



ACEP

Alaska Center for Energy and Power

ACEP Mission: Develop and disseminate practical, cost-effective, and innovative solutions for Alaska and beyond

Results-Driven Research for Alaska

March 26th, 2014

Gwen Holdmann, Director

Alaska Center for Energy and Power



Presentation Agenda

ACEP program and projects examples and overview

- Diesel fuel price benchmarking
- Assessment of Southeast-BC Intertie
- LNG – screening assessment for rural AK communities
- Private investment models for renewable energy in Alaska
- Small modular nuclear reactors – update
- A role for Independent Power Producers – an example from Nome
- others

Working Relationships (how we do business)

- State Agencies
- Industry

Funding energy projects

- Attracting private funding, and thoughts on the Renewable Energy Fund and proposed Rural Capital Energy Fund
- Emerging Energy Technology Fund – positioning Alaska in a global energy economy

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Who we are:

- 🔧 Organized 6 years ago under the Institute of Northern Engineering as 'Gateway' to Energy Research for UA
- 🔧 Based at UAF with a satellite office in Anchorage
- 🔧 20 dedicated staff (mostly engineers)
- 🔧 35 affiliated faculty and 50 students

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ACEP is a revenue center, not a cost center

- ACEP has received a total of \$3.1M through UA operating budget (over 6 years)
- ACEP has received a total of \$26M in grants and contracts during this period
- Where has this funding gone?
 - ~40% to fund 100+ small Alaska-based businesses to support research enterprise
 - ~40% to fund researchers throughout UA system (not just within ACEP)
 - ~20% to fund base University operating costs (\$6M)

Role of ACEP and the University of Alaska



Developing information for decision makers

- Technology testing and optimization (industry)
- Energy analysis (policy makers, communities)
- Data management



