

Nuclear Energy Update

Senate Arctic Affairs

Gwen Holdmann

Chief Scientist

Alaska Center for Energy & Power (ACEP)

University of Alaska Fairbanks





ACEP
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Presentation Outline

Topic 1. Nuclear Energy Update

-  Brief overview of advanced nuclear technologies
 - ACEP DRAFT Practical Guide to Nuclear for Alaskans
 - Review SB 177
-  Update on U.S. activity related to advanced nuclear technology
 - Air Force - Eielson microreactor project
 - Army - Project Janus & Project Pele
 - Other commercial activities
 - DOE RFI
 - Finland/Onkalo Long Term Storage Facility

Topic 2. Rural Energy Considerations

What are Advanced Reactors?

“Advanced nuclear” refers to a group of newer reactor designs that differ from the large commercial nuclear power plants built in the United States between the 1960s and 1990s. These designs are being developed to be:



Scalable &
Modular



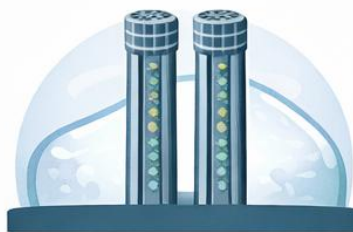
Closer to
Demand



Electricity
& Heat



Passive Safety
Features



Advanced Fuels
HALEU / TRISO



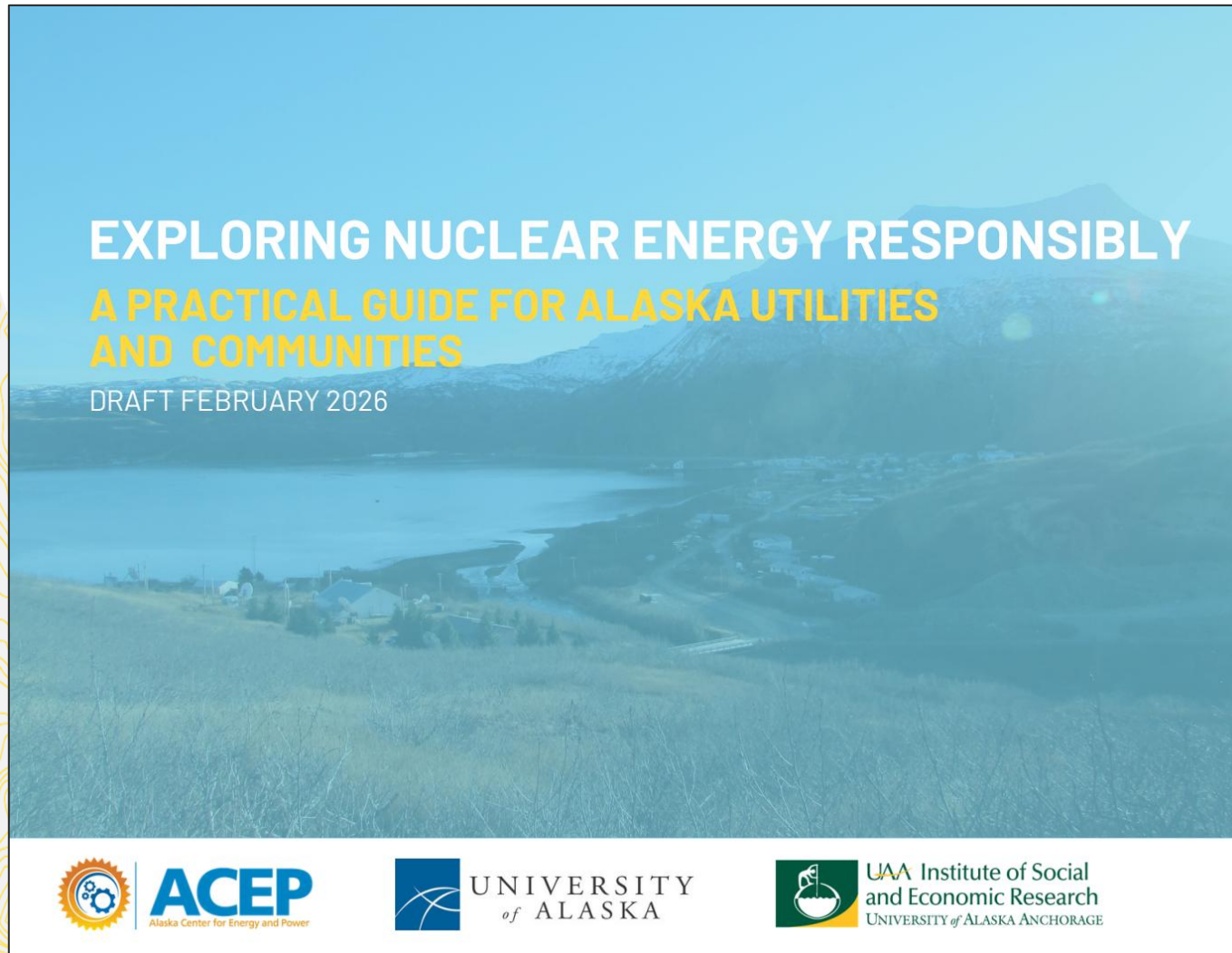
Alternative
Cooling



Life-sized mockup of the Westinghouse eVinci 5 MW reactor at the Saskatchewan Research Council (SRC) facility in Saskatoon, SK

srcnuclear.ca
 SRC
NUCLEAR

What are Advanced Reactors?



Basic primer prepared by ACEP and ISER on advanced nuclear energy for interested communities and utilities
(draft currently under peer review)

Supported partly through the U.S. DOE Nuclear Energy University Program (NEUP) under Grant DE-NE0009299 and through a 2023 capital appropriation from the Alaska State Legislature.




ACEP Studies on Small/Advanced Nuclear



Small Scale Modular Nuclear Power: *an option for Alaska?*

2011



Prepared by the University of Alaska, Alaska Center for Energy and Power and the Institute for Social and Economic Research with funding through the Alaska Energy Authority

Small Scale Nuclear Power: an option for Alaska?

Update October 20, 2020



Prepared by the
Alaska Center for Energy and Power
University of Alaska Fairbanks
acep.uaf.edu



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NOME MICROREACTOR CONCEPT DRAFT BRIEFING PAPER APRIL 2024

Authors: Gwen Holdmann (UAF), Richelle Johnson (UAA), and David Lockard (UAF) with significant input from Ken Morton and John Handeland (Nome Joint Utilities System) and John Parsons (Massachusetts Institute of Technology Center for Energy and Environmental Policy Research) and reviewed by Kathleen Araújo (Boise State University CAES Energy Policy Institute).

2024



ACEP
Alaska Center for Energy and Power

UAF UNIVERSITY OF
ALASKA
FAIRBANKS

Public engagement

Forums for discussion



Nuclear Energy Working Group



With rapidly evolving technology, shifts in energy policy and the regulatory framework, and more favorable economics we're aiming to understand how small-scale nuclear power could fit into the energy landscape for Alaska, and whether the time is right.

The Alaska Nuclear Energy Working Group is an informal group of stakeholders interested in following developments related to small nuclear energy technologies, and in providing input related to any proposed future deployment in the state. ACEP plans to host regular meetings of the working group, which will include presentations from industry and other stakeholder groups. The working group will also be called upon to provide input on future studies, as well as the development of a state roadmap.

Interested in learning more? [Register to join](#) the Alaska Nuclear Working Group.

[Alaska Nuclear Energy Working Group Charter](#)

Project Details

Lead Researcher(s)

- Gwen Holdmann
- Richelle Johnson (rmjohnson6@alaska.edu)

Reports

[Small Scale Modular Nuclear Power: An option for Alaska?](#) (2020)

[Small-Scale Modular Nuclear Power: An Option for Alaska?](#) (2011)



