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Alaska Energy Authority
Emerging Energy Technology Grant Application

Abstract
For

Tundra Greens

March 9, 2012

Contact Information:

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Partners: FTC Energy, Inc.
Monolithic Domes
Clanton and Associates

Total Project Cost: \$1,610,100
Grant Funds Requested: \$1,188,700
Match Committed: \$421,400

No previous projects
No previous applications



Alaska Emerging Energy Technology Fund
Grant Request Abstract – Tundra Greens

1) Project Summary

a) Project Description

Tundra Greens proposes to create a demonstration project to grow robust vegetables year – round using renewable energy generation, energy efficient greenhouse building design and lighting, and aeroponic plant growing techniques. Energy generation for the operation will be accomplished using the latest developments in vertical axis wind generation with battery back-up. The greenhouse building will use thermally efficient urethane dome construction. Plants will be grown using LED lighting and break-through nutrition systems to provide crop harvests about three times more often than with traditional methods at a fraction of the energy costs of traditional greenhouses.

b) Project Eligibility

Tundra Greens is bringing together several new and newly applied technologies to create a project that when expanded can benefit all of Alaska. There are several components to this project, all of which support the intention of this grant.

For energy generation, we are using a 50 kw vertical axis wind turbine (VAWT) and inverter by FTC energy. VAWT are generally smaller, simpler and less expensive than horizontal axis wind turbines (HAWT). They are particularly effective in a “gusty” wind environment and could provide renewable power in places where HAWT are not warranted. To our knowledge this is an emerging technology, or at a minimum an improvement on an existing energy technology, that has not been demonstrated in the state. Power back-up will be supplied by Trojan deep cycle and Lithium Ion battery banks.

The structure will be a 5 inch thick externally insulated monolithic dome with an energy recovery ventilation system. Domes, by the nature of their construction style as well as construction materials are inherently more thermally efficient than traditional structures. In addition, the structure of the dome enhances wind capture and wind turbine performance. This is old technology modernized to conserve energy. Soldotna has a few dome dwellings, but there is no verifiable data collection on the thermal efficiency.

We will grow organic plants using an aeroponic system. Aeroponics is cutting edge in the world of hydroponics. The proposed aeroponic tower and LED grow light system uses 80% less power than traditional high pressure sodium growing systems and 95% less water. This is emerging technology and has not been demonstrated on a commercial scale in Alaska.

c) Project Innovation

This project will provide an off-grid, climate controlled, year-round growing system. With advances in VAWT technology, battery storage, thermally efficient construction, LED grow light technology and aeroponic growing systems Alaskans can grow fresh, organic produce in both rural and urban settings in an energy neutral environment. This can be accomplished independently of light and weather conditions.

The proposed aeroponic system within the dome structure will represent an equivalent 5 acres of traditional farming. The system does not rely on traditional farming methods, but uses automated systems that significantly reduce energy requirements and operating costs. The VAWT is less



costly to install and maintain than HAWT and other alternative energy producers. Harvested bio product can also be burned to power the greenhouse.

d) Priority

Tundra Greens is an Alaskan company solely owned by an Alaskan resident. Our intention is to use the testing facilities at UAF to test power quality, performance, reliability and efficiency of the turbine and generator unit and to work with UAA on dome thermal efficiency performance. Additionally, it is our intention to use the University of Alaska cooperative extension service as appropriate. Our budget reflects the Alaska University System as third party testing partners.

This project is supported by both in-kind contributions from its partners as well as reduced labor costs. Our contribution is approximately 26% of the total project cost.

Each component of this system, or combination of components of this system can be used to: provide small scale renewable power, provide thermally efficient housing, and grow organic crops year round to the benefit of potentially all Alaskans.

2) Technology Validation and Research Methodology

a) Objectives

We have four main objectives: 1) test performance of the vertical axis wind turbine/battery system, 2) measure thermal efficiency of the domes, 3) evaluate growing system performance including grow cycle and crop yield as well as LED efficiency 4) determine overall energy requirements for the dome, and for the combined dome and growing system to determine the applicability of this technology for various locations in Alaska.

b) Research Methodology

We intend to work with a third party testing facility in two phases for the wind turbine/battery testing system. Phase one will be pre-deployment testing of various performance parameters, phase two will be in service testing. We have allocated \$45,000 in our budget to cover 10 test days by the Alaska Center for Energy and Power.

The thermal efficiency of the dome will be measured by determining the make-up energy needed to keep the dome at a constant temperature vs. outside conditions.

We intend to work with the UAF School of Natural Resources and Agriculture to evaluate the efficiency of the aeroponic/LED grow system from germination through harvest. We have allocated \$20,000 for their efforts.

Our project schedule includes a 7 month testing schedule to capture both summer and winter operation.