Preparing students to work in energy-related disciplines



Commercializing energy innovation

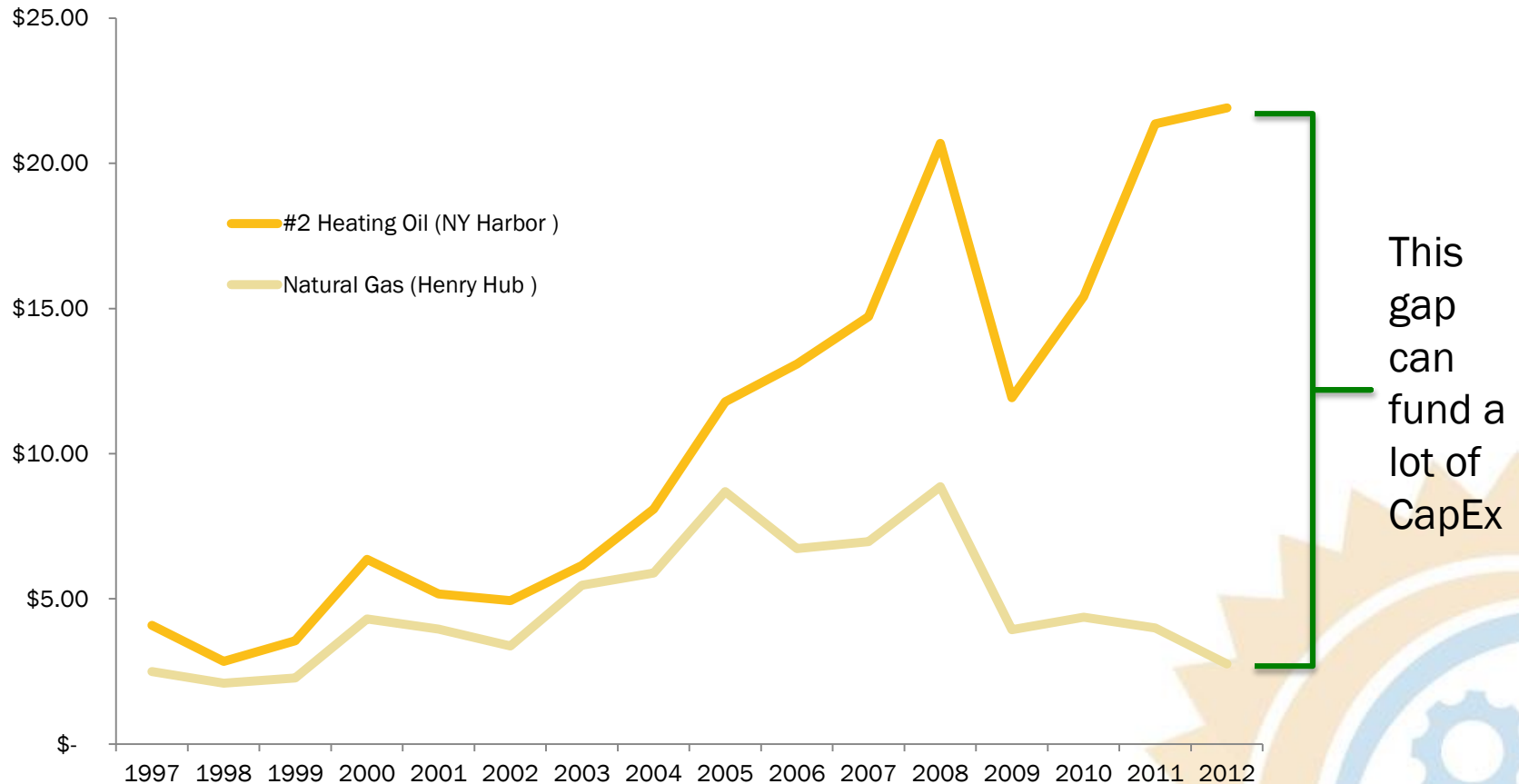


Energy Analysis Group: Examples of Ongoing Projects

-  Diesel fuel price benchmarking
(Helps with comparative economic analysis)
-  Assessment of Southeast-BC Intertie
(Report from AEA is forthcoming)
-  Private investment models for renewable energy in Alaska
(Private money can sometimes offer better rates)
-  LNG screening assessment for coastal Alaska communities

Why small scale LNG now?

Comparative Commodity Costs, \$/MMBtu



