Cordova
Priority Climate Action Plan

April 1, 2024

PREPARED FOR:
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Acknowledgements

The Priority Climate Action Plan (PCAP) is the result of the hard work and persistence of many people (see list below), including staff from various agencies and organizations, consultants, Tribal representatives, and reviewers who spent many hours researching, writing, crunching numbers, and reviewing the Plan.

A special thanks to the Environmental Protection Agency (EPA) for providing grant funding through its Climate Pollution Reduction Grant (CPRG) Program to support the preparation of community climate action plans.

In the spirit of our ancestors and with deep respect for the land that sustains us, we dedicate this PCAP to our families, our friends, and the children of the Chugach region. This climate action plan is our promise to the future generations who will walk this land after us and a commitment to uphold the legacy and wisdom of our elders. May our successes today pave the way for their prosperity, ensuring they inherit a world where our traditions, our culture, and our community continue to thrive in harmony with nature.

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Acronyms

ADFG	Alaska Dept. of Fish & Game
AK	Alaska
AMHS	Alaska Marine Highway System
ANCSA	Alaska Native Claims Settlement Act
AW	Anadromous Waters Catalogue
CCAP	Comprehensive Climate Action Plan
CCMC	Cordova Community Medical Center
CEC	Cordova Electric Cooperative
CH4	methane
CO2	carbon dioxide
CO2e	carbon dioxide equivalent
CPRG	Climate Pollution Reduction Grant
CR	Copper River
CREW	Cordova Renewable Energy Workgroup
CRRC	Chugach Regional Resources Commission
CTC	Cordova Telecomm Cooperative
DOT	Department of Transportation
EEMs	Energy Efficiency Measures
EPA	Environmental Protection Agency
EV	Electric Vehicle
GHG	Greenhouse gas
HBC	Humpback Creek
ICHC	Ilanka Community Health Center
kWh	kilowatt hour
LED	light-emitting diode
MSW	Municipal Solid Waste
mt	metric tons
MW	Megawatts
N2O	nitrous oxide
NO2	nitrogen dioxides
NVE	Native Village of Eyak
PC	Power Creek
PCAP	Priority Climate Action Plan
PM2.5	particulate matter
PWS	Prince William Sound
RHA	Regional Housing Authorities
RHO	Regional Health Organizations
RSW	Refrigerated Seawater Systems
RUS	USDA Rural Utilities Service
SNAP	Scenarios Network for Alaska + Arctic Planning
SOX	sulfur dioxides
USCG	United States Coast Guard
USDA	United States Dept. of Agriculture
USFS	United States Forest Service
USPS	United States Postal Service

Figures and Tables

Purpose and Scope

Purpose and Scope: Tribal Roadmap for GHG Reduction

The core purpose of this our Climate Action Plan is to create a tangible, effective roadmap for reducing greenhouse gas (GHG) emissions in the electricity generation, solid waste, and blue economy sectors by leveraging this planning phase to develop impactful community projects. This Climate Action Plan, developed with the support of the EPA's Climate Pollution Reduction Program, represents the concerted effort of a consortium of Tribes dedicated to preserving their way of life and natural resources. It is a strategic response to the urgent challenge of climate change, encompassing both the Priority Climate Action Plan (PCAP) and the Comprehensive Climate Action Plan (CCAP), reflecting the Tribes' role as stewards of their ancestral lands.

Alaska's Chugach region, which encompasses over 6 million acres of land and 5,000 miles of coastline in Southcentral Alaska, has been home to the dAXunhyuu (Eyak) and Alutiit/Sugpiat people since time immemorial. Today, over 1,500 Tribal members still live and work in seven communities throughout Prince William Sound and the Lower Cook Inlet: Chenega, Cordova (Eyak), Nanwalek, Port Graham, Seward (Qutekcak), Tatitlek, and Valdez. The Chugach Regional Resources Commission (CRRC) is an inter-Tribal fish and wildlife commission authorized as a Tribal consortium under the Indian Self Determination and Education Assistance Act of 1991. CRRC is authorized by our seven member Tribes to provide essential government services to Tribal citizens around natural resource management, subsistence activities, climate change adaptation and environmental concerns, food security, and access to healthy traditional foods and clean water.

For the purpose of this planning project, CRRC has worked with the Native Village of Eyak (NVE) located in the community of Cordova as a pilot project to better understand greenhouse gas mitigation measures that can be implemented throughout the region, with a focus on energy generation and efficiency, solid waste management, and the blue economy (mariculture and the fishing fleet).

Phase I: Priority Climate Action Plan – April 1, 2024

The first phase of our journey begins with the creation of this PCAP. Our focus in this phase is to identify immediate, actionable strategies to reduce GHG emissions. The PCAP will encapsulate near-term priorities, reflecting our unique environmental challenges. This plan will serve as a springboard, enabling us to pursue the necessary funding through the EPA CPRG Implementation Phase and support for our envisioned projects.

Phase II: Comprehensive Climate Action Plan

With the foundational work of the PCAP in place, we will expand our vision in the CCAP, due Summer 2025. This comprehensive plan will delve deeper, covering significant GHG emission sources and carbon sinks within our region in the three priority sectors. It will outline both short- and long-term goals, strategies, and measures, encompassing a broad spectrum of environmental, economic, and project opportunity considerations. The CCAP is our roadmap to not only meet the immediate challenges of climate change but to set a course for the future in the priority sectors identified here.

Implementation Grant Applications

Application Type	Applicant Eligibility	PCAP Deadline	Grant Application Deadline
General Competition ($2MM - $500MM)	State, Municipality, Tribe, Tribal Consortium, Territory	March 1, 2024	April 1, 2024, at 11:59 pm (ET); 7:59 pm (AKST)
Tribal Competition ($1MM - $25MM)	Tribe, Tribal Consortium, Territory	April 1, 2024	May 1, 2024, at 11:59 pm (ET); 7:59 pm (AKST)

**Note – Measures/Projects must be listed in a PCAP to be eligible to be included in an Implementation Grant Application. See: https://www.epa.gov/inflation-reduction-act/about-cprg-implementation-grants for more information.*

Community Description

The Native Village of Eyak (NVE) is located in the city of Cordova (figure 1) along the southeastern shores of the Prince William Sound (PWS), AK in the Chugach region, 150 air miles southeast of Anchorage. Cordova, with a population of 2,600 (23.6% Alaska Native), is accessible only by plane or boat. Cordova receives daily commercial jet service at the Merle K. "Mudhole" Smith Airport and receives year-round barge service for shipped goods. Cordova is also connected to the Alaska Marine Highway System (AMHS) for ferry service to Whittier and Valdez. Because of its remote location and limited access, goods and services can become quite expensive. In particular, the cost of fuel can be much higher than the national average causing cascading impacts on the economy. Thus, programs and projects that promote energy efficiency and reduce fuel consumption can benefit the economy as well as the environment.[1]

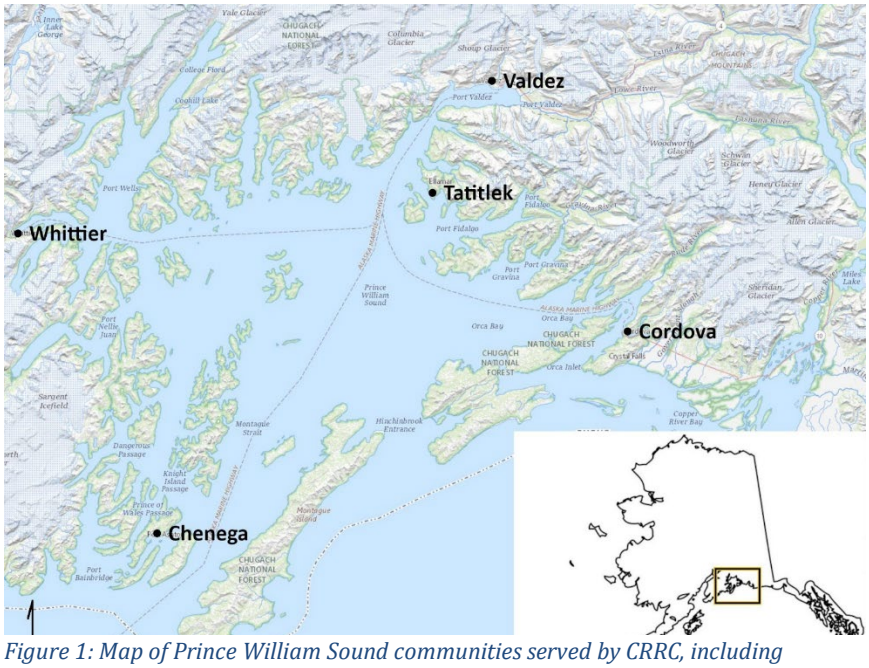

Figure 1: Map of Prince William Sound communities served by CRRC, including Cordova (Native Village of Eyak), the Native Village of Chenega, the Native Village of Tatitlek, and Valdez (Valdez Native Tribe). Whittier does not have a Tribe located in the community.

Cordova is nestled in a temperate rain forest with heavy coastal influences.

[1] "About Cordova - City of Cordova, Alaska," City of Cordova, Alaska, December 8, 2022, https://www.cityofcordova.net/about-cordova/.

Historical (1950-2009) winter temperatures averaged 28.8˚F and summer temperatures 54˚F. Models from Scenarios Network for Alaska + Arctic Planning (SNAP) predict that temperatures will increase up to 11˚F under all climate change scenarios, with the most pronounced warming in winter (between 3.7˚F – 11.5˚F degrees of warming depending on the pathway and model used) and summer (between 2.1˚F and 11.3˚F degrees of warming). Precipitation trends shown by climate models are much more varied, but indicate the potential for more intense precipitation events over shorter periods of time.[2] As a rainforest, Cordova already has a very wet climate, averaging 167 inches of precipitation including 80 inches of snow annually.[3] Models predict a slight increase in precipitation in most seasons, particularly in spring. More noticeable in precipitation models for Cordova is a significant increase in the potential maximum 1-day and 5-day precipitation totals, increasing by up to 76%. This indicates a high likelihood that heavy precipitation events could become increasingly frequent and intense as early as mid-century.[4]

The Copper River Delta and eastern PWS have been home to the dAXuhnyuu (Eyak), Sugpiat Alutiit, Tlingit, and Athabaskan people since time immemorial. The mild coastal climate, rich waters, and abundant food sources of the rich ecosystem of the region made it a natural meeting place for diverse groups of Alaska Native people.

Resource extraction brought white Europeans and Russians to the area as far back as the 18th century.[5] Permanent settlements began in the late 19th and early 20th century with the advent of mining activities. As a settled community formed in 1909 due to copper mining in the region, Cordova's economy has historically relied heavily on natural resource extraction. Katalla, 47 miles southeast of Cordova, was the first producing oilfield in Alaska, operating until 1933. Cordova served as the railroad terminus and shipping port for ore from the Kennecott Mine up the Copper River, which yielded over $200 million in copper and silver between 1911 and 1938. In the 1940s commercial fishing became the primary economic driver of the community and continues to be the main industry today.[6]

NVE and Cordova face significant economic and environmental challenges due to climate change. With a history of bearing a disproportionate burden of risks (e.g. the 1989 Exxon Valdez Oil Spill) related to oil tanker traffic in our traditional waters and the associated effects of climate change from the far away consumption of those fossil fuels, NVE and CRRC pursue mitigation strategies to address these Environmental Justice issues. Traditional foods, which include shellfish, marine mammals, herring, ground fishes, salmon, and kelp, are under threat from climate change-induced shifts in the environment, including glacial melting, marine heatwaves, invasive and expanding species ranges, and ocean acidification.

