03/26/14 Presenta-tion: Alaska Center for Energy and Power

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Alaska Legislature
House Special Committee on Energy

Rep. Charisse Millett
State Capitol Building, Room 403
Juneau, AK 99801
Phone (907) 465-3879
Fax (907) 465-2069
rep.charisse.millett@akleg.gov

Rep. Doug Isaacson
State Capitol Building, Room 13
Juneau, AK 99801
Phone (907) 465-4527
Fax (907) 465-2197
rep.doug.isaacson@akleg.gov

AGENDA

State Capitol Building, Room 124
Juneau, Alaska

Wednesday, March 26, 2014, 8:00 a.m. – 10:00 a.m.

\+ **Alaska Center for Energy and Power (ACEP)**
Presenters – Gwen Holdmann, Director and Antony Scott, Energy Economist

ACEP program and projects overview
ACEP working relationships state and industry
Funding energy projects

* First hearing in first committee of referral
\+ Teleconferenced
= Bill previously heard/scheduled

If you or your staff has any questions please contact Katherine Eldemar at (907) 465-4527 (katherine.eldemar@akleg.gov) or Jeff Turner at (907) 465-6588 (jeff.turner@akleg.gov).

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ACEP

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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

UNIVERSITY OF ALASKA FAIRBANKS

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

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)

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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**

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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

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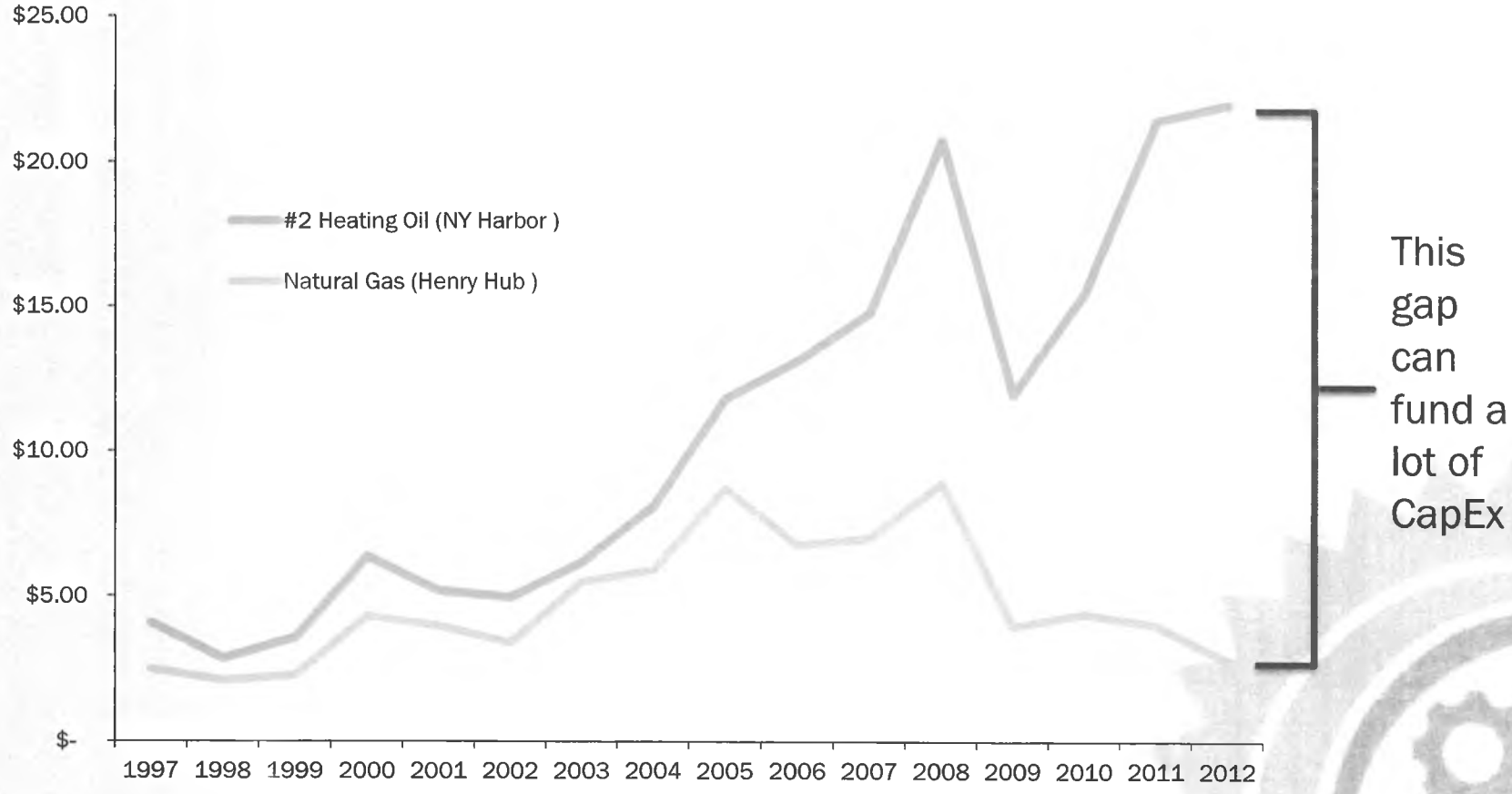
Why small scale LNG now?

