ACEP
Alaska Center for Energy and Power

ACEP is housed under the Institute of Northern Engineering in the College of Engineering and Mines at the University of Alaska Fairbanks.

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ACEP Mission

ACEP develops and disseminates practical, cost-effective, and innovative energy solutions for Alaska and beyond.

ACEP Values

Pragmatism
We seek solutions that make both technical and economic sense for Alaska.

Integrity
Integrity and quality in our research are our most critical assets.

Teamwork
ACEP works as a team with people from diverse backgrounds and with a wide range of expertise to fully understand and address challenges.

Agility
We can quickly assemble skilled research teams in a wide array of subjects by tapping a broad range of existing expertise among our partners inside and outside the university.

Professionalism
ACEP’s client-driven culture demands efficient project management, performance metrics and a corresponding tracking and reporting system, and rapid dissemination of results.

An eye to the future
Through relevant research, outreach and workforce development, we are helping build the future of energy in Alaska.
The Alaska Center for Energy and Power is an applied energy research program based at the University of Alaska Fairbanks.

With over 25 affiliated researchers, 16 dedicated staff, and a wide range of established partnerships, ACEP can quickly assemble a high-caliber research team to address key questions facing Alaska, the nation, and the world.

ACEP Team

ACEP Staff

Gwen Holdmann
Director

Amanda Byrd
Biomass Coordinator

Max Frey
Program Assistant

Jerry Johnson
Director, Alaska Hydrokinetic Energy Research Center

Heike Merkel
Data Manager

Jack Schmid
Research Engineer

Marcia Cassino
Program Assistant

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Research Engineer

Tom Johnson
Research Engineer

Jason Meyer
Emerging Energy Program Manager

Antony Scott
Energy Economist

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Research Manager

Julie Estey
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Melody Cavanaugh-Moen
Outreach Coordinator

Jeremy Kasper
Asst. Director, Alaska Hydrokinetic Energy Research Center

David Light
Research Engineer

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Director, Power Systems Integration Program

Lesli Walls
Research Grant Manager
Affiliated Researchers

Katey Walter Anthony  UAF, Water and Environmental Research Center
Dick Benoit  Sustainable Solutions
Terry Chapin  UAF, Institute of Arctic Biology
Steve Colt  UAA, Institute of Social and Economic Research
Matt Cullin  UAA, School of Engineering
Ronnie Daanen  UAF, Water and Environmental Research Center
Ginny Fay  UAA, Institute of Social and Economic Research
Rajive Ganguli  UAF, Mineral Industry Research Lab
Cathy Hanks  UAF, Geophysical Institute
Christian Haselwimmer  UAF, Geophysical Institute
Arthur Nash  UAF, Cooperative Extension Service
Chuen-Sen Lin  UAF, Institute of Northern Engineering
Sohrab Pathan  UAA, Institute of Social and Economic Research
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Bill Schnabel  UAF, Water and Environmental Research Center
Andrew Seitz  UAF, School of Fisheries and Ocean Sciences
Stephen Sparrow  UAF, School of Natural Resources and Agricultural Sciences
Martin Stuefer  UAF, Geophysical Institute
Diwaker Vadapalli  UAA, Institute of Social and Economic Research
Horacio A. Toniolo  UAF, Water and Environmental Research Center
Richard Wies  UAF, Institute of Northern Engineering
Frank Williams  UAF, Institute of Northern Engineering
Dennis Witmer  Energy Efficiency Evaluations

ACEP FUNDING SOURCES FY12 (JULY 2011 – JUNE 2012)

- 30 current projects* spanning a wide range of technologies
- $18 million in external grants and contracts
- $750,000 base funding from State of Alaska

* Some projects span multiple years

US Department of Defense  $2,300,000  13.5%
US Department of Energy  $7,342,038  43.1%
State of Alaska  $3,764,283  22.1%
Denali Commission  $2,114,699  12.4%
Tribal  $315,000  1.8%
Private  $1,204,985  7.1%

University of Alaska team of researchers and advisors sponsored through the US DOE EPSCoR program
ACEP Testing Facilities

ENERGY TECHNOLOGY FACILITY
Power Systems Integration Lab

ACEP’s Power Systems Integration Lab provides a unique opportunity to test new equipment and integration strategies in a controlled setting, lowering costs to industry and reducing the risk to utilities.