The Cordova Electric Cooperative (CEC) is the sole provider of electric energy in Cordova. CEC is not connected by transmission line to other communities, and as a micro grid electric cooperative, CEC

[2] "Northern Climate Reports, Lower Copper River Watershed HUC8 19020104," Northern Climate Reports, 2024, https://northernclimatereports.org/report/area/19020104#results.

[3] "About Cordova - City of Cordova, Alaska."

[4] "Northern Climate Reports, Lower Copper River Watershed HUC8 19020104."

[5] Jim Lethcoe and Nancy Lethcoe, *A History of Prince William Sound, Alaska* (Todd Publications, 1994).

[6] "About Cordova - City of Cordova, Alaska."

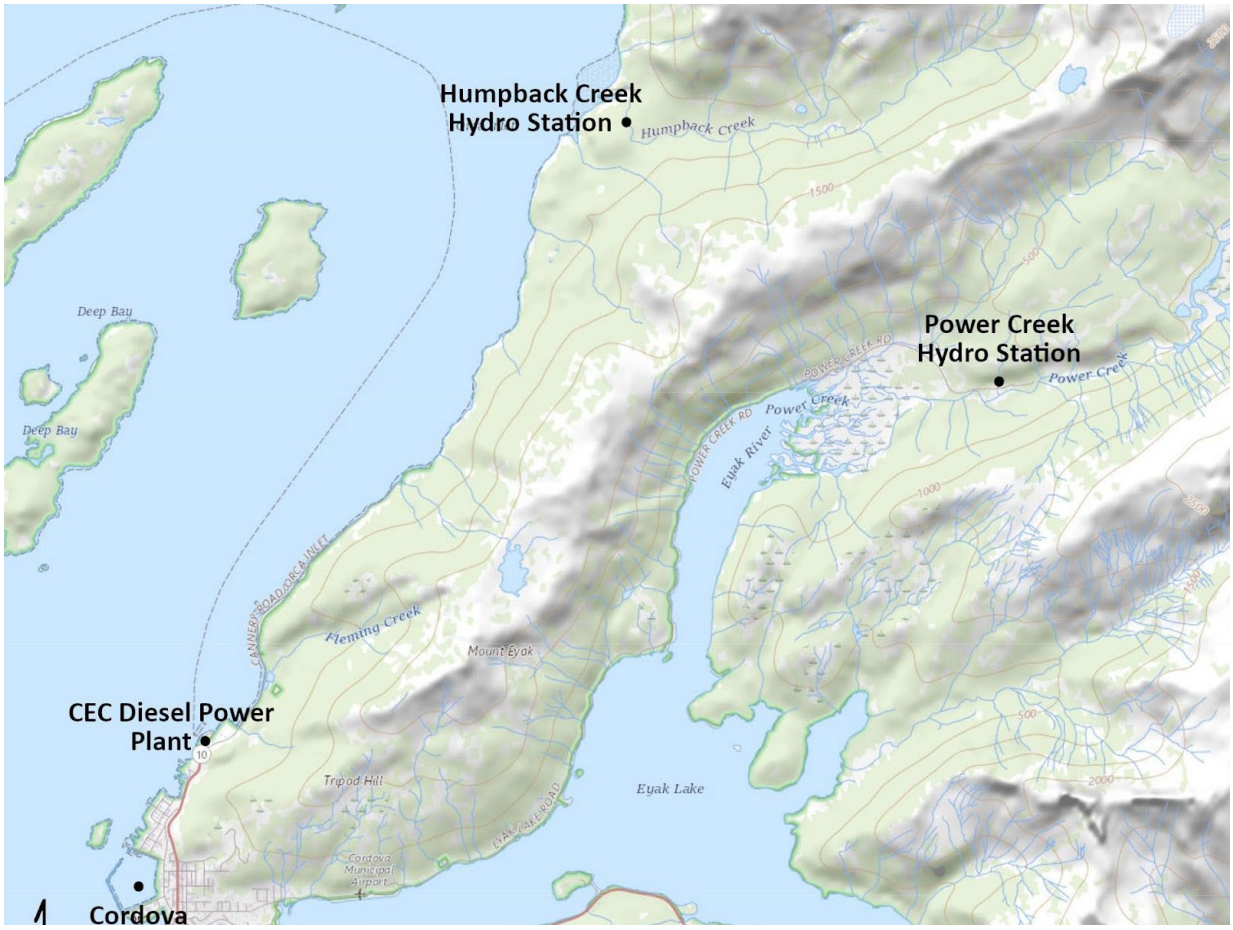

Figure 2: Map of the power generation stations for the Cordova microgrid and the city harbor that contains the bulk of the city's fishing fleet.

owns and operates all power production and distribution facilities for the whole community. CEC serves 1,594 customers and can produce as much as 78% of the community's electricity with renewable energy. The cooperative currently has a generating capacity of 19 megawatts, 11.5 MW from a diesel power plant (Orca Diesel Plant) and 7.25 MW in two hydroelectric facilities (Power Creek and Humpback Creek – see figure 2).[7] During the winter, power production is primarily from the diesel power plant as hydroelectric power is unavailable due to freezing water temperatures at the two creek sites.

NVE and CEC have a long history of cooperation and collaboration on renewable energy and energy efficiency projects through the Cordova Renewable Energy Workgroup (CREW) active between 2007 – 2017. CREW was comprised of a long-standing ad-hoc group of citizens, NVE and CEC staff, and community leaders committed to reducing GHG emissions from utility production and consumer energy efficiency and conservation in Cordova. While active, CREW accomplished home weatherization projects, a wind power study, hydro reconstruction, lighting efficiency upgrades and

[7] "Meet Cordova Electric Cooperative – Cordova Electric Cooperative," n.d., https://www.cordovaelectric.com/about/.

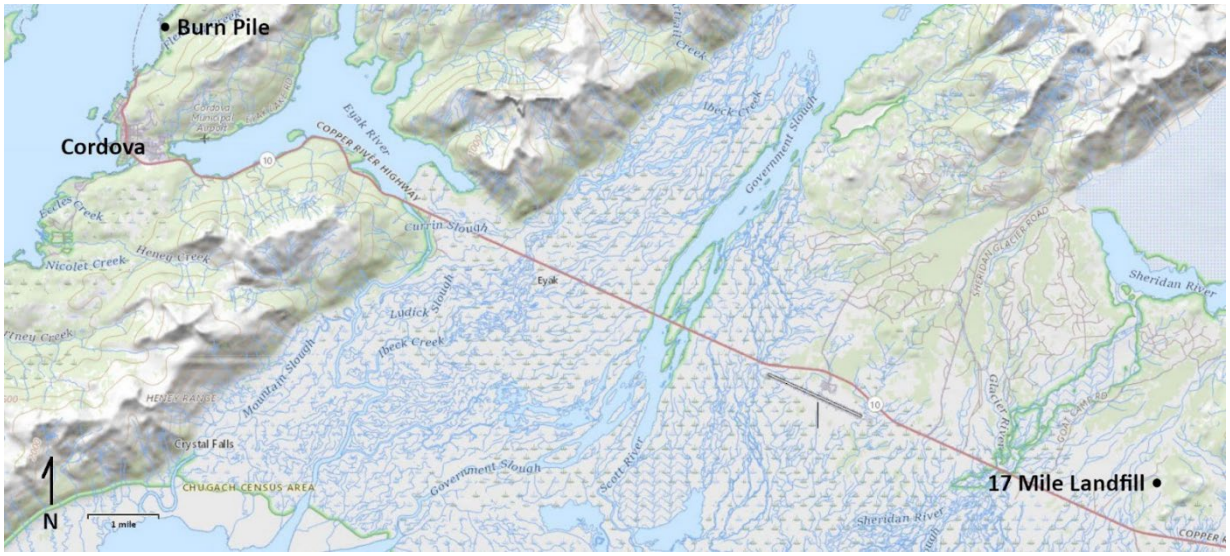

Figure 3: Map of the Cordova area including the 17-mile landfill located outside of the city center. The city managed burn pile is located to the northeast of the city center.:

recycling, community energy efficiency outreach, a high school wind project, free electric vehicle (EV) charging stations in town, a solar power study, and hydro efficiency upgrades.

Established in 1999, the current landfill (figure 3) serving and managed by the City of Cordova is a Class II municipal solid waste disposal facility located at mile marker 17 off the Copper River Highway. The 17-mile Landfill is authorized for the disposal of municipal solid waste, construction and demolition waste, inert waste, sewage sludge, and asbestos waste. Waste management practices include the collection of solid waste from residential and commercial buildings. The current permit requires an updated closure plan for cells in the trench & fill landfill to be updated by June 4, 2024, to comply with current best practices. Records, maintained since 2018, are based on volume measured in cubic yards and are categorized into Municipal solid waste, construction and demolition debris, or metal waste.[8] The landfill is in close proximity (less than 1 mi) to four distinct anadromous streams (AWC: 1212-10-10010-2021; 1212-10-10010-2031; 1212-10-10010-2041; 1212-10-10010-2041-3015-4009) where spawning silver salmon (*Oncorhynchus kisutch*) have been documented. This landfill is positioned three miles from the quickly retreating Sheridan Glacier and its associated lake.

No burning of solid waste is allowed at the 17-Mile Landfill; instead, it must be burned at the City of Cordova operated burn pile, located at Mile 1 of New England Cannery Road. All burning of solid waste in the burn area must comply with the open burning standards of the Air Quality Control regulations (18 AAC 50.065), but activities there are not monitored by the City. Located within 100 ft of the shores of Orca Inlet, the burn pile endeavors to minimize the influx of burnable materials into the landfill thereby extending the landfill's capacity. It is 0.2 mi from Fleming Spit Lagoon, a tide

[8] "Cordova Mile 17 Landfill," State of Alaska - DEC, 2024, https://dec.alaska.gov/Applications/EH/SWIMS/ModFacility.aspx?SiteId=681.

water pond stocked by the Alaska Department of Fish and Game (ADFG) with silver and king salmon (*Oncorhynchus kisutch* and *O. tshawytscha*), the latter being the largest and most valuable species of salmon for sport fishing. The terminus of Fleming Spit Creek (AWC: 221-10-10080) is also located here with documented presence of silver, chum (*O. keta*), and pink (*O. gorbuscha*) salmon; all important commercial, subsistence, and sport fish. There are several residences in the immediate area as well as the new scientific research building for the Prince William Sound Science Center.

Cordova is a hub for commercial fishing, specifically salmon, and is consistently in the top 20 ports in the nation for landed value (figure 4). The commercial fishing fleet for PWS and the Copper River fishery is the primary economic driver, earning $76.4 million from 65.3 million pounds of harvested fish in 2021.[9] In southcentral Alaska as a whole, a region that includes Anchorage, the Kenai Peninsula, and Prince William Sound, commercial fishing accounted for an estimated 7,100 FTE jobs, produced $323 million in income, and generated $877 million in economic output in 2019.[10] Identifying opportunities to increase fleet efficiency and reduce GHG emissions can have economic as well as environmental benefits. For example, during the fishing season in July of 2019 diesel retail prices at Shoreside Petroleum, the sole provider of fuel in Cordova, was $3.17/gal. By July 2022 those prices had risen 77% to $5.61/gallon.[11]

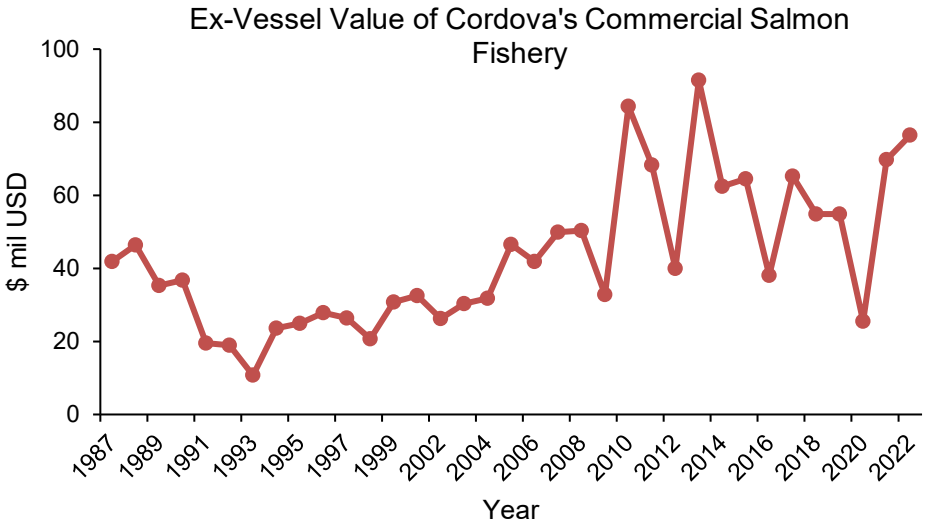

Figure 4: The price per pound at first purchase of the commercial landings (ex-vessel value) of Cordova's commercial salmon fishery landings, 1987 - 2022, in millions of dollars.