WORKSHOP AGENDA

TUESDAY, JANUARY 27

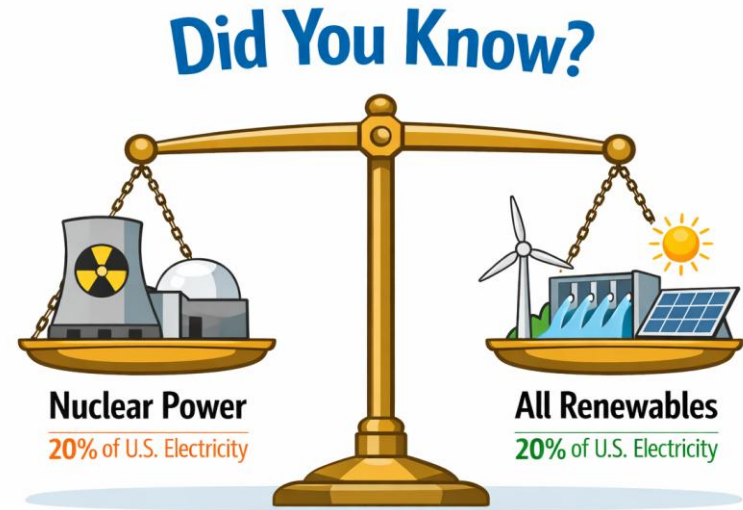
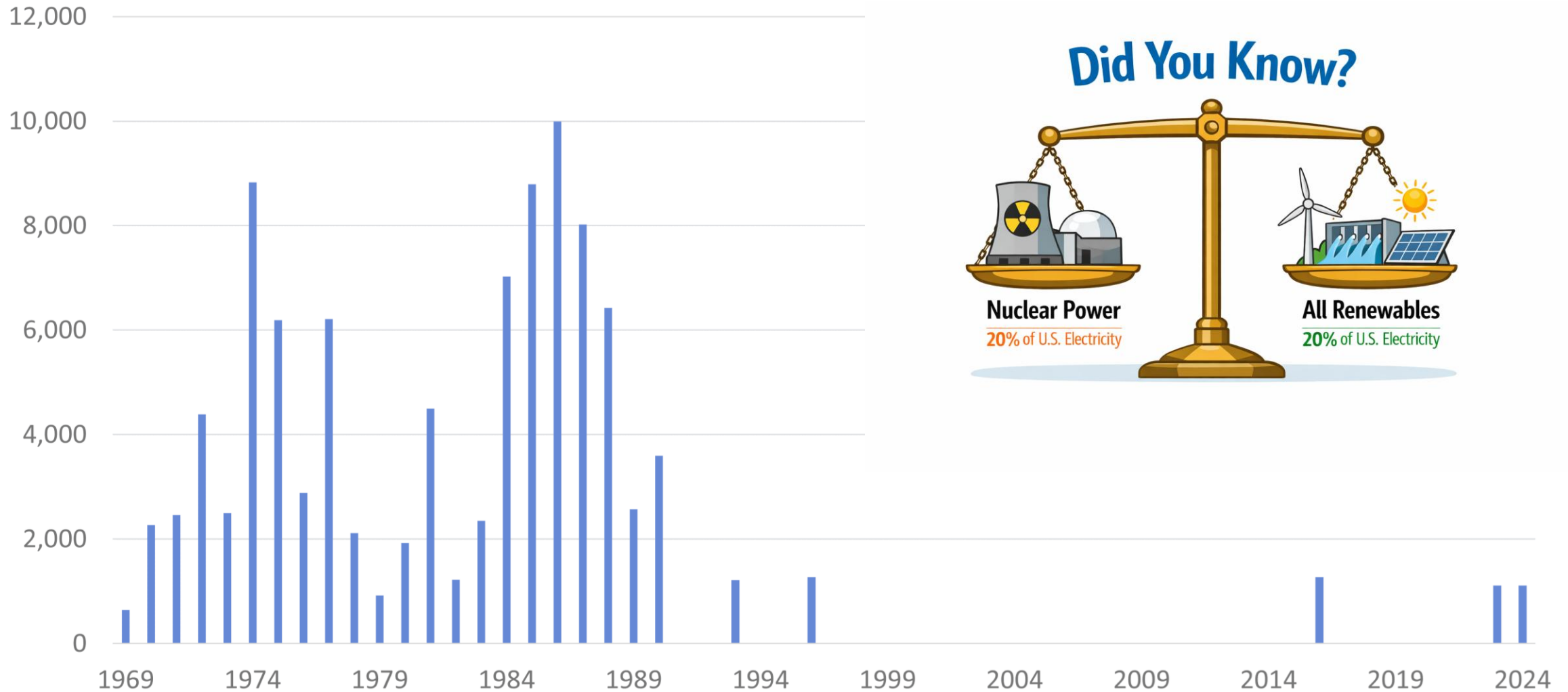
8:30 AM AKT | **Welcome and Opening Remarks**

- **Gwen Holdmann**, Chief Scientist, Alaska Center for Energy and Power, University of Alaska Fairbanks
- **Mike Dunleavy**, Governor, State of Alaska

Workshops and other educational opportunities



U.S. Nuclear Power New Capacity (1969-2024)



SB 177 – Updated State Statutes on Nuclear

Enacted in 2023, included a separate category for small reactors under 50 MW that was less restrictive than previous regulations for nuclear energy in Alaska.

Alaska was one of the first states to recognize advanced reactors and seek to reduce barriers to adoption



The screenshot shows the official website of the Office of Governor Mike Dunleavy. At the top left is the Seal of the State of Alaska. To its right, the text reads "Office of Governor MIKE DUNLEAVY". Below this is a navigation bar with four items: "GOVERNOR HOME", "NEWSROOM & MEDIA", "STRONG FAMILIES", and "ADMINISTRATIVE ORDER". The main content area shows a breadcrumb trail: "You are here: Home / Microreactor Regulations Put Alaskan Communities at Forefront of Energy Innovation". The article title is "Microreactor Regulations Put Alaskan Communities at Forefront of Energy Innovation" with a date of "Jul 27, 2023". The article text states: "This month the State of Alaska adopted regulations to streamline the regulatory process for communities wanting to provide low-cost and clean energy by nuclear microreactor power generation." It concludes with: "The regulations stem from Senate Bill (SB) 177 which Governor Dunleavy signed into law in 2022, updating Alaska Statute (AS) 18.45."

Eielson Air Force Base Microreactor

- Project achieved a major acquisition milestone in mid-2025 by issuing a Notice of Intent to Award (NOITA) to Oklo for design, construction, and operation of the microreactor
- This NOITA begins contract negotiations but does not yet mean the contract is fully executed; NRC licensing and final agreements are still required.
- A 30-year, fixed-price power purchase agreement between the Air Force and Oklo would be finalized once the NRC grants a license.
- Oklo is also one of 10 companies selected under the DOE Nuclear Reactor Program to “*construct, operate, and achieve criticality of at least three test reactors using the DOE authorization process by July 4, 2026.*”



Artist rendering of the Oklo Aurora reactor (top);
groundbreaking at INL of 75-MWe Aurora reactor
at Idaho National Laboratory

U.S. Army Project Pele

Develop a mobile microreactor prototype designed to provide resilient power for military operations. project is led by the Department of War's Strategic Capabilities Office in partnership with BWXT, the Department of Energy and INL.



Casks arrive at INL containing TRISO fuel that will power the Project Pele reactor.

U.S. Army Project Janus Initiative

The Army's Project Janus is designed to develop and test a transportable microreactor prototype. The objective is to evaluate performance, safety, and logistics in a defense context while generating operational data that may inform future commercial designs.



Fort Wainwright has been identified as one of nine potential locations to host a microreactor under the U.S. Army's Project Janus initiative

February 15th, 2026 Demonstration airlift of unfueled Valar 5 MW reactor on C-17 as part of Project Janus.

Commercial Reactors Under Development

TerraPower is building its first Sodium reactor in Kemmerer, Wyoming, under DOE's Advanced Reactor Demonstration Program. The project pairs a sodium-cooled fast reactor with molten salt energy storage. Site preparation and non-nuclear construction activities are underway, but full nuclear construction is contingent on Nuclear Regulatory Commission approval. Target operation is in the early 2030s.