With over 300 remote communities whose reliance on diesel power results in some of the highest energy costs in the nation, Alaska has a strong interest in improving performance of both new and existing systems. To address this need, ACEP has established the Power Systems Integration Laboratory for testing hardware and software components within an integrated grid system.

Designed for maximum flexibility, this system is capable of testing a wide range of islanded microgrid and distributed generation scenarios, as well as the performance of individual components. Examples include next generation utility energy storage such as innovative battery systems and flywheel technology, diesel-off operation, power electronics development and testing, and model verification.
PERMANENT TESTBED COMPONENTS

- 100 kW wind turbine simulator (VFD-controlled 3-phase 480 VAC 60 Hz input motor coupled to a 3-phase 480 VAC 60 Hz output induction generator)
- Energy storage power converter (160 kVA 480 VAC 60 Hz 3-phase)
- MATLAB/Simulink model of diesel generator, inverter, battery and primary loads
- Ability to connect with the Diesel Testbed to test various arrangements of distribution grid models and inter-operability scenarios
- Programmable reactive load banks to simulate actual village or industrial loads (250 kW 208 VAC 3-phase and 250 kW 480 VAC 3-phase)
- Lead acid battery bank (336 VDC, 1000 Ah)
- Distributed control system
- High-resolution data acquisition equipment
ACEP Testing Facilities

ENERGY TECHNOLOGY FACILITY
Diesel Generator Testbed

Established in 2003, ACEP's Diesel Generator Testbed has been used to assess diesel engine efficiency, waste heat recovery options, bio-fuels, synthetic fuels, and fuel additives. ACEP's Energy Technology Facility is capable of housing up to three diesel generators. The testbed was built to allow maximum flexibility for quickly swapping generators of various sizes to support short or long term testing needs.

ON SITE DIESEL GENERATION
320 kW Caterpillar C-15 as well as a 125 kW Detroit diesel generator sets are available. These generators are connected to multiple load banks for up to 500 kW, at 208 – 480 VAC to simulate a wide variety of community loads.

IN-HOUSE EMISSIONS ANALYSIS
CO, O₂, NOₓ, and SO₂

DATA ACQUISITION
Key performance metrics include:
- fuel flow
- intake air mass flow
- electrical output
- intake air temperatures and pressures at each stage
- coolant temperatures
- engine vibration data
- real time combustion pressures
- exhaust temperature
- ambient air temperature, humidity, and barometric pressure
To facilitate the development of hydrokinetic power in Alaska, ACEP established the Alaska Hydrokinetic Research Center (AHERC). AHERC examines the river and ocean environment and investigates other industry-advancing research questions.

AHERC’s Tanana River Hydrokinetic Test Site in Nenana is used to test hydrokinetic power-generating devices, related technologies, and to characterize the river environment under realistic Alaska river conditions.

Researchers use the test site to determine ways hydrokinetic turbines and aspects of the marine environment interact, including fish, debris, hydrodynamics, sediment transport and icing. Information collected from these studies will be used by hydrokinetic developers to improve their designs or identify the appropriate location for their turbines. It may also be used by Alaska’s permitting agencies to inform their decision making process.

hy·dro·ki·net·ic en·er·gy

noun. Extracting energy directly from moving water without use of a dam or diversion channel.

HYDROKINETIC TEST SITE FEATURES

- Potential deployment locations have been identified based on river velocity, bathymetry, sediment transport, hydrodynamics, power density and turbulence.
- Mandatory baseline fish stock studies have been completed for the site.
- Demonstrated technology to divert surface woody debris, a major impediment of operating devices in Alaska, is available to all users; a prototype for protecting devices from subsurface debris is in development.
- The site’s anchored mooring system, located mid-channel, supports a floating platform able to secure a load up to 50,000 pounds.
- AHERC has various imaging devices in its inventory, including:
  - Blue View P900-2250-45 imaging sonar
  - Acoustic Doppler Current Profiler
  - Simrad EK60 split beam sonar (120 kHz)
  - Novatel RTK/L1 positioning system (20 cm accuracy)
- All required permits are secured. Placement of turbines in river is subject to final regulatory review.

