

4.5.6 Well Monitoring Systems for EGS

Presentation Number: 026

Investigator: Normann, Randy (Perma Works and Frequency Management International)

Objectives: To address the immediate needs of the Geothermal EGS industry for monitoring hydraulic fracturing activities, reservoir recovery testing, well interconnectivity and production monitoring while creating the ability to build-in future reservoir controls.

Average Overall Score: 3.0/4.0

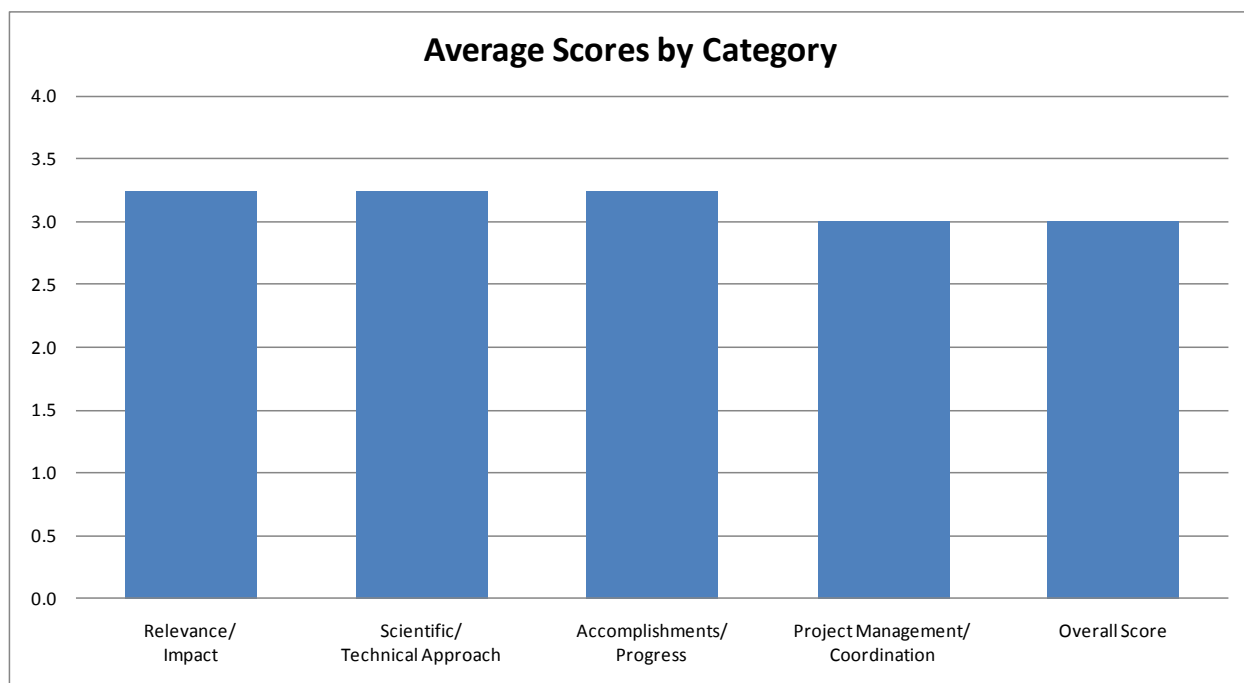


Figure 34: Well Monitoring Systems for EGS

4.5.6.1 Relevance/Impact of the Research

Ratings of Four-member Peer Review Panel: Good (3), Good (3), Good (3), Outstanding (4)

Supporting comments:

- This projects develops instrumentation and sensors that are capable of operating in a high-temperature regime appropriate for borehole conditions in geothermal production areas. The PI has demonstrated working prototypes of such equipment. These developments are relevant for the DOE goals as continuous in situ monitoring of geothermal production will improve operation of EGS.
- New borehole tools are critical for making progress in management of geothermal fields.

- This project is intended to provide high-temperature, high-pressure tools for monitoring EGS. This is sorely needed. The project seems to be on track.
- High-temperature (HT) geothermal tool development is very important for it enables the solution of many other EGS barriers and if successfully completed, should make a very important contribution to the Geothermal Program mission. The project's activities should provide a better understanding of known technical barriers, such as reservoir creation, validation and sustainability, as well as inter-well connectivity and overall reservoir management. If this project is successfully completed, this reviewer is confident that the EGS program will benefit and that the results will surely add to the knowledge base.