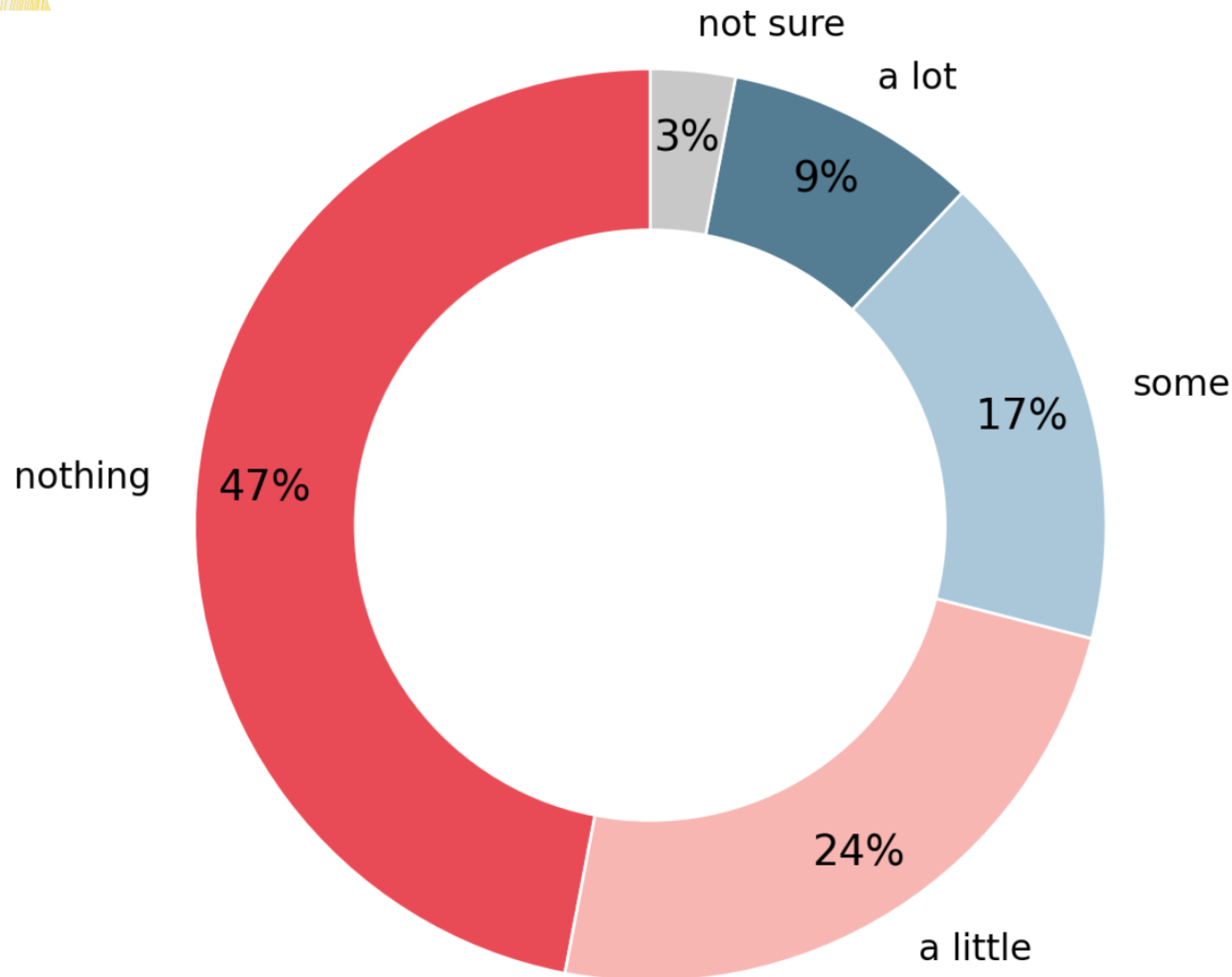


Commercial Reactors Under Development

Kairos Power Hermes (Tennessee): Kairos is constructing the Hermes non-power demonstration reactor in Tennessee, which received the first NRC construction permit for a non-light-water advanced reactor in decades. Hermes is a molten salt-cooled test reactor intended to validate design and licensing approaches before a larger commercial unit. Construction is ongoing, with first operation anticipated later this decade.



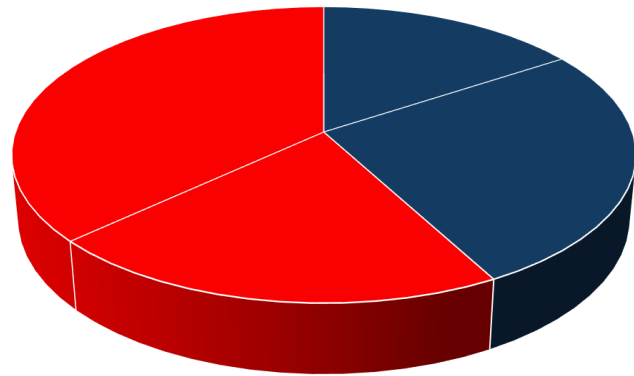
Public Awareness of Advanced Reactors



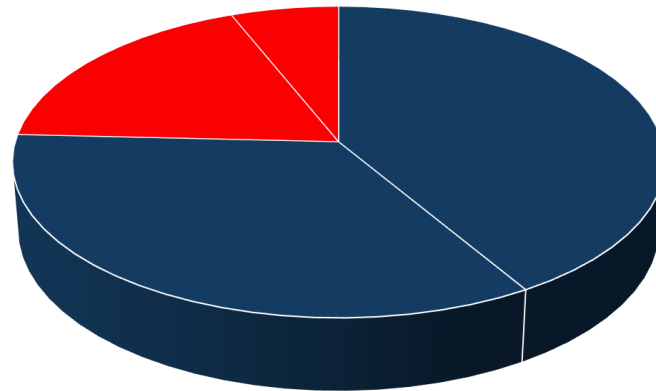
When it comes to advanced reactors/microreactors, there is a large information gap ...

Public Awareness of Advanced Reactors

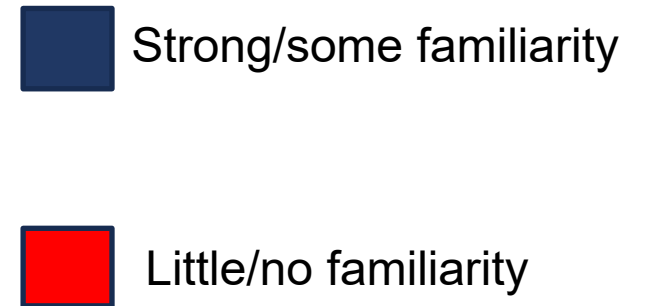
Based on public polls and surveys conducted by ACEP over the past three years, most public survey respondents have heard little or nothing about microreactors, while energy-focused audiences including people in leadership positions tend to show higher familiarity.



