DDI Energy, Incorporated

ARC Power Generation Systems

Alaskan Applications

In partnership with WHPacific

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Total Project Cost: **$550,000** = Grant Funds $385,000 + DDI Energy, Inc., $165,000

Summary

DDI Energy Inc., proposes to place the ARC Power Generation System into small towns, facilities and remote sites with existing natural gas or propane supplies that require stable electrical power. Built for use in Arctic conditions, the ARC units use natural gas, propane or methane to provide energy to a solid oxide fuel cell that can produce 3kW to 40kW with virtually no CO2 production. The SOFC process also provides heat for small enclosures and potable water as by-products of it's operation.

Using existing infrastructure, ARC units can be brought online to:

- produce the primary electrical needs for remote locations, such as transmission towers, switch gear, pump station units, navaids, etc;
- supplement a facility's energy requirements;
- act as an emergency backup source of electricity.

This proposal is eligible as it will act as a test for an emerging technology that has not been previously demonstrated in the State of Alaska, as well as being supported by matching funds from DDI Energy, Inc. This project has potential for widespread use throughout Alaska and DDI Energy, Inc., is committed to match funds up to thirty percent.

Innovation and Scientific Concept

Solid Oxide Fuel Cell (SOFC) power plants are a proven source of electrical energy and have been used in residential applications in Europe since 1992. These power plants provide clean power, are highly efficient, run on numerous fuel sources and require minimal maintenance. They perform consistently regardless of weather and climate, produce a minimal amount of CO2 and the waste products are heat and water which can be co-generated.

A fuel cell is a device that hydrocarbon fuel and oxygen to produce electricity, heat and water. It is different from a combustion driven system since the hydrocarbon fuel and oxygen are not allowed to burn but are combined electrochemically. Without combustion, the fuel cell produces low amounts of CO2 as well as low amounts of harmful oxides of nitrogen and sulphur dioxide.

The fuel cell is a direct energy conversion device, so is inherently more efficient than a combustion engine or steam driven generator (from 35% to 55% efficiency with no co-generation – 80-85% with co-generation). This means that ARC units will be more cost-effective that diesel or TEG generators over the lifetime of the unit.

The ARC power plants also deliver the energy as required by the load factors. This means it will conserve fuel and energy, delivering only the amount of energy being requested. They can be monitored remotely over the Internet or phone lines as required, decreasing the cost of maintenance.

ARC generation systems are self-contained, with a small footprint as compared to diesel or TEG generators. This reduces the ecological footprint of the facility, especially in remote, pristine locations. They are also scalable up to 40kW and can be run in parallel for larger power needs.

Technological Readiness

DDI Energy, Inc., is at TRL 7.

DDI Energy, Inc., has developed, sold and installed seven prototype systems in the United States that being used to power internal systems for those companies. We are presently increasing our manufacturing capability and expect to have the ARC power plants available for use commercially by January 2013.

DDI Energy, Inc., will be installing ARC units at the University of Calgary, to power one of their new facilities as well as act as a focus for teaching engineering students about alternative energy processes. We are also providing ARC units to Haiti in conjunction with Haiti ARISE to power a clinic, school and a small farm. DDI Energy, Inc., also has agreements to power demonstration sites in Liberia, Tanzania, India and Bangladesh.

The project team consists of Marc Dionne, Chief Executive Officer, an engineer from DDI Energy, Inc. (to be selected depending on company workload) and a representative from our partner, WHPacific.

Validation and Research Methodology

Project Objectives – to place ARC Generation Systems in hard to reach locations or facilities to provide stable electrical power. This will be achieved by installing units at locations to be determined and hooking them up to existing fuel supplies. Technical data collection will be done via internet connection from the units themselves. The ARC units will provide real time outputs on the main display which will include:

- Output power in kilo-Watts
- Battery Charging current in Amps
- Battery Charge Level
- HRU Output status
- Other System Status Codes
- Fault codes
- Data/Command link Status

The units will have on-board memory that will store run-time data including the above data plus other information regarding set-points, temperatures, pressures etc. This data will be retrievable by a trained technician using proprietary software to retrieve the data and generate appropriate reports.

