

A Carbon Capture and Storage Deployment Roadmap for Alaska & The Alaska Railbelt Carbon Capture and Storage (ARCCS) Project

January 10, 2024

Support Industry Alliance Presentation
Fairbanks

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SPE Paper 213051: *“Alaska CCUS Workgroup and a Roadmap to Commercial Deployment”*

download paper from <http://INE.UAF.EDU/Carbon> select item #6 or <https://doi.org/10.2118/213051-MS>



North Slope

Advantaged by low-cost natural gas

Natural gas-fired capture

Direct Air Capture (DAC)

Subsurface data integration & site-specific data gathering needed

40 year track record of successful CO₂ sequestration & use, ~15 TCF

Major Gas Sales 2015 LNG plan sequestered CO₂ back in reservoir

Interior

Existing coal plant infrastructure

Coal-fired capture

Basic regional subsurface data gathering needed

Southcentral

Proximity to Port, potential for import

Capture not attractive at natural gas plants or refineries due to gas supply shortage & high price

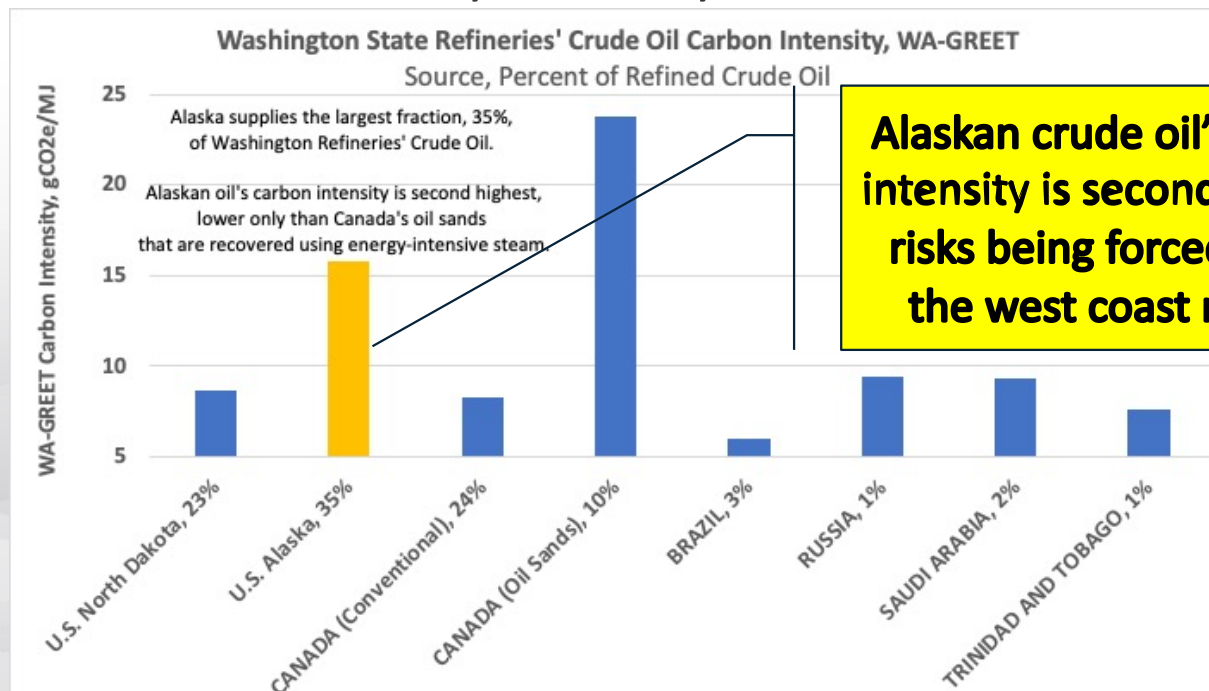
Coal or Hydrogen power with CCS can address natural gas shortage, food security, lower emissions

Imported CO₂ storage (US West Coast or Asia-Pacific)