General Public

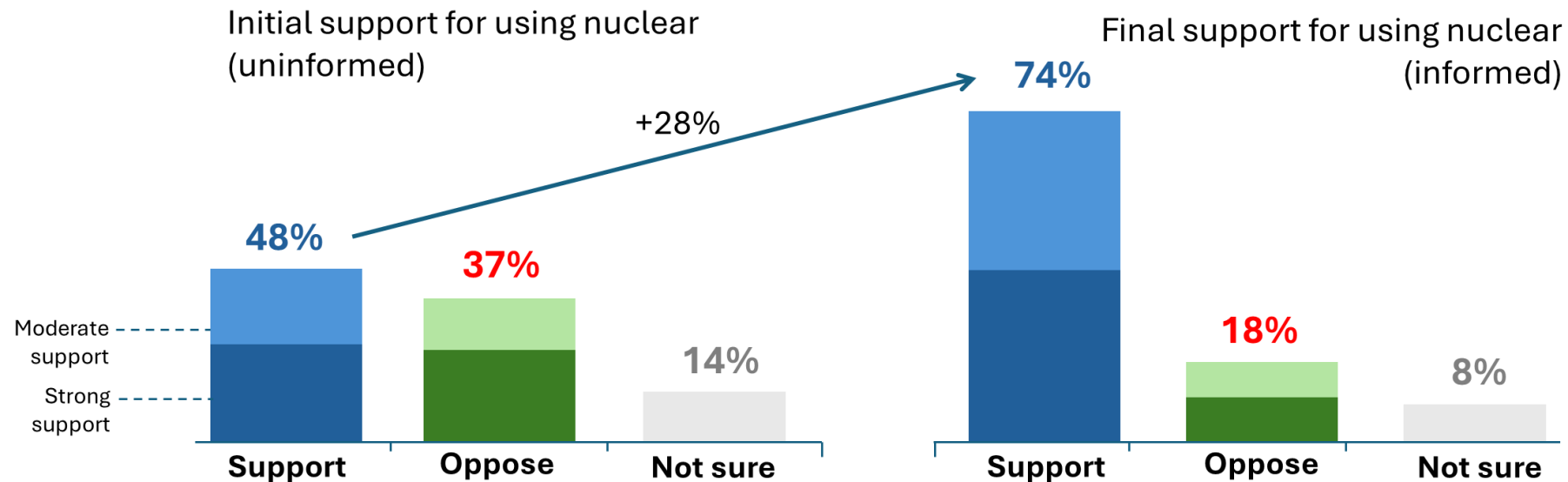


Alaskans attending ASEC



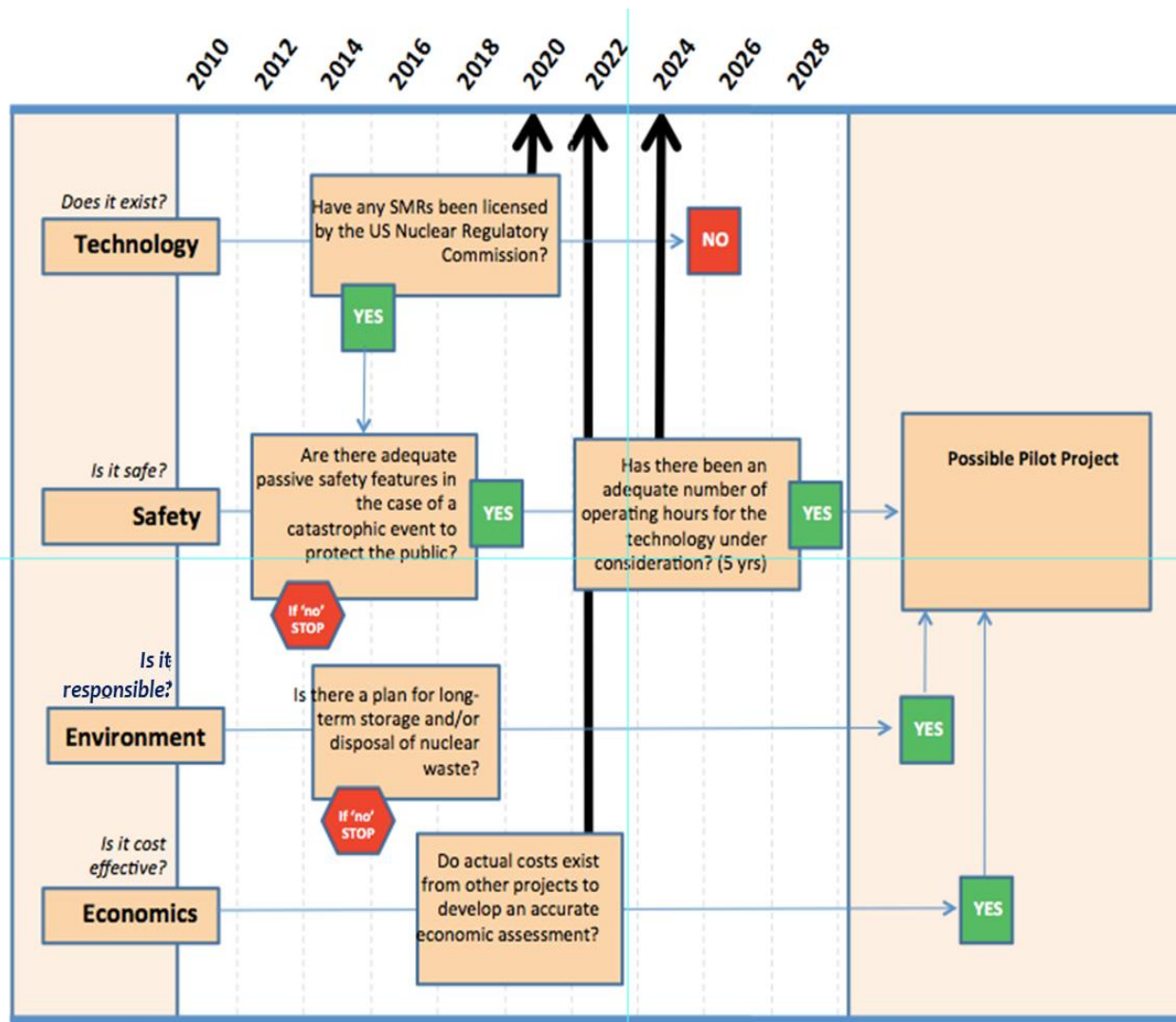
Public Awareness of Advanced Reactors

In a poll of 600 registered Alaska voters conducted by Strategies 360 on behalf of the University of Alaska Fairbanks, perceptions shifted significantly after respondents were provided with a basic description of what a microreactor is**.



** A nuclear microreactor is a small nuclear reactor that is much smaller than conventional nuclear technology. Microreactors are essentially a small nuclear-powered battery. They vary in size based on the manufacturer, but in general would be small enough to fit inside a shipping container and produce around 10 megawatts, which could power around 7,000 homes and also provide heat. Because of their small size, microreactors use much less nuclear fuel and have enhanced safety features. They also do not require water for cooling. After learning more, do you support or oppose the idea of Alaska exploring the use of microreactors to supply energy to Alaskans?

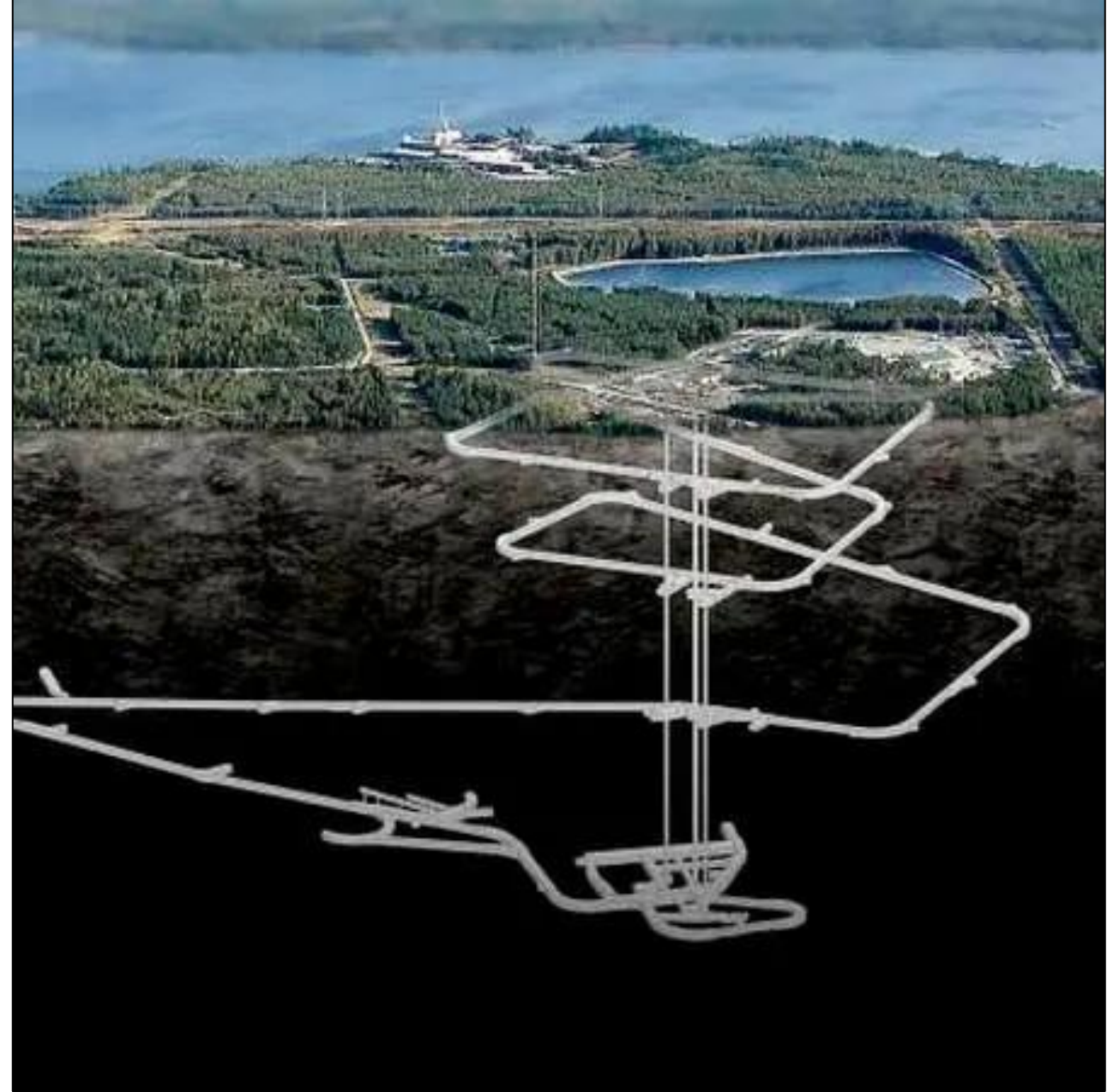
2011 Alaska Roadmap



Does it exist?
 Is it safe?
 Is it responsible?
 Is it cost effective?