SITE SUPPORT SERVICES

Nenana is served by major rail and highway infrastructure and offers a variety of technical services to deploy, recover, and modify or repair devices under test (e.g., welding, tugs, barges, and a dock-operated crane). Major industrial services and an international airport are available in Fairbanks, 60 miles north of Nenana.
ACEP is engaged in projects ranging from resource assessments and integration of renewable energy generation, to improving the way we utilize fossil fuels.

**Pilgrim Hot Springs Geothermal Exploration**

Conventional geothermal resource exploration can be an expensive proposition in remote locations. At Pilgrim Hot Springs near Nome, the largest identified geothermal resource in the central Alaska Hot Springs Belt, ACEP and Geophysical Institute researchers tested an innovative remote sensing technique for assessing low temperature geothermal resources by quickly estimating the amount of heat available at the surface from a remote sensing platform. This provided a low cost, albeit preliminary, assessment of the economic viability of developing a project.

Preliminary results indicate the potential for developing between 2-4 MW of power from the site, which has attracted the interest of the community and private developers. Phase II of this project includes more traditional exploration techniques, including confirmation drilling and testing of the resource to confirm the team's conceptual model and determine if it can be sustainably developed as an economic source of power for Nome and the surrounding region.

**Project funding:**
Department of Energy · Alaska Energy Authority Renewable Energy Fund · Bering Straits Native Corporation · White Mountain Native Corporation · Sitnasuak Native Corporation · Norton Sound Economic Development Corporation · Nome Chamber of Commerce

**Project partners:**
Unaatuq LLC · Mary’s Igloo Native Corporation · United States Geological Survey

“ACEP was great to work with and made every effort to include the local knowledge gleaned from our people’s thousands of years of dwelling in the area while providing timely and usable scientific input back to Mary’s Igloo Native Corporation.” **Dora Hughes**, Mary’s Igloo Native Corporation
**Comparative Analysis of Fairbanks Energy Projects**

A number of projects have been proposed to reduce Fairbanks energy costs in recent years, including producing a liquid fuel from locally available coal, trucking natural gas from the North Slope, various proposals for building a small or large diameter natural gas pipeline, the Susitna-Wantana hydropower project, and HVDC transmission of electricity generated on the North Slope.

Economics for each project have been developed at different times, by different proponents, using different assumptions. This has obscured comparative value and hindered decision-making.

This project systematically compares options on an apples-to-apples basis. It adjusts cost estimates to a common project start date, and imposes common assumptions for financing, risk tolerance and consumer demand. It marries the resulting per-unit infrastructure costs to a data-driven assessment of Alaska commodity markets. Finally, it addresses comparative effectiveness of different subsidy instruments for reducing Fairbanks energy costs.

**Project funding**

Air Force Office of Scientific Research

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**Sustainable Village Energy**

Over the past decade, Alaska has funded the installation of small, community-based renewable energy systems in an effort to diversify its energy portfolio, especially in rural villages where residents rely on expensive imported fuel for both heat and power. Alaska’s non-integrated electric grid and resulting ‘islanded’ power systems pose unique challenges for communities who want to integrate variable renewable energy into their small, typically diesel-based systems.

This project continues research from an EPSCoR Phase 1 award, which expanded capacity at UA in the niche market technology of hybrid wind-diesel systems. Phase II broadens the scope to include integration of other renewable energy resources with traditional generation and fuel sources. The project’s tasks are designed to reduce implementation barriers and improve performance of existing systems through a combination of improved data management and addressing engineering challenges.

**Program funding**

Department of Energy EPSCoR

**Project partners**

Alaska Energy Authority · Denali Commission · National Renewable Energy Laboratory · Sandia National Laboratory · Institute of Social and Economic Research (UAA)
**Effectiveness of Diesel Fuel Additives**
Due to the high cost of fuel in villages, diesel generators are expensive to operate. Many new fuel additive products have recently flooded the market and interested rural Alaskan utilities claiming to boost diesel engine efficiency.

