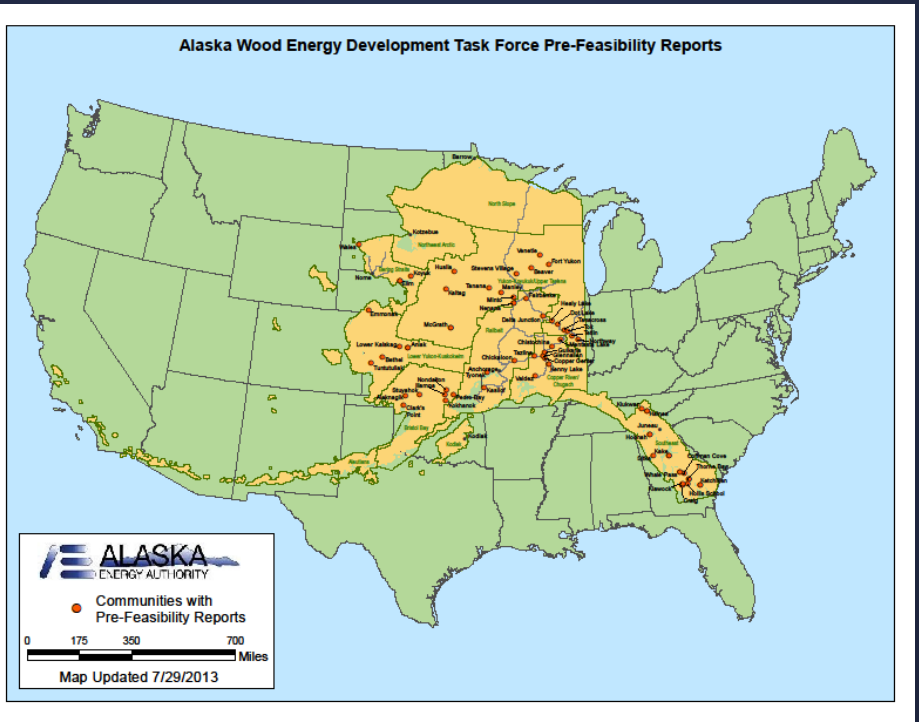
Path to Economic Sovereignty: Arctic Opportunities

Presented by Kip Knudson
Office of Alaska Governor Bill Walker
Slide Deck prepared by Sean Skaling, Director, Alaska Energy Authority

Photo by Chuck Berray

200 remote microgrids spread over large area



- Population: 735,000
- Area: 660,000 sq. miles
- 1.2 people/sq. mile
- New Jersey has 1,000 times the density
- About 200 stand-alone microgrid communities

