based task forces, workshops and outreach. Through its website it will insure all information is available to all interested parties and provide mechanisms for broader community participation in discussions and outcomes.

–PARTNERSHIPS IN GEOTHERMAL ENERGY –

WHO ARE THE INITIAL MEMBERS?

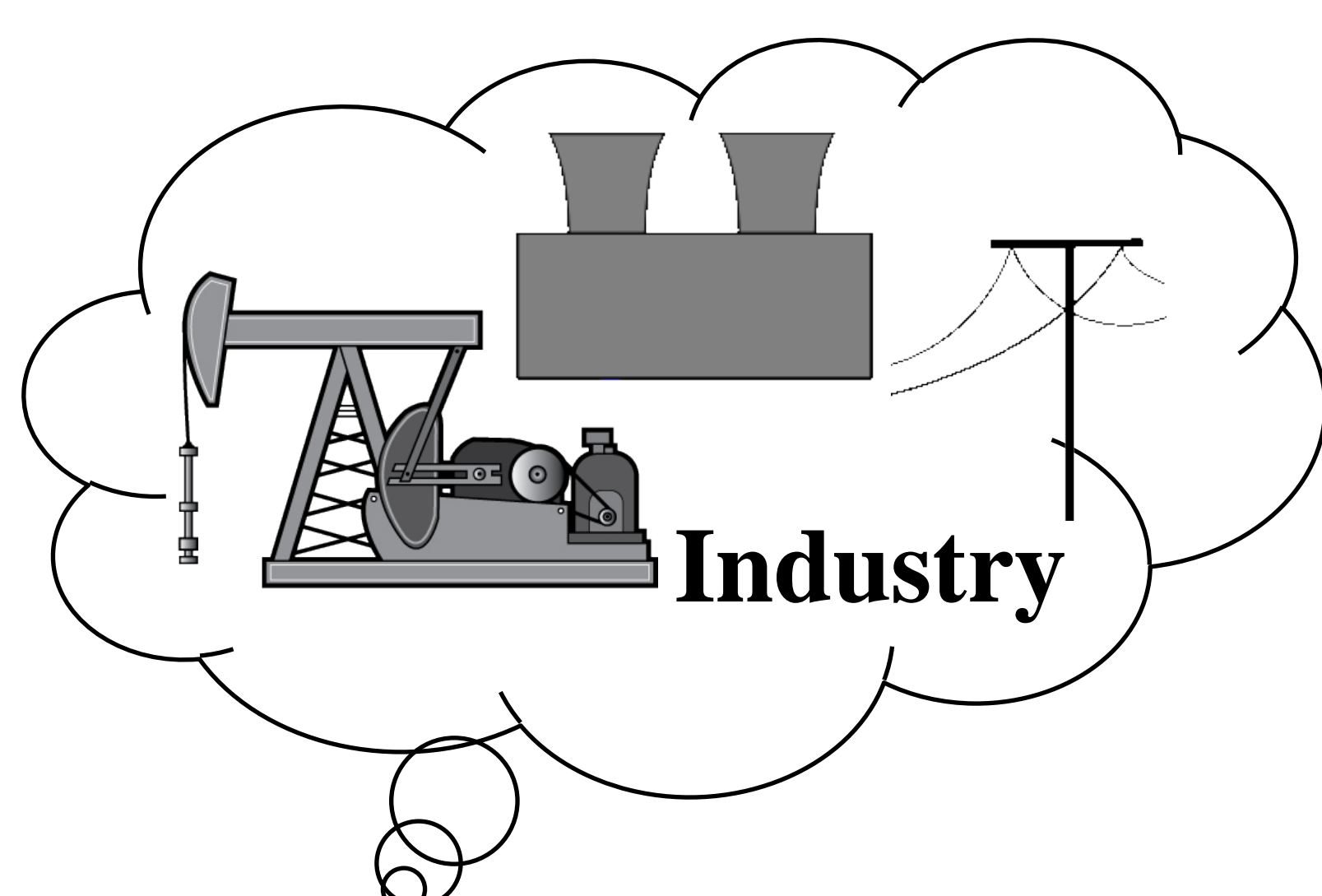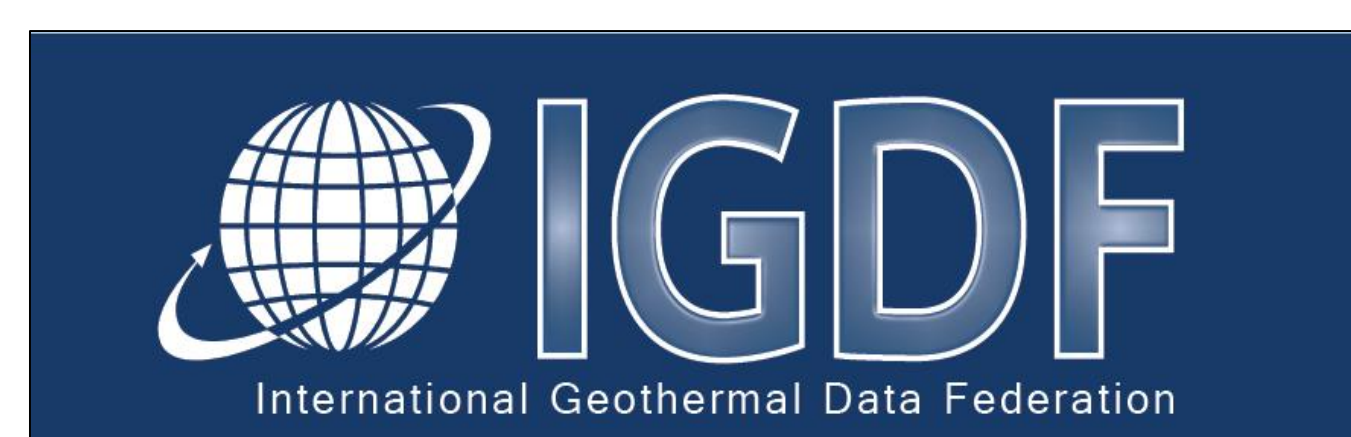### GEOTHERMAL DATA CONSORITUM

