1/27/12 UPDATE: RENEWABLE ENERGY PROJECT AND TECHNOLOGY

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A Brief Report to the Alaska Energy Authority

On the Installation of a Geothermal Heat Pump System at

Juneau International Airport

Prepared by Douglas Murray, PE and

Catherine Fritz, JNU Airport Architect

January 19, 2012

Jeannie Johnson, Airport Manager 789-7821

Murray & Associates, P. C. *Consulting Engineers*

PO Box 21081, Juneau, Alaska 99802-1081 (907) 780-6151 Fax: (907) 780-6182

Background.

In 2008, the Juneau International Airport (JNU) received grant funding in the amount of $513,000 to assist in the construction of a geothermal heat pump system for the heating, cooling, and ventilation needs in the airport terminal. This work was part of a multi-phase renovation and expansion of the airport terminal. The loop field was designed by mechanical engineer, Douglas Murray, PE. The life cycle cost analysis (basis of AEA grant application) was developed collaboratively by Mr. Murray and mechanical engineer James Rehfeldt, PE.

The geothermal loop field is located under the pavement of the commuter plane airfield ramp. It consists of 108 vertical borings to a depth of 350 feet each (fig 1). A mix of 88% water and 12% methanol circulates through a continuous underground loop of more than 16 miles of HDPE piping. The piping enters the building and is distributed to 31 electric heat pumps that provide heating, cooling, and ventilation to interior spaces, as well as heat to the building's front sidewalk that prevents build-up of ice and snow. The heat pumps are digitally controlled to efficiently respond to changing air conditions.

Construction of the loop field was completed in the fall of 2009. Installation of the heat pumps inside the building began in early 2010 and continued alongside other renovation work until May, 2011.

Figure 1. Vertical borings for JNU Airport loop field. *Image courtesy of JNU staff*

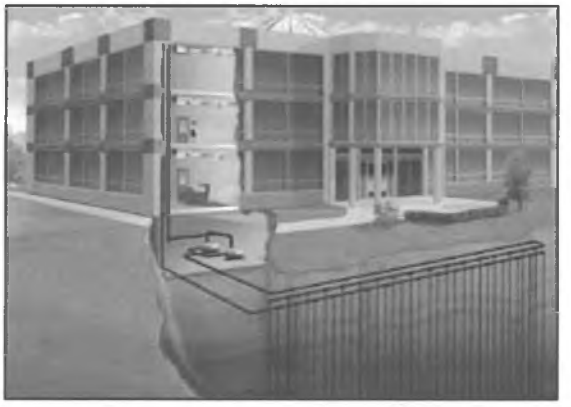


Figure 2. Schematic rendering of closed loop heat pump system. *Image from www.mcquay.com*

Performance Data.

The completed geothermal heat pump system has not yet been operating under design conditions long enough to draw substantive conclusions. Additionally, nearly half of the 96,000 sq. ft. building area is not using the new geothermal system and will continue to be served by diesel boilers until funds can be obtained to replace these older portions of the terminal. Regardless of these obstacles, data gathered to date show promising evidence of a successful conversion from traditional diesel fired boilers to renewable geothermal heat pumps. Preliminary findings are documented below.

Diesel Fuel Usage:

A decrease in diesel fuel usage since installation of the geothermal heat pump system can be seen in fig. 3 below. Fiscal years are highlighted by color in order to provide two methods by which to compare diesel usage through seasonal cycles. The geothermal heat pump installation was fully operational in May, 2011, so calendar year 2011 represents the best available period of post-construction data; Calendar year 2008 represents a full 12 month period prior to any installed heat pumps.

MONTH	2008	2009	2010	2011
	GALLONS	GALLONS	GALLONS	GALLONS
JANUARY	9636	8939	9920	9307
FEBUARY	9725	8462	11776	1116
MARCH	4722	10220	10733	7788
APRIL	10327	2988	7100	3199
MAY	6451	1150	1841	5350
JUNE	8075	7812	1908	999
JULY	1425	7225	0	1900
AUGUST	5659	2000	1200	3600
SEPTEMBER	8679	4600	2638	4400
OCTOBER	8227	4712	4995	1377
NOVEMBER	8314	9844	3333	4209
DECEMBER	8442	10165	4391	9355
TOTAL Calendar Year (Jan-Dec)	**89,682 gal**	**78,117 gal**	**59,835 gal**	**52,600 gal**
TOTAL Fiscal Year (July 1 – June 30)		**FY 2009 (grey) 80,317 gal**	**FY 2010 (aqua) 81,824 gal**	**FY 2011 (yellow) 46, 216 gal**

Figure 3. Diesel Usage at JNU Terminal prior to, during, and after geothermal heat pump installation.

Electrical Usage:

While diesel usage has declined, electrical usage, noted in fig. 4 below, has increased. Fiscal years are highlighted by color in order to provide two methods by which to compare electrical usage through seasonal cycles. The geothermal heat pump installation was fully operational in May, 2011, so calendar year 2011 represents the best available period of post-construction data; calendar year 2008 represents a full 12 month period prior to any installed heat pumps. Electric spaces heaters were used extensively for temporary heat during construction from 2009 through 2010.

MONTH	2008	2009	2010	2011
	KWHR	KWHR	KWHR	KWHR
JANUARY	192,960	191,840	189,280	232,800
FEBUARY	209,280	166,400	175,840	200,000
MARCH	181,280	161,440	186,720	233,760
APRIL	175,520	152,160	201,760	209,760
MAY	153,760	163,840	186,880	191,520
JUNE	149,280	151,680	158,560	197,440
JULY	158,880	166,400	169,600	186,400
AUGUST	185,600	182,880	177,440	184,160
SEPTEMBER	170,080	174,240	165,920	184,160
OCTOBER	171,840	168,960	180,320	180,160
NOVEMBER	181,920	180,960	190,560	218,720
DECEMBER	163,200	172,160	220,480	227,840
TOTAL Calendar Year (Jan-Dec)	**2,093,600** KWHR	**2,032,960** KWHR	**2,203,360** KWHR	**2,262,560** KWHR
TOTAL Fiscal Year (July 1 – June 30)		**FY 2009 (grey) 2,018,880** KWHR	**FY 2010 (aqua) 2,144,640** KWHR	**FY 2011 (yellow) 2,369,600** KWHR

Figure 4. Electrical Usage at JNU Terminal prior to, during, and after geothermal heat pump installation.

Operational Cost Savings Summary.

The savings in fuel oil between Calendar Year 2008 (pre-construction) and Calendar Year 2011 (post-construction) is 37,082 gallons. The average cost of fuel oil diesel #2 in Juneau during the period of this analysis is $3.52 per gallon. Therefore, the cost of fuel oil saved between Calendar Year 2008 and Calendar Year 2011 is approximately $130,529.

The airport terminal project added approximately 12,000 sq. ft. of new area to the building. The difference in electrical usage between Calendar Year 2008 (pre-construction) and Calendar Year (post-construction that includes 12,000 sq. ft. building expansion) is approximately 168,960 KWHR. The electrical local cost, including demand charges, used for purposes of this analysis is $0.092 per KWHR. Therefore, the additional cost of electricity for the airport terminal is approximately $15,544. Subtracting the additional electrical usage cost from the fuel oil cost savings results in **$114,985 in direct annual fuel cost savings for the Juneau International Airport facility with the installation of the ground source heat pump system.**

Another significant benefit that the airport has seen is the decrease in operations costs due to the snowmelt system. This is a new system, and while it demands significant energy to operate, the safety and passenger comfort issues are very positive. The snow melt system is energized by three water-to-water electric heat pumps that are integrally tied to the geothermal loop field. While not analyzed in detail, it is expected that operating this system by an equivalent diesel energy source would have made the installation cost prohibitive for the airport's annual operating budget. The geothermal snow melt system savings over traditional snow removal operations is approximately **$10,000 per year in staff labor, and $1,000 in equipment and supplies.**

Note:
This operational cost savings summary is limited in scope. A full energy usage analysis of pre and post construction conditions would require more extensive investigation of electrical consumption from computers, lights, and other electric equipment used throughout the facility, as well as trending data from the control system operation for all ground source equipment. In order to produce a more accurate calculation, information would be required on how often each water-to-air heat pump operates in cooling mode and how often it operates in heating mode. Additional information that indicates the percentage of use of each of the two system circulation pumps would be required, as well. A similar usage question arises with the water-to-water heat pumps during shoulder months (ie transition from times of snow and no snow) when heat pumps are intermittently in operation, rather than having all three in full operation 24/7, as the rough electrical usage calculation implies.

Further Analysis of additional operational savings is expected to be done as the airport implements energy conservation measures recommended from a recent energy audit, and performs ongoing minor renovation projects in the terminal building. Most notably, as the airport learns more about the intricacies of the geothermal heat pump system, it is expected that additional savings will be realized through more detailed control of heat pump set points and usage patterns. Of particular interest is the May-October period (when snow melt system is not in operation) when the ground source system average power consumption drops significantly as the building's heating and cooling needs are "balanced" and the system does not require recirculation through the outside loop field.

Other operational and human comfort benefits of the geothermal heat pump system are still being realized, not the least of which is the building's new ability to provide cooling (air conditioning) throughout the occupied spaces which did not exist before.

Juneau International Airport
Geothermal Heat Pump Project

Images throughout courtesy JNU Airport staff, unless noted.

Juneau International Airport
City & Borough of Juneau — Alaska's Capital City

Airport Manager, Jeannie Johnson
Airport Architect, Catherine Fritz, AIA

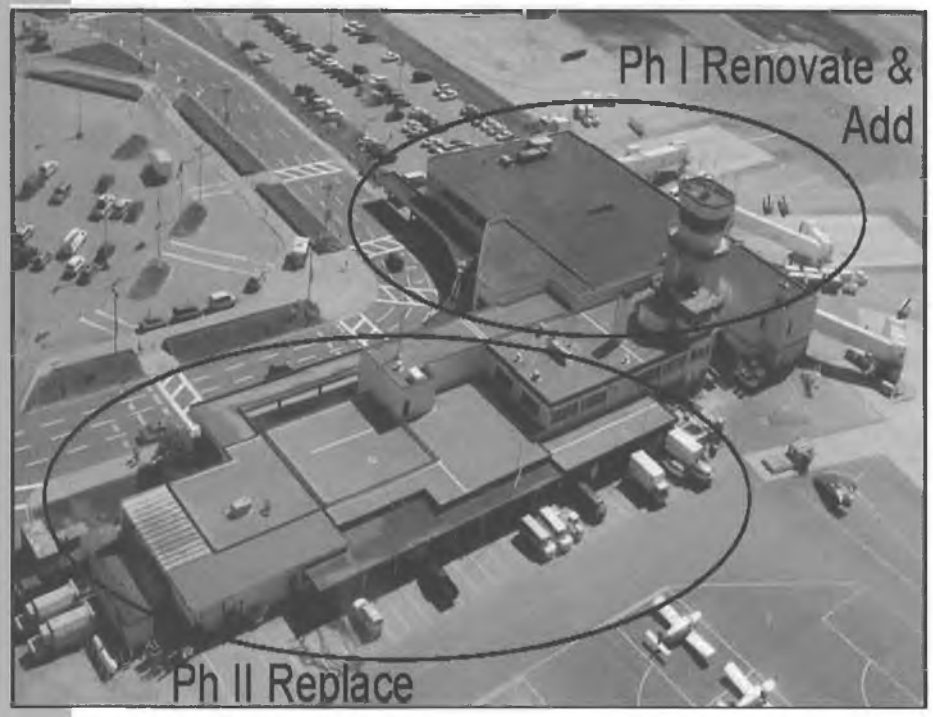
Presented to Alaska House Resources Committee
January 27, 2012

Terminal Renovation Project Goals

- Reduce Operating Costs
- Modernize Infrastructure
- Improve passenger experiences

$50 million problem, with only $23 million available to address it.

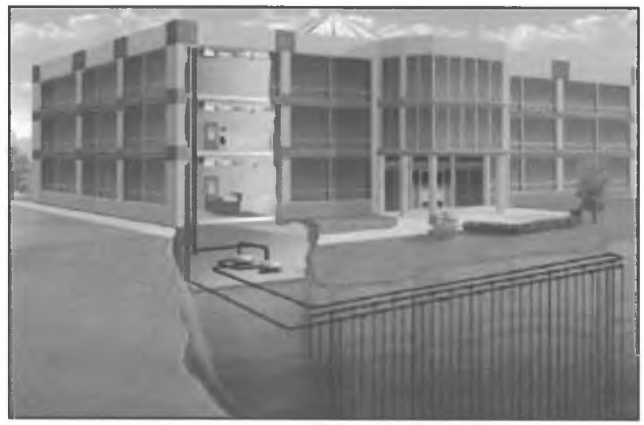
Terminal Renovation Project Approach



- Address challenges with ***good*** design, rather than lots of design. Be efficient.
- Modernize facility & clean up aesthetics.
- Design/construct to high performance standard.

Geothermal Heat Pump System Basics

- Pipes are placed in the ground, then filled with fluid.
- The earth's constant temperature warms (or cools) the fluid as it passes through the piping.
- Fluid is pumped into the building and "exchanged" by way of electric heat pumps. This provides heating, cooling, and ventilation to the occupied space.



Schematic rendering of closed loop geothermal heat pump system. *Image from www.mcquay.com*

350' deep
ground temp 42°

ALASKA ENERGY AUTHORITY

Grant Funding

- Alternative Energy Program, Construction Funding Request; February 2008
- Application completed by JNU staff; funding request = $1,026,000 (50/50 grant)
- Grant award made October 2008

Loop Field Construction

108 borings, each are 350 ft. deep.

6"

Summer 2009

Loop Field Construction

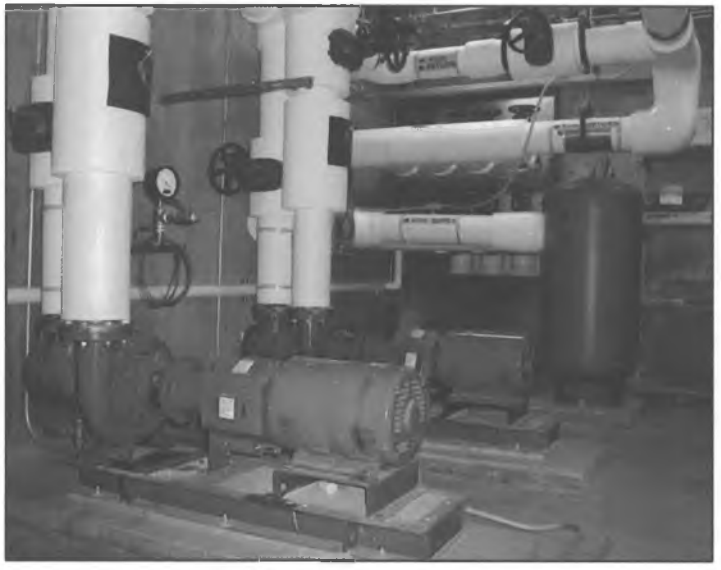
16 miles of HDPE piping in the ground. Ground temperature is approximately 42 degrees F.

Pipe Fusion

Each pipe seam is welded and tested multiple times to ensure bond. The life span of HDPE piping is more than 100 years.

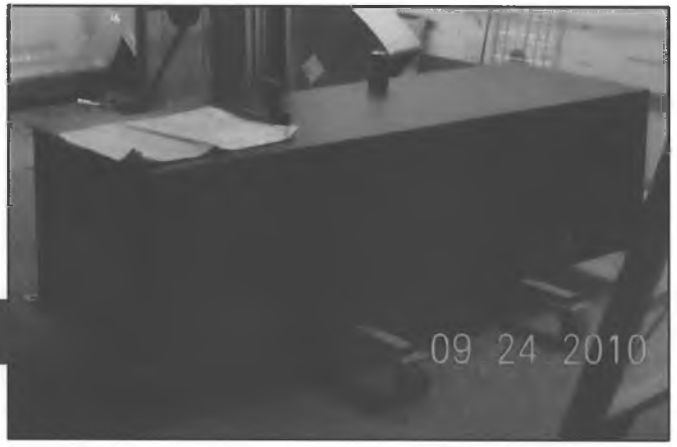
Into the Pump Room

Fluid of 88% water and 12% methanol is pumped throughout the building. A 3-way valve controls when the fluid circulates within the building, and when it returns to the loop field to capture more heat.



Fall 2009

Into the Ceilings



28 water-to-air heat pumps are located in ceilings throughout the airport terminal.

Ice-Melt System

3 water-to-water heat pumps serve the ice melt piping system.

System Performance to Date*

Decrease in Diesel Usage:

- **2008** (prior to heat pump installation) = **89,682 gal**
- **2011** (heat pump installation completed in May 2011) = **52,600 gal**

Savings = $130,529

Increase in Electrical Usage:

- **2008** (prior to heat pump installation) = **2,093,600** KWHR
- **2011** (heat pump installation completed in May 2011) = **2,262,560** KWHR

Increased Cost = $15,554

Direct Fuel Usage Annual Savings = $114,985

* Data is preliminary. Multiple years of complete system operations under varied demand conditions should be considered for comprehensive analysis.

Additional Benefits

- Snow/Ice removal operations have been reduced by approximately $11,000 per year while providing safer public access to the terminal.
- Removing central heat/vent equipment has freed up valuable square footage areas inside the building for other uses.
- Heat pumps provide improved air quality, including air-conditioning.
- The geothermal loop field has been sized to accommodate replacement of pre-1984 areas of the terminal.
- Reduction in diesel usage contributes to carbon emissions reduction.
- The confidence gained through this installation has convinced the airport to use geothermal technology in the new Snow Removal Equipment Facility.

Geothermal is part of a holistic approach to design and construction

Thank You for the grant funding and the opportunity to share our success.

Juneau International Airport
City & Borough of Juneau Alaska's Capital City

Jeannie Johnson, Airport Manager

Jeannie_Johnson@ci.juneau.ak.us

789-7821

January 27, 2012

Report to the Ahtna Land Committee

Geothermal Options

The Ahtna, Inc. Land Department is considering offering an area to geothermal leasing. The attached maps identify potential geothermal sites from a 1985 Alaska Division of Geological and Geophysical Survey report. The report was a preliminary assessment and recommended further follow-up in the specific zones 1-7 with zone 5 having the highest potential.

The total Ahtna ownership surrounding zones 1-7 equals approximately 40,960 acres. There is an opportunity to publically offer the area for a geothermal lease similar to what the State of Alaska has recently done near Mount Spur.

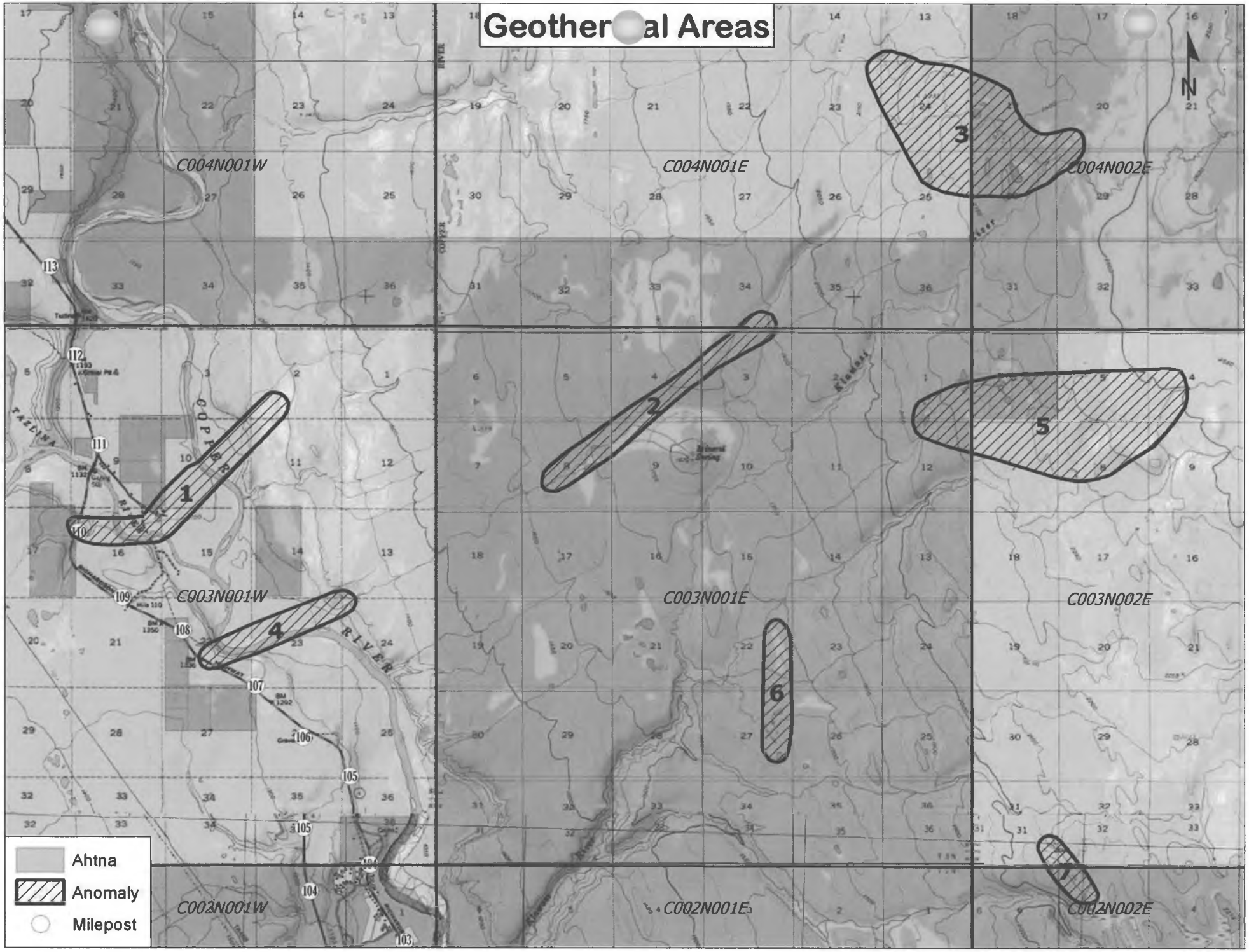
At a minimum a geothermal bid package would consist of the following requirements:

1. **Mitigation and Work Commitments** – Scope and schedule of work and environmental concerns.
2. **Bid Methods** – Generally $1.00 per acre.
3. **Length of Lease** – Primary term of exploration of 10-years.
4. **Royalty Rate** – Generally 10% of gross revenues.
5. **Formal Lease** – Similar to an oil and gas lease.
6. **Rent Amount** – $3.00 per acre, or negotiated amount, depending on acres and work commitment.
7. **Bonding** - $10 per acre or $10,000 whichever is greater.
8. **Sale Information** – Instructions, tract map, permit requirements, etc.