Comparative Commodity Costs, $/MMBtu



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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)?

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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	511	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	

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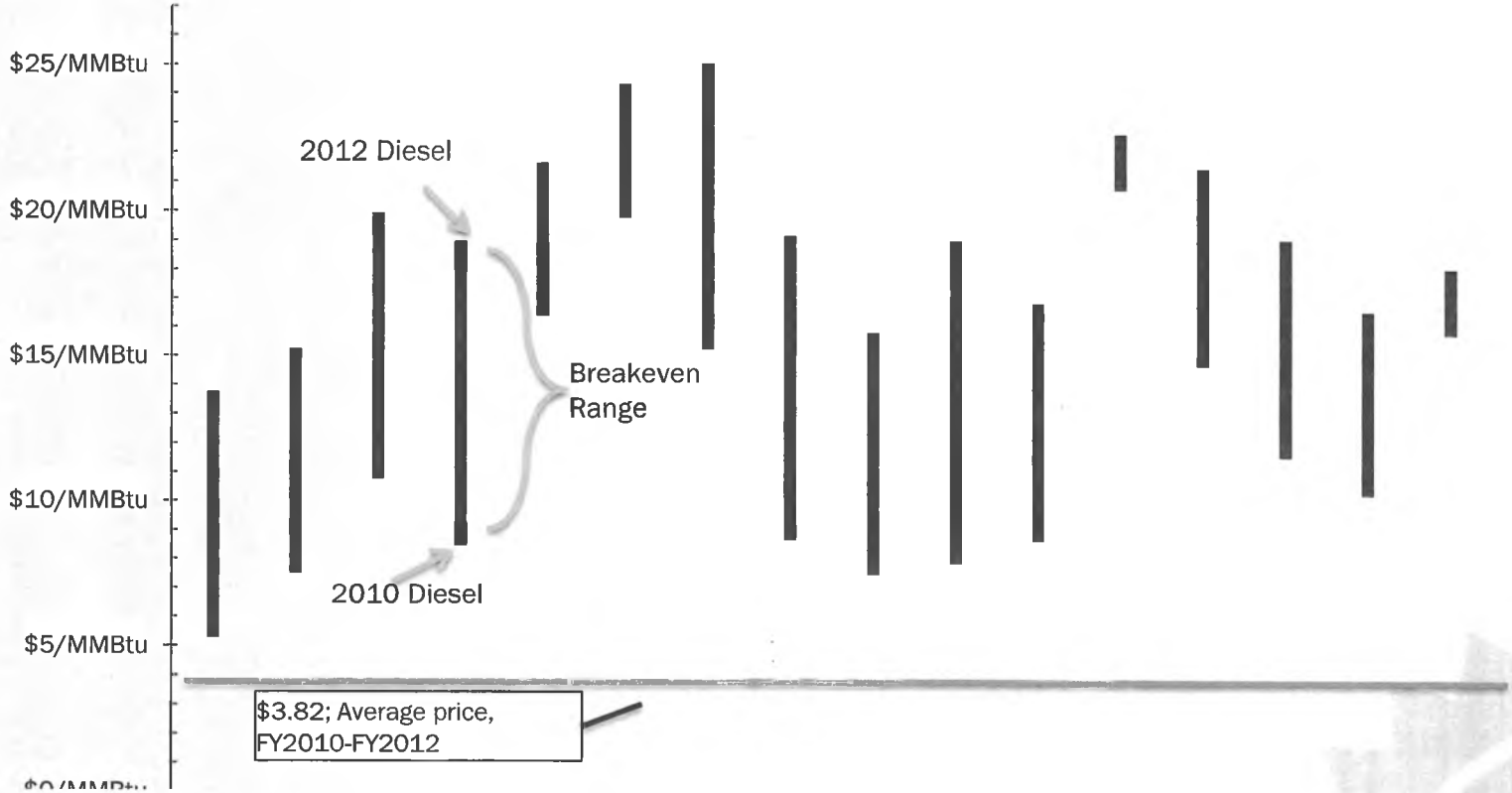
Break-even Natural Gas Prices for Select Ice-free Communities Given FY2010 & 2012 Diesel Costs