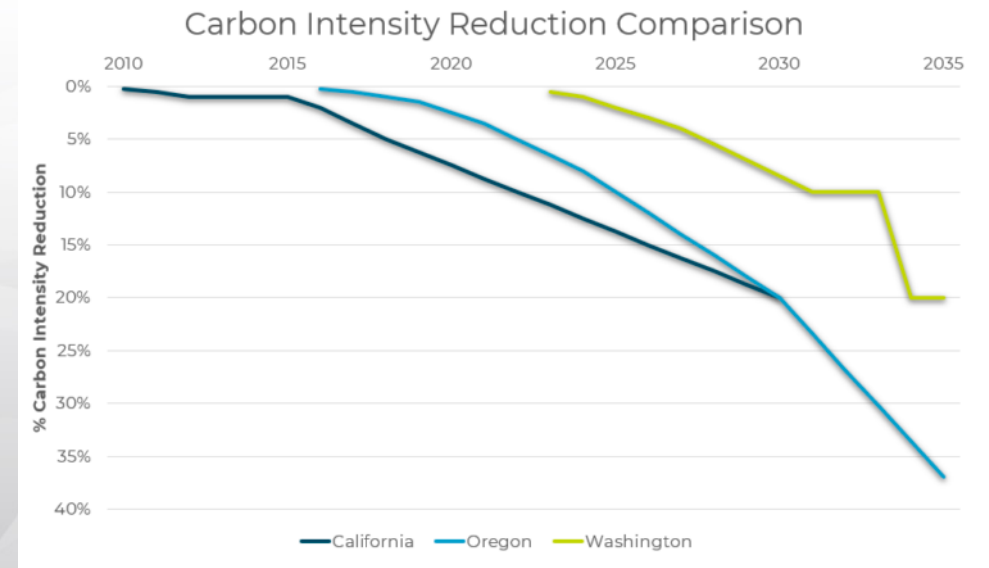
Subsurface data integration & site-specific data gathering needed



- Producers are electing to reduce Carbon Dioxide emissions, and may be forced by regulations
 - California, Oregon, and Washington have adopted their own clean fuel standards.
 - Washington, passed by the Legislature in 2021, requires fuel suppliers to reduce the carbon intensity of their products 20% below 2017 levels by 2038. (WA-GREET)
 - Carbon Capture and Storage, CCS, is one of the most cost-effective ways to reduce crude oil carbon intensity. CCS may enable Alaskan Crude to remain acceptable to the market.



Alaskan crude oil's carbon intensity is second highest, risks being forced out of the west coast market