Since a road accessible portion of the geothermal potential opportunities exist on State lands (see Geothermal Area 1) it would be beneficial to have the State lands included, under a separate agreement with the State, to promote greater opportunities for development.

Regardless, if the geothermal lease opportunities do not produce the desired response, future funding should be requested for further site reconnaissance and evaluation through State or Federal funding.

P.O. Box 649 – Glennallen, Alaska 99588
Phone: (907) 822-3476 – Fax: (907) 822-3495


Geothermal Areas
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7
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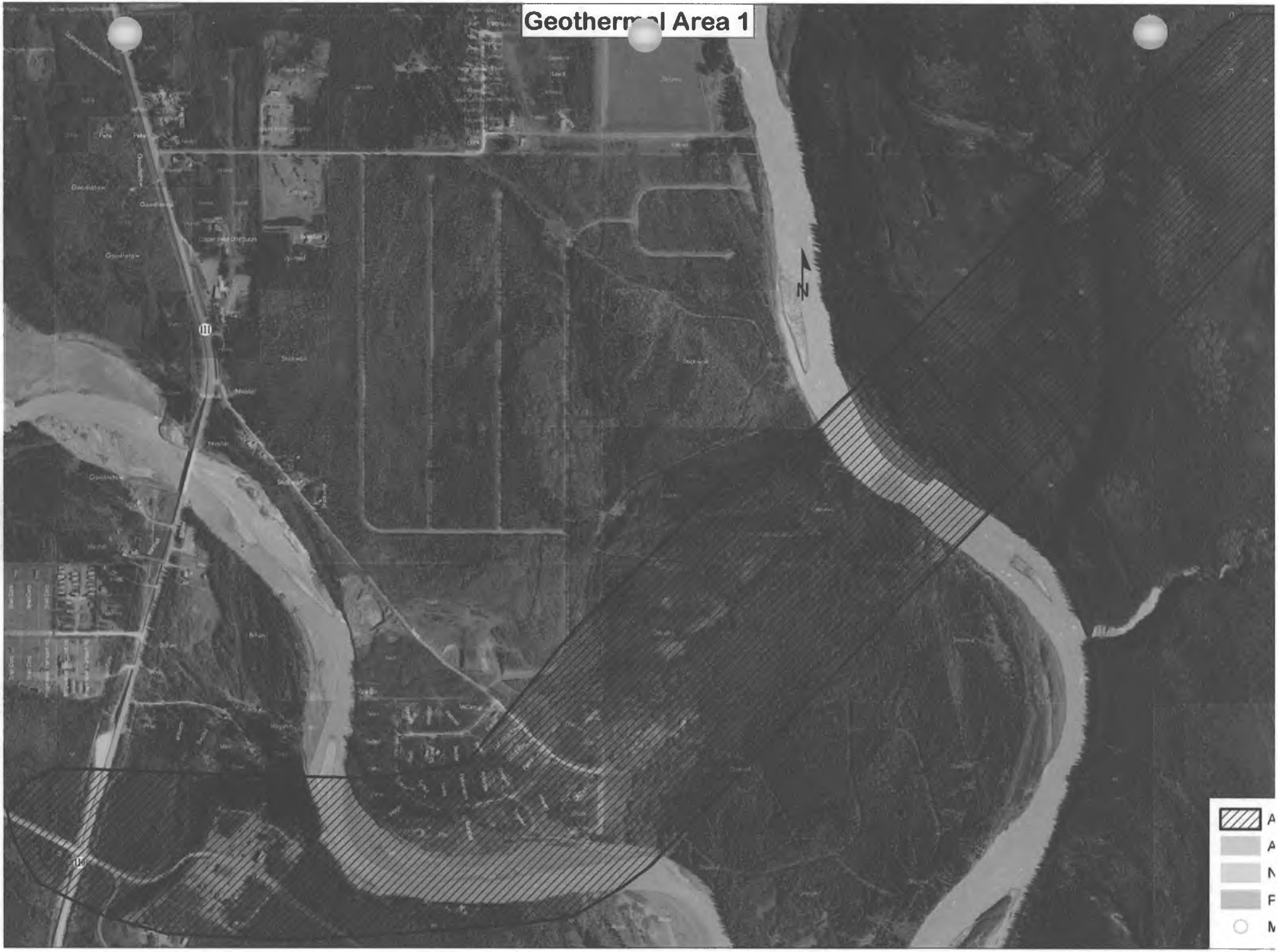
Ahtna
Anomaly
Milepost


Geothermal Area 1
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COPPER RIVER BASIN REGIONAL ENERGY CONFERENCE

Copper River Basin
Regional Energy Conference

Wednesday through Friday, March 14-16
8:00 a.m. to 4:30 p.m.
Glennallen School Auditorium
Glennallen, Alaska

Who Should Attend?

- Copper River Basin **Policymakers**
- Ahtna Village **Tribal Leaders**
- **Management** of For-Profit and Non-Profit Corporations
- **Regional community development staff** responsible for village planning, land and resource management, economic development, housing, and operation and maintenance of community facilities
- Copper Basin **Residents** interested in developing local energy

For More Information

For additional information regarding the Copper River Basin Regional Energy Conference, please contact:

Joe Bovee @ Ahtna, Inc. (907) 822-3476 | jbovee@ahtna-inc.com

Jason Hoke @ Copper Valley Development Association (907) 822-5001
JHoke@coppervalley.org

Sponsors

Ahtna, Incorporated
Copper Valley Development Association
Alaska Energy Authority
United States Department of Agriculture
United States Department of Energy
Denali Commission

ORPC Alaska Update

House Resource Committee Renewable Energy Update

January 27, 2012

ORPC
OCEAN RENEWABLE POWER COMPANY

D. Douglas Johnson, Director of Business Development
Monty Worthington, Director of Project Development

Company Overview

- Ocean Renewable Power Company (ORPC) is a developer of hydrokinetic power systems and commercial projects for tidal, river and ocean current power generation.
- ORPC Alaska is a wholly owned subsidiary of Ocean Renewable Power Company.
- Business development activites are focused on the Bay of Fundy (Maine and Nova Scotia) and Alaska.
- Lead project is Maine Tidal Energy Project through which ORPC is developing power system technology and project sites. This expertise is being tranferred to develop projects in Alaska.
- Founded 2004 - now 28 employees in Maine and Alaska.

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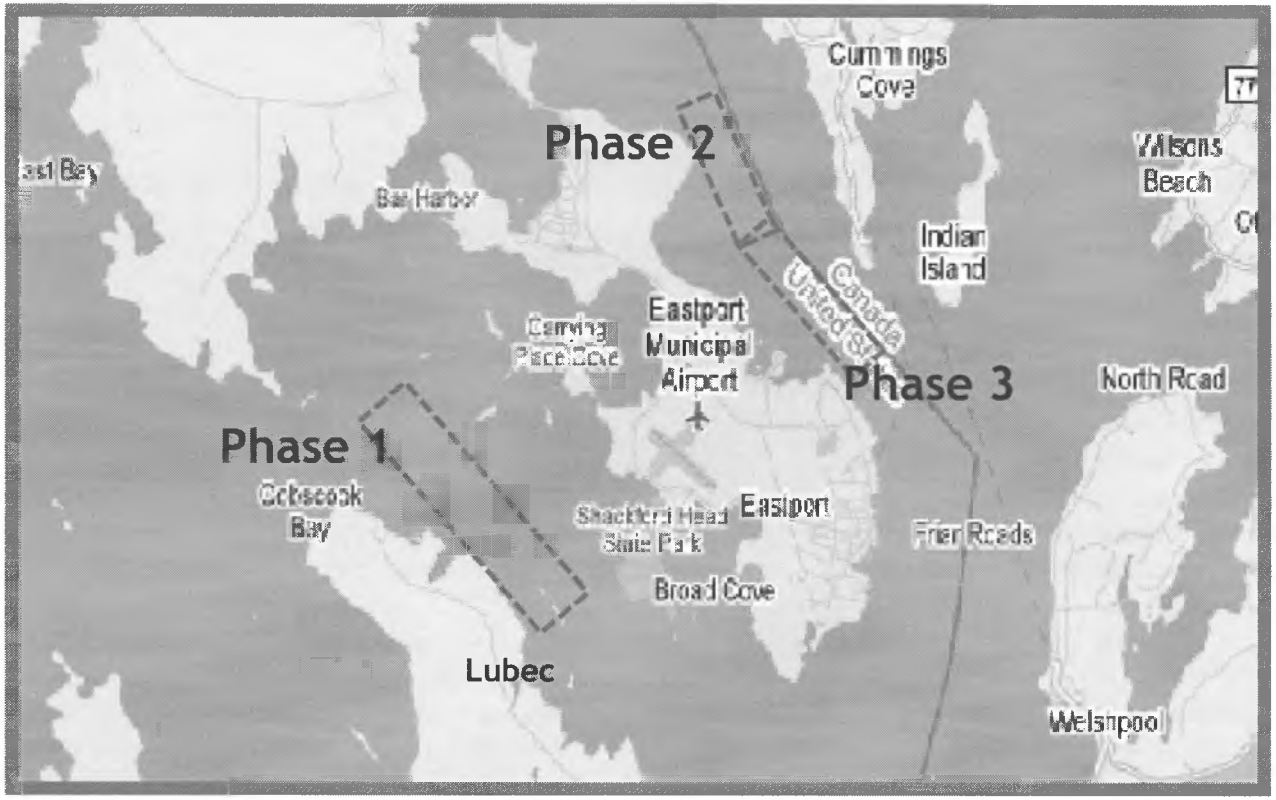
Maine Tidal Energy Project Schedule

Expect to receive pilot project license from FERC (first-ever for tidal energy project in Maine, second-ever in U.S.) in February 2012.

Phase 1
Cobscook Bay
(2012-2013)

Phase 2
Kendall Head
(2014-2015)

Phase 3
Western Passage
(2015-2016)



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ORPC's Economic Impact in Maine *Partners, Contractors, Service Providers & Vendors*

Androscoggin, Kennebec & Oxford Counties

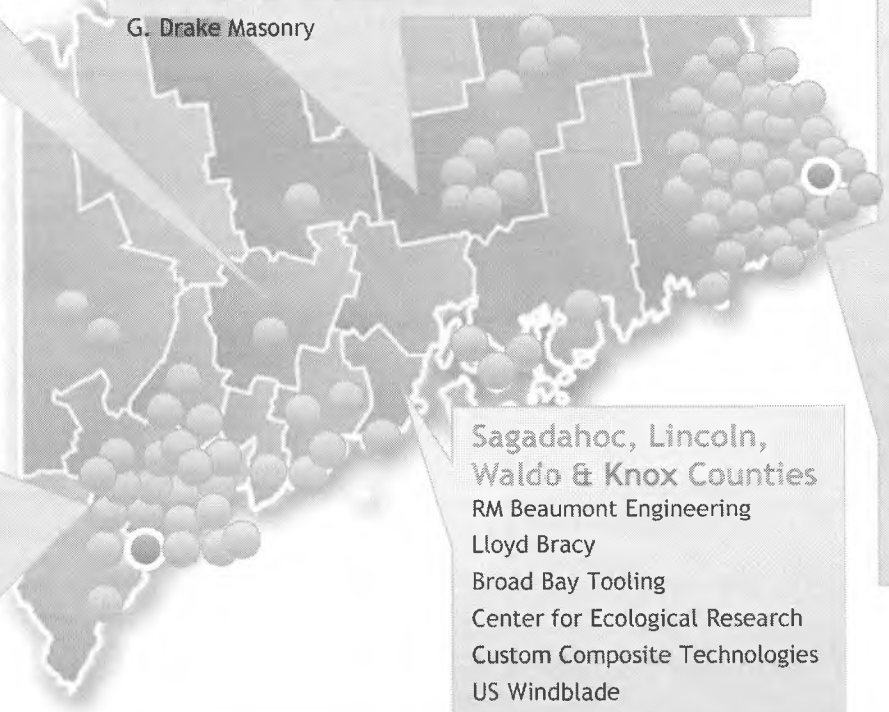
Affordable Office Solutions
Connectivity Point
Northland Industrial Truck Co.
Second Street Consulting
Small Hydro East
The Barn

Cumberland & York Counties

ORPC Corporate HQ
Bonney Staffing Center
Casco Bay Frames
City of Portland
Edison Press
Exhibit Source
Flotation Technologies
Writer, Camryn Hansen
Harbor Technologies
HDR/DTA Engineering
La Capra Associates
LMGi
Maine Composites Alliance
Maine Marine Composites
McAllister Towing
MER Assessment
George Monaco
Nelson & Wright
Pierce Atwood
W.B. Mason
Winter People

Penobscot, Somerset & Hancock Counties

Aerohydro Inc.
Alexander's Welding and Machine
Blue Hill Hydraulics
Burton G. Fisheries
CES, Inc.
Downeast Marine Resources
G. Drake Masonry
Land-Air Express of New England
Maine Maritime Academy
MariSources
NES Rentals
SGC Engineering
Stillwater Metalworks
University of Maine



Sagadahoc, Lincoln, Waldo & Knox Counties

RM Beaumont Engineering
Lloyd Bracy
Broad Bay Tooling
Center for Ecological Research
Custom Composite Technologies
US Windblade

Washington County

ORPC Eastport Office
AD Pottle Trucking
Archi-CHECK, LLC
Brayden's Future
Brewster Construction
Cobscook Bay Properties
Cobscook Bay Resource Center
Cooke Aquaculture
D&B Marine Salvage
DiCenzo Crane
Diving Services
Eastern Plumbing
City of Eastport
Eastport Port Authority
ECR Refrigeration
Federal Marine Terminals
Friends of the Boat School
Hamilton Marine
Captain Butch Harris
H&H Marine
Jamieson Diving
Jason Leighton
Kilby House
Town of Lubec
Maine Marine Technology Center
Milliken House
Moose Island Marine
Morrison Manufacturing
The Motel East
Murphy's Electric
Newell Construction
Perry Marine & Construction
Preston's Septic & Portables
Ricker Electric
Stanhopes Trucking
Dennis Turner
Turner Signs
Weston House B&B
Woodland Machine Works

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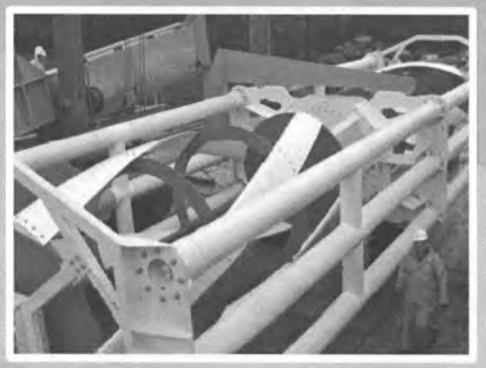
Economic Impact in Maine *Job Creation and Investment*

From 2007 to 2011, ORPC has:

- Created or helped retain more than 100 jobs statewide
- Grown from 0 to 25 fulltime employees in Maine
- Spent over $8 million on goods and services in thirteen of Maine's sixteen counties
- Created new R&D and other professional opportunities for young Mainers

In the Next 7-10 Years, the Tidal Energy Industry in Maine will:

- Create 400 to 500 direct jobs, including new working waterfront jobs
- Attract investment of up to $1 billion in Maine
- Create new, sustainable markets for Maine's world class composites industry



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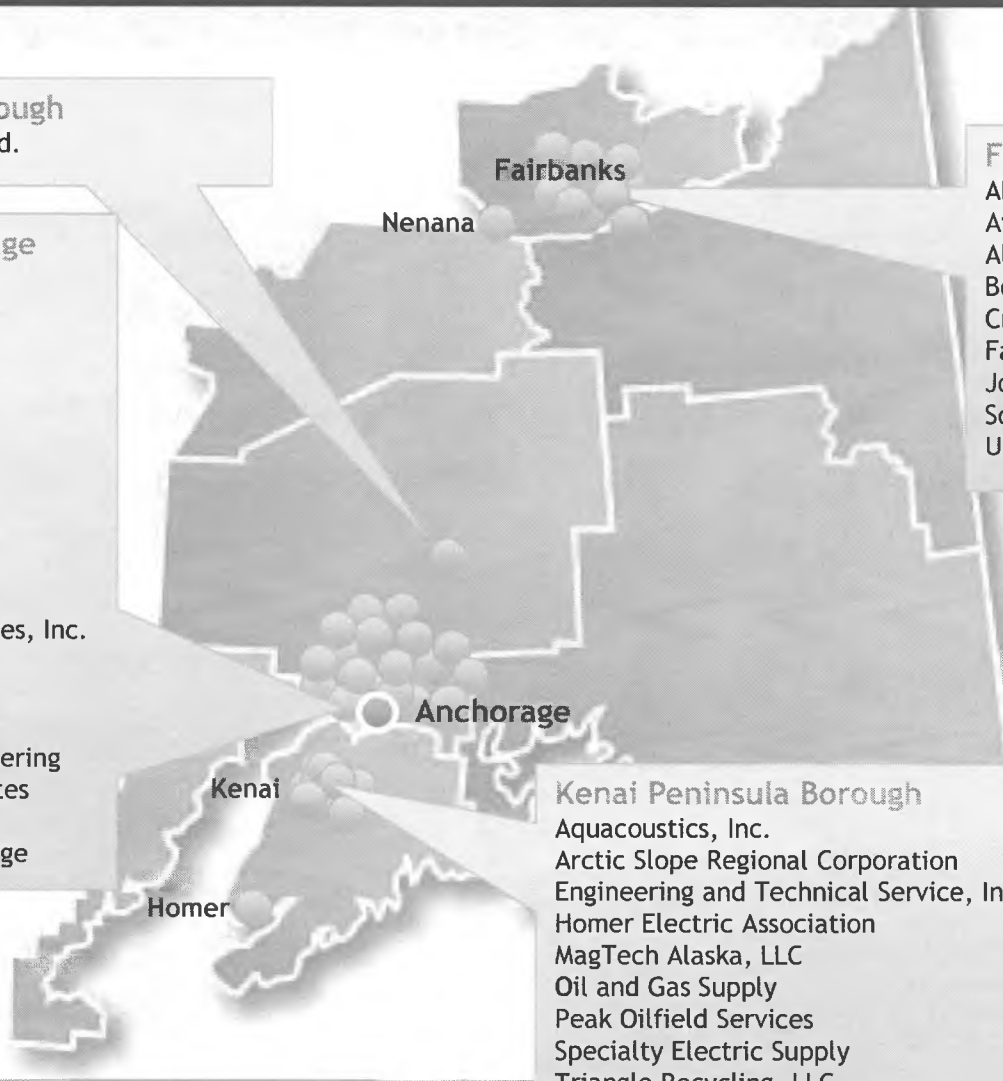
Impact of Tidal Energy in Alaska

- In Maine, ORPC has proven that tidal energy creates significant benefits including high quality, longterm jobs.
- With your help, ORPC is committed to bringing these same economic, environmental and energy diversity benefits of tidal and river hydrokinetic energy projects to Alaska.
- We're just getting started here, but economic benefits are already being realized in Alaska.

ORPC's Economic Impact to Date in Alaska *Partners, Contractors & Consultants*

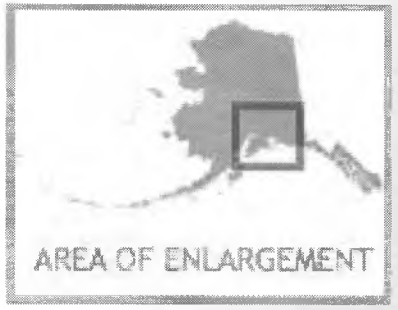


MatSu Borough
TerraSond Ltd.