This study explores the various fuel additive options for rural Alaskan application and their viability including an inventory of products, analysis of the chemical composition of the different products, and anecdotal performance results from people in the field.

**Project funding** Alaska Energy Authority
**Project partners** U.S. Department of Energy

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**Heat Utilization**
One possible way to increase overall efficiency for rural utilities is to capture and utilize the waste heat produced by the diesel generators.

Waste heat utilization can be accomplished through an Organic Rankine Cycle (ORC) which can generate power from a low quality industrial waste heat source. Small ORC devices that fit village-sized gen-sets are new to the market and ACEP is assessing options for applying these systems to Alaska.

ACEP has tested a device at the UAF Power Plant with encouraging results. Based on those results, ACEP partnered with utility Alaska Power and Telephone to install and test the device in the rural village of Tok. If successful, it has the potential to increase the efficiency of powerhouses throughout the state.

**Project funding** Alaska Energy Authority · Denali Commission · Department of Environmental Conservation · Environmental Protection Agency
**Project partner** Tanana Chiefs Conference · Alaska Power and Telephone
UAF has identified energy as a key research growth priority. ACEP is leading this charge, serving as a gateway to energy research throughout the system and focusing on areas that most directly meet the immediate needs of the state and its critical industries.” **Brian Rogers**, Chancellor, University of Alaska Fairbanks

ACEP Current Projects

- Islanded electric grid integration
- River hydrokinetics
- Low temperature geothermal
- Remote sensing/thermal imaging
- Waste heat utilization
- Coal-to-liquids technology
- Biomass energy
- Transmission and distribution
- Fuel additives assessment
- Small modular nuclear reactors
- Advanced energy storage
- Ground source and seawater source heat pumps
- Stranded renewable resources assessment
ACEP educates the workforce of tomorrow by involving graduate and undergraduate students from diverse backgrounds in almost all of our research projects. Meet a few of our students here.

**Lisa Stowell**
Masters Student, Mechanical Engineering
GEOTHERMAL TECHNOLOGIES
Lisa grew up in Alaska and after receiving her undergraduate degree at UAF in mechanical engineering, she decided to continue her studies. Today, Lisa is involved in the Pilgrim Hot Springs geothermal project, working in the field, building a model to calculate development potential of the site.

**Chris Pike**
Masters Student, Appropriate Technology
EMERGING TECHNOLOGIES
Chris is a student at Appalachain State, NC, but developed an interest in Alaskan energy issues after living in Bethel, AK. Chris investigated the viability of solar thermal technology for the state as well as Icelandic district heating systems for applications in Alaska.

**Dominique Pride**
PhD Student, Natural Resource Management
RESOURCE ECONOMICS
Dominique has built a wide range of skills working with ACEP’s multi-disciplinary teams. She completed her MS in resource economics in 2010 and turned down an opportunity to go to law school on the East Coast to stay at UAF and focus on economic decisions of Alaskan utilities.

“Siemens has a vested interest in the development of young Alaskan engineers. ACEP is an ideal partner for UA students, and we are pleased to support their efforts.” Ben LaRue, Siemens Building Technologies
Funding for student research is a critical need. Recent donations from BP and Siemens Building Technologies have allowed us to involve students in our projects. Through this funding we have also developed the ACEP Summer Internship Program, which includes seminars, field trips and student presentations to complement project work.

Josh Miller
Masters Student, Geology

Levi Overbeck
Undergraduate Student, Physics and Civil Engineering

Josh came to Alaska after receiving his BA in Geology from the University of Georgia. Josh was an integral part of the field team and conceptual model development for ACEP’s Pilgrim Hot Springs exploration. Based on his experience at ACEP, Josh has received a scholarship and internship with BP.

Levi grew up in Whittier and Seward. After receiving an associates degree in Colorado, he returned to Alaska to pursue a UAF degree in physics and civil engineering. Levi’s work with the Alaska Hydrokinetic Research Center involves hydrodynamic modeling and the characterization and mitigation of debris for river turbines.
ACEP Education

ACEP reaches hundreds of Alaska’s K–12 youth each year through a variety of popular and growing programs.

