May 1, 2016

Karlene Fine
Industrial Commission
State Capitol 14th Floor
600 E. Boulevard Ave. Dept. 405
Bismarck, ND 58505-0840

Re: Transmittal Letter for North Dakota Renewable Energy Grant

Dear Ms. Fine,

This letter is to make a binding commitment to the Industrial Commission in regard to the attached application.

Also included with this package is the following:

- Application titled "Commercial Demonstration of Geothermal and Hybrid Electricity Generation using Produced Fluids at Existing Hydrocarbon Wellsite"
- Tax Statement Letter

As the Chief Executive Officer of TerraCOH, Inc., I commit for our entire organization that, if the grant is made to TerraCOH, we will complete this project as described in the attached application.

We are very motivated because this application is 100% aligned with our business plan.

Yours truly,

John P. Griffin
Chief Executive Officer

TerraCOH
ADVANCED GEOTHERMAL ENERGIES

May 1, 2016

Karlene Fine
Industrial Commission
State Capitol 14th Floor
600 E. Boulevard Ave. Dept. 405
Bismarck, ND 58505-0840

Re: Tax Statement

Dear Ms. Fine,

This letter is to attest that TerraCOH, Inc. does not owe any tax payments or other items to the State of North Dakota.

Yours truly,

John P. Griffin
CEO

TerraCOH, Inc. • P.O. Box 82 • Excelsior, MN 55331

Renewable Energy Program

North Dakota Industrial Commission

Application

Project Title: Commercial Demonstration of Geothermal and Hybrid Electricity Generation using Produced Fluids at Existing Hydrocarbon Wellsite

Applicant: TerraCOH, Inc.

Principal Investigator: Dr. Jimmy B. Randolph

Date of Application: May 1, 2016

Amount of Request: $420,000

Total Amount of Proposed Project: $840,000

Duration of Project: 18 months

Point of Contact (POC): John Griffin

POC Telephone: 612-201-6896

POC Email: j.griffin@terracoh-age.com

POC Address: PO Box 82, Excelsior, MN 55331

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ABSTRACT

Objective: The primary objective of this project is to examine and demonstrate the commercial viability of North Dakota's extensive moderate-temperature geothermal resources, specifically by employing TerraCOH's unique and proprietary geothermal power technology that uses CO_2 as the heat transfer fluid. At an existing oil well site in ND, TerraCOH will implement our intellectual property (CO_2 Plume Geothermal – CPG™) to extract currently-wasted heat energy from produced fluids. TerraCOH plans to also demonstrate that low-value field/natural gas can be integrated with produced geothermal heat, resulting in a hybrid power system that optimally uses all energy resources at a given site.

Expected Results:

- Result #1— Conversion of moderate temperature (i.e., 70-150 °C) geothermal heat, contained in produced fluids at an oilfield site, to power using TerraCOH's novel CPG™ technology. We expect to accomplish this without interrupting existing wellsite activities, while producing power at <$0.05 per kWh with zero or minimal emissions.
- Result #2—Capture any available field gases and combust them in a boiler, in series with the geothermal power system, thereby using all energy sources in a single, efficient power system and maximizing power production.
- Result #3—Develop a formula for taking oilfield wellsite parameters and accurately calculating the BTU's of otherwise wasted energy available from the well, the size and style of the ideal power system for the site, whether sufficient field gases are available to justify use of a hybrid system, and the well depletion rate. All data will be incorporated into a long term economic analyses.
- Result #4—Update estimates of North Dakota's geothermal power potential and associated job growth.

Duration: It is expected that the project should last 18 months from funding.

Total Project Cost: $840,000 in funding will be required to accomplish the objectives.

Participants: TerraCOH, Inc., University of Minnesota (UMN), Lawrence Livermore National Lab (LLNL), University of North Dakota (UND), NetPower, L&M Radiator, Wenck Associates, Inc., power system supplier (identified, discussions in process) , Site Owner (TBD).

PROJECT DESCRIPTION

Objectives: The primary objective of this project is to examine and demonstrate the commercial viability of North Dakota's extensive moderate-temperature geothermal resources, specifically by employing TerraCOH's unique and proprietary geothermal power technology that uses CO_2 as the heat transfer fluid. Secondary objectives include:

- Implement a 10 to 50kW TerraCOH geothermal power system, which uses CO_2 as the heat transfer working fluid, at an operating ND hydrocarbon well, and provide emission-free or low-emission power to a local consumer at a competitive rate.

- Preferably, the current project will demonstrate a hybrid system – i.e., one that makes use of both geothermal energy and energy from otherwise wasted or low-value natural gas to produce very low cost and low emission electricity. Such a system would be unique to ND and would serve as a test platform for making use of the massive, currently wasted or low-valued energy resources in ND.
- Examine and demonstrate the economic and technical feasibility of mining otherwise wasted geothermal heat and field gases from existing gas and oil wells, and using that energy to produce baseload (with capability factor greater than 80%) electricity at a cost less than $.05/kW with low or zero carbon emissions .
- Develop a formulaic approach for determining the viability of operational oil and gas wells in ND for implementation of TerraCOH's technology using publically-available well fluid flow rates, temperatures, natural gas production rates, and power end-user availability. The resultant model will account for well geographic location as well as the geologic reservoir being utilized, and it will estimate how much power and emissions (in the case of a hybrid system) will be produced.
- Determine the extent, if at all (as anticipated), that a TerraCOH power system affects the operation of an existing oil and gas well.
- Calculate and provide an updated estimate of North Dakota's geothermal electric and geothermal/field gas hybrid power system electric potential given current oil/gas/co-produced water flows rates (using publically available data). In addition, estimate potential for future growth in geothermal power in ND if the resource is harnessed at higher rates, as well as the investment and infrastructure required to achieve such growth.
- Estimate potential for job growth in ND from geothermal power development.