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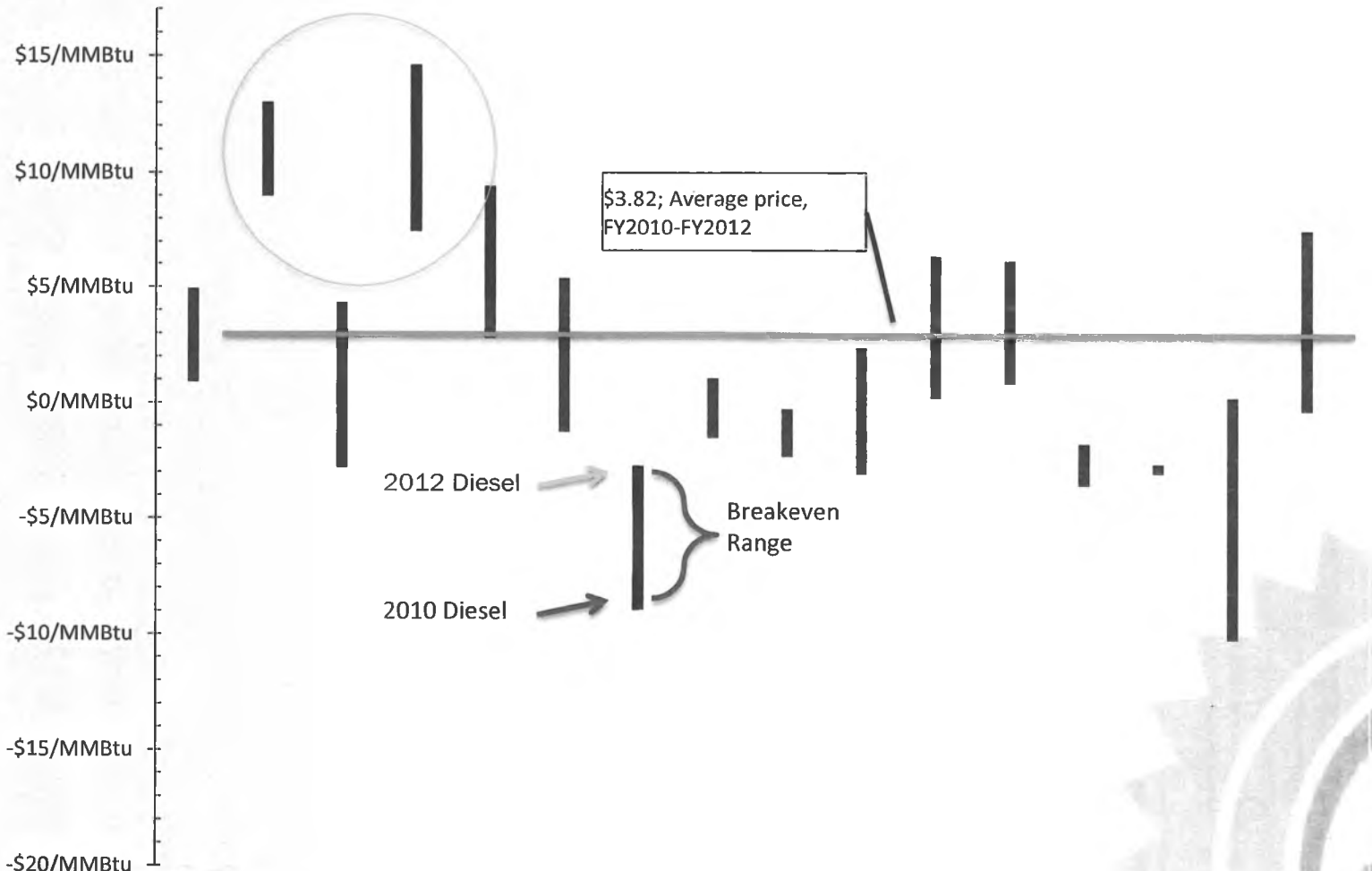
Break-even Natural Gas Prices for Select Ice-bound Communities Given FY2010 & 2012 Diesel Costs



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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

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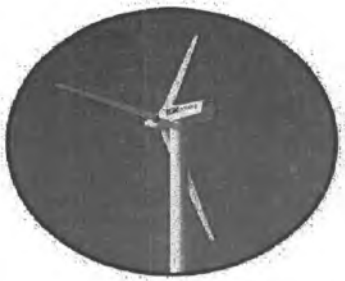
ACEP Focus Areas