Wind for Schools and KidWind Challenge

The Alaska Wind for Schools program uses wind power to enhance STEM education opportunities and raise awareness about energy issues among Alaska’s youth. This program is part of the Department of Energy’s national initiative led by the National Renewable Energy Laboratory (NREL). In addition, ACEP hosts the annual KidWind Challenge, a national wind turbine design competition for students in grades 6-12.

Classroom and Field Trip Experiences

ACEP provides K-12 outreach to classes upon request. Hands-on materials and dynamic presentations provide students with the necessary background to understand energy and engage their imagination in developing novel solutions for Alaska’s complex energy needs.

Energy Curriculum Development

Aligned with state and national standards, ACEP, in partnership with REAP, has developed an energy efficiency curriculum for use in K-12 classrooms across the state. Funded by the Alaska Housing Finance Corporation, this curriculum gives Alaskan youth an understanding of the high cost of power generation and the importance of taking measures to conserve energy at home and school.

Energy Summer Camps

Each summer ACEP staff are immersed in week-long science camps for students and teachers, both through the Alaska Summer Research Academy (ASRA) and Alaska Space Camp. These intensive hands-on courses allow participants to delve into more complex topics and encourages interest in science and technology concepts and careers.
ACEP Outreach

ACEP makes unbiased energy information accessible to decision makers at all levels, including legislators, tribal leaders, business and industry representatives, and individual homeowners.

Community Energy Lecture Series
Each month, ACEP brings together experts for an evening lecture series on a wide range of energy topics. Each lecture is also available via download on YouTube and iTunesU.

Advising Alaskans
ACEP dedicates a portion of our staff time to respond to energy related questions from communities or individuals.

Publications
ACEP produces a variety of online and print publications to provide information on specific topics or research projects.

Workshops
ACEP hosts a variety of small conferences and workshops throughout the year on specific topics. Recent examples include the International Wind-Diesel Conference, Small Modular Nuclear Reactors Workshop, Hydrokinetics Conference and the first Alaska-based Energy Storage Workshop.

Rural Energy Conference
Every 18 months, ACEP and AEA partner to host the Alaska Rural Energy Conference, bringing together 500 participants representing 100 villages in Alaska to share information about energy challenges and opportunities.

ACEP ONLINE
ACEP maintains an active website and Facebook page to guarantee 24 hour access to our resources. In addition, we manage an Alaska Energy Wiki site that provides information on all aspects of energy in Alaska, from resources and technology to projects. For more information find us at www.uaf.edu/acep/

“ACEP is a dynamic and immensely helpful organization. A million words of thanks from the community of Yakutat for your help in our energy work, and for the overall development of the community. Your staff are genuine and respectful in addition to being a diverse group of people with real world experience and the desire to apply knowledge to true progress. Thanks again for your visit!” Ian Fisk, Renewable Energy Coordinator, City and Borough of Yakutat
ACEP Advisors

ACEP’s Advisory Committee is a group of dedicated industry and agency professionals who inform our planning and help shape our research agenda.

MEMBERS

Mark Agnew  
ExxonMobil
Craig Dorman  
University of Alaska (retired)
Samuel Enoka  
Viasyn, Inc.
Sara Fisher-Goad  
Alaska Energy Authority
Mark Foster  
Mark Foster and Associates
Steve Haagenson  
GVEA (retired), Alaska Energy Authority (retired)
Jack Hebert  
Cold Climate Housing Research Center
Brian Hirsch  
National Renewable Energy Laboratory
Brian Holst  
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Tom Lovas  
National Rural Electric Cooperative Association
John Lyons  
Marsh Creek, LLC
Joel Lindstrom  
Arctic Energy Office, Department of Energy
Joel Neimeyer  
Denali Commission
Chris Rose  
Renewable Energy Alaska Project
AlexAnna Salmon  
Igigig Tribal Village Council
Aaron Schutt  
Doyon, Limited
Ethan Schutt  
CIRI
Lorna Shaw  
Pogo Mine
Robert Swenson  
Alaska Division of Geology and Geophysical Surveys
Gene Therriault  
Alaska Energy Authority
Joseph Usibelli  
Usibelli Coal Mine
Robert Venables  
Southeast Conference
Dick Williams  
Shell Wind Energy

Ethan Schutt, Senior Vice President Land and Energy, CIRI, and ACEP Advisory Council Chair

“ACEP plays a critical role in the state’s energy industry, assessing and validating technology for Alaskans and serving as a laboratory where emerging solutions can be researched, improved, and matured for deployment.”
ACEP Partners

ACEP fosters a wide range of partnerships outside the university at the local, state, national and international levels to ensure our research is relevant, current and world class.

