

# User Needs – Alaska

GAIN – EPRI – NEI - US NIC  
Micro-reactor Workshop  
Idaho Falls, ID // 18 June 2019

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# Alaska Center for Energy & Power

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

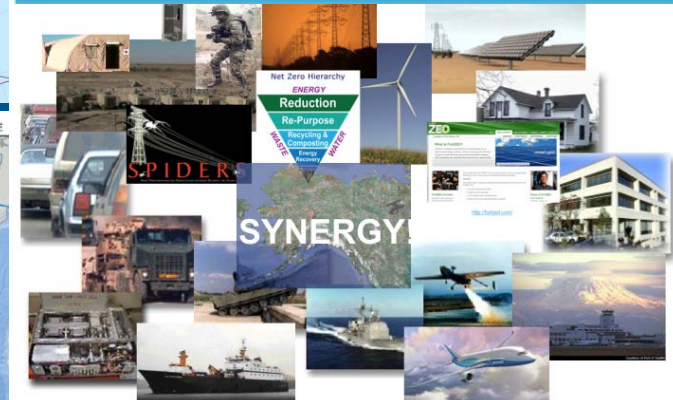
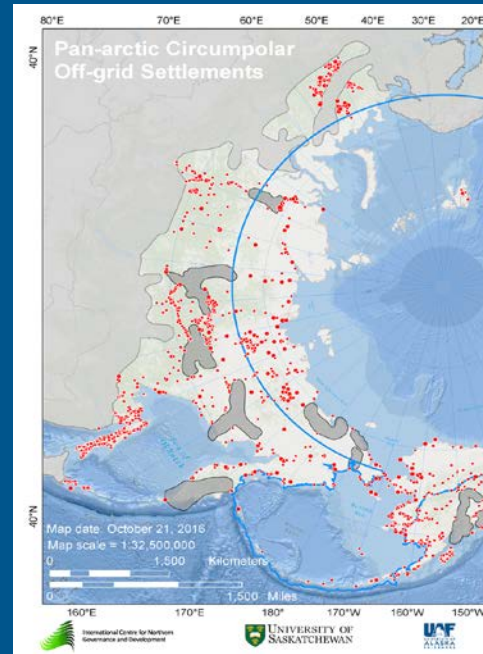
- Applied energy research program
- Technology testing & optimization
- Energy systems modeling & analysis
- Knowledge network creation
- Commercializing energy innovation



- Industry
- Utilities
- Policy makers
- Communities
- Practitioners
- Students

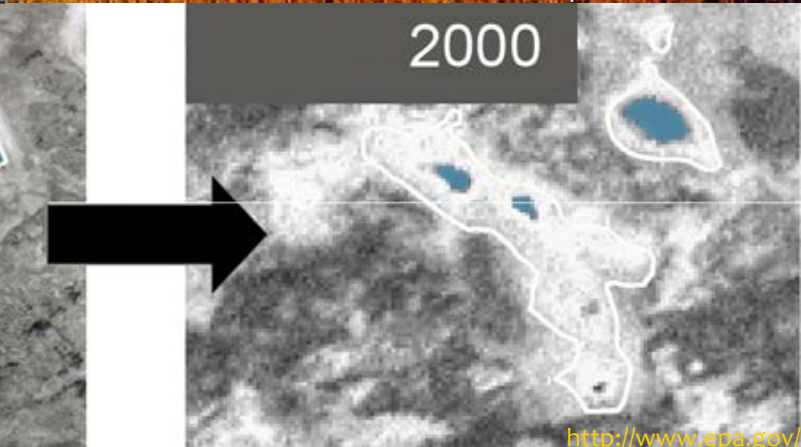
# Alaska the 49<sup>th</sup> State

- 736,239 people (2018)
- 663,300 sq miles
- 85+% public lands
- Resource-driven economy
- Not grid-tied to other regions
- Synergies across & beyond Arctic





Images from [www.travelalaska.com](http://www.travelalaska.com), unless otherwise noted.



