



## **TECHNICAL ASSISTANCE REQUEST**

### **PROJECT TITLE: "DEVELOPMENT OF A NaKCl LIQUID METAL GRID-LEVEL DISTRIBUTED RENEWABLE ENERGY STORAGE SYSTEM"**

Whether the feasibility testing and proof of concept testing is completed in a private or public electrochemical laboratory, Veridia will provide oversight and management of the project. The proposed feasibility testing will require the use of laboratory equipment, testing systems, chemical access, storage and use, safety measures in place for handling chemicals and the technical expertise of trained electrochemical engineers and laboratory investigators.

Although Veridia is open to the testing being done in a private laboratory, with the technical assistance of an American-Made Network member, or at a government operated public laboratory such as the Pacific Northwest National Laboratory in Portland, Oregon or in Richland, Washington, Veridia's goal is to provide a renewable energy education experience for graduate-level engineering students and so the planned testing site could be a university-based chemical engineering laboratory.

For the feasibility testing at a university electrochemical laboratory, Veridia is in early discussions with graduate chemical engineering programs at Portland State University, Oregon State University, Montana State University, CalPoly and an American-Made Network member, the University of Arizona Center for Innovation.

### **PROJECT PROOF OF CONCEPT PLAN**

#### **Benchtop Testing of Fuel Cell Unit and Chemicals**

**(1)** Experimental work on a specially constructed benchtop Fuel Cell Unit will evaluate different membrane, electrode, sparger, electrolyte materials and physical conformations, to minimize cost and optimize performance, and to quantify system energy output/efficiency and discharge capacity.

**(A)** Testing for promising combinations of materials to determine a) current & voltage versus time of operation at a fixed impedance and, b) composition of salt as a function of operation time. Questions include: ratio by weight in the salt mixture of Na to K? How much Aluminum is present in the salt as an indicator of AlCl<sub>3</sub> drag-out or precipitation?

**(B)** With successful combinations of materials and chemicals, the final rounds of tests will measure changes in operating characteristics with long-term operation. This information will enable a better understanding of the potential operating issues and

constraints of the Fuel Cell as well as further development/engineering of designs for a pilot scale NaKCl Fuel Cell Unit.

### **Working Prototype for Real World Testing**

(2) Based upon the success of the benchtop energy storage tests, a complete and operational small-scale liquid metal energy storage system prototype will be built to test onsite at a residential home or small with business with a readily available renewable energy source, i.e., a solar panel rooftop, a wind turbine farm, or a hydroelectric source and, over a three month period, the processing system will be monitored for energy storage stability, capability and capacity and NaKCl stored chemicals integrated in the processing system monitored for stability and safety.

### **Commercialization of Industrial-Scale System**

(3) Along with its current partner, Polaris Battery Labs and with the engineering assistance of an American Made Network connector member, over a six-month long monitoring period, with Ready! Set! Go! awarded funds and additional funding from SBIR DOE, ARPA-E or NSF grants or investors, Veridia will construct an industrial-sized system to be set up to store energy from a grid-level, distributed renewable energy source, i.e., wind, solar or hydroelectric power, for use in a large factory, warehouse or other large complex and monitored for energy storage stability, capability and capacity, and assessment of cost per kWh, to support the long-term energy storage and on demand energy needs of the target businesses.

### **Technical Assistance Personnel Needs to Carry out Benchtop Testing, Prototype Build, and Industrial System Testing**

Veridia, to accomplish its development goals, will seek American-Made Network connector member, government-based laboratory technicians and scientists, or university-based laboratory graduate students, with the following expertise: Electrochemical Engineers, Laboratory Researchers, Laboratory Technicians, Project Managers, Mechanical Design Engineers, Graduate-Level Engineering Students, Metal Workers, Metal Fabricators, Chemists, Environmental Engineers, Test Site Manager, Test Site Performance Monitors, and Data Analysts.