Screening-Level Evaluation of LNG for Coastal PCE Communities

- ⚙️ Assessment framework – keeping it simple(er)
 - Electric utility loads only (commercially simpler)
 - Coastal communities (logistically simpler)
 - ISO containers (“plug & play”)
- ⚙️ Can LNG work in this framework (worst case!)?
 - Can we get to 10,000 MMBtu/day in load (supports favorable shipping economics)?

How big is SE & SW AK utility demand?



Small!

- Insufficient to get to 10,000 MMBtu/day



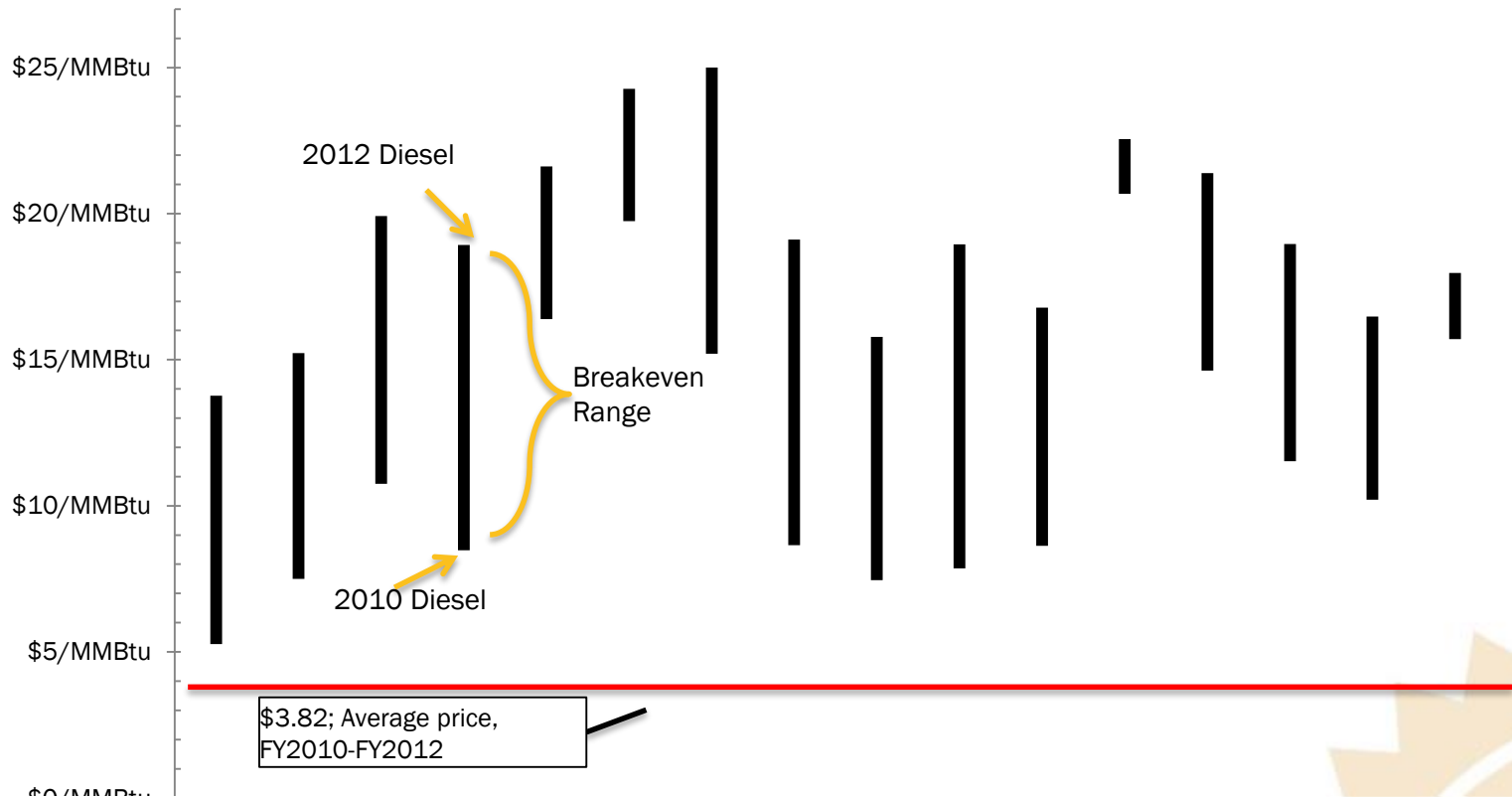
Total annualized demand ≈4,000 MMBtu/day

