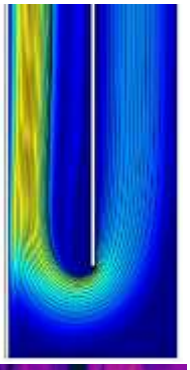
Emerging Energy Technology Fund

Status Report, February 2016

The Emerging Energy Technology Fund (EETF) was created in 2010 to promote the expansion of energy solutions available to Alaskans. EETF grants are for demonstration projects of technologies that have a reasonable expectation of becoming commercially viable within five years. Projects can:

- test emerging energy technologies or methods of conserving energy;
- improve an existing technology; or
- deploy an existing technology that has not previously been demonstrated in the state.

This report describes the program and provides a status update of each of the 19 projects funded.



Program Description

Eligible technologies include those that promote, enhance, or expand the diversity of available energy supply sources or means of transmission, increase energy efficiency, or reduce negative energy-related environmental effects. This includes technologies related to renewable sources of energy, conservation of energy, enabling technologies, efficient and effective use of hydrocarbons, and integrated systems.

Project funding made available for awards and data collection has come from $6.8 million of state funds, $4.8 from Denali Commission and a quarter million from US Department of Energy for a total of approximately $11.8 million. An additional $4.7 Million was dedicated by the award recipients and project partners in the first two solicitations and more match is expected in the third solicitation.

Data collection is a central component of all EETF awards. Under an agreement with the University of Alaska, performance data generated by projects are independently verified and analyzed by the Alaska Center for Energy and Power (or another independent third party, as needed). As projects conclude, summary reports and non-sensitive data are made available to the public.

Program Highlights

- **Nineteen demonstration projects awarded grants over two funding rounds from an applicant pool of nearly 100**
- **Funded projects include energy storage, wind-diesel integration, and space heating technologies, all key areas of focus in Alaska**
- **Field deployments of 3 river hydrokinetic devices each successfully generating electricity**
- **Diesels off operation of two remote wind-diesel power grids using battery and flywheel energy storage systems**
- **Continued development of in-state technologies, including building efficiency, power electronics, and diesel generation efficiency**
- **Use of technology testbeds made available by the University of Alaska for power systems integration and hydrokinetic testing**
- **Eight projects are completed, or very near completion, and now looking at securing patents and commercialization options**

Program Successes

- **New Exhaust Thimbles have been tested and yielded excellent results. The grantee is now beginning the patent process with plans to commercialize.**
- **The EETF program has led to multiple successes with in-situ hydrokinetic devices that have advanced the technology of this developing field significantly. These successes are moving towards Commercialization**
- **Biomass Reforestation is paving the way to rapid replanting and regrowth of forest areas for more sustainable wood energy systems in Alaska.**

Program Process

Project selection for the EETF program uses a two-stage application process and a volunteer advisory committee appointed by the governor. In the first stage, project abstracts submitted in response to a funding solicitation are reviewed by the advisory committee and the Alaska Energy Authority. Select applicants are then invited to submit full applications and give in-person presentations to the committee.

Applications are scored and ranked on a range of criteria including the quality of the innovation, the method of validation, and the public benefit and market potential for the proposed technology. Priority is given to projects demonstrating potential for widespread deployment, partnerships with post-secondary institutions, Alaska entities, projects committing in-kind or matching funds, and alignment with any focus identified in the solicitation.

In 2012, 15 projects were awarded over $8 million in grants in **Round 1** of the EETF. The state funds available for awards was nearly doubled by a matching contribution by the Denali Commission, a federal

agency. A wide range of technologies were selected for funding, including energy storage, building efficiency, biomass, wind generation, and river hydrokinetics.

In 2014, **Round 2** of the EETF focused on energy storage and heating efficiency and 5 projects were awarded $2 million from the State of Alaska.

In 2016, **Round 3** of the EETF will focus on microgrid and microgrid enabling technologies. It is anticipated that $750,000 in returned funds from Rounds 1 and 2 will constitute the majority of funding available, though an additional $250,000 was granted to AEA from the Department of Energy to be distributed through the EETF.

Emerging Energy Technology Fund Advisory Committee

National Renewable Energy Laboratory
seat currently unfilled

Alaska Industrial Development and Export Authority
Matthew Narus, Project Manager - AIDEA

Forest Service
Robert Deering – Renewable Energy Coordinator

Denali Commission
John MacKinnon, Executive Director - Associated General Contractors of Alaska

Electric Utility
Eric Eriksen, V.P Transmission & Distribution - Alaska Power Association

Fossil Fuel Energy Sector
David Hart – Sr. Manager, Operations and Production, Caelus Energy Alaska, LLC

Renewable Energy Sector
Brent Petrie, President – Petrie and Associates

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Additional information is available at AEA's website, www.akenergyauthority.org.