4.5.6.2 Scientific/Technical Approach

Ratings of Four-member Peer Review Panel: Good (3), Good (3), Outstanding (4), Good (3)

Supporting comments:

- This is primarily a technological development. The PI team is at the leading edge of high-temperature sensor production both nationally and internationally.
- Not clear how deep the instruments will be able to perform. Other than temperature and pressure, what other tools could be attached to the borehole device?
- The investigators are dealing with subcontractors for appropriate materials and approaches. They have isolated the problems to deal with, and have mapped out a nice approach to reaching a final product -- starting with analog tools, then digital tools, and finally leading to fiber-optic. They may well succeed, but if they don't, they will have the intermediate products which will themselves be of great use.
- The overall technical approach looks good. HT tools will make a significant difference to EGS monitoring and understanding while providing cost savings. Adequate resources are evident, however, this reviewer is not able to assess if there is sufficient rigor of the work elements, procedures and methods to achieve the project objectives. The design of the project is straightforward and deemed reasonable and the technical approach is adequately described and clear tasks descriptions are provided. What are not evident are a project timeline and a delineation of tasks and subtasks by partner.

4.5.6.3 Accomplishments, Expected Outcomes and Progress

Ratings of Four-member Peer Review Panel: Outstanding (4), Good (3), Good (3), Good (3)

Supporting comments:

- A high-temperature probe was developed and successfully tested.

- The borehole tool looked to be useful and the levels of temperature resistance are improving - I think the cabling may be a problem in real world situations. Cramming high-tech instruments down hot boreholes is a very tricky business and testing in the labs is only part of the rigorous assessment that needs to be performed.
- It appears that the project has accomplished its goals so far; the investigators seem to have great experience and are likely to succeed.
- The overall quality of the research team, equipment and facilities looks good given the long list of partnering organizations and the assumption that more is better—none of the partners are familiar to this reviewer. Relevant experience and the balance of appropriate skills of the research team looks okay, however, this reviewer is not an expert in this field of HT tool development. This reviewer knows none of the team members. There are several accomplishments to date and Phase I is completed (33%). According to the calendar the project should be 47% completed so my guess is that the project is behind schedule by 14%, which is significant. Also, this reviewer was not able to ascertain the accomplishments as compared to costs to date (Cost of Work Performed) since current costing was not given.

4.5.6.4 Project Management/Coordination

Ratings of Four-member Peer Review Panel: Good (3), Good (3), Outstanding (4), Fair (2)

Supporting comments:

- All bits and pieces required for a successful completion of the project appear to be in place. The PIs are maintaining a dialog with other potential producers of high-temperature borehole sensors and are investigating plans for commercializing their product.
- Management looked to be good - it is too early to tell if the product will be priced at a level useful to researchers outside of industry.
- This is difficult to judge, but it appears that the project management is extremely business-like, and is working well.
- The technical, policy, business, and spend plans for the project are not presented simply or clearly in one place. The individual tasks make sense and are on-track and there is one appropriately placed project decision point. Because this is a for-profit, private company, the business plan predominates and the technical, policy, and spend plans are not clearly described. It is recommended that an integrated project plan with timeline should be developed that includes all of the requisite plans described.

4.5.6.5 Overall

Ratings of Four-member Peer Review Panel: Good (3), Good (3), Good (3), Good (3)

Supporting comments:

- New equipment produced under this project will be beneficial for monitoring of EGS reservoirs.
- This looks to be a reasonable effort overall - it is not clear how non-commercial research teams will benefit. The testing is in the early stages and needs to be checked in situ in real wells at realistic depths.
- This project is valuable, and is likely to succeed in delivering tools that can be deployed long-term in producing or injecting wells. I see no weaknesses, but also find little risk - it is a project that needs to be done.
- Overall, this reviewer recommends that the project proceed. In the reviewer's opinion, this project is a very important component of the overall EGS portfolio and should be funded. HT geothermal tools and sensors that can be left in place for long periods and during stimulation tests is a real improvement, saving costs and providing a never-before available capability that should have significant impact and gather pertinent data for all other projects in the EGS program.

4.5.6.6 PI Response

No response.