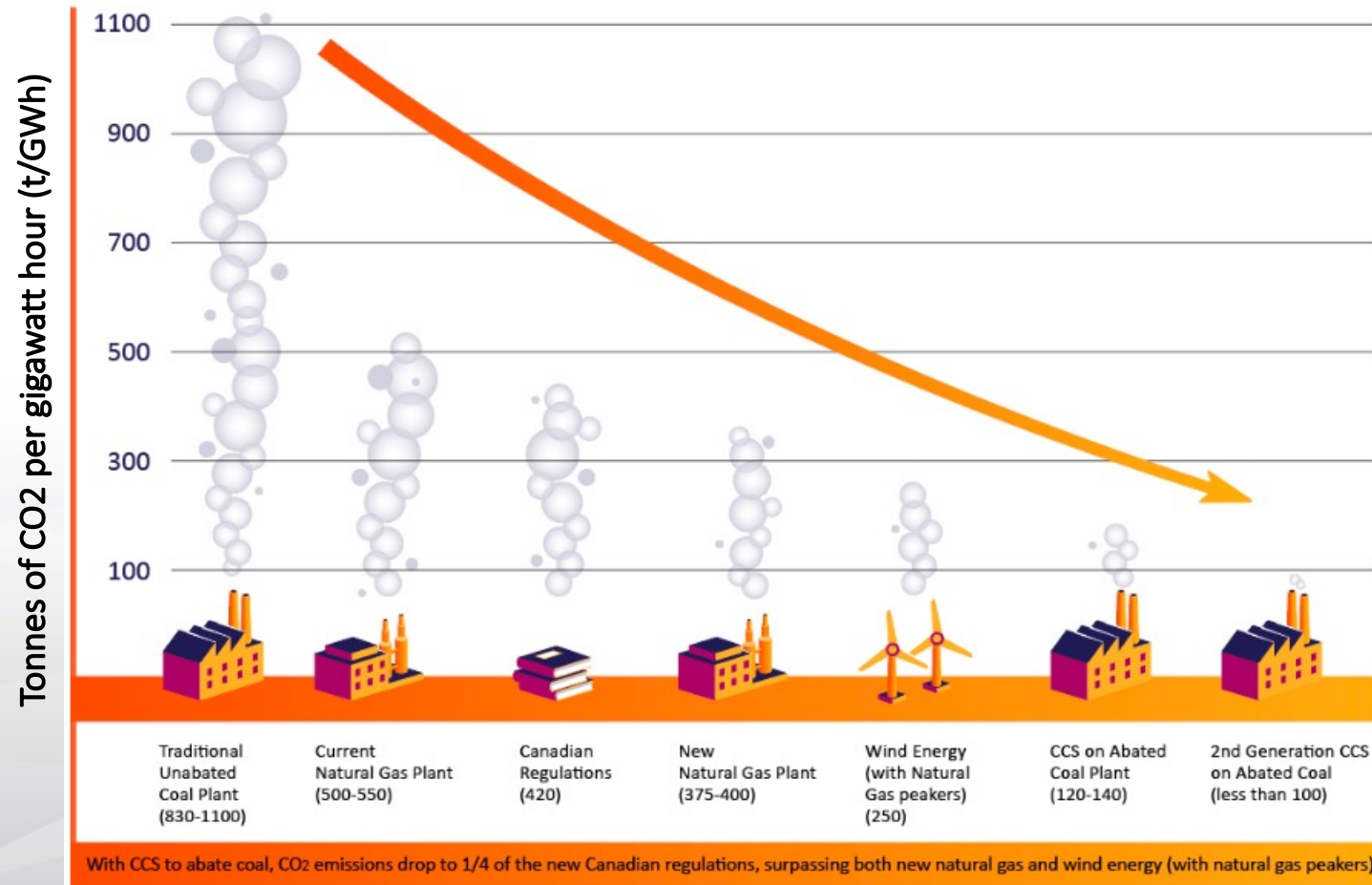


Why CCUS?



- World faces dual challenge of increasing energy demand and reducing carbon emissions
- Carbon (CO₂) Capture and Storage (CCS) also removes other pollutants
- CO₂ Use (CCUS) like agriculture can make electricity net zero emissions, support food and energy security
- Cost for clean energy security more than doubles without CCUS [IPCC]
- CO₂ Emissions Reductions may be Voluntary or Required, e.g. by Clean Air Standards (WA-GREET)

CO₂ Emissions - Significantly Reduced with Carbon Capture & Storage (CCS)



CCS prevents pollution, by capturing:

90% CO₂
100% SO₂
50% NO_x
92% PM₁₀
70% PM_{2.5}

* numbers from Saskpower Boundary Dam 3 CCS Facility

2nd Generation CCS Abated Coal Plant will reduce the CO₂ emissions to well below 100t/GWh

* based on data from Shand CCS Feasibility Study



- **Coal is lowest cost fuel**
 - \$4/MMBtu vs. \$10 to \$20+/MMBtu
 - Abundant supply
 - With CCS, Coal emits
 - ½ to ¼ of natural gas
 - ½ of wind with natural gas peakers
- **Natural gas forecast (from AEA) may not reflect high price risk for imported LNG**

NREL renewables report for State of Alaska 2022.pdf

Fuel Prices

Fuel prices trajectories were derived from projections by the Alaska Energy Authority (Figure 5).