Alternately, the data can be sent by the unit to the customer using the Data/Command link on a regular interval, which would then be used by the customer, again with proprietary software to download the data and generate the reports.

Project schedule – From the date the grant is awarded, we estimate pre-deployment activities to take approximately four months for determining data to be collected, permitting, finalizing financing and locating the most suitable site for installation.

Deployment for the full scale project will take approximately three months, to have the site prepared and installation and testing completed.

Post deployment will encompass one year, for operation and data collection, O & M, training local personnel in O & M and initiating performance monitoring plans through to 2015.

Site/Facility - The location will be determined in consultation with WHPacific, who have access to sites available throughout NW Alaska. The sites chosen can be existing facilities or new facilities requiring power generation of 3kW, 5kW, 7kW or 10kW.

ARC units can be placed in critical facilities such as hospitals and emergency services buildings or in remote locations such as cell/transmission tower sites that relay communications throughout the State.

Market applicability – whether the units are placed in facilities within municipal boundaries or out in remote locations, ARC power generation systems will reduce operating costs by having lower maintenance needs, producing only the power required by load factors and by providing consistent, clean electrical output for the facility. ARC units will also co-generate heat and water for use in the facility, reducing costs by not having to have a separate heating system for the generator units and the equipment being powered.

By using the reports generated by the ARC units, analysis can determine the cost effectiveness and energy efficiency for the sites chosen.

Permitting – all that is required is a gas fitting permit and building permits for the enclosure required, as well as a permit to tie into an existing electrical grid, if needed.

Market/Commercialization – Anywhere there is a need for a consistent output of electrical power, an ARC system can be installed. The ARC units are optimized for use in Arctic environments due to the co-generation ability. These units can be utilized anywhere in the State.

ARC Power Generation Systems were initially designed for remote Arctic locations such as pump stations for pipelines, remote transmission towers, pipeline control stations, metering sites and work camps. These units are able to generate heat to keep equipment and fuel supplies warm enough to operate properly. They also require minimal maintenance - usually ensuring the fuel supply is kept current is sufficient and a once-a-year physical check on the system parameters. Most of the monitoring is done remotely via phone or internet links, whichever is the most efficient for the particular site.

There is also a unique anti-theft system built into each ARC system that can be monitored by DDI Energy, Inc., or the client. If a unit is taken from the original site without notification, the ARC unit will not function without a reset code sent by DDI Energy, Inc., or the client themselves.

Having units in critical facilities as backup units in case of natural or man-made emergencies will ensure that electricity will be supplied even if the normal electrical supply grid is offline, as long as a fuel supply is present.

Emerging Energy Technology Fund Grant

Grant Budget Form

12-28-10

Milestone or Task	Anticipated Completion Date	EET Fund Grant Funds	Grantee Matching Funds	Source of Matching Funds: Cash/In-kind/Federal Grants/Other State Grants/Other	TOTALS
(List milestones based on phase and type of project. See Attached Milestone list.)		$	$		$
Pre-deployment	4-5 months	$ 16,100	$ 6,900	in-kind	$ 23,000
		$	$		$
Deployment	3-4 months	$ 360,500	$ 154,500	in-kind	$ 515,000
		$	$		$
Post-deployment	1 year	$ 8400	$ 3,600	in-kind	$ 12,000
		$	$		$
		$	$		$
		$	$		$
					$
					$
TOTALS		385,000	165,000		$ 550,000
Budget Categories:					
Direct Labor & Benefits		$ 7,700	$ 3,300		$ 11,000
Travel & Per Diem		$ 22,400	$ 9,600		$ 32,000
Equipment		$ 332,500	$ 142,500		$ 475,000
Materials & Supplies		$ 5,600	$ 2,400		$ 8,000
Contractual Services		$ 2,800	$ 1,200		$ 4,000
Construction Services		$ 14,000	$ 6,000		$ 20,000
Other		$	$		$
TOTALS		$ 385,000	$ 165,000		$ 550,000

Applications should include a separate worksheet for each project phase (Pre-Deployment, Deployment and Research, Post-Deployment)- Add additional pages as needed