In addition to Cordova's well-established commercial fishing fleet, there is a burgeoning interest and investment in mariculture in the form of kelp and shellfish farming, particularly as climate change, fishing pressure, and other stressors negatively impact legacy commercial species. Kelp mariculture has the potential to act as a carbon sink, as well as provide potential low-carbon and carbon-neutral industries to Cordova's economy. This project will evaluate the potential for kelp mariculture and the blue economy to provide good quality green jobs for the community.

[9] NOAA Fisheries Office of Science and Technology, "Commercial Landings Query", Available at: www.fisheries.noaa.gov/foss.

[10] The Alaska Seafood Marketing Institute, "The Economic Value of ALASKA'S SEAFOOD INDUSTRY," *The Alaska Seafood Marketing Institute*, 2022, https://www.alaskaseafood.org/wp-content/uploads/MRG_ASMI-Economic-Impacts-Report_final.pdf.

[11] Alaska Department of Commerce, Community, & Economic Development, "Gas Prices, All Years," 2024, Available at: https://dcra-cdo-dcced.opendata.arcgis.com/datasets/DCCED::gas-prices-all-years/

Entities in the Region

There are three entities that function within Cordova. This includes the Native Corporation, the City government and the Tribal government. It is easy to get confused and there are some common misconceptions about the various groups and their roles. There are also other organizations that provide services in the region. Below is information regarding the different regional entities including what their role is and how they can be a resource.

Tribe

The Native Village of Eyak is a federally recognized self-governing Tribe that provides governmental services within the Tribe's customary and traditional use area: Prince William Sound, the Copper River, and the Northern Gulf of Alaska.

Tribal governments are sovereign entities in the U.S., recognized by the U.S. Constitution as having the same powers as federal and state governments for internal regulation. These governments, predating the U.S. and the State of Alaska, have their own laws primarily for their citizens, and manage various programs for their communities. They also provide social and economic services, often in partnership with an Alaska Native Regional Non-Profit. The Native Village of Eyak partners with regional non-profits on select projects such as the CPRG but also provides direct health and natural resource services to its Tribal members and on Tribal Corporation lands.

The NVE and the Traditional Council are a tribal government that promotes self-determination to NVE tribal members. Under the guidance of the Council, tribal offices provide health and social services, economic development, natural resource/environmental education, job opportunities and job training to the Native Village of Eyak. The Tribe operates in a way that is acceptable to Alaska Native cultural values and traditions in order to enhance the well-being of the Eyak people both physically and spiritually. The Tribal Council seeks ways to enrich tribal living through community-operated tribal programs and self-determination. Membership requirements vary by tribe. The Native Village of Eyak is the federally recognized Tribe that provides services to over 500 Tribal members within their customary and traditional use area.[12]

Alaska Native Regional & Village Corporations

Under the Alaska Native Claims Settlement Act (ANCSA), regional corporations and village corporations were established as for-profit businesses with different focuses and scales of operation. Regional corporations were created to manage land and financial assets on a broad scale, aiming to generate revenue for shareholders—Alaska Natives enrolled at the time of ANCSA's enactment in 1971 and those born afterward. They typically hold rights to subsurface estates and engage in various business ventures, including natural resource management, to increase shareholder value through dividends.

Village corporations, in contrast, operate at a more localized level, holding title to the surface estate of lands received under ANCSA. Their focus is on using and developing this land for community

[12] Native Village of Eyak, "Native Village of Eyak - Government," February 15, 2024, https://www.eyak-nsn.gov/government/

benefits, such as housing and local commercial projects. Shareholders are Native individuals from specific villages, and these corporations aim to foster economic growth within their immediate areas, often focusing on the village's social and economic well-being.

While both types of corporations serve the economic interests of their shareholders, regional corporations focus on large-scale economic development and subsurface rights across extensive geographic areas. In contrast, village corporations concentrate on surface rights and local development. This approach under ANCSA offered a unique method for economic self-determination for Alaska Natives, differing from the reservation system in the "Lower 48" by promoting corporate structures and asset management.

Chugach Alaska Corporation is the regional ANCSA corporation. Chugach lands include nearly one million acres in southcentral Alaska, including 378,000 acres of full fee estate and 550,000 acres of subsurface estate, though much of the subsurface estate is currently inaccessible due to land trusts created after the 1989 Exxon Valdez oil spill. In addition, federal land acquisitions in the region greatly restricted the land available for Chugach Alaska Corporation to choose from, leaving largely mountain tops and glaciers that had little viable economic value. Chugach Alaska Corporation has long lobbied for a land exchange bill that would allow for more regional sustainable development on usable lands.[13]

The Eyak Corporation is the for-profit village corporation for Cordova and one of five village corporations within the Chugach region. ANCSA did not originally include reference for NVE. Local leader Cecil Barnes pushed the petition and enrollment drive to form the Eyak Corporation in 1973 . As of the beginning of 2024, Eyak Corporation had 636 shareholders.[14]

City

Cities in Alaska operate as autonomous municipal governments, functioning within the boundaries set by the state constitution and laws, particularly under the authority of Title 29 of the Alaska Statutes. Some of their responsibilities may include managing utilities, overseeing landfills, and providing essential services including fire protection and public safety. Sometimes these responsibilities are split with the Tribe. All residents who live within city limits are considered citizens of the municipality and have the right to elect their local government officials, including the Mayor and City Council, who direct municipal operations and enact local ordinances enforceable through the State's court system.

The city of Cordova is a class 1 home rule city that serves the roughly 2600 citizens of the community with land use, housing, economic development, fiscal health, public facilities and services, recreation, transportation, and community wellness. Public facilities and services include emergency services; the harbor; the Cordova Center which houses the city government, library, museum, and meeting rooms; parks and recreation, including a public recreation center and pool in addition to parks and trails; and water and sewer and solid waste disposal.[15]

[13] Chugach Corporation. “Home Page.” https://www.chugach.com/
[14] Eyak Corporation. “About us.” https://www.eyakcorporation.com/about-us
[15] “About Cordova - City of Cordova, Alaska.”

Service Organizations

Regional Non-Profits | Chugach Regional Resources Commission and Chugachmiut

In Alaska, there are multiple regional non-profit organizations focused on serving Alaska Native communities. These non-profits were established to administer a wide array of social services, healthcare, and educational programs, aiming to improve the welfare of Alaska Native peoples. Unlike the corporations formed under ANCSA, these regional non-profit corporations operate independently, focusing primarily on service delivery rather than corporate benefits.

The mission of these organizations often includes enhancing healthcare access, promoting cultural and educational opportunities, and supporting the preservation of Alaska Native heritage. To achieve these goals, they rely on a combination of federal contracts, grant funding, support from ANCSA Regional Corporations, and partnerships with village non-profits. Their services range from providing comprehensive healthcare and behavioral health services to offering scholarships for Alaska Native students, sponsoring cultural events, preserving Alaska Native languages, and protecting sites of historic or religious significance.

These regional non-profits play a crucial role in the Alaska Native community by bridging the gap between federal support and local needs. ANCSA Regional Non-Profit Corporations contract with the federal government to ensure that Alaska Native people in their regions have access to essential social, education, and health services. The non-profits are tasked with the administration of these services, ensuring that programs are effectively targeted to meet the community's needs. Through this collaborative effort, Alaska Native regional non-profit organizations work to ensure the health, education, and cultural vitality of Alaska Native peoples, operating with a deep commitment to the communities they serve.

CRRC serves as a regional non-profit focusing on natural resource matters affecting tribal communities within the Chugach region. Since 1984, CRRC's mission has been to promote Tribal sovereignty and the protection of traditional subsistence lifestyles through the development and implementation of Tribal natural resource management programs to assure the conservation, sound economic development, and stewardship of the natural resources within the traditional use areas. CRRC was founded as a community-based, Alaska Native, natural resource management organization. Community resiliency and self-determination are central threads interwoven throughout all CRRC's activities.[16]

Chugachmiut is the Tribal consortium created to promote self-determination to the seven Native communities of the Chugach Region. Chugachmiut provides health and social services, education and training, and technical assistance to the Chugach Native people in a way which is acceptable to Native cultural values and tradition in order to enhance the well-being of our people by continuing to strengthen the tribes and increase self-determination opportunities for community operated tribal programs.[17]

[16] Chugach Regional Resources Commission. "Home Page," https://crrcalaska.org/
[17] Chugachmiut. "About us." https://www.chugachmiut.org/about-us/about-chugachmiut/

Healthcare | Native Village of Eyak's Ilanka Community Health Center and the Cordova Community Medical Center

Regional Health Organizations (RHOs) serve as key healthcare providers across various regions, operating as non-profit health corporations. These organizations are not federally recognized Tribal governments but play a crucial role in delivering healthcare services to all residents within their respective regions, regardless of Native status. Their operations are characterized by a strong commitment to community health and well-being, offering a comprehensive range of medical services that cater to the needs of the local population.

Funding for RHOs typically comes from a mix of sources, including the federal Indian Health Service, state and federal grants, and reimbursements from programs like Medicare and Medicaid, as well as private insurance. This diverse funding base supports the RHOs in their mission to provide accessible and quality healthcare services.

The governance of RHOs is typically overseen by a Board of Directors, which includes representatives from Tribal governments within the region, appointments from local municipalities, and representatives from key regional organizations. This governance structure ensures that the RHOs' policies and strategies are closely aligned with the community's needs, allowing for effective management and decision-making that reflects the interests and well-being of Alaska Natives and other residents in the region.

Cordova is served by two main health care providers: the Cordova Community Medical Center and the Ilanka Community Health Center.