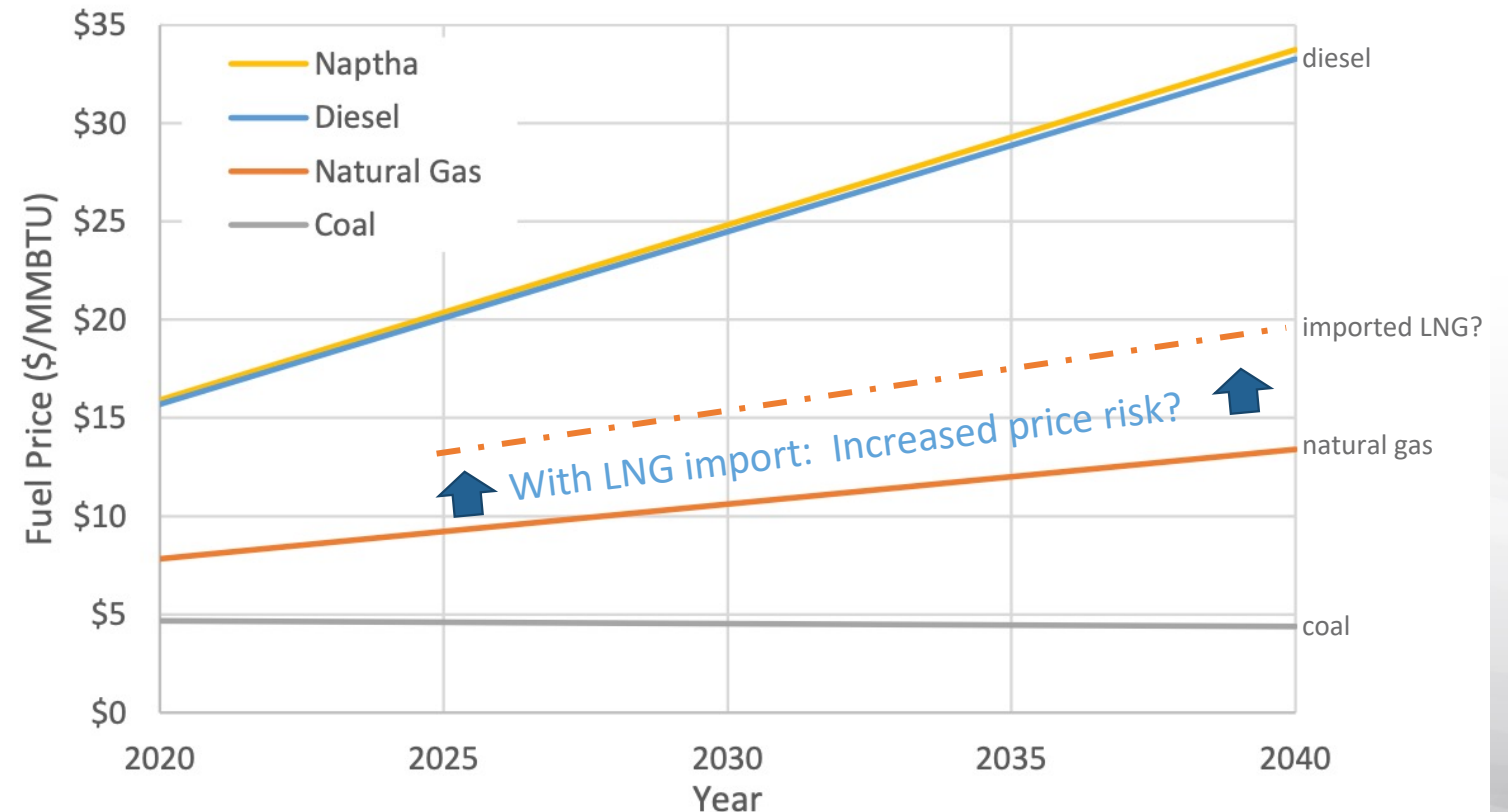


Figure 5. Assumed fuel price trajectories (2020\$)



Alaska Capture Screening

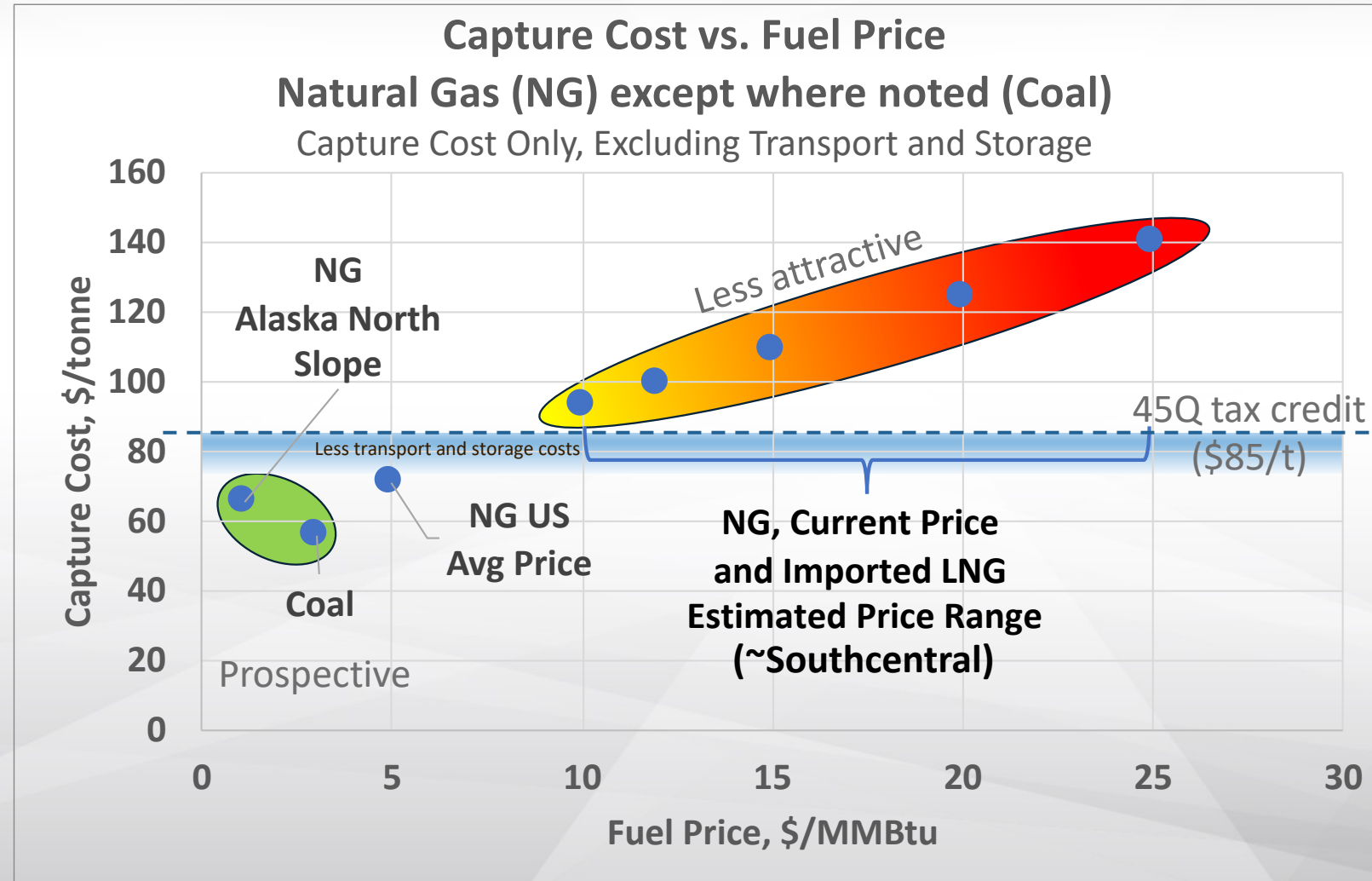
- Using typical Lower 48 costs
- Fuel price a key cost driver¹
- \$20 per tonne (maximum) for transport & storage