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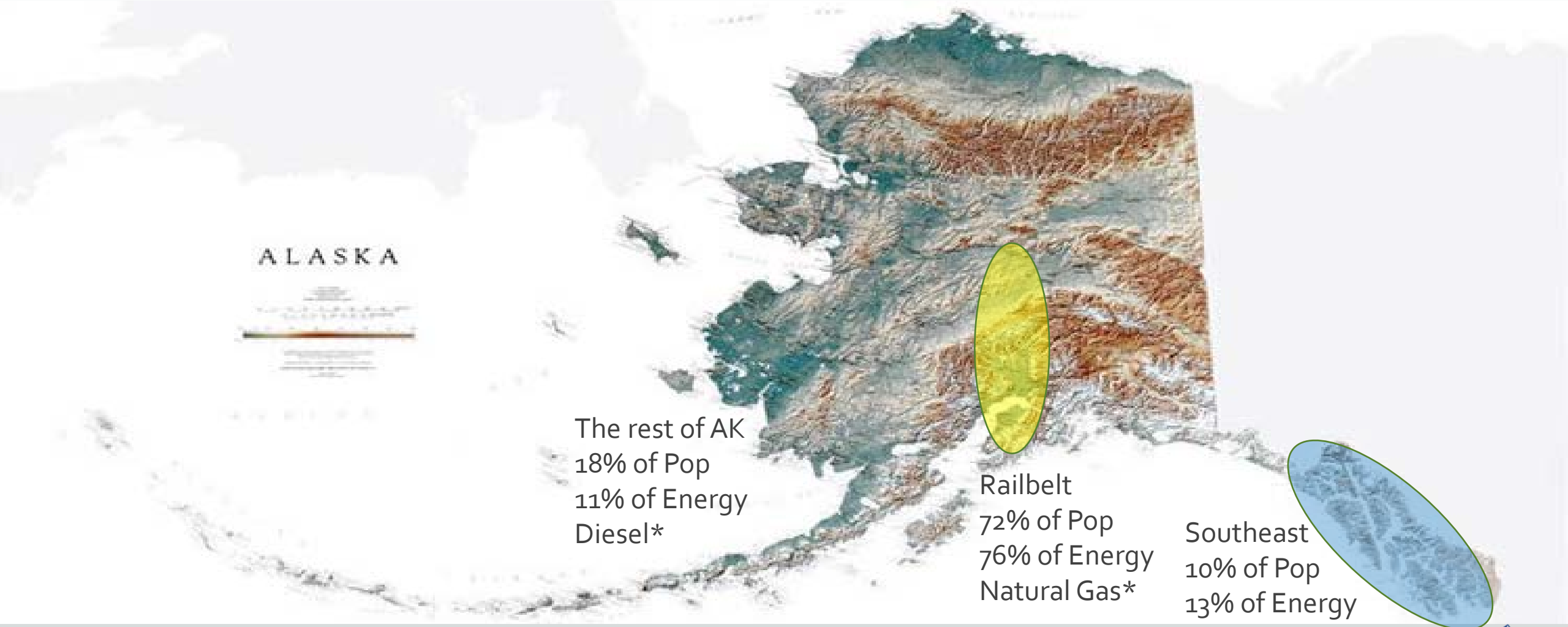
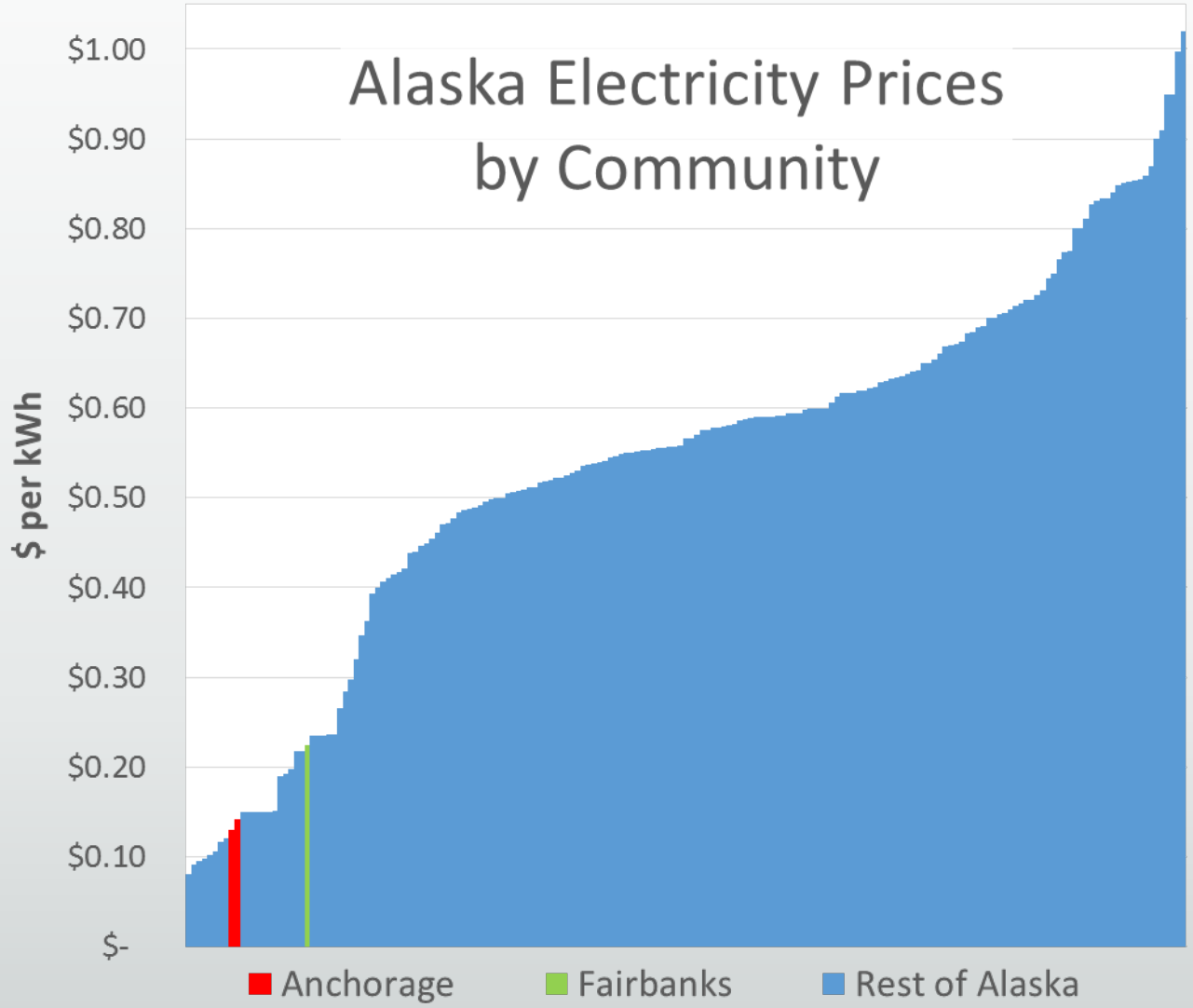
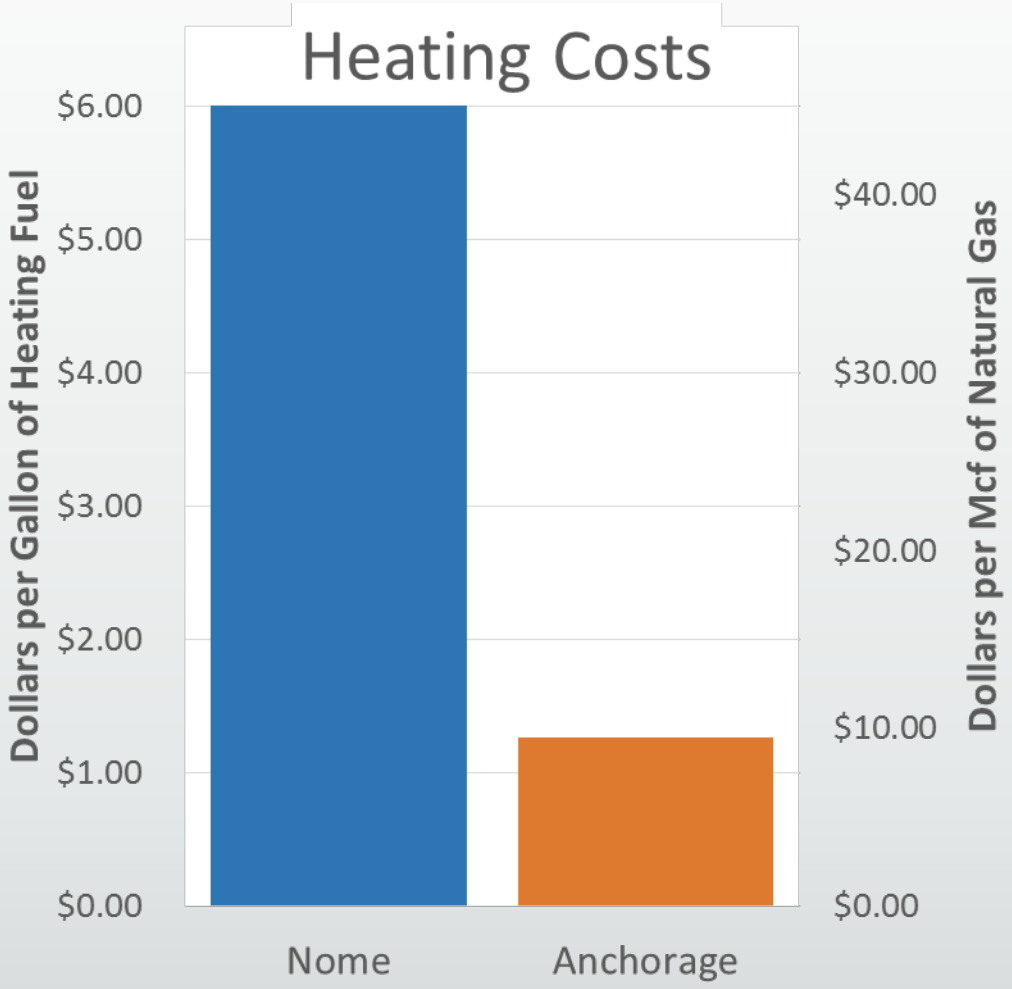
Alaska Electrical Generation