GEOTHERMAL RESEARCH INITIATIVE
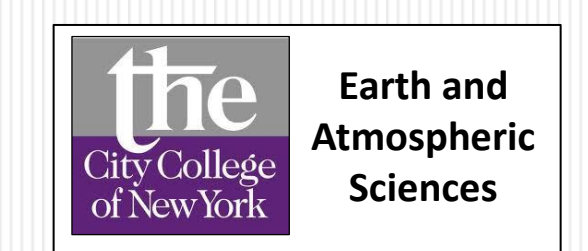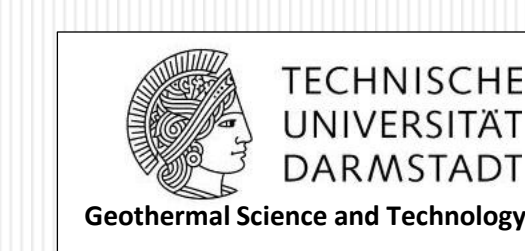
–IGDF TASK FORCES –

Topical task forces will be comprised of community members to address specific issues and produce specific outcomes. The topics each task force considers will vary by the group, but all will consider the data, tools and modeling needs of their respective segment of the community, review impact on users, and relay user comments and reactions to the Board of Directors and management team. Some will be "standing" task forces, most will have defined terms. Typically volunteers will be requested for task force membership, but the Board of Directors will have final selection authority. Task Forces may initiate "working groups" for shorter-term activities. Initial task forces include:

- Sedimentary Geology & Sedimentary Basins
- Geofluid Dynamics, Geochemistry and Sustainability
- Geothermal Systems
- Geophysics
- Engineering, Rock Physics & Mechanics
- Education, Diversity & Career Development
- Public Policy, Economics, Engagement & Knowledge Transfer
- Cyberinfrastructure Technology, Standards, Protocols & Data Integration

–FOR MORE INFORMATION –

Interested in joining or supporting the IGDF – please contact one of the people below

John Holbrook - SedHeat - Texas Christian University - John.Holbrook@tcu.edu

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Walter S. Snyder - SedHeat, NGDS, IGDF – Geothermal Data Exchange (GDEx), Boise State University – wsnyder@boisestate.edu