With Lower 48 costs and 45Q

- Natural gas capture prospective on North Slope
- Natural gas capture not attractive for Southcentral
- Coal capture looks prospective Statewide

Further work should be done for prospective projects

Based on Table 1 in SPE paper



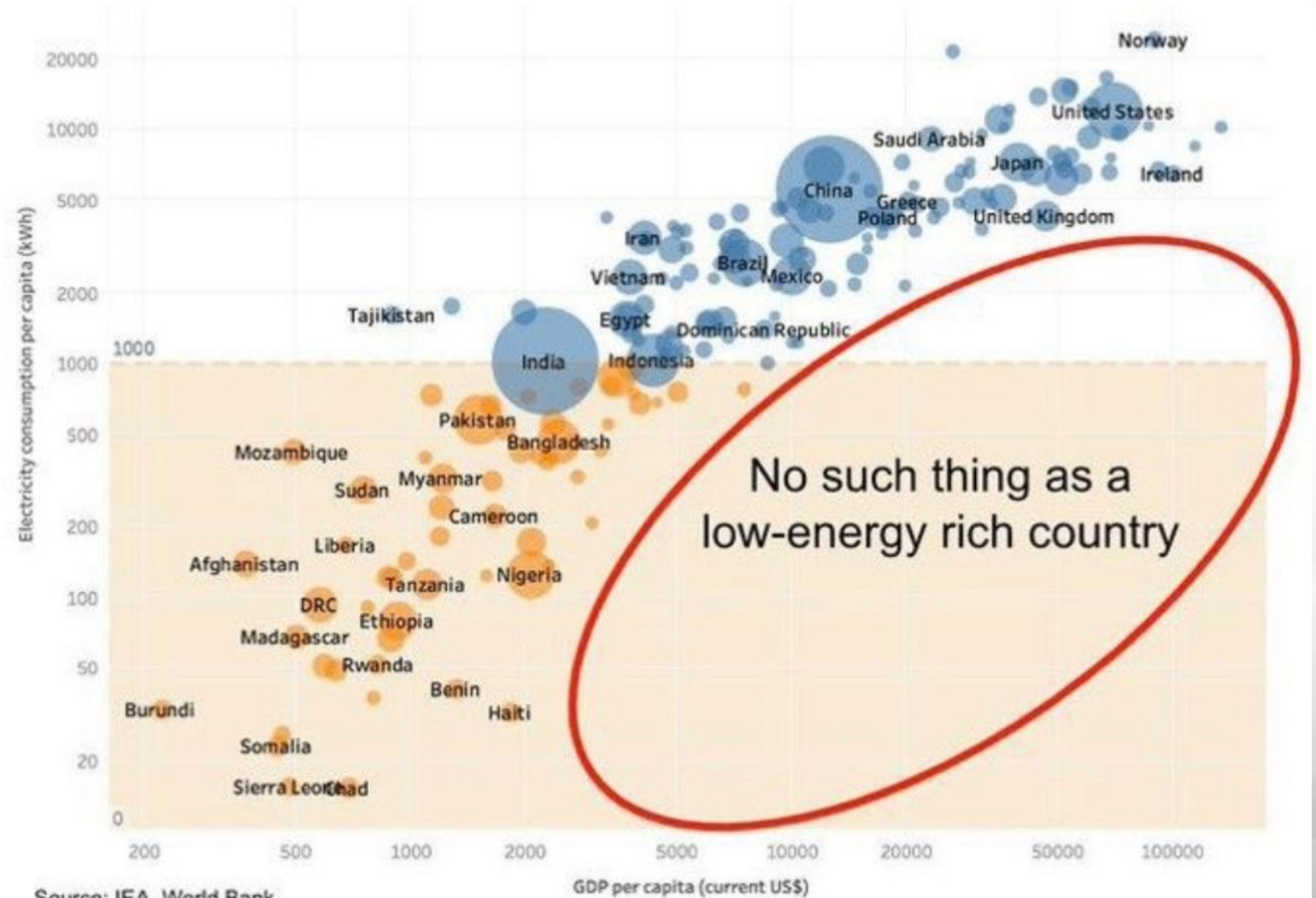
¹Cost methodology benchmarked against NETL, U.S. Department of Energy National Energy Technology Laboratory, 2015, "Cost and performance baseline for fossil energy plants volume 1a: Bituminous coal (PC) and natural gas to electricity" revision 3. July 6, 2015, DOE/NETL-2015/1723.