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

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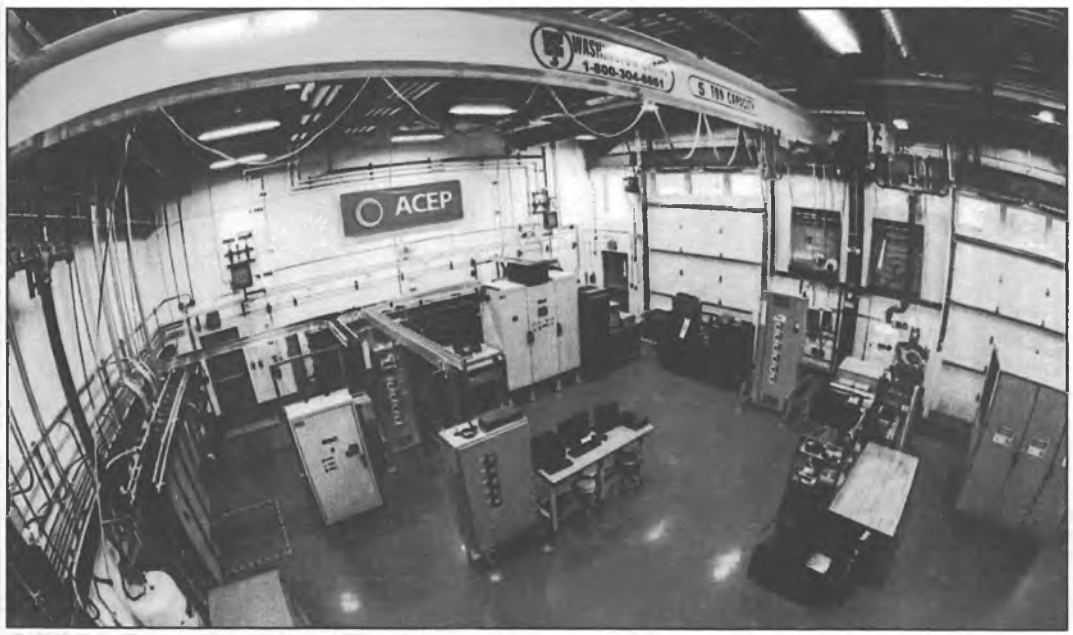
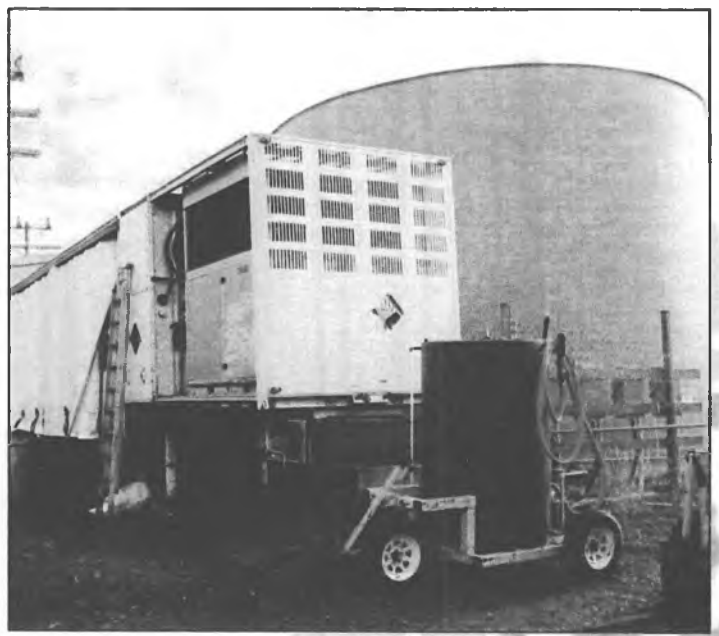
Testing and System Optimization

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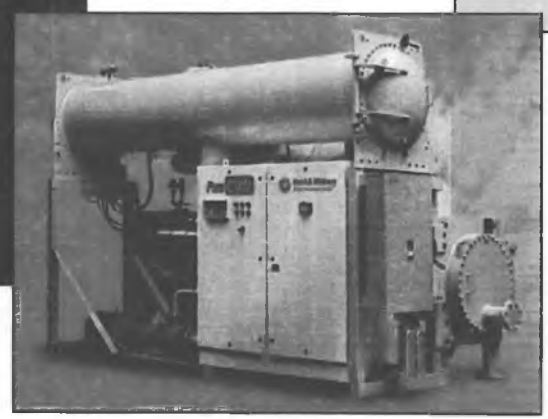
ACEP Energy Technology Lab (L) and Premium Power Installation in Kotzebue (R)

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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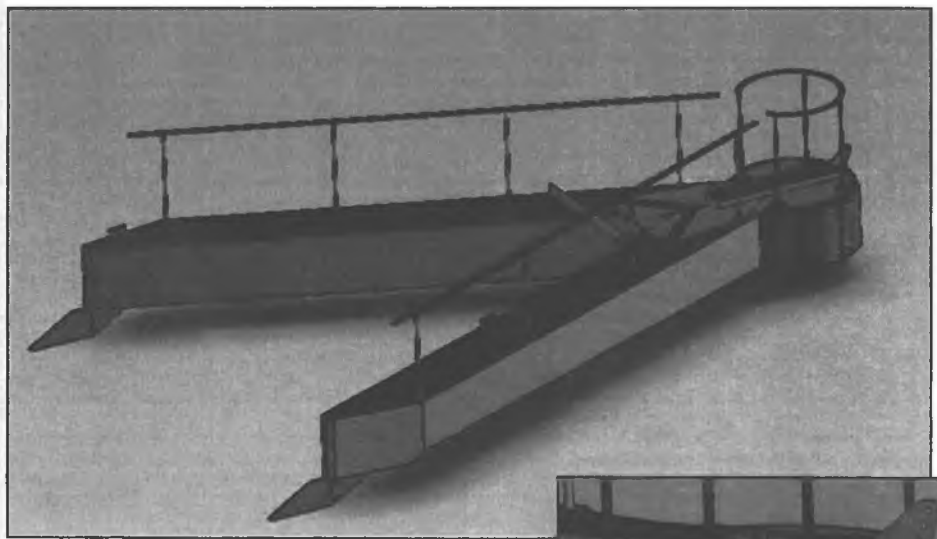
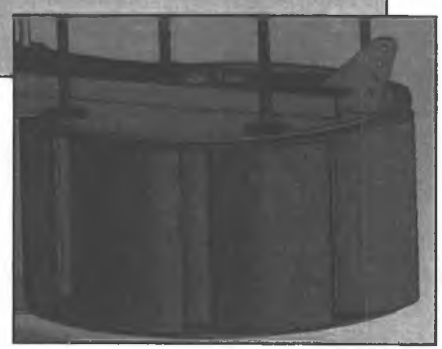
Development of IP with Alaska applications