Company Overview: TerraCOH's mission is to produce environmentally-friendly, low-cost electrical power and energy storage using our proprietary CO_2 Plume Geothermal (CPG™) technology. We hold a broad portfolio of issued and pending patents – including 16 issued patents worldwide in key countries and three in the US – granting TerraCOH exclusive rights to below-ground use of non-water based working fluids for geothermal power production and energy storage.

TerraCOH's CPG™ technology is the next generation of geothermal, lowering both the capital and operating cost for electricity production and exponentially increasing the geographic extent for economically-viable geothermal power commercialization. This simultaneously allows power generators to lower their costs while meeting their customers' and regulators' demands for baseload (24/7), CO_2 emission-free power. TerraCOH's technology – CPG™ licensed from the UMN, Multi-Fluid Geo-Energy Systems optioned from LLNL, and additionally technology developed internally – will ultimately be expanded beyond power production to include geologic energy storage using intellectual property and expertise that are held by the company. Moreover, TerraCOH's technology platform is ideally suited for implementation of hybrid geothermal-natural gas power systems, which use otherwise-wasted energy resources to provide ultra low-cost, low emission power.

Methodology:

TerraCOH has begun establishing relationships with oilfield operators in ND, and we anticipate identifying and executing a use agreement for a well site shortly after the start of the proposed project. Should we be unable to come to agreement with an independent operator, as a backup alternative, we anticipate being able to make use of one of the wells in the Dickenson, ND, area that is used by our colleagues (i.e., Dr. Will Gosnold) at the UND.

While TerraCOH anticipates being able to design an economically-viable power production solution to match the unique characteristics of most well sites, particularly those in ND, our early installations will be targeted to sites with more ideal conditions. Ideal well conditions include produced fluid temperatures in excess of 90 °C, an on-site power consumer, and some natural/field gas in the produced fluids. We use publically-available production data to narrow the set of wells to those with preferred characteristics.

Upon identifying appropriate wells and executing a use agreement with an operator, we will determine an appropriate size for the power system at a given site. For the current project, we anticipate installing a 10 kW power system, which will serve to demonstrate cost-effective distributed and clean power production, but a larger system may be ordered if supported by the site and budget (i.e, if there is existing well-site infrastructure can be repurposed).

Thereafter, TerraCOH will order the CO_2 power system from one of two suppliers with whom we have a relationship. Our supplier, together with partner NetPower, will be tasked with process engineering and design for the power system. NetPower specializes in design and installation of natural gas-based power systems that use CO_2 as the heat transfer fluid. Our power system supplier – together with partner L&M Radiator, a manufacturer of radiators and heat exchangers for the oil and gas and mining industries – can provide all required power system equipment.

Design requirements for the well site will be completed with project partner Wenck, which is an industrial and oilfield services provider with extensive operations in ND. Wenck will also be employed to file any required permits as well as provide construction services.

TerraCOH's power system supplier and partners will install the CO_2 power system onsite, then we will proceed through a testing checklist, verifying system performance falls within design guidelines, testing all safety systems, and confirming remote operational control before turning system up to full operational levels. Because the power system is both off-the-shelf, and thus thoroughly tested in non-geothermal environments, and closed cycle, with no heat transfer fluid directly exposed to production fluids or the environment, there is very low risk of performance or safety problems.

Finally, we will monitor the TerraCOH power system operation and performance for six months, paying particular attention to power production efficiency, operation and maintenance requirements, and associated produced power costs. To determine long-term viability of hybrid geothermal-natural gas power systems, we are particularly interested in observing and testing system performance with natural variations in availability of said field gas at a given site.

Concurrent with power system testing and operation, we will compile data and complete estimates of geothermal and hybrid system power production potential in ND. We will use publically-available oil and gas well production data, together with geothermal heat flow maps available from Southern Methodist University and UND, to complete said estimates. The geothermal potential estimates will be updates of those completed by the UND in 2009-10 and will account for the massive growth of oil and gas development since that time. Geothermal and hybrid geothermal-gas estimates will be used to calculate job creation potential for ND, using metrics from the US Department of Energy.

Anticipated Results:

As previously noted, because the TerraCOH power system platform has been tested in non-geothermal applications, even though such CO_2 power systems are quite new, we are confident that the geothermal incarnation will produce to design specifications. That is, we expect that a system designed to generate 10 kW will indeed provide that much power. However, we do anticipate some degree of maintenance for our system, beyond what is required in other waste heat-to-power settings, because we are pulling geothermal heat out of potentially complex oilfield produced fluid streams. For example, there is a potential for mineral scaling in the heat exchanger that transfers heat from the produced fluids to the TerraCOH closed loop power cycle. We are working with L&M Radiator to design heat exchangers that both minimize scaling and can be serviced in the field, minimizing the impact of this potential issue.