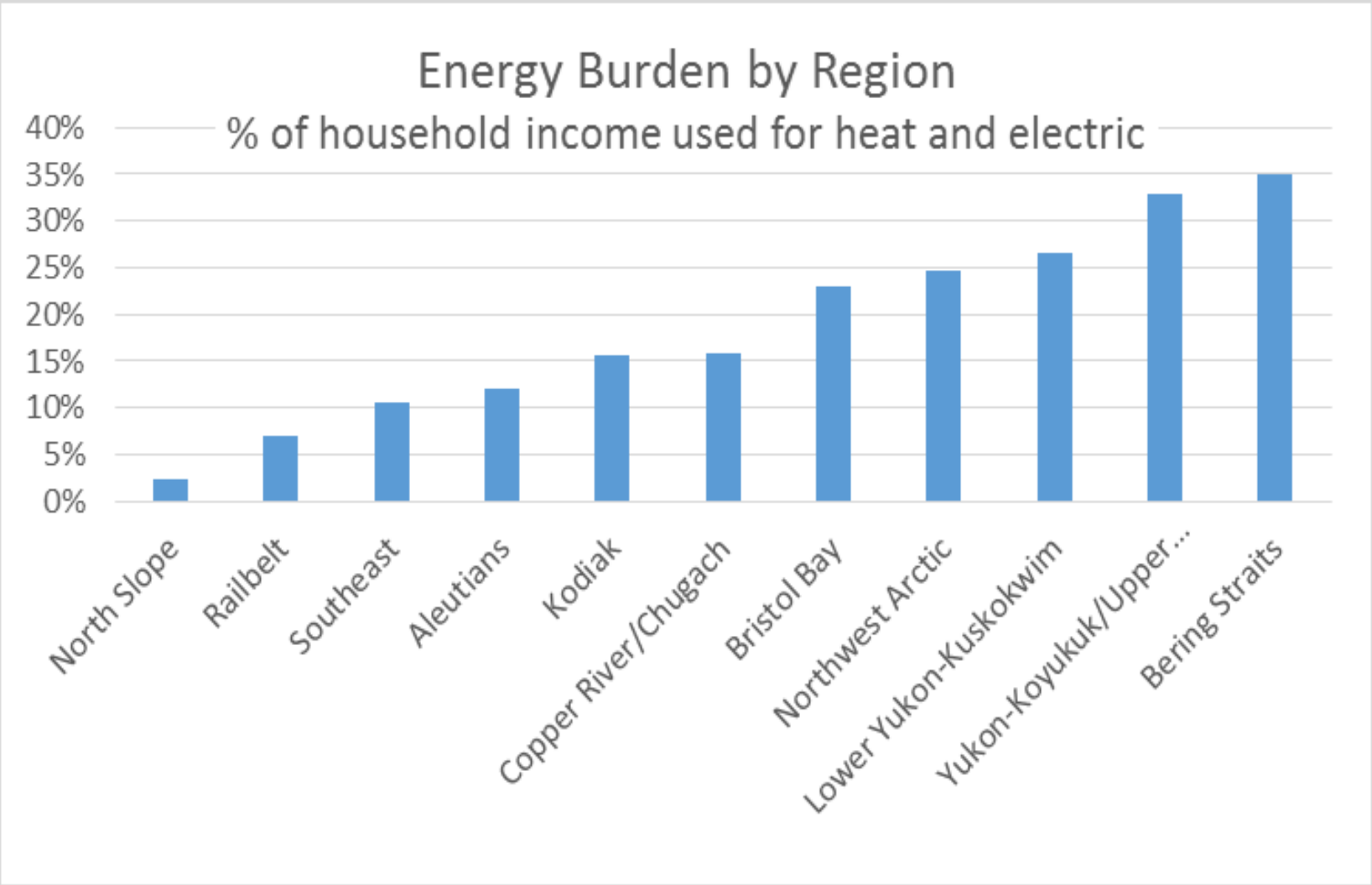
** Primary fuel type*

Alaska's Energy Costs Vary





Energy Burden by Region



Lowering Energy Costs is the Governor's Priority

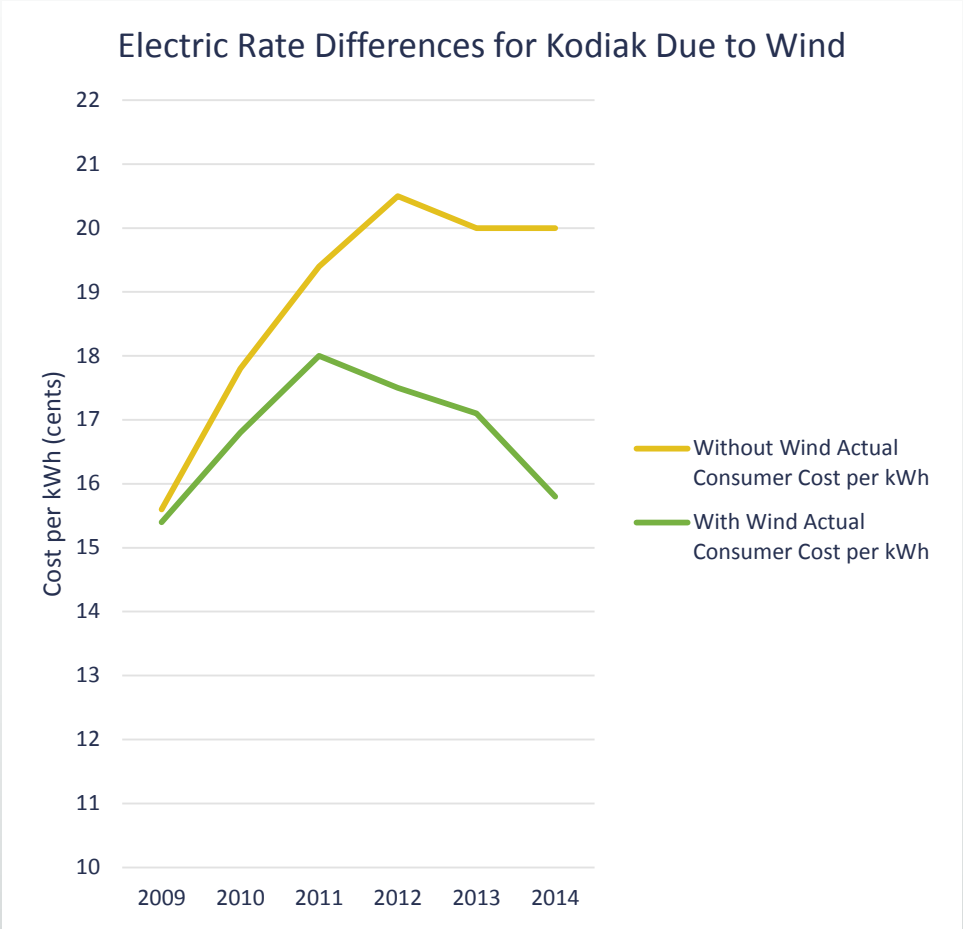
- Monetizing Alaska's natural gas – propane and LNG to villages, money to alternative energy
- All Hands on Deck
  - Alaska Energy Authority
  - University of Alaska – Alaska Center for Energy Policy
  - Alaska Housing Finance Corporation
  - Alaska Industrial Development and Export Authority
  - Alaska Departments of Natural Resources, Commerce and Community Development and Environmental Conservation

Lowering Energy Costs is the Governor's Priority

- Not-for-profit
  - Cold Climate Housing Research Center
  - Renewable Energy Alaska Project
- Utilities
  - Alaska Village Electric Coop
  - TDX Power
  - Inside Passage Electric Coop
- Every tribe and local government
- The U.S. Government – DoE, DoI, State Department, Arctic Executive Steering Committee
- The Arctic Council