Municipality of Anchorage
ORPC Alaska Office
Alaska Heater Rentals, LLC
Alaska Industrial Hardware
Alaska Rubber & Supply
Alaska Serigraphics
Arctic Office Products
Arctic Wire Rope and Supply
GCI
HDR/DTA
Holloway Associates, LLC
Kinetic Laboratories Inc
LGL Alaska Research Associates, Inc.
Marsh Creek, LLC
Northwest Arctic Aviation
PND Engineers, Inc.
Restoration Science & Engineering
Stephen R. Braund & Associates
The UPS Store
University of Alaska, Anchorage

Fairbanks Region
ABS Alaskan, Inc.
Airport Equipment Rentals
Alaska Rubber & Rigging Inc.
Boat Shop
Crowley Petroleum Distribution, Inc.
Fairbanks Paint and Glass Co.
Jon's Machine Shop
Sourdough Express, Inc.
University of Alaska, Fairbanks

Kenai Peninsula Borough
Aquacoustics, Inc.
Arctic Slope Regional Corporation
Engineering and Technical Service, Inc.
Homer Electric Association
MagTech Alaska, LLC
Oil and Gas Supply
Peak Oilfield Services
Specialty Electric Supply
Triangle Recycling, LLC



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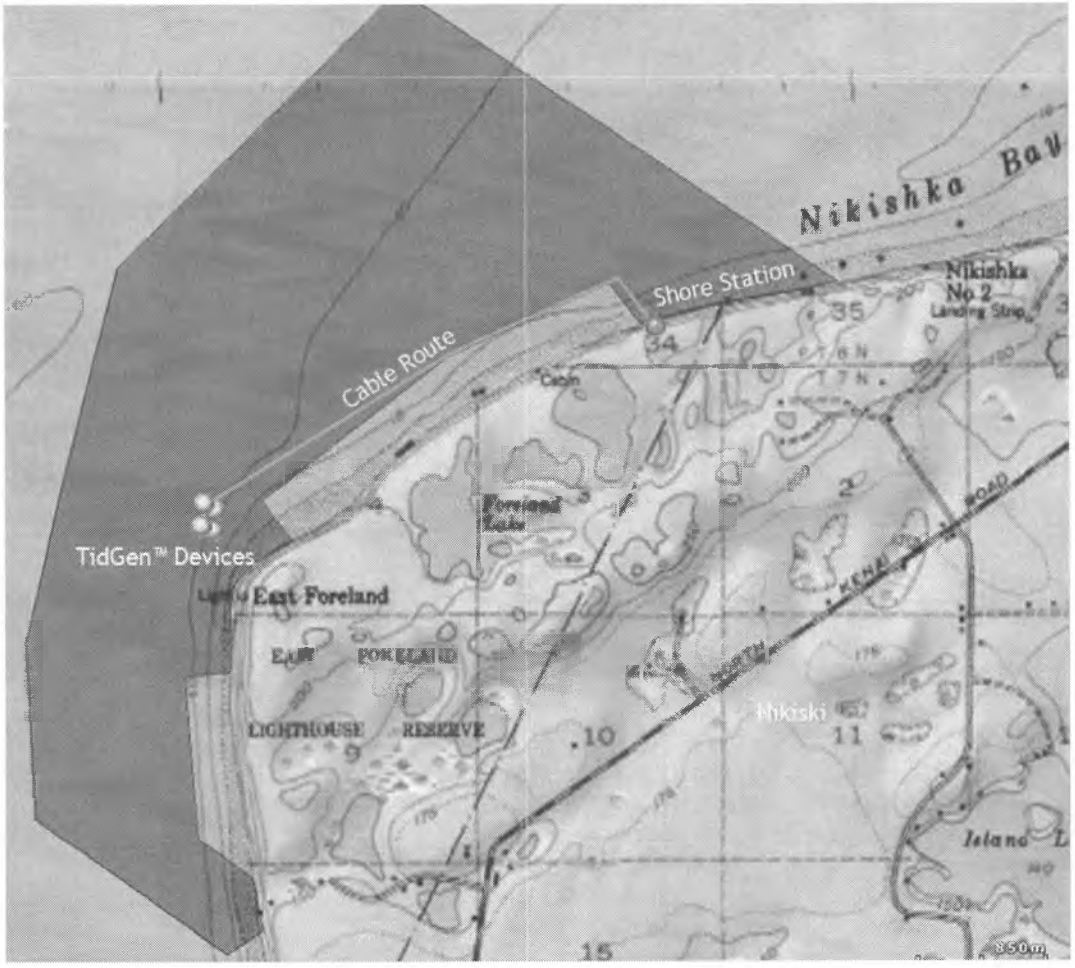
East Foreland Project Layout

Demonstration Project (estimated 600 kW capacity)

- Four TidGen™ devices
- Power & data cables to on-shore station in Nikiski

TIDGEN™ DEVICE



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East Foreland Tidal Energy Project Deployment Schedule

	2014	2015	2016	Number of TGUs	Project Output
	Demonstration Phase				
Cook Inlet TidGen™ Array Project	Four TidGen™ Devices			4	600 kW
		Pilot Project			
Year One of Build-Out		Four TidGen™ devices and one 4-TGU OCGen™ module or two 2-TGU OCGen™ modules		8	1,200 kW
Year Two of Build-Out			Eighteen 175 kW TGUs in array of OCGen™ modules and/or TidGen™ devices	18	3,150 kW
Total Installed Capacity	**600kW**	**1,800 kW**	**4,950kW**	**30**	**4,950 kW**

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Comparing Tidal Energy Market Incentives

Maine	Nova Scotia
Maine PUC program to incentivize up to 5 MW of Tidal Energy capacity through Systems Benefit Charge	Community Feed In Tariff (COMFIT) for: • Devices under 500 kW • Arrays up to 2 MW
Proposed at 0.26 $/kWh Contract term of 20 years	Approved at 0.65 $/kWh Contract term of 20 years
Rate Payer Impact Estimated 0.03 cents/kWh or 15 cents/month ($1.80/yr) for average house	Rate Payer Impact Estimated at less than $1.60/month (approx. $20/yr)

In both Maine and Nova Scotia, elected officials have determined that the economic benefits of tidal energy far exceed the minimal costs.

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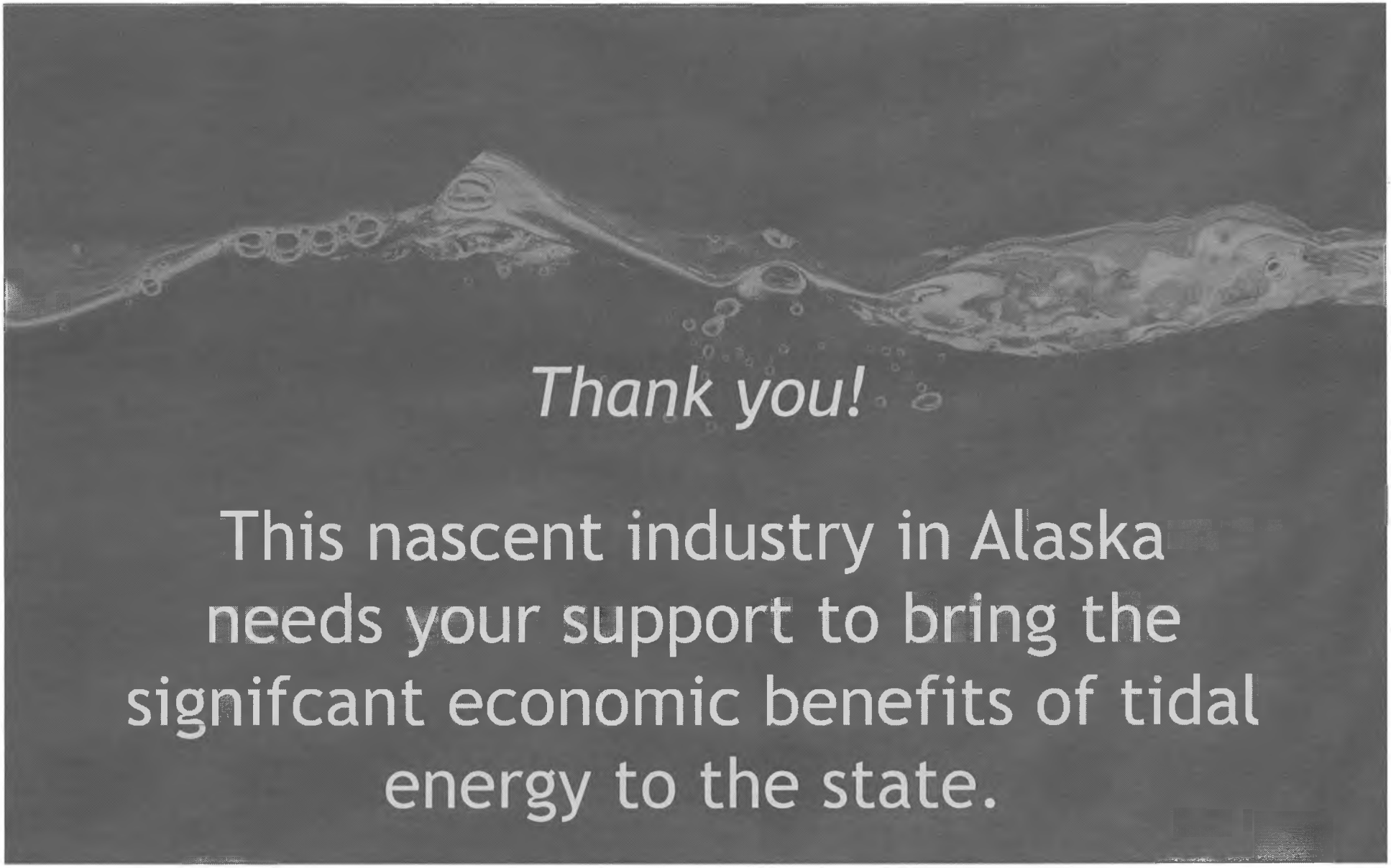
600kW Cook Inlet Power Cost Projections

Preliminary Estimate

	Funding required	Amount Spent in Alaska	AEA Funding Available	ORPC Cost Share	Additional needed
Total Project Capital	$10,250,00	$5,025,000	$2,000,000 (secured AEA REF Rd 4)	$950,000	$7,300,000
Monitoring & Operation and Inspection, Maintenance & Repair 2013-2016 (3.5 yrs)	$2,800,000	$2,275,000	$0	$850,000	$1,950,000
Total	$13,050,000	$7,300,000	$2,000,000	$1,800,000	$9,250,000

600kW for 3 yrs.

ORPC OCEAN RENEWABLE POWER COMPANY



OR.PC
OCEAN RENEWABLE POWER COMPANY

ORPC
OCEAN RENEWABLE POWER COMPANY

CLEAN, PREDICTABLE, RELIABLE POWER from COOK INLET TIDES

COOK INLET: Outstanding Tidal Energy Resources

- Cook Inlet has a 12-meter tidal range, the fourth largest in the world, and tidal currents that flow at speeds up of to 10 knots.
- Tidal power is predictable, produces no greenhouse gases, and is one of the easiest renewable power sources to integrate with the grid.
- As tidal energy technologies mature and fossil fuel prices rise, power costs will become competitive with both old and new power sources.
- ORPC is developing tidal energy sites in Cook Inlet at East Foreland and Fire Island. We envision an eventual system of distributed tidal power installations in Cook Inlet that will provide a base load supply of clean, predictable electricity to the Railbelt grid.

Map source: *International Tidal Energy Market Analysis- Review of Projects & Developments* by T. Kaminski, Research Analyst Frost & Sullivan, 2010.

ORPC PROJECT MILESTONES

- ORPC's Cook Inlet tidal energy project will begin with a pilot project at East Foreland, near the town of Nikiski, Alaska. ORPC is collaborating with Homer Electric Association on this pilot project, which will deliver clean tidal power to the Homer Electric grid while creating high-quality, sustainable jobs on the Kenai Peninsula. This pilot project could ultimately generate up to 5 megawatts of electricity, enough to power approximately 2,300 Kenai Peninsula homes.
- ORPC has received a preliminary permit from the Federal Energy Regulatory Commission (FERC) to assess Cook Inlet's East Foreland area and is in the initial stages of submitting an application for a pilot project license.

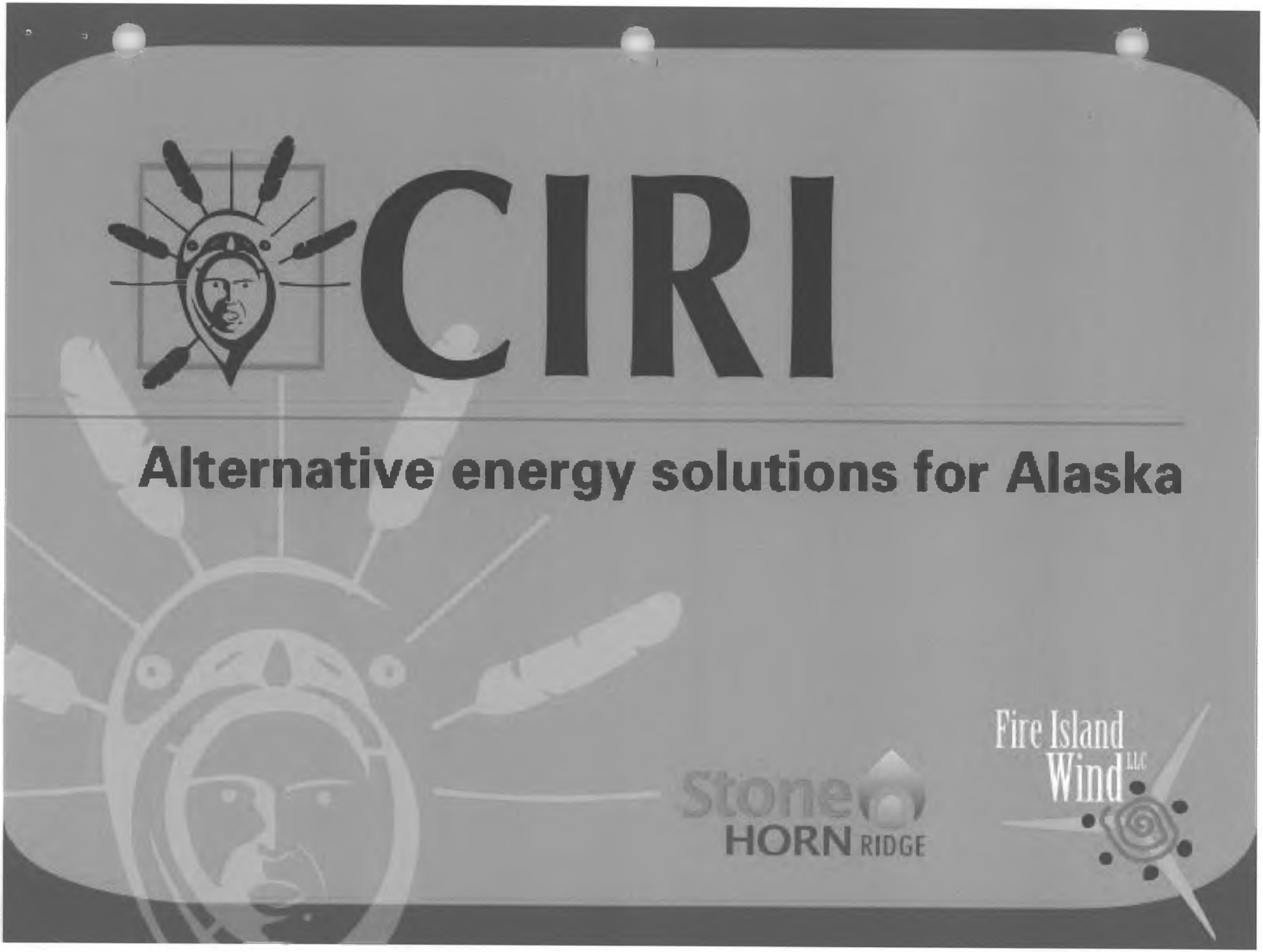
INNOVATION and ECONOMIC BENEFITS

- ORPC has been developing breakthrough tidal power technology and eco-conscious projects since 2004.
- ORPC's proprietary TidGen™ Power System will be installed in East Foreland and connected to Kenai Peninsula's electric grid. The first TidGen™ Power System will be installed and connected to the grid in Maine in the spring of 2012. In 2010, ORPC successfully deployed, operated and tested a beta version of this power system in Maine, which was the largest ocean energy device ever deployed in the United States.
- ORPC is a pioneer in advancing state-of-the-art site characterization and environmental monitoring techniques.
- ORPC has already brought more than $3 million in public and private funding to Alaska. Company-wide, ORPC has secured more than $40 million in public and private funding to develop tidal and river technology and energy projects. These efforts will continue to support development of the Cook Inlet tidal energy projects.
- To date, ORPC has collaborated with 37 Alaskan businesses. In addition to providing a clean, reliable and predictable source of renewable power, ORPC's Cook Inlet projects will bring sustainable, high quality local jobs and associated benefits to the local economy.
- The U.S. Department of Energy is funding a University of Alaska, Anchorage study that will help ORPC adapt its power system design to the unique environment of Cook Inlet. Funding supported the building of a laboratory flume for long term abrasion testing of key components.
- The Department of Energy also funded a multiyear ORPC study to develop monitoring technology for beluga whales in Cook Inlet, which will help assess potential interactions between the whales and ORPC's power systems.

COOK INLET TIDAL ENERGY PROJECT: Next Steps

- In the summer of 2011, ORPC collected initial data at the East Foreland site on current velocity and sea floor bathymetry. In 2012, ORPC will complete the FERC pilot project license application, continuing 2011's work and conducting a year of environmental monitoring.
- In 2013, ORPC hopes to install the first single-device TidGen™ Power System at the East Foreland site for a full year of operation and monitoring. Under the plan, three devices will be added in 2014 to complete the 600kW demonstration phase with Homer Electric Association.
- ORPC is continuing development of a site next to Fire Island in Northern Cook Inlet that began in 2007 under a FERC preliminary permit. As the transmission line for the Fire Island wind project installation materializes, ORPC will continue project development efforts for the Fire Island tidal energy project.
- Over time, ORPC envisions a series of tidal energy installations distributed throughout Cook Inlet that will become a base load power supply, providing tens of thousands of Railbelt homes with clean, reliable, predictable power.
- Please visit our website for videos and updates on our projects in Alaska, Maine, and Canada.

ORPC Alaska, LLC • 725 Christensen Drive • Suite 6 • Anchorage • Alaska • 99501
www.orpc.co


CIRI
Alternative energy solutions for Alaska
Stone
HORN RIDGE
Fire Island
Wind LLC

CIRI

An Alaska Native corporation with diverse business interests:

- Energy and resource development
- Oilfield and heavy construction services
- Real estate development and management
- Environmental remediation services
- Tourism and hospitality

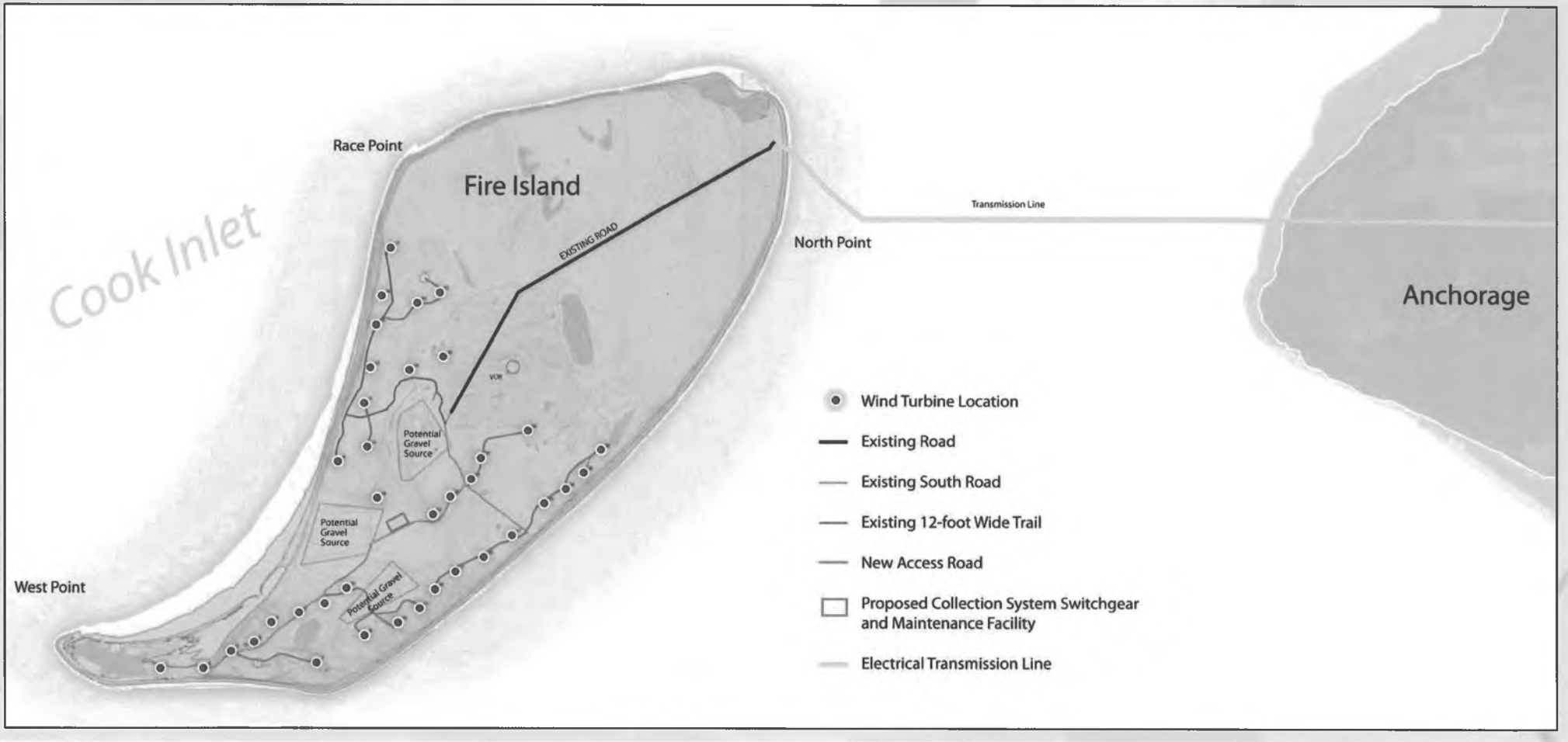
CIRI is the **largest private landowner in Southcentral Alaska** with more than 1.3 million acres of surface and subsurface estate available for responsible oil, gas, mineral and alternative energy development

Fire Island Wind LLC

Sustainable wind energy
for Southcentral Alaska

Fire Island Wind Project

Fire Island Wind LLC (a CIRI subsidiary) is developing Southcentral Alaska's first utility-scale wind project



Project Overview

- Located on Fire Island, near Railbelt load center, three miles west of Anchorage
- First power fall 2012
- Chugach Electric Association power purchase agreement: 25-year term starts Jan. 1, 2013

Fire Island Wind LLC

Project description

- 11 General Electric 1.6 MW XLE wind turbines
- 17.6 MW capacity
- 32.8 percent net capacity factor
- ~51,000 MW-hours annually ~ 6,000 households
- Offset ~0.5 bcf natural gas consumption annually
- On-island infra-structure: roads, electrical collection and transmission systems, overnight crew facilities, and operations and maintenance building
- Subsequent phases could include 22 more turbines