Ultimately, we expect to demonstrate that TerraCOH's technology can produce sub $.05/Kw electricity with an up-time (or capacity factor) of greater than 80%, with a zero carbon footprint, if using geothermal heat exclusively, or lower-carbon emissions than standalone natural gas when using a combination of geothermal heat and field gases. This will prove commercial viability for wider-scale and large size projects, and our current, early-stage analyses indicate that this would permit at least 10,000 MW's of geothermal and hybrid power systems to be put online in ND. Consequently, ND could become a regional leader in clean, renewable and low-emission, baseload (i.e., 24/7) power generation.

Facilities:

The facilities that will be required for the proposed project include an operating oilfield well site, at which will be installed a containerized (i.e., small shipping container) TerraCOH CO_2 geothermal hybrid power system.

TerraCOH's partners will provide access to computational facilities for system simulation and economic analyses (UMN and LLNL), power system testing (power system suppliers), heat exchanger design and testing (L&M Radiator), process design and engineering (NetPower), and wellsite design (Wenck Engineering).

Resources:

TerraCOH, Inc. has internal resources related to project and business management, geophysical and mechanical engineering system design and numerical simulation, fundraising and accounting, and business and intellectual property legal affairs. Our partners at the UMN bring additional geophysical and power system design and modeling resources, together with applied economic modeling capabilities. Moreover, the UMN, as a technology licensing partner with TerraCOH, can provide access to private investors and strategic partners, as well as assisting in general business development. Similarly, LLNL, as a technology licensing partner, provides access to investors and strategic partners. Moreover, LLNL provides extensive computational resources that can be applied to geophysical modeling, as well as mapping of geothermal resource and associated economic potential. Our industrial collaborators also bring extensive experience and resources to the project (see partner descriptions).

Techniques to Be Used, Their Availability and Capability:

The novel CO_2-based power systems that TerraCOH will employ for the proposed project are quite new, having become commercially available for waste heat-to-power applications only within the last few years. However, they have been thoroughly tested and verified, thus the technical risk of installing them in a geothermal application is very low. In contrast, their potential in these applications, to which TerraCOH has exclusive rights, is very high, as they are less expensive and more efficient than alternative, legacy systems in this renewable energy application.

Numerical simulation and design of CO_2-based geothermal power systems has been ongoing at TerraCOH, the UMN, and LLNL for up to eight years, depending on the institution, and TerraCOH has access to the accumulated knowledge from this extensive effort. The design and numerical modeling work has progressed to the stage that the technology is ready for commercial deployment in geothermal applications.

Finally, legacy geothermal systems, which are sufficiently similar to the system in the proposed project to be sources of information, have been installed in moderate-temperature geothermal settings such as ND for decades. Moreover, collaborator Dr. Will Gosnold at UND has a research grade, legacy style geothermal system in ND; this site will inform the design and operation of TerraCOH's commercial CPG™ power system – the first commercial geothermal system in ND and the first CO_2-based geothermal system in the world.

Environmental and Economic Impacts while Project is Underway:

We anticipate no environmental impact to the site, and we expect that each site will have essentially no carbon emissions when operating on a geothermal resource alone and fewer carbon emissions per kW of produced power when operating as a hybrid geothermal-field gas facility than a standalone natural gas power station. Moreover, the environmental impacts of our hybrid facilities will be less than sites that simply flare any produced natural gas. Finally, we anticipate using air cooling for the power system, thus fresh water resources for cooling will not be required.

The majority of the proposed project money will be spent in ND, and the project power system will be installed in the state, as well. Because of the vast potential for geothermal development in ND, in the event that the proposed project is funded, TerraCOH anticipates forming a ND subsidiary to own and operate all TerraCOH power systems in the state.

Moreover, all field service and maintenance functions will be performed by companies with a ND presence.

Ultimate Technological and Economic Impacts:

TerraCOH's is a private early stage entity that is focused on deploying this technology both in ND and beyond. Our technology will enable ND to leverage their oil and gas infrastructure and industry to produce zero or low-carbon electricity. This will also provide ND with a technology that continues to use existing oil and gas infrastructure for the production of zero carbon electricity, even when the hydrocarbons are exhausted or economically not viable.

Geothermal energy is an inherently local resource, thus its widespread development using CPG™ – which has not been possible with existing technologies – provides clean, scalable, baseload or on-demand power where there are unmet needs. Development of resources in ND will benefit ND, and power that exceeds local demands can be exported.

Job creation potential: Direct, indirect, and induced jobs created by geothermal power systems equals 6.2 job-years/MW, averaged over the lifespan of the power plant and accounting for all positions associated with the power system, including construction and operations (U.S. National Renewable Energy Lab report). This is almost eight times as many jobs per MW as coal power and almost 18 times as many as natural gas. Thus, large-scale implementation of CPG™ has the potential to drive massive job growth and economic development.