Arctic Field Testing of the Eocycle EO-25/12 Wind Turbine

Project Lead: Northwest Arctic Borough **Location: Kotzebue**

The Northwest Arctic Borough is demonstrating the cold weather capabilities of a 25 kW wind turbine at the Kotzebue wind farm. The turbine is mounted on a tilt-up monopole tower that uses a winch to raise and lower the unit during installation and for maintenance, eliminating the need for a crane.

Project Status

The turbine and tilt-up tower arrived at Kotzebue on the last barge of 2013 and the project team was able to take advantage of an existing unused tower foundation to the mount the turbine. Commissioining began in late 2013 and continued for the next year with extensive troubleshooting as numerous problems were encountered including: overheating in the nacelle, a problem with the brake assembly shutting down the turbine, converter failure and data/communication issues. The turbine was operational in November 2014, however;in September 2015 the connection between the rotor and the generator ruptured; replacement parts have since been delivered and repairs are underway.

Assembling the tower

Installing turbine blades

What's Next

Performance data collection is ongoing. A fully instrumented meteorological tower will be installed within five rotor-lengths of the tower to collect baseline wind data as the turbine generates electricity.

Tower tilted down

Raising the tower

Photos from Northwest Arctic Borough and Kotzebue Electric Association.

Ultra-Efficient Generators & Diesel Electric Propulsion

Project Lead: Genesis Machining & Fabrication **Location: Kodiak**

Genesis Machining and Fabrication is demonstrating two core technologies, the Power Dense Motor and Universal Modular Inverter Controller, for use in both stationary power generation and propulsion applications. The technologies are being concurrently developed and demonstrated in stages using prototypes of increasing in size and capacity that will be used to power electric vehicles and gensets of varying sizes. Ultimately, the team hopes to demonstrate that its approach to variable speed generation and diesel-electric propulsion offers efficiency gains over traditional technologies.

Project Status

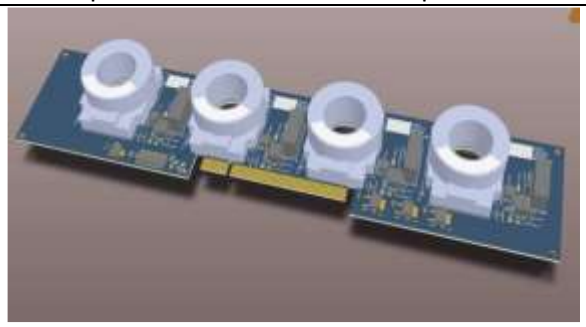
The team demonstrated the prototype inverter in an electric vehicle testbed by logging over 1,000 Kodiak road miles in the first year. A 15kW load matching genset was designed to deliver power via the inverter and built as a proof of concept. With that accomplished, work shifted to the design and installation of the prototype inverter in a Diesel-Electric bus testbed. A 275HP engine and a 50HP motor have been acquired to serve as a power dense generator head and a propulsion motor respectively. New heat sinks and circuit boards are near completion; the team is preparing to begin testing the new inverter prototype.

Converted ’97 Eagle Talon EV testbed

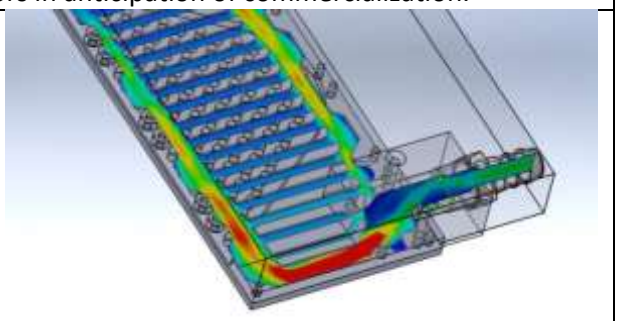
Monitoring performance in the EV testbed

What’s Next

Due to a loss of lab and testing space, the project has been put on hold. A final report is being prepared to detail the accomplishments and lessons learned from this project. The project team has also filed for several patents and reached out to potential investors in anticipation of commercialization.



Printed circuit board design for the inverter



Heat sink modelling

Photos from Genesis Machining and Fabrication.

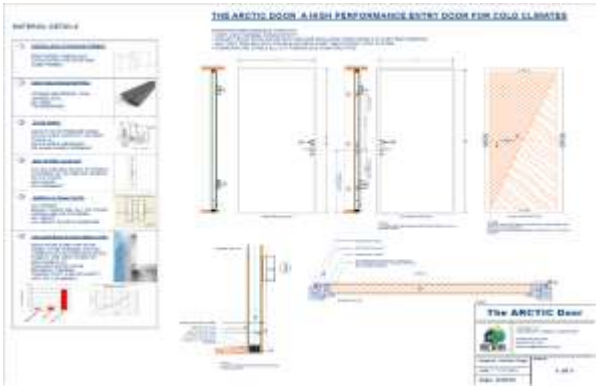
Arctic Thermal Shutters & Doors

Project Lead: Arctic Sun, LLC **Location: Fairbanks**

Arctic Sun, LLC is demonstrating energy efficiency improvements of homes in colder climates using arctic doors, arctic shutters and blown-in insulation shutters. Maintaining climate control in arctic high-efficiency housing has been challenging because of high condensation on doors and windows. The technological improvements proposed by Arctic Sun include improving R-values in the arctic doors; creating exterior arctic shutters that are controlled by an electric drive and use air-tight weather stripping; and shutters for retrofitted fixed-pane windows that can be automatically filled and emptied with insulating beads.

