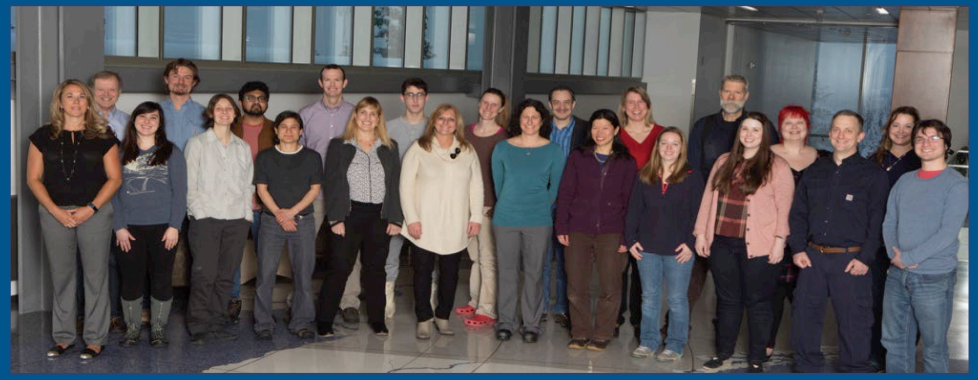
Alaska Center for Energy & Power (ACEP)

Mission: Fostering development of practical, innovative and cost effective energy solutions for Alaska and beyond

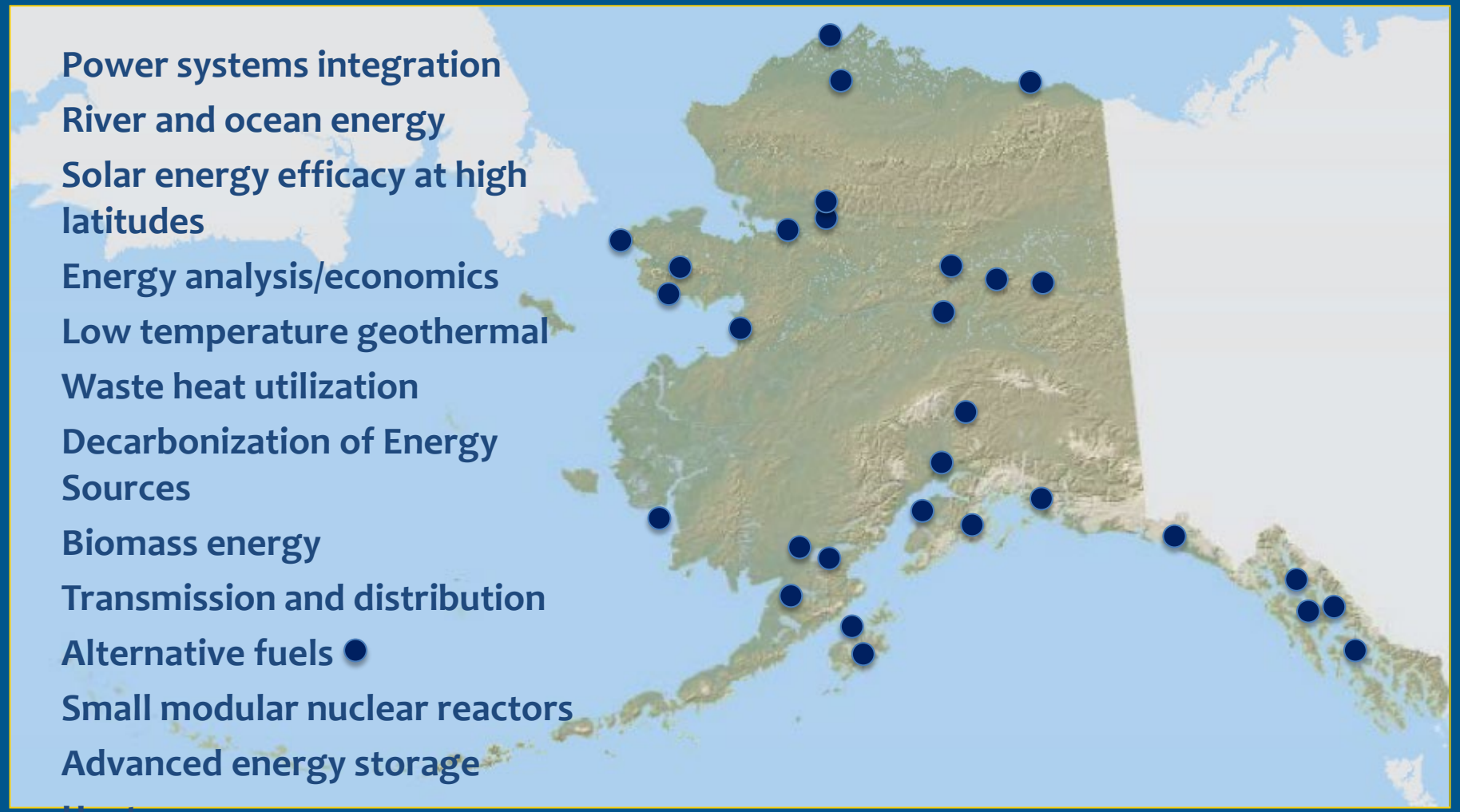
- Applied energy research program
- Technology testing & optimization
- Energy systems modeling & analysis
- Energy education
- Commercializing energy innovation