Electricity Powers Progress: Community Benefits

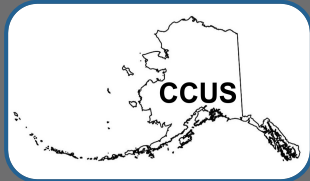


- Affordable, reliable power essential to human well being
- Alaska Electricity costs are high, energy demand per capita is second-highest in the nation, and Alaska is home to some of the lowest income socioeconomic groups in USA
- With Alaska's Power Cost Equalization (PCE) Program, Investments lowering Railbelt energy cost also lowers power costs Statewide
- PCE serves 82,000 Alaskans in 193 communities largely reliant on diesel fuel for power generation by lowering electricity cost to level comparable to Railbelt cost.
- See article by the State Governor on the railbelt grid: <https://gov.alaska.gov/state-labor-and-utilities-are-aligned-on-modernizing-the-railbelt-grid/>
- Alaska facts: <https://www.eia.gov/state/print.php?sid=AK>

Electricity & Income (per capita, all countries)



Source: IEA, World Bank



Alaska Railbelt Carbon Capture and Storage (ARCCS) Project

Funding application for DOE FOA-2711 AOI-4 CarbonSAFE Phase II Storage Assessment

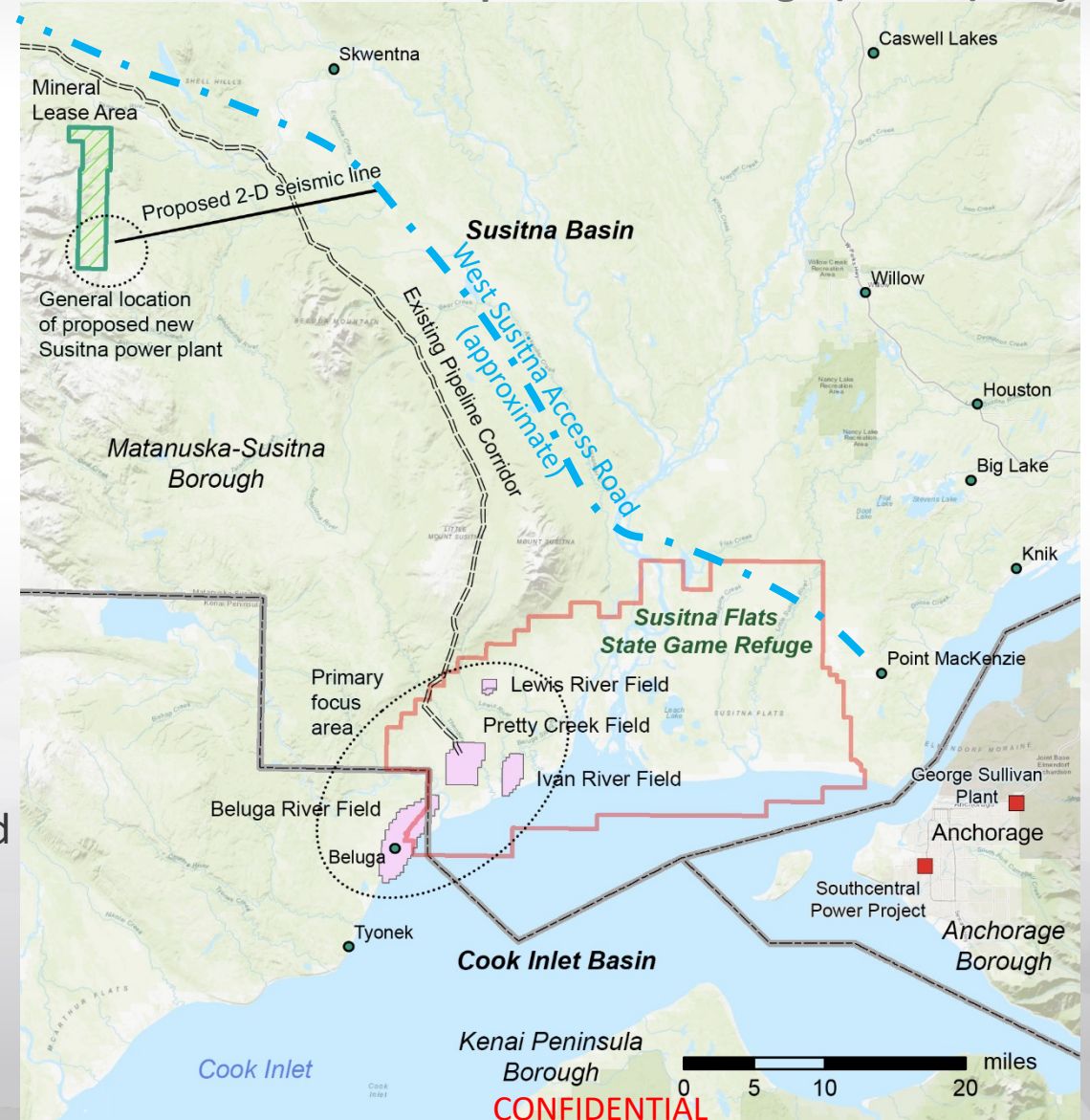
“The ARCSS Project supports affordable, reliable, clean power generation with carbon capture and storage. The ARCSS Project is expected to lower power costs for Alaska’s Railbelt and, through the Power Cost Equalization Program, also lower power costs to rural areas across the State.”

FOA-2711: ARCCS Project Study Basis



- Project would install dual-fuel capable Susitna Power Plant, biomass and coal, with Carbon Capture at mineral lease near proposed West Susitna Access Road
 - Electrical and CO₂ transmission along existing, permitted, Donlin, pipeline corridor
 - Electrical intertie and CO₂ storage at Beluga River and surrounding depleted gas fields
 - With agricultural use of CO₂ and waste heat, provides food and energy security and approaches zero emissions
 - Consider capture of CO₂ from two CEA power stations
- **FOA-2711 ARCCS work scope: Assess storage volumes using CarbonSAFE Phase II framework.**
 - Preliminarily, Beluga River Field alone has 60+ years storage for 300 MW net with CCS (400 MW gross) power plant
