SITKA SOUND
SCIENCE CENTER

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1. Title: Seawater Intake Wet Well and Pump Station District Loop

2. Applicant: Sitka Sound Science Center
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3. Partners: Foraker Group
   YourCleanEnergy, LLC
   National Science Foundation

4. Total Project Cost: $891,586

   Grant Request: $755,986
   Match: $135,600

5. Previous project/application: N/A

6. Previous Project titles: N/A

Abstract

1. Project Summary

a. **Project Description**: *(Provide a summary description of the project).*

Design and construction of an innovative demonstration sea water intake and pump station system for the Sitka Sound Science Center that will improve the potential for sea water heating for coastal communities with ice free bays in Alaska. This project will be capable of commercialization as it will be built to share with the former Sheldon Jackson neighborhood in Sitka that includes buildings owned by the National Park Service, the State of Alaska Department of Education Division of Museums, and the Sitka Fine Arts Camp which owns the 20-building Sheldon Jackson campus. In a single pre-engineered structure located on protected shoreline, the project will: **1. Replace an inefficient suction type wet well with a gravity flow wet well; 2. Allow sea water intake lines to be cleaned from land with a water pressure driven pig; 3. Provide efficient variable-speed drive vertical turbine sea water supply pumps; 4. Provide exchange of sea water heat into an efficient buried district heating loop to supply adjacent buildings that are equipped with water to water heat pumps.** The payback on investment when the district loop is utilized is anticipated to less than 10 years.

b. **Project Eligibility**: *Provide a summary explanation of how the project is an eligible emerging energy technology demonstration project, as outlined under AS 42.45.375(c)(1-3), 3 AAC 107.715, and this RFA (sec. 4.2).*

This project seeks to improve the existing energy technologies presently used in Alaska in coastal communities for moving sea water heat into buildings, and will also deploy some existing technologies now used in Europe and Canada, but not yet demonstrated in the state of Alaska. At this time, there is no pre-engineered sea water intake / wet well / pump station/ district heat system that has been demonstrated for commercial use in coastal Alaska; there is however a strong interest in the use of sea water heat as a cost effective alternative to heating oil or electric resistance heating.

c. **Project Innovation**: *Describe how the project will increase performance (output or range of conditions), reliability, decrease capital or operating costs, increase lifespan, etc. in Alaska. Include technical and scientific explanations as needed.*

The operational cost of sea water transport from the ocean is reduced dramatically by employing a gravity siphon system into a wet well, instead of a conventional suction lift system that requires electric powered horizontal pumps operating continuously under inefficient conditions (@50% pump efficiency). The cost of cleaning two 600 ft long 8" diameter HDPE sea water intake pipes of bio foul and sediment is reduced significantly by employing a pigging system that allows a single operator to launch a foam pig down the entire length of the intake pipes with hydrostatic pressure from the pump station. The cost of cleaning bio foul from fine passage (0.8mm opening) heat exchangers is greatly reduced by allowing settling of heavier particles in the wet well; using a basket strainer on vertical pump intake bowls; and by employing a clean-in-place in-line wye strainer. The cost of moving sea water thru grade level heat exchangers is reduced significantly by employing high efficiency (@80%+ pump efficiency) vertical turbine pumps with variable speed drives; this pump technology is also more reliable than suction lift pumps and has lower maintenance costs. The cost of moving heat thru buried district pipes is reduced by employing variable speed drive high efficiency circulation pumps; by maintaining loop temperatures very close to ground temperatures to reduce pipe heat loss and the need to insulate the return pipe; and by minimizing the concentration of expensive and viscous propylene glycol in the buried district pipes.

d. **Priority**: *Describe how the proposed project addresses the priority considerations established by AS 42.45.375(d) and this RFA (sec. 4.3).*