Moving technologies from the lab into the field

Example: flywheel testing and microgrid integration for Raglan mine

ACEP Research Projects and Locations



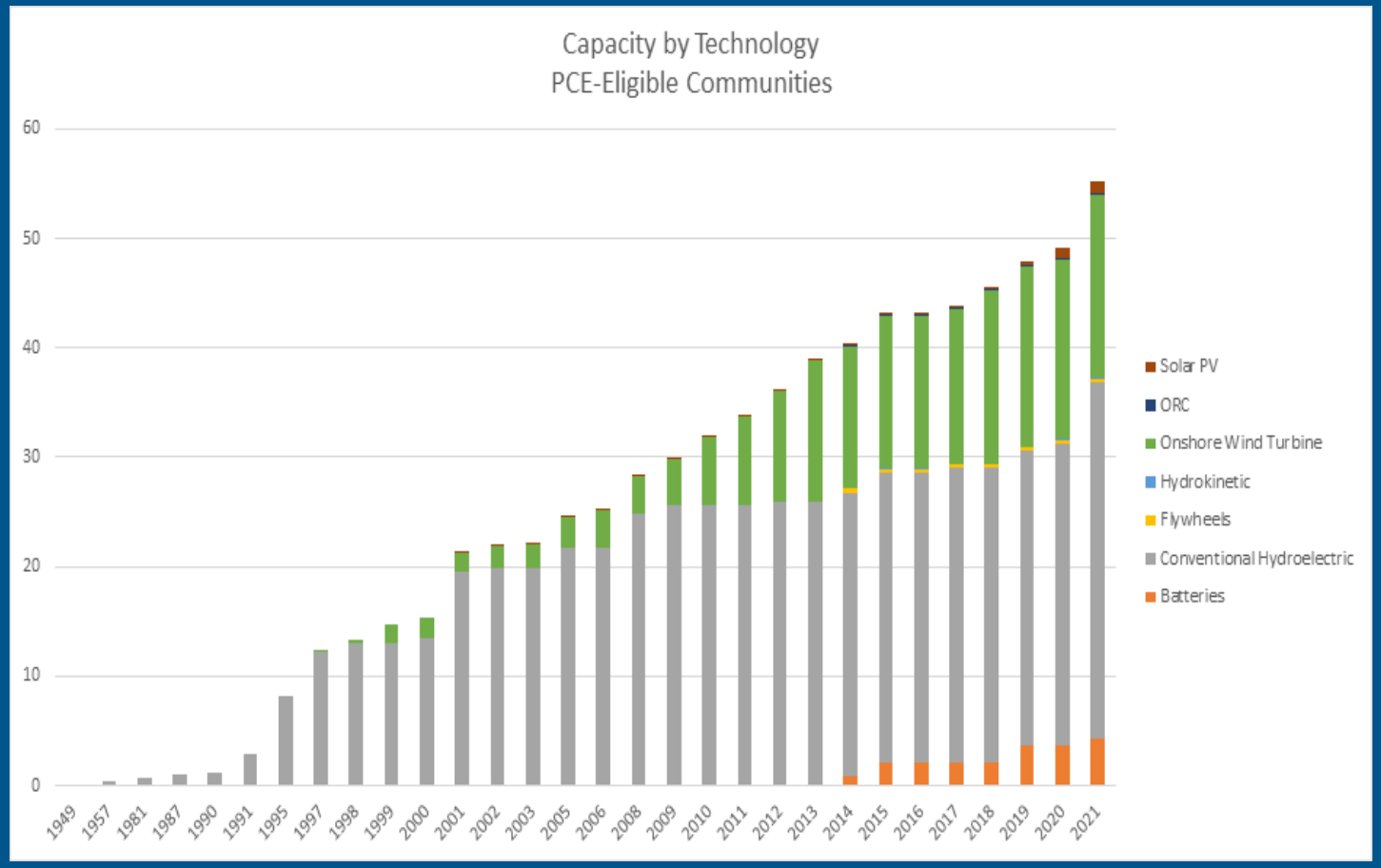
Our Philosophy

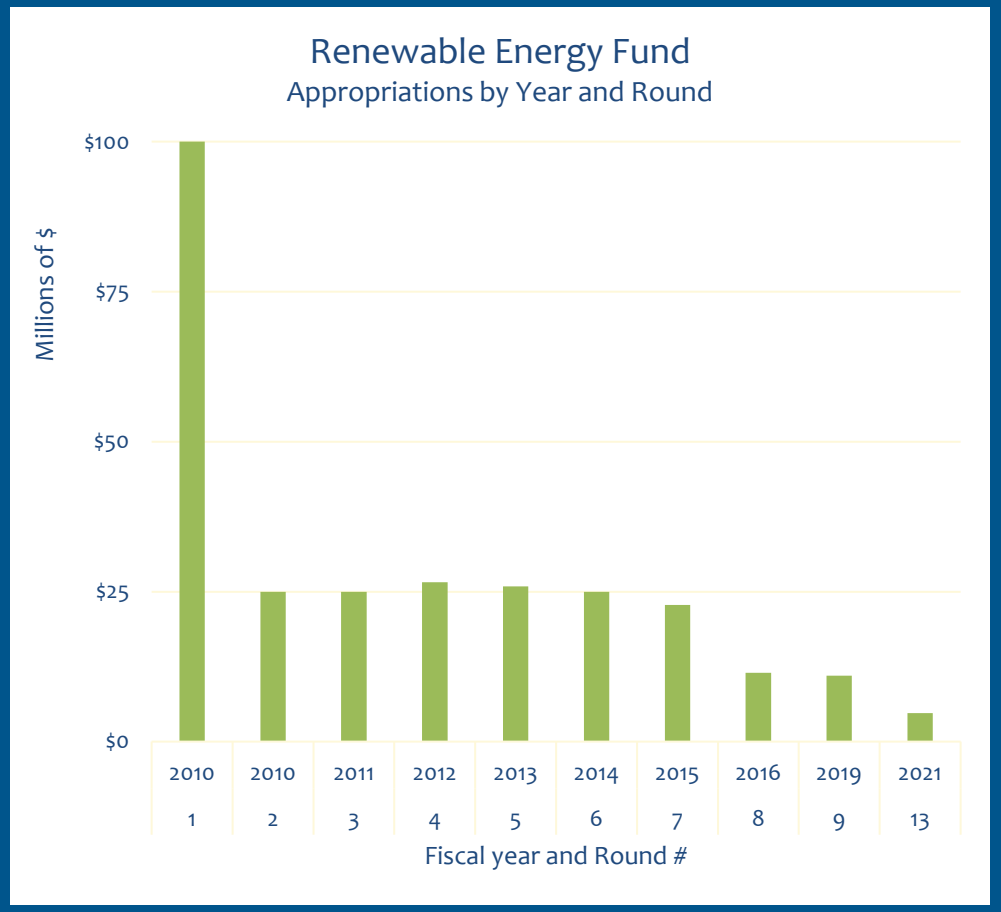
Emphasis is on the research question,
not the interests of individual researcher

Project Locations Highlighted Today

Alaska Investment in Renewable Energy

Many projects developed over the past decade have benefited from $256M invested by the State of Alaska through the Alaska Renewable Energy Grant Fund.





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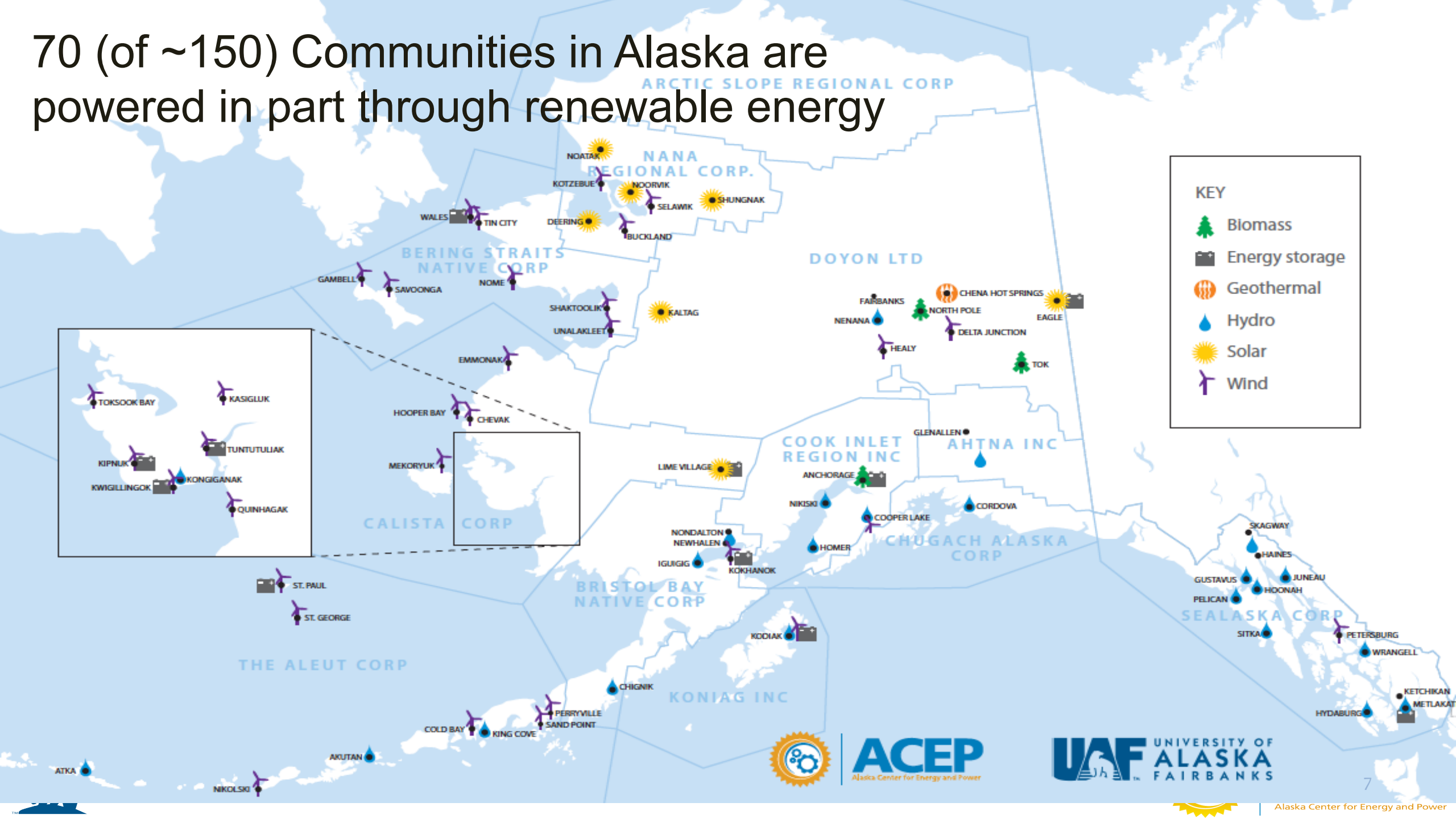
70 (of ~150) Communities in Alaska are powered in part through renewable energy