Alaska Energy Authority

- Mission: To Reduce the Cost of Energy in Alaska
- Programs:
  - Renewable Energy Fund
  - Emerging Energy Technology Fund
  - Rural Power Systems Upgrades
  - Energy Efficiency programs
  - Power Project Loans
  - Fuel Loans



State Policies

- Power Cost Equalization
  - Result of 1980s hydro projects
- 2008 Renewable Energy Fund Established
  - Intent to fund $50M per year for 5 years
  - Extended 10 extra years
- 2010 Energy Omnibus Bill:
  - “It is the intent of the legislature that the state remain a leader in petroleum and natural gas production and become a leader in renewable and alternative energy development.”
  - Emerging Energy Technology Fund created

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State Goals

- 50% Renewable Electricity by 2025
- 15% Energy Efficiency improvement by 2020

Renewable Energy Grant Fund

- Grant **recommendation** program
- Helps achieve renewable goal
- Displaces volatile-priced fossil fuels
- Provides a vetting mechanism
- Capitalizes on local energy resources
- Expands Alaska's RE knowledge base
- Provides local employment
- Benefits businesses not PCE eligible
- Reduces State expenses through Schools and PCE

Coffman Cove School Garn boiler.

Photo courtesy of Karen Petersen

Renewable Energy Grant Fund

- Emphasis on
  - Technically strong
  - Economically viable
  - High cost areas
  - Regional balance
  - Public benefit
- Eligible applicants:
  - Utilities, local governments, tribal councils, Independent Power Producers
- Eligible projects:
  - Wind, hydro, biomass, heat recovery, heat pumps, geothermal, solar, wave, tidal, river hydrokinetic, landfill gas, local natural gas, transmission of renewables

St. Paul Island Wind and Flywheel

Renewable Energy Fund

- State invested $259M in REF since 2008
- 800 Applications evaluated
- 300 Grants
- 200 Projects
- 50 Operating now
- 90 Operating by 2018

All numbers rounded

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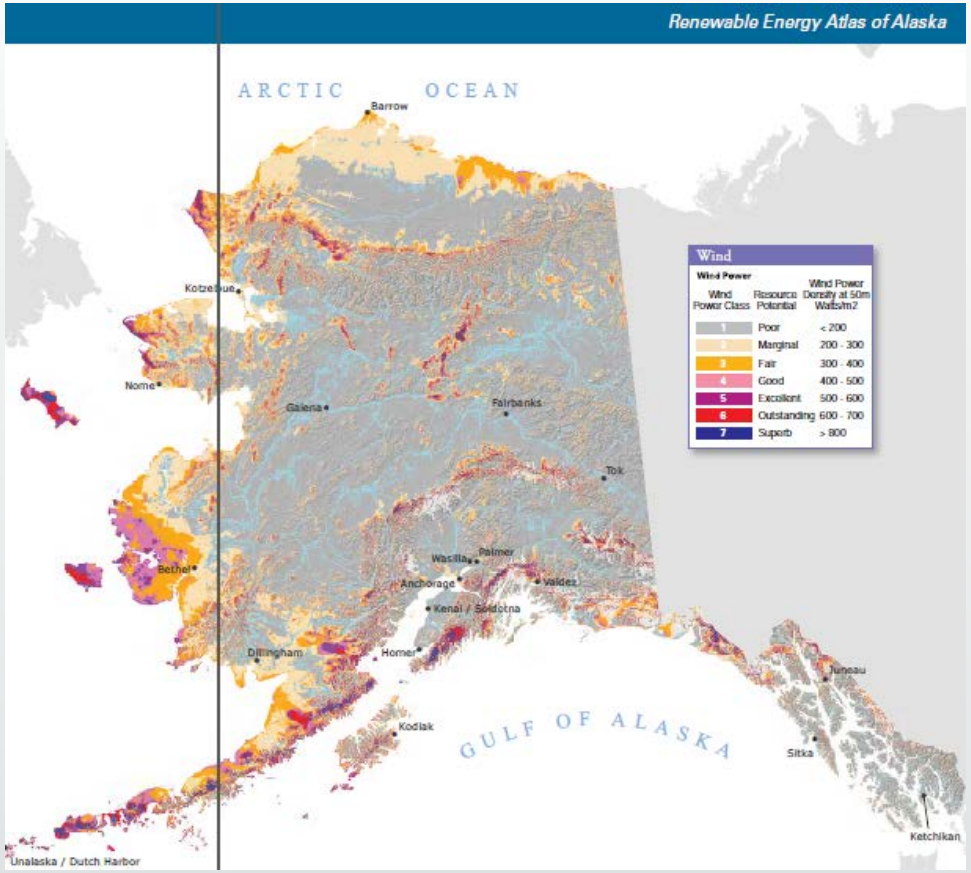
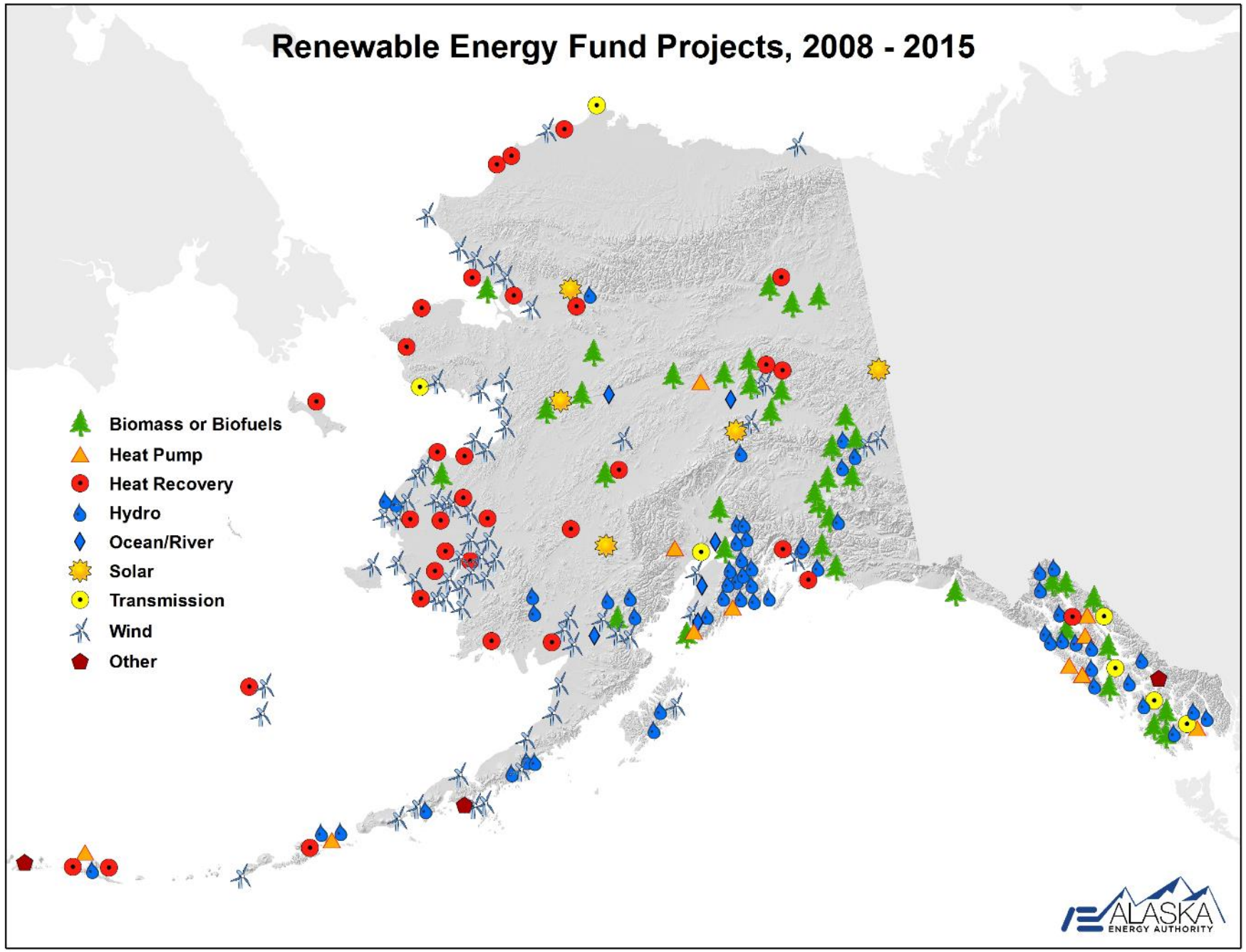
Abundant Energy Resources