Fire Island Wind LLC

Project Status Report

- Chugach agreed to purchase 100% of Phase I power
- Regulatory Commission of Alaska reviewed and approved cost recovery for Chugach PPA in October
- Contracts executed for major project components
- Project financial closing with CoBank on November 30
- Transmission line construction is underway and on schedule

Fire Island Wind LLC

Transmission Interconnection
Your $25 million State of Alaska investment

- 12.5 mile, 34.5 kV double-circuit transmission line
- Land-based construction: Northern Powerline Constructors, a local company
- Marine construction: Cruz Companies, a local company
- Transmission cable and switchgear
- Chugach to own and maintain line

Fire Island Wind LLC

Balance of Plant Construction (On-Island Activities)

Delaney Construction Group

- A Tetra Tech company
- Constructed wind projects nationwide
- Constructed a megawatt-scale wind project in Alaska (Kodiak's Pillar Mountain)
- Significant subcontracts with local contractors

Fire Island Wind LLC

Project Schedule

2011

- Executed commercial contracts
- Closed project financing
- Initiated transmission line construction

2012

- Complete on-island civil and electrical construction
- Deliver and erect wind turbines
- Finish transmission interconnection
- Project commissioning and commercial operation

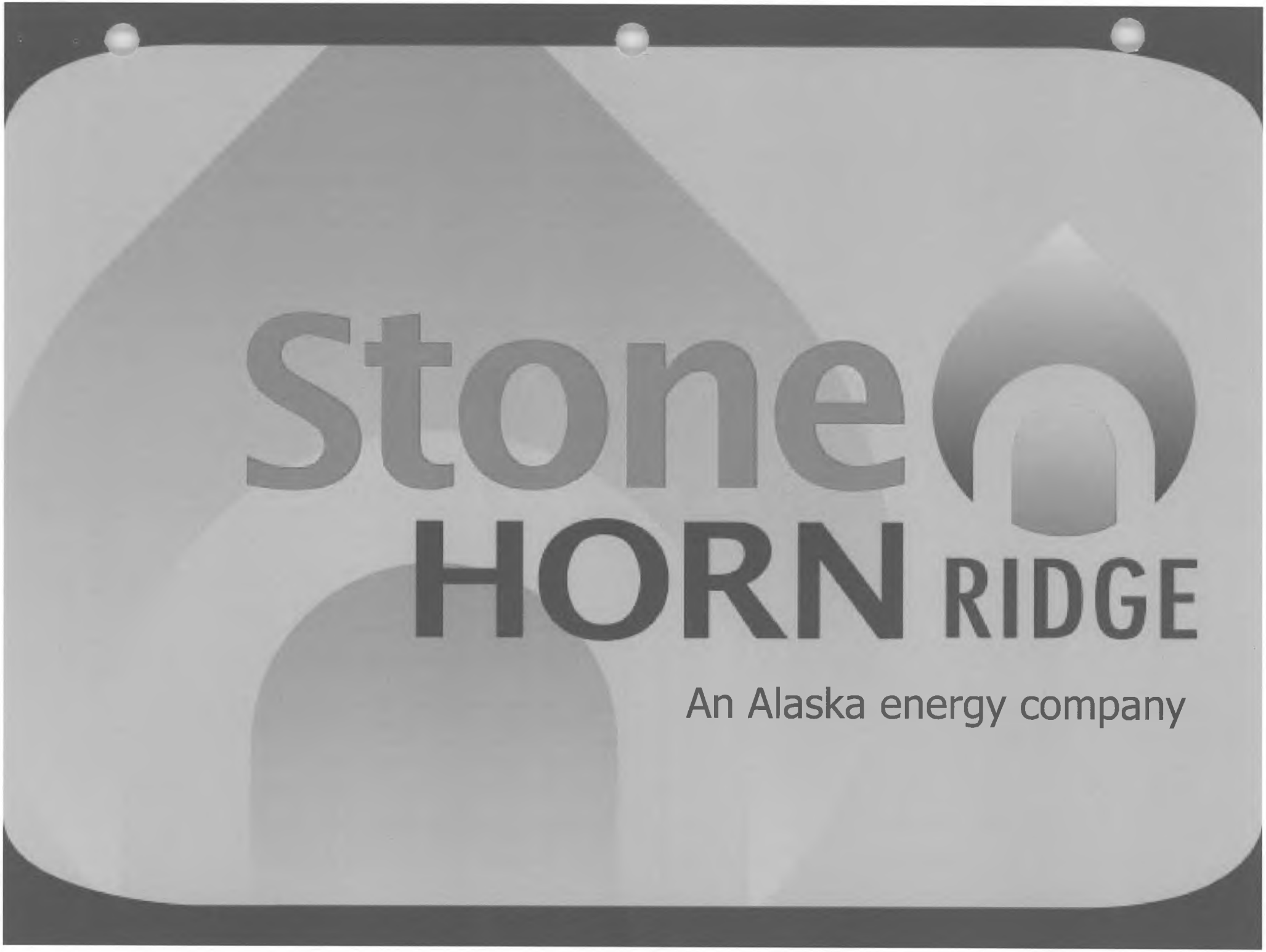
Fire Island Wind LLC

Project supports Alaska energy goals, domestic manufacturing and local job creation

Sustainable energy project

- Private investment
- Locally owned and operated
- Local job creation
- Local contract opportunity
- Energy supply diversification
- Long-term energy price stability
- Environmentally responsible

Fire Island Wind LLC


Stone
HORN RIDGE
An Alaska energy company

Stone Horn Ridge

- Alaska energy company developing underground coal gasification (UCG) project
- Joint venture of CIRI and Laurus Energy, a Houston-based UCG technology company
- UCG technology provided by license from Ergo Exergy

Stone HORN RIDGE

UCG: Proven, Clean Technology

- UCG is a proven technology that converts coal "in situ" to produce syngas
- Process occurs below impermeable rock layers isolated from freshwater aquifers
- Eliminates many environmental and safety risks
- More than 50 test and commercial projects completed worldwide
- An emerging energy technology

Stone HORN RIDGE

Southcentral Alaska Energy

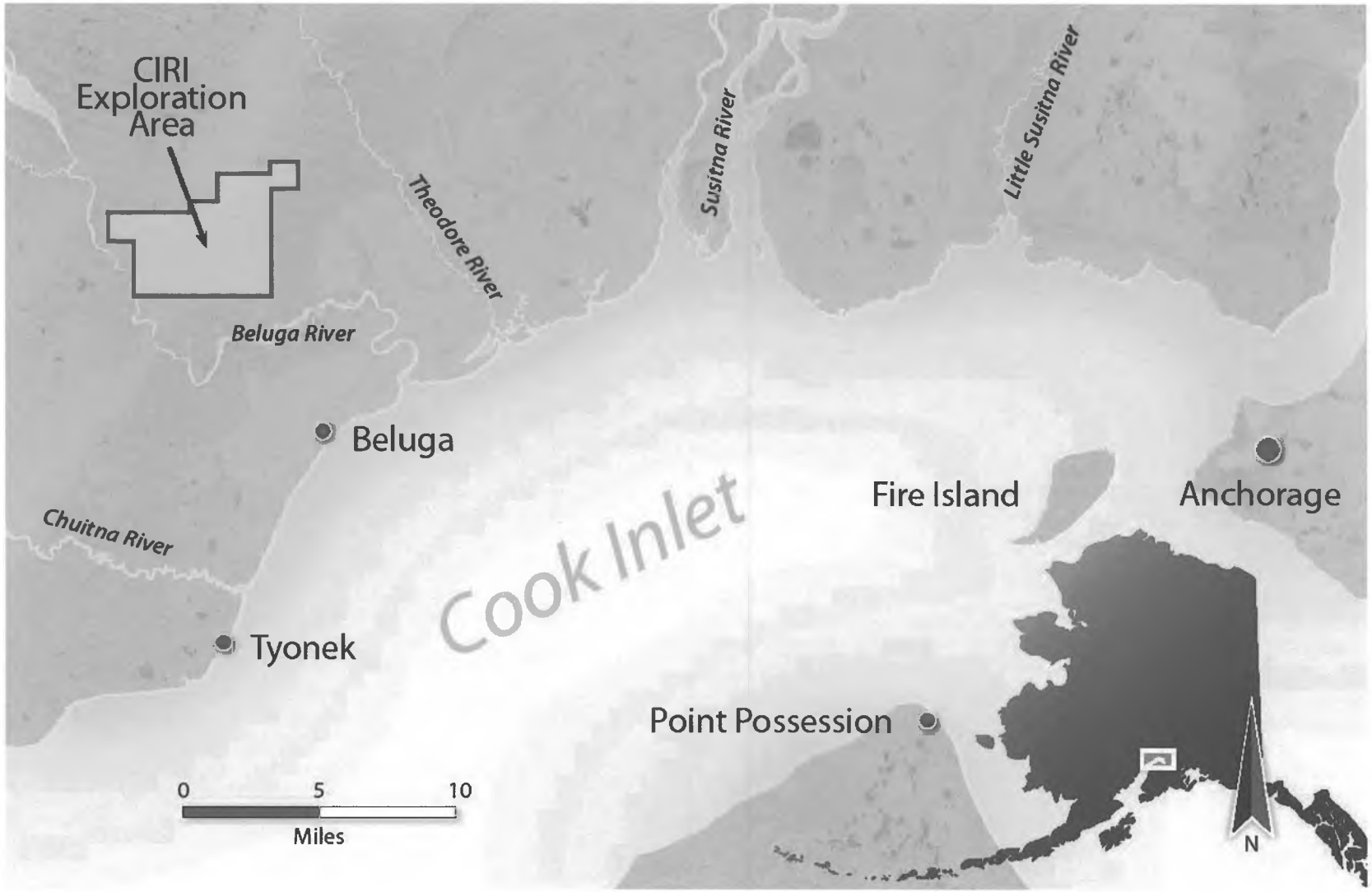
- Produce energy for local use and export
- CIRI core drilling confirmed significant commercial coal reserves
- Favorable geology for UCG development
- Global-scale coal resource
- Tidewater location
- Local energy market need

Stone Horn Ridge

Synthesis Gas

- Electrical generation
- Upgrade via methanation into methane (CH_4 -- a/k/a synthetic natural gas)
- Feedstock to produce
  - clean liquid fuels
  - fertilizer
  - other petrochemical products

Stone Horn Ridge site



Project History

- 13-hole core drilling and wire line data program
- Completed concept-level engineering and costing of large scale surface facility
- Completed initial geological, rock mechanics and hydrogeological site model
- Validated large commercial UCG resource and appropriate geology for development
- Completed shallow, high-resolution, 2-D seismic program with project

Project Update and Next Steps

- Incorporate seismic data to complete model of site geology
- Initiate permitting process for site characterization
- Start baseline environmental data collection
- Design site characterization drilling program
- Pursue commercial operations and syngas production

Stone HORN RIDGE

CIRI.COM

Pillar Mountain Wind Project Update

Kodiak Electric Association, Inc.

Darron Scott, President/CEO

House Resources Committee Meeting

January 27, 2012

Vision Statement

kodiak electric association

ENERGY

vision

KEA shall endeavor to produce 95% of energy sales with cost effective renewable power solutions by the year 2020

Kodiak Electric Association, Inc.

KEA

Kodiak Electric Association, Inc.

- Locally-Owned Electric Cooperative
- Provides Electricity to approximately 5,800 Meters
- Isolated Electric Grid
  - Peak Load – 26 MW
  - Minimum Load – 11 MW
- Diverse Power Generation Portfolio
  - Terror Lake Hydroelectric Plant: Two 11.5 MW Units
  - Pillar Mountain Wind Project: Three 1.5 MW Units
  - Four Diesel Generating Stations
    - Generator size ranges from 140 kW to 6.5 MW
    - Total diesel generating capacity of 33 MW

Pillar Mountain Wind Project

- Operational since July 2009
- Power generated since startup: 32,188,281 kWh

28-9% of total usage

Kodiak Electric Association, Inc.

KEA

Project Financing

- $1 million in general state grant
- $4 million from Renewable Energy Fund Round I
- $12 million low interest CREB loan
- Remainder $4.4 million financed directly from KEA

16.6 ≈ 25%

Operational Successes

- No power outages
- Approximately 98% availability
- No bird strikes

Savings

- 2.2 million gallons of diesel saved since startup
- Net savings at $3.25 per gallon for fuel:

$4.8 Million

Kodiak Electric Association, Inc.

KEA

Building on Success

Pillar Mountain High Penetration Wind Project

Kodiak Electric Association, Inc.

Energy Storage System

Xtreme Power Battery System

Kodiak Electric Association, Inc.

Pillar Mountain
High Penetration Wind Project

Doubling our community's wind and fuel savings.

Kodiak Electric Association, Inc.

KEA

Alaska SeaLife Center
windows to the sea

Sea Water Heat Pump Project

Alaska SeaLife Center, Seward, AK

Presenters:

Dr. Tara Riemer Jones, Ph.D., President & CEO

Darryl Schaefermeyer, Operations Manager

AK House Resource Committee – Renewable Energy & Technology Update – Juneau – January 27, 2012

Alaska SeaLife Center

- **Mission:** The Alaska SeaLife Center generates and shares scientific knowledge to promote understanding and stewardship of Alaska's marine ecosystems.

- The Alaska SeaLife Center achieves this mission through:

Research
Education
Stranding (Rescue and Rehab)
Exhibits

Alaska SeaLife Center

Economic Profile of the Center

- **$4.77 million in annual payroll**
- **90 year round employees**
- **Largest private employer in Seward, and 11th largest on Kenai Peninsula**
- **Year round tourism for South Central Alaska: 160,000 visitors/yr**

Sea Water Heat Pump Project

Summary of Partnerships with Strong Support

- **City of Seward –** looking to reduce future cost of heating for downtown district
- **Kenai Fjords National Park –** looking to reduce cost of heating for future visitor center and administration building
- **Alutiiq Pride Shellfish Hatchery –** also has an existing seawater intake available
- **UAF School of Fisheries & Ocean Sciences - Seward Marine Center –** also has existing seawater intake available

Goals = Reduce Energy Cost & Carbon Emissions

Energy Use Profile for the 115,000 sq ft Alaska SeaLife Center:

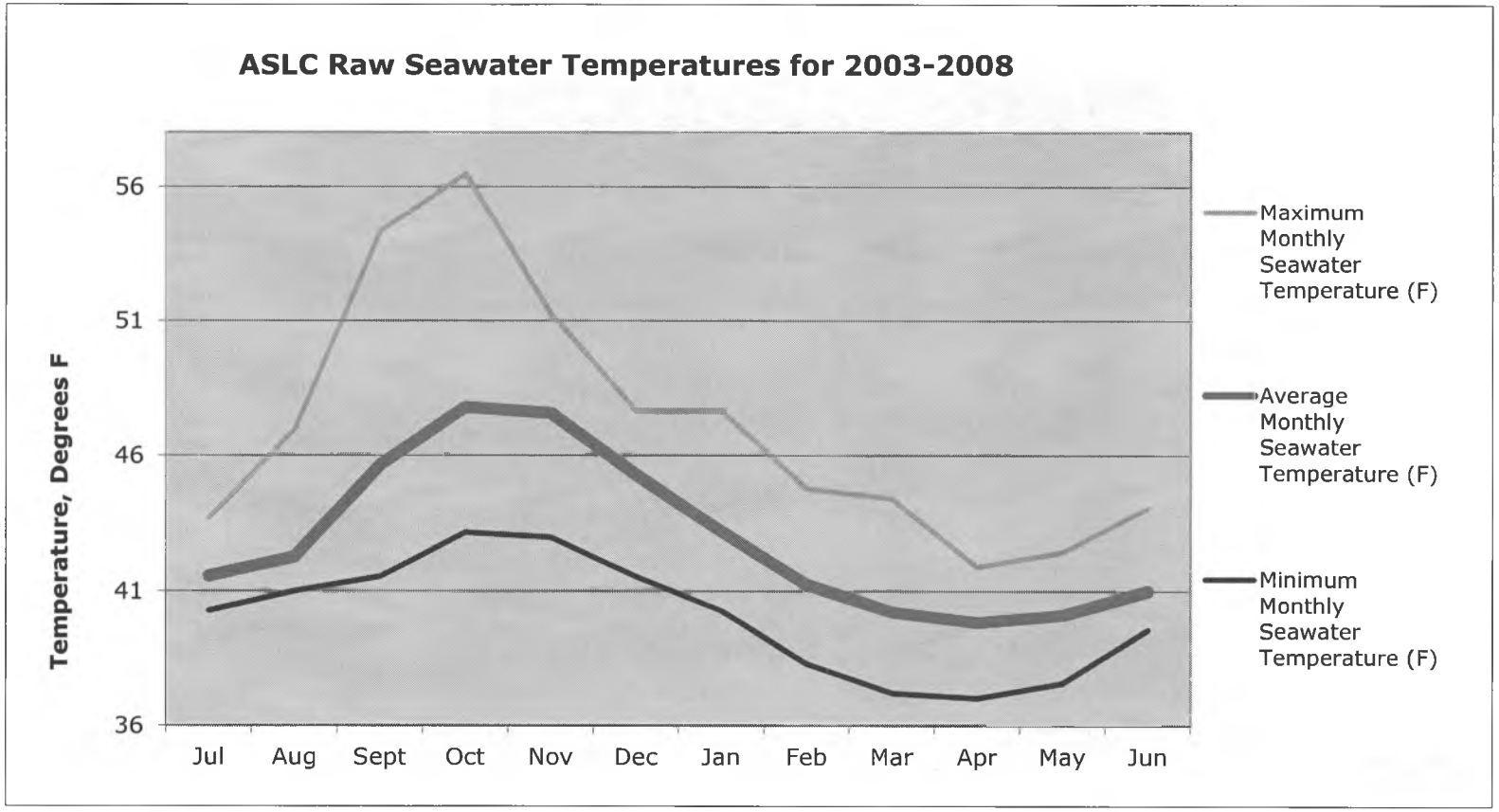
- **Heating loads are large = air handlers, baseboards, duct coils, pavement heating, domestic hot water**
- **Two oil fired boilers plus one electric boiler in plant**
- **Heating oil demand can exceed 500 gallons per day in winter and up to 132,000 gallons per year.**
- **In 2008 with $5/gallon pricing, annual heating costs reached $463,000.**

Sea Water Heat – Sweden & Norway

The concept of using heat from seawater for building demands has been employed for nearly 20 years in fjords along the coast of Scandinavia:

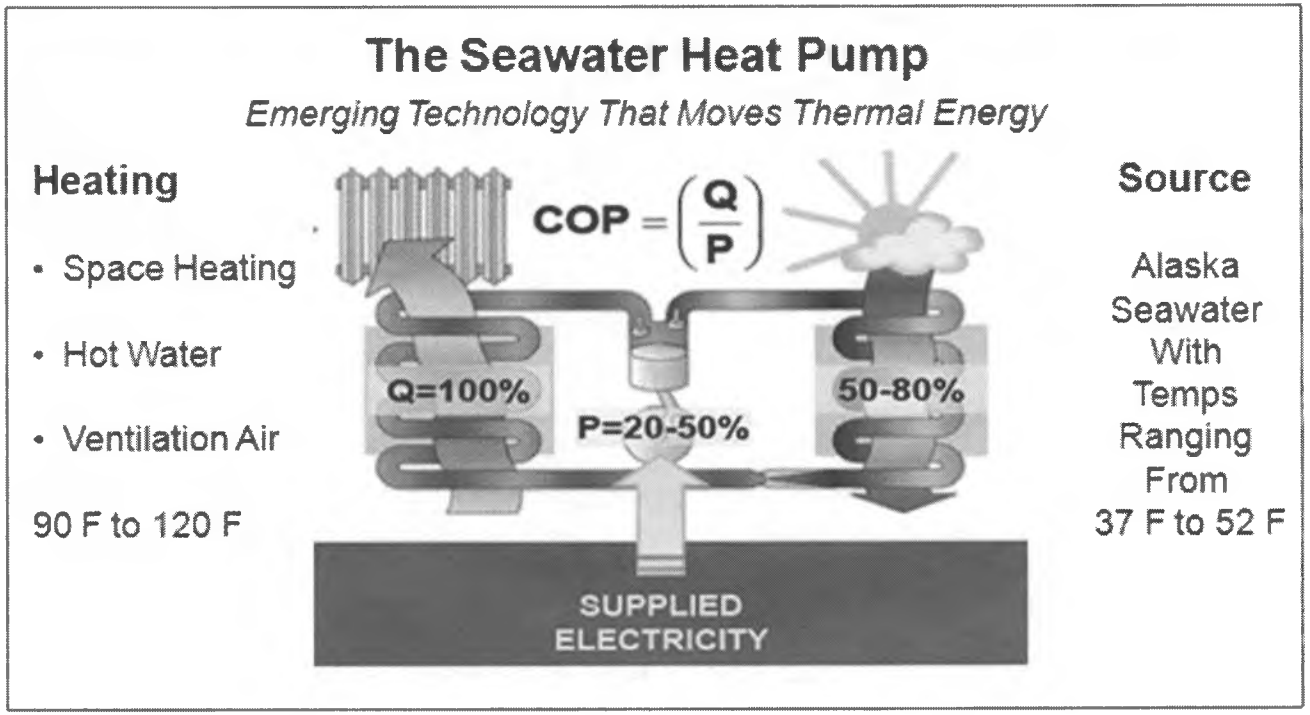
- **Stockholm, Sweden = Vartan Ropsten = largest seawater heat pumps on the planet**
- **Bodo Norway, pop 41,000, district heating w/44.6F seawater – on military base**
- **STATOIL Research Centre, Trondheim, Norway, district heating with seawater**