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





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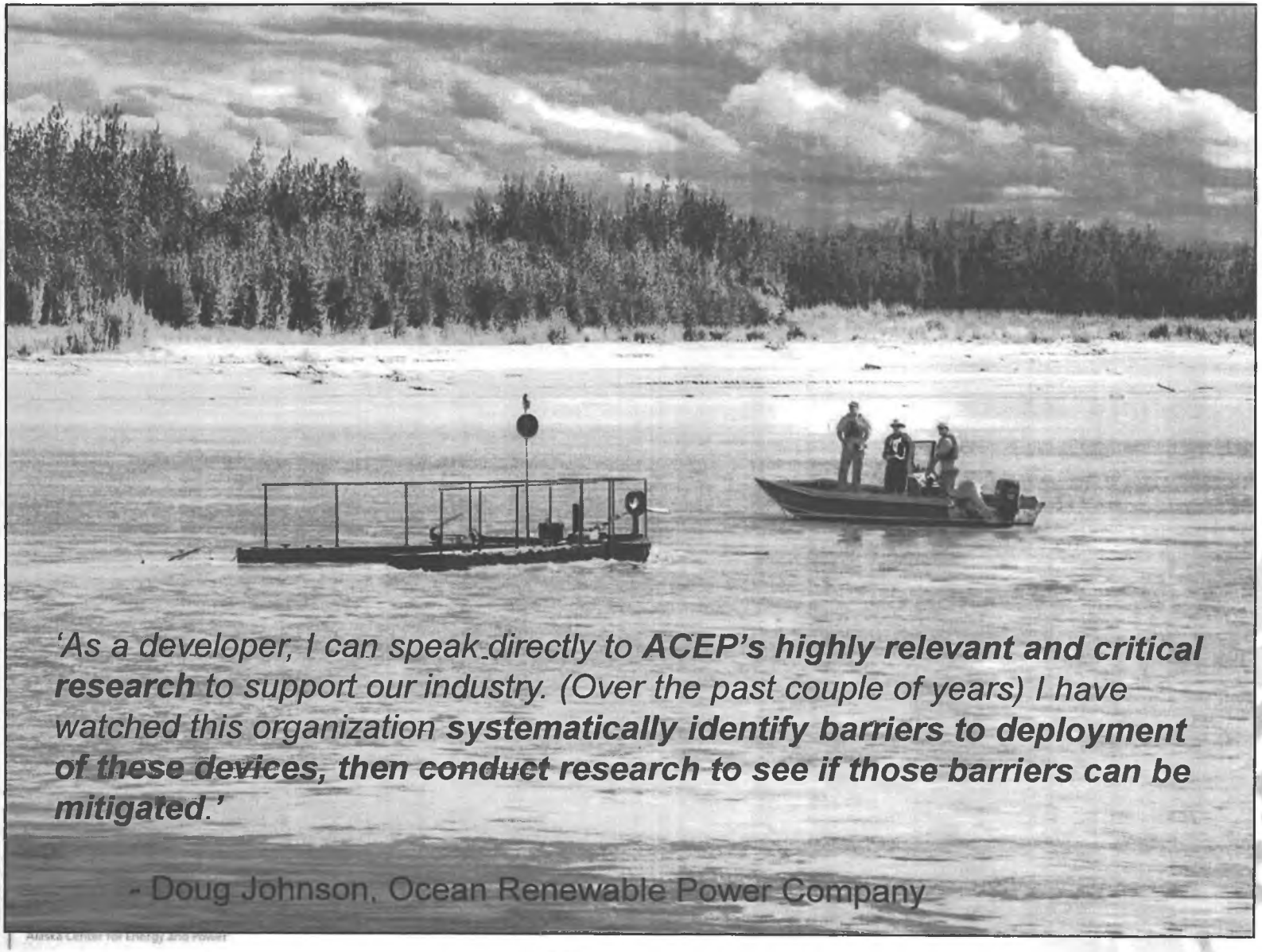
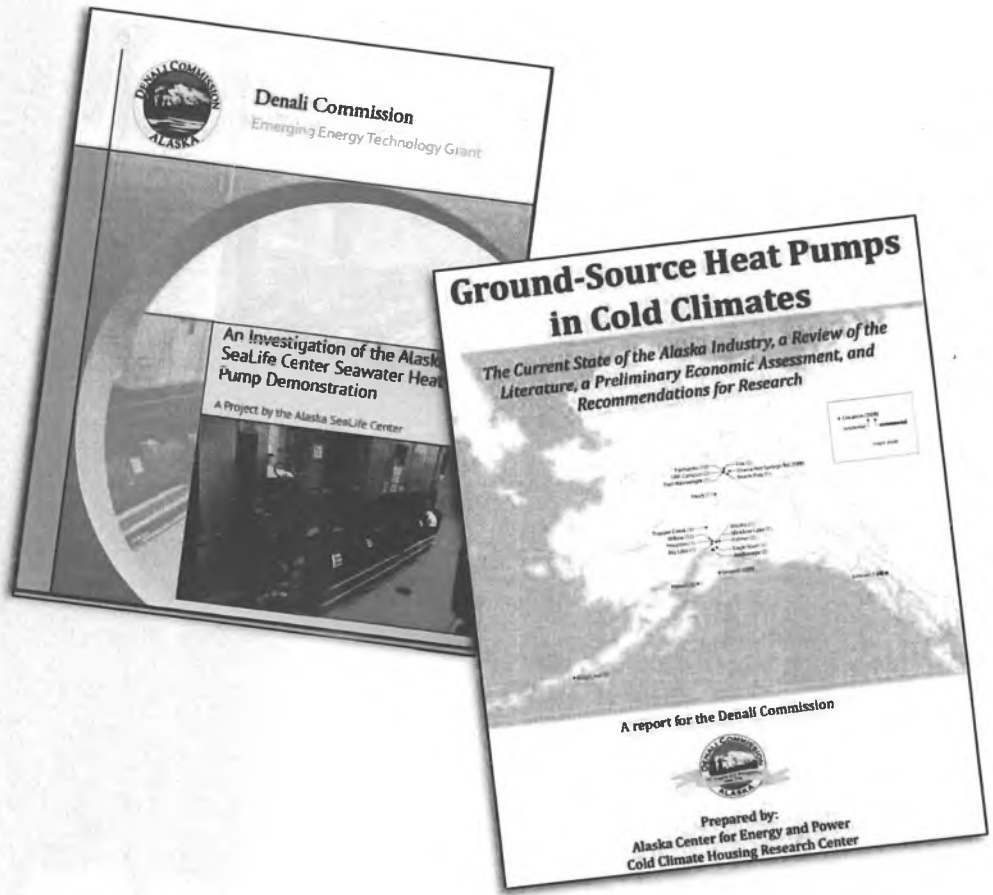
Development of IP with Alaska applications