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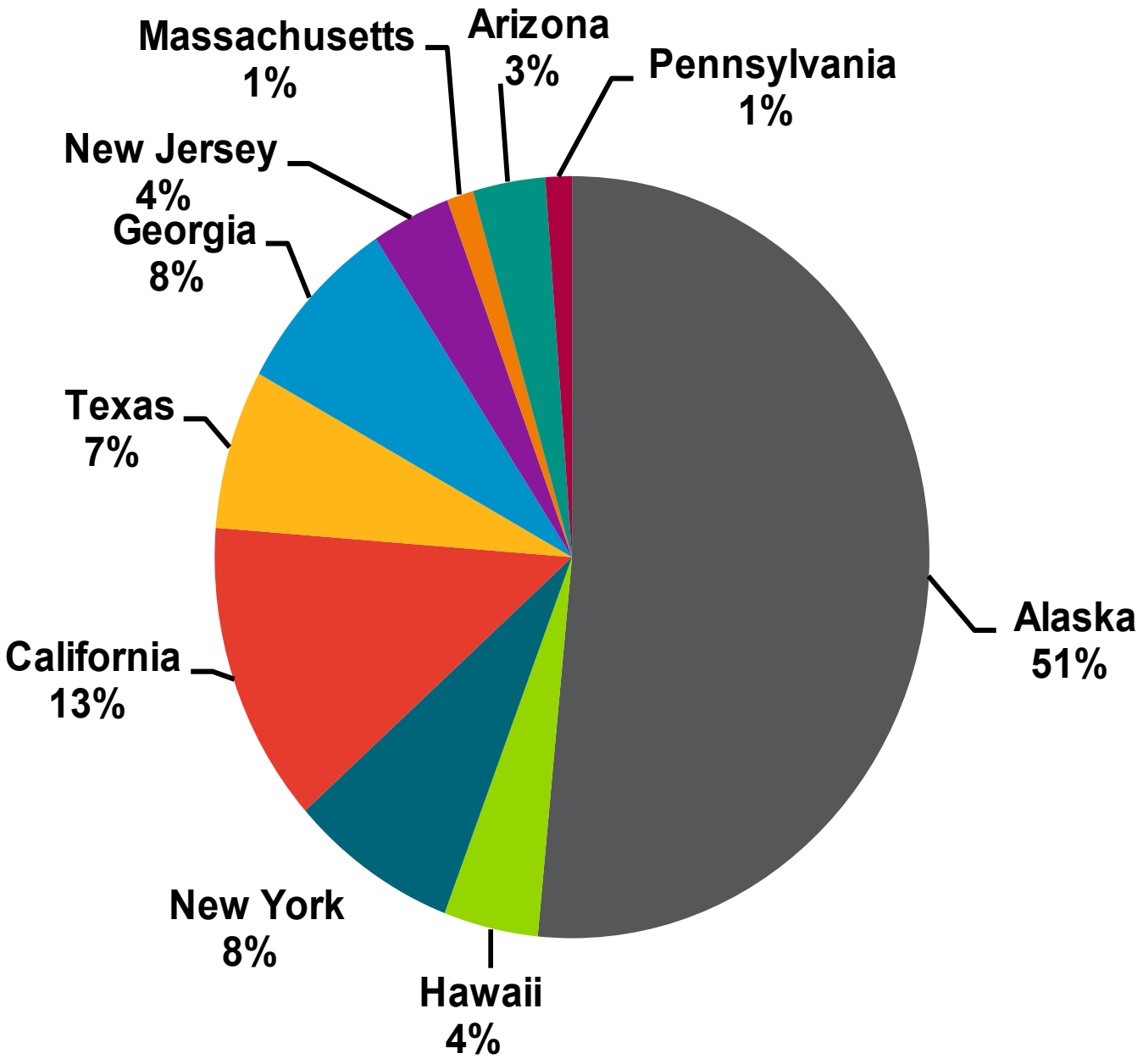
UAF UNIVERSITY OF ALASKA FAIRBANKS



Top 10 States for Microgrid Capacity

Data from Navigant Research (Q2 2019 Microgrid Tracker)

"Alaska has the world's greatest concentration of experience and expertise for integrating renewable and conventional power in hybrid systems."

—Peter Lilienthal, CEO HOMER Energy

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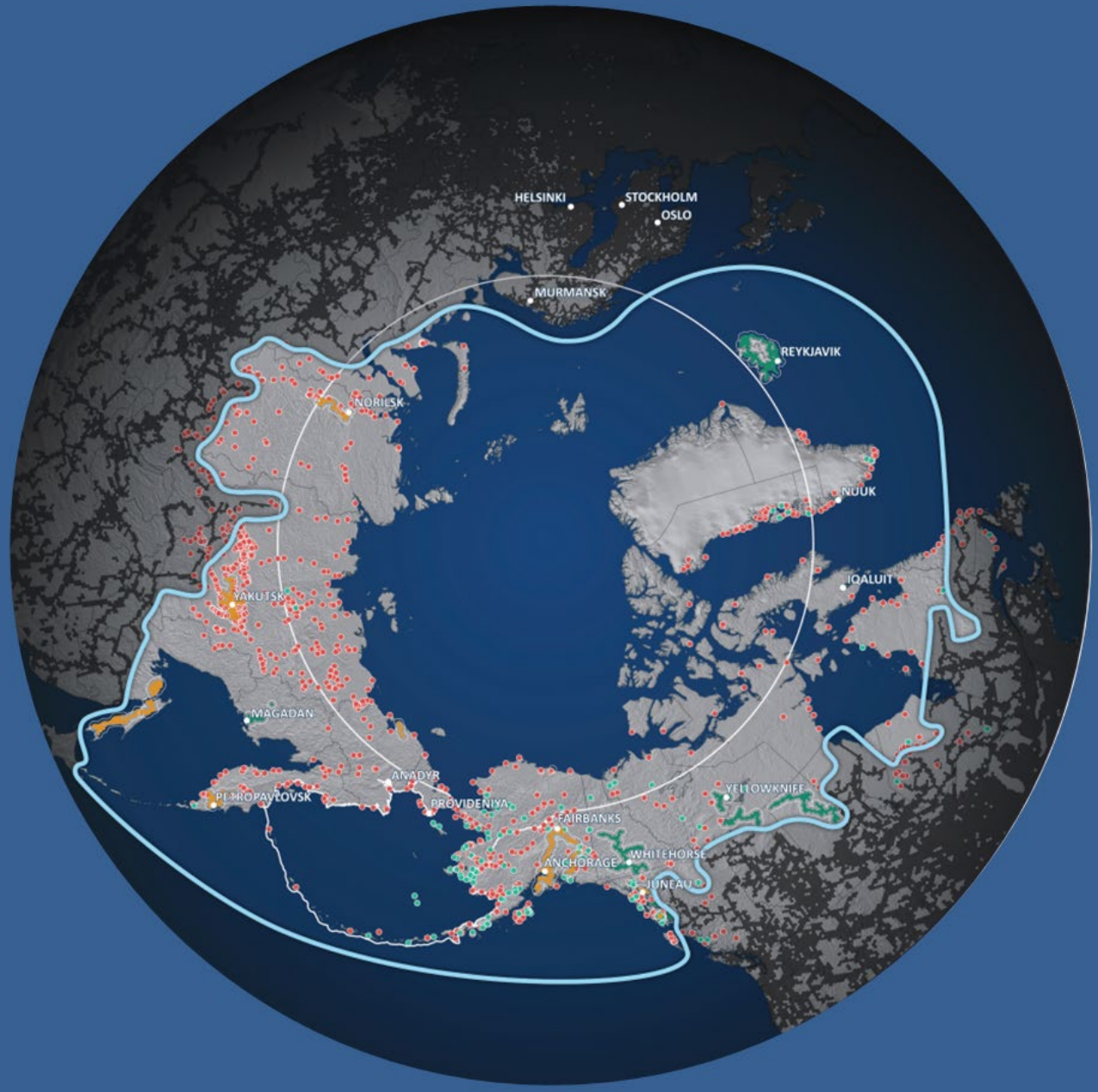
Much of the Arctic relies on remote energy systems and 12 regional grids