Market Analysis: Geothermal currently provides only 0.3% (~3,500 MW's) of U.S. power requirements, but as the lowest cost source of electricity and the only form of renewable power that is baseload yet could achieve major growth, its potential is massive, limited only by development of new technologies that decrease risk and cost. In existing hydrocarbon fields, TerraCOH analyses indicate that 10,000 MW of CPG/Multi-Fluid™ geothermal could be put online in North Dakota alone, representing less than 10% penetration into viable geologies and a 300% increase in installed geothermal power in the US. Hybrid CPG™ systems that are supplemented with field gas would further increase installed low-emission power capacity while making use of otherwise wasted fuel. With expansion into saline aquifers and alternative hydrocarbon formations, 100,000 MW's could be put online in the US.

Data from the U.S. Energy Information Administration (EIA), 2015, indicates that the unsubsidized Levelized Cost of Electricity (LCOE) for legacy geothermal power is $0.047 per kWh, the lowest cost of any power technology, renewable or not. TerraCOH estimates that our CPG™ technology will reduce the geothermal LCOE to ~$0.031 per kWh by using existing infrastructure (i.e., wells) in oilfield applications, reducing risks and development costs by up to 40% over legacy geothermal systems; using novel power systems that employ CO_2 as the heat transfer fluid, decreasing power facility cost by up to 30% over legacy systems; and/or by employing hybrid systems that take advantage of low- or no-cost field natural gas to increase total power production. At any given site, one or more of these opportunities will be present in TerraCOH installations, decreasing power generation costs well below the current state-of-the-art.

Environmental & Energy Impact: The TerraCOH geothermal power and energy storage solutions are projected to change the landscape for geothermal energy in several ways, including energy cost savings, increased overall power system efficiency and capacity factors, reduced greenhouse gas emissions from power production overall, reduced parasitic loads in geothermal power production, and increased regulatory and utility acceptance of baseload and on-demand geothermal power production and energy storage. TerraCOH systems, by decreasing project development risk, will increase market acceptance and tolerance of new geothermal implementations, helping utilities meet regulatory requirements for low- or no-emission power while providing stable energy supplies. Moreover, TerraCOH hybrid systems will aid oilfield operators in meeting regulatory requirements to eliminate emissions from flaring while simultaneously providing a valuable consumer for otherwise low-value natural gas.

As TerraCOH further develops our technology portfolio, we will be able to take CO_2 emissions from industrial emitters, the atmosphere, or natural sources and inject it into the subsurface to harness geothermal energy.

CPG™ requires minimal or no use of precious clean water resources. Any water requirements can be met using deep subsurface brines, which are not directly potable.

CPG™, both geothermal standalone and hybrid geothermal-natural gas systems, meet and surpass all government mandates for installation of clean power systems. Moreover, energy storage with TerraCOH's technology allows the expansion of other renewable power systems, thus permitting maximum use of all clean-energy resources.

Why the Project is Needed:

The power generation industry world-wide is under pressure from requirements to lower CO_2 emissions while simultaneously meeting growing electricity demand. Existing emission-free options (wind and solar) have high capital and operating costs, yet these platforms can only deliver intermittent power. Legacy geothermal technologies deliver baseload energy at the LCOE of any power technology, renewable or not, but existing systems are constrained geographically. To date, the limited number of economically viable geologic sites, high capital costs and risky drilling have increased pay-back timeframes, severely limiting legacy geothermal deployment. To grow the geothermal resource base, new approaches are needed.

TerraCOH's technology will enable an exponential increase in the geographic extent of economically viable geothermal power production through a combination of decreased drilling risk and, particularly in low-temperature geologic formations, increased power production efficiency. The latter is accomplished by taking advantage of the unique properties of CO_2 as a heat transfer fluid in geologic formations and power systems. The net result of will be superior financial returns for TerraCOH and partners, together with renewable, low or no CO_2 emission electricity.

Specific Problem Definition: Development of conventional geothermal power fields is inherently risky and requires high upfront capital. A challenge for TerraCOH as we commercialize our solution is to identify the lowest risk and cost initial installations of our technology portfolio at every stage of development, thereby offering a geothermal platform that the market will more readily support.

The TerraCOH team has spent several years conducting market research, completing extensive numerical modeling, and developing relationships with key partners in the industry and with suppliers. For the very first stages of commercial development, we have identified a system design that has low technical risk, using off-the-shelf equipment in a new application, and is very affordable. Under this design, TerraCOH will install a novel, high efficiency power system – that uses CO_2 as the working fluid – in an operational oilfield. The power system will use existing oilfield infrastructure and harness otherwise wasted geothermal heat from produced fluids, making use of sites with geothermal temperatures that are too low to be economical for conventional geothermal technologies.

However, being in the energy field, TerraCOH has to deal with an ever-changing marketplace – i.e., the energy landscape looks substantially different now than it did a year ago, with changes in energy and oil prices. TerraCOH has identified a market entry point that both fits our intellectual property space and meets the needs of the market – hybrid geothermal-fossil energy systems. Two hybrid-type systems exist in the US, but they have not achieved market penetration because of the lack of technological advancement of geothermal power systems combined with the historically high cost of natural gas.