- 50% of this met by 3
- 65% of this met by 6
- 75% of this met by 10
- 95% of this met by 30 (cutoff for smallest communities)

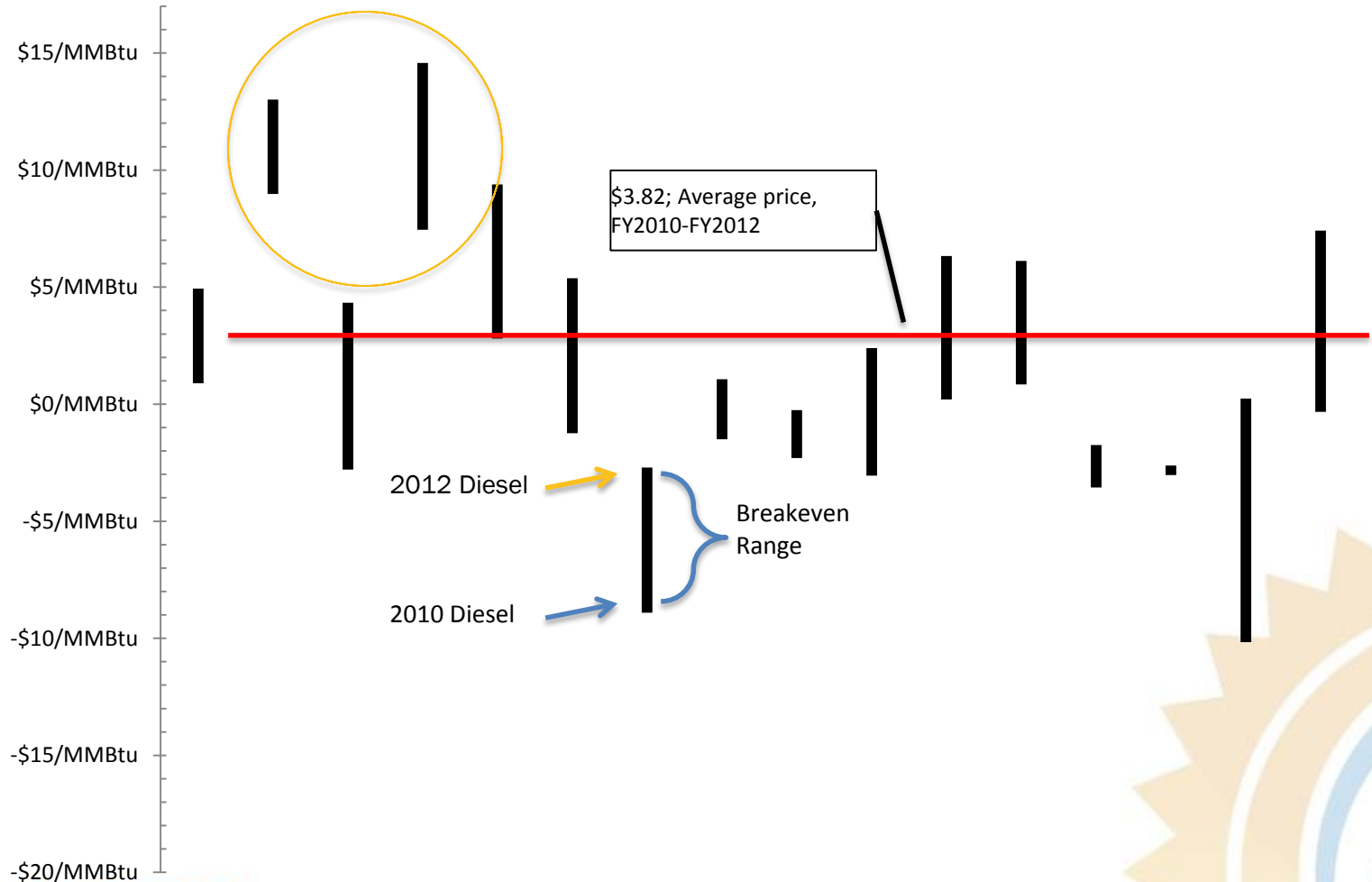
	MMBtu/day	Cumulative %
Unalaska/Dutch Harbor	1,005	24.98%
Naknek, South Naknek, King Salmon	512	37.71%
Dillingham	480	49.65%
Cordova	311	57.37%
Yakutat	160	61.34%
Hoonah	119	64.31%
St. Paul	117	67.22%
Sand Point	95	69.59%
Adak	94	71.94%
Togiak	82	73.97%
Cold Bay	81	75.99%
Kake	78	77.93%
Craig	73	79.75%
Hooper Bay	71	81.50%
King Cove	69	83.23%
Toksook Bay	67	84.89%
Angoon	50	86.14%
Scammon Bay	44	87.23%
Quinhagak	42	88.28%
Kwigillingok	32	89.09%
Kongiganak	28	89.77%
Nunam Iqua	27	90.45%
Chignik (Bay)	27	91.11%
Port Heiden	23	91.69%
Mekoryuk	22	92.23%
Pelican	21	92.75%
Goodnews Bay	20	93.26%
Egegik	20	93.76%
Old Harbor	20	94.26%
False Pass	20	94.76%
St. George	19	95.23%
Akutan	17	95.65%
Tatitlek	16	96.05%
Ouzinkie	15	96.43%
Pilot Point	15	96.80%
Nelson Lagoon	15	97.16%
Chignik Lake	14	97.52%
Twin Hills	14	97.87%
Chignik Lagoon	14	98.21%
Naukati	13	98.54%
Tenakee Springs	12	98.84%
Atka	11	99.11%
Perryville	10	99.36%
Chenega (Bay)	9	99.59%
Elfin Cove	9	99.81%
Pedro Bay	7	100.00%
Total	4,022	