For remote locations in the Arctic, most power and heat relies on imported fuels



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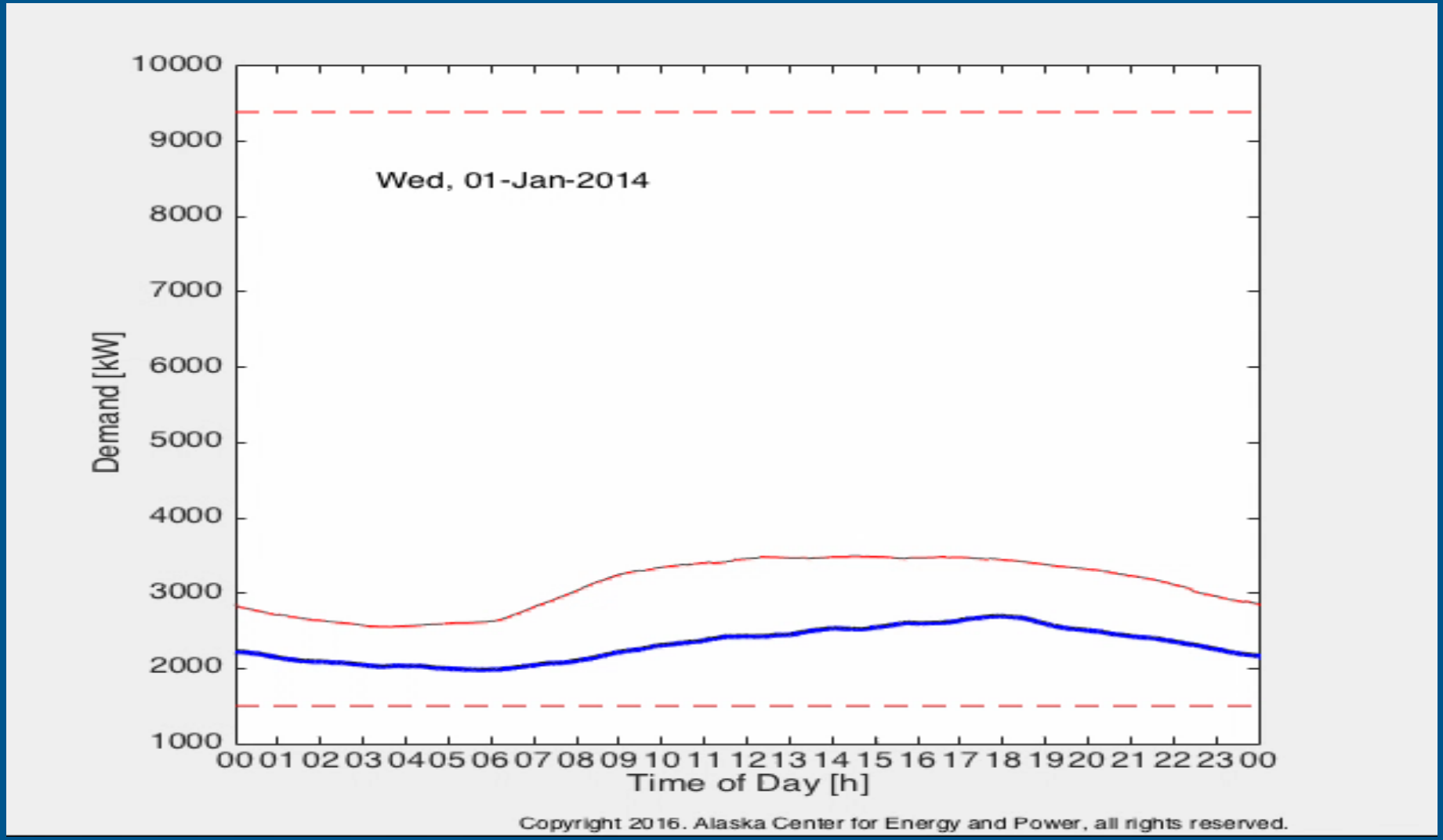
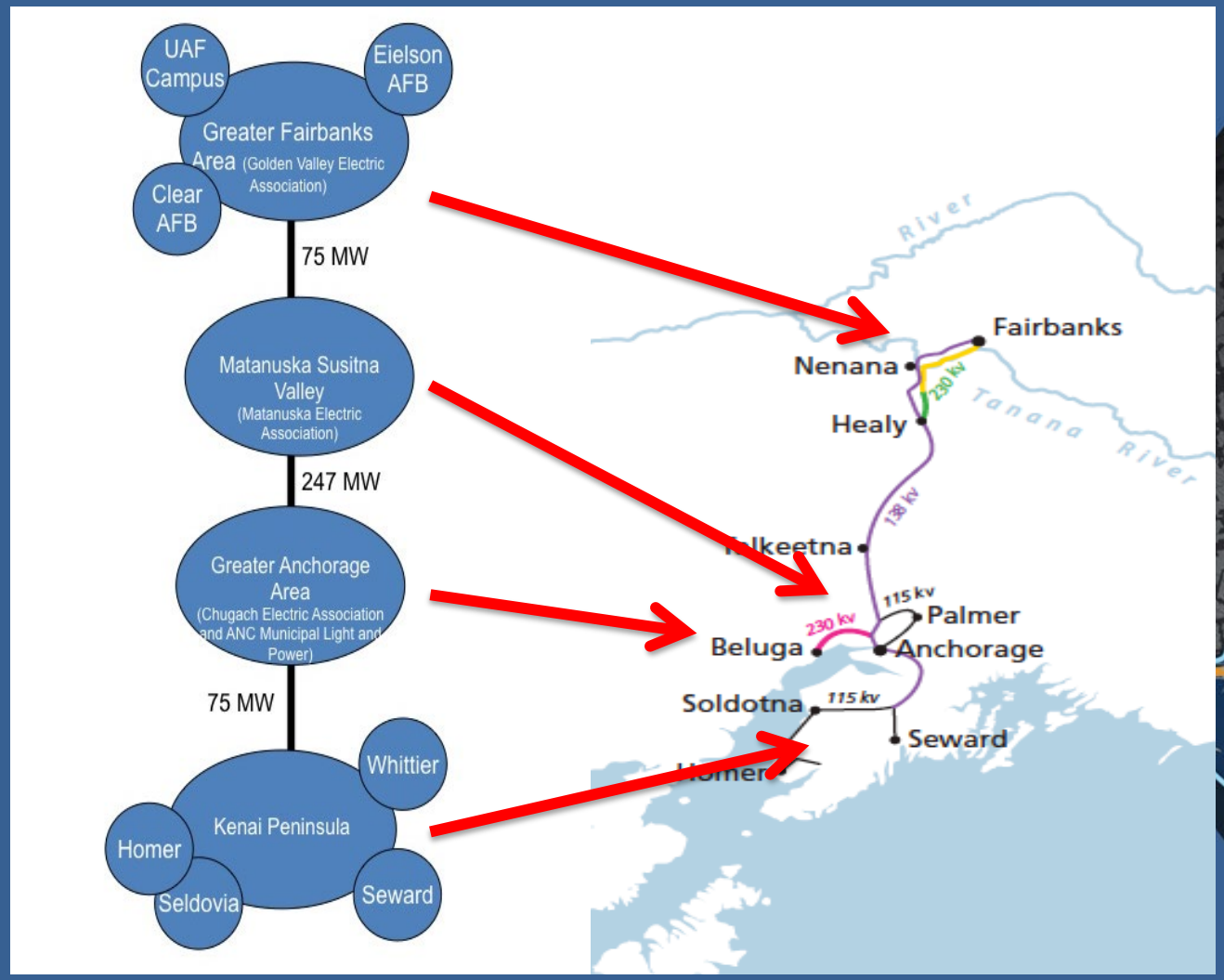
Design Challenges – Cordova Example



