Remote Energy Solutions in Alaska

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

- Applied energy research program, founded in 2008
- Primarily funded through grants and contracts
- Part of the University of Alaska in Fairbanks
- 20 staff, ~30 affiliated faculty, students
- Analysis, lab testing, product development
Is there an energy crisis, now or could there be one in the future?

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Danger  Opportunity  Energy  Crisis

If so, would that be a bad thing, or a good thing?
Alaska Realities

- High energy costs
- Fragmented electric grid
- Harsh & changing climate
- End of supply lines
- Stranded resources
- Dispersed population
- Limited road network
- Challenged economy

In rural Alaska:
- Electric power: 0.50-1.50 $/kWhr
- Heating fuel: 3.50-10.00 $/gallon
Diesel, renewables, storage, loads, ...
Microgrids ... integrate & manage

- Diesel Power Plant
- Renewable Energy Resources
- System Control
- Diversionary Loads
- Managed Customer Loads
- Energy Storage

Graphic source: ACEP
AK energy investments – e.g., REF

Source: akenenergyauthority.org
Kodiak Island: 100% renewable generation

Hydropower + Wind + Energy Storage (Battery and Flywheel)
NW Arctic Borough – Solar PV

- Powering village water treatment plants
- Launched in Ambler, replicated to area
- 10,000 kWh/year from 10 kW array
- Peak production April-June
- Long sunlight in summer + 30% reflection off snow-covered ground in spring

(Amher PV Data – 2014)
Small Scale Biomass for Heat and Power

Tok School Biomass Project
(125 kW power + heating)
Geothermal Power Plant (Chena Hot Springs)
Eagle Hydrokinetic Energy Project

25 kW system provided diesel off 100% power to Eagle Village
Existing Alaska Battery & Flywheel Projects

- Wales
- Kotzebue
- GVEA (Fairbanks)
- Lime Village
- Kokanok
- St Paul
- Metlakatla
- Battery systems
- Flywheel systems
Tuntiluliak, Kongiginak, Kwig: Wind Heat System
Diesel off with wind + energy storage + distributed heating

Images: Left: 20+ thermal electric stoves installed in elder and low income homes; Windmatic direct drive turbines (30-40% wind penetration annually)
Alaska is a global leader in microgrid development

Alaska has ~12% of the world's microgrids that incorporate grid scale renewable resources. (data from Navigant Research)
Off-grid settlements in the North

Nearly 2 million people living in the Arctic.

About 80% without connection to the energy, gas, and often even the roads of their neighbors to the south.

Note: preliminary / in-progress (10/21/2016)
Credits: University of Saskatchewan, University of Alaska Fairbank
Microgrids: multi-region knowledge sharing & collaboration opportunity

- 200+ AK remote microgrids
- 1,000,000+ hours annually
- $10B global market by 2024
  - Energy surety / security
  - Energy-water-food nexus
  - Climate change resilience
  - Rural & urban
  - Community-industry-military
Power Systems Integration Program

Goals:
• Reduce problems in the field
• Reduce the cost of energy (including heat and power)
• Turn diesel off when there is adequate wind, solar, etc.
• Training for system operators

Lab recreates a remote microgrid at full power levels (500 kW)
500 kW grid emulator:
- 480 VAC 600 A main bus
- 208 VAC 600 A secondary bus
- 12 main CB switch gear
- 1000 VDC 400 A DC bus
Facilitating technology transition
Helping communities define needs

Required for meeting objective 99% of times:
• 959 kW power capacity
• 58 kWh energy capacity
• High cycle life

Fuel savings for primary objective:
• 430-1150 gal/wk (med-high wind)
• Slight increase in stand-by fuel

Potential value add:
• Diesel demand smoothing
Where’s the technology come from?
Objectives:

• Build microgrid economy
• Provide accelerated pathways to commercial products that work
• Ensure that companies with good products survive
AK Center for Microgrid Technologies Commercialization (ACMTC)

- Economic Development Administration i6 Challenge award
- $500K EDA / $500K UA, July 2015 – July 2018
- Providing technical and business assistance to accelerate commercialization, and implementation, of technologies for affordable and reliable microgrid energy systems.

Guidance Document → Microgrid R&D Competition → Develop Sustained Microgrid Industry in AK

Extend Lab Capacity

Provide information and support to businesses
Round 1 awardees – in-work!