- Oil & gas
- Hydro
- Wind
- Biomass
- Wave, tidal, river
- Geothermal
- Efficiency opportunities



Alaska wind resource map from Alaska Energy Atlas


Renewable Energy Fund Projects, 2008 - 2015
Biomass or Biofuels
Heat Pump
Heat Recovery
Hydro
Ocean/River
Solar
Transmission
Wind
Other
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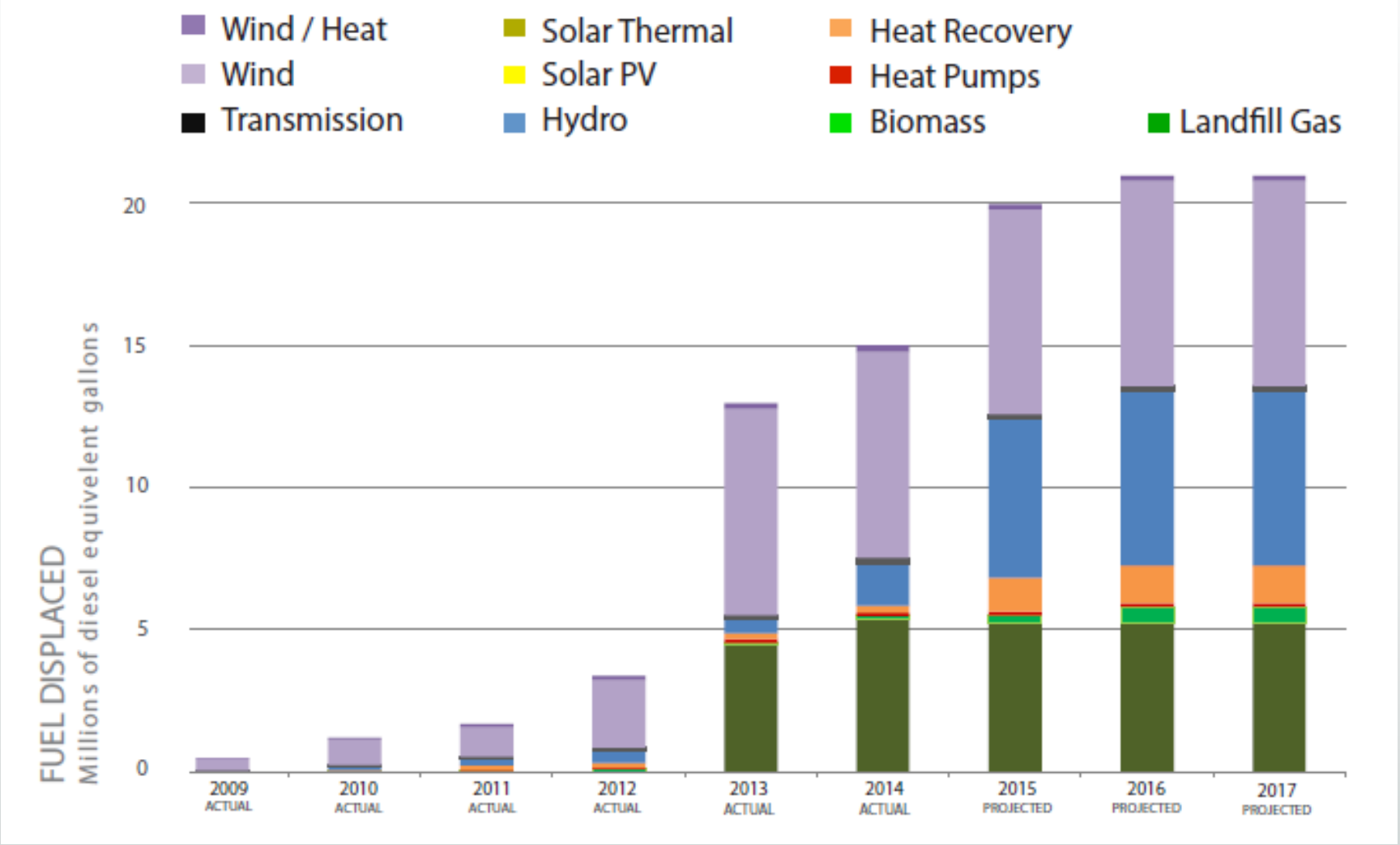
Diesel Savings from Renewable Energy Fund

