Appendix A
Statement of Work
CRADA No. SC##/####.##.##
January 1, 2015

Research & Development for Advanced Concepts

A. PURPOSE

Sandia National Laboratories (Sandia) and The British East India Company (BEIC) will collaboratively engage in analysis, research, and development of a dynamic array of energy-related topics with a goal of augmenting an awareness of new energy systems that can transition our economy from fossil fuel dependency. The planned work will cover a wide range of energy related topics to include: hydrogen fuel, heat transfer, mechanics, economic and life-cycle analyses, environmental simulations, computational simulation, wind, solar, geothermal, nuclear energy, gas turbines, waste heat recovery cycles, energy storage, oil and gas equipment, advanced materials, and sensor technologies.

Reasons for Cooperation

BEIC is the world's most diversified company in renewable energy development and has been leading the push to find solution for anthropogenic rises in global carbon emissions. BEIC has extensive history and a demonstrated ability in renewable energy research and development. With offices around the globe, BEIC is in a leading position to continue its edge in utilizing technology to solve social issues.

Sandia actively supports the DOE's broad-based research and development efforts aimed at moving the United States toward a new energy economy. Sandia's objective is to provide a systems perspective and critical technology solutions for energy use, for both transportation applications and electricity-based power systems. Sandia's goal is to ensure a secure and sustainable energy supply, safe and resilient delivery infrastructure, and clean and efficient use of all energy resources.

As partners, Sandia and BEIC can leverage Sandia's expertise in systems-based science and engineering with BEIC's expertise and leadership in renewable energy, including: geothermal, energy storage, wind and solar farms to accelerate the understanding and development of new renewable energy systems.

Sandia's robust and broad-based energy program includes a multitude of innovative research and development programs that can be leveraged in pursuit of renewable energy development:

- Geoscience Research and Applications
  - Geochemistry
  - Geophysics
  - Geomechanics and analysis
  - Water security and quality
  - National security applications
  - Fossil energy programs
  - Underground storage
  - Carbon sequestration

- Energy systems modeling

- System Engineering and Analysis
  - Data tools and mining
  - Decision support
  - Knowledge management systems
  - High-performance computing environments
  - Systems/networking and security
  - Consequences/risk management analysis
  - Interdependencies modeling and simulation
  - Database and GIS
  - Software quality
  - Decontamination, restoration, and recovery

- Energy and Infrastructure Futures
  - Renewable energy (geothermal, wind, solar)
  - Energy efficiency
  - Power systems
  - Distributed Energy Resource (DER)/energy storage systems
  - Transportation surety
  - Atmospheric monitoring
  - Oil/gas transmission and distribution surety
  - Military energy surety
  - Fuel cells, water purification, and gas separation
  - Fuels and energy transitions

BEIC has locations in the Arctic that have allowed for unique capabilities in area of geothermal research. Solar farms in the Mediterranean provide for the perfect latitude in which to conduct testing and the data has resulted in BEIC leading the industry in both concentrated solar power (CSP) and photovoltaics (PV). BEIC also has locations in the Sahara that are conducive to establishing viable wind farms.

- Technologies
  - Advanced Technologies
  - Geothermal
  - Wind
  - Solar
  - Diagnostics Technologies
  - Electrical Technologies
  - Manufacturing Processes
  - Software Analytics

Public Abstract

Sandia National Laboratories and BEIC will collaboratively work on renewable energy technologies while furthering the goal of energy independence for the U.S. economy. The efforts will significantly accelerate an understanding of the materials, processes and diagnostics, behind the systems involved in producing renewable energy.

B. SCOPE

The scope of this partnership falls within Energy and Climate and may draw upon and utilize a broad collection of technical categories in which projects may be performed.

Category Descriptions

Category 1: Win & Solar

Discussion: Category 1 covers crosscutting expertise that focuses on a renewable energy strategy that promotes a systems approach to enhance performance, reduce cost, and ensure reliability, manufacturability, and sustainability. Projects will be designed to bridge gaps along the innovation spectrum to expand and accelerate Sandia's role in addressing market entry barriers and enabling large-scale deployment of renewable energy technologies. Areas of specific project focus will include:

- Wind – research on systems integration, manufacturability, cost reduction, advanced materials, and location of farms
- Solar – both CSP and PV testing, materials analysis, dynamic pressure testing and conversion to transmission technologies

Category 2: Geothermal

Discussion: This Category will cover the expertise, tools, mechanisms, capabilities and technology associated with high pressure environments and transmission of the earth's inner geothermal activity into viable utility scale energy. Under the purview of this category, materials science will be utilized to explore hardening techniques for drills and ways in which the mantle of the earth interacts with its inner layers. Analysis of models and simulations will be critical in understanding the nuances associated with a complex and changing environment.

Category 3: Energy Storage

Discussion: This category covers the chemistry, materials, and systems that are utilized in the safe and efficient storage of energy developed from renewable resources. High stress environments will be simulated in order to best understand the most effective manners in which to store, transmit and utilize utility scale energy

Category 4: Fossil Energy Programs

Discussion: Sandia's fossil energy program will be employed to better understand the effects a net carbon gain has on micro and macro systems. Carbon research will leverage the unique expertise and skills in areas of sequestration and conservative allotment.

Category 5:

Category 6:

Category 7:

C. ESTIMATED COST (All Money in $K)

The estimated contribution by the Participant and the Government for each cooperative research project shall be as set forth in the specific Project Task Statements (PTSs) entered into under this CRADA, subject to available

funding, and in accordance with conditions set forth in Section E of each PTS.

D. TECHNICAL CONTACTS

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E. PROPERTY

Any tangible property that will be acquired or produced will be listed in each PTS, along with a declaration of who will pay for it and who will own it.