North Dakota's recent success in expanding oil production has greatly benefited the State. TerraCOH offers a technology that can leverage this infra-structure, create additional high paying jobs, lower the flaring of natural gas, and sheltering ND from the cyclical nature of the oil and gas industry. If or when these wells become unusable, they can continue to be used to help ND and the world by generating low cost, zero carbon electricity. TerraCOH's CPG technology portfolio, together with recent advancements in CO_2 power systems and the expansion of oil and gas development in ND, have made the landscape ripe for new geothermal and hybrid power system development.

STANDARDS OF SUCCESS

Deliverables: The primary deliverable of the project will be a commercial-grade, 10 to 50 kW, CO_2 working fluid power system that is fueled by geothermal heat co-produced at an operating oilfield site. The power system may also make use of otherwise-wasted natural gas produced at said site, boosting total power production while generating very low emissions per kWh of power. The present project will be deemed successful if the proposed TerraCOH power system generates, or demonstrates that such a system can with minor modifications generate, unsubsidized power at a LCOE that is cost competitive with non-renewable sources, i.e., at $0.05 per kWh or less. This LCOE will be based on capital costs of the proposed system, projections of costs for second-generation systems, and operating and ancillary costs.

Secondary deliverables will include: 1) Updated estimates of the total geothermal energy potential of ND energy resources, particularly co-produced fluids from oil and gas operations. This estimate will be coupled with estimates of the cost of developing said resources, based on the results of the primary deliverable, and compared against values for development of other energy resources using data from the US EIA. 2) Estimates of the job creation potential in ND from full development of the state's geothermal resources.

Value to North Dakota: ND could become the hub of renewable electricity production in the Midwest. Extensive geothermal resources are present in the state; however, legacy geothermal technology has not been able to harness them to any but the smallest degree because they are of relatively low temperature. TerraCOH's next-generation, proprietary CPG™ technology is ideally suited to the geothermal resources in ND, with temperatures that tend to be between 70 °C and 150 °C. Additionally, as noted, TerraCOH's technology can harness the energy of otherwise flared natural gas, combining it with geothermal heat in hybrid power systems.

With implementation of TerraCOH's systems, ND can also make long term use of oilfield infrastructure (i.e., wells), long after it is no longer of value for oil production, creating a renewable electricity production legacy.

What parts of the public and private sector will use results, when and in what way: The electricity (i.e., utilities and power producers) and hydrocarbon industries will make primary use of the results of the proposed project. With successful demonstration, we anticipate that both industries will find value in contracting with TerraCOH for immediate implementation of additional CPG™ power systems.

In addition, public regulatory agencies may also find value in the results of this project, in particular, the ability to provide baseload, emission free or low emission power using local resources. CPG™ will help the state meet renewable energy and power plant emission requirements that already exist and are planned on the federal level, as well as helping the state meet basic power requirements.

Potential for commercial use of project's results: The current project is distinguished from an existing research project in progress at UND, led by Dr. Will Gosnold, in that the current project is being undertaken by a private entity with the express goal of establishing a plan for commercial development of North Dakota's extensive geothermal resources.

Critically, the proposed project uses an innovative power system, one that makes use of the unique properties of CO_2 as a heat transfer fluid, vastly improving the economic feasibility and heat use efficiency of moderate temperature geothermal systems. This is particularly critical for ND, where the geothermal resources are extensive but primarily below the utilization threshold for legacy technologies. With the successful demonstration of the proposed project, TerraCOH intends to rapidly expand our presence in ND and vastly grow the generation of geothermal-based electricity in the state.

How project will enhance the education, research, development and marketing of North Dakota's renewable energy resources: Existing commercial geothermal projects are limited almost exclusively to the western and southern US. Thus, the successful demonstration of a *commercial* geothermal project in ND will generate extensive press. TerraCOH, with our partners at the UMN and LLNL, will further facilitate marketing and press releases concerning the proposed CPG™ project, emphasizing the potential for massive geothermal development in ND.

How project will preserve existing jobs and create new ones: As previously noted, large-scale development of geothermal energy resources in ND will help insulate the state from the cyclical nature of oil and gas development. The geothermal industry employs many of the same field services professionals as the oil and gas industries, thus when oil and gas are on the downturn, geothermal can provide job opportunities.

In addition, as previously noted, geothermal development creates far more jobs per MW of installed power than coal or natural gas, thus large scale geothermal use is inherently a job creator. Moreover, geothermal heat is fundamentally a local resource, one that cannot be exported like fossil fuels but must be used where it is produced. Thus, geothermal development will create jobs in ND.

BACKGROUND/QUALIFICIATIONS

TerraCOH and its predecessor company raised over $1.3 million in private investment to advance the commercialization of our technologies from academic models to market-ready designs via extensive market research, numerical modeling, and development of new intellectual property. We have contracted with academic institutions and private entities to advance elements of the system design, resulting in a product that fits our intellectual property portfolio, minimizes technical risk by using off-the-shelf components in new ways, has low cost and has a rapid return on investment.