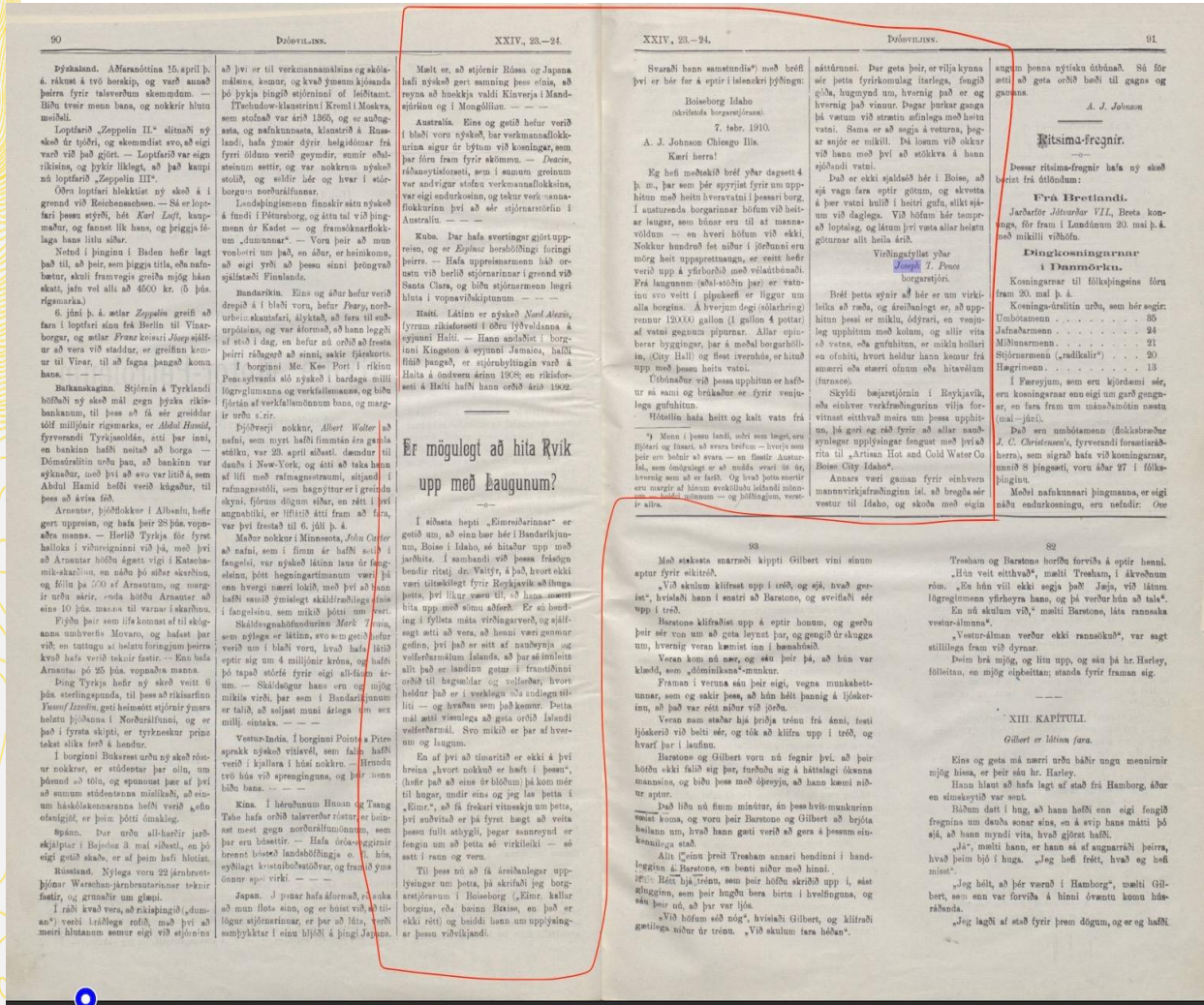
Finland's Onkalo permanent geologic repository for high level nuclear waste will open this year, demonstrating an approach to managing nuclear waste.





Copper corrodes extremely slowly in the deep, oxygen-poor groundwater environment 400+ meters underground.

Predicting the Future can be Difficult ...



“Engineers of our time devise many peculiar inventions—often so astonishing they seem like fabrications. Yet time and again, what was once thought impossible has proved achievable, reminding us to be cautious before dismissing any idea, however implausible it may first appear.”



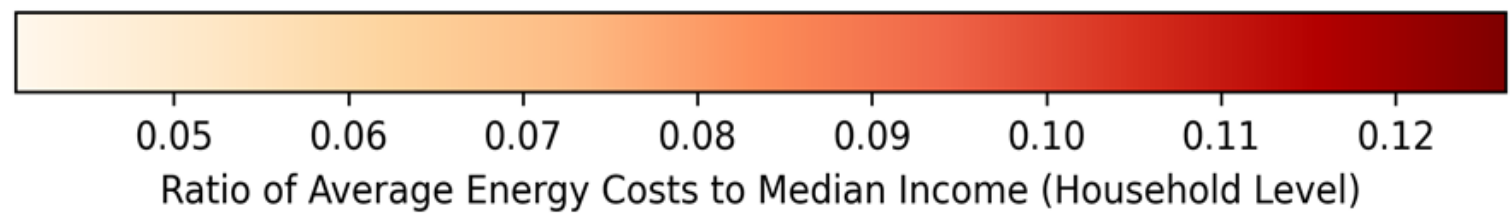
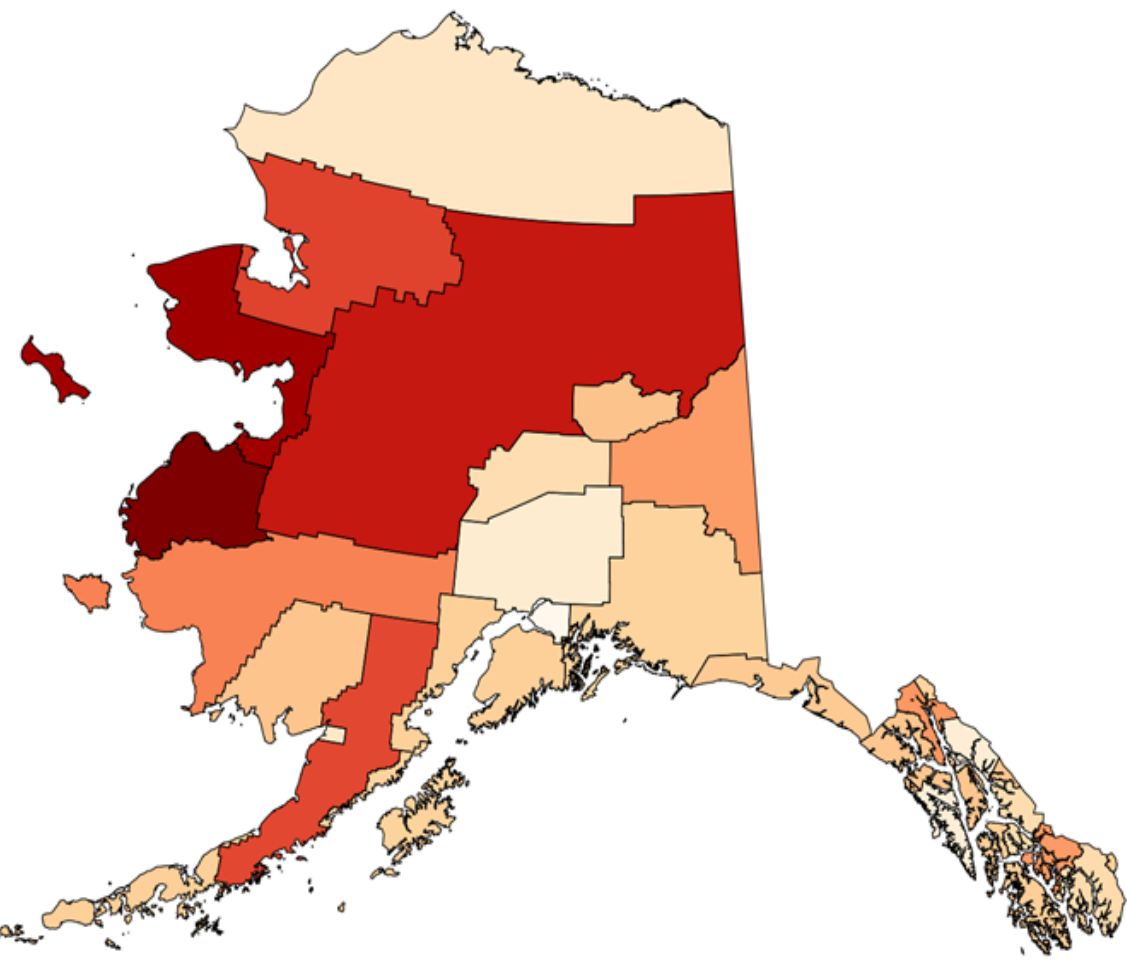
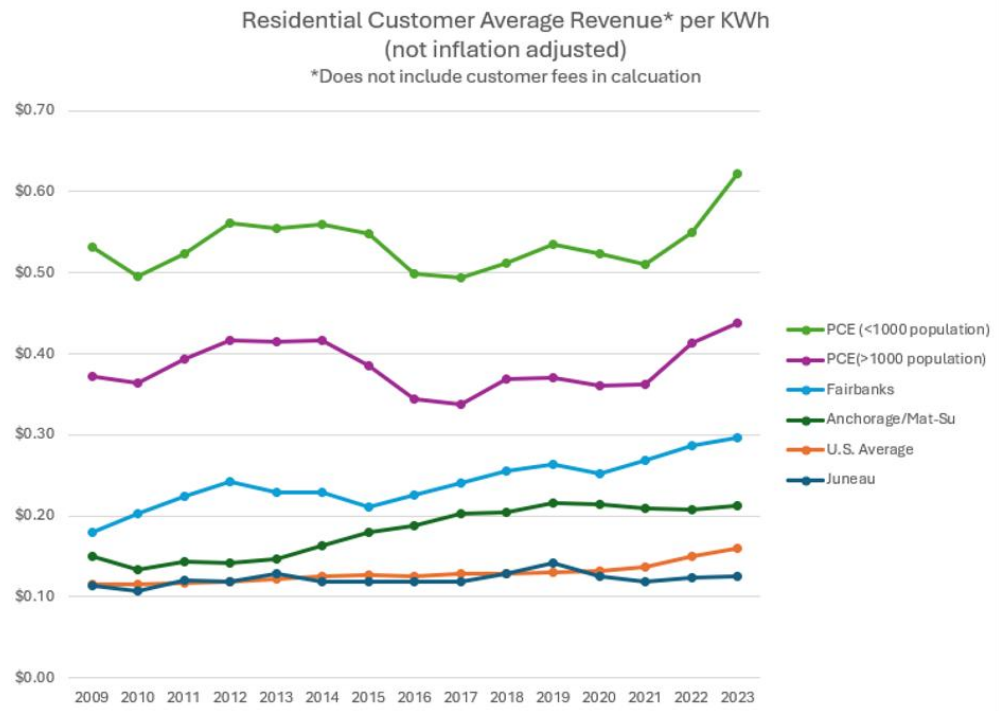
The “Electric North”