The Ilanka Community Health Center (ICHC) is owned and operated by NVE and serves as a vital healthcare hub within the community offering comprehensive medical services and promoting overall well-being. As a federally qualified health center and Indian Health Services partner, ICHC provides accessible and patient-centered care, catering to diverse healthcare needs. Services encompass primary care, dental care, behavioral health services, and preventive health initiatives. The center is committed to serving the residents of Cordova and surrounding areas, emphasizing inclusivity and community engagement. ICHC plays a crucial role in enhancing the health and quality of life for individuals and families in the region through its holistic and community-focused healthcare approach. The clinic is governed by NVE tribal members who sit on the ICHC health board for a term of 1-4 years.[18]

The Cordova Community Medical Center (CCMC) operates as a publicly owned Critical Access Hospital and offers a comprehensive range of medical services encompassing preventive, inpatient, outpatient, and long-term care. The hospital provides diverse services, such as emergency care, laboratory services, radiology, physical therapy, and swing-bed services. In the Outpatient Clinic, primary care is available, along with quarterly specialist visits for orthopedics, pediatrics, optometry, and women's health. CCMC extends its services to include community behavioral health, offering assessments, individual, family, and group counseling, medication evaluation and management, and referrals. Additionally, developmental disability services cover respite and community-based rehabilitative services, with a focus on enhancing daily living and independent skills. A board of

[18] Native Village of Eyak, "Ilanka Community Health Center," https://www.eyak-nsn.gov/ichc/about-ichc/

directors oversees CCMC's operations. The board comprises community members, healthcare professionals, and individuals with expertise in relevant fields. The CCMC Hospital Services Board is responsible for making strategic decisions, setting policies, and ensuring the overall well-being of the medical center. The five board members are elected by the voters of Cordova, Alaska. Board members are qualified electors of the City of Cordova.[19]

Regional Housing Authority | North Pacific Rim Housing Authority

Regional Housing Authorities (RHAs), also known as Tribally Designated Housing Entities, operate under the Native American Housing and Self-Determination Act of 1996 and Alaska statutes to address housing needs. They focus on constructing low-income housing and managing affordable housing programs for Alaska Native and broader communities. Funded by federal grants, state funding, and housing-specific resources, RHAs collaborate with local governments, tribal entities, and regional organizations to develop sustainable housing solutions tailored to regional needs and cultural considerations. Governed by a board of community and Tribal government representatives, RHAs work to improve housing accessibility and quality, supporting community development through strategic housing initiatives.

Developing enough affordable housing to meet the needs of communities is an ongoing challenge. In Cordova in particular, affordable housing remains a challenge, with a medium home price estimated at $330,000 and a near-zero vacancy rate in the summer.[20]

Electric Utilities | Cordova Electric Cooperative

In rural Alaska, electric utilities operate as independent islanded microgrids, managed either by local entities such as Tribes and city governments or by cooperatives owned and governed by the ratepayers in the communities they serve. These microgrids, crucial for areas where connecting to larger grids is impractical, face unique challenges due to their isolation but also have opportunities for innovative energy solutions, including the integration of renewable resources. The governance by local entities or cooperatives allows for energy decisions that align closely with community needs, promoting energy sovereignty and sustainability.

Cordova Electric Cooperative is the sole provider of electric energy in Cordova. CEC is not connected by transmission line to other communities, and as a micro grid electric cooperative, CEC owns and operates all power production and distribution facilities for the whole community. CEC serves 1,594 customers and can produce as much as 78% of the community's electricity with renewable energy. The cooperative currently has a generating capacity of 19 megawatts, 11.5 MW from a diesel power plant (Orca Diesel Plant) and 7.25 MW in two hydroelectric facilities (Power Creek and Humpback Creek). During the winter, power production is primarily from the diesel power plant as hydroelectric power is unavailable due to freezing temperatures. During summer, there is often excess hydropower available which cannot be stored by the two run-of-river facilities.[21]

[19] Cordova Community Medical Center. "Home Page," https://www.cdvcmc.com/
[20] Snowdon Smith, Zachary. "Cordova needs doctors, teachers and police – but struggles to find room for them," May 23, 2021, The Cordova Times. https://www.thecordovatimes.com/2021/05/23/cordova-needs-doctors-teachers-and-police-but-struggles-to-find-room-for-them/
[21] "Meet Cordova Electric Cooperative – Cordova Electric Cooperative."

Water/Sewer Utilities | City of Cordova

Water and Sanitation utilities are typically locally owned and operated by the City or the Tribe. The owner is often supported by an outside entity such as the Alaska Native Tribal Health Consortium or Village Safe Water, which support project development, securing grant funding, and assistance in carrying out projects.

The City of Cordova maintains water and sewer utilities for the community. The main source of drinking water is the Meals water reservoir. Cordova has a municipal water system to provide residents and businesses with a safe and reliable water supply. The water utility includes three water treatment facilities to ensure that water regulatory standards for quality and safety are met.[22]

Greenhouse Gas Inventory Baseline

The baseline GHG Inventory for Cordova is an accounting of greenhouse gas emissions in the diesel electricity generation, solid waste, and commercial salmon fishing fleet sectors during 2022.

The Cordova Electric Cooperative, City of Cordova, and Cordova Fishermen provided the core data for the primary components of this GHG Inventory. Regional baseline data includes:

- Baseline GHG emissions in the primary sectors of opportunity identified through conversations with NVE and CEC staff and through two public meetings held in September 2023 and January 2024: Electrical Generation and Distribution, Solid Waste, and the Blue Economy. Its purpose within this Climate Action Plan is to identify where the most significant emissions are occurring and opportunities for reductions and co-benefits of those reductions in these priority sectors.

- A focus on direct carbon dioxide emissions from the use of diesel fuel for electrical generation by the utility or Independent Power Producers. Emissions are expressed in terms of metric tons of CO_2 equivalents.

- Usage data on all relevant activities that lead to GHG emissions within the prioritized sectors of electrical generation and distribution, residential energy consumption, commercial facility energy consumption, and community facility energy consumption was collected on the community scale. The source of the majority of this data was internal records shared by the Cordova Electric Cooperative. Other sources of data are referenced in the methods section of each measure.

- Emission Factors are coefficients that quantify the emissions or removals of greenhouse gases per unit of activity. Emission factors were used to convert displaced diesel fuel and heating oil into estimates of GHG emissions or removals.

[22] "City Utilities (Water, Sewer, Garbage) - City of Cordova, Alaska," City of Cordova, Alaska, 2024, https://www.cityofcordova.net/city-utilities/

- A Data Management plan ensures data quality, including accuracy, completeness, consistency, transparency, and comparability.
- An independent review of the inventory to ensure its accuracy and reliability was conducted in accordance with the approved CRRC Quality Assurance Project Plan.

This baseline GHG inventory serves as a crucial tool for Cordova to understand their impact on climate change, set reduction targets, and track their progress over time in these three priority sectors. Cordova's remote location and relatively small size by national standards mean that it is often grouped with other communities in federal and state datasets. Cordova-specific GHG emission data is sparse. In the National Emissions Inventory, for example, Cordova is grouped with Valdez, a community 52 air miles to the north and separate from Cordova's electric grid. What little data exists for Cordova in national inventories is not collected at an appropriate scale to be useful for this project. The State of Alaska PCAP process included collaboration with Constellation Energy to produce a map tool resource for community level emissions inventories within the state.[23] While the PCAP's state-wide emissions inventory is a valuable estimate of GHG in Alaska to plan impactful mitigation strategies, the community level information for Cordova requires more data. The Constellation tool shows a total of 2,169 CO_2e metric tons (mt) community-wide for Cordova. However, as seen in Table 1 of this analysis (below), that figure does not align with either the fleet or diesel electricity sectors estimated here. The preliminary analysis presented here does not cover residential, commercial, or many of the fuel types assessed by the State PCAP. Therefore, the three sector GHG inventory here is also an underestimate of emissions. The table below summarizes the 2022 baseline greenhouse gas emissions in metric tons for this PCAP's three priority sectors.

Sector (2022)	**CO_2 (mt)**	**Methane (mt)**	**CO_2e (mt)**
Electric - Diesel Generation	6,269	6	6,289*
Solid Waste	49-59	18-22	553-664
Blue Economy	7,454	NA	7,454
Total	**13,771-13,781**	**24-28.3**	**14,296-14,407**

*Table 1: 2022 estimated GHG emissions in metric tons for Cordova's three priority sectors: Diesel Generation, Solid Waste, and the Blue Economy. * Includes 15 tons of N2O emissions converted to CO2e, a significant source of GHG.*

[23] Alaska Municipal League, "State of Alaska Priority Sustainable Energy Action Plan," *Alaska Department of Environmental Conservation*, March 1, 2024, https://www.epa.gov/system/files/documents/2024-03/ak-priority-sustainable-energy-plan.pdf

Electric Generation Emissions Calculations Methods

Cordova Electric Cooperative keeps precise records of electricity generation for their facilities, required for regulatory reporting for state and federal air quality permits. High resolution fuel meters are placed on each diesel generator, each day tank, each bulk tank, and to the bulk tank supply line. These meters are reconciled with each other and with the fuel supplier purchases on a monthly basis. The data is collected for regulatory emissions which includes nitrogen dioxide (NO2), sulfur dioxides (SO_x), particulate matter (PM), and ash. GHGs are represented by N_2O, methane (CH_4), and the greatest contributor, carbon. The USDA Rural Utilities Service (RUS) Greenhouse Gas (GHG) Calculator for Utility-Scale Renewable Energy Projects Generating Electricity calculator was used to estimate carbon equivalent emissions.[24] First, the bulk production of N_2O and CH_4 are calculated, then normalized to the carbon dioxide equivalent (CO_2e) and added to CO_2 for a total CO_2e contribution of 6,289 metric tons. Figure 5 shows historical generation in kilowatt hours (kWh) for Cordova by source. CEC took historical kWh generation data and applied USDA conversion factors to develop CO_2, N_2O, and CH_4 emissions estimations for 2022 (Table 2). For CEC's air quality reporting, real-time measurement of emissions is complex and costly, so emissions level reporting includes simplifying assumptions. These assumptions assume a consistent high output for each operating hour of the diesel generators. In reality the output of the diesel generators fluctuates wildly in response to electrical demands, from 40% to 90% of its output. However, this is an industry wide standard methodology. The measurement of reductions uses the same methodology providing consistency and validation of the achieved reductions.

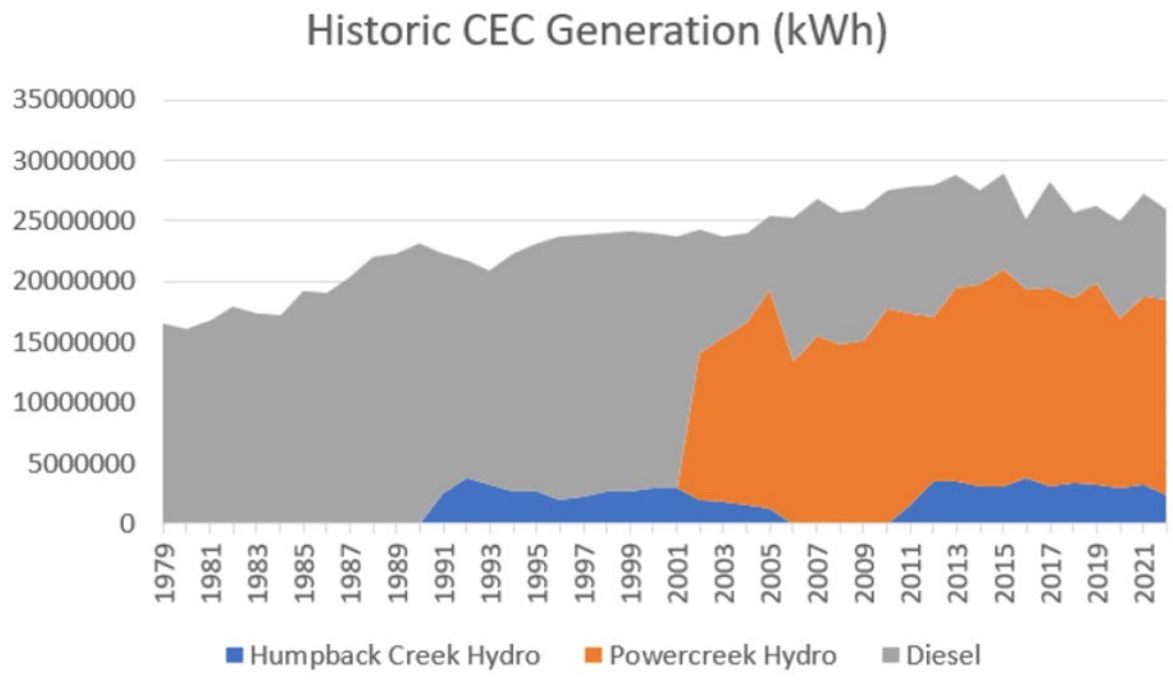

Figure 5: Cordova Electric Cooperative historical electric generation by source.