Break-even Natural Gas Prices for Select **Ice-free** Communities Given FY2010 & 2012 Diesel Costs



Break-even Natural Gas Prices for Select **Ice-bound** Communities Given FY2010 & 2012 Diesel Costs



Some takeaways

- ⚙️ Economies of scope and scale matter
 - Project must aggregate larger (and industrial) loads to start
 - Economics for smaller loads in ice-free communities may work, but larger-project must first be commercially assembled
- ⚙️ Efficiency of use matters; scale can sometimes overcome
 - Economics for ice-bound communities are challenged
 - Ice-bound communities with larger demand (e.g. Dillingham) may get enough economies of scale from bulk (non-ISO) storage
- ⚙️ Reasonable to expect:
 - Unalaska/Dutch – Dillingham – Naknek bulk (non-ISO) project
 - ISOs for proximal communities may follow
 - SE ISO project with PCE utility needs met by ISOs will need:
 - SE industrial anchor tenant(s), or
 - Backhaul from Unalaska



ACEP Focus Areas

ACEP is an honest broker (and developer) of information to help clarify choices and assist with decision making related to energy technologies and options



**Community Energy
Solutions**



**Powering the
Economy**



**The EnergyField of
the Future**

ACEP Focus Areas

	 Community Energy Solutions	 Powering the Economy	 The EnergyField of the Future
Testing & optimization			
IP Development			
Analysis and Planning			
Student involvement			

Testing and System Optimization



Both in the laboratory and in the field

Recent lab-based examples include: Electratherm, Sustainable Automation grid-forming inverter, Prudent Energy flow battery, Williams flywheel (next up)



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ACEP Energy Technology Lab (L) and Premium Power Installation in Kotzebue (R)