The Electric North refers to regions north of the interconnected continental grids of North America and Eurasia.

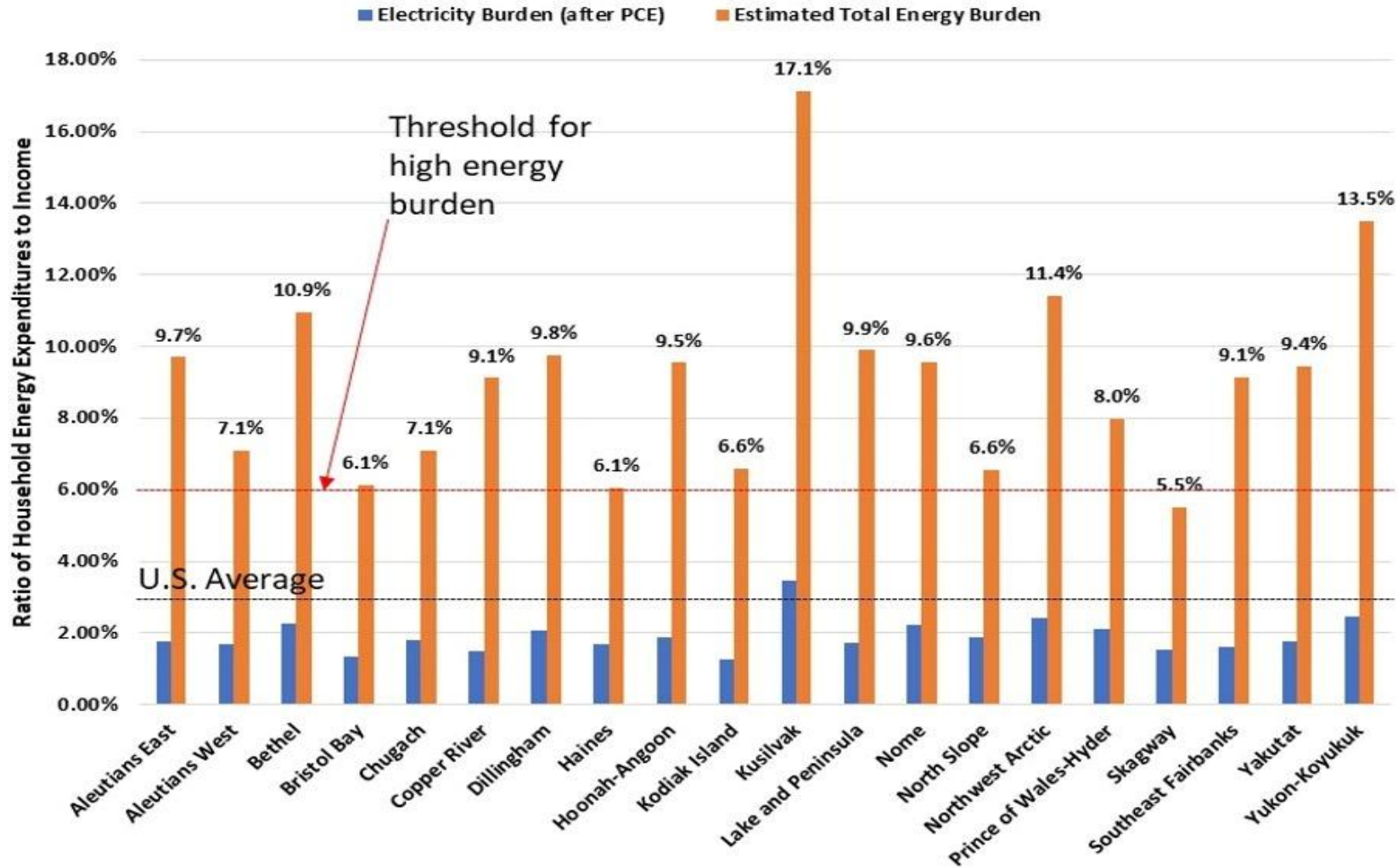
These areas are electrically served by a combination of regional grids, small distribution grids, or isolated microgrids.

Annual Household Energy Burden Estimates (2017)



Energy cost estimates are from the Alaska Housing Finance Corporation's 2018 Housing Assessment. All data, including prices, are from 2017 and represent single family homes. Energy costs include space heating and electricity. Income data is the median household income from the American Community Survey 5 year estimates.

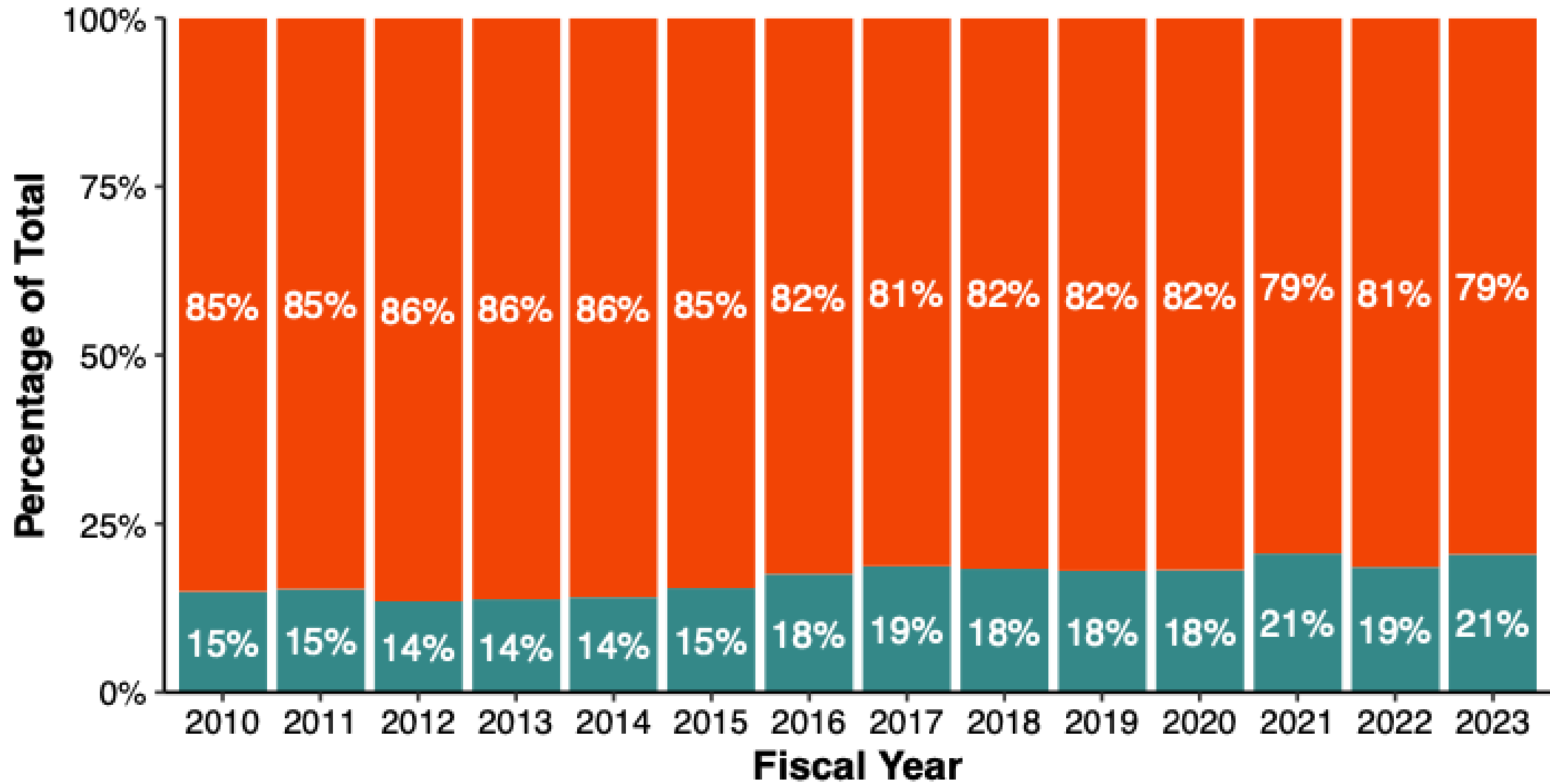
Estimated Household Electricity and Energy Burden for Rural (PCE eligible) Communities, Calendar Year 2022