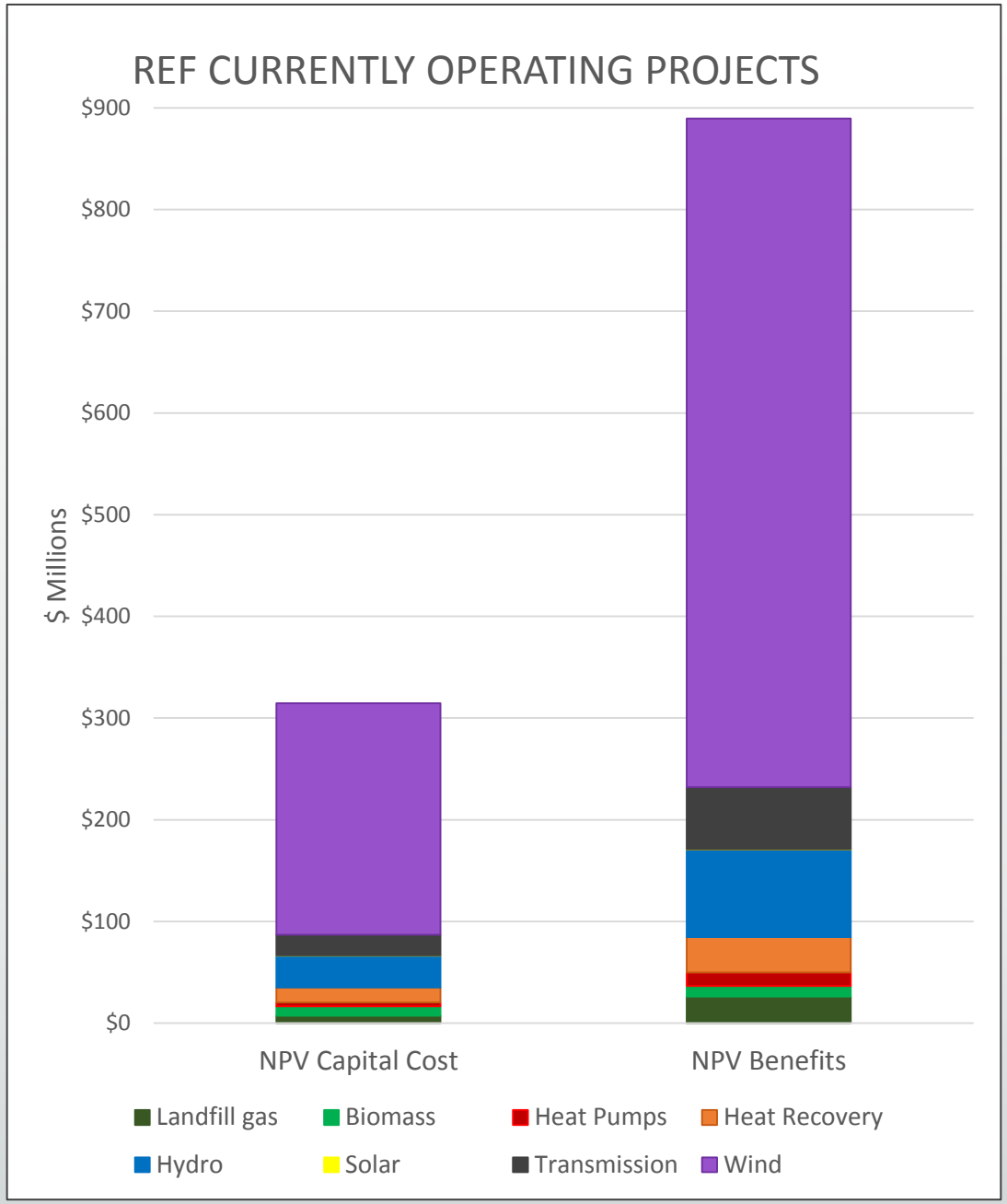


Renewable Energy Fund: Value Generated

- For first 44 projects in operation
- Total NPV cost of $314M
- NPV Benefits: $889M

Overall Program

Benefit/Cost Ratio: 2.8



Pelican Hydro Before, During & After

- Wood stave and blue tarp penstock before
- Aerial view of site during construction
- AEA project manager with new surge tank

Greenhouse Gas Reductions (estimates):

2014: 147,000 metric tons

2009-2014: 347,575 metric tons

Projected 2015-2017: 682,360 metric tons

Blue Lake Hydro in Sitka

Whitman Lake Hydro in Ketchikan

Chuniixsax Creek Hydro in Atka

Story: Kodiak, Alaska

Pillar Mountain Wind

- 99.8% Renewable in 2015
  - 79% Hydro
  - 21% Wind
- Terror Lake Hydro added 3rd turbine
- Wind: 9MW installed capacity 6 GE 1.5MW turbines
- Battery
- Next: Flywheel to lengthen battery life and add electric crane at port

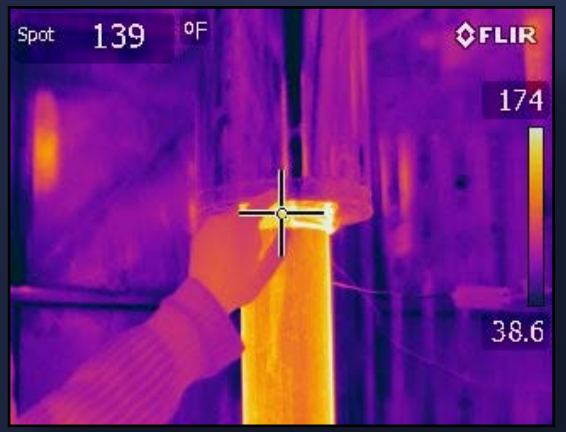
REF Summary

- Brilliant!
- Huge catalyst at a good time
- Approach: fund **good** projects to get built
- Mostly above 1.0 benefit/cost
- Greater focus on feasibility stage
- Blend with loans to extend grant reach?

Pelican surge tank

Emerging Energy Technology Fund

Installing cold climate heat pump



Testing Safe and Efficient Exhaust Thimble

"…make grants to eligible applicants for demonstration projects of technologies that have a reasonable expectation to be commercially viable within five years that are designed to:

- test emerging energy technologies or methods of conserving energy;
- improve an existing energy technology; or
- deploy an existing technology that has not previously been demonstrated in Alaska. "

Oceana turbine in the Tanana River

ORPC RivGen turbine in the Kvichak River

EETF: Hydrokinetics

Three river in-stream energy conversion device deployments in 2014

- Ocean Renewable Power Company (ORPC) in the Kvichak River at Igiugig
- Boschma Research Inc. in the Kvichak River at Igiugig
- Oceana Energy Company in the Tanana River at Nenana