Seasonal Demand Swing – Cordova, AK



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Alaska Railbelt Decarbonization Pathways Study

Partnership with all Railbelt utilities and AEA
Funded through ONR in partnership with the University of Hawaii and Telos

Scenarios/Pathways modeled:

- Decentralized energy transition
- Centralized low-carbon generation
- Export project offtake

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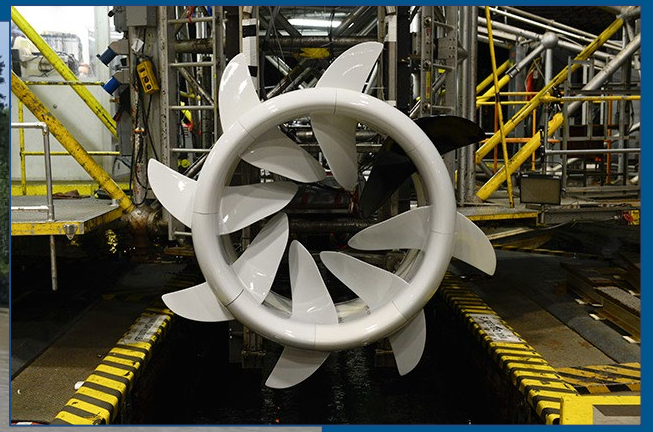
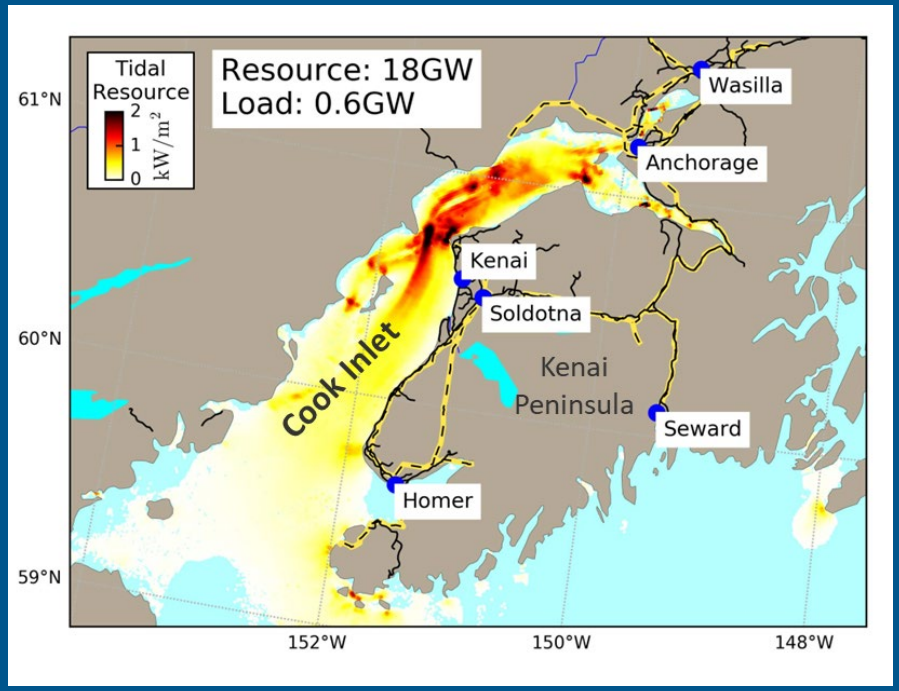
Pacific Marine Energy Center (PMEC)

Cook Inlet is largest tidal resource in the USA at 18GW (equivalent to 1,000 BCF/year of natural gas)





ACEP's Tanana River Test site in Nenana (left).
Cook Inlet Assessment collaboration between ACEP, NREL, industry, and the State of Alaska (top)

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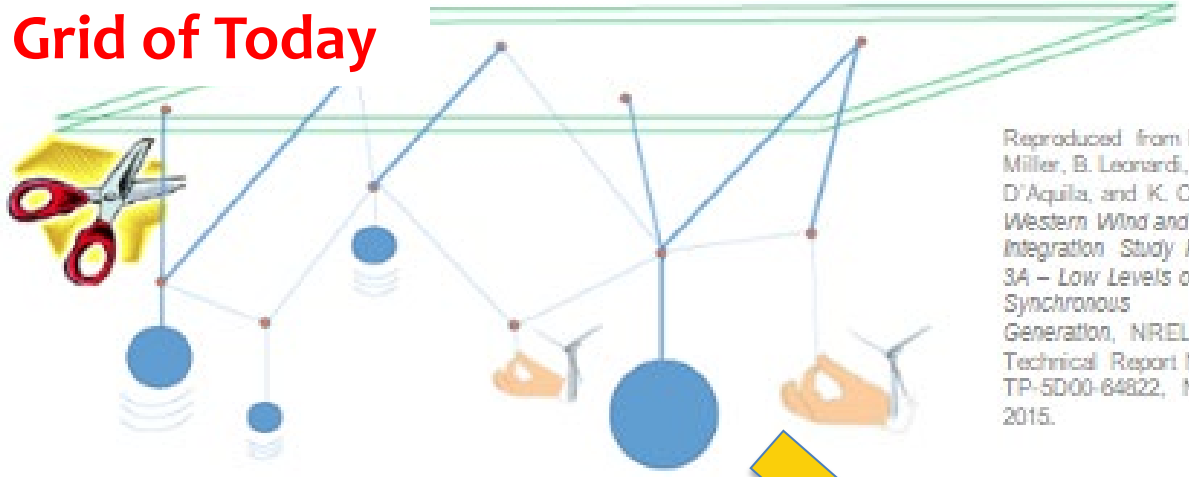
Assess Dynamic Response of Converter-Dominated Power Systems Across Multiple Spatiotemporal Scales

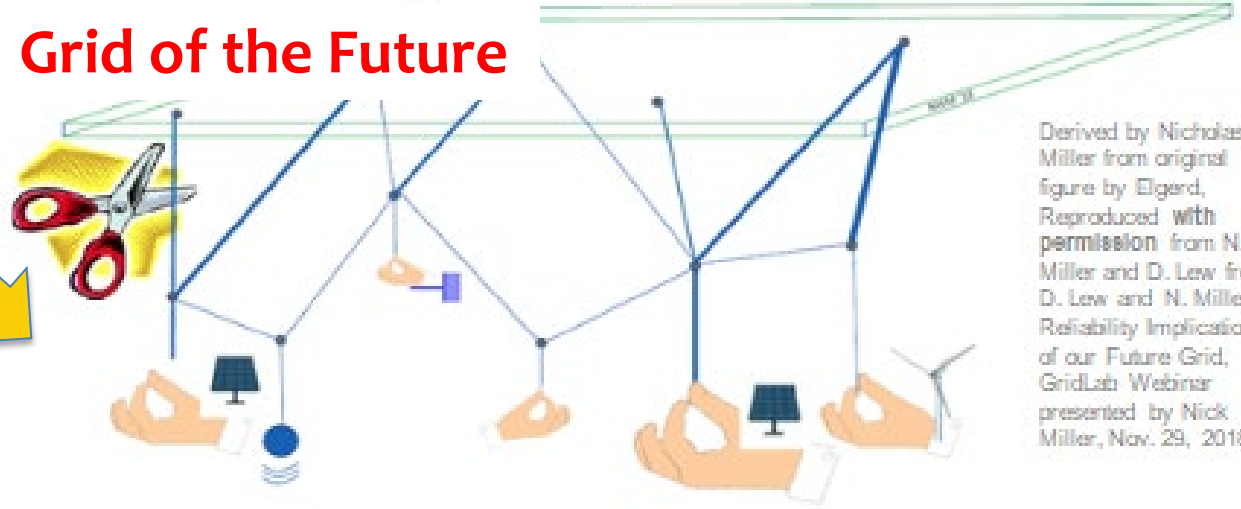
Grid of Today



Reproduced from N. Miller, B. Leonardi, R. D'Aquila, and K. Clark, *Western Wind and Solar Integration Study Phase 3A – Low Levels of Synchronous Generation*, NREL Technical Report No. TP-5D00-64822, Nov. 2015.