Project Status

The project team has completed design, component selection, and prototype construction of the arctic door and two shutter types. A fully instrumented dedicated testing structure was designed and constructed for comprehensive performance monitoring; baseline data was collected in advance of installation of the arctic shutters. For the blown-in shutter cavity, solid extruded polystyrene (EPS) beads were selected as the fill material, and subjected to ultra-violet resistance testing over the course of the summer. After undergoing design revisions, all components have now been field installed and performance data is being gathered for the second consecutive winter.



Arctic door design

Testing box under construction

What's Next

The project will continue to gather data through the end of the 2015-2016 heating season and hope for cooler temperatures to provide a contrast to the abnormally high temperatures experienced to date.

Installing vacuum panels into the arctic shutter

Testing the blown-in shutter

Photos from Arctic Sun, LLC.

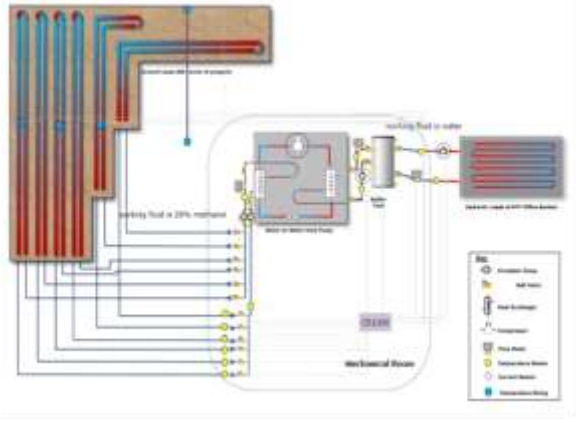
Cold Climate Heat Pump Demonstration

Project Lead: Cold Climate Housing Research Center **Location: Fairbanks**

The Cold Climate Housing Research Center (CCHRC) is demonstrating the potential for ground source heat pumps (GSHPs) as an efficient and economic heat source in colder climates. This project will install a GSHP at the Cold Climate Housing Research Center's research and testing facility in Fairbanks in a narrow band of thawed ground. Several different surface treatments will be modeled and tested to maximize surface heat capture during summer months and to prevent winter heat loss.

Project Status

The horizontal loop field was installed and buried along with a network of thermcouples at varying depths. The heat pump unit was then installed and fully comissioned. Different surface treatments have been installed above selected areas of the ground loop including several gravel types and grass; a fence has been installed around the area to minimize snow compaction and maximize wintertime insulation. During the first year, the heat pump operated with an average Coefficient of Performance of 3.6. The system is now gathering its third and final heating season of performance data.

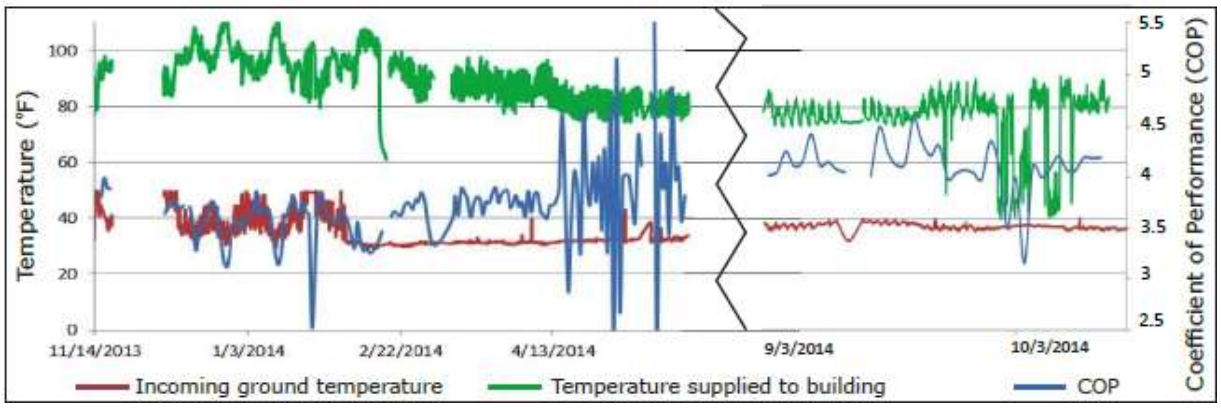


System layout

Installation of the slinky loop

What's Next

With installation complete, the remainder of the project will consist of data collection of the system's performance, monitoring the loop field for thermal degradation, and comparison of the effect of the different surface treatments on the thermal health of the loop field. Data collection for the EETF project will continue through the 2015-2016 heating season, followed by a final analysis.