3) Summary of Project Schedule and Summary of Project Budget

a) Project Schedule:

Project Selection:	8/17/2012
Contract Award	9/17/2012
Site Control Complete	11/16/2012
Final Design Complete	2/1/2013
Permitting Complete	4/12/2013
Site Preparation Complete	5/03/2013
Dome Construction Complete	7/03/2013
Turbine Installation Complete	7/14/2013



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Aeroponic Installation Complete	8/05/2013
Final System Check-out Complete	8/19/2013
Begin Data Collection and Tech. Validation	8/19/2013
Start of Commercial Operation	9/02/2013
Complete Performance Evaluation	2/28/2014
Issue Analysis and Recommendations	3/28/2014

b) Project Budget

Total Project:	\$1,610,100
Grant request:	\$1,188,700
Matching Funds:	\$421,400

Contributed Matches

Match Provider	Match Amount	Match Source
Tundra Greens	\$159,000	*Reduced Salaries and Benefits
FTC Energy	\$124,400	Equipment discount
Monolithic Domes	\$108,000	\$100,000 material, \$8,000 Installation labor
Grow System Provider	\$30,000	Commitment rec,d. from several vendors
Total Match	\$421,400	

*Salary and Benefit Reduction

Position	Retail Rate	Grant rate
Program Manager (PM)	\$150,000/year	\$90,000/yr.
PM benefits rate	38%	22.8%
Project Engineer (part time)	\$90,000/yr	\$54,000/yr
Proj. Engineer benefits	38%	22.8%
Gardener	\$18/hr.	\$0/hr
Gardener Benefits	38%	\$0

4) Project Team Qualifications

Janet Reiser, owner of Tundra Greens will manage the project. Ms. Reiser is a degreed Chemical Engineer with over 30 years of technical and executive management experience. She is the founder and a past President of NANA Pacific, LLC, an engineering and construction company specializing in government contract work. Ms. Reiser has a background in food process development and experimental design. She currently serves as board chair for Chugach Electric Association and as chair of the Alaska Railbelt Cooperative Transmission and Electric Company (ATCTEC) board of directors.

FTC Energy, Inc. will provide their new patent pending vertical axis wind turbine (VAWT) generator and inverter. FTC Energy is pioneering advances in VAWT technology. Their new turbine is UL listed, and third party certified as vibration and noise free. VAWT are generally smaller, simpler and less expensive than horizontal axis wind turbines (HAWT). They are particularly effective in a "gusty" wind environment and could provide renewable power in places where HAWT are not warranted.

Monolithic Domes has been designing and constructing dome shaped structures all over the world since 1982. The benefits of dome structure are well known: affordability, strength and energy efficiency. Using airform technology Monolithic Domes will provide a 60 foot diameter, 30 foot tall



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dome with an arctic entry for this project. The dome construction of 4 to 5 inch urethane is expected to provide greater than 98% thermal efficiency. They will also provide fire protection and air handling.

Clanton and Associates is an award winning lighting design firm specializing in sustainable design. Nancy Clanton is a member of the National Academy of Science Assessment of Solid State Lighting committee and will serve as advisor on LED lighting design.

Tundra Greens is continuing to discuss specific hydroponic/aeroponic systems with several vendors. As the technology matures over the grant evaluation period, Tundra Greens will assess and select the most promising system for testing.

5) Discussion of Commercialization of Funded Technology

This cutting edge wind turbine system can be easily deployed in a variety of applications throughout the state. The turbines are relatively light-weight, inexpensive, easily transported and easily maintained, and as such can provide power where HAWT may be cost prohibitive. They reliably produce power in gusting and high wind situations. They are short lead-time items and are customizable to various locations. This technology is being commercialized already in the lower-48 and with modifications for Alaskan conditions (as determined through this grant) can be commercial in Alaska within the next five years.

Aeroponics with the right LED grow lights represent a revolutionary approach to food production. With Alaska importing over 90% of our food, this technology will increase our food security and lower the cost of healthy, fresh food. Aeroponic technology is already in use in the lower 48 and other countries. Through this grant we will optimize LED grow lighting for energy efficiency and crop production. The project will grow the equivalent of 5 acres of traditional produce production. Local crop production will dramatically reduce the amount of energy needed for transportation, making scarce fuels available for other uses.

With all elements working together we will get a good picture of the energy requirements for growing high quality produce in Alaska and be able to optimize our system to meet these requirements with renewable energy.

6) Signed Applicant Certification

By signature on this application, I certify that we are complying and will comply with the amount of matching funds being offered..

Authorized Signatories: Janet Reiser, Michael Luberski

Michael Luberski
Michael Luberski

03/08/12
Date

Proof Of Eligibility: Alaska Business License No.: 967957 ✓ *sme 3/9/12*