# Alaska Realities

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



In rural Alaska:

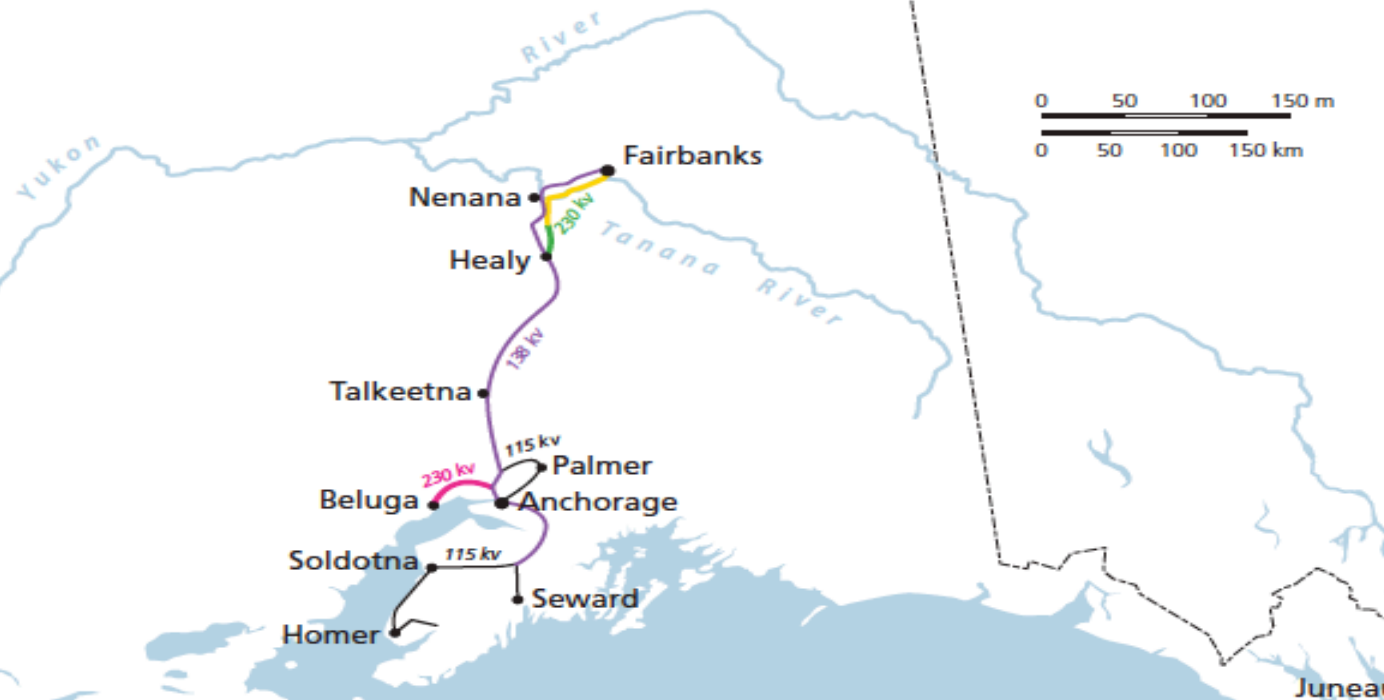
- Electric power: 0.50-1.50 \$/kWh
- Heating fuel: 3.50-10.00 \$/gallon

# Alaska & hybrid energy microgrids

*Alaska has >250 microgrids and 70 communities are served by hybrid renewable-diesel systems*



# Alaska's Transmission Network



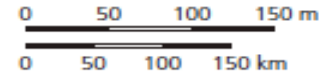
# Railbelt Energy System

GVEA 27 MW (15 minutes)  
BESS supports northern end  
of Alaska Railbelt Intertie

- GVEA Solar PV (400 kW)
- Eva Creek Wind (24.6 MW)