[24] US Department of Agriculture. "Rural Utilities Service (RUS) Greenhouse Gas (GHG) Calculator for Utility-Scale Renewable Energy Projects Generating Electricity," 2024. https://www.rd.usda.gov/media/file/download/rus-ira-ghg-calculator-v42c-test-4-subsid-proj-developer-w-no-system-data.xlsx

GHG	USDA Factor	Emissions Factor (Oil)	CO_2e/MWh	Baseline Diesel Use (MWh)	CO_2e (lbs)	CO_2e (mt)
CO_2	1	1,815	1,815	7,612	13,815,027	6,269
N_2O	298	0.015	4.327	7,612	32,935	15
CH_4	25	0.073	1.815	7,612	13,815	6
				CO_2e Total:	13,861,777	6,289

Table 2: Cordova Electric Cooperative baseline GHG emissions in 2022 for the amount of diesel used to power generators based on the average 100 year GHG global warming potential multipliers (USDA).

Solid Waste Emissions Calculation Method

The City of Cordova provided NVE and CRRC with landfill capacity data from 2018-2022. The city records municipal solid waste (MSW) as volume based on the number of truck loads that are dumped at the landfill. The only landfill cell currently open (cell 2) began in 2018 and will close in 2036. In 2022, a total of 7560 yds^3 of MSW originating from the community was deposited in cell 2. To convert this volume into short tons, we used the EPA's guidance from the Volume-to-Weight Conversion Factors.[25] Based on these conversion factors, we estimated that in 2022, 945-1134 U.S. tons of MSW was deposited into the landfill (Figure 6). This range is attributable to the variance inherent in the conversion factors used, leading to a lower and upper limit in our tonnage estimation.

The City of Cordova does not currently report or differentiate between various categories of solid waste. Moreover, Alaska has not undertaken a comprehensive statewide MSW composition study. Based on national average statistics provided by EPA[26] and Milbrandt et al. (2024) [27], the MSW composition in Cordova (Figure 7) is primarily characterized by significant quantities of food waste (ranging from 221.7-266 tons), plastics (125.8-151 tons), and paper and cardboard (105.6 to 126.7 tons).

While cardboard and paper comprise the third most prevalent type of MSW in the landfill, this is not the whole story for how much of this waste is in Cordova. The city relies on an unmanaged open air burn pit to incinerate a large portion of cardboard and

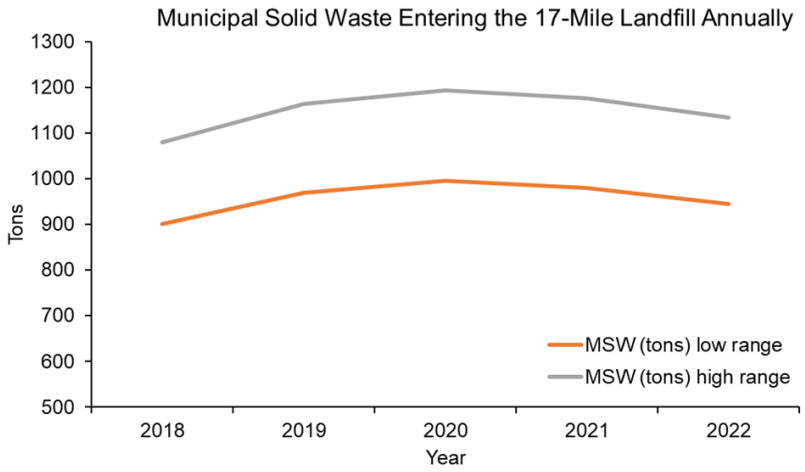

Figure 6: Amount of municipal solid waste that annually enters Cordova's 17-mile landfill since the current active cell (cell 2) opened in 2018.

[25] US EPA, "Volume-to-Weight Conversion Factors for Solid Waste | US EPA," March 11, 2024, https://www.epa.gov/smm/volume-weight-conversion-factors-solid-waste

[26] US EPA. "National Overview: Facts and Figures on Materials, Wastes and Recycling," 2018, https://www.epa.gov/facts-and-figures-about-materials-waste-and-recycling/national-overview-facts-and-figures-materials#Landfilling

[27] Anelia Milbrandt et al., "Paper and Cardboard Waste in the United States: Geographic, Market, and Energy Assessment," *Waste Management Bulletin* 2, no. 1 (April 1, 2024): 21–28, https://doi.org/10.1016/j.wmb.2023.12.002.

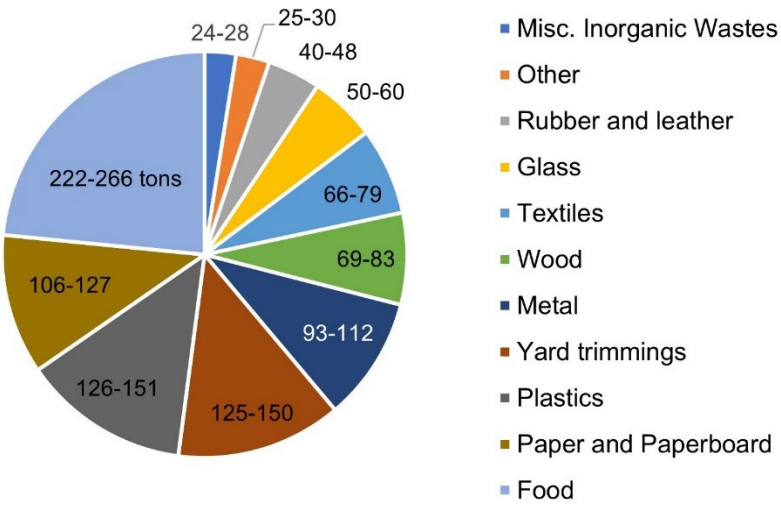

Figure 7: Pie chart of the estimated composition of municipal solid waste in the Cordova 17-mile landfill based on the EPA's national average. Units are reported as U.S. tons. Paper and paperboard percentages were changed to reflect the use of the community burn pile for this category. It is estimated that only 50% of paper and paperboard entered the landfill in 2022. The 106-127 ton estimate is 11.17%, or half of Milbrandt et al. (2024)'s 22.34% for Alaska.

paper in town. This reduces the amount of volume going into the landfill to increase the longevity of the cell. City waste management officials estimate that 50% of citywide cardboard and paper still enters the landfill each year through residential and commercial waste streams.

Milbrandt et al. (2024) estimated that MSW in Alaska is comprised of 22.34% cardboard and paper. Using this estimate along with the 50% estimate from the City would suggest that 105.6-126.7 tons of cardboard are incinerated in the burn pile each year. The city has a cardboard/paper collection container for community members to drop off residential cardboard and paper and reports that approximately 12 tons per year are collected in this manner and deposited into the burn pile.

The US Postal Service (USPS) office also collects paper and cardboard for the burn pile in bins available to the public. There is no home delivery of mail in Cordova, so all registered USPS users must visit the post office for mail. Bins are located in the post office box area to collect discarded mail and packaging material. This suggests that the Cordova USPS may be receiving a significant portion of paper items ultimately destined for disposal. This portion of paper and cardboard is not measured or reported.

The city's burn pile operates without oversight, offering unrestricted access to individuals beyond municipal control. Consequently, an estimated 93.6-114.7 tons of cardboard and paper could potentially be deposited into the burn pile by community members. As a rural Alaskan community, Cordova is geographically isolated from the broader Alaska road system and Railbelt. Consequently, our reliance on mail delivery for goods and services exceeds the national average. This heightened dependence translates into a surge of corrugated cardboard containers entering our waste stream. As a result, the reported figures likely underestimate the true volume of waste generated.

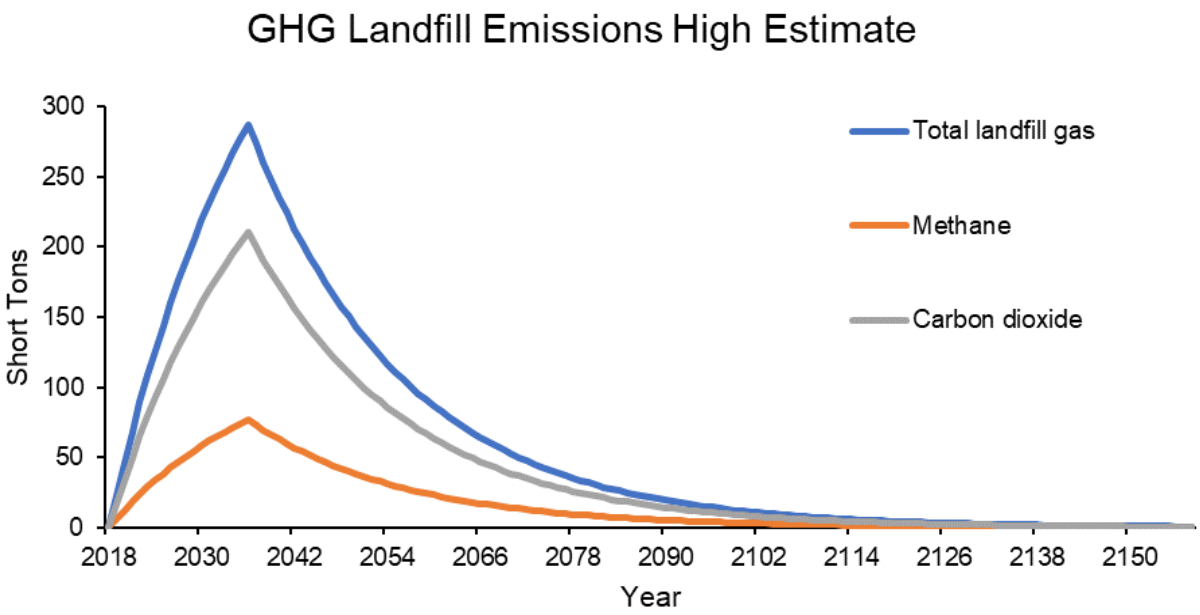

Figure 8: High estimates for GHG emissions of the 17-mile landfill based on the converted MSW volume data reported by the city via the EPA's LandGem model. The start year of 2018 indicates the opening of the landfill cell. The cell will close in 2036 when GHG emissions are at their peak.