ACEP CLIENTS AND COLLABORATORS (2008 – PRESENT)

ABB
ABS Alaskan
Air Force Research Laboratory
AK Department of Environmental Conservation
AK Department of Labor
AK Division of Geological and Geophysical Surveys
AK Division of Forestry
Alaska Energy Authority
Alaska Forward
Alaska Housing Finance Corporation
Alaska Power and Telephone Corporation
Alaska Sealife Center
Alaska Village Electric Cooperative
Alaska Wood Energy Development Task Group
Arctic Energy Office, Department of Energy
Battelle
Bean Ridge Native Corporation
Begich Middle School
Bering Straits Native Corporation
Boeing
Boschma, Inc
BP
Bureau of Land Management
Bristol Bay Native Association
Charles Darwin University
Chena Hot Springs Resort
Chena Power
City of Anvik
City of Galena
City of Nikolai
City of Nome
City of Ruby
City of Tanana
City of Tenakee Springs
City and Borough of Yukon
Cold Climate Housing Research Center
Cordova Electric Cooperative
Denali Commission
DOE Indian Energy Program
DOE Office of Electricity
Doyon, Ltd
Elison Air Force Base
Electratherm
Elm Tribal Council
Elmendorf Air Force Base

Energy Concepts
Energy Efficiency Evaluations
Environmental Protection Agency
Fairbanks Economic Development Corporation
Fairbanks North Star Borough
Fort Yukon Tribal Council
Golden Valley Electric Association
GraphiteOne
Hatch
HOMER Energy
Huslia Tribal Council
Inside Passage Electric Cooperative
Interior Regional Housing Authority
Institute of the North
Jacobs Engineering
Juneau Economic Development Corporation
Kawerak
KidWind
Kodiak Electric Association
Kodiak Island Borough School District
Kotzebue Electric Association
Lawrence Berkeley National Laboratory
Lawrence Livermore National Laboratory
Lynden Transport
Manley Hot Springs Tribal Council
Mary’s Igloo Native Corporation
Marsh Creek Energy Systems
McGrath Tribal Council

McKinley Services
Minto Tribal Council
Mount Edgecumbe High School
NANA Corporation
National Renewable Energy Laboratory
National Energy Technology Laboratory
Nenana Tribal Council
Nikolai Tribal Council
NIUS
Nome Chamber
Nome Joint Utility Services
Norton Sound Economic Development Corporation
Northern Power
Northern AK Career and Technical Education Center
Ocean Renewable Power Company
Patriot Solutions
Pilgrim Geothermal LLC
Polarconsult Alaska, Inc
Potelco Inc
PowerCorp
Power Water
Prudent Energy
Renewable Energy Alaska Project
Renewable Energy Solutions
Ribbit Tribal Council
Sandia National Laboratory
Sealaska
Shell Wind
Sherrod Elementary School
Siemens Building Technologies
Sitnaatuk Native Corp
Southern Methodist University

Southwest Alaska Municipal Conference
Stanford University Strategies 360
Sustina Energy Systems
Sustainable Automation
Sustainable Solutions
Tanana Chiefs Conference
Tanana Tribal Council
TDX Power
Teck Cominco
Terrasond
Unatuq, LLC
Unataq, LLC
University of Maine
University of Massachusetts
University of Texas at Austin
University of Washington
United States Coast Guard
United States Geologic Survey
Usibelli Coal Mine
Village of Eyak
Village of Elim
Village of Igiugig
Vortex Hydro
Western Community Energy
WH Pacific
White Mountain Native Corporation
Williams Engineering

A current list of ACEP partners is available at www.uaf.edu/acep/