- UAF Grid
- ACEP PSI lab

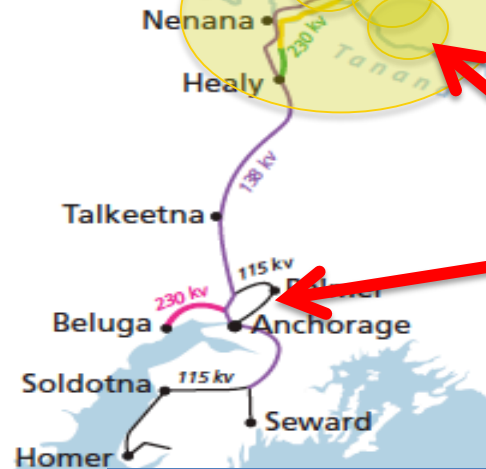
Fort Wainwright



- Delta Wind (2 MW)

Eielson AFB

JB Elmendorf-Richardson

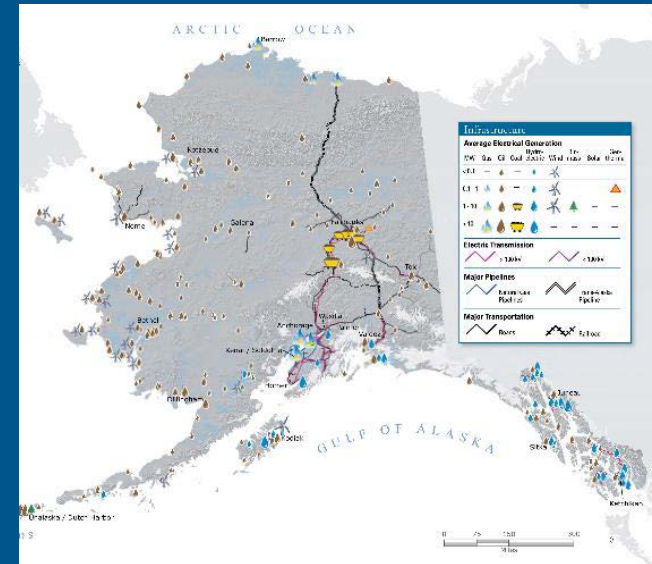


- Radial & matrix electrical networks
- Transmission & distribution
- Residential, commercial, defense & critical infrastructure loads
- Combined heat & power systems

- 6 interconnected utilities
- Battery / flywheel
- Hydro
- Natural Gas
- Landfill syngas
- Coal
- Diesel

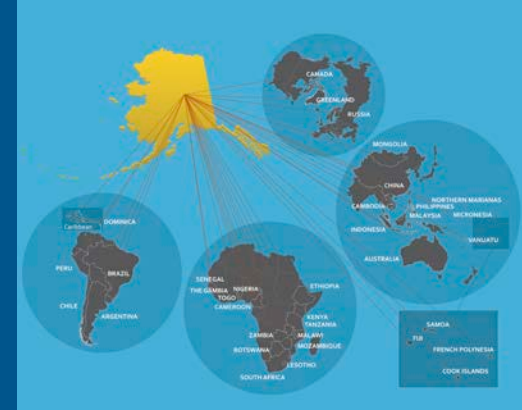
# Energy in Alaska

- Fossil fuels
  - Diesel systems
  - Natural gas
  - Coal
- Renewable energy
  - Hydroelectric
  - Hydrokinetic
  - Wind
  - Biomass
  - Solar
  - Geothermal
- Energy efficiency
- Heat recovery
- Heat pumps
- Storage – electrical
- Storage - thermal
- Control systems
- Energy Literacy
- Workforce Development
- Policy
- Finance



- XX kW – YY MW Scale Systems
- Rural – Urban – Industrial – Military
- Retrofit & Greenfield Needs