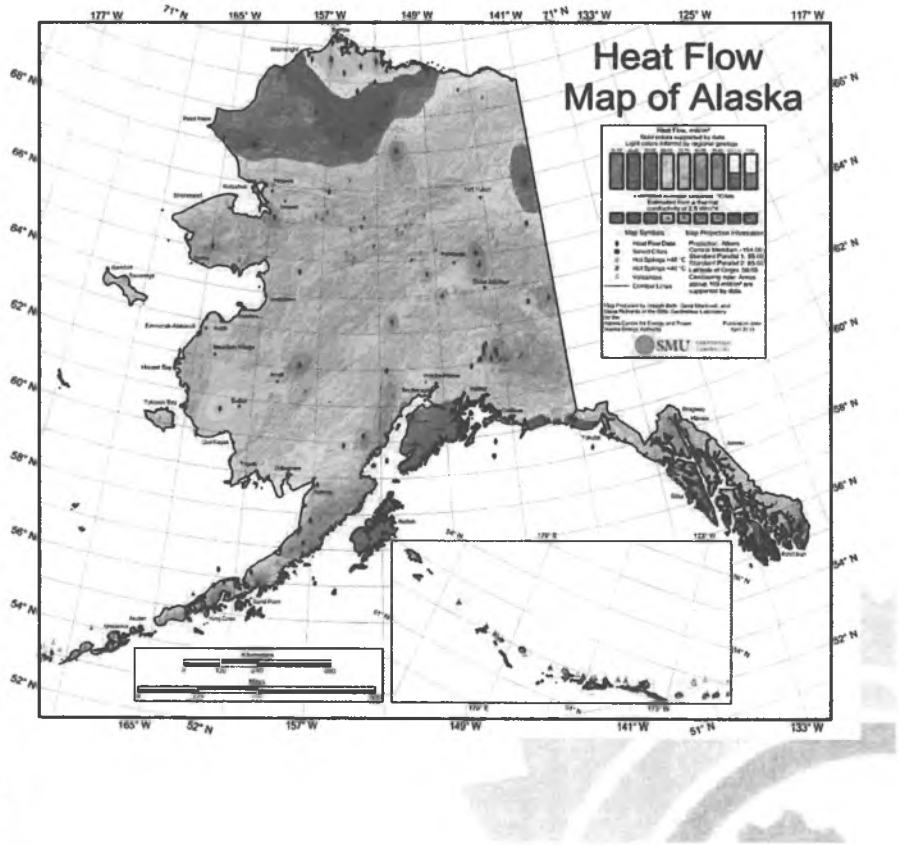


*'As a developer, I can speak directly to **ACEP's highly relevant and critical research** to support our industry. (Over the past couple of years) I have watched this organization **systematically identify barriers to deployment of these devices, then conduct research to see if those barriers can be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

- Doug Johnson, Ocean Renewable Power Company

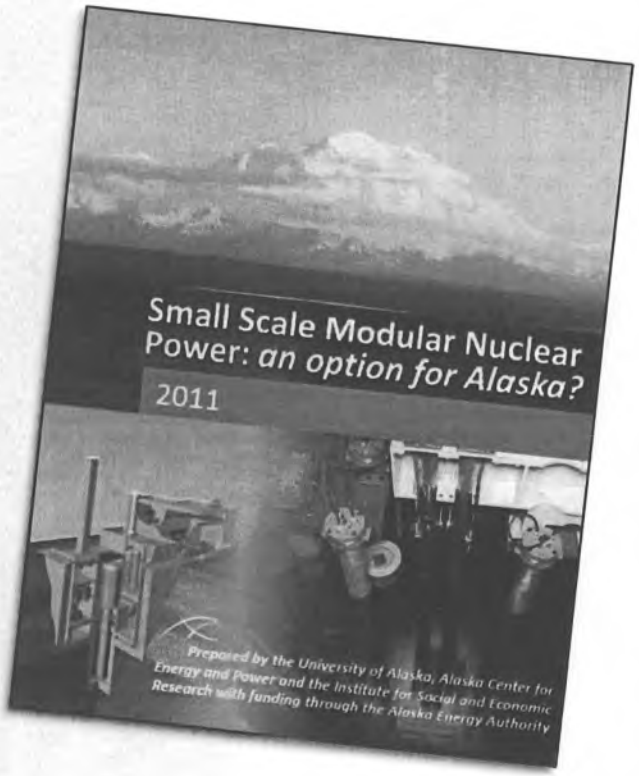
Technology Analysis: Ground and Seawater Source Heat Pumps