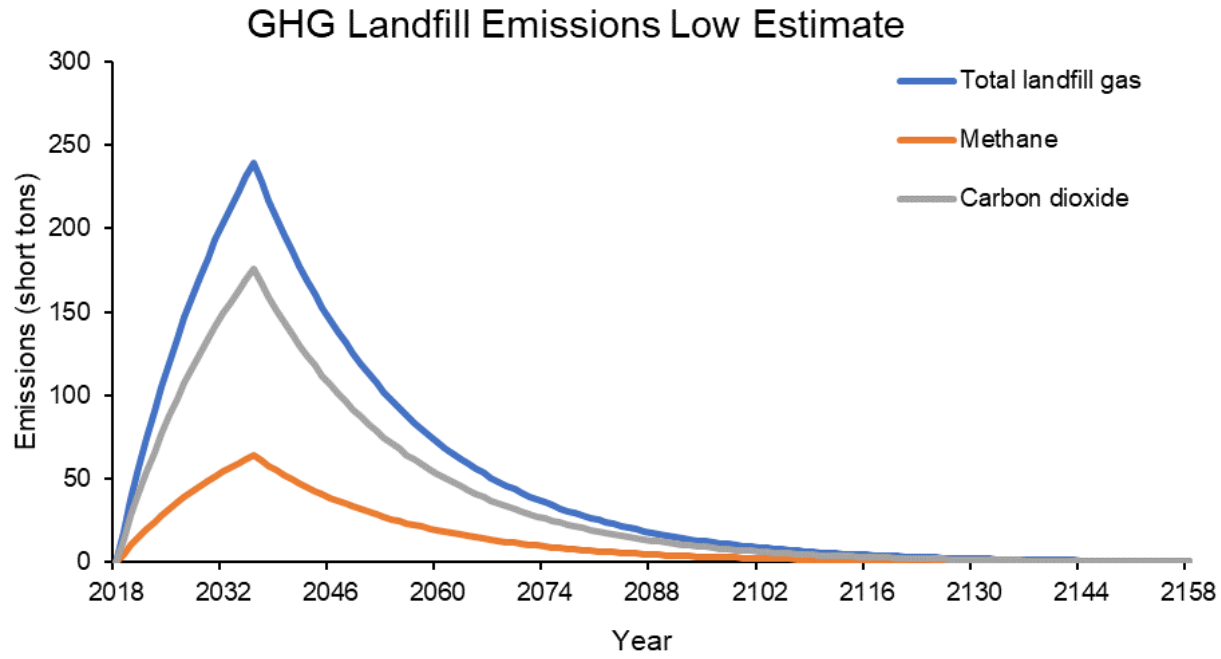

Figure 9: Greenhouse gas emissions estimates for the City's 17-mile landfill cell 2 based on low estimates of converted MSW volume reported by the city using the EPA's LandGem model.

assess landfill GHG emissions, the EPA's Landfill Gas Emissions Model (LandGEM; V3.03) was used based on the above estimated figures from the city's volume data (Figure 7).[28] According to this analysis, the 17-mile landfill will generate a peak amount of GHG (Figures 8 and 9) when it closes in 2036 (Total GHG emissions: 239.4-287.3 tons; Methane: 64-76.7 tons, CO_2: 175.4-210.5 tons). These emissions will decline to a negligible amount by 2158, 140 years after the start of cell 2 and 122 years after its closure.

We do not have GHG estimates for burn pile emissions as it is unmanaged and unmonitored. In 2008, NVE staff observed that over 60% of materials added to the burn pile violated the State of Alaska Air Quality Control regulations (18 AAC 50.065) and included items such as household trash, plastic fishing nets, general plastics, tires, and construction material.[29] These materials have the potential to produce hazardous gases including dioxins, nitrogen oxides, sulfur dioxide, volatile organic chemicals and polycyclic organic matter. Because volume, type, and frequency of materials added to the burn pile are not monitored or reported, there is not enough information to quantify burn pile usage, but it is evident that this is a potential large source of GHG in the community and a potent health hazard to those nearby.

The Prince William Sound Science Center, a local research institute located less than 700 ft from the burn pile, has setup a Purple Air Quality Monitor (PurpleAir Flex Air Quality Monitor, Purple Air, This monitor records particle counts, volatile organic compounds, pressure, temperature, and humidity every 1-10 seconds. Air quality data are collected using two separate laser channels to ensure measurement confidence. These data are compiled into an Air Quality Index based on the EPA's 2.5PM fine inhalable particles standards. As is evident in Figure 10, air quality consistently reaches into the "Unhealthy" and higher range, even to the "Hazardous" and beyond range, often and very quickly. Unfortunately, these data are not a proxy for CO_2 or other GHG emissions from this source but highlight the importance of assessing unconventional sources of GHG emissions.

[28] US EPA. "Landfill Gas Emissions Model (LandGEM) | US EPA," January 5, 2024. https://www.epa.gov/land-research/landfill-gas-emissions-model-landgem.
[29] Native Village of Eyak. "Cordova Biomass Feasibility Study," 2020. https://www.eyak-nsn.gov/wp-content/uploads/2020/05/Cordova-Biomass-Feasibility-Study.pdf

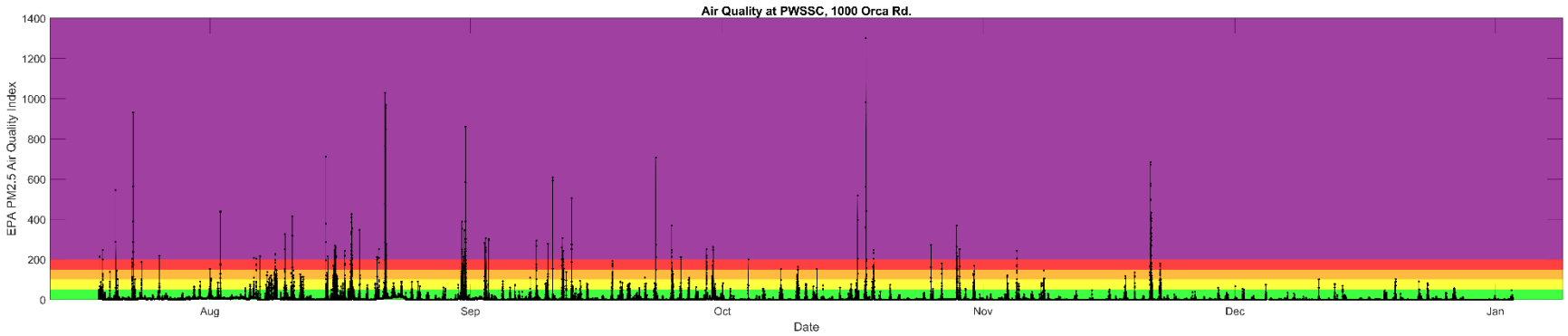

Figure 10: PM 2.5 Purple air quality monitor data collected from July 2023-January 2024. Colors correspond to the EPA's air quality index standards indicating AQI categories from "Good" (green) to "Very Unhealthy" (purple). Note that the "Hazardous" category is included in the purple bar.

Blue Economy Emissions Calculations Methods

The commercial salmon fishing season takes place every year in the Northern Gulf of Alaska near the mouth of the Copper River and in the Prince William Sound (PWS). This fishery targets the five species of Pacific salmon that return to their natal streams in the region to spawn and die. Each species times this life history strategy differently. The first two species of salmon that herald the beginning of the commercial harvest season are sockeye and king salmon that migrate into the Copper River in early May. Commercial fishermen that harvest these early fish (mid-May through late June) are restricted by State regulations regarding fishing gear and vessel type. In this region, commercial fishing is restricted to one drift gill net less than 900 ft long per vessel. Purse seining is restricted. Bowpickers, a common type of boat with an aft cabin and open forward deck, are commonly used because they are specifically designed for this gear type during this season. On average these boats are 30 ft in length. Gillnet operations are manned by 1-2 fishermen who travel 40-70 nm from Cordova to reach the fishing grounds.

Once the May-June king and sockeye salmon migration is complete, commercial fishing starts to focus on pink and chum salmon runs in PWS from late June through August. During this period, both gillnets and purse seine nets are allowed for harvesting. Purse seining requires different gear, boats, and personnel. These boats are larger (max length: 58ft; average: 48 ft) than bowpickers, usually have three to five crew members on board, and require a second smaller vessel or "skiff" to operate. A purse seine net is limited to 1,350 ft long and 450 ft deep and can catch orders of magnitude more fish than single gillnets.

For all fishing gear types, the amount of time to harvest is restricted by management staff at the Alaska Department of Fish and Game (ADFG). Fishing time is only allowed during fishing "openers" consisting of 12, 24, 36, 48 hr, etc. a few times per week at the discretion of ADFG. Openers are determined based on the number of salmon that return to the area's freshwater streams. These in-river abundance estimates are collected by ADFG field crews during the season. In total, the 2022 commercial salmon season harvested 31.6 mil fish valued at $100 mil.

To estimate greenhouse gas emissions by this sector, we surveyed several Cordova-based fishermen: four owners of diesel bow pickers, two gas powered bowpickers, and two diesel seiners; one with all diesel power, the other with a gas skiff (Appendix A). Each fisherman was very knowledgeable about their engines providing us with engine make, model, engine age, hours during the 2022 fishing season, fuel used during this time, and several other metrics to understand their fuel and vessel usage (Tables 3 and 4). Surveys were done by phone and lasted 20-40 minutes. All identifying information was removed to keep the surveys anonymous.

Using the EPA's Ports Emissions Inventory Guidance (EPA 2022), survey data was converted into tons of greenhouse gas emissions for the 2022 commercial salmon fishing season. All individual diesel vessels were analyzed using the harbor craft source sector criteria (fishing ships). When assessed, all engine types surveyed fell under engine category 1 (C1). Emissions were calculated using the following equation:

$$E = P \times LF \times A \times EF$$

Where E = per vessel emissions (g)
P = engine power (kW)
LF = engine load factor (unitless)
A = engine operating activity (h)
EF = emission factor (g/kWh)[30]

Seine operations were assigned an overall emissions rate for the 2022 season (Table 3) that included the seine boat, skiff, and any auxiliary engines used (ex: generator set). Many gillnetters use two engines for propulsion, so these and any other auxiliary engines were added together as well. Gasoline powered engine emissions were determined by converting the amount of gas combusted (Table 4) into CO_2 according to the EPA's Greenhouse Gases Equivalencies Calculator. The average amount of CO_2 emitted was calculated per gear type and engine type (Table 5). These averages were then applied to the publicly available State of Alaska Commercial Vessel Database that includes all vessel registration information for boats registered in the state.

For this emissions inventory analysis, vessels included were restricted to the following criteria: participated in commercial salmon fishing in the Copper River (CR) and/or PWS regions, fished in 2022, and were registered to a Cordova address. This resulted in 314 fishing operations with 73 seiners, 111 gas engine gillnetters, and 130 diesel gillnetters (Figure 11).[31] Overall, the 2022 commercial salmon fishing season Cordova-based fishing fleet emitted 8,571 tons (7776 metric tons) of CO_2. This accounts for 0.004% of global fisheries GHG emissions and 0.2% of U.S. fisheries emissions.[32] Many fishing vessels aggregate in the region from all over the state and lower 48. For this initial calculation, we assume this is a low estimate for PWS and CR salmon fisheries.

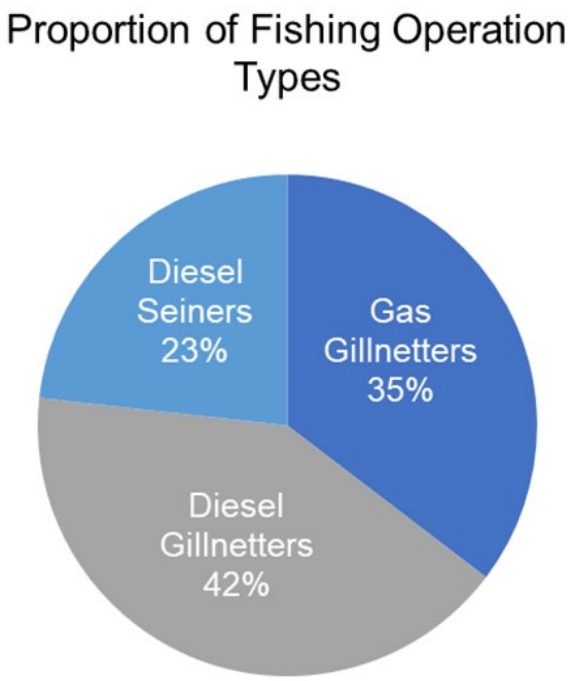

Figure 11: Proportion of each gear and engine type in the Cordova fleet based on the State of Alaska's Public Commercial Vessel Database.

[30] EPA. 2022. Port Emissions Inventory Guidance: Methodologies for Estimating Port-Related and Goods Movement Mobile Source Emissions. EPA-420-B-22-011
[31] State of Alaska Department of Fish and Game. "Commercial Fisheries Entry Commission Public Database." https://www.cfec.state.ak.us/plook/#permits
[32] Parker, R.W.R., Blanchard, J.L., Gardner, C. et al. 2018. Fuel use and greenhouse gas emissions of world fisheries. Nature Clim Change. 8: 333–337pgs.