# Why in Alaska?



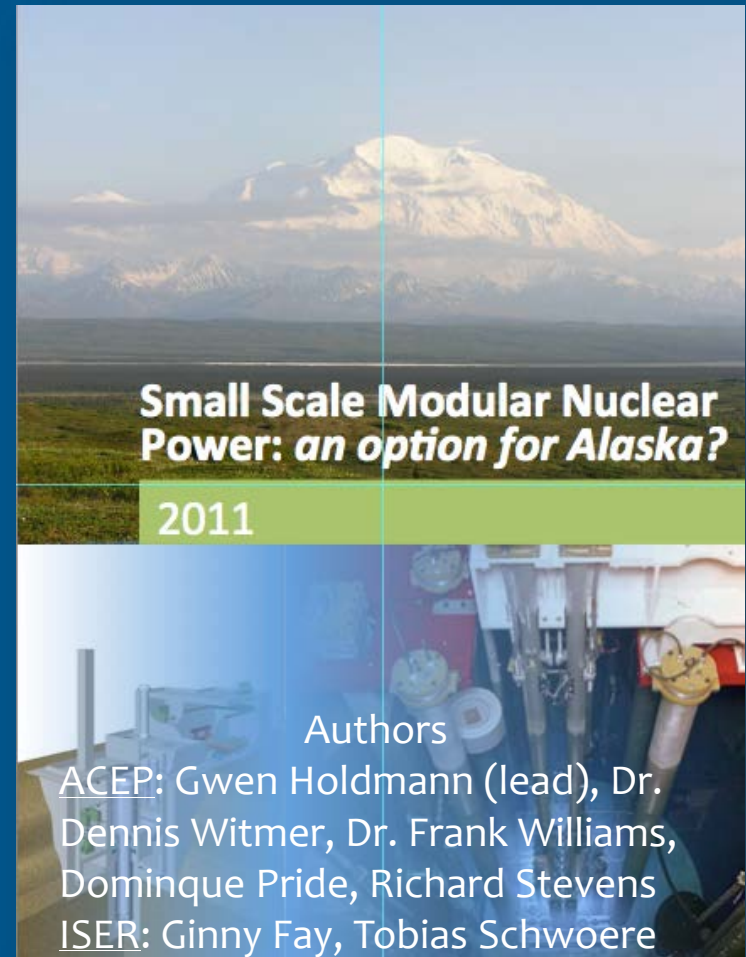
- Diverse requirements
- Appropriate scale applications
- Existing sites for lower demonstration \$\$\$
- Local replication potential
- Broad skills for adapting / tailoring systems
- Price of energy → earlier break-even
- Street credibility ... “as proven in Alaska”

# 2010 Study of SMR's

“Small Modular Nuclear Power: *an option for Alaska?*”