 - Plan with Operator simultaneous natural gas production and CO₂ injection in depleted fields and Hemlock formation
 - Acquire 2D Seismic over alternate saline aquifer storage site
 - Community Benefits Planning and Engagement
 - UAF-led with EERC and ARI, with community support

Alaska Railbelt Carbon Capture and Storage (ARCCS) Project





Congress of the United States
Washington, DC 20515

July 27, 2023

The Honorable Brad Crabtree
Assistant Secretary, Office of Fossil Energy and Carbon Management
Department of Energy
1000 Independence Avenue, SW
Washington, DC 20585

Assistant Secretary Crabtree:

We are writing in support of the University of Alaska Fairbanks' Institute of Northern Engineering's (UAF-INE) proposal to the Department of Energy (DOE) CarbonSAFE Phase II funding opportunity. The UAF-INE's proposed "Alaska Railbelt Carbon Capture and Storage (ARCSS) Project" will evaluate carbon dioxide aggregated from sources for injection into a secure geologic storage complex.


Throughout Southcentral Alaska, there is a growing concern that the current energy supply will be unable to meet the anticipated regional electricity demand. As such, the region is looking at all-of-the-above alternative fuel sources that will bring Alaskans low-cost, reliable, and clean energy. Research by the Plains CO2 Reduction (PCOR) Partnership Initiative concluded that a dual biomass and coal-fueled carbon capture and sequestration (CCS) power plant could achieve net zero emissions through carbon sequestration, helping to reduce carbon emissions while providing a domestic, low-cost solution to a region with some of the highest electricity rates in the country. Developing a CCS coal-fueled power plant in Alaska, such as the ARCSS Project, is an opportunity for an in-state secure base-load energy source. Alaska is a leader in embracing CCS technologies, being home to some of the largest geologic storage capabilities in the world. Safe carbon dioxide storage capacity is the cornerstone of CCS, and the ARCSS Project can be the foundation for the first fully carbon-neutral electricity grid.