- UniEnergy Technologies
- DONμT Energy
- Ocean Renewable Power Corporation
Round 2 of competition is here

**Microgrid Project***

Up to 40 days R&D in the ACEP PSI (Power Systems Integration) Laboratory

(Lab days either going to 1 project or be split between 2 projects)

**Technology Seed Support**

R&D to commercialization review

3 small projects (for each with up to 125 man-hours)

**Microgrid Technologies Competition**

View the competition description.

**Competition Information Webinars**

August 4th, 2017 Webinar - Q&A
August 21st, 2017 Webinar - Q&A

**ACMTC Proposal Submission Guide and Budget Worksheet**

ACMTC Proposal Guidelines
ACMTC Proposal Budget Worksheet

Link at: acep.uaf.edu

Send all inquiries to ACMTC.QUESTIONS@ALASKA.EDU
Arctic Remote Energy Networks Academy (ARENA)

Putting the right information in the hands of the right people at the right stage of project development to accelerate viable local energy solutions

- Learning focused on real community energy projects
- Peer and industry interactions
- Tailored training & mentoring
- Visits to operating energy sites
- Pilot program: Jan-Sept 2017

arena.alaska.edu
Alaska Affordable Energy Study (AKAES)

Reports available online at http://www.akenergyauthority.org/

- Energy Efficiency Program Evaluation and Financing Needs Assessment
- LNG Feasibility for Alaska Affordable Energy Strategy Communities
- Documentation of Alaska-Specific Technology Development Needs
- Rural Utility Financial Analysis
- Fuel Transportation Improvement Report
- Barriers and Opportunities for Private Investment in Rural Alaska Energy Projects
- Sustainable Utilities Study
- True Cost of Electricity & Bulk Fuel In Rural Alaska
- Energy Costs & Rural Alaska Out-migration

"AEA investigated opportunities for delivering more affordable energy to non-Railbelt communities, the efficacy of existing energy programs, as well as policy and/or regulatory changes that have potential to contribute to more reasonably priced, safe, stable and reliable consumer energy."

[Source: University of Alaska Fairbanks]
Technology Needs

- Biomass
- Diesel Generator
- Energy Storage
- Heat Pump
- Hydroelectric Power
- Integration
- Organic Rankine Cycle
- Solar Photovoltaic
- Electrical Transmission
- Wind Power

Summary

- Technology trends
- Gaps and Barriers to Successful Project Development & Operation
- Recommendations
Barriers to Investment

Barriers

• Scale & population density
• Oil & transportation markets
• Historic availability of subsidies & grants
• Utility structure
• Terrain & climate
• Diversity of stakeholders
• Institutional knowledge
• Heterogeneous nature of projects

Recommendations

• #2 Project Specification Process that Facilitates Public-Private Partnerships for Energy Projects
• #3 Rural Energy Project Development Portal
• #5 Build Capacity & Mentorship to Improve “Bankability” of Communities
• #6 Use REF for High Risk, Early Stages of Project Development

“Private investment … is investment by financial entities and businesses rather than by government … includes both traditional loans, as well as direct private sector investment through public-private partnerships.”
AK Energy Efficiency Impact Forecast

- Alaska Energy Model - On-line resource
- Residential & non-residential, Power & heat
- Benefit & cost
- Community info

Alaska Affordable Energy Strategy

Non-residential energy efficiency forecast
- 151 of 265 communities have b/c > 1.0
- Total cost: $496M & **Net** savings: $418M
- Heating oil displaced: 12,517,468 gal/year
- Electricity displaced: 260,143,818 kWh/year

Source: http://model-results.akeneryinventory.org/current/Non-residential_Energy_Efficiency.html
Win-win opportunities?

• Shared challenges, needs & interests
• Related & complementary markets
• Places to start?
  – Use cases for Commercialization Center
  – Integrated testing & demonstration
  – Knowledge-sharing facilitation
  – Dual-use & net-zero synergies exploration
  – Technologies: energy storage, renewables, heat pumps, electric transportation, waste-to-energy, …
North to the future!

SAVE THE DATE!
April 9th - 12th, 2018
Westmark Fairbanks Hotel & Conference Center | Fairbanks, Alaska

http://www.akruralenergy.org
So, how about an energy crisis?

“Never let a good crisis go to waste”
(Winston Churchill)

“Action springs not from thought, but from a readiness for responsibility.” (Dietrich Bonhoeffer)

“Do what you can, with what you have, where you are.” (Theodore Roosevelt)
Thank you!

Suvisi?

(Sü-vī-see) in the Iñupiaq language means:
“What are the many people doing?”

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“If you want to walk fast, walk alone. If you want to walk far, walk together.” (African proverb)