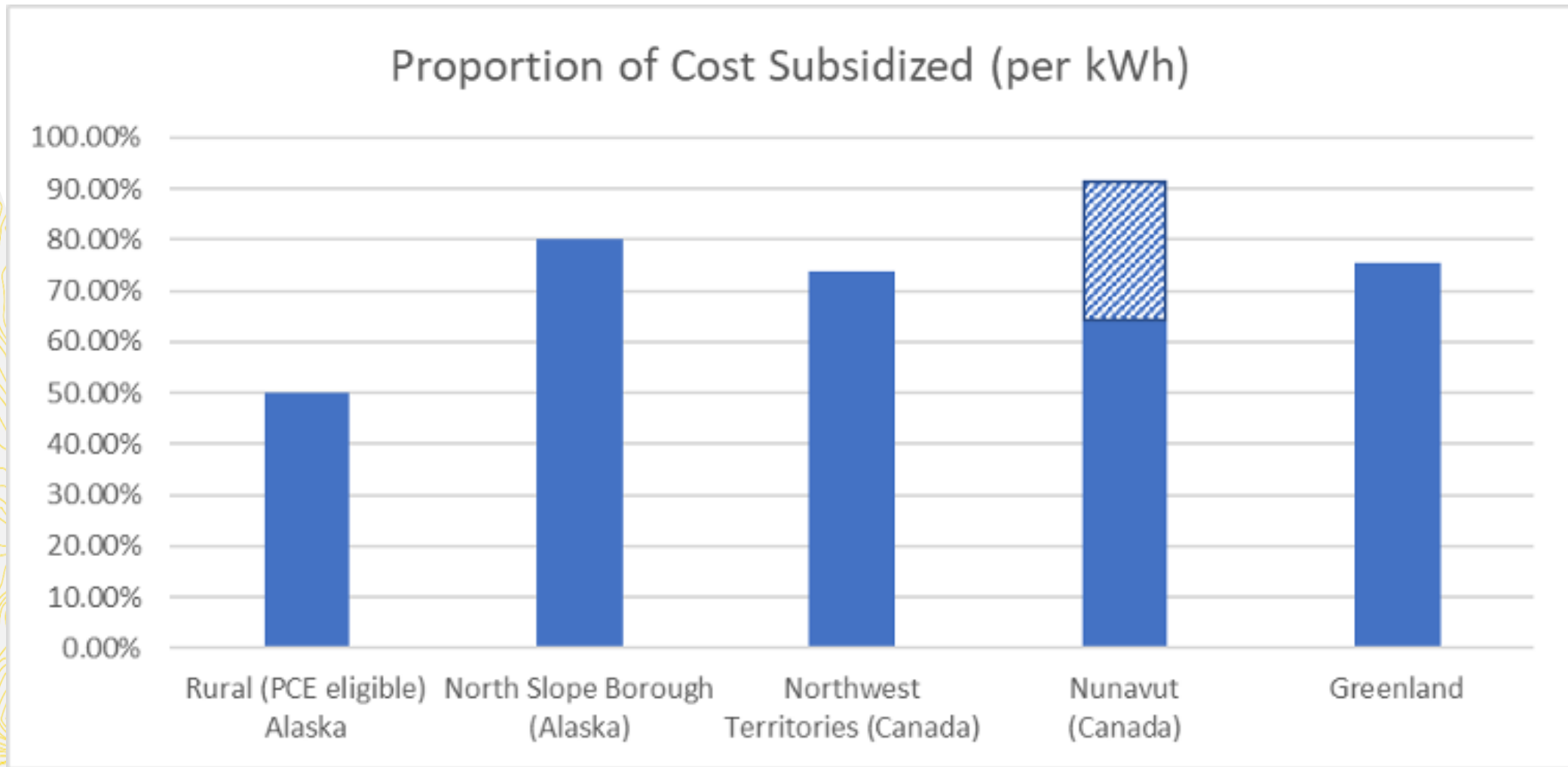
Rural Alaska communities experience a high energy burden (Holdmann, 2025)

Estimated Electricity Expenditures by PCE Eligibility

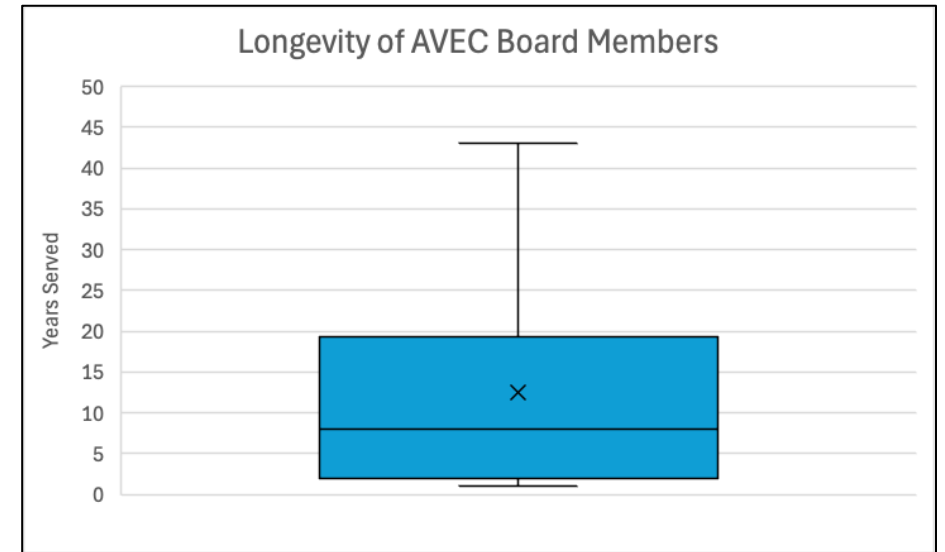
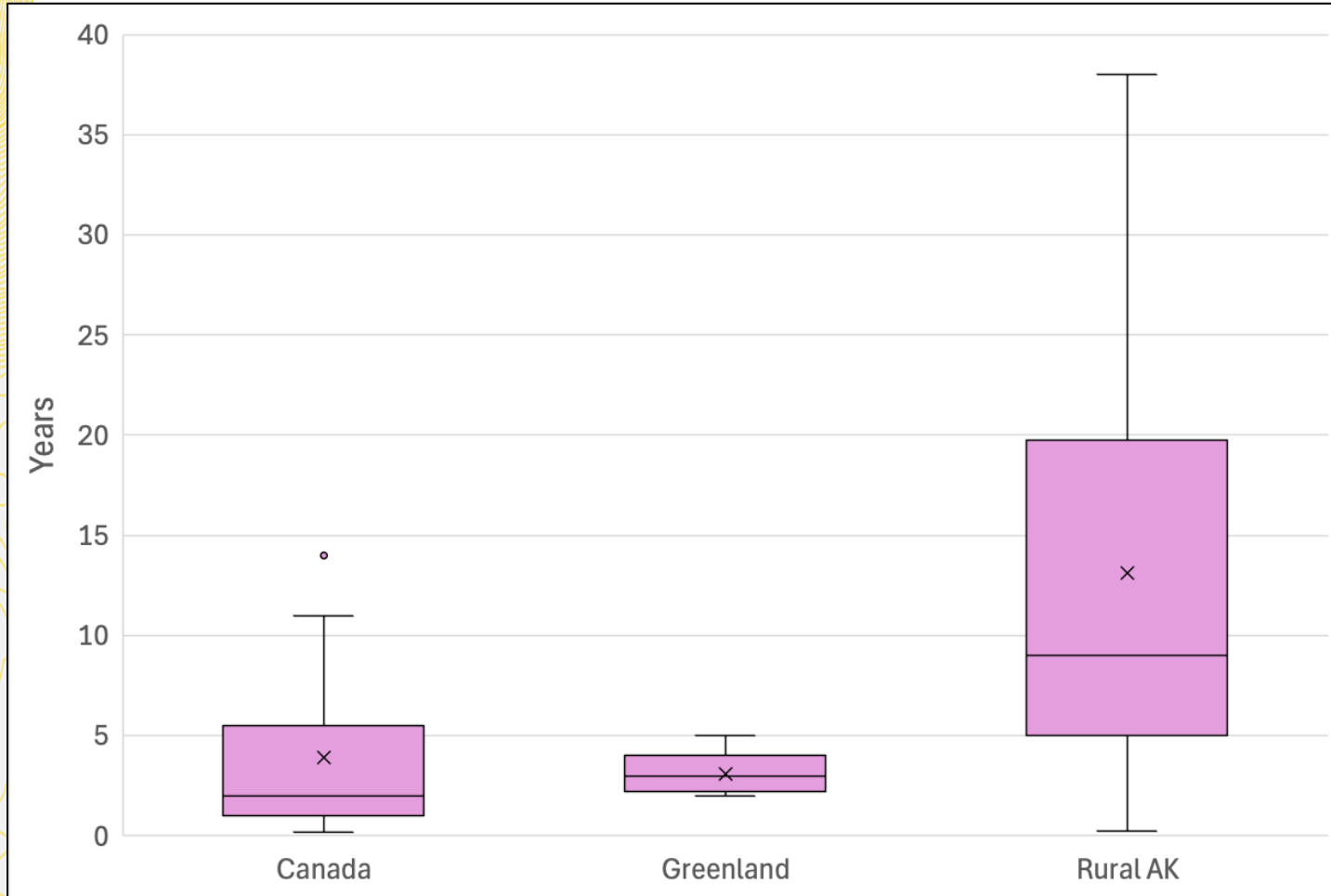
Not PCE Eligible PCE Eligible