Consistent with applicable law, policy, and guidance, we respectfully ask that you give due consideration to UAF-INE's application to the CarbonSAFE Phase II program. We ask that you keep our offices apprised of the outcome. Thank you for your consideration.

Sincerely,


Lisa Murkowski
United States Senator


Dan Sullivan
United States Senator


Mary Sattler Peltola
Representative for All Alaska

STATE CAPITOL
P.O. Box 110001
Juneau, AK 99811-0001
907-465-3500



Governor Mike Dunleavy
STATE OF ALASKA

550 West Seventh Avenue, Suite 1700
Anchorage, AK 99501
907-269-7450

June 29, 2023

Mr. Bradford Crabtree
Assistant Secretary for Fossil Energy and Carbon Management
FECM-1 / Forrestal Building
U.S. Department of Energy
1000 Independence Avenue, S.W.
Washington, DC 20585

RE: Letter of Commitment for Alaska Railbelt Carbon Capture and Sequestration Project
DE-FOA-0002711


Dear Mr. Crabtree:

The State of Alaska's University of Alaska Fairbanks (UAF) is pleased to submit for the funding opportunity DE-FOA-0002711 for Alaska Railbelt Carbon Capture and Sequestration Project. One of the priorities of my administration is to lay the foundation for a robust carbon capture, utilization, and storage (CCUS) industry in Alaska. I am grateful for the ongoing collaboration between the University of Alaska Fairbanks, the Alaska Department of Natural Resources, and industry in establishing a CCUS working group that continues bringing together subject matter experts to help inform our state strategy. Working with the Alaska State Legislature, we have made tremendous progress toward establishing the legal and regulatory framework for incentivizing CO2 capture and storage in Alaska.

I am in full support of evaluating certain geologic structures in the Cook Inlet for CO2 storage as proposed in the aforementioned application under the Carbon SAFE Program, DE-FE-0002711. Acquiring this funding and completing the evaluation is an important next step in establishing a CCUS industry for Alaska.

I understand UAF is continuing to pursue other partners, including from the private sector, to meet the cost sharing requirement for this project. The State of Alaska strongly supports UAF's Alaska Railbelt Carbon Capture and Sequestration Project application and, absent other partners, could provide required cost share up to \$2.25 million, subject to legislative approval.

Sincerely,


Mike Dunleavy
Governor

ARCCS Cost Share Commitments from:

- State of Alaska Office of the Governor
- Advanced Resources International
- Flatlands Energy Corporation
- State of Alaska Department of Natural Resources
 - Division of Oil and Gas
 - Division of Geological and Geophysical Surveys
- Friends of West Susitna
- blueprint Alaska

ARCCS Project Support Letters from:

- The Alaska Congressional Delegation
- Hilcorp Energy Corporation
- Chugach Electric Assn.
- Cook Inlet Region Inc.
- Matanuska Susitna Borough
- Alaska Native Science and Engineering Program
- Alaska Energy Authority
- Nova Minerals Ltd
- U.S. Gold Mining Inc.



Budget By Task	Task Overview		
	Total		
	DOE Funds	Required Cost Share	Total
Task 1.0 – Project Management and Planning	\$1,303,626	\$211,871	\$1,515,497
Task 2.0 – Site Specific Characterization and Assessment of CO ₂ Storage Complex	\$3,121,341	\$1,717,996	\$4,839,337
Task 3.0 – Preliminary Project Risk Assessment with Mitigation and Management Plans	\$744,446	\$4,888	\$749,334
Task 4.0 – Plan for Subsequent Detailed Site Characterization and Permitting	\$551,693	\$14,576	\$566,269
Task 5.0 – Project Technical and Economic Feasibility Assessment, Including CO ₂ Transport Design Study	\$1,200,934	\$100,593	\$1,301,527
Task 6.0 – Community Benefits Plan	\$1,958,309	\$170,177	\$2,128,486
Total (\$)	\$8,880,349	\$2,220,101	\$11,100,450

ARCCS Project

- Questions?

- Website: <http://INE.UAF.EDU/Carbon>
- Follow-up: yzhang35@alaska.edu, Brent.Sheets@alaska.edu, Frank.Paskvan@gmail.com