First year performance data

Photos and plot from Cold Climate Housing Research Center.

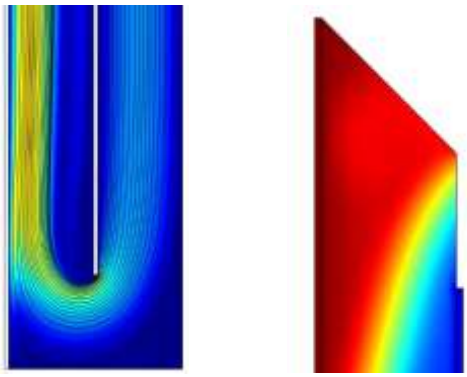
Safe and Efficient Exhaust Thimble

Project Lead: UAF - Institute of Northern Engineering **Location: Fairbanks**

The Institute of Northern Engineering is demonstrating a new design of ventilated exhaust thimbles for wood stoves, oil-fired furnaces, diesel generators and other high-temperature exhaust-generating sources. Stove thimbles prevent wood framing from igniting from the hot exhaust flues pass through the building envelope. In this project, the traditional thimble will be replaced with one that relies on thermal siphoning for passive cooling. The new design building eliminates heat loss that accompanies traditional thimbles by maintaining integrity of the building's envelop.

Project Status

The project team has completed final design and computational fluid dynamics modeling of the exhaust thimble, modified a conex container for testing, and constructed prototypes of varying sizes. Testing has been completed for each prototype size under a range of temperature conditions. The final results of the tests and models have been compiled, and commercialization cost estimates have been obtained from local manufacturers.



Modelled airflow at thimble base (left) and temperature distribution at vent outlet (right)

Instrumented prototype

What's Next

After compiling the final report, an independent report assessing performance data has been completed by ACEP. A request to change the language of the National Fire Prevention Association (NFPA) mandates is being formulated to include this new prototype thimble. Once the ACEP assessment and the NFPA changes are made, the patent and commercialization processes can begin.

Thimble in operation

Infrared image

Images from UAF. Photo credit Stephen Gemmel.

Wind-Diesel Battery Hybrid for Kwigillingok

Project Lead: Intelligent Energy Systems **Location: Kwigillingok**

Intelligent Energy Systems is demonstrating the use of high-performance lithium ion batteries, similar to those found in some electric vehicles, to provide short-term energy storage in Kwigillingok's wind-diesel electrical system.

Project Status

A lithium ion battery manufactured for use in electric cars was selected and delivered by barge to Kwigillingok in the fall of 2013. An abnormally warm winter delayed freeze-up and transportation to the installation site. Commissioning, started in 2014, continues as unrelated issues with the wind turbines, diesel generators, and distribution system have presented challenges and delays. The battery system was operational for two weeks before a genarator failure precluded sufficient wind contribution; during the two weeks, however, the grid was able to transition to wind-battery mode 8 times for a total of 42 hours of diesels off operation.

Battery and enclosure awaiting freeze up

Transport to the installation site

What's Next

Improvements to the powerhouse are critical prior to project continuation, especially now that the community's new school is operational. Data is being recorded and analyzed, and with the Initial Report in December 2014 the results show that the system is working. Ongoing data collection and analysis by ACEP will confirm these results.

Start of commissioning

Installation

Photos from Intelligent Energy Systems.

St. Paul Flywheel Demonstration

Project Lead: TDX Power **Location: St. Paul**

A flywheel energy storage system manufactured by Beacon Power will be integrated into an isolated wind-diesel microgrid and operated to facilitate extended diesels-off electricity generation. A successful demonstration could pave the way towards higher wind penetration rates and increase the value of the power contributed by renewables into hybrid systems.

Project Status

After factory acceptance testing, the flywheel was barged to St. Paul, installed, and commissioned in late 2014. The system has been operating and collecting data since December 2014 and ample winter winds have enabled significant periods of diesels off operation. Frequency regulation is being provided by a load regulating boiler and voltage regulation is provide by a synchorous condenser (both installed and operational prior to the project). A redesign of the Beacon Power inverter was planned that would allow the flywheel to form the grid and allow more stable diesels off operation. For business reasons, Beacon Power is exiting the flywheel market and will not be completing the grid forming inverter design. A main bearing failure also occurred. TDX is evaluating options and the project may be rescoped to accommodate these changes.