Comparison with other northern regions



Comparison with other northern regions



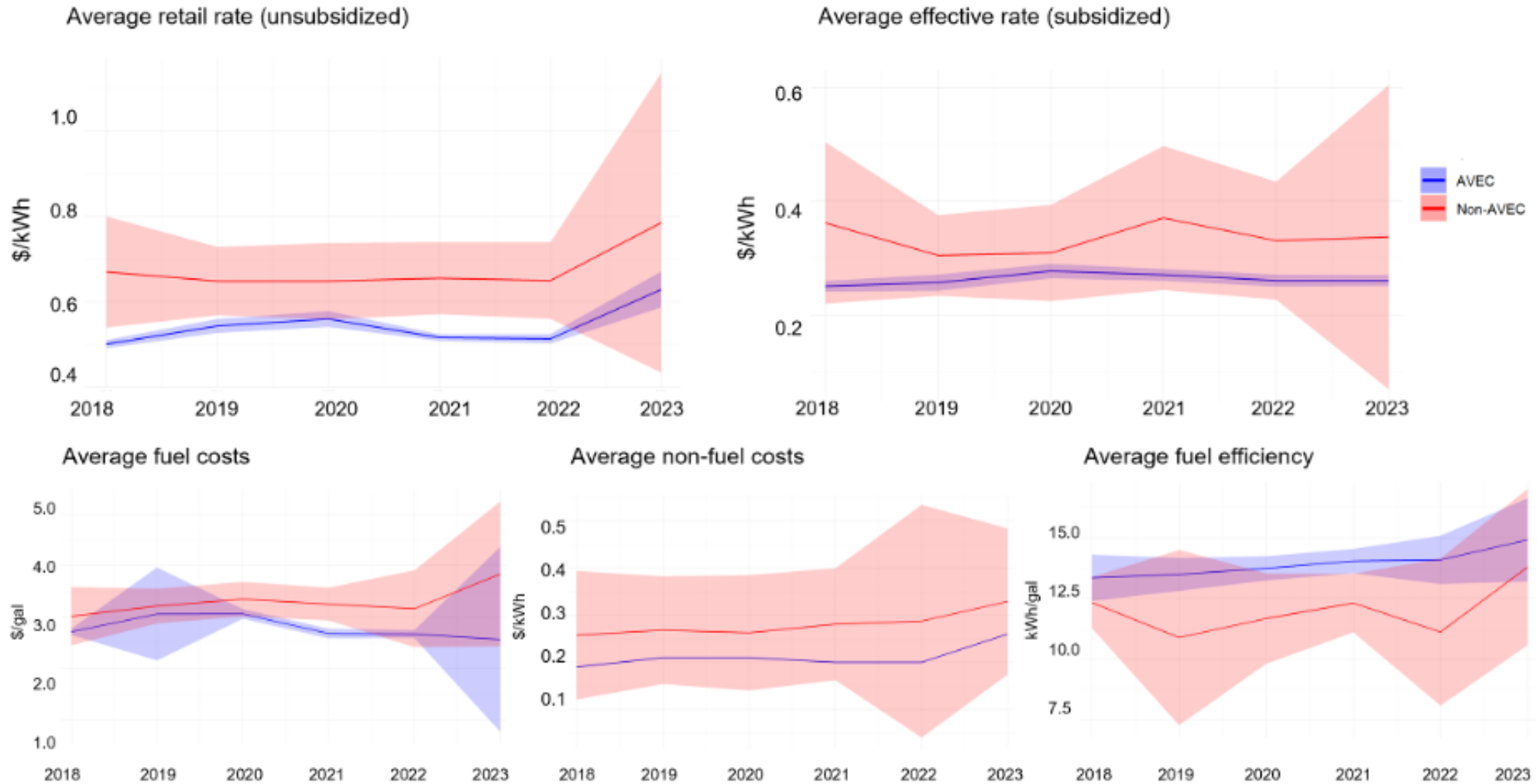
Leadership tenure for rural Alaska utilities is significantly higher than in Canada or Greenland

Do communities benefit from being part of AVEC?



Community	Population	Utility
Eek	296	AVEC
Goodnews Bay	243	AVEC
Kasigluk	569	AVEC
Lower Kalskag	282	AVEC
Mekoryuk	191	AVEC
Nightmute	280	AVEC
Nunapitchuk	496	AVEC
Quinhagak	669	AVEC
Toksook Bay	590	AVEC
Tununak	327	AVEC
Upper Kalskag	210	AVEC
Akiak	346	Akiak City Council
Akiachak	627	Akiachak Native Community
Aniak	501	Aniak Light & Power
Atmautluak	277	Atmautlæk Tribal Utilities
Kipnuk	639	Kipnuk Light Plant
Kwethuk	721	Kuiggluu
Kwigillingok	321	Kwigillingok Power Company
Napakiak	354	Napakiak Ircinraq
Napaskiak	405	Napaskiak Electric Utility
Cheforanak	418	Naterkaq Light Plant
Kongiganak	439	Puvumaq Power Company
Tuluksak	373	Tuluksak Traditional
Tuntutuliak	408	Tuntutuliak Community
Newtok	354	Ungusraq Power Company

Do communities benefit from being part of AVEC?



Do communities benefit from being part of AVEC?

Community	Net annual savings unsubsidized kWh sold compared to IND (retail rate)	Net annual savings CFs sold compared to IND (effective rate)	Net annual savings residential kWh sold compared to IND (effective rate)	Total Annual Benefit to Community for being part of AVEC	Community Benefit per Resident for Being AVEC Member
Eek	\$31,024	\$38,253	\$80,739	\$150,016	\$371
Goodnews Bay	\$18,698	\$15,076	\$68,537	\$102,311	\$397
Kasigluk	\$49,749	\$40,336	\$121,736	\$211,822	\$340
Lower Kalskag	\$14,285	\$23,047	\$56,511	\$93,843	\$338
Mekoryuk	\$36,802	\$22,471	\$48,475	\$107,747	\$523
Nightmute	\$41,955	\$23,167	\$45,693	\$110,815	\$362
Nunapitchuk	\$45,422	\$15,916	\$102,850	\$164,188	\$276
Quinhagak	\$71,025	\$55,281	\$169,513	\$295,819	\$381
Toksook Bay	\$36,837	\$70,177	\$128,177	\$235,192	\$357
Tununak	\$40,070	\$27,209	\$66,456	\$133,735	\$325
Upper Kalskag	\$33,995	\$15,843	\$55,593	\$105,430	\$497
TOTAL per year	\$419,863	\$346,776	\$944,279	\$1,710,917	N/A
AVE per community	\$38,169	\$31,525	\$85,844	\$155,538	\$379

Do communities benefit from being part of AVEC?

- There seem to be real benefits to pooling of resources through models like AVEC.
- Communities that pool resources are also more likely to successfully develop renewable energy projects.
- AEA and Denali Commission programs supporting rural communities, especially those with independent utilities, are very important.
- PCE endowment is a unique structure that creates more certainty around longevity of rural subsidies.



Thank You!

Dr. Gwen Holdmann, Chief Scientist

Gwen.Holdmann@alaska.edu

<https://www.uaf.edu/acep>

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