Example: Geothermal → Industrial Process Energy

Using Organic Rankine Cycle technology for waste heat recovery



Electratherm testing at UAF



Electratherm
50kW ORC
System



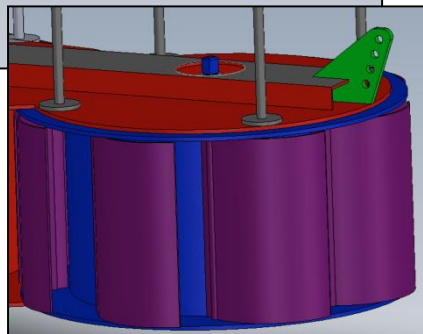
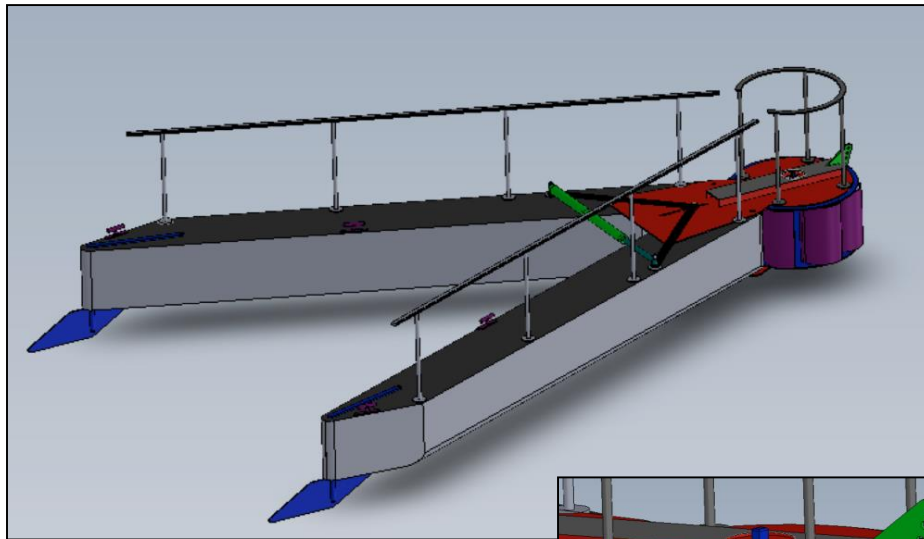
Pratt & Whitney 280 kW ORC System



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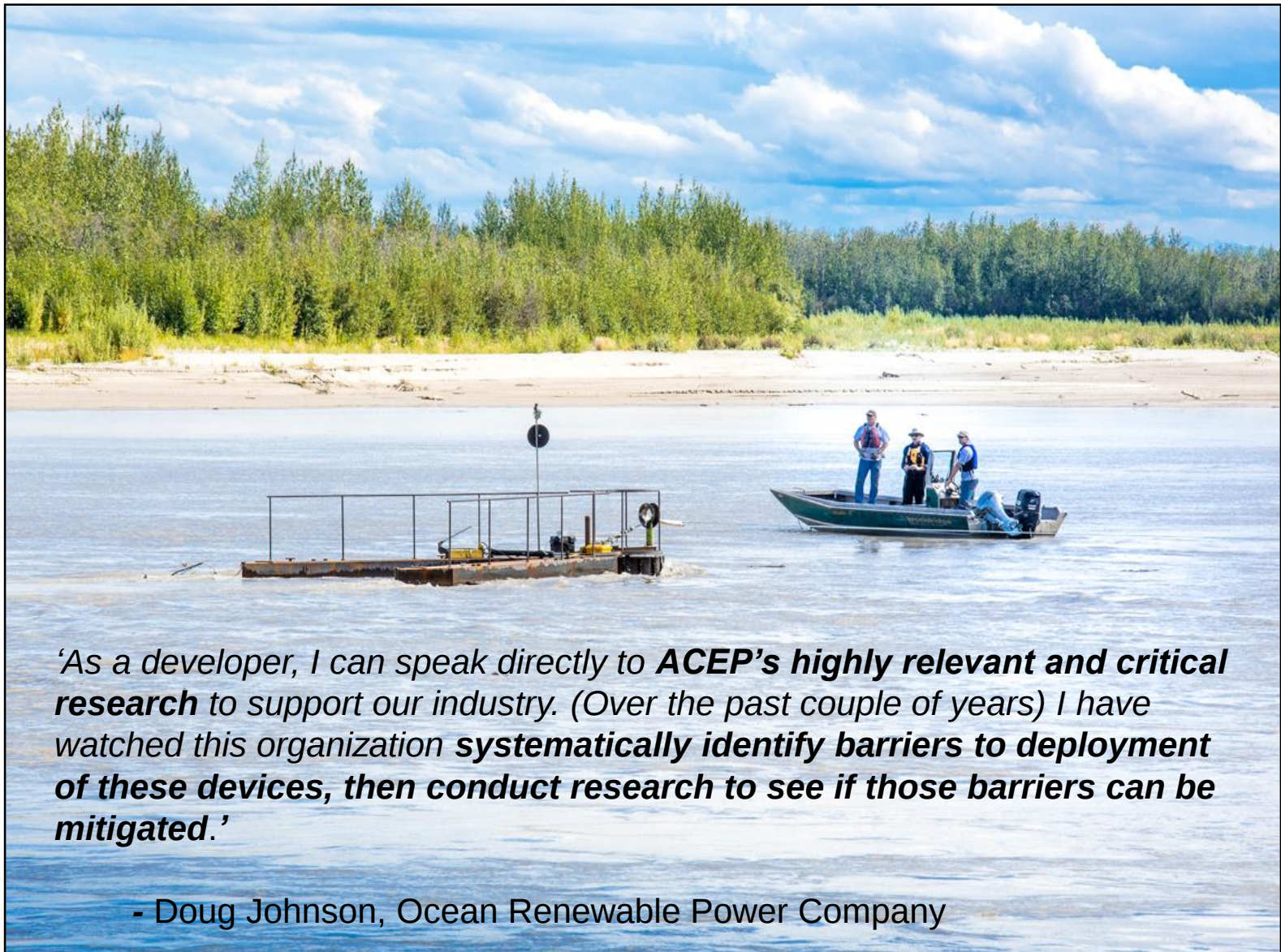
Development of IP with Alaska applications