Flywheel cutaway (Beacon Power)

Flywheel containment (blue), dust control system (green), and power control module (gray)

What's Next

Over a year of data has been collected and is being assessed while the direction of the project is re-evaluated

TDX wind turbines

Air Source Heat Pump Potential in Alaska

Project Lead: Cold Climate Housing Research Center **Location: Juneau, Wrangell, Dillingham**

The performance of a new generation of air-source heat pumps will be demonstrated in an effort to provide energy efficient space heating for Alaska's cold climates and better define the potential geographic range for economic operation of the technology. Cold Climate Housing Research Center instrumented three air source heat pump installations in order to determine performance over the 2014-2015 heating season.

Project Status

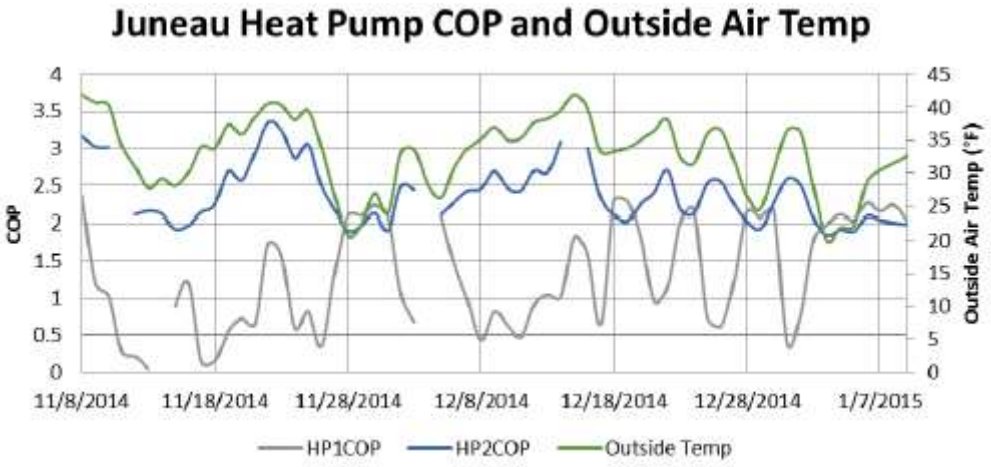
The project team has design and installed comprehensive instrumentation packages on the three heat pump systems and has been monitoring performance. Nearly thirty additional systems are being monitored for electrical consumption as a part of the proejct. A final report has been drafted.

Heat pump installation in Wrangell

Heat pump installation in Juneau

What's Next

With data collection complete, the final results are being analyzed and a final report has been prepared and is under review. The initial assessment of the data shows definite promise and incentives to install the systems are being tentatively explored.



Initial performance results

Photos from Cold Climate Housing Research Center and ACEP.

Biomass Reforestation of Boreal Forests

Project Lead: Alaska Division of Forestry **Location: Palmer, Delta**

The Alaska Division of Forestry is demonstrating a low cost planting technique intended for forest regeneration after a biomass harvest that uses un-rooted poplar tree stem-cuttings. Although less energy-dense than other biomass fuel stocks, poplars have much faster growth rates. The technique involves the wintertime collection of branch cuttings that are stored and then planted as stems after snowmelt. Stooling beds will also be planted to facilitate future stem harvests of species that are found to thrive over the course of the project.

Project Status

The project team harvested cuttings during the winter of 2013 which then underwent a pre-soak treatment in advance of planting in the late spring at sites in the Matanuska-Susitna Valley and near Delta. Unfortunately, abnormally hot and dry conditions during the summer of 2013 resulted in a very high mortality rate of the planted cuttings. However, cuttings at the wettest site fared significantly better, and the project team noted higher survival rates among hybrid species. A replanting of 4 poplar varieties in 2014 resulted in significantly higher survival rates, especially among certain hybrid species. In May 2015, additional varieties were planted to evaluate their viability in Alaska as an easily renewable source of biomass fuel.

Winter poplar cuttings

Pre-soaking cuttings in preparation for planting

What's Next

Survival will be evaluated after the 2014-2015 winter and all plantations will be evaluated for growth at the end of the 2015 growing seasons. Results are being compiled into a final project report.

Mat-Su field site

First year poplar growth

Photos from AK Division of Forestry.

BRI Cyclo-Turbine Hydrokinetic Demonstration

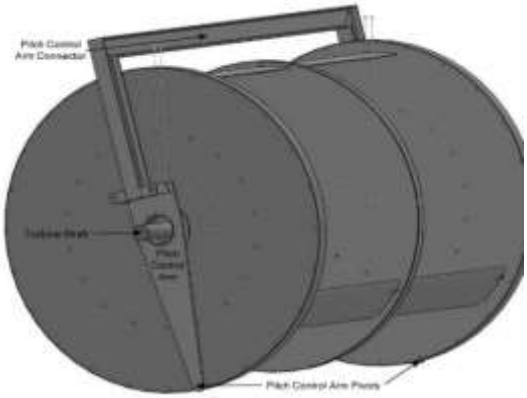
Project Lead: Boschma Research, Inc. **Location: Igiugig**

Boschma Research, Inc. (BRI) demonstrated a 5 kW River In-Stream Energy Conversion (RISEC) device in the Kvichak River at Igiugig. The cycloidal turbine is housed within an open-ended venturi enclosure with a fish/debris guard at the entrance. Intended to be mounted on the river bottom in shallow water, the device's frame uses buoyancy chambers for river transport which are filled with water to submerge the device to its final position.