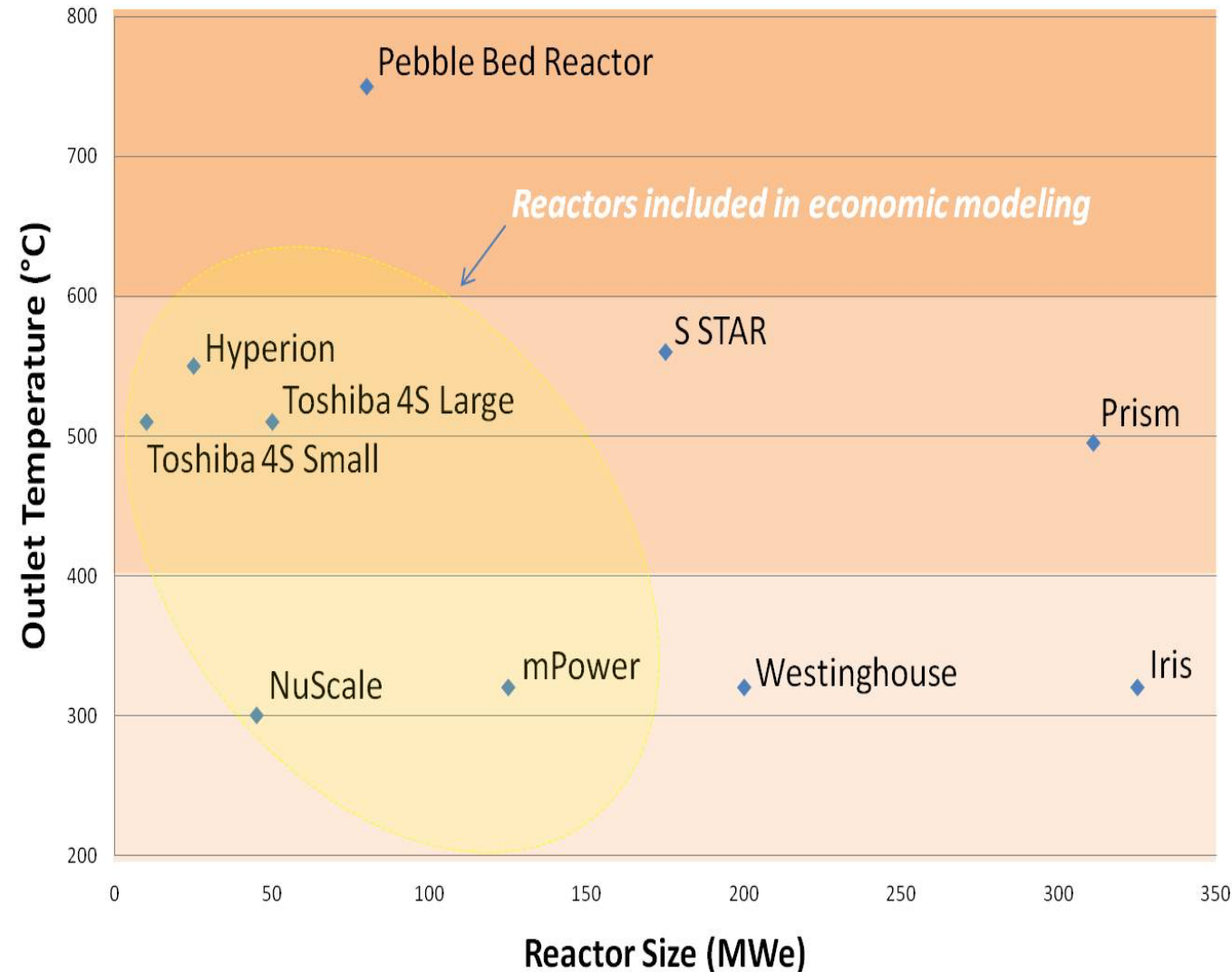
- 2009 requested by Alaska State Legislature in response to 2008 Global oil price spike that exposed vulnerabilities of Alaska to annual / intra-annual oil price fluctuations
- Interest in solutions that can provide baseload power (many remote locations only have access to intermittent renewables)
- Interest in options that can offset heating loads as well as electric power

**Available for Download at:**  
[acep.uaf.edu](http://acep.uaf.edu) under publications

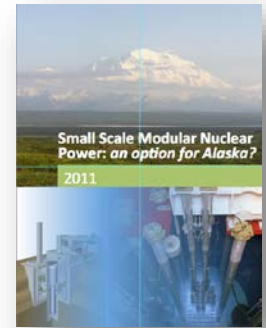


Authors  
ACEP: Gwen Holdmann (lead), Dr. Dennis Witmer, Dr. Frank Williams, Dominique Pride, Richard Stevens  
ISER: Ginny Fay, Tobias Schwoere




# Representative Small Reactor Sizes and Operating Temperatures



*Includes SMR designs that have been proposed for the US market*



## Reactor Size Appropriate for:

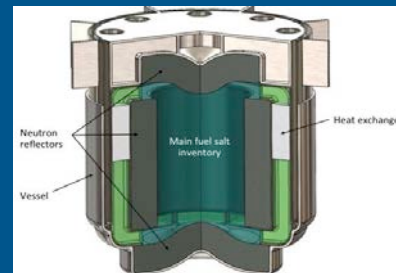
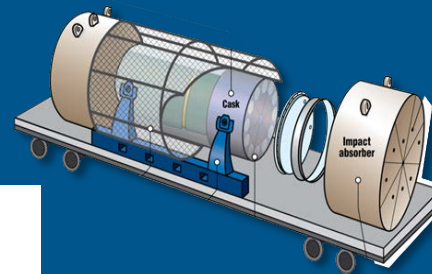
-  Power and Waste Heat
-  Power and Cogeneration
-  Direct Process Heat