What are implications for grid stability as we incorporate increasing amounts of renewable resources like wind and solar?

Grid of the Future



Derived by Nicholas Miller from original figure by Elgerd, Reproduced with permission from N. Miller and D. Lew from D. Lew and N. Miller, Reliability Implications of our Future Grid, GridLab Webinar presented by Nick Miller, Nov. 29, 2018.

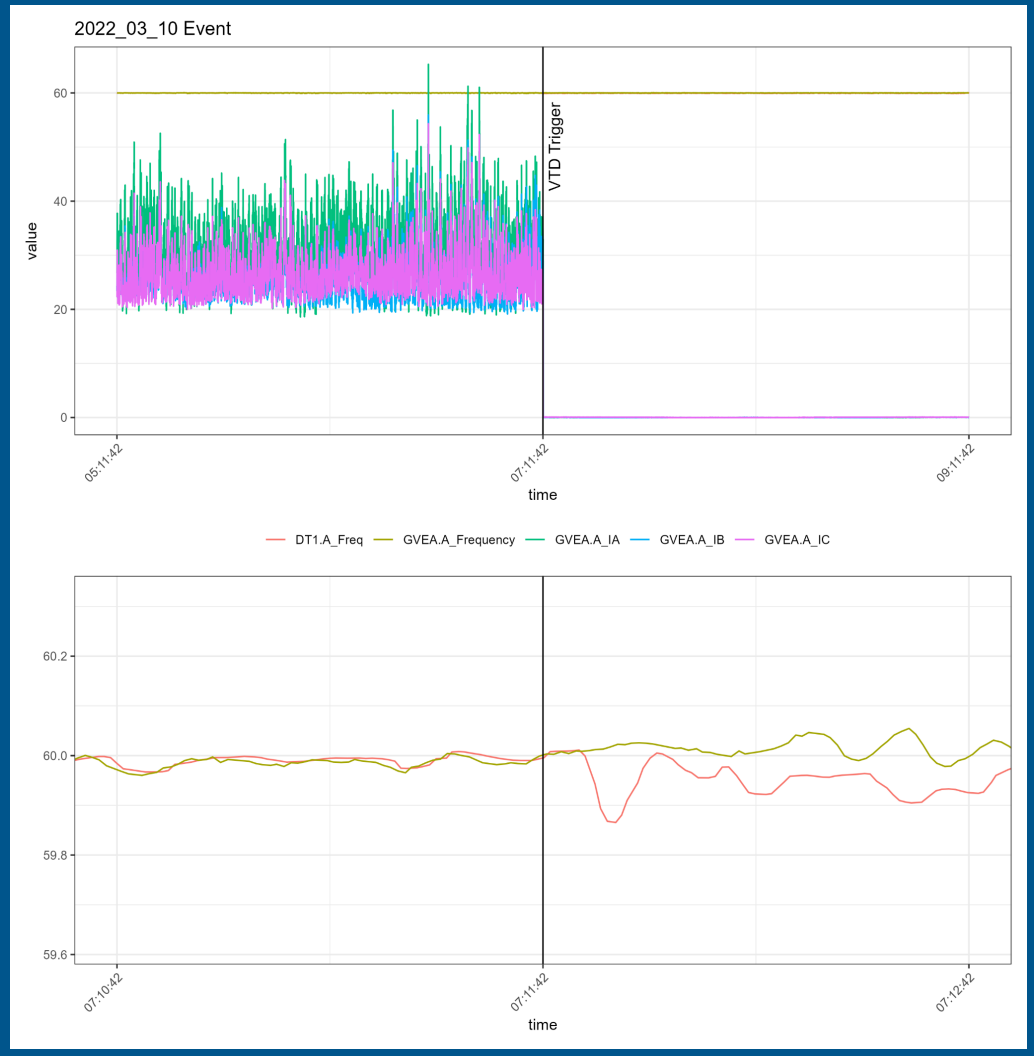
Project Partners:
University of Puerto Rico Mayaguez
South Dakota State University
University of Hawaii - Manoa

Sponsors:
DOE Office of Science, EPSCoR
DOE Office of Electricity Microgrid R&D Program
DOE Office of Energy Efficiency and Renewable Energy Solar Energy Technology Office

Project Example: Eielson AFB Energy Resilience

Advanced metering infrastructure to address:

1. Near-term: resilience issues
2. Mid-term: modernize controls to integrate new complex system loads (F35s) and new electrical generation (such as nuclear)



Partnership with Eaton Funded through Army CREL. Example of reduced power quality during unexpected islanding event (right)

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Micronuclear Reactors – an emerging technology

Town Hall meetings in Fairbanks (top, September 2022) and Nome (right, August, 2022)

Artist renderings of microreactors under current development

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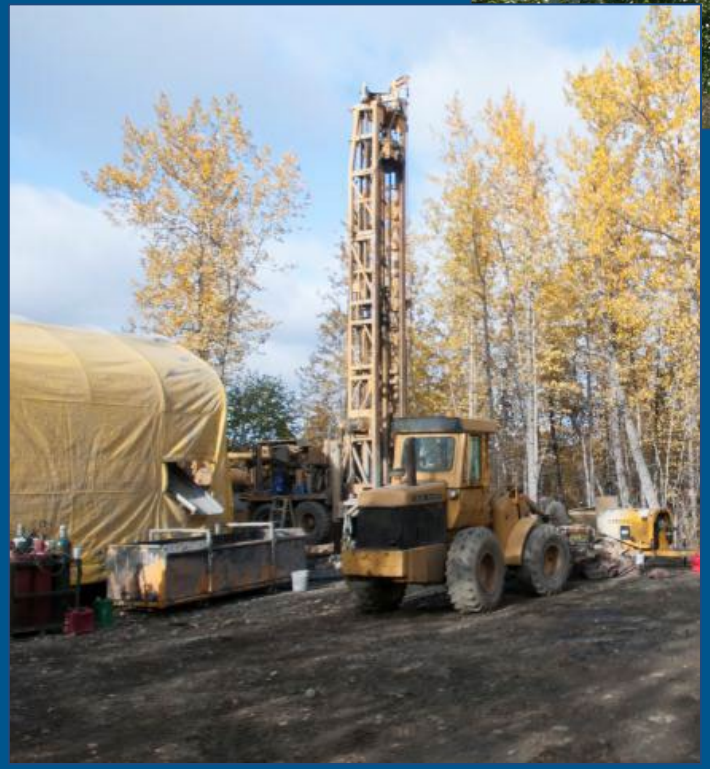
Pilgrim Hot Springs (Nome)

Evolving support over 13 years

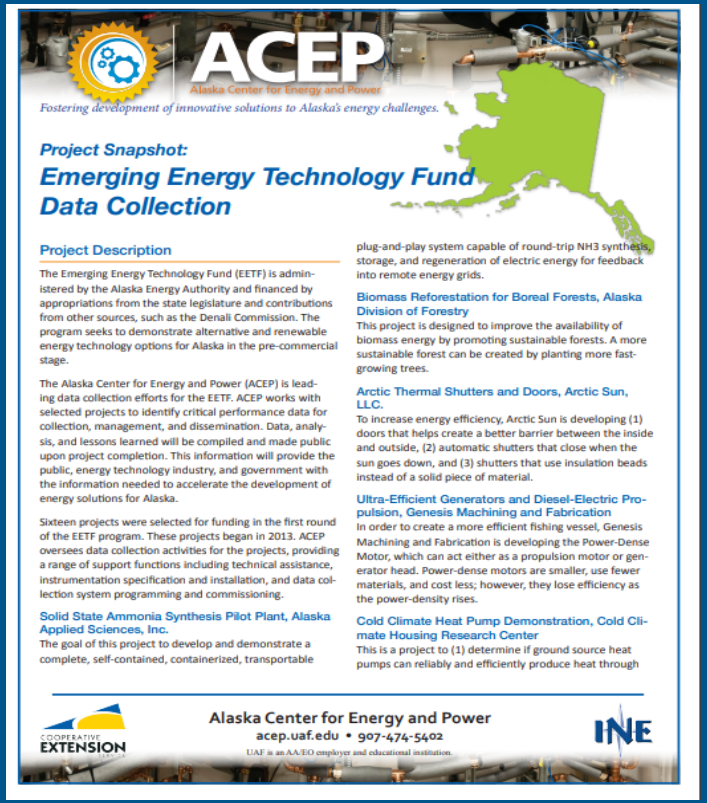


Emerging Energy Technology Grant Fund (EETGF)*

Program was designed as a mechanism for deploying and testing new technologies appropriate for Alaska.