Project Status

The project is now complete. The turbine was constructed in 2013 and deployed in the Kvichak River in the summer of 2014. The project team experience numerous difficulties manuvering in the device in the swift moving water; once positioned, moored, and sunk in place, the anchor slipped causing damage to the housing and communications cables. Ultimately, however, the device was able to operate, generate approximately 4.5-5kW of power which was fed directly into the Igiugig grid for 36 continuous hours towards the end of the permitted period.

Assembled venturi box and ballasts



Turbine assembly sketch

What's Next

The project team has submitted a final project report summarizing the work performed and lessons learned. An independent report assessing performance data will be completed by ACEP. With testing and analysis complete, BRI is exploring commercialization options on an international level.

Assembly on the shores of Iliamna Lake

Device on anchor prior to being submerged

Photos from Boschma Research, Inc.

Application of Composite Flywheels

Project Lead: Hatch **Location: Fairbanks**

Hatch demonstrated a lightweight high-power flywheel which could be used to provide grid stability in wind-diesel systems.

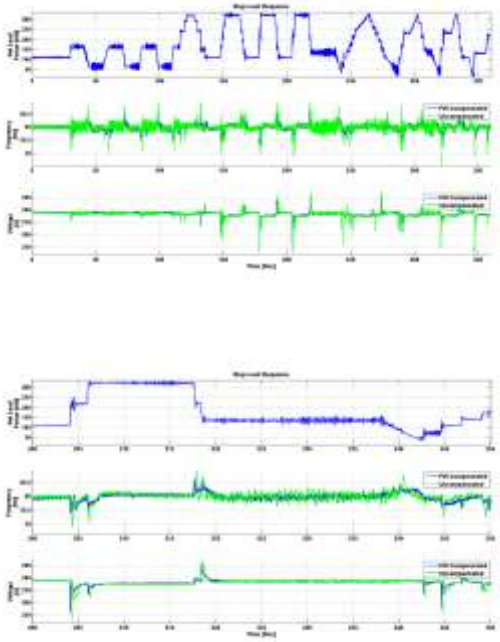
Project Status

The project team collected one month of high resolution baseline data from Nome's wind-diesel system which was used in modelling and controller programming. The flywheel was installed in a simulated grid at the Alaska Center for Energy and Power's Power System Integration lab in Fairbanks for a series of trials that characterized the response of the flywheel system and its capability of supporting the grid using the lab's grid-forming inverter.

What's Next

The tests are complete and the project team has compiled a final project report that is currently under review. An independent report assessing performance has been completed by ACEP.

Installed flywheel, control cabinet, and cooling system



Flywheel response testing

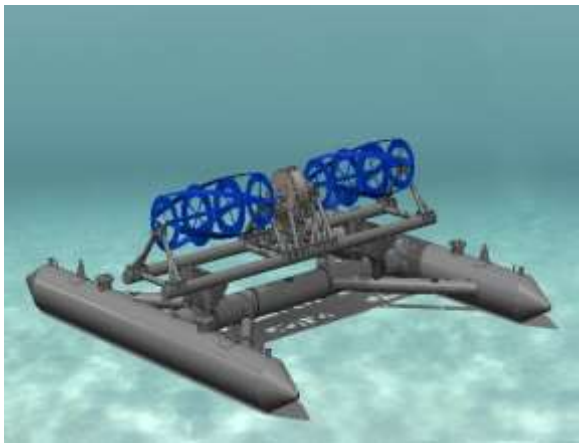
RivGen Power System Hydrokinetic Demonstration

Project Lead: ORPC Alaska, LLC **Location: Nikiski, Igiugig**

ORPC proposes to demonstrate the RivGen hydrokinetic device, a river bottom-mounted River In-Stream Energy Conversion (RISEC) device. The device is mounted on a redesigned pontoon support structure, which consists of a mounting frame resting on buoyancy chambers that can be filled and emptied of air for controlled submerging during deployment and floatation during retrieval.

Project Status

ORPC refursbished and dry-tested its first generation device prototype and completed modeling and redesign of the support structure in 2013. After testing of the support structure in Cook Inlet in 2014, the device was shipped by barge to Igiugig for summer deployment. The device was successfully submerged and operated, generating up to 13 kW. An issue with the inverter prevented synching with the Igiuig power grid, however, the project team had identified additional funding for a follow up deployment in 2015. After the completion of the 2015 deployment, the project team prepared a final report.