Seward Sea Water Heat Resource



Storage of solar heat in Resurrection Bay = year round usable heat resource

Technology Overview

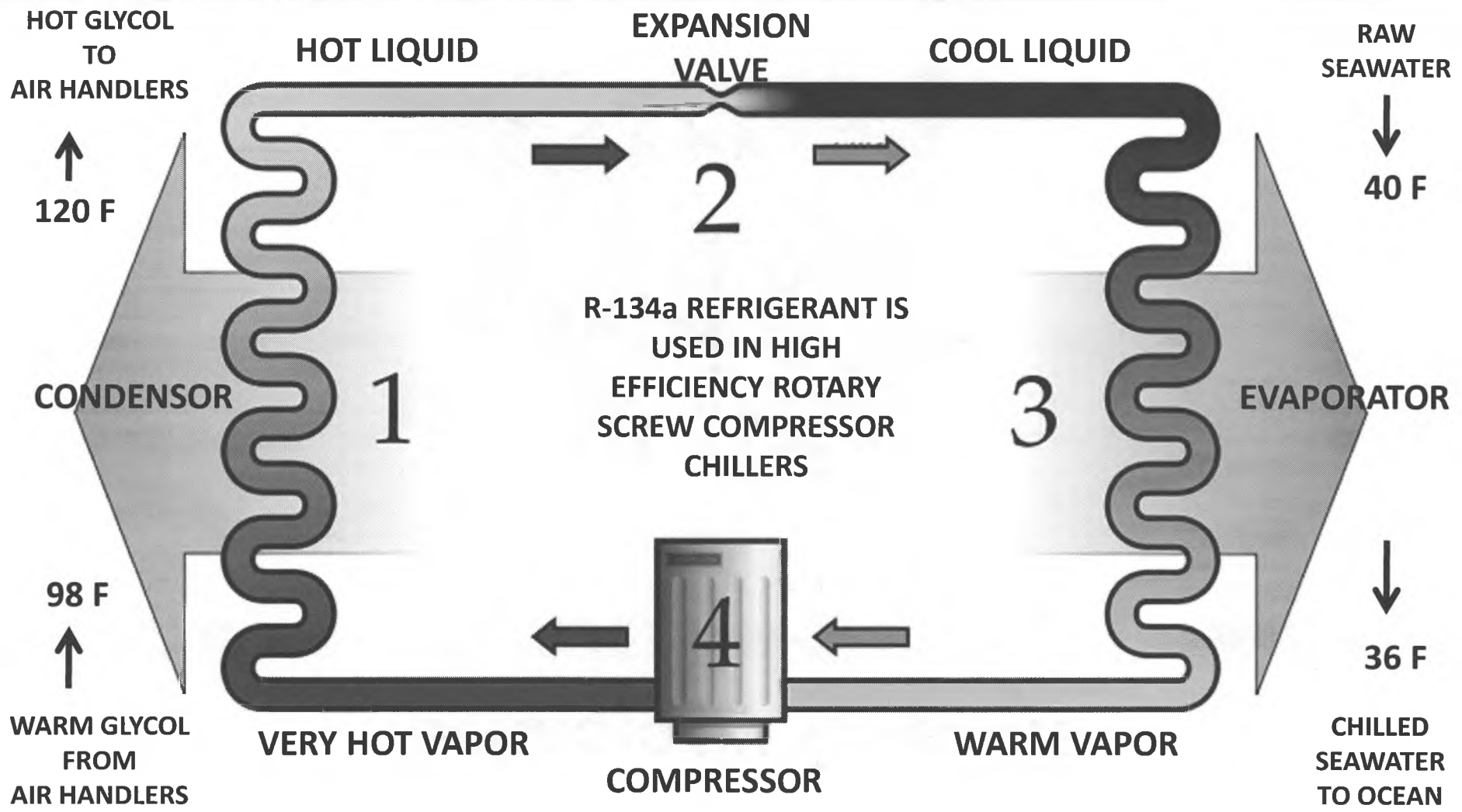


Q = Quantity of heat produced by heat pump

P = Electrical power used by heat pump

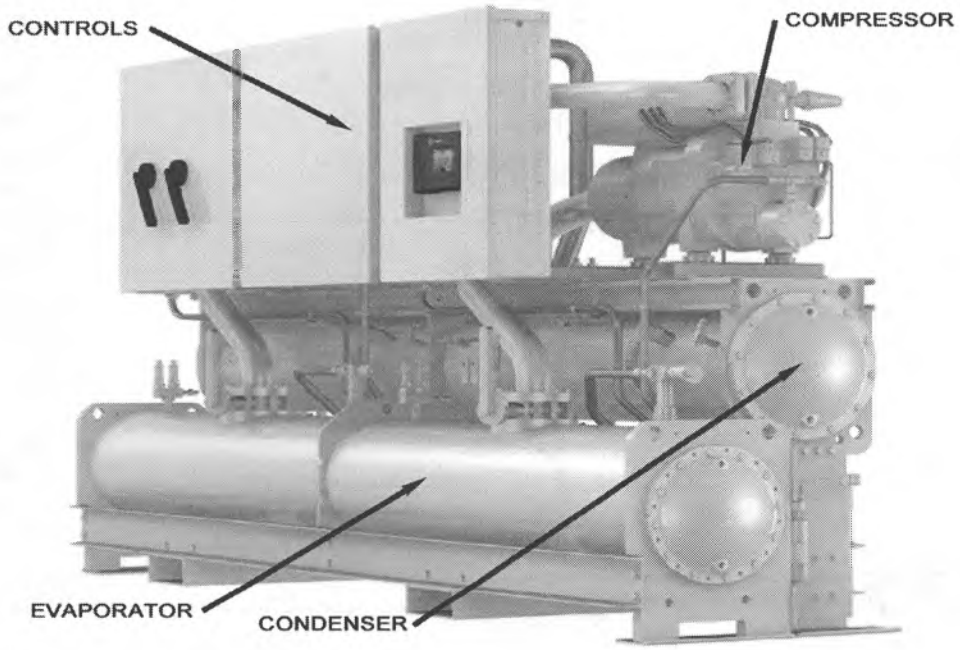
COP (Coefficient of performance) of 3.1 – 3.6 expected from ASLC seawater heat pump

Technology Overview



Technology Overview

HIGH EFFICIENCY ROTARY SCREW HEAT PUMP



Emerging technology with more efficiency & lower maintenance

Single packaged unit can now perform complex heat pump functions with high reliability and serviceability

Can be operated and supported with automated controls and web based monitoring

Technology Overview

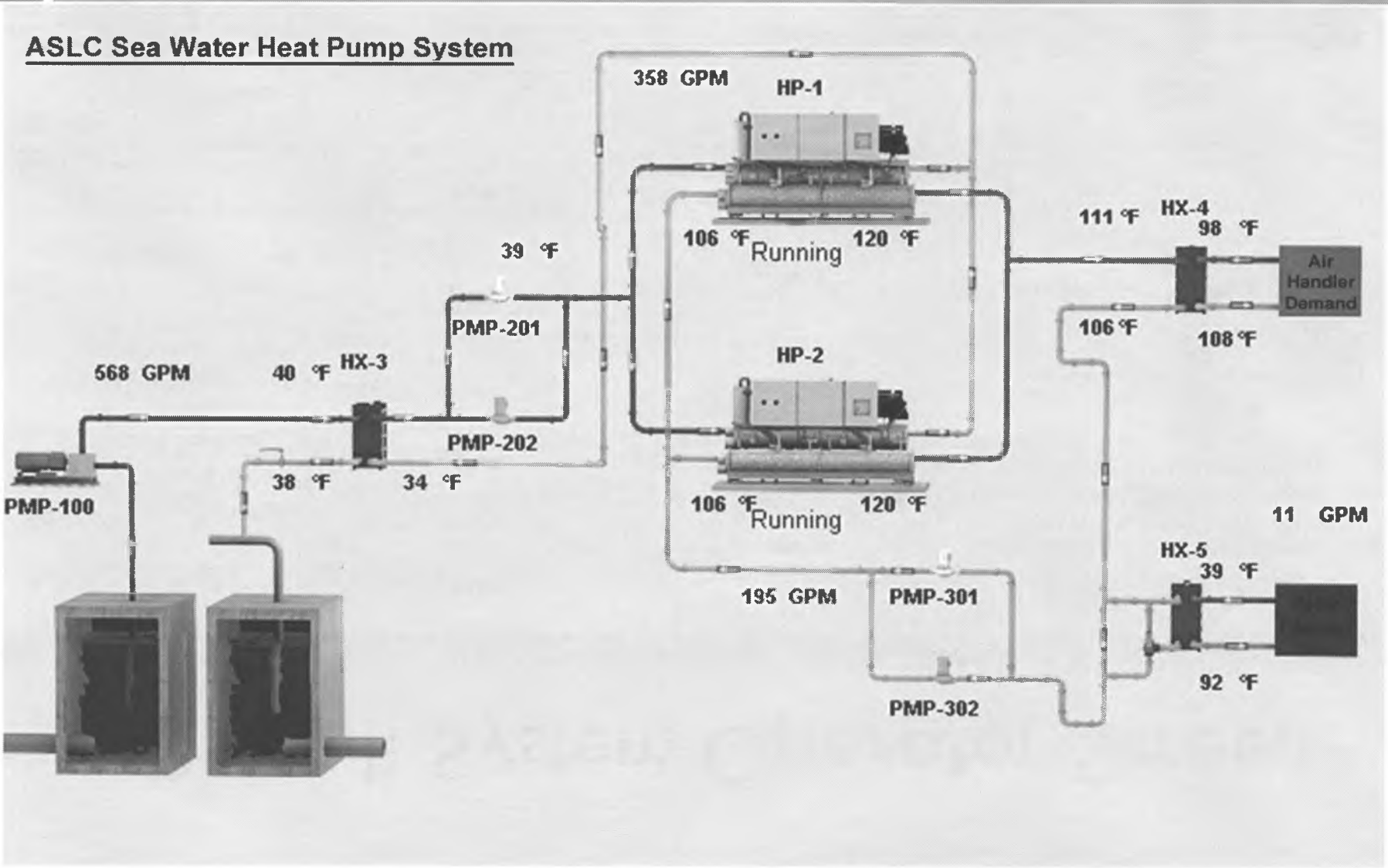
Month	Entering Evaporator deg F	Heating MBH (output)	kW (input)	COP
Jan	41.2	955.9	81.94	3.42
Feb	39.3	921.4	81	3.33
March	38.2	901.4	80.46	3.28
April	37.8	894.2	80.26	3.26
May	38.1	899.6	80.41	3.28
June	39	915.9	80.85	3.32
July	39.6	926.8	81.15	3.35
August	40.3	939.5	81.49	3.38
September	43.7	1001.6	83.17	3.53
October	45.8	1040.3	84.21	3.62
November	45.6	1036.8	84.11	3.61
December	43.3	994.2	82.97	3.51
Worst	35	843.7	78.89	3.13

Project Financial Evaluation

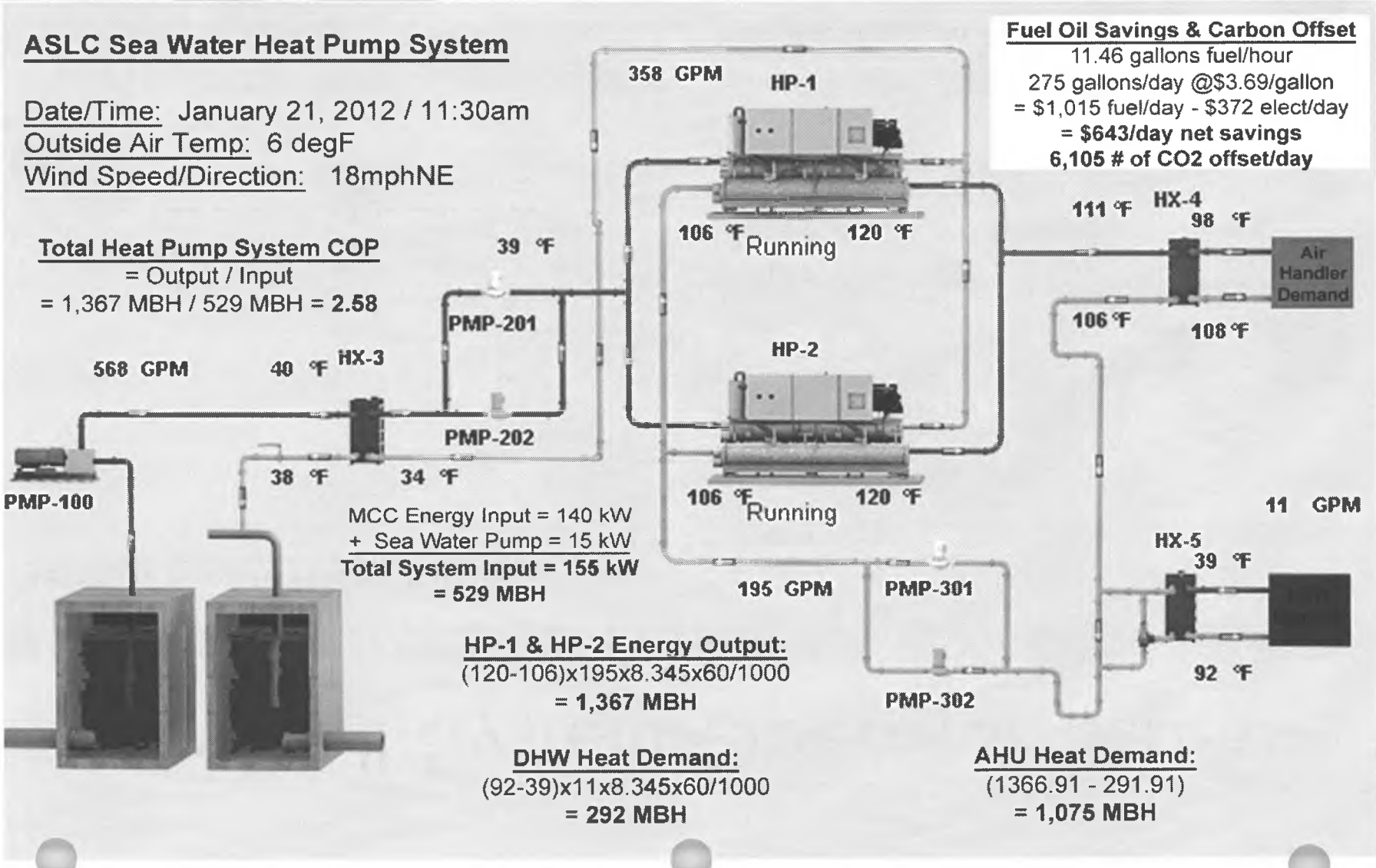
CAPITAL COST: ($713,300 Grant + $120,000 Match)	$ 833,300
Denali 2/3 & AEA 1/3	
ANNUAL COST FOR GLYCOL PUMPING:	$ 24,833
ANNUAL COST FOR HEAT PUMP ELECTRICITY:	$ 61,300
ANNUAL COST FOR O&M:	$ 10,000
ANNUAL VALUE OF HEATING OIL SAVED:	$ 212,738
NET PRESENT WORTH WITH 20 YR LIFE CYCLE:	$ 2,426,513
YEARS TO PAYBACK INVESTMENT:	6.7 YEARS
ANNUAL CO2 PRODUCTION AVOIDED:	1.3 million LBS CO2

- Electricity cost = start at $0.10/kwh with 4% per year escalation
- Heating oil cost = start at $3.69 /gallon with 6% per year escalation

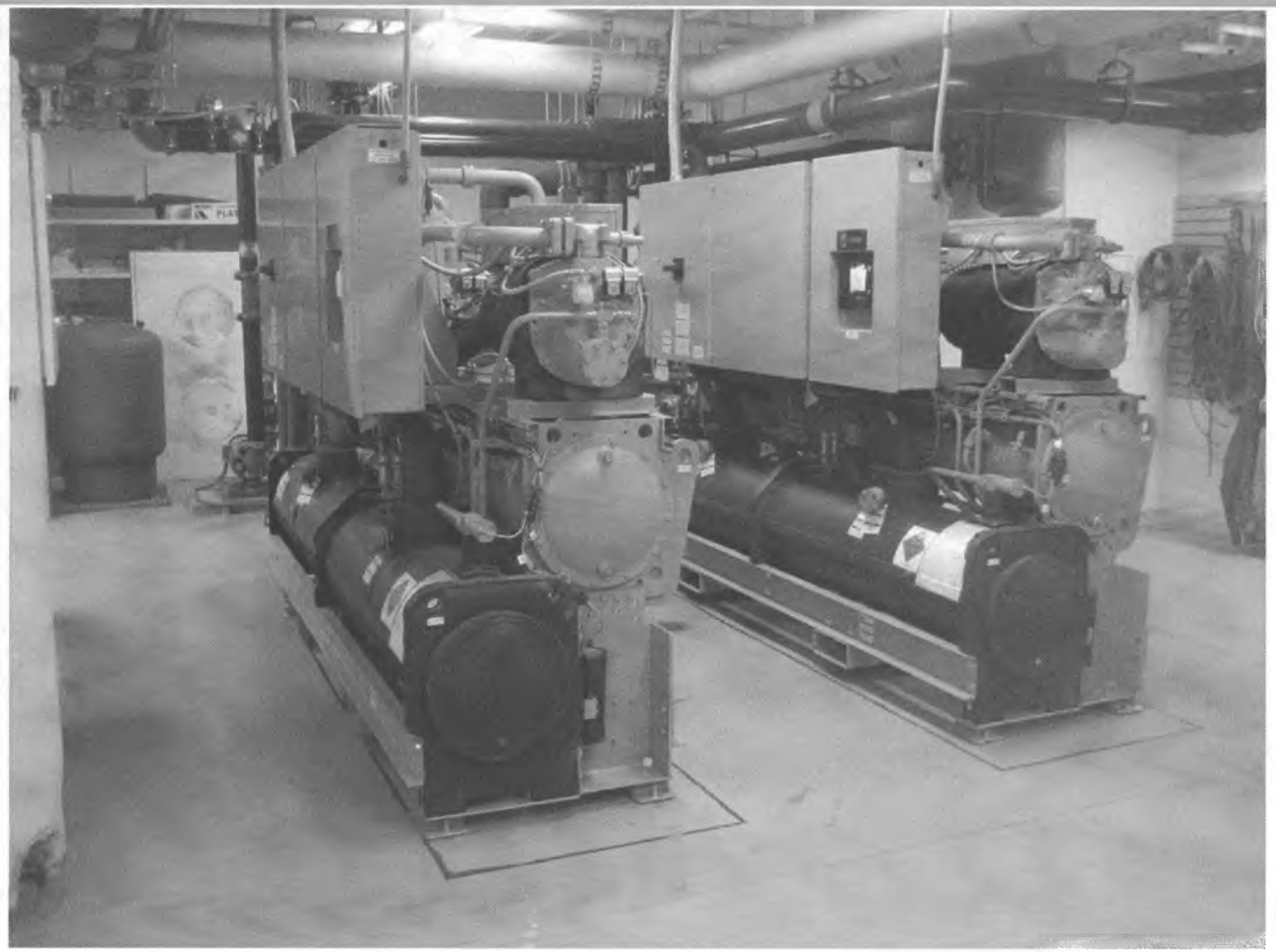
Overall System Operator Screen



Overall System Operator Screen



Actual Installation – Heat Pumps

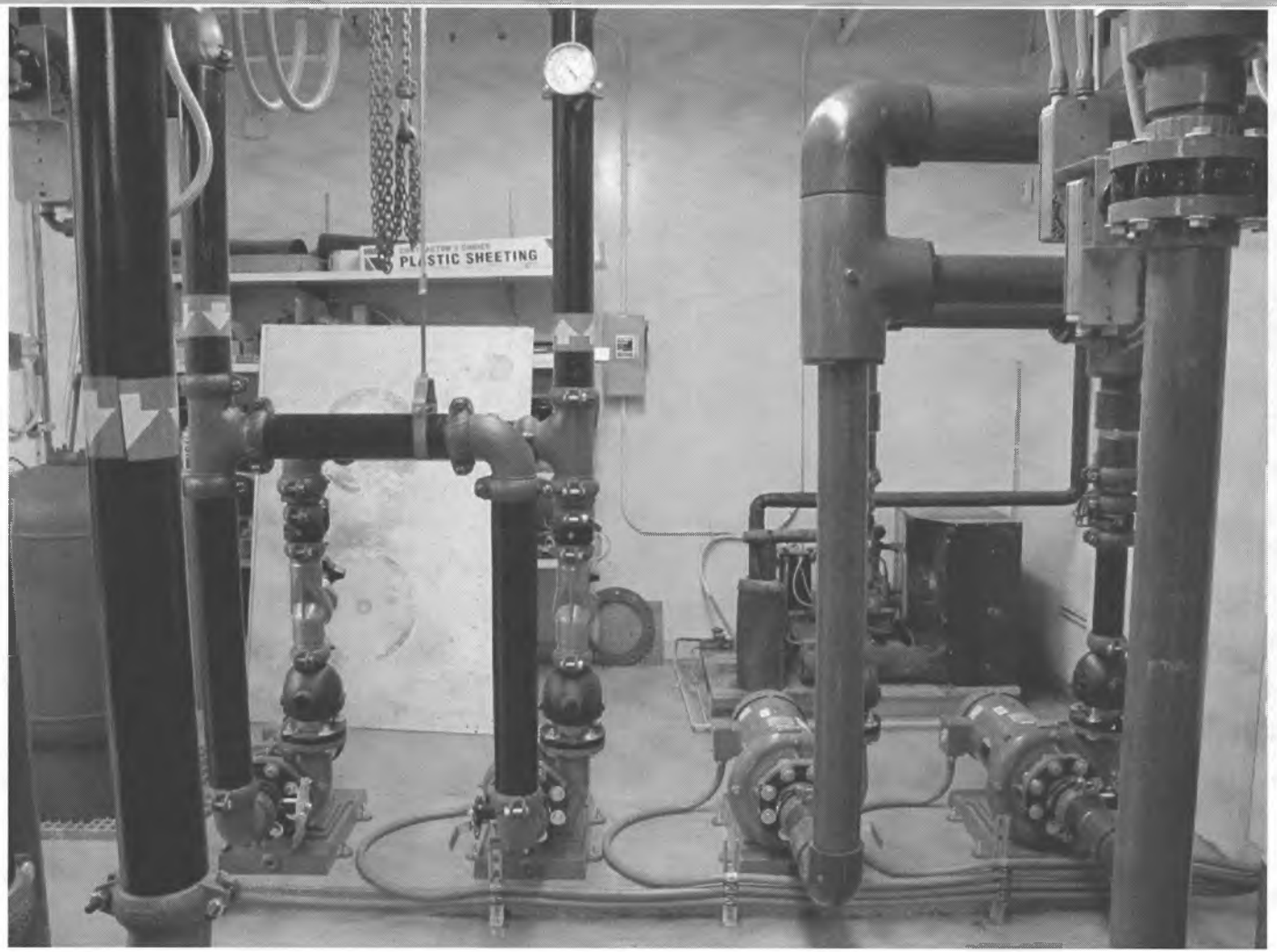


Two 90-Ton Heat Pumps – One or Two Heat Pump Operation

Actual Installation – Sea Water HX

Transfers Heat From Sea Water Into a Glycol Loop That Then Passes Through Heat Pumps