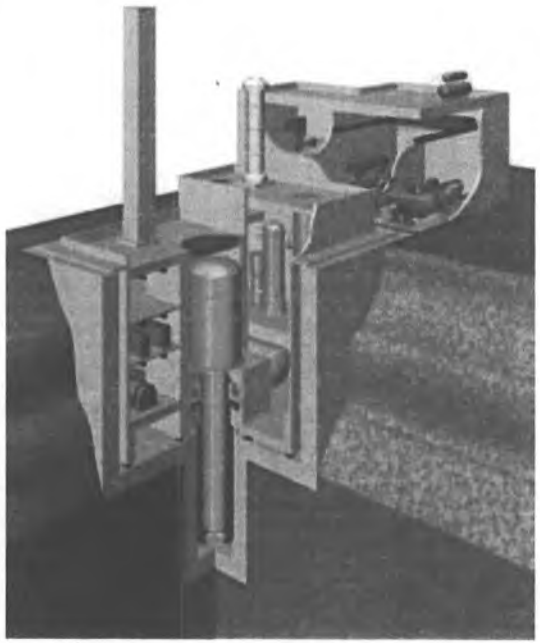




ACEP has compiled data and completed technical evaluations of operating systems statewide – these reports have been downloaded and used extensively. ACEP has also collected data statewide to update our understanding of heat flow. *In collaboration with: AEA, the Denali Commission, CCHRC, the Seward Sealife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