Rendering of the RivGen device

Device on anchor prior to being submerged

What's Next

After the 2015 deployment, the RivGen team conceived several design improvements which would increase energy production. ORPC is now exploring tentative commercialization options and is still finding ways to improve the system for future use.

Underwater operation

Warning sign

Photos from ORPC.

Oceana In-Stream Hydrokinetic Demonstration

Project Lead: Oceana Energy Company **Location: Nenana**

The Oceana Energy Company is demonstrating a barge-mounted River In-Stream Energy Conversion (RISEC) device in the Tanana River. Originally intended for tidal power applications, the demonstration will verify performance under harsh the conditions typical of Alaska rivers. The turbine uses an open ring design, with blades located on both the inside and outside of the structural ring.

Project Status

The project team completed a redesign of the first generation protoype (built and tested prior to this project), constructed a unit for testing, and performed tow testing to establish a performance baseline in the Carderock David Taylor Model Basin in Maryland prior to shipping the unit to Alaska. Next, the unit was deployed from a testing barge at the Alaska Hydrokinetic Energy Research Center river testbed in the Tanana River at Nenana. The unit was operated over the course of 2 weeks, dissipating power to an onboard load bank.

Tow testing

Lowering into the Tanana River

What's Next

With a second season of testing complete, the project team is using the data gathered from both field seasons to create an electrical characterization of the device; this will allow a more accurate model for future development.

Left to right: testing barge, debris diverter, mooring buoy

Trans-Critical CO2 Heat Pumps

Project Lead: Alaska SeaLife Center **Location: Seward**

A trans-critical CO2 heat pump system using seawater as a heat source will provide space heating at the Alaska SeaLife Center and demonstrate the potential for higher output temperatures than is available from heat pumps using traditional refrigerants.

Project Status

The project team has surveyed available CO2 heat pumps units and completed initial design of the system. Procurement of long lead items is complete. The system will provide space heating for the building and additional sidewalk snowmelt heating, working in conjunction with the building's existing heating system, which use seawater source heat pumps with a traditional refrigerant. The Heat Pump is installed and operating, as-built mechanical drawings have been finished

What's Next

The system is operating and collecting performance data over the course the 2015-2016 heating season. A training session that will be attended by AEA and ACEP, is scheduled with the manufacturer to ensure the system is operated properly throughout its life time.

Photo from the Alaska SeaLife Center.

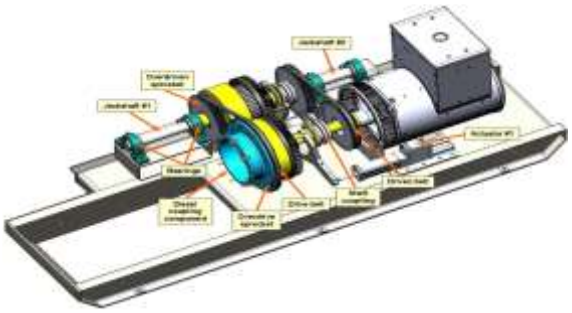
High Efficiency Diesel Electric Generator Set

Project Lead: Marsh Creek, LLC **Location: Anchorage**

Marsh Creek is demonstrating the use of a permanent magnet "soft clutch" coupling in a diesel genset to facilitate engine operation at speeds of both 1200 and 1800 rpm. Operating at a lower rotational speed when power demand is low could significantly increase fuel efficiency.

Project Status

The project team has modelled performance, designed the system architecture, and constructed a prototype. Basline efficiency testing was conducted at 1200 and 1800 rpm, but excessive mechincal vibration prevented complete testing of the transition between the speeds. The team has since designed a solution to the vibration issues.



Coupling system design

Prototype testing

What's Next

Another round of testing was planned for fall 2015. Now completed, a joint review of the results will be performed by Marsh Creek and ACEP.

Enhanced Condensation for Organic Rankine Cycle

Project Lead: UAF - Institute of Northern Engineering **Location: Fairbanks**

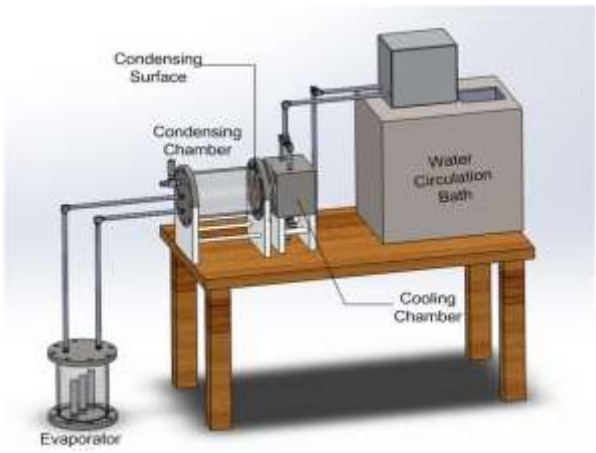
The Institute of Northern Engineering seeks to demonstrate a technology that could improve the efficiency of Organic Rankine Cycle (ORC) systems by increasing the heat transfer rate of the condenser. A hydrophobic coating will be patterned onto the condenser to create a heterogeneous surface, reducing film formation on the condensing surface.