ACEP has developed a device to divert surface debris from a surface deployed hydrokinetic device



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Development of IP with Alaska applications

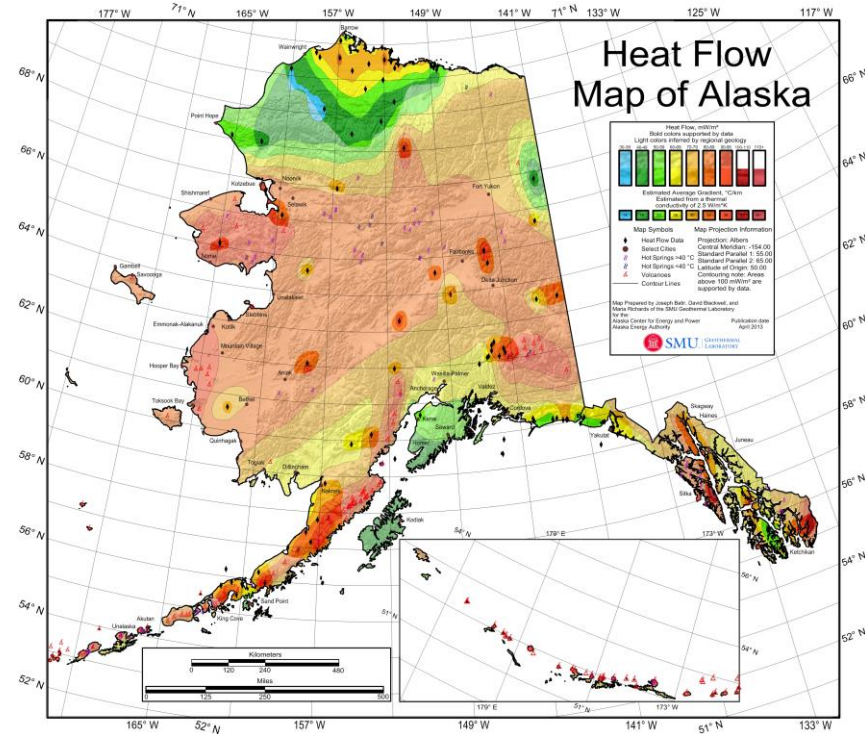


*'As a developer, I can speak directly to **ACEP's highly relevant and critical research** to support our industry. (Over the past couple of years) I have watched this organization **systematically identify barriers to deployment of these devices, then conduct research to see if those barriers can be mitigated.**'*

- Doug Johnson, Ocean Renewable Power Company

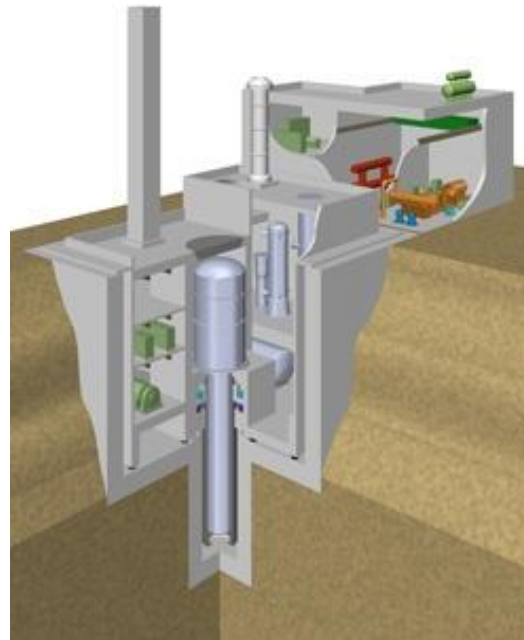
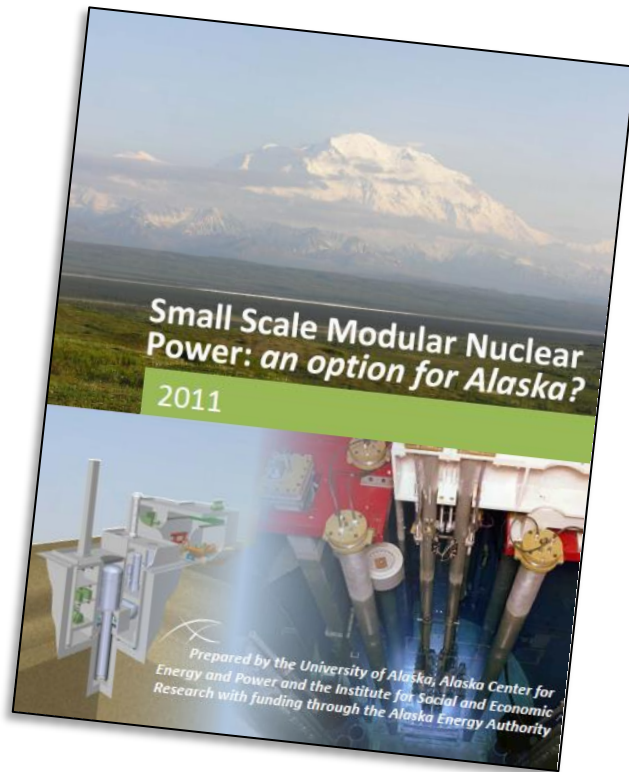