TerraCOH Staff: Dr. Jimmy B. Randolph, Principal Investigator. Dr. Randolph received a B.A. in physics and mathematics from St. Olaf College in 2006 and a Ph.D. with Prof. Saar in geophysics from the UMN, in 2011. As an active researcher Dr. Randolph, focuses on numerical modeling of geophysical fluid and heat transfer, applied to geothermal energy, geologic CO_2 sequestration, groundwater flow, and novel power systems. Dr. Randolph is also Chief Technical Officer, Chairman of the Board and Founder of TerraCOH. Prior to that he was at Heat Mining Company LLC, where he was Senior Scientist and Chief Technical Officer. At Heat Mining, he was responsible for new technology development; forming strategic partnerships for intellectual property acquisition, equipment manufacturing, project development, and financing; and advancing proprietary and acquired technology to a commercial product stage. He has numerous issued and pending patents in the fields of geothermal energy, CO_2-based power systems, and geologic energy storage

John P. Griffin, CEO of TerraCOH and POC for the proposed project. John holds an undergraduate degree in Mechanical Engineering and an MBA from the UMN. John is an executive with 30+ years in leading companies and organizations to success. As CEO and General Manager, he has led and consistently grown organizations with zero to $200+ million in revenue. He has raised capital from various sources and completed partnerships in technology development, distribution, and other strategic areas. He has successfully completed M&A work as both a buyer and a seller. His board experience includes industry associations, along with private and public company boards. He has been in two companies that went public one as part of the management team and another while on the Board of Directors.

Steven W. Price, Project Management, Administration & Logistics. As a founder of TerraCOH Inc., Steve's has

20+ years of management experience, was a contract/lease advisor, and has an artistic eye with attention to detail. Steve came to TerraCOH from Heat Mining Company, where he served as Operations Manager and was responsible for maintaining invoicing, researching materials, pricing and documentations, cataloging company documents, contacts and progression of on and off site activities.

John F. Dolan, Business Development, Legal Affairs and General Counsel. John has undergraduate degrees in marketing and chemistry (*with honors*), a juris doctorate from Hamline University School of Law, and is a registered patent attorney with the United States Patent and Trademark Office. John has extensive experience working as a business development executive and is able to assist in managing projects, both on-site and remotely.

Consultants: Timothy Bennington. Former Vice President of Power Generation at Alliant Energy and member of the International Energy Association (IEA) board.

Donny Meadows. CEO of Envoy Resources, a Texas-based oil & gas operating and investment company.

Stephen O'Rourke. Managing Director of Heat Mining Company LLC and former President of Global Petroleum Exploration at BHP Billiton, the world's largest natural resource company.

Clay Parker. CEO of Sciogen, former President of the Chemical Management Division of BOC Edwards, CEO in residence at the Office for Technology Commercialization at the University of Minnesota.

Scientific and Technical Advisors: Dr. Martin Saar, University of MN. Co-inventor of the CPG™ technology and Professor at ETH (Swiss Federal Institute of Technology) in Zürich, Switzerland. Adjunct professor at the UMN, Twin Cities.

Dr. Thomas Buscheck, Lawrence Livermore National Lab. A civil and reservoir engineer and earth scientist, group leader of geochemical, hydrological, and environmental sciences in the Physical and Life Sciences Directorate at Lawrence Livermore National Laboratory. His research interests involve multiphase heat and mass flow in porous media, with application to geologic radioactive waste isolation, geologic CO_2 storage, geothermal energy, and energy storage.

Dr. Jeffrey Tester. World-renown geothermal energy expert. Professor of Sustainable Energy Systems in the School of Chemical and Biomolecular Engineering at Cornell University, Director of the Cornell Energy Institute, and a Fellow in the Atkinson Center for a Sustainable Future. Former Professor of Chemical Engineering at the Massachusetts Institute of Technology (MIT), Director of MIT's Energy Laboratory and MIT's School of Chemical Engineering Practice.

Other Project Partners and Collaborators: University of North Dakota: Dr. William Gosnold: Dr. Gosnold is a Professor of Geophysics in the Department of Geology and Geological Engineering, where he specializes in continental heat flow and geothermal energy, among other research interests. He also is the Principle Investigator on a US Department of Energy project entitled "Geothermal Energy Production from Coproduced Fluids from Oil and Gas Wells," which was a research project that studied implementation of a legacy geothermal system in North Dakota.

Wenck: Founded over 30 years ago in Minneapolis, Wenck is now located in six states including ND. Wenck specializes in environmental compliance and permitting, engineering design, facilities and process engineering, water supply, wastewater treatment, construction, and emergency response and preparedness, amongst other capabilities.

NetPower: A young company that developed and is implementing CO_2 power system technology, currently applied to large scale natural gas power plant applications. NetPower specializes in process design and implementation, new technology development and testing, and power plant operations.

L&M Radiator: Founded nearly 60 years ago in Hibbing, MN, and now located internationally. L&M designs and manufacturers robust, field-serviceable radiators and heat exchangers for the oil and gas, mining, and similar industries.