This project will be undertaken by Sitka Sound Science Center, a well-supported, well-established non-profit organization that owns and operates its own sea water intake system, salmon hatchery, and 11,000 sq ft science research and science education facility in Sitka, Alaska. This project is supported by both matching funds (SSSC staff labor) and in-kind partnerships (YCE, City of Sitka) and it will strengthen the existing partnership with the University of Alaska Southeast (UAS). The SSSC has a Memorandum of Understanding with UAS. We provide laboratory space and a bioacoustic analysis lab facility for UAS in the Sitka Sound Science facility. In addition, SSSC provides hands-on facilities for the UAS Fisheries Technology Program which trains people in aquaculture and fisheries management. This project will demonstrate emerging energy technologies that can be deployed in many other facilities in coastal communities in Alaska that are located on ice free ocean bays. Funded by the USDA, NOAA, the Northern Southeast Regional Aquaculture Association, the Douglas Island Pink and Chum Inc., the National Science Foundation, the State of Alaska, and private foundations and individuals, SSSC is dedicated to the promoting and providing scientific education and scientific research in the Gulf of Alaska. SSSC operates an aquarium and a salmon hatchery as educational tools for both formal and informal programs. SSSC hosts thousands of visitors each year who travel to Sitka independently and on cruise ships. The downtown, easily accessible, waterfront location of the SSSC makes it an ideal place for a demonstration project to educate tourists and residents about new energy systems.

2. Technology Validation and Research Methodology (sec. 4.7)

a. **Objectives**: *Explain the project information objectives and how they will be achieved.*

The project information objective is to document and report the actual costs of sea water heat production from the intake wet well, heat exchangers, district loop system, and finally from heat pumps to be installed in the two on-site buildings served (Sage Building and Mill Building). This documentation and reporting will be achieved by the use of flow, temperature, and electrical energy metering and web based data monitoring.

b. **Methodology**: *Explain how these project performances will be monitored, reported, documented and analyzed. Include both technical and economic aspects and a discussion of project location and testing environment.*

Project data (fluid temperatures, sea water and heat pump loop flows, electricity usage, energy production) will be monitored with instrumentation (flow and temp sensors, power meter) in the new pump station and the Sage Building. This will be reported in real time via a web based building automation system (similar to Trane TRACER). The Coefficient of Performance (COP) will also be calculated and logged in real time as the expression of heat produced per hours divided by electrical energy (KW) consumed by the sea water pumps, loop pumps and heat pumps. An average COP of 3.0 or greater over the heating season is expected (meaning that for every unit of electrical heating energy consumed, three units of heat will be produced). This project will allow complete displacement of heating oil for the Sage and Mill Buildings and the amount of heat produced by heat pumps can equate to gallons of heating fuel not burned and the cost savings realized. Another performance item that will be evaluated is the firm sea water pumping capacity (GPM) at low tide levels (-2 ft or lower). This testing will confirm the minimum (firm) quantity of sea water heat that will be available for a future district loop to buildings on the adjacent Sheldon Jackson campus that is currently consuming heating oil .

3. Summary of Project Schedule and Summary of Project Budget

Summary Project Schedule - Design and Construction Of SSSC Sea Water Heating System

Project Milestone Description	Target Date
Pre-Deployment Phase	
Begin application for required federal, state and local permits	Sept 1, 2012
Project scoping and agreements with design consultant finalized	Sept 30, 2012
Complete final civil, architectural, mechanical, electrical design	Feb 1, 2013
Secure required permits (federal, state, local) based on final design	March 1, 2013
Deployment Phase	
Advertise for construction contractor bids	March 15, 2013
Award construction contract, begin construction activities	May 1, 2013
Complete construction of wet well, pump station, yard piping	Aug 30, 2013
Complete start up and commissioning of sea water heating system	Sept 30, 2013
Post-Deployment Phase	
Data monitoring for entire heating season (8 months)	Oct 1 2013 thru May 2014
Complete final performance reports and analysis	May 31, 2014