Technology Analysis: Ground and Seawater Source Heat Pumps



ACEP has compiled data and completed technical evaluations of operating systems statewide – these reports have been downloaded and used extensively. ACEP has also collected data statewide to update our understanding of heat flow. *In collaboration with: AEA, the Denali Commission, CCHRC, the Seward Sealife Center, and Southern Methodist University.*

Technology Analysis: Small Modular Nuclear Reactors



Proposed Toshiba 4S reactor (10MW, proposed for Galena)

In 2011, ACEP completed a comprehensive report on the potential for using small modular reactor technology for Alaska. We continue to track this technology, and are sending 3 UAF graduate students to Idaho National Lab to participate in the design of a 1MW system for space applications. *In collaboration with ISER (UAA).*

ACEP Projects are Statewide

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

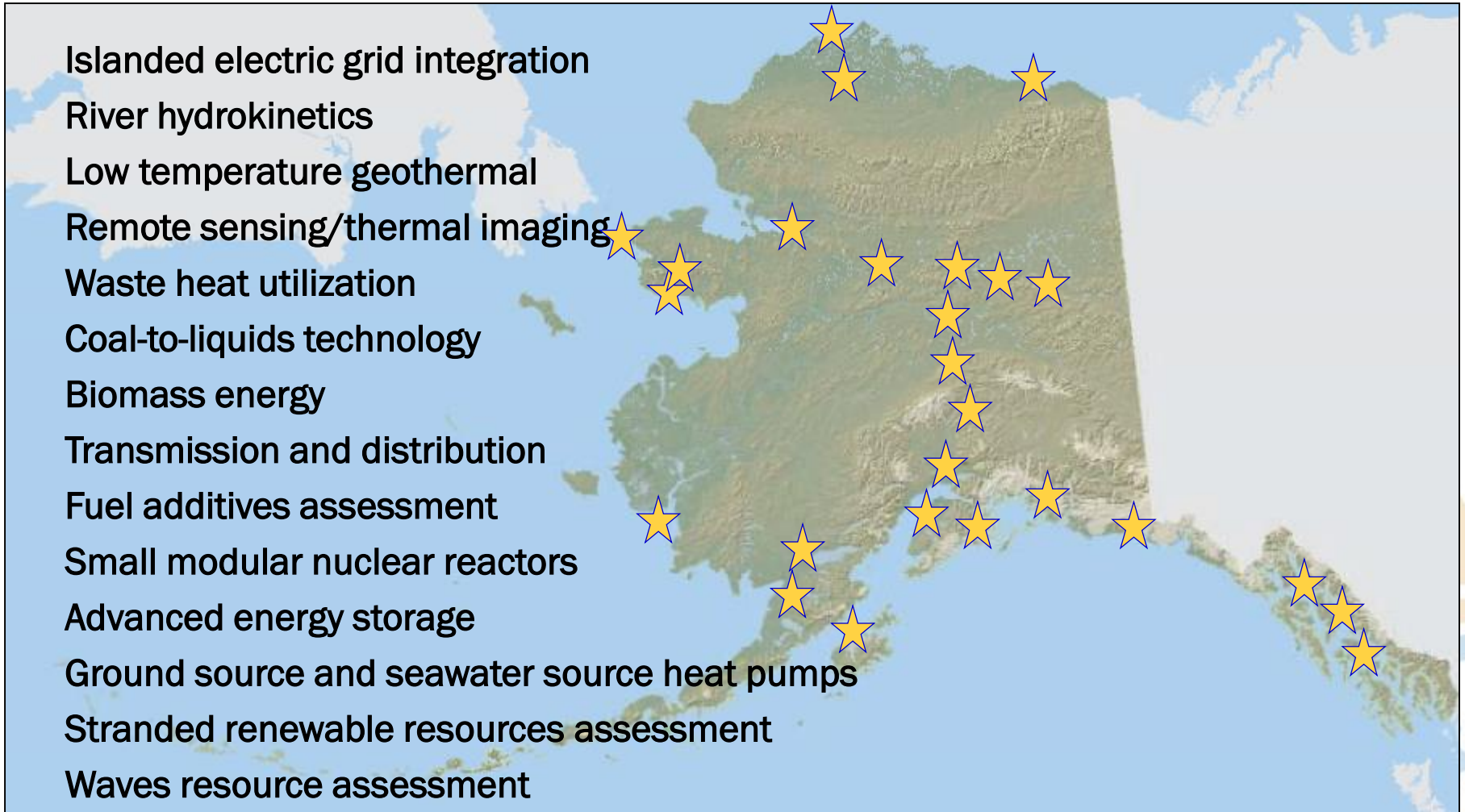
Small modular nuclear reactors

Advanced energy storage

Ground source and seawater source heat pumps

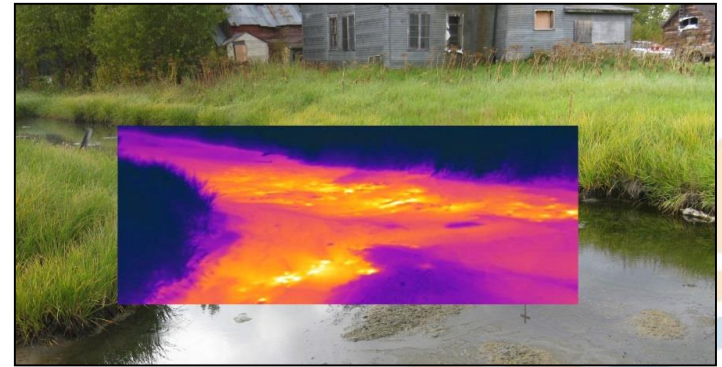
Stranded renewable resources assessment

Waves resource assessment



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Example: Geothermal Energy for Nome



Clockwise from left: ACEP shallow drilling program; confirmation drilling program in 2013, community meeting in Teller; thermal mapping of region.

ACEP been involved in multiple aspects of assessing geothermal energy as an option for Nome, including an extensive resource assessment, economic analysis, fuel pricing, and integration with existing generation sources. *In collaboration with: AEA, US DOE, Unaatuq, BSNC, NSEDC, the City of Nome and NJUS, SNC, WMNC, TNC, MINC, USGS*

Project Financing- A Role for Independent Power Producers – Lessons from Nome



Above: Binary power plant at Chena Hot Springs. Right: Two turbines from BSNC wind farm at Banner Peak in Nome. Note turbine repairs to tip breaks taking place in winter conditions.



Nome has been purchasing power from BSNC via a power purchase agreement for several years and is in the process of entering into a second PPA with a subsidiary of Potelco, Inc for the possible development of a geothermal project. If developed, as much as \$40M in private financing could be invested in energy infrastructure to serve Nome, and to provide a substantial portion of the utilities' base load needs.

Thoughts on Proposed Rural Energy Capital Energy Fund (HB 277/SB 138)

Initial Analysis by AEA would entail:

- 1) Develop a plan for developing infrastructure to deliver more affordable energy to areas of the state that are not expected to have direct access to a North Slope natural gas pipeline.
- 2) Recommend a plan for funding the design, development, and construction of the required infrastructure, and may identify a source of rent, royalty, income, or tax received by the state that may be appropriated by the legislature to implement the plan.
- 3) Provide the plan and suggested legislation for the design, development, construction, and financing of the required infrastructure to the legislature before January 1, 2017.



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VISION: Alaska leading the way in innovative production, distribution, and management of energy



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What does this mean?

-  We are maximizing production of our oil and gas resources
-  We are developing local resources wherever practical
-  We are using innovative financing mechanisms to incentivize private sector investment in Alaskan project
-  Diesel-off is common place in our rural communities
-  Experience gained by solving Alaska's energy challenges is exported (knowledge-based economy)



Iceland – World leader in geothermal energy



Creating opportunities at home & abroad

- Over 80 companies involved in geothermal industry (exploration, development)
- Provides free education to students from countries with undeveloped geothermal potential
- Pipeline for business opportunities for Icelandic businesses in emerging markets
- High quality jobs, energy sector significant contributor to GDP

Supporting Statewide Economic Development: *Alaska's comparative advantages*

- ⚙️ High contribution renewables
- ⚙️ Difficult to extract/transport fossil fuels
- ⚙️ Value added processing
- ⚙️ Niche technologies (low temp geothermal, hydrokinetics)



Funding Energy Research is a Critical Component to a Healthy Business Ecosystem

- ⚙️ Emerging Energy Technology Grant Fund – funding pilot and demonstration projects
- ⚙️ University-based research in energy (including support for extractive industries) – creating value
- ⚙️ Example from Texas – sustainably funded research through STARR program



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