MANAGEMENT

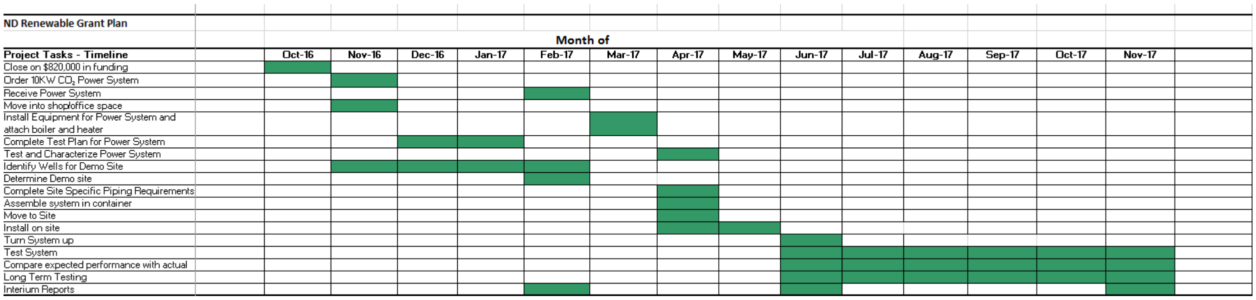
Steve Price will serve as Project Manager for this program, where he will take the general plan shown in this document and create a complete project plan using Microsoft Project (or equivalent). Each milestone in the present document will be broken down into specific tasks, and if required, additional milestones will be added as we proceed with the project.

This detailed project plan will include a list of all tasks required along with identifying those responsible for each task and dependencies of all tasks.

Steve will also chair a weekly meeting of the team to go over the project plan, both from the past week's progress, plus any changes and anticipated modifications to the plan based on the present circumstances.

Major Milestones and their schedules are shown below:

TIMETABLE



Important note: We have 13 months of budgeted activities, however we have allowed 18 months for the project duration, permitting some flexibility in locating an appropriate well site and completing associated negotiations.

See Appendix #1 for a larger view of the above table and See Appendix #2 for a more detailed budget spreadsheet.

BUDGET

Project Associated Expense	Expense Type	Amount	NDIC's Share	Applicant's Share (Cash)
John Griffin	Direct	$70,000	$35,000	$35,000
Jimmy Randolph	Direct	$70,000	$35,000	$35,000
Steve Prices	Direct	$70,000	$35,000	$35,000
John Dolan	Direct	$70,000	$35,000	$35,000
Equipment Installation Cost	Direct	$60,000	$30,000	$30,000

Equipment & Fees	Direct	$30,000	$15,000	$15,000
Site Manager	Direct	$50,000	$25,000	$25,000
Power Engineer	Direct	$52,000	$26,000	$26,000
Piping Consultant	Direct	$21,000	$10,500	$10,500
10 kW CO2 Power System and Boiler	Direct	$200,000	$50,000	$50,000
Travel Costs	Direct	$53,500	$26,750	$26,750
Tools/Test Equipment	Direct	$37,000	$18,500	$18,500
Contingency	Direct	$35,000	$17,500	$17,500
Indirect Costs	Indirect	$121,500	$60,750	$60,750

Budget Justification:

The applicant's cash share of costs will be provided by private funding sources, primarily private equity and angel investors. If less funding is available than requested, TerraCOH anticipates being able to make up the difference through private investments and in-kind contributions from partners such that the project objectives should not be delayed. Similarly, if costs of project tasks increase during the project period, TerraCOH does not anticipate requesting additional funds, rather, we will obtain any needed funds from private sources. Furthermore, to minimize the risk of funding shortfalls, a small contingency has been added to the budget, with the indirect costs and contingency totaling 25% of the total budget. Moreover, TerraCOH direct staff time has been limited to 50% in the budget, thought salaried staff may dedicate more time to the project as needed.

Salaries (Griffin, Randolph, Price & Dolan) **–** Employees will be working full time for ½ pay

Equipment Installation Costs **–** Estimate, from discussions with the power system providers and oilfield consultants.

Equipment and Fees **–** Estimate for remote monitoring equipment and monthly fees to monitor well.

Site Manager **–** Estimate for full time Site Manager.

Power Engineer **–** Estimate for consulting time to analyze and recommend the correct power system and heat exchangers. Services provided by power system supplier, NetPower, and L&M.

Piping Consultant **–** Estimate for time spent consulting with our team and well owner to design and supervise the correct size, material and approach to integrating TerraCOH's power system at the well site. Services provided by Wenck.

10kW CO_2 Power System and Boiler **–** Estimate provided in January, 2016, to TerraCOH by system supplier.

Travel Costs **–** Frequent visits to the site and oil well partners will be required to insure a safe installation and the collection of date. This assumes travel by vehicle.

Contingency **– I**ncluded for un-anticipated expenses. Contingency plus indirect costs totals 25% of total project budget.

Indirect Costs **–** This is indirect costs with a rate of about 14%.

CONFIDENTIAL INFORMATION: There is no confidential information in this document.

PATENTS/RIGHTS TO TECHNICAL DATA: This does not apply to our proposal.