Summary Project Budget - Design And Construction Of Sea Water Intake/Wet Well/Pump Station/District Loop

Contractor site mobilization / demobilization	$ 20,000
Improve existing sea water intake pipes and inlet boxes at depth	$ 42,000
Install new sea water wet well and pump station	$336,715
Install new local district heat system to Sage Bldg and Mill Bldg	$122,680
Total Construction cost	$521,395
Construction contingency (20%)	$104,279
Civil, architectural, mechanical, electrical engineering design services (18%)	$ 93,851
Construction inspection services, including submittal reviews, commissioning (8%)	$ 41,712
Project administration by SSSC (20%)	$104,279
Permitting applications, management (5%)	$ 26,070
Cost of Design, administration and permitting	$370,191
Total Project Cost - Sea Water Intake/Wet Well/Pump Station/District Loop	**$891,586**
SSSC in-kind labor for project administration - Project Match	$ 27,530
SSSC in-kind labor for permitting applications, management - Project Match	$ 26,070
National Science Foundation Grant for sea water intake pipes - Project Match	$ 72,000
YourCleanEnergy LLC in-kind engineering services - Project Match	$ 10,000
Total Project Match Secured By SSSC (15%)	**$135,600**
Total Grant Funds Requested	**$755,986**

4. Project Team Qualifications

Briefly outline the project team and their respective responsibilities, and relate the qualifications of the project team.

Owner: Sitka Sound Science Center, SSSC owns and operates the 11,000 sq ft Sage Building, the 5,000 sq ft Mill Building and the surrounding grounds and salmon hatchery. Sitka Sound Science Center is a non-profit

organization that owns and operates property once owned by Sheldon Jackson College. The SSSC employs a staff of 8 professionals with expertise in project and facilities management, aquaculture, aquarium science, fisheries biology and grant administration. The staff will provide in-kind labor project match for the extensive application and processing of federal, state and local permits that will be required to construct the wet well and pump station adjacent to a river channel and tidelands.

Pre-development Sponsor: Foraker Group (Chris Kowalczewski) - Foraker Group has provided service funding for pre-development activities regarding the Sage Building, including a concept level engineering evaluation of the proposed sea water intake wet well and pump station. Foraker has already provided master planning on the mechanical systems.

Contributing Grantor: National Science Foundation (NSF), Division of Ocean Sciences, NSF may provide a grant of $72,000 towards improvements of the sea water intake system that will count toward project match. This grant application has been submitted and is pending approval. Notification is expected in May.

Engineering Consultant: YourCleanEnergy LLC, c/o Andy Baker, PE, Owner - has performed initial concept design of the sea water intake improvements, wet well, pump station, and on-site district loops to supply heat pumps proposed for the Sage and Mill Buildings. YCE has also compiled technical and financial information for this grant application and has the capacity to provide lead design services for this project as well as submittal review and construction inspection. YCE designed the Alaska SeaLife Center heat pump exchange system and has extensive experience working on systems with Alaska marine conditions.

5. Discussion of Commercialization of Funded Technology

Provide a description of how the proposed project will advance the commercialization of the energy technology within the next five years, and the market for purchasing energy generated by the proposed project.

Because the project is located at a facility with high visitation by the public, traveling educators and scientists, the demonstration of the proposed energy technologies has a high probability for adoption by other Alaska coastal communities. Additionally, this project will provide a firm capacity of sea water flow that can supply water source heat at an attractive price to other buildings on the nearby Sitka Fine Arts Campus including two state operated buildings, and the National Park Service via a district loop. The deployment of a larger district loop for the campus is expected to occur within five years of the commissioning of this project, because local costs of heating oil and electric resistance heating will continue to escalate and make the availability of lower cost sea water heat increasingly attractive. *Letters of interest in connecting to a district heat supply from the adjacent Sitka Fine Arts Camp, State Museum, Hames Center, NPS, etc have already been received.*

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."

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Lisa Busch, SSSC Director