Survey ID	Fishery	Vessel Type	Fuel Type	Engine Make	Model	No. Engines	Total Gal.	Engine Hrs	Engine Year	P_p (kW)	BSFC (g/kWh)	EF_{CO2} (g/kWh)	FC_p (g)	LF_p (unitless)	E_{CO2} (g)	E_{CO2} (US tons)	Total CO_2 (US tons)
2024.03.01	Purse Seine	Genset	Diesel	John Deere	60 kw 140 hp	1	1363.64	1200	2012	104.4	213	679.5	4363636	0.16	13920000	15.3	30.1*
	Purse Seine	Seiner	Diesel	Cummins	355 300 hp 6bt	1	695.19	600	1977	223.7	213	679.5	2224599	0.08	7096471	7.8	-
	Purse Seine	Skiff	Diesel	John Deere	160 hp	1	614.97	550	2001	119.3	213	679.5	1967914	0.14	6277647	6.9	-
2024.01.03	Purse Seine	Seiner	Diesel	Caterpillar	3306	2	623.89	1000	1977	171.5	213	679.5	1996435	0.05	6368627	14.0	19.4
2024.01.01	Drift Gillnet	Bow picker	Diesel	Caterpillar	C7	1	1500.00	500	2007	339.3	213	679.5	4800000	0.13	15312000	16.9	16.9
2024.01.02	Drift Gillnet	Bow picker	Diesel	Caterpillar	C7	1	2272.73	700	2012	339.3	213	679.5	7272727	0.14	23200000	25.6	25.6
2024.01.04	Drift Gillnet	Bow picker	Diesel	Cummins	QSB 5.9L	2	756.57	250	2018	234.9	213	679.5	2421039	0.19	7723113	17.0	17.0
2024.02.01	Drift Gillnet	Bow picker	Diesel	Volvo	D4	2	950.00	500	2017	167.8	213	679.5	3040000	0.17	9697600	21.4	21.4

*Table 3: Survey data and GHG emissions for each diesel fishing operation based on EPA (2022). Headings correspond to equation 4.1 from EPA (2022; pg. 51). All final units were converted into U.S. short tons (2000 lbs./ton). * Indicates a seining operation that included a gas engine for the skiff. See Table 4 for details.*

Survey ID	Fishery	Vessel Type	Fuel Type	Engine Make	Model	No. Engines	Total Gal.	Gas CO_2 (US tons)	Total CO_2 (US tons)
2024.01.03	Purse Seine	Skiff	Gas	Mercury	Cruiser 4.3L v6	1	551.47	5.40	*
2024.02.02	Drift Gillnet	Bow picker	Gas	Marine Power	5.3L	2	2454.55	24.04	48.08
2024.02.03	Drift Gillnet	Bow picker	Gas	Ford	Small block V8 5.2L	2	1350.00	13.22	26.44

Table 4: Fishermen survey data for each gas-powered engine included in the questionnaire. (*) indicates a gas-powered seine skiff. The CO_2 emissions from this small craft were included in the total CO_2 emissions for that seine operation in Table 3.

Gear/Engine Type	Average CO_2 (US tons)	SD
Seiners	24.76	±7.52
Diesel Bowpicker	20.21	±4.14
Gas Bowpicker	37.26	±15.3

Table 5: Average CO_2 emissions based on gear and engine type for the 2022 commercial salmon fishing season in CR and PWS. These averages were applied to the state Commercial Vessel Database information for Cordova-based registered commercial fishing vessels to calculate the GHG emissions inventory for the fleet in 2022.

Quantified GHG Reduction Measures

Measures refer to proposed projects, programs, and policies that would reduce GHG emissions if implemented.

The strategy for selecting GHG reduction measures is informed by data on the highest sources of GHG emissions. The rural, tribal communities addressed in this plan are isolated, relying on independent microgrid electric utilities predominantly powered by diesel for both electricity generation and the bulk of community space heating requirements. Consequently, GHG mitigation strategies are focused on the three key areas assessed in the GHG emissions inventory (see page 19):

1. **Electricity Generation & Distribution**
2. **Solid Waste**
3. **Blue Economy**

Although these primary sectors do not encompass all sources of emissions within Cordova, they represent the sectors and projects that stakeholders identified as the highest priority for emissions reduction efforts in Cordova. Below, the plan outlines specific measures for each prioritized sector to achieve these goals.

Sector - Electricity Generation & Distribution

The region is composed mostly of individual community electric utilities that are islanded microgrids that generate electricity primarily from diesel fuel. Electricity generation comes at a high cost and is one of the highest generators of greenhouse gas emissions in the region. It is also one of the largest opportunities for greenhouse gas reductions.

Within this sector, three opportunity areas or measures were identified: ***Hydro Storage Upgrade, Line Extension plus Solar Emissions Reduction, Community LED Street Lighting Upgrade.*** These measures are detailed below.

Measure 1 - Humpback Creek Storage Upgrade

Description of project

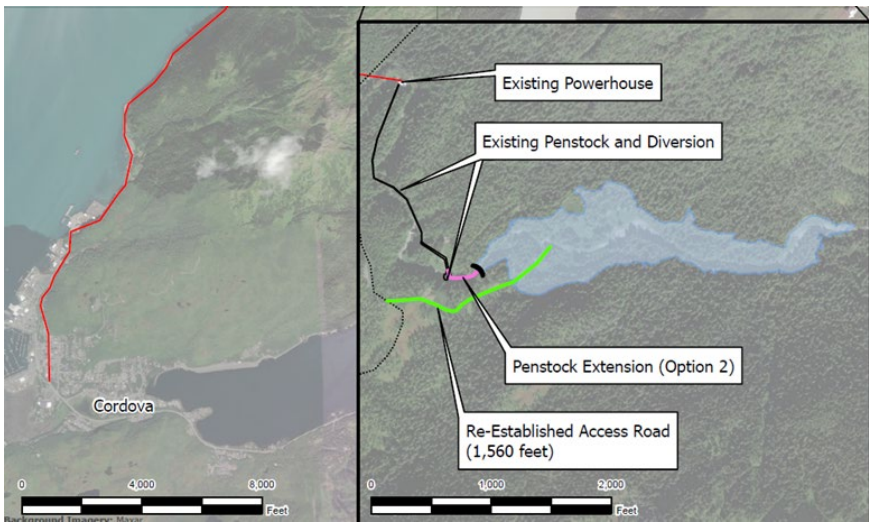

Figure 12: CEC proposed upgrades for the Humpback Creek site.

Cordova generates a significant amount of power from its two run-of-the-river hydro projects CEC completed and developed the Humpback Project (HBC) on the Eyak Corporation (surface) and Chugach Alaska Corporation (subsurface) lands in 1991. The project was based on an abandoned hydro project developed on the site in 1907. In 2002, CEC completed development of the Power Creek Hydroelectric project (PC) and was able to meet approximately 75% of Cordova's energy needs between the two projects (10% HBC and 65% PC). However, the lower cost, reliable power resulted in the rapid replacement of offshore diesel-based seafood processing with expansion of Cordova's onshore seafood processing and within a few short years had experienced an increase in peak demand from 4MW in 2002 to 10MW in 2007. To compound challenges from the growing demand for hydro resources, both projects were impacted by extreme flooding (48" in 72 hours in August and again in October of 2006) catastrophically destroying the HBC project while causing minor damage to the PC project. However, incremental improvements at PC including work with agencies to reduce in-stream flow requirements, innovative leveraging of the 100% underground power lines in Cordova and the power factor balance they brought to the microgrid, improvements to trash screens at the intake, and continuous optimization of the plant automation grew hydro capacity. Efficiencies and capacity gains with the reconstruction and redeployment of HBC in 2012 and automation optimization allowed CEC to maintain a 65-75% renewable supply to Cordova as loads grew, and in 2022 CEC set all-time hydro production records to achieve 75.5% renewable power on a large sales year. A graphic of CEC power production by resource is shown on page 21 (Figure 5). While these two projects have combined to meet most of Cordova's energy needs for the past two decades, their run-of-river (no storage reservoir) status creates a unique situation where several million-kilowatt

hours of potential hydro production spills over the dam and is therefore not used during warm summer months of snow and glacier melt complemented by fall rainstorms. Then in winter as the two rivers freeze up, little hydropower is available, and CEC must meet community needs with several million-kilowatt hours of primarily diesel-powered electric generation. In 2019, CEC added a battery energy storage system to replace hydropower for supplying spinning reserve and frequency control to the microgrid, further reducing diesel use by as much as 50,000 gallons per year to solve a small-scale, high value storage need to liberate additional hydro capacity.

In summer, the daytime demand for energy often has CEC spilling excess hydropower at night, then running diesel generators during the day to meet the peak energy intermittent rainstorms that quickly transition CEC from primarily diesel to 100% hydro and spilling excess. Within days of the rain event, CEC is primarily back on diesel. This load and climate pattern make even small-scale hydro storage particularly essential to the Cordova community where as many as 200 each 100% hydro to diesel transitions and back occur in a year.

In spring of 2022, CEC was successful in matching State of Alaska grant funds to assess several potential hydro storage sites close to the CEC grid (44% CEC to 56% State match for $540,000 of work). In February of 2024, the assessment was completed and indicated that construction of a 70-foot-tall dam several hundred feet upstream of the existing Humpback Creek intake structure could offset more diesel fuel at a lower cost than the only other small-scale ($35 Million or less) storage option. In February of 2024, at their regular monthly board meeting, the CEC Board of Directors authorized staff to seek partner funding for the project to further reduce Cordova's dependence on diesel fuel.

Table 6: Annual CO2 emission reductions from Measure 1 - Humpback Creek hydro storage upgrade based on the 100-year GHG global warming potential multiplier.

GHG	USDA Factor	Emission Factor	CO_2e/MWh	Reduction (MWh)	Annual reduction CO_2e (metric tons)
CO_2	1	1,815	1,815	3,802	2,537
N_2O	298	0.015	4.327	3,802	6.4
CH_4	25	0.073	1.815	3,802	2.7
				CO_2e total:	**2,546**

Methods for Quantifying the Measure

An Engineering feasibility study (McMillen and associates, February 2024) prepared a construction estimate based upon site hydrologic data, geologic field study and seismic refraction survey, a feasibility level design and operational model. CEC staff reviewed the modeled diesel offset against historical production records and recognized that the feasibility study understated the potential by approximately 35% because the capacity currently competes with the Power Creek run of river project which would be time-shifted by the storage addition to offset additional diesel fuel use. CEC estimated a "most likely" scenario for initial plant operation diesel offset. To calculate greenhouse gas emissions reductions, CEC used ten-year average rainfall for 2012-2022 and 2022 energy sales data. CEC's average diesel efficiency rate at humpback creek is 13.8 kWh / gallon of diesel consumed. USDA standard conversions were applied to convert kWh from offset diesel generation into annual reduced greenhouse gas emission totals, reducing annual carbon emissions by an estimated 2546 metric tons of CO_2e.

Figure 13 shows the projected annual hydro generation improvements, and Table 6 shows estimated carbon emission reductions from implementing this measure. CEC has a long-demonstrated ability to exceed the ultimate output of new hydro resources through careful monitoring and optimization with staff skilled in this technology.