Actual Installation – Loop Pumps

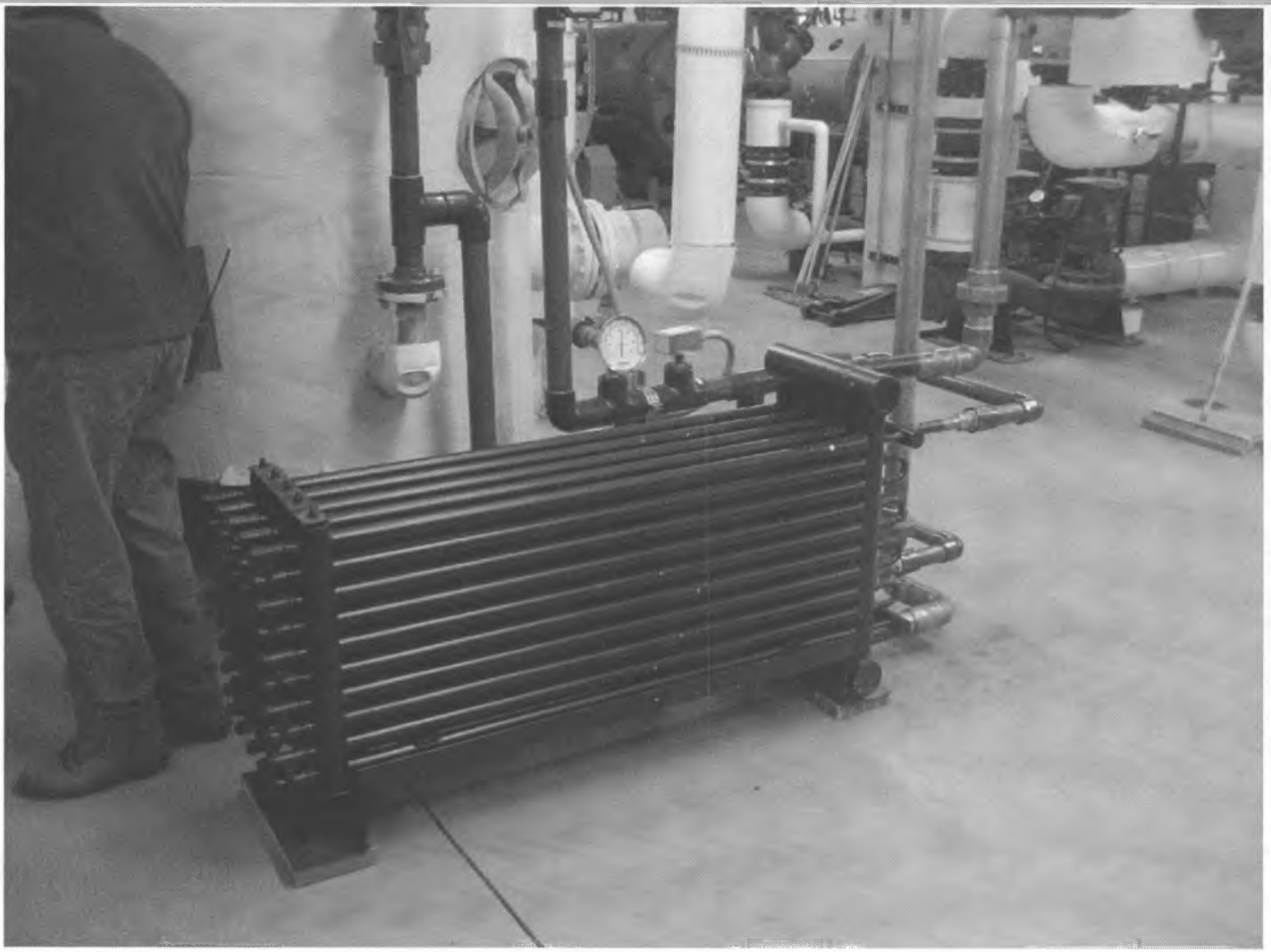


High-Efficiency Circulation Pumps Move Glycol and Water Through the Heat Pumps

Actual Installation – Air Handler HX

Heat Pumps Warm Up Water Loop to 120°F – This Heat is Then Transferred to Air Handler Loop

Actual Install – Domestic Hot Water HX



City Water Entering at 45°F is Pre-Heated Up To 100°F With a Side Loop From Heat Pumps

Actual Installation – Motor Control Center

All Electricity Used For Heat Pumps, Circulation Pumps, and Controls is Supplied by One MCC

Alaska Application

- **Opportunities for use in Alaska:**

  Coastal communities with warm sea water (ice free) and low cost hydro electricity = heating of large buildings + district heating

- **Challenges:**

  Constructing and maintaining sea water intakes, making use of low temperature heat in existing buildings (120F).

- **Potential Benefits:**

  Significant cost savings for heating against both heating oil and straight electric heat; large reductions in carbon emissions compared to equivalent heating oil burn; reduction of demand load on local utility grid (to one third) compared to straight electric resistance heating systems

Project Tasks & Timeline

- **Final Design** was completed by YourCleanEnergy on November 30, 2010
- **Equipment installation** - March & April 2011
- **Commissioning/start up** - July 2011 – Feb 2012
- **TRACER Operating Screens Enabled** – August 2011, technical challenges with system control integration
- **Testing & Data Monitoring** – Heating Season of Sept 2011 Thru April 2012

Project Status

- Construction completed July 2011, now in testing and commissioning phase

- Alaska SeaLife Center secured additional funding from Murdock Foundation to <u>improve the base sea water heat pump system</u>: $183,000 for slab heat construction
  - install **heat recovery system** that uses waste heat from exhaust fans to pre-heat glycol before entering heat pumps; will increase COP, and the investment will payback in less than 3 years
  - connect the **pavement heating system** to heat pump system so that further reductions in oil usage will occur in shoulder seasons

Alaska SeaLife Center
windows to the sea

Sea Water Heat Pump Project

Tara Riemer Jones, Ph.D., President & CEO
Darryl Schaefermeyer, Operations Manager

Alaska SeaLife Center, Seward, Alaska

Your Questions About This Project?

Thank you for coming today
Please visit your Alaska SeaLife Center in 2012

NEA Investment in Naknek Geothermal Project
January 2012

Why Not Diesel?

- Volatile and unpredictable fuel pricing
- Graph: Fuel Costs compared to Naknek Geothermal Project Costs 2008 – 2011
- Regulatory costs
- New energy - new paradigm - clean & renewable
- Value-add trends in the Bristol Bay seafood industry
- Increased load = increased fuel requirement

10 Years Researching Alternatives to Diesel Generation

- Coal Bed Methane
- Tidal
- Wind
- Geothermal

Geothermal Research and Reconnaissance 1999 – 2009 $3M

- Geological, Geochemical & Geophysical Surveys
  - Shallow Boreholes
  - 2-meter temperature probes
  - 3-D Seismic
  - Aerial Magnetics
  - Ground Magnetics
  - Magnetotellurics

Spring 2009

- Budgeting & Planning for Drilling Program
- Select Contractors, Engineers, Consultants & Suppliers
- Purchase Rig #7 **$11.5M (with improvements)**
  - Why buy a drilling rig?
    - Naknek Geothermal Project requires multi-well production field
    - High costs of mobilization and demobilization to remote area
    - High cost of drilling operation and standby day-rates
    - Retained value of rig ownership
- Survey Site and Design Road, Pad and Storage Cells

Summer - Fall 2009

- Barge Rig #7, Materials and Equipment to Naknek, Alaska
  - Northland Services contract for all ocean freight
  - More than 13 million pounds of equipment and supplies, including casing, cement, mud, heavy equipment, mixing tanks, and Rig #7
  - Everything required to commence drilling arrives in Naknek on time
  - Bristol Bay Borough dock crew drops top drive on the dock after it is off-loaded from barge
- Glacier Construction Contract to Build Road, Pads, Cells and Monitoring Wells

Naknek-G #1 Drilling Operations $19.3M

- DNR issued Geothermal Drilling Permit June 2009.
- AOGCC revised the Drilling Permit for Naknek-G #1 August 2009, without regarding geothermal techniques for underbalanced drilling – drilling the first well as an exploratory oil and gas well resulted in unanticipated regulatory compliance cost overruns
- Spud August 16, 2009
- Temperature downhole 9,000' – Baker Hughes survey 290 degrees.
- BJ Services calculated estimated temperatures based on logging and termperatures by drilling at approximately 350 degrees.

- Drilling Naknek-G #1 Sidetrack 1 began January 5, 2010
- Lost Naknek-G #1 Sidetrack 1 and suspended drilling operations January 22, 2010
- Drilling Naknek-G #1 Sidetrack 2 began February 8, 2010
- Lost BHA while drilling Sidetrack 2 April 6, 2010
- Fired company man April 8, 2010

Naknek-G #1 Cleaning & Flowing Operations

- First attempt commenced June 9, 2010
- Ended August 9, 2010 with mechanical failure
- Some of the heavy mud used to drill through production zone removed from fractures
- Temperatures reached 225°F - 250°F consistently with a single point measurement of 300°F at the flow line on August 6, 2010
- Thermal gradient based on Measurement While Drilling tools (MWD) higher than DNR estimates
- Recharge rate increased substantially as cleaning progressed
- Air compression system purchased from Vince Carlyle of Advantage Equipment in Midland, Texas and shipped to Naknek in January 2011
- Second attempt commenced February 18, 2011 using newly purchased air package
- Geothermal consultants on site to supervise flow and temperature tests March 2011
- Formation immediately surrounding well plugged with heavy mud
- Geothermal experts concur that based MWD data regarding inflow/outflow temperature, geologic logging, permeability and drilling fluid loss indicate a hydrothermal system capable of generating electricity.

Bankruptcy Hiatus - Events Leading to Voluntary Filing for Chapter 11 Reorganization

- Line of Credit reduced from $15M to $10M
- Long-term debt on the purchase of Rig #7 reduced from $11.5M to $8.5M
- Congressionally Designated Program (CDP) grants delayed and requiring matching funds
- Environmental Assessment (EA) required before the release of DOE's EGS competitive grant funding
- Co-Bank called in fuel loan requiring Chapter 11 protection for NEA and other creditors
- Rig #7 maintenance and improvements (winterization for year-round operations) performed while waiting for funding and larger capacity air compression system (August 10 2010 – January 2011)
- $.09 rate increase to NEA consumers May 1, 2010 to comply with National Rural Utilities Cooperative Finance Corporation debt covenants and demonstrate ability to cover debt service obligations

Preparations for Naknek-G #2

- AOGCC Drilling Permit for Naknek-G #2 issued mid 2011.
- Casing, cement, drilling chemicals, and equipment delivered to the site in 2009
- Determine drilling parameters for Naknek-G #2 with GeothermEx consultants

NEA Geothermal LLC

- Business Plan and Financial Plan completed in August 2010
- 10-year payback start-up capitalization - $500,000 annual dividends to NEA
- Opportunities for putting NEA Rig #7 to work after completion of the Pikes Ridge field include geothermal prospects at Mt. Spurr, Akutan, and US Air Force bases in the Aleutians; plus oil and gas plays in Alaska

NEA Consumer Support for Naknek Geothermal Project

- Naknek Electric Association voluntarily filed for Chapter 11 to protect the cooperative's assets, restructure debt, and continue the geothermal project
- Under bankruptcy protection NEA is eligible for geothermal project financing

- Board and management moved forward on the project and have focused on tasks that will bring geothermal energy online as soon as possible
- NEA held a Special Membership Meeting December 4, 2010 to vote on changing the Association's Articles of Incorporation debt limit language allowing the debt limit to be set by the Board of Directors through a duly enacted resolution
- The language reflected the standard among rural cooperatives for setting debt limits and was recommended by the Rural Utilities Service (RUS)
- A two-thirds (66%) majority vote was required to change Articles of Incorporation in the state and with surprising membership participation in the vote Amendment 1 was affirmed
- The State of Alaska has approved and recorded the amendment to NEA's Articles of Incorporation
- Amendment 1 Balloting Results:

Valid Ballots Cast	289	100%
"Yes" Votes	214	74%
"No" Votes	75	26%

- Board of Directors ratified NEA Resolution 2010-10 setting the cooperative's debt limit at $75M

Current Bankruptcy Status

- NEA filed Chapter 11 Reorganization September 30, 2010
- U.S. Bankruptcy Court hearing in December 2011 determined that NEA would submit a revised "diesel only" Plan of Reorganization, with a hearing on April 27, 2012.
- The judge will determine if NEA's Plan of Reorganization is in compliance with the U.S. Bankruptcy Code and creditors will decide if they agree to the plan
- If creditors agree unanimously to the terms of the plan then it can be confirmed and becomes binding; specifying the treatment of debts and operation of the utility for the duration of the plan
- The plan's payment schedule may be amended if resource confirmation tasks are funded and the geothermal project moves forward with federal and state renewable energy funding both authorized and prospective
- NEA's creditors understand that proceeding with geothermal resource confirmation, and the approval of the NEA's 2010-2014 Generation Construction Work Plan and loan guarantee by Rural Utilities Service (RUS) is in their best interests

Federal Grant Funding Status

- 2009-2010 Congressionally Directed Project funding (CDP) $5.35M ($2.86M reimbursed)
- $2.5M CDP funds remain (NEA geothermal project management will be meeting with DOE project managers in the next week to continue cost share discussion)
- January 2009 DOE – Energy Efficiency and Renewable Energy (EERE) competitively awarded $12.3M Enhanced Geothermal System Demonstration (EGS) Project funding
- Environmental Assessment completed and signed May 2010..
- NEA reimbursed $150,000 for EGS tasks completed to date; over $12M remains and will be released after NEA emerges from bankruptcy, cost share requirements are determined
- NEA geothermal project management has submitted cost share documentation and remains confident that funds will be made available for crucial resource confirmation tasks
- NEA geothermal project management, DOE project managers, DOE technical team, and Sandia National Laboratory scientists to formulate a plan forward, and revise tasks and Statement of Project Objectives (SOPO) to mitigate formation and heavy mud issues and move the project past the "go-no-go" decision point (resource confirmation
- Experts concur that Naknek-G #1 Sidetrack 3 is the preferred action to obtain resource confirmation

Rural Utilities Service (RUS) Funding – Guaranteed Loan – Catch 22

- RUS Environmental Review (ER) completed and signed in June 2011.
- NEA's guaranteed loan application will be complete when temperature and flow data collected during Naknek-G #1 resource confirmation activities are included in the financial forecast model

- Only after resource confirmation that will substantiate the worst case scenario in NEA's financial forecast will Rural Utilities Service (RUS) approve NEA's 2010-2014 Generation Construction Plan and loan guarantee application
- Senators Murkowski and Begich as well as Representative Young support NEA's project and have communicated this to key staff at RUS, DOE, and the State of Alaska

State Funding – Catch 22

- $1.25M awarded and received in September and October 2010
- Applications are under development for capital project funding consideration through the legislature and the Governor's Office

Resource Confirmation Tasks - Naknek-G #1 Sidetrack 3 $3.2M

- NEA geothermal project management, DOE project managers, DOE technical team, and Sandia National Laboratory scientist to determine best way to mitigate formation/heavy mud issues
- Experts concur that Naknek-G #1 Sidetrack 3 is the preferred action
  - Naknek-G #1 Sidetrack 3 Budget
    - Equipment **$55,500**
    - Supplies **$631,900**
    - Rig Hands & Direct Rig Costs **$708,734**
    - Contractual **$1,075,000**
    - Transportation **$450,000**
    - Contingency (10%) **$292,113**

Bristol Bay's Natural Renewable Resource Base

- Trends in the Salmon Industry
- In 2010 Sockeye Salmon accounted for 92% of the total Bristol Bay salmon harvest, 95% in 2009, and 94% in 2008
- In 2010 67% of the total Bristol Bay sockeye salmon harvest was processed in Naknek, Alaska, 58% in 2009, and 64% in 2008
- In 2010 the value of Sockeye Salmon harvest equaled $148.7M, in 2009 $127.6M, and in 2008 $111.4M
- Vacuum pack fillets and other value add activities are increasing among processors in the Bay which in turn increase ex-vessel value, demand, and energy requirements
- As the Bristol Bay floating processing fleet ages and corresponding operation and maintenance costs increase floating processing capacity will come on-shore
- NEA will realize increased sales if they can meet the demand
- Processors need firm and reliable power – geothermal energy could meet that demand without any increase in environmental liability or exposure to oil price volatility
- Trident Seafoods will build a $30M fish waste processor plant in Naknek, Alaska
- Bristol Bay Salmon Industry Workforce Contributions
  - 13% of Alaska's processing jobs
  - 26.1% of Alaska's harvesting jobs
  - 19.9% of all Alaska fishery jobs

NEA's Current Debt Load

Naknek-G #1	$23.5M
Long-Term debt for the purchase of Rig #7	$ 8.5M
Upgrades to Rig #7	$ 3M
CFC Fuel Loan / DIP Loan	$ 6.5M
Long-Term RUS Existing Loan	$ 3M
TOTAL	**$44.5M**

#1.25 state to clean out barite

Naknek Geothermal Project Update

January 2012

The $80 million Naknek Geothermal Project, in which Naknek Electric Association (NEA) has invested approximately $23 million to date, is now at a critical juncture – the immediate need for $3.2 million to leverage approximately $17 million in previously obligated federal grants as well as a federal loan guarantee.

The $3.2 million will allow confirmation of the geothermal resource in the initial well, which has been drilled at the project site seven miles from the King Salmon Airport (which NEA serves) in the Bristol Bay area of southwestern Alaska. Geothermal experts, engaged by NEA as requested by federal and state agencies, are in agreement that the initial well and the overall site hold high potential for Alaska's first utility-grade geothermal power production facility.

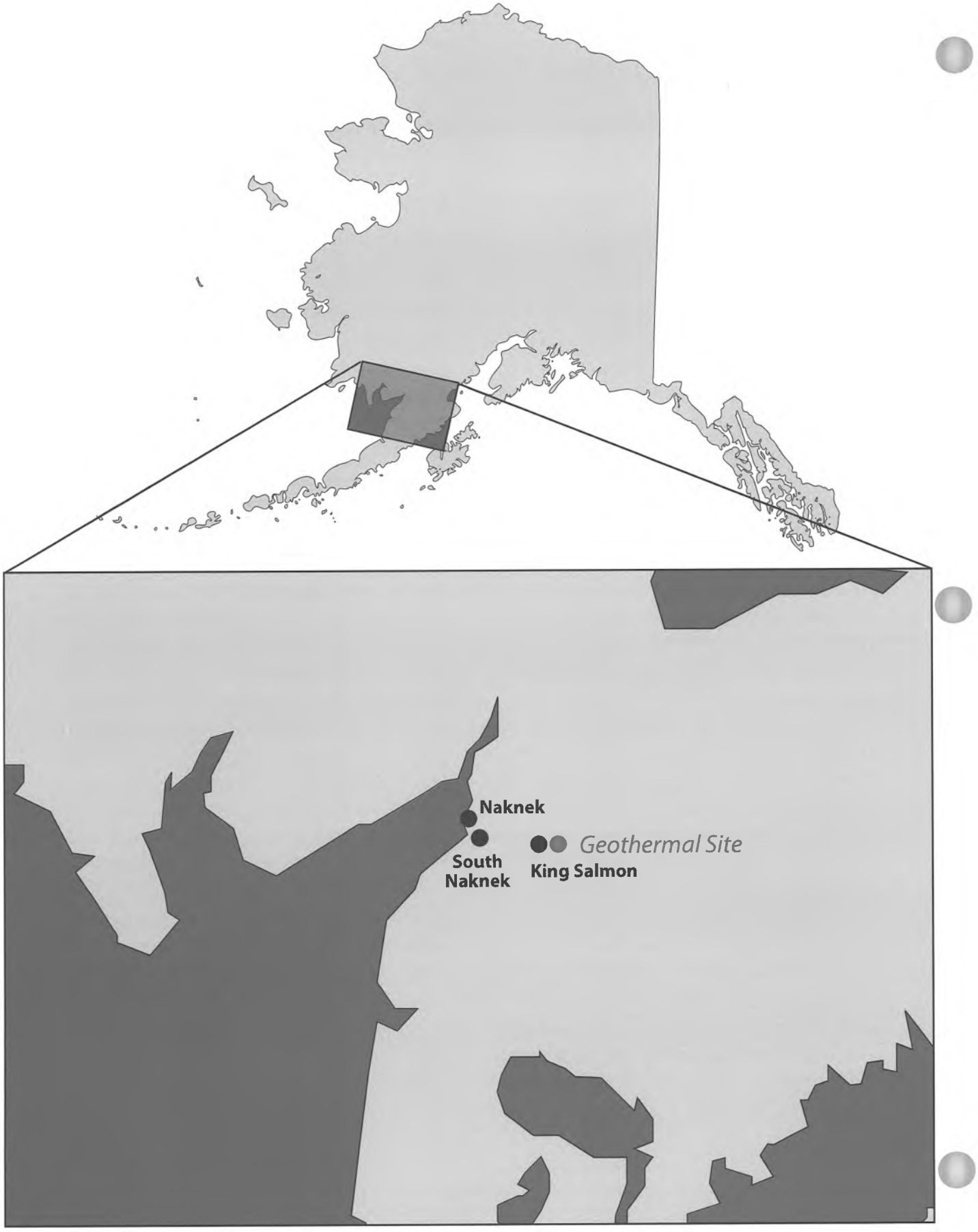
NEA is a member-owned electric cooperative serving residents of Naknek, South Naknek and King Salmon. The geothermal project has the support of the majority of NEA's consumers, as well as the Bristol Bay Borough, the Bristol Bay Native Association, the Bristol Bay Native Corporation, Paug-Vik, Inc. and the Alaska congressional delegation.