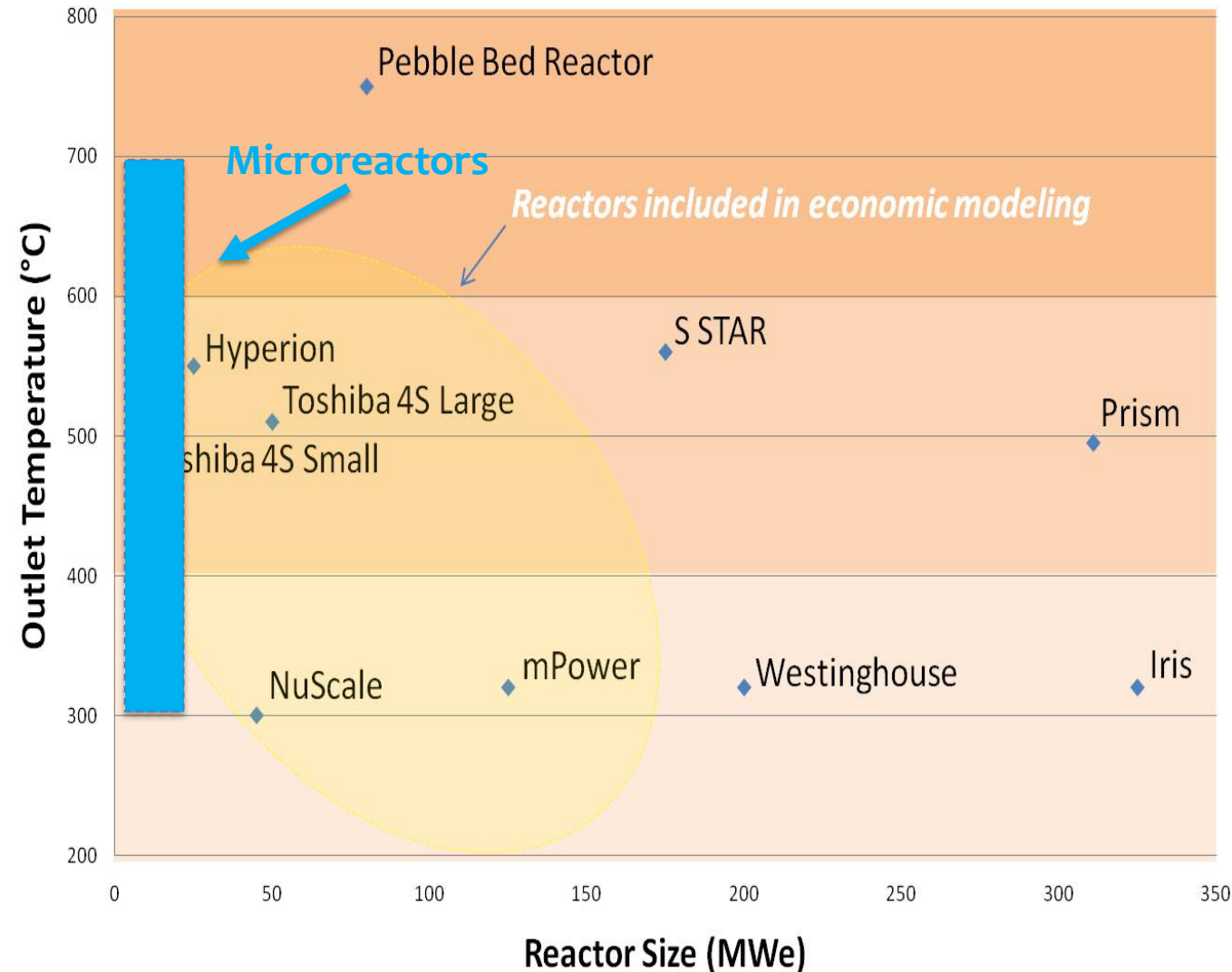
# Nuclear microreactor technology

Cost, scalability, transportability, size, safety zone and regulatory treatment, passive safety features, standardization, etc.

