R021-B
Distributed Geothermal Power
Response to Reviewers Questions

The project team would like to address a couple of the main points raised by the reviewers on our project. We will provide additional clarification during the presentation on July 10th.

The question about why this project has taken so long to progress to the installation phase is appropriate and raises issues we would like to address.

> We initially expected this project to go online in 2012. The long delay has been due primarily to complications with contractual issues. Specifically, the University of North Dakota will not approve a contract with an external agency that requires UND to hold harmless and indemnify the external contractor. When this issue first arose, the PIs on this project requested help from University Council for negotiation with Continental Resources (CLR). The usual solution for this issue, which affects all UND contracts, is for the attorneys of both parties to find language that will allow a project to go forward. Typical solutions are for each partner to assume responsibility for their part or to remain silent on the issue. In this case there was no resolution of the differences; UND would not allow the article in the contract and CLR insisted that it must be there. These negotiations cost about one year of time. With no resolution through written and telephone correspondence, we sought to resolve the issue with the UND PIs and University Council and Access Energy representatives meeting with CLR managers and attorneys at CLR headquarters in Oklahoma. As a result of the meeting, Access Energy (AE) agreed to assume the lead on the project and accept the terms of CLR's contract. This arrangement was acceptable for both parties until Access Energy was made aware of the financial risk involved in case of an extreme accident for which they would be liable. This delay was shorter and the solution is for AE to purchase insurance to cover the liability. Following that, AE made design changes that set the project back until the summer of 2014
>
> Early January 2014 after the PIs received the electrical design and drawings of the ORC power generating unit from AE engineers and checking into details of the design suggested by AE, the PIs determined that the data collection capabilities designed into the demonstration system would not provide the information required to fully execute the electrical system performance modeling and efficiency studies and to communicate the results/outcomes to the public and interested professionals/communities. In addition to the power production measurements that the initial AE design provided, we also requested that measured data on voltage, current, and their corresponding phase angles be measured to evaluate the electrical power that will be consumed by each component of the ORC system and its auxiliaries. These measurement data will allow us to model and assess the efficiency performance of the electric side of the system. Discussion between PIs and AE engineers on the requested data and the associated design updates/changes/additions, placing an order for the necessary voltage, current and power sensor hardware and measurement equipment, the final approval of the purchase order by the UND Purchasing Office, and the eventual PO reception by AE engineers took around

5 months (January through May 2014). Most of the actual delay was due to the paper work, sole source investigation discussions between PIs and UND Purchasing Office, and the routine bureaucracy involved with the UND Purchasing Office procedures.

A second question that was raised several times had to deal with the costs for the project.

This project was proposed with three phases. The first phase involved a preliminary design and economic assessment, with the goal of reviewing all of the relevant geothermal technologies to find the best match for the site conditions. The result of this phase was the selection of the geothermal technology and vendor. Access Energy was chosen as the vendor, and also agreed to be a partner in the venture, providing significant cost share to the project. The second phase of the project involved the redesign of the Access Energy organic rankine cycle engine (ORC) to match the conditions specific to this and other similar projects. Of primary concern is how to improve the efficiency of the ORC to make it economically viable for the low temperature resources (200-220ºF) typical for western North Dakota sites. Once the redesign was completed, the system was built by Access Energy. Additional modifications were made during the calendar year, as noted above, to ensure the system will generate and report the data needed to evaluate the technical aspects of the system. The final phase of the project is the installation and monitoring of the system. The project had included $75,000 in its initial budget to cover the costs of installation. However, due to changes in the required site preparation and the cost and availability of contractors to do the on-site work, the bid for the installation came back at $285 thousand, which was reduced to $253 thousand after some negotiations. This left a significant shortfall for the project.

The project team approached the Department of Energy for additional funding. However, since the original project was funded through the American Competes Act, the DOE Program Manager indicated that he had no options for adding funding to the program. The project team has been working to locate other funding sources to make up this deficit, and is a part of this application to the ND Renewable Energy Program.

A third set of questions focused on the risks associated with the project, the potential benefactors, and the commercialization strategy.

We will present data at the July 10th meeting that shows the demand for electricity that is a direct result of the oil and gas activity in the State is huge. This demand can be met in a number of ways, including additional coal and natural gas plants and distributed diesel and gas generators. These options are all fossil energy based. The option we propose would replace a portion of this fossil generation with geothermal energy. We do agree with one of the reviewers who noted that this project appears to have significant benefit to the oil and gas industry. This is a major benefit for the project as it represents the most important potential user of these systems in the State. While it may have been implied by the reviewer comments that this fact makes the project an oil & gas project, our response is that major adaptation of geothermal technology by the oil & gas industry will have significant environmental impact on the State. We know the electricity required to support the industry will be made available. It is our contention that we need to find and

incorporate as much renewable energy into that mix as is practical. We feel our project can have significant environmental benefits.

The high demand for electricity to support the oil & gas industry also represents an important part of the commercialization of the technology. Access Energy has invested approximately $1 million into this project with the goal of developing and demonstrating a product that will generate significant sales. They will be an aggressive marketer of the technology and will provide a big commercialization push. As one reviewer noted, the oil and gas industry does not like being the front man unless the wildcatting ends up successful. One of the primary goals of this project is to have a site where potential users can "kick the tires". We expect having this demonstration site will help overcome the risk adverse nature of the industry.

The reviewers also note other aspects that will impact commercialization, with policy issues related to the interaction of federal and state agencies and the local and regional power producers and suppliers. Many of these issues have been explored and addressed during Phase I of the project. We agree that this part of the study should be updated to reflect changes that have occurred over the past three years, but wanted to note for the record that these issues have not been ignored.