Resource confirmation within the initial well is necessary to verify its electricity-producing potential, and allow release of approximately $17 million in designated grants by the U.S. Department of Energy (DOE) and approval of a pending $54 million loan guarantee request to the U.S. Department of Agriculture's Rural Utilities Service (RUS).

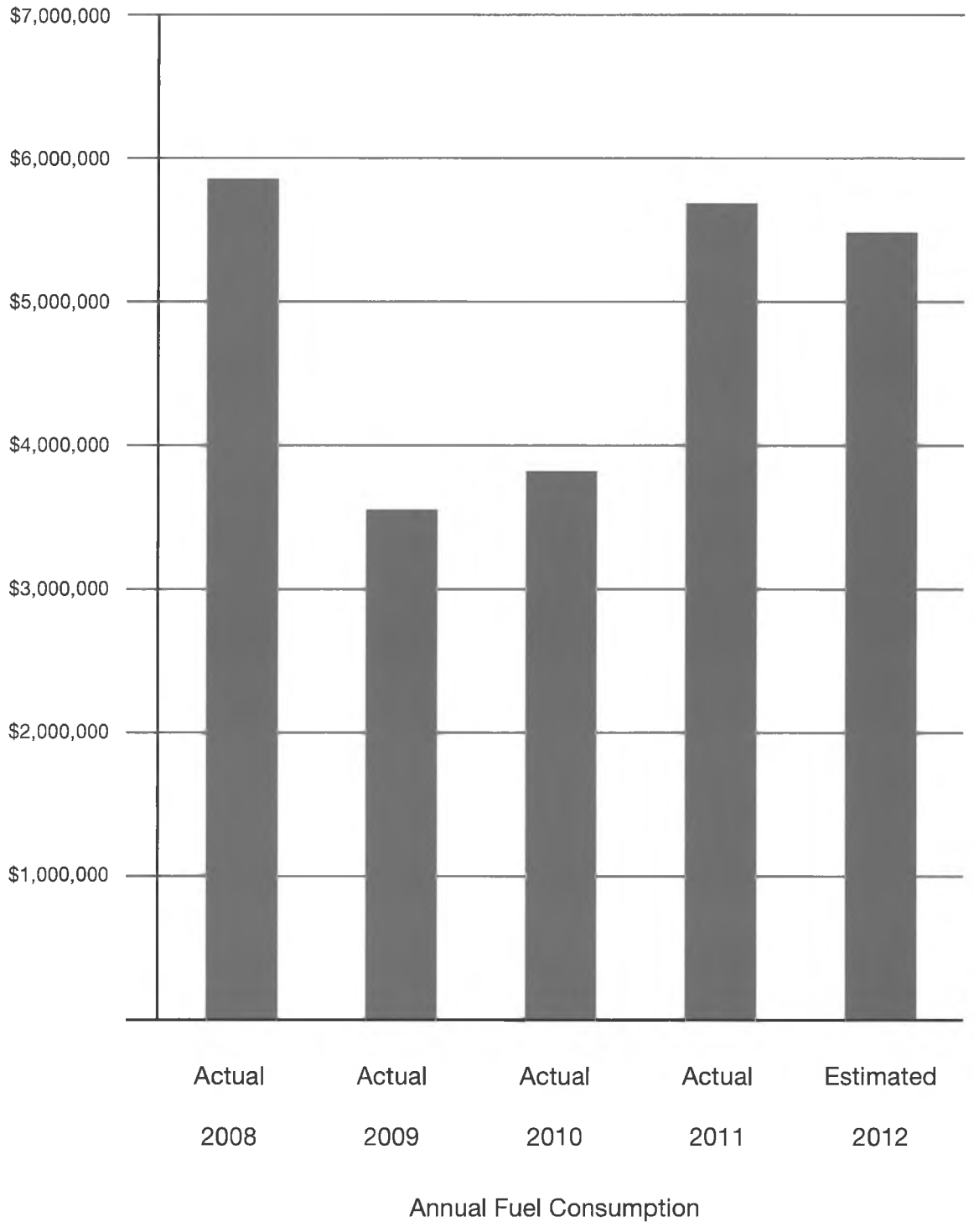
NEA is currently in Chapter 11 reorganization brought on by the heavy front-end costs associated with development of the initial well coupled with delays in freeing up the bulk of the DOE grants and the RUS loan guarantee. The $3.2 million is necessary immediately to assure the bankruptcy court that the resource confirmation will proceed without delay. The next scheduled proceeding in the Chapter 11 process is in late March.

Without assurance of resource confirmation, the bankruptcy court could effectively halt the project, forcing NEA to continue its total reliance on diesel generation, with rising fuel costs and environmental impacts. Currently, NEA is spending about $6 million a year on diesel fuel. Within just 13 years, that fuel expense would eclipse the total cost of the geothermal facility with its renewable fuel source – hot water.

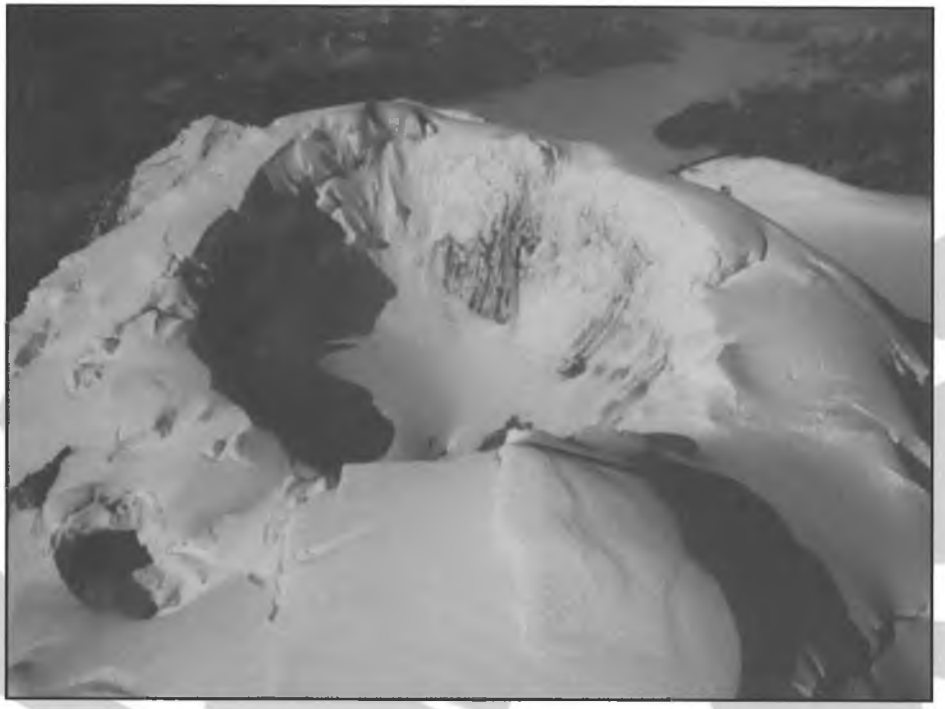
In addition to NEA's residential, business and government consumers in Naknek, South Naknek and King Salmon, the geothermal facility would serve major seafood processors in the largest salmon-producing region of the United States. Like others in the area, the processors are currently dependent on diesel generation. Bristol Bay seafood is a major economic engine in Alaska.


Naknek
South Naknek
Geothermal Site
King Salmon

Annual Diesel Fuel Consumption



The Mount Spurr Geothermal Project



House Resources Committee Meeting
January 27, 2012
Juneau, AK

Paul Thomsen (pthomsen@ormat.com)
Ormat Technologies, Inc.
www.ormat.com

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Disclaimer

Statements in this presentation including information provided in slides 11, 17, 18 and 21 as well as oral statements made by the officers or directors of Ormat Technologies, Inc., its advisors, affiliates or subsidiaries often will contain "forward-looking statements." Whenever you read or hear a statement that is not simply a statement of historical fact (such as when we describe what we "believe", "expect" or "anticipate" will occur, and other similar statements), you must remember that our expectations may not be correct, even though we believe they are reasonable. You should read and listen to these statements completely and with the understanding that actual future results may be materially different from what we expect, as a result of certain risks and uncertainties. For a complete discussion of the risks and uncertainties relating to the forward-looking statements in this presentation, please see "Risk Factors" as described in the Annual Report on Form 10-K report filed with the Securities and Exchange Commission on February 28, 2011.

We will not update these forward-looking statements, even though our situation will change in the future.

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Outline

- Introduction to:
  - Ormat Technology, Inc
  - Geothermal power
  - The Mt. Spurr geothermal project
- Project status and timeline
- Costs, matching funds and overall funding plan
- Local support
- Amount and cost of power supplied to Railbelt
- Economic and environmental impact

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Ormat Brings Credibility

- A leader in geothermal power
- Owns and operates 553* MW worldwide
- Supplied approximately 1,410 MW to 24 countries
- Vertically integrated:
  - Explores, develops, engineers, manufactures, constructs, operates
- Employs approx. 500 people in the U.S. ; >1,150 worldwide
- Publicly traded on the NYSE ("ORA")

*Including 50 MW of North Brawley in California and 15 MW of Jersey Valley in Nevada, which are currently below design capacity.

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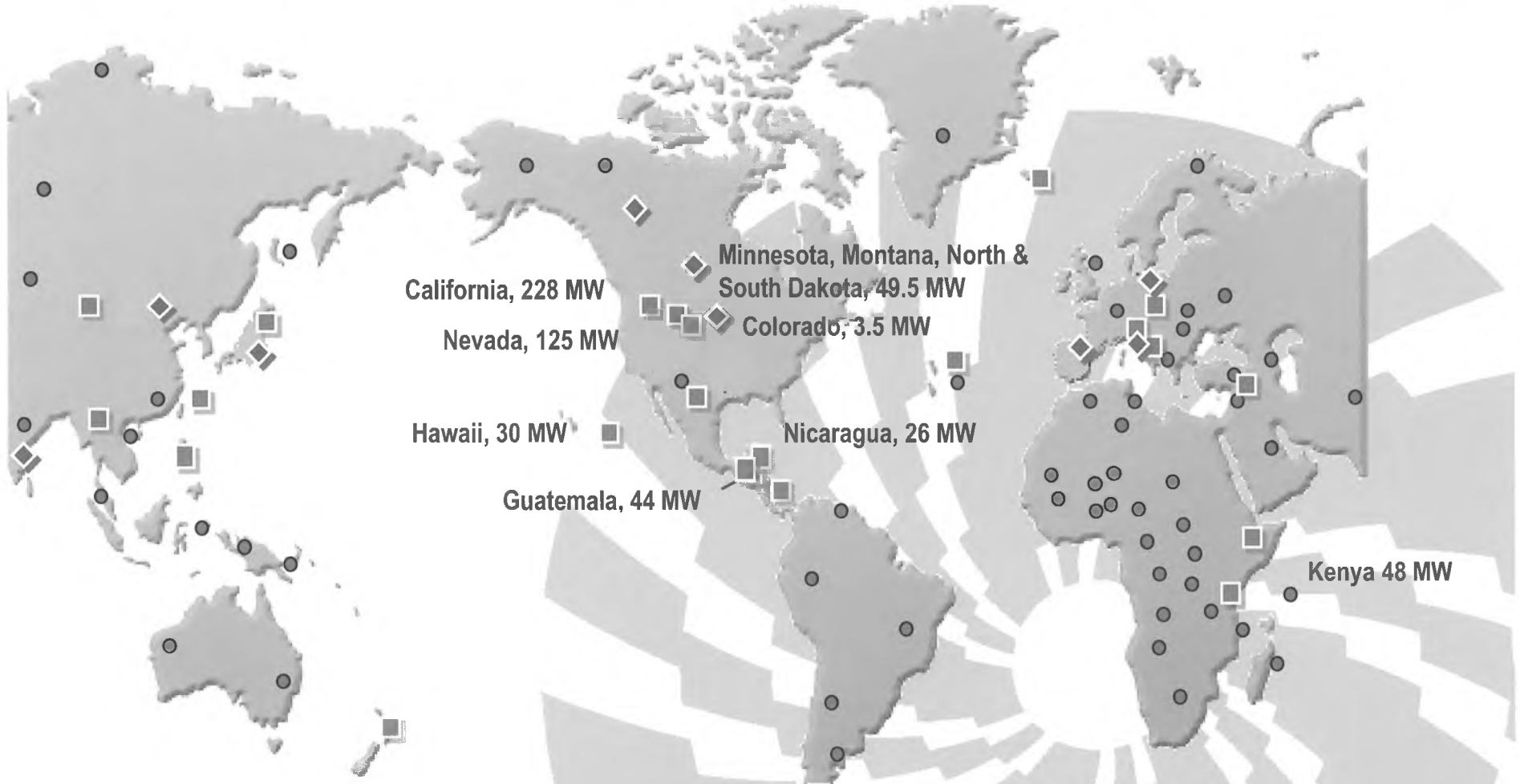
Global Presence

Meeting the Needs of Customers in 71 Countries



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Ormat's Commitment to Alaska

- >100 Remote Power Units
  - Serving remote gate valves
  - TransAlaska Pipeline
  - Since 1975
- First geothermal unit
  - Tested in 1979
  - University of Alaska Fairbanks
  - At Manley Hot Springs
- Approx. $6 million of Ormat equity invested in Mt. Spurr to date

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Geothermal – Key Attributes

- Utilities' renewable energy of choice:
  - Base-load generation
  - Cost-competitive
  - Highly reliable; >95% availability
  - Proven technology: ~11,000 MW deployed worldwide
- No fuel cost risk; Fixed long-term pricing
- Sustainable & environmentally friendly
  - Closed loop system with near zero emissions
  - No water consumption [Mt. Spurr plant will be air-cooled]
  - Minimal surface and visual impact
- Creates long-term, high-quality jobs

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Geothermal – Development Inhibitors

- Resources are scarce
- High upfront CAPEX and risk required in order to discover and confirm the resource

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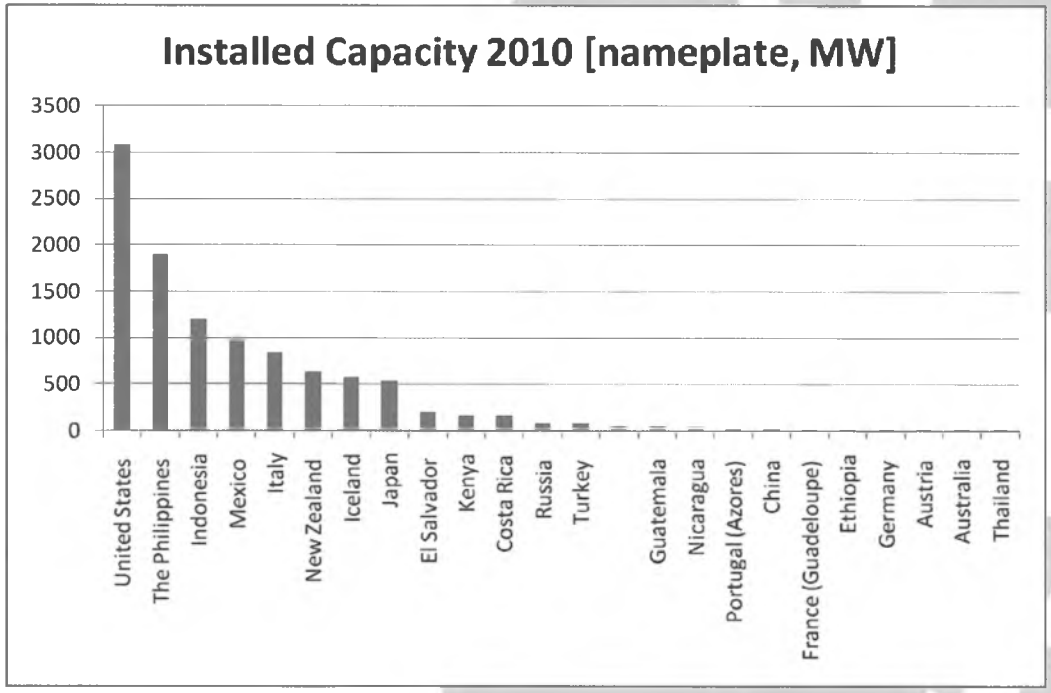
Worldwide Geothermal Deployment

- Approximately 11,000 MW deployed world-wide
- 24 nations have utility-scale geothermal generation
  - US is the world leader, with plants in CA, NV, HI, UT, ID
- Supportive policies have been key to success in all nations



Source: International Geothermal Association

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Project Location

West Cook Inlet

~75 miles west of Anchorage

Source: GoogleEarth

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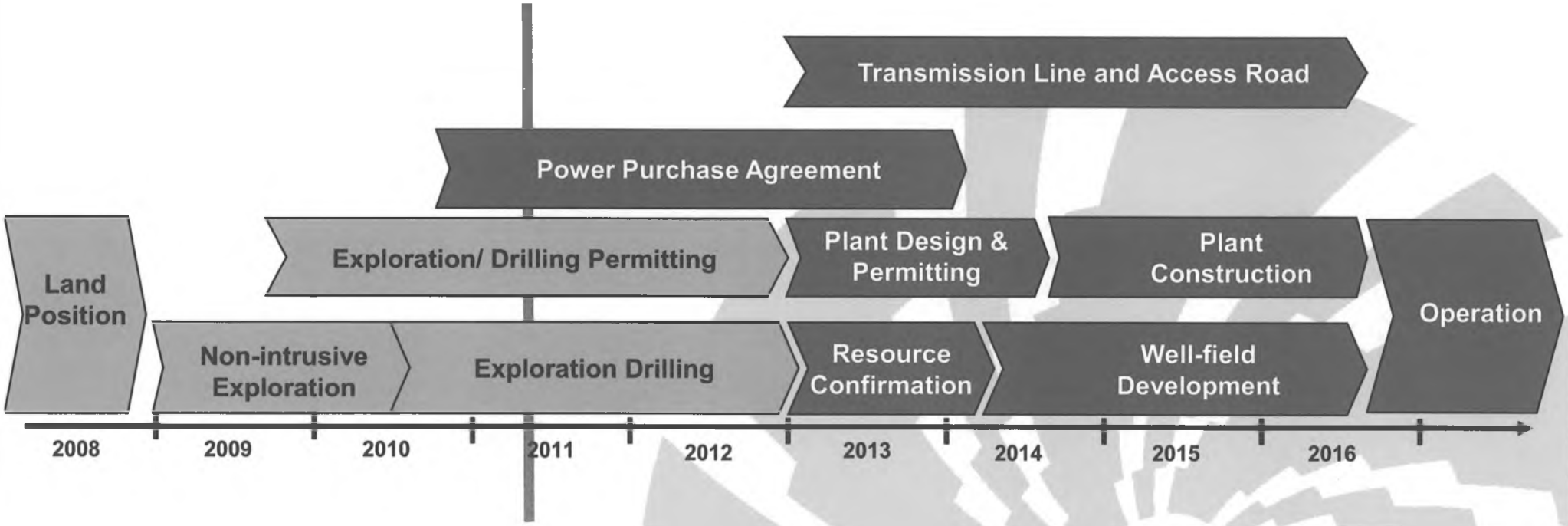
Mt. Spurr – Status & Estimated Timeline



- 36,000 acres of state lands leased from DNR in October 2008
- Non-intrusive exploration conducted summer of 2009 and of 2010
- Two exploration core holes (~1,000 ft) drilled in September 2010
- One deep exploration core hole (~4,000 ft) drilled during summer of 2011