Today it could fund exploration of nuclear, CCUS, long duration energy storage, hydrogen, etc.

* The EETGF was a grant program governed under AS 42.45.375 and 3 AAC 107.700 to 3 AAC 107.779 which sunsetted in 2018.



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Fostering development of innovative solutions to Alaska's energy challenges.

Project Snapshot:
Emerging Energy Technology Fund Data Collection

Project Description

The Emerging Energy Technology Fund (EETF) is administered by the Alaska Energy Authority and financed by appropriations from the state legislature and contributions from other sources, such as the Denali Commission. The program seeks to demonstrate alternative and renewable energy technology options for Alaska in the pre-commercial stage.

The Alaska Center for Energy and Power (ACEP) is leading data collection efforts for the EETF. ACEP works with selected projects to identify critical performance data for collection, management, and dissemination. Data, analysis, and lessons learned will be compiled and made public upon project completion. This information will provide the public, energy technology industry, and government with the information needed to accelerate the development of energy solutions for Alaska.

Sixteen projects were selected for funding in the first round of the EETF program. These projects began in 2013. ACEP oversees data collection activities for the projects, providing a range of support functions including technical assistance, instrumentation specification and installation, and data collection system programming and commissioning.

Solid State Ammonia Synthesis Pilot Plant, Alaska Applied Sciences, Inc.
The goal of this project to develop and demonstrate a complete, self-contained, containerized, transportable plug-and-play system capable of round-trip NH3 synthesis, storage, and regeneration of electric energy for feedback into remote energy grids.

Biomass Reforestation for Boreal Forests, Alaska Division of Forestry
This project is designed to improve the availability of biomass energy by promoting sustainable forests. A more sustainable forest can be created by planting more fast-growing trees.

Arctic Thermal Shutters and Doors, Arctic Sun, LLC.
To increase energy efficiency, Arctic Sun is developing (1) doors that helps create a better barrier between the inside and outside, (2) automatic shutters that close when the sun goes down, and (3) shutters that use insulation beads instead of a solid piece of material.

Ultra-Efficient Generators and Diesel-Electric Propulsion, Genesis Machining and Fabrication
In order to create a more efficient fishing vessel, Genesis Machining and Fabrication is developing the Power-Dense Motor, which can act either as a propulsion motor or generator head. Power-dense motors are smaller, use fewer materials, and cost less; however, they lose efficiency as the power-density rises.

Cold Climate Heat Pump Demonstration, Cold Climate Housing Research Center
This is a project to (1) determine if ground source heat pumps can reliably and efficiently produce heat through

COOPERATIVE EXTENSION

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INE

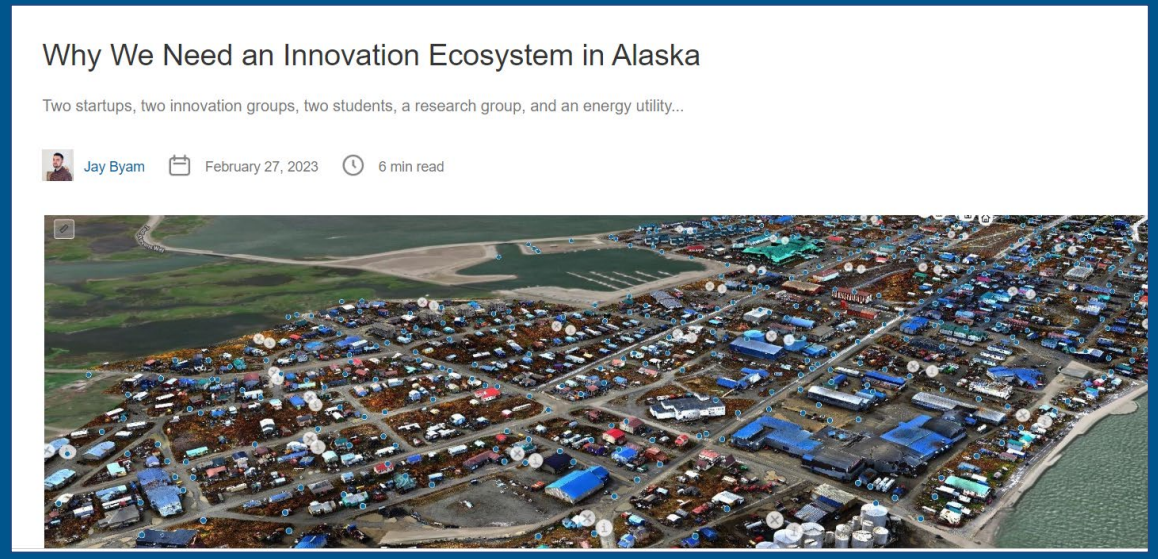
Each project was subject to independent review and analysis through ACEP

Kotzebue Advanced Metering

- More granular, real-time load and power quality measurements, key nodes on distribution network, and distributed generation assets.
- Necessary to support increased renewable penetration, utility goal is >100%

Kotzebue Electric Association distribution network (bottom); wind and solar farm (top)

Kartorium Blog (https://blog.kartorium.com/)



"Why We Need an Energy Innovation Ecosystem in Alaska

Two startups, two innovation groups, a research group, and an energy utility"

"I want to highlight a multi-layered collaboration that I think is best explained in story form. It's a story I'm proud to have been a small part of, a story of collaboration and innovation that I hope will serve as a wonderful example of how things could be and should be done."

- Jay Byam, Kartorium

KOTZEBUE ELECTRIC ASSOCIATION

LAUNCH ALASKA

Alaska Center ICE

ACEP Alaska Center for Energy and Power

UAA Business Enterprise Institute University of Alaska Anchorage

60 HERTZ

STUDENTS2STARTUPS

Air Source Heat Pumps (Beneficial Electrification)

KAKE - Assess potential for a heat pump incentive rate for IPEC for Kake, where hydropower will soon supplement a diesel microgrid.

KOTZEBUE - ACEP student researcher Alana Vilagi installs an ACEP-developed PUMA meter in a home in Kotzebue