**eVinci™ Micro Reactor**  
Ultimate Energy Solution for the Off-grid Customer



# Representative Small Reactor Sizes and Operating Temperatures



*Includes SMR designs that have been proposed for the US market*



**Reactor Size Appropriate for:**

- Power and Waste Heat
- Power and Cogeneration
- Direct Process Heat

# Multiple & diverse stakeholders



- ANCSA Corporations
- Community Representatives
- Economic Dev't Organizations
- Entrepreneur Support
- Industry (Construction, Mining, Oil & Gas, Energy Project Developers, Seafood)
- Investors
- Military Base Representatives
- Non-gov'tal Organizations
- Nuclear Industry & Associations
- University of Alaska
- State & Federal Elected Officials
- State of Alaska Departments
- Utilities
- Workforce Development

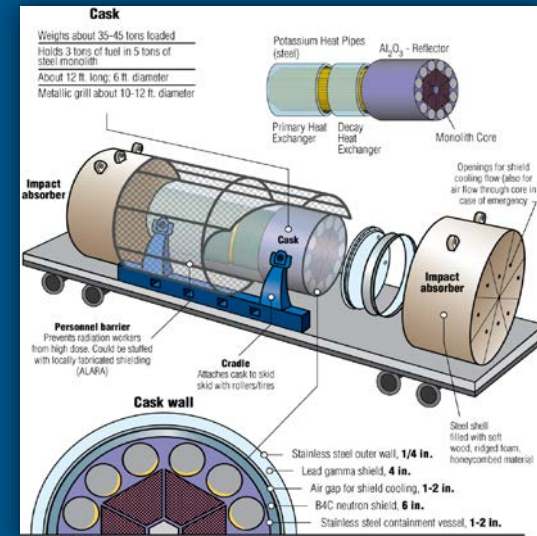
75+ participants at 18 April 2019 Information Session

# 4/18 Information session objectives

- Microreactor technology introduction
  - Features & attributes
  - Status & plans
- AK heat & power perspectives & priorities
  - Applications & capacities
  - Challenges & concerns
- AK engagement with technology pilot programs & demonstration programs
- Items for consideration by microreactor co's

# Nuclear microreactor applications?

- Stationary
- Baseload / Baseload with load-following
- TBD capacity & electrical / thermal mix
- Applications
  - Military bases
  - Industrial or institutional sites
  - Remote locations



Los Alamos National Lab  
MegaPower Microreactor

# 4/18 participant discussion - summary

- Ongoing stakeholder consultation
- Assess reliability, safety, environmental risks
- Determine siting requirements
- Characterize regulatory and policy environment
- Incorporate cradle-to-cradle thinking
- Develop integrated commercialization roadmap
- Monitor industry / regulatory developments
- Incorporate Alaska interests & use cases in any microreactor pilot program(s)