Technology Analysis: Small Modular Nuclear Reactors

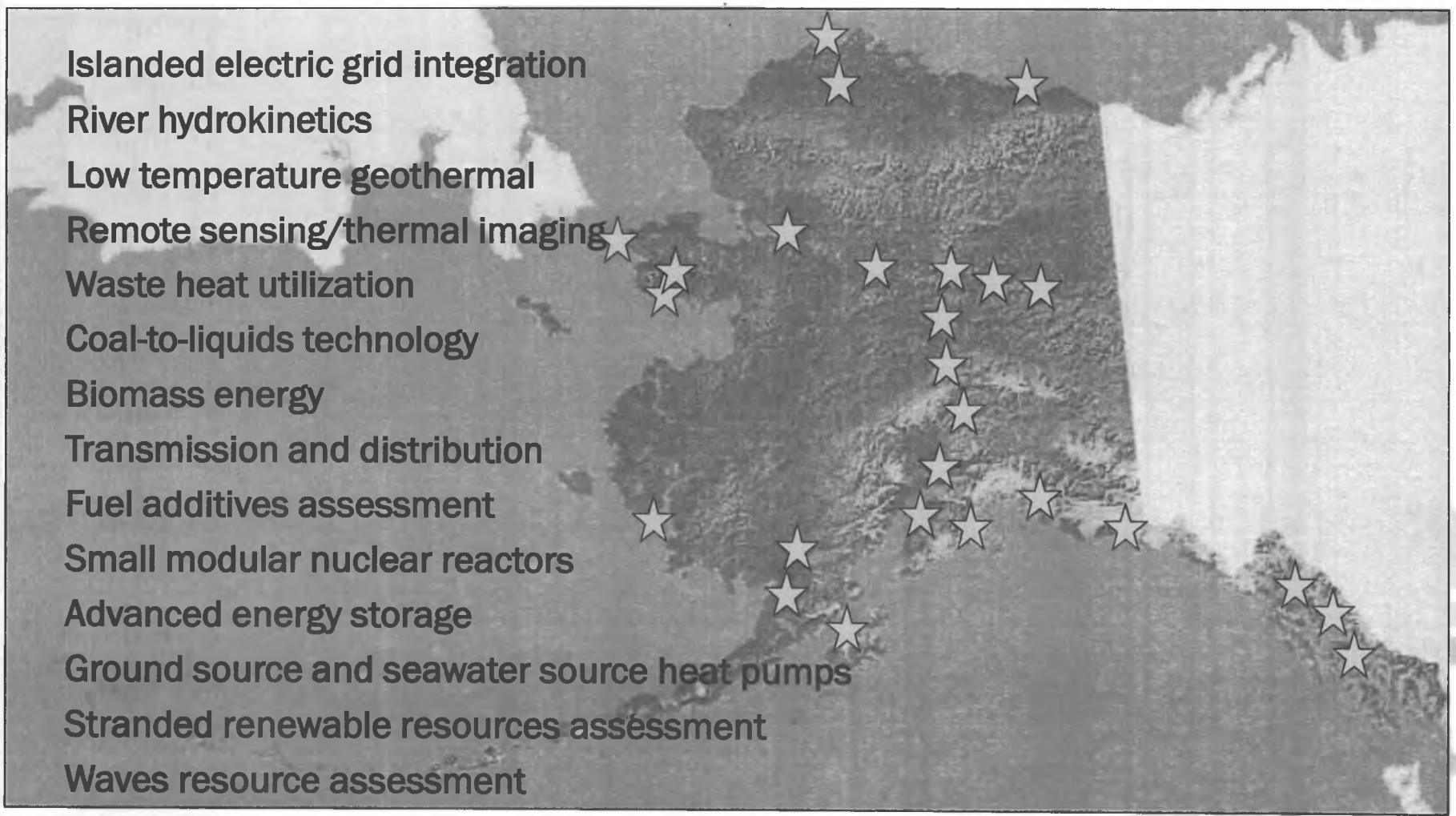




Proposed Toshiba 4S reactor (10MW, proposed for Galena)

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



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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

POTELCO INC
A Quanta Services Company

QUANTA SERVICES

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)

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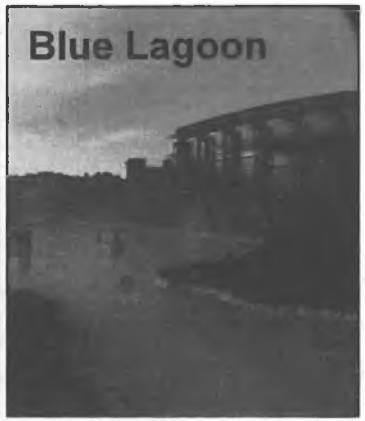
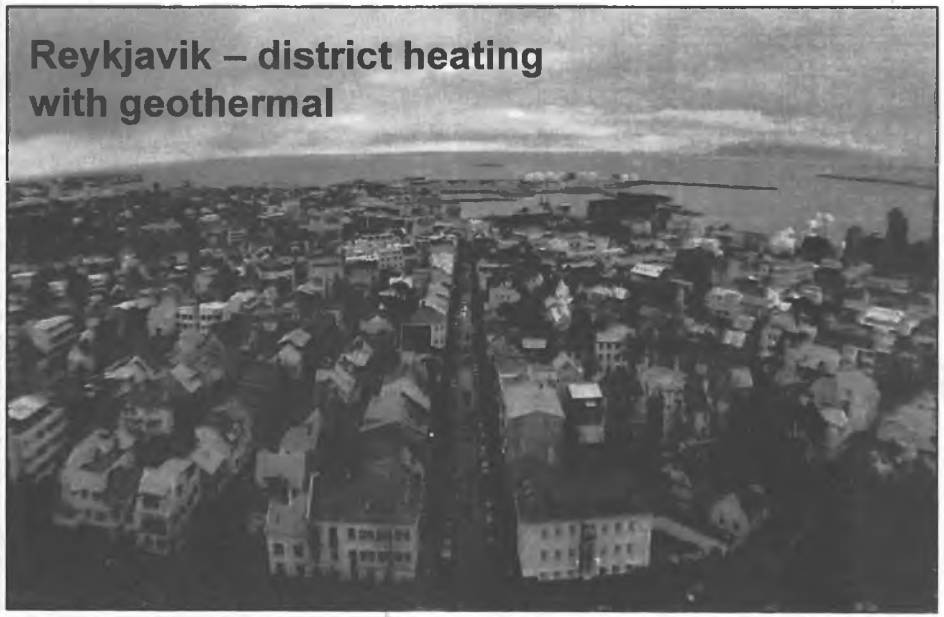
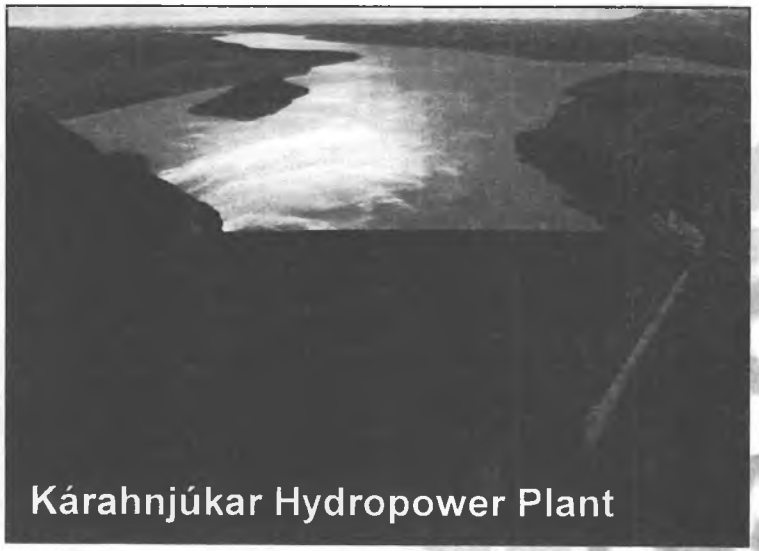
Iceland – World leader in geothermal energy







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

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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)

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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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For more information contact:

Gwen Holdmann
Director, Alaska Center for Energy & Power
University of Alaska
Tel: (907) 474-5402
E-mail: gwen.holdmann@alaska.edu

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