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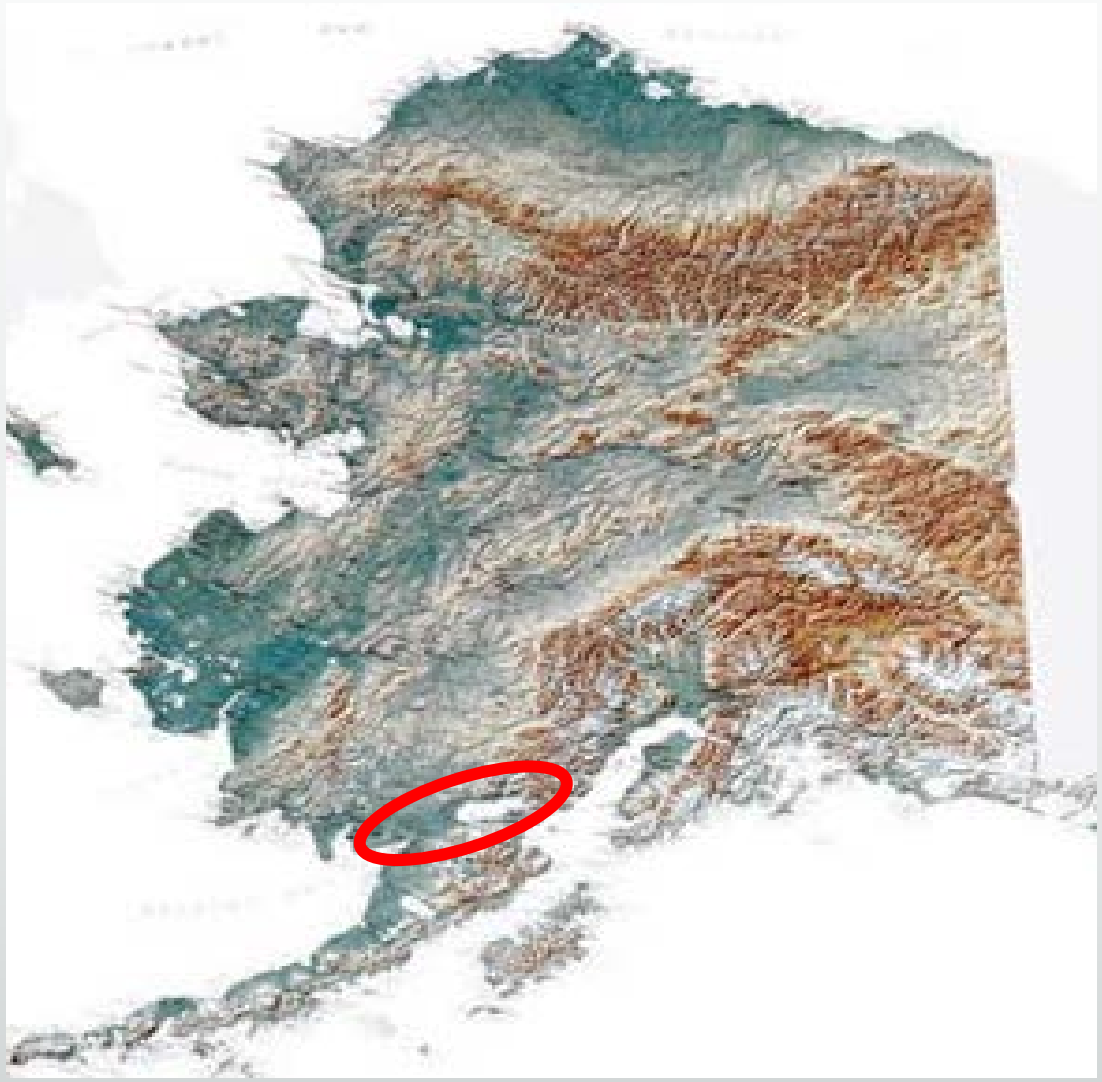
Lake Iliamna, Kvichak River, Igiugig, Alaska



EETF Solicitation

- May be focused on maximizing diesel savings on RE/diesel microgrid "Grid Bridging System"
- Goal 1: Fuel sipping
- Goal 2: Diesels off
- Control system, inverters, and storage enough to act as spinning reserve so smaller efficient diesel can be used with time to start larger diesel
- Q4 2015 or Q1 2016

Susitna Watana Hydro Project

- 600 MW Hydro Project
- 50% of Railbelt electrical demand
- 12,000 jobs between 2010 and 2028
- State seeking license
- $5.6 billion to construct
- Energy savings of $14 billion in first 50 years

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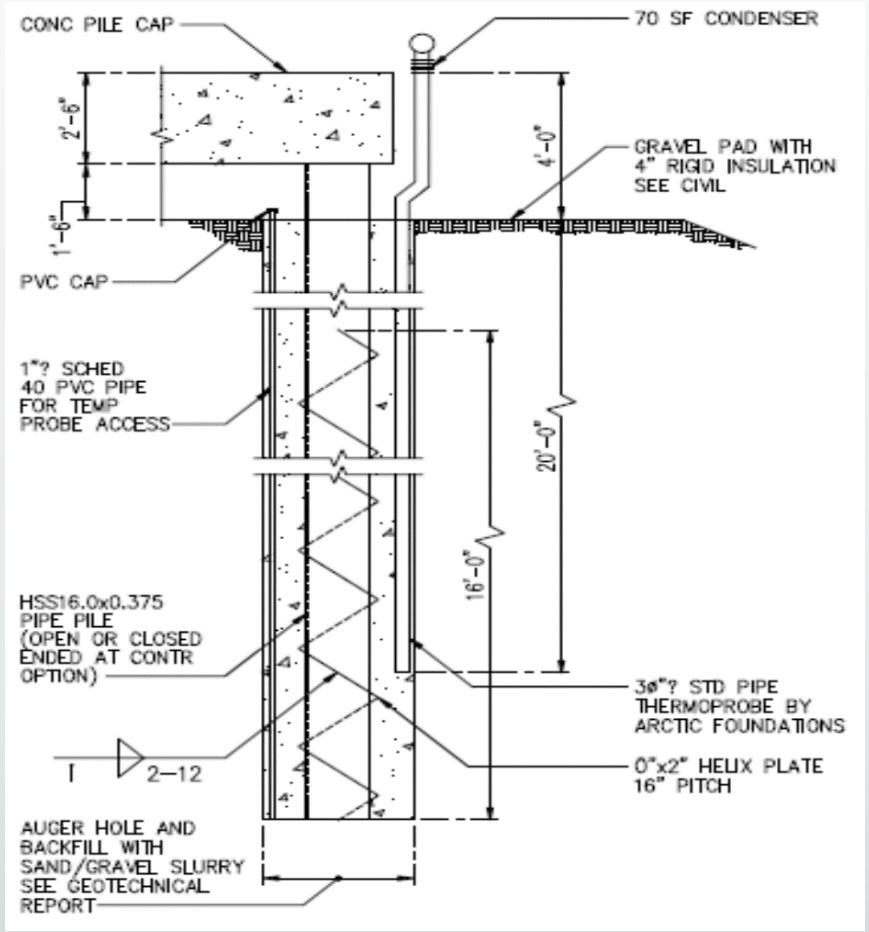
Typical Permafrost Foundation – Thermopile with Concrete Cap