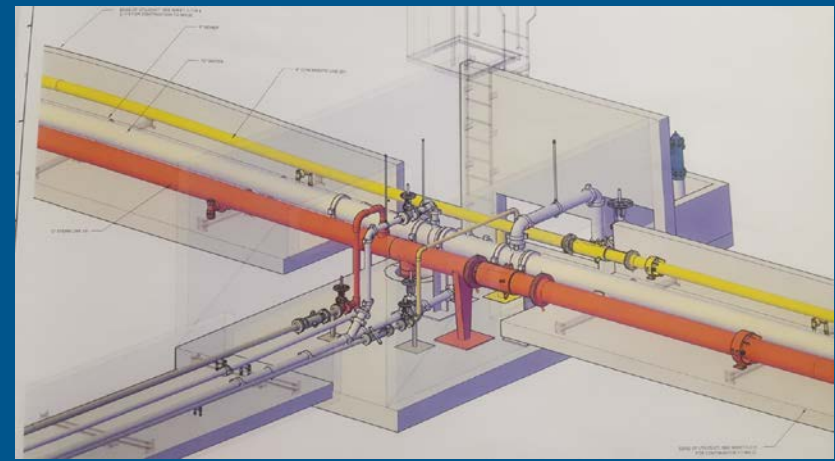
# Some questions from Alaska

- When available?
- What capacity (electrical, thermal)?
- Siting requirements are ...?
- What are the costs?
- What is the life?
- Will the fuel be available?
- Contingency plans = ...?
- What happens at the end of life?
- Regulatory status?
- Who else is interested?
- Why & when Alaska?

# Defense sites?



- Existing heat & power network
- Known baselines
- Emission reductions
- Energy surety / security
- Existing utility interties
- Shared resilience initiatives



# Mining sites?



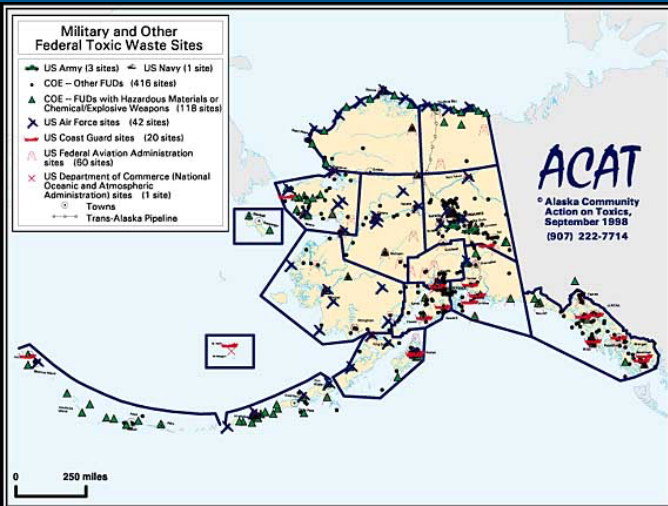
Current: coal, gold, lead, silver, zinc

Future: barite, copper, graphite, molybdenum, rare earth elements

CHP needs: extraction, value-add processing, facilities

Additional information: Alaska Miners Association, Resource Development Council

# Waste management opportunities?



- Mobile / transportable reactors
- Drying / incineration
- Brownfield enablement
- Circulating or permanent





# Modular Greenfield Infrastructure?





# What, when & where in Alaska?

- Stakeholder pull?
- Capacity?
- Logistics?
- Communications?
- Workforce?
- Application sequencing?
- Contingency response / results?
- Fiscal resources?



# NMR-related site selection

- Transportation – road, water, air
- Geotechnic – seismic, permafrost
- Existing energy infrastructure
- Security – site, personnel
- Communication: speed, reliability
- Safety – access, emergency
- Energy issues – cost, resilience

# CHP-related site selection

- Site electrical load: 500+ kWe (total)
- Site thermal load: 1,500+ kWth (total)
- Existing heating circuitry – local or regional
- Powerplant accommodates multiple sources
- Energy storage options (electrical, thermal)

# Alignment & Integration

## NMR CHP System

- Cost
- Performance
- Reliability
- Feedstock
- Emissions

## Electrical & Thermal Loads

- Load size
- Load profile
- Circuitry
- Gensets
- Energy costs

## Enabling Technologies

- Interconnect
- Energy storage
- Communication
- Transportation
- Supply chain

# Proposed next steps

- Roadmap development
  - Application use case details & sequence(s)
  - Enabling synergy areas
  - NMR status & schedule
- Ongoing industry engagement / exchange
- 2019/20 Alaska Microreactors Study
- Alaska information / applications incorporated in pilot program(s)

QUESTIONS?