Appendices #1: Project Schedule with Interim Reports

Project Tasks - Timeline	Oct-16	Nov-16	Dec-16	Jan-17	Feb-17	Mar-17	Apr-17	May-17	Jun-17	Jul-17	Aug-17	Sep-17	Oct-17	Nov-17
	Project Schedule Month of													
Close on $820,000 in funding	■													
Order 10Kw CO2 Power System		■												
Receive Power System				■										
Move into Shop/office space		■												
Install Equipment for Power System and attach boiler						■								
Complete Test Plan for Power System			■	■										
Test and Characterize Power System							■							
Identify Wells for Demo Site		■	■	■	■									
Determine Demo Site					■									
Complete Site Specific Piping Requirements							■							
Assemble system in container							■							
Move to site							■							
Install on Site							■	■						
Turn system up									■					
Compare expected performance with actual									■	■	■	■	■	■
Long Term Testing									■	■	■	■	■	■
Interium Reports					■				■					■

Appendices #2 Detailed Budget

USE OF FUNDS - $840K	Direct Costs	Oct-16	Nov-16	Dec-16	Jan-17	Feb-17	Mar-17	Apr-17	May-17	Jun-17	Jul-17	Aug-17	Sep-17	Oct-17	Totals
	Project Budget														
John Griffin	$ 5,000	$ 5,000	$ 5,000	$ 5,000	$ 5,000	$ 5,000	$ 5,000	$ 5,000	$ 5,000	$ 5,000	$ 5,000	$ 5,000	$ 5,000	$ 5,000	**$ 70,000**
Jimmy Randolph	$ 5,000	$ 5,000	$ 5,000	$ 5,000	$ 5,000	$ 5,000	$ 5,000	$ 5,000	$ 5,000	$ 5,000	$ 5,000	$ 5,000	$ 5,000	$ 5,000	**$ 70,000**
Steve Price	$ 5,000	$ 5,000	$ 5,000	$ 5,000	$ 5,000	$ 5,000	$ 5,000	$ 5,000	$ 5,000	$ 5,000	$ 5,000	$ 5,000	$ 5,000	$ 5,000	**$ 70,000**
John Dolan	$ 5,000	$ 5,000	$ 5,000	$ 5,000	$ 5,000	$ 5,000	$ 5,000	$ 5,000	$ 5,000	$ 5,000	$ 5,000	$ 5,000	$ 5,000	$ 5,000	**$ 70,000**
Equipment Installation Costs		$ -	$ -	$ -	$ -	$ 10,000	$ 10,000	$ 40,000	$ -	$ -	$ -	$ -	$ -	$ -	**$ 60,000**
Equipment & Fees		$ -	$ -	$ 10,000	$ 2,000	$ 2,000	$ 2,000	$ 2,000	$ 2,000	$ 2,000	$ 2,000	$ 2,000	$ 2,000	$ 2,000	**$ 30,000**
Site Manager		$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 10,000	$ 10,000	$ 10,000	$ 10,000	$ 10,000	**$ 50,000**
Power Engineer		$ 4,000	$ 4,000	$ 4,000	$ 4,000	$ 4,000	$ 4,000	$ 4,000	$ 4,000	$ 4,000	$ 4,000	$ 4,000	$ 4,000	$ 4,000	**$ 52,000**
Piping Consultant			$ 5,000	$ 5,000	$ 5,000		$ 3,000	$ 3,000							**$ 21,000**
10KW CO2 Power System, Heat Exchanger and Boiler						$ 100,000									**$ 100,000**
Travel Costs			$ 6,000	$ 6,000	$ 6,000	$ 4,000	$ 4,000	$ 4,000	$ 4,000	$ 4,000	$ 4,000	$ 4,000	$ 4,000	$ 3,500	**$ 53,500**
Tools/Test Equipment			$ 15,000	$ 8,000	$ 2,000	$ 2,000	$ 2,000	$ 2,000	$ 2,000	$ 2,000	$ 2,000				**$ 37,000**
Contingency					$ 5,000	$ 5,000	$ 5,000	$ 5,000	$ 5,000	$ 5,000	$ 5,000				**$ 35,000**
Direct Cost Sub Total		**$ 24,000**	**$ 50,000**	**$ 53,000**	**$ 44,000**	**$ 147,000**	**$ 50,000**	**$ 80,000**	**$ 37,000**	**$ 47,000**	**$ 47,000**	**$ 40,000**	**$ 40,000**	**$ 39,500**	**$ 718,500**
Indirect Cost Sub Total		**$ 7,500**	**$ 9,500**	**$ 9,500**	**$ 9,500**	**$ 9,500**	**$ 9,500**	**$ 9,500**	**$ 9,500**	**$ 9,500**	**$ 9,500**	**$ 9,500**	**$ 9,500**	**$ 9,500**	**$ 121,500**
TOTALS:		$ 31,500	$ 59,500	$ 62,500	$ 53,500	$ 156,500	$ 59,500	$ 89,500	$ 46,500	$ 56,500	$ 56,500	$ 49,500	$ 49,500	$ 49,000	**$ 840,000**
CUMMULATIVE TOTALS:		$ 31,500	$ 91,000	$ 153,500	$ 207,000	$ 363,500	$ 423,000	$ 512,500	$ 559,000	$ 615,500	$ 672,000	$ 721,500	$ 771,000	$ 820,000	
EOM Cash		**$808,500**	**$749,000**	**$686,500**	**$633,000**	**$476,500**	**$417,000**	**$327,500**	**$281,000**	**$224,500**	**$168,000**	**$118,500**	**$69,000**	**$20,000**	
Indirect Cost Percentage		**24%**	**16%**	**15%**	**18%**	**6%**	**16%**	**11%**	**20%**	**17%**	**17%**	**19%**	**19%**	**19%**	**14%**
Grant		**$840,000**													