Project Status

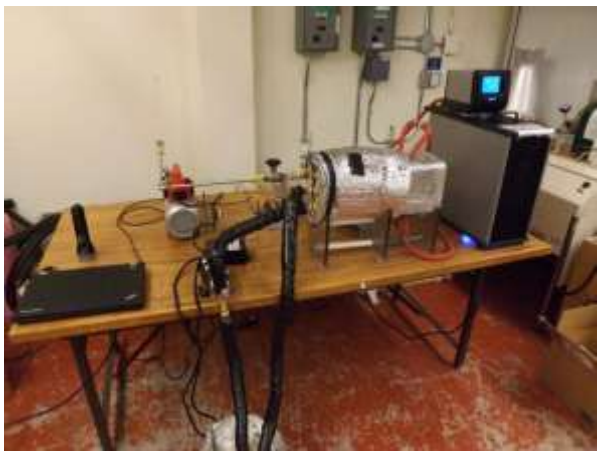
The project team has completed design and construction of a testing apparatus that will be used to measure the efficacy of the hydrophobic coating that will be applied to give the condenser a heterogeneous surface. Instrumentation calibration and preliminary baseline testing of the apparatus revealed an issue with leaking. The leaks were identified and repaired and performance data collection is underway.

What's Next

When instrumentation has been calibrated and baseline data collection completed, the effect of different hydrophobic coatings on heat transfer coefficient will be demonstrated, along with the physical geometry and orientation of the condensers.



Design of the test apparatus



Preliminary baseline testing

Photos from the Institute of Northern Engineering.

Small Community Self-Regulating Grid

Project Lead: Intelligent Energy Systems **Location: Tuntutuliak**

Intelligent Energy Systems (IES) is demonstrating a method of electrical grid stabilization using an advanced control system with ceramic electrical heating units. A distributed network of Steffes heaters in the community will be equipped with modified controllers that respond individually to grid frequency, providing grid stability during times of high wind penetration rates.

Project Status

A modified controller has been independently lab tested. Thirty heaters in the community have subsequently been retrofitted with the controllers; after initial tests the controller logic was revisited and improvements identified. Programming revisions to the controller have been disseminated to each individual unit in the field in advance of additional testing and commissioning in the spring of 2015.

What's Next

With data collection complete, the initial results yielded very valuable information. The data is going through a final analysis and a final report will be composed and reviewed by ACEP as well as AEA.

High Capacity Airborne Wind Turbine

Project Lead: Altaeros Energies, Inc. **Location: Fairbanks**

Altaeros Energies, Inc. proposes to demonstrate a 30 kilowatt (kW) wind turbine suspended 1,000 feet above ground in a helium-filled shell. The project seeks to take advantage of higher and more consistent wind speeds and to demonstrate an improved capacity factor relative to tower-mounted wind turbines. By tethering to a portable trailer, a substantial decrease in installed capital costs is expected. Altaeros plans to commercialize both 30 and 100 kW models.

Project Status

Altaeros has identified candidate sites throughout Alaska, visited a selection of sites, and selected the Eva Creek wind farm as the deployment site. In Maine, construction and testing of a half-scale prototype has progressed and the project team has raised additional capital to complete full-scale construction. A permit is still being outlined with the FAA's Obstruction Evaluation Group; 9 out of the 10 evaluation groups have submitted their feedback reports.

What's Next
Permitting from FAA is the critical next step for the project. The agency has been drafting policy regarding airborne wind energy system deployment, and extended testing of any system awaits clarification from FAA regarding the permitting process.

Multi-Stage Energy Storage System

Project Lead: Chugach Electric Association **Location: Anchorage**
Chugach Electric Association will use a pilot-scale energy storage system to demonstrate the technical and economic viability of a staged flywheel/battery response to grid instabilities. A full scale system could assist in integrating additional wind power into Alaska's primary electrical grid in coordination with existing conventional hydroelectric and fossil fuel resources.

Project Status
A schedule and scope of work were negotiatied and the grant was executed. Quotes received through an RFP caused a delay in the project and an amended RFP was published. Beacon Flywheel was chosen as the flywheel manufacturer and has decided to exit the flywheel industry for business reasons. Other alternatives are being explored.

What's Next
Alternatives to the chosen flywheel are being explored and an RFI may be issued to inform another RFP>