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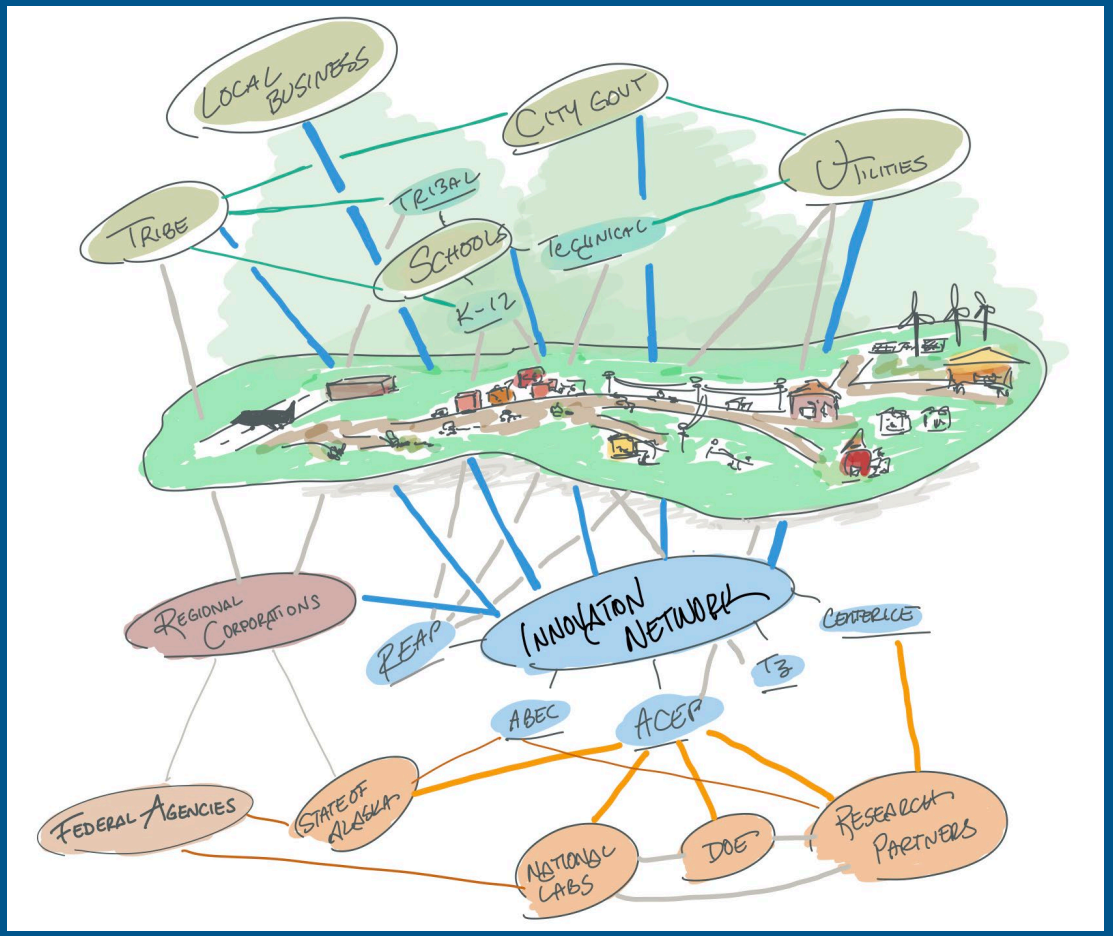
Community Innovation Hub Network

Community Innovation Hubs in Nome (top right); Cordova (top left) and Kotzebue (bottom)



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Training and Workforce Development

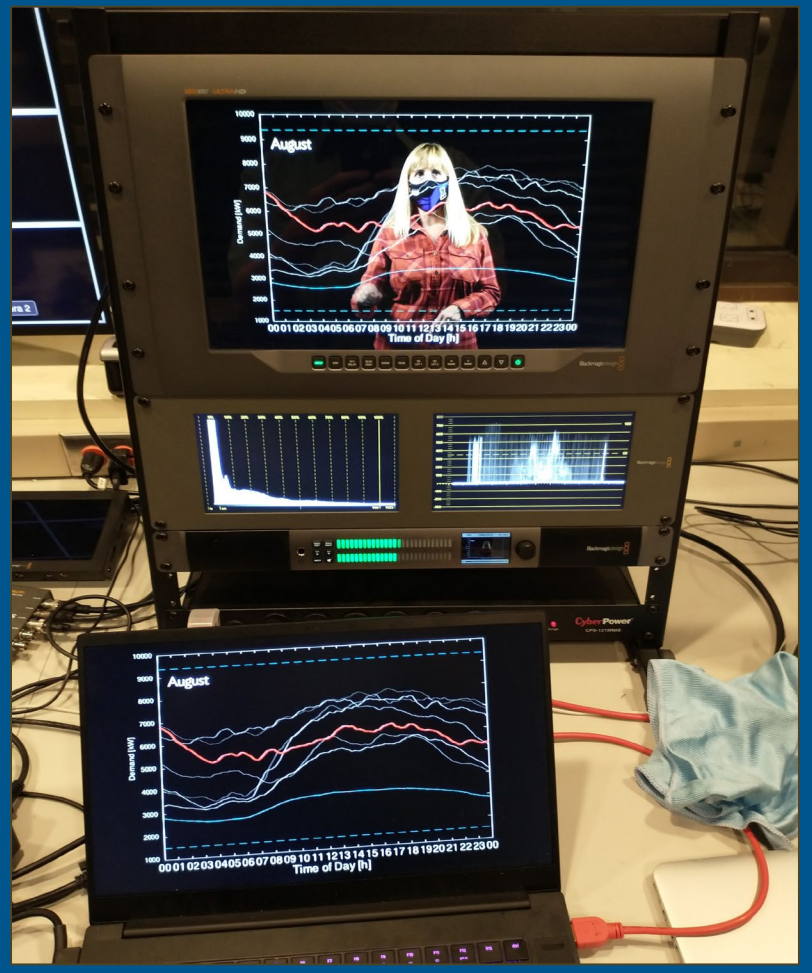
Arctic Remote Energy Networks Academy

Adapted from Iceland's Geothermal Training Program. Cohort 1 in Colville Lake, Canada (above) and Cohort 2 in Kotzebue (right)

Open Access Course Development

ACEP1x:
FOUNDATIONS *of* MICROGRIDS
ALASKAX

A foundational course on microgrid systems design with an emphasis on community-based projects and non-grid connected remote systems.



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Online and In-Person Workshops

Examples:

Micronuclear
Tidal Energy
Ben. Electrification
Hydrogen economy

Carbon Capture Utilization and Storage
Low-carbon energy transitions
Long duration energy storage

WORKSHOP 2: Carbon Capture and Sequestration: The Myth and the Reality

Name: Carbon Capture and Sequestration: The Myth and the Reality
Dates: Tuesday, April 11th and Wednesday, April 12th, 2023
Location: Virtual via Zoom
Cost: Free to attend, must register in advance
Description: Carbon capture utilization and storage (CCUS) covers the suite of technologies used to capture carbon dioxide from stationary point sources, industrial processes, or the atmosphere, and then transport it to either 1) utilize for other beneficial use, or 2) inject deep underground into subsurface formations for permanent storage. Although based on decades-old technology in the oil and gas sector, emissions reduction goals and changes to the federal tax code have ignited a growing wave of implementation on the international scale. Join us for this conversation to learn from project developers, subject matter experts, and regulators to address the myths and realities of this industry and discuss the potential role it may play in Alaska in the coming years.

REGISTER NOW

For event notifications sign up for the ACEP weekly newsletter at:

https://acep.uaf.edu/

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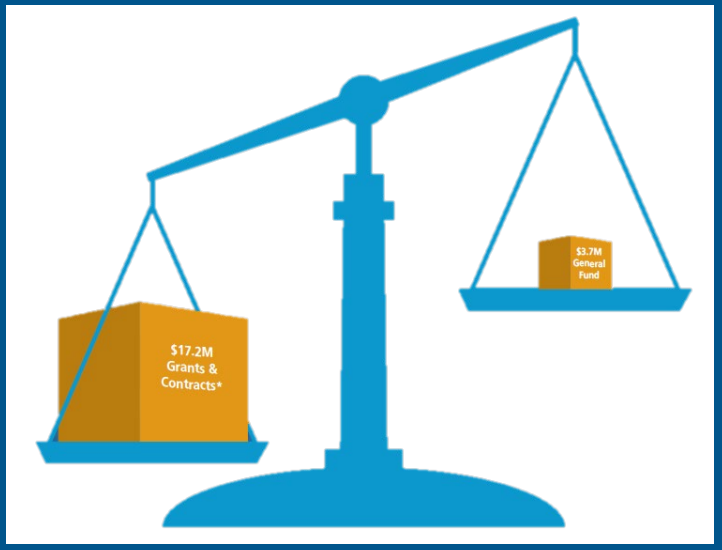
The University of Alaska is a key resource for the state

- **Alaska's Skunk Works** – Industry partnerships, innovation, research, designing the future
- **Alaska's Think Tank** – Strategic planning, convening, public education
- **Investing in Alaska's Human Capital** – building the workforce of tomorrow, today



The University of Alaska is a good investment in Alaska's future

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Thank you!

Gwen Holdmann
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University of Alaska Fairbanks
Gwen.Holdmann@alaska.edu

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