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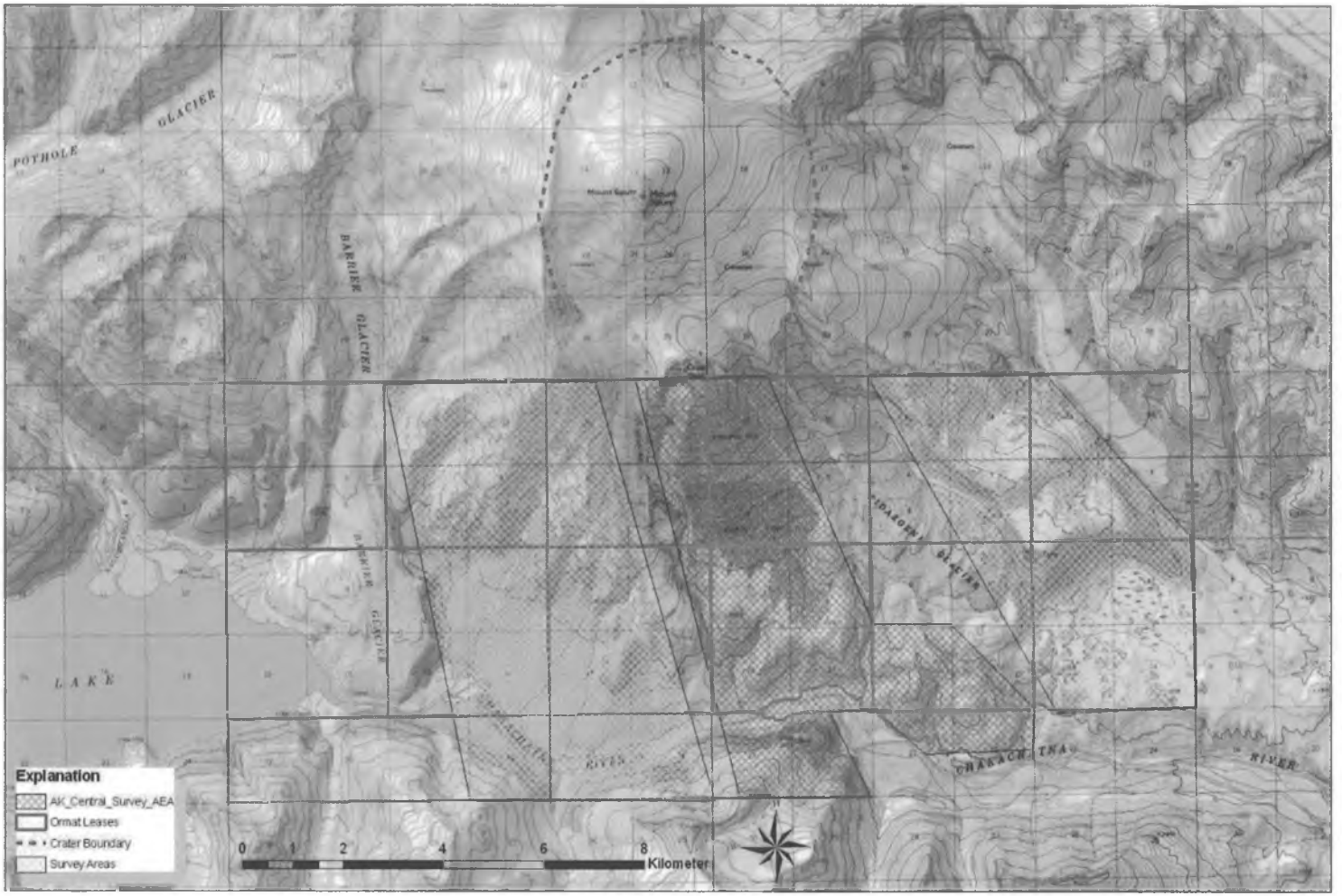
General Lease Area: 3 Regions



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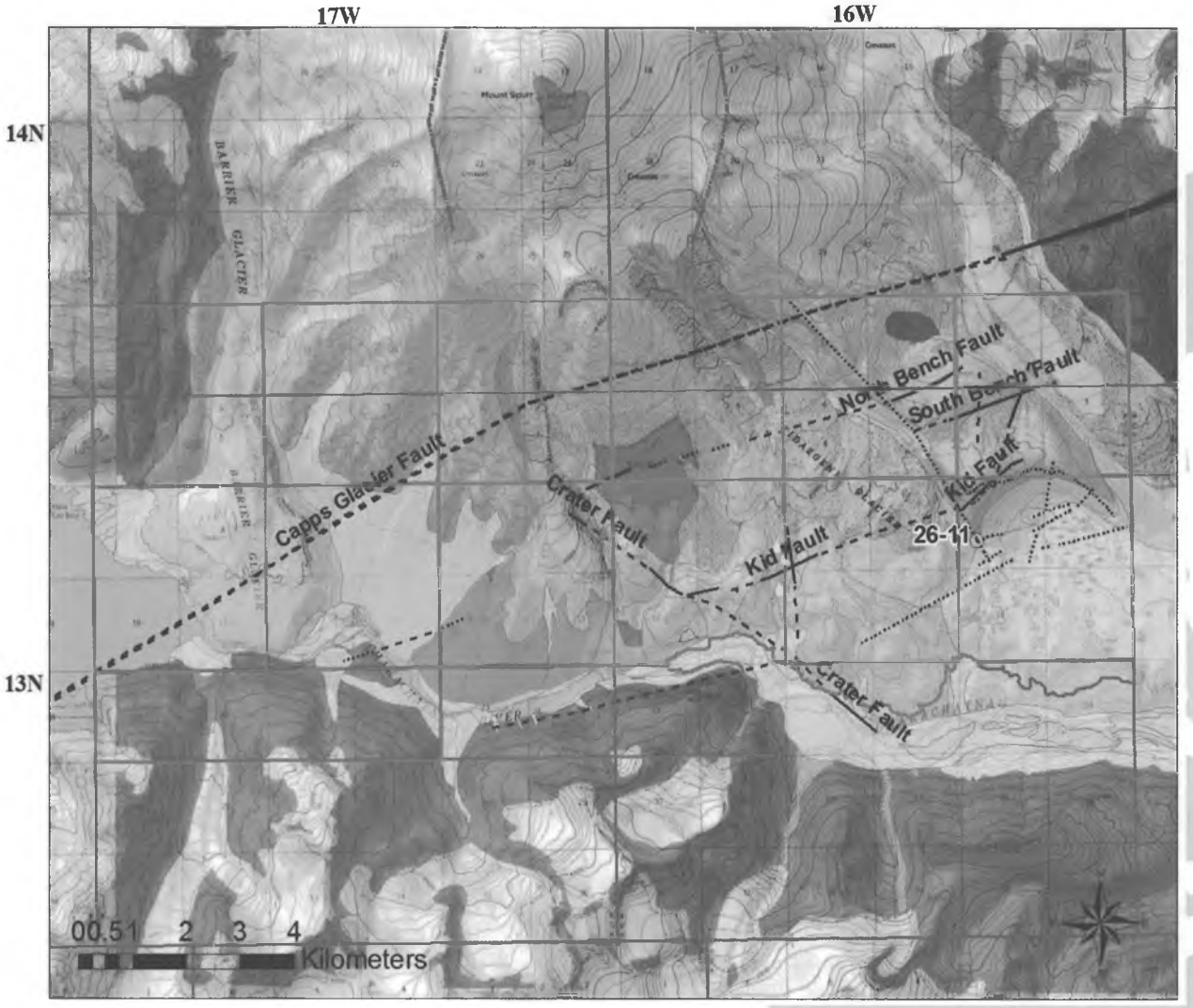
Drilling Work Focused on Easten Region



- Closest to infrastructure (road, transmission)
- Outside the known volcanic hazardous zone
- Geologic faults identified could potentially accommodate a geothermal resource

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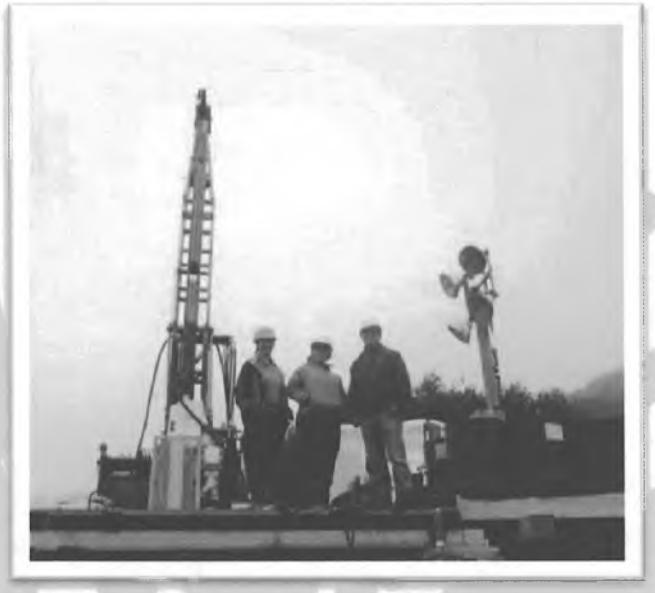
Core Drilling in 2010 and 2011



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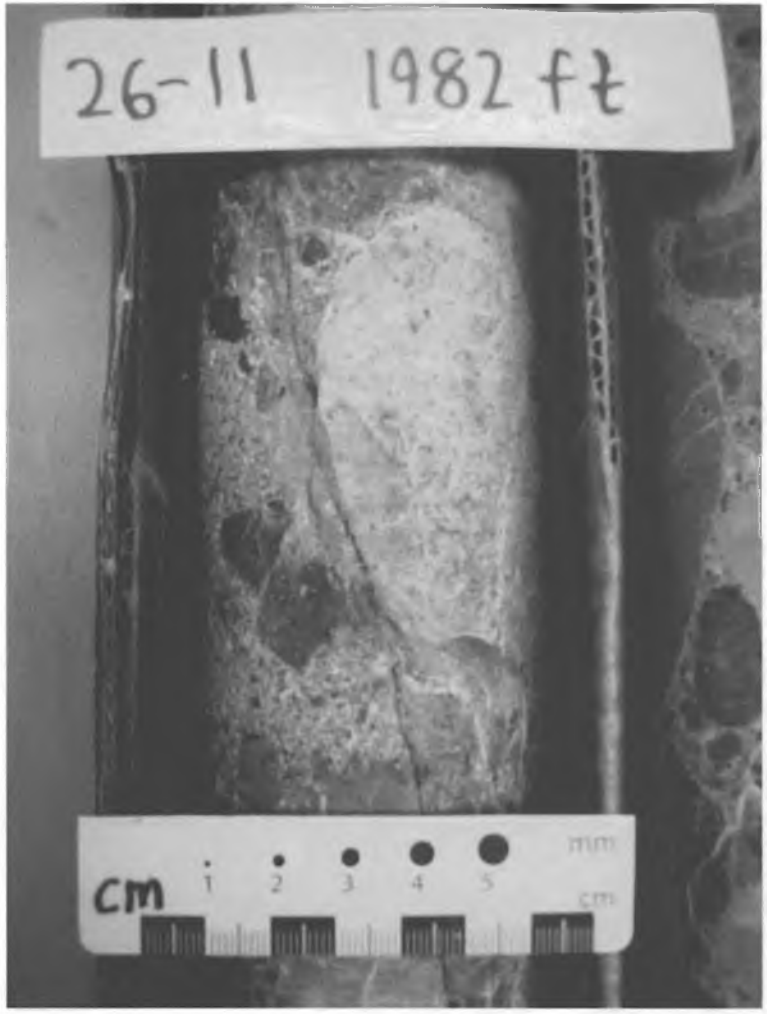
Core Collected – Donated to DNR/DGGS



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Results to Date

- Results from the 2009-2010 exploration and drilling work were encouraging as to the potential existence of a geothermal resource at commercial depths, primarily in the central (harder to develop) region but also in the eastern region
- Results from the 2011 deep core hole in the eastern region were not encouraging as the rock type encountered was not a good reservoir rock and the temperatures measured were colder than expected
- Current geologic model predicts low likelihood of finding a commercial geothermal resource at the eastern region
- However, geologic data still support the potential existence of a commercial resource at the central region

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Status and Next Steps

- Current efforts focus on trying to find a location in the central region that satisfies all major requirements:
  - Reasonable likelihood of finding a commercial resource
  - Volcanic hazard risk can be mitigated
  - Access road and transmission line could be connected to it at reasonable costs

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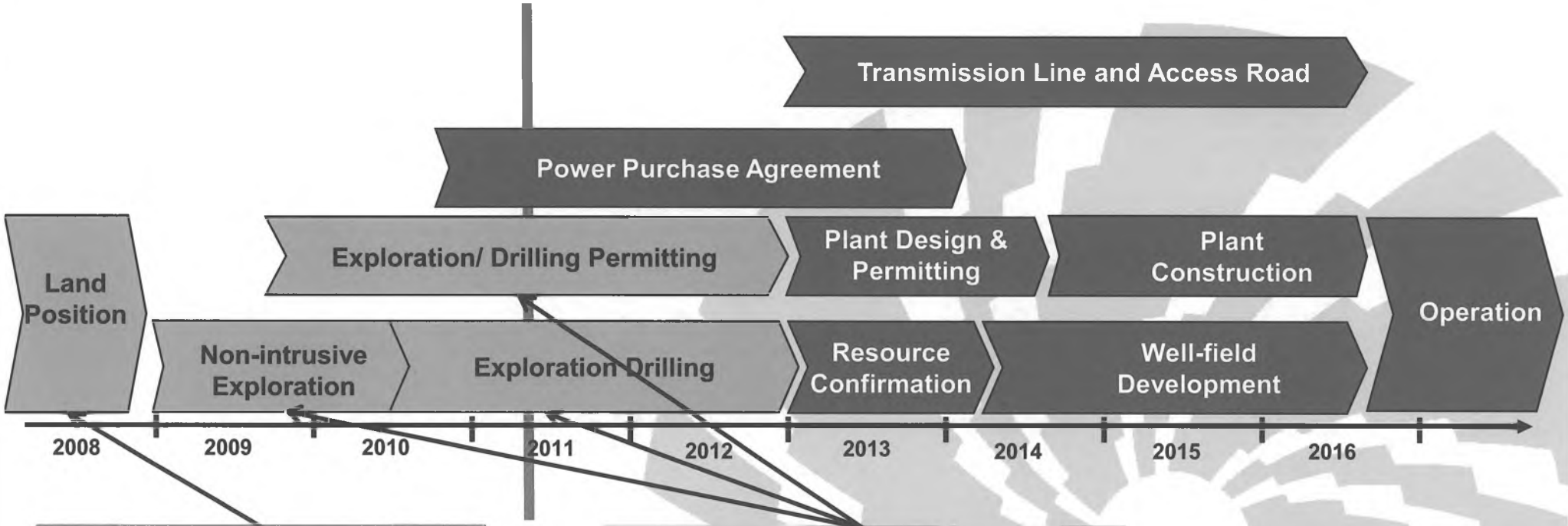
Sources of Funding So Far



Ormat

~$3.5 million bonus payment;
~$100,000 annual rent

Ormat and AEA (round III)

Ormat: ~ $3 million*

AEA: ~$2 million

* $2.1 million as matching funds per the grant agreement and the rest outside it

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Energy to the Railbelt

- Capacity estimated at 50~100 MW net, average. Target is:
  - ~50 MW in 2016
  - Expand to ~100 MW in 2019
- Near-term solution, bridging the gap to longer-term mega-solutions, e.g. Suisitna/Watana hydro and/or gas pipeline
- At 95% availability: 416~832 GWh/year

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Cost of Power to Railbelt Utilities

- Estimated at ~12 c/kWh
- Fixed price, not coupled with fossil fuels
- Geothermal is a baseload 24/7 resource, therefore utilities will not incur any integration costs
- Price is higher than current avoided costs (5-10 c/kWh), however:
  - Is comparable to other alternatives, e.g. Suisitna/Watana
  - Railbelt utilities' avoided costs are likely to go up with the continued depletion of Cook Inlet gas reserves

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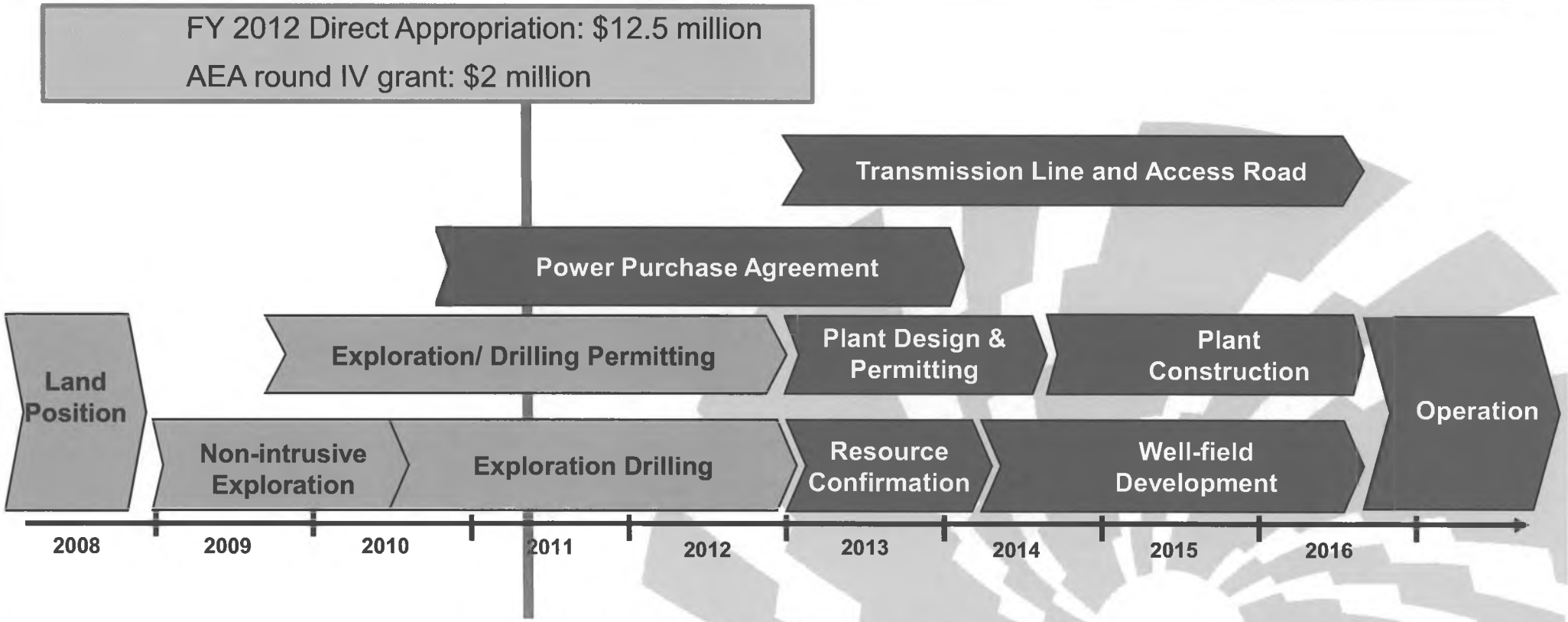
Additional Appropriated Funds



We would greatly appreciate making these appropriations available to this project in 2013, should Ormat and the State decide further drilling in the central region is justified

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Local Support

- From nearest communities:
  - Tyonek:
    - Cooperative agreement with Tyonek Native Corporation (TNC) in place
    - TNC provided Ormat with letters of recommendation
  - Kenai Peninsula Borough
    - Mayor provided Ormat with letters of recommendation
  - Anchorage
    - Mayor provided Ormat with letters of recommendation

- Environmental and renewable energy communities:
  - Cook Inletkeeper
  - Renewable Energy Alaska Project (REAP)

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Regional Priority and AEA Vetting

- Project supported by all 6 Railbelt utilities, separately and via ARCTEC, as a potentially viable near term solution
- Identified by the AEA-sponsored 2010 Railbelt Integrated Resource Plan as a beneficial component in the Railbelt's generation portfolio
- Selected by AEA for round III and IV of the Renewable Energy Fund Grant (REFG)

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Economic Impact

- Alaska's 100 MW of geothermal power could:
  - Provide 50-80 long term high paying jobs
  - Provide more than 300-450 construction jobs
  - Impact >400 local vendors
  - Fuel local economy with >$850 million over 30 years

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Environmental Impact

- Alaska's 100 MW of geothermal power could annually:
  - Save ~6,000,000 MMBTU of depleting Cook Inlet natural gas
  - That's roughly the equivalent of Anchorage's entire residential heating consumption
  - Avoid emission of ~320,000 tons of CO_2*

*Calculated for natural gas, assuming 53 Kg of CO_2 per MMBtu (DOE/EIA http://www.eia.doe.gov/oiaf/1605/coefficients.html)

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Summary – Mt Spurr Benefits

- Clean, reliable, field-proven, base-load power to the Railbelt
- Significant relief in Cook Inlet natural gas consumption
- Significant contributor towards 50% renewables by 2025
- Provides long-term price stability
- Near-term solution, bridging the gap to longer-term mega-solutions, e.g. Suisitna hydro and/or gas pipeline
- Provides high quality, long term green jobs

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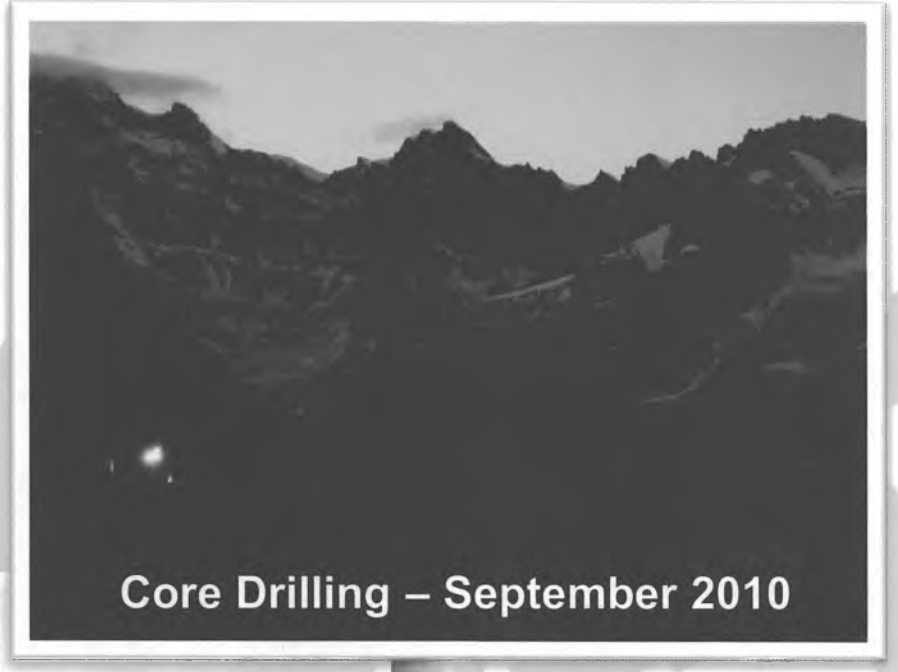
Thank You!


Mt. Spurr Summit – August 2009


Core Drilling – September 2010


Core Drilling – Summer 2011

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