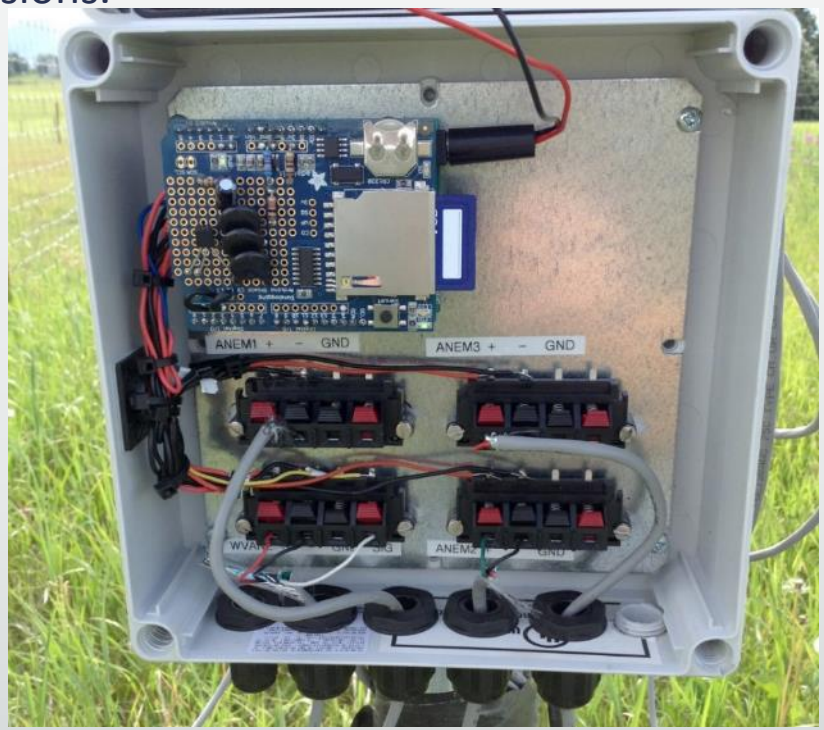
SpiDAR Evaluation

- Cold-weather evaluation to test equipment accuracy and survivability.
- Light detection and ranging system weighs 60 kg.
- Remote power module weighs 375 kg.
- Deployed at Delta Wind Farm – Latitude 64 deg
- Very limited winter performance data due to warranty repair.
- Possible option in lieu of met tower

Wind Datalogger for Alaska

- RFP issued with $20k to seed development of datalogger specifically designed to meet the needs of wind resource assessment in remote Alaska.
- Current offerings (12-15 data channels at $1800+ per unit) targeted at large wind farm resource assessment market.
- Winning design proposal has 3 anemometer channels and 1 vane, on-board temperature sensor, 1-sec logging interval of date & time, min, max, average and std. dev for anemometer/vane and min, max, avg for temperature. .CSV format.
- Data cable inputs are spring-clip, providing for fast and reliable connection in harsh weather installations.
- Halus Power Systems is designer, manufacturer and supplier.
- Unit sells for $500-$650 depending on exact configuration/options.

- Datalogger unit at field test site in Palmer, AK showing controller board with SD card, spring-clip connectors and water-tight seals around cable intrusions.



Investment Options

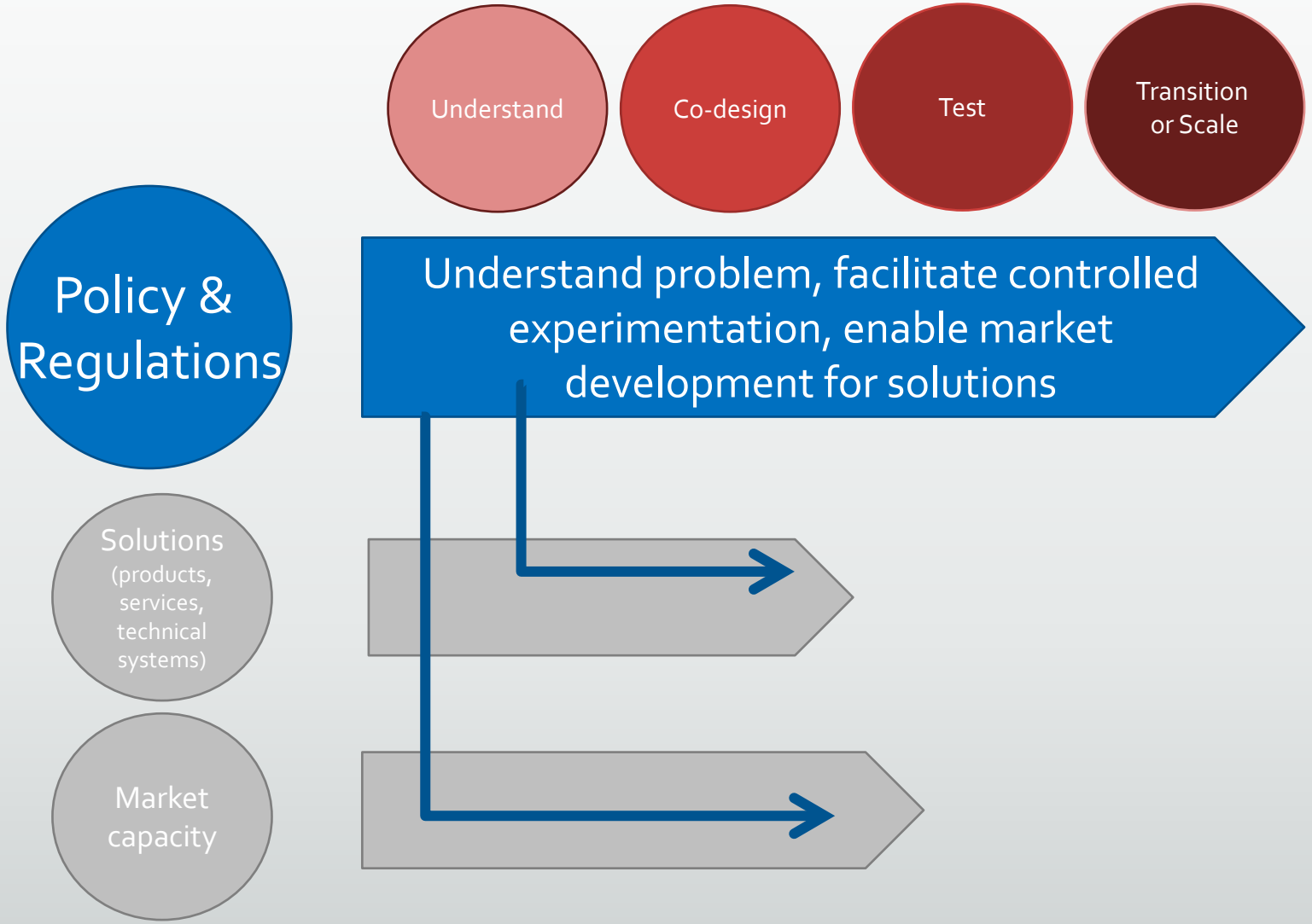
- Renewable energy and efficiency projects
- Emerging energy technologies
- Susitna-Watana Hydro
- Energy materials
  - Turbines, penstock, pipe, wood-fired boilers, inverters, controls, diesel engines
- Social investment directly into funds

Final Thoughts

- Do everything you can to get the greatest value out of remote renewable systems
- Perform good modeling and engineering!
- Quandary: High penetration, RE for heat; displaces more diesel, but economics erode
- Use public funds for their greatest good

- Focus on community/global benefit, not individual
  - Count benefit of avoided fuel, not whole bill.
  - Fixed costs are not saved by utility, just spread to other users.
- Help communities identify the best, most cost-effective energy system
  - It might be efficiency measures (end user & generation efficiency)

Policy & Program Innovations



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