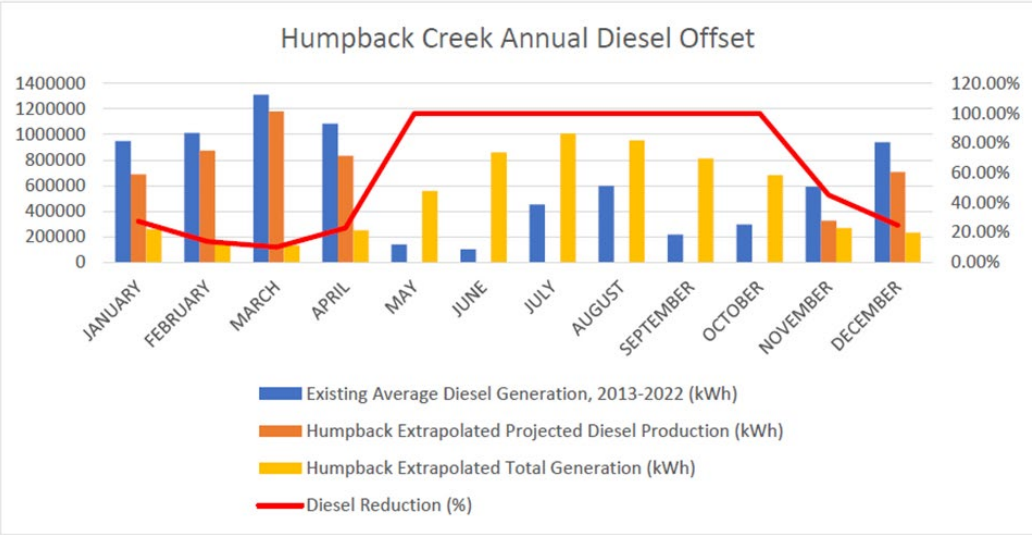

Figure 133: Projected Humpback Creek Reductions to Diesel Generation.

Additional Benefits:

As CEC builds on incentive and partner programs, more hydropower on the supply side is complemented by further decarbonization on the user side in the form of beneficial electrification and efficiency upgrades, including:

- 2017 Installation of 4 type II EV charging Stations
- 2023 installation of 3 Air Source Heat Pumps (in partnership with Pacific Northwest National Laboratories)
- 2023 Prince William Sound Science Center installation of ocean water-source heating of their science laboratories and campus.

These customer – side deployments of fossil fuel offsetting technologies complements CEC's supply-side decarbonization with customer-side carbonization resulting in an environmental "doubling down" on carbon and greenhouse gas emissions, adding value and reducing costs as a multiplier to funding the Humpback Creek storage project, and allowing load growth into additional hydropower that is currently spilled during the rain events as CEC works with these customers to allow optionality in their charging and heating times in a "smart grid" architecture. The US Department of Energy and CEC hosted the largest grid modernization project in the country and has this capacity available to few other utilities. Another element of this "flexible supply, flexible load" approach is available with the 150 kilowatts of new cloud server capacity located inside the Humpback Creek power plant and hyper-efficient water cooling with ice cold hydro plant water on our green power platforms.

Measure 2 – Line extensions 13-Mile Transmission, Solar and Residential GHG Offset

Description of project

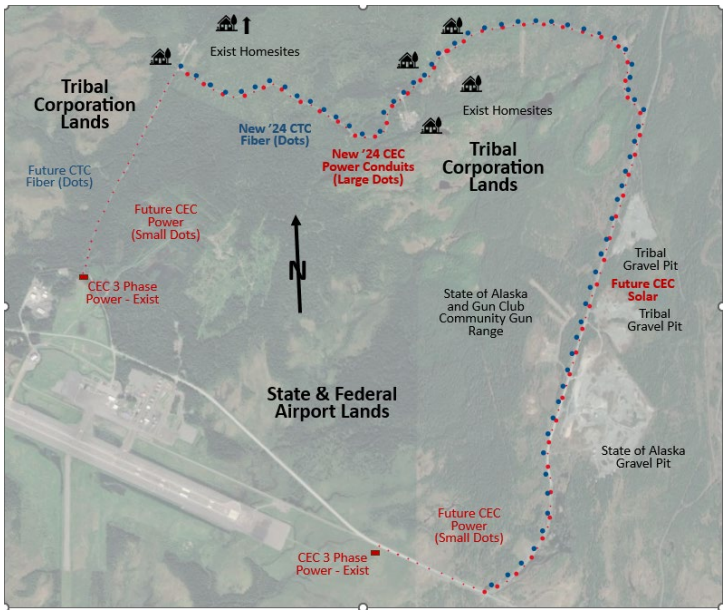

Figure 144: Proposed 13-Mile Transmission line route and solar site. Blue dots represent CEC transmission lines and blue dots represent Cordova Telecomm Cooperative (CTC) fiberoptic lines.

A line extension and siting for solar generation at 13-mile of the Copper River Highway will address multiple challenges facing Cordova. It has long been a goal of CEC to build this transmission line to create a loop feed to serve critical State of Alaska airport and United States Coast Guard (USCG) Air Rescue station infrastructure, to extend power to Eyak Corporation Shareholder Land Use Permit residential lots (some with unserved homes on them) and to a community archery and rifle range facility for gun and hunter practice and safety along with law enforcement and USCG/USFS training, and to commercial State/Eyak Corporation gravel pits. Extending the transmission line to access preferred siting for a solar plant for additional renewable power generation complements these community goals. The 13-Mile Transmission Extension and Solar Project will add critical generation capacity in March and April during peak solar when existing run of river hydro is minimum, and during daytime and summertime system peak energy use, as well as extend co-op generated power to sites currently run off of diesel generators including the homesites, gun range, and diesel powered gravel pit equipment: rock crushers, conveyors, sorters, etc..

1.7 miles of the line are in the State of Alaska Department of Transportation (DOT) Right of Way on gravel roads, and the remaining 3.5 miles of the 5.2-mile line are located on The Eyak Corporation's gravel roads. The smooth alluvial gravel roads are particularly suited to plowing in the transmission line conduits at low cost for high reliability operation. CEC line extension tariffs provide a small $3,700 line extension credit for new residential services, and $1,700 for commercial services. The existing base of 6 home sites, one commercial facility, and industrial aggregate sites offer a small component of GHG offset in the overall scope of the line extension, with the addition of the solar plant in the flat terrain and excellent solar exposure offering the more substantial GHG offset. Due to limited existing energy use at the site and the requirements of the CEC tariff, outside funding is critical to build the transmission and solar power infrastructure to provide secure, affordable energy to the residential and commercial demand in this loop and CEC grid. The power loop also provides critical grid resiliency to key emergency services as the airport including Alaska Department of Transportation highway maintenance facilities for the entire community, the FAA flight support station, the National Weather Service station, the State Airport Fire and Rescue station, the US Coast Guard Air Rescue station supporting commercial fishing, sport and subsistence fishing and hunting activities, Alaska Airlines terminal, and small commercial and private aviation activities. Cordova is

the only all-weather airport with IFR rating in the Prince William Sound region and is a critical aviation hub and emergency diversion airport for Anchorage and Juneau, which more frequently experience inclement aviation weather than Cordova (gusty wind in Anchorage and fog in Juneau). The Eyak Corporation and Chugach Alaska Corporation (Alaska Native Corporations with tribal funding eligibility status) have long desired power to their lands and support renewable energy and reduction of Greenhouse Gases.

Technical Details and Value Proposition

Cordova Telecomm Cooperative is installing fiber optic cables in this transmission path in 2024 and can share the installation cost of empty conduits along 80% of this line length in summer of 2024. The installation of empty conduits represents over 50% of the overall transmission line cost. The 20% balance of transmission line conduits will be installed by CEC to complete the loop. CEC is highly experienced in the installation, operation, and maintenance of underground power lines, including converting 100% of the Cordova electrical system to underground lines. This construction is anticipated to precede the installation of the solar plant to better coordinate with CTC schedule and facilitate affordable extension of power to this area. The installation of solar has been sized at 500kW to yield a positive net present value, and integrate with existing grid assets and installation of CEC storage so that the solar output can be fully utilized without overbuilding or underbuilding the resource.[33] CEC is a daytime and summertime peaking system, due to the large and growing seafood catching and processing industry which ranks in the top 20 in the nation by landed value and represents 90% of the local economy. The solar energy cycle is closely correlated to CEC grid energy needs supporting financial feasibility to solar integration despite the often-cloudy environment. High levels of albedo (reflection off snow and water), peak solar gains in March and April when CEC run-of-river hydro power is at its lowest annual production, and the low-maintenance nature of solar installations further contribute to the viability of solar in this otherwise marginal environment for solar installations. At the southerly Alaskan latitude of Cordova, winter solar is low, but still contributes even at the winter solstice, unlike arctic regions of Alaska.

Methods for Quantifying the Measure

Table 7 shows the annual estimated CO2e reductions for the solar site alone, and Table 8 shows the estimated CO2e emission reductions for the combined solar farm and transmission line. The contribution of solar will directly displace the use of diesel fuel for power generation. The additional 481,800 kWh of renewable energy are calculated based on an 11% solar capacity factor resulting in 13,300 gallons of annual offset per Alaska Solar company; based on past performance of commercial solar installations at similar Alaskan latitudes and climates, and commercial solar power estimating methodology. While the Arctic Energy Consultants engineering feasibility study indicated a higher diesel fuel offset of 25,000 gallons for a 500kW Solar Plant at the site, CEC feels that the 13,300 gallons of annual offset is a conservative calculation based on Alaskan installations analogous to the Cordova climate with appropriate allowances for competing hydro resources on the CEC grid.

In addition to adding renewable (solar) energy as a CEC supplier-side GHG offset, electrification of residential, small commercial, and industrial sites results in a 75% decrease in fossil fuel use on the

[33] Arctic Energy Consulting. "Solar power integration in Cordova: Feasibility study on integration of solar power in the power system of Cordova, Alaska. April 2020.

consumer side for those who electrify. For over two decades, these customers in the 13-mile area have relied almost solely on fossil fuels for running gasoline or diesel generators for electricity, and for crushing, sorting, batching aggregate, and cement at tribal and state gravel pits. The estimated GHG offsets are, based on CEC observed customer use patterns for internal assessments of EV and Air Source Heat pump feasibility, and performance of CEC owned EV and monitored air source heat pumps installed in 2023 as part of a pilot program. Fossil fuel offsets for electric vehicles were based on an estimated 10% adoption and air source heat pumps at 25% adoption for the six homes at the site and homes added over the next ten years. These are conservative estimates based upon CEC 2023 customer survey responses. Industrial diesel offset is assumed at 100% adoption due to relatively low electric rates, and the sharply reduced operations and maintenance cost for electric vs. diesel-power gravel pit operations.

Table 7: Estimated annual GHG reductions with the 500k solar farm based on USDA's 100-year GHG global warming potential multiplier.

GHG	USDA Factor	Emission Factor (Oil)	CO_2e/MWh	Reduction (MWh)	Annual reduction CO_2e (metric tons)
CO_2	1	1,815	1,815	482	396
N_2O	298	0.015	4.327	482	0.9
CH_4	25	0.073	1.815	482	0
				CO_2e total:	**397**

Table 8: GHG reductions for both the 13-mile transmission line and 500kW solar farm using the USDA's 100-year GHG warming potential multiplier.

GHG	USDA Factor	Emission Factor (Oil)	CO_2e/MWh	Reduction (MWh)	Annual reduction CO_2e (metric tons)
CO_2	1	1,815	1,815	546	449
N_2O	298	0.015	4.327	546	1
CH_4	25	0.073	1.815	546	0.5
				CO_2e total:	**451**

Measure 3 – Advanced LED lighting

Description of project

CEC has proactively sought opportunities to incorporate energy efficiency and renewable energy improvements into their power profile. As a result, during the summer up to 95% of power is produced from hydroelectricity. When streams freeze in winter, CEC is forced to switch to diesel generation to meet electricity demand. Thus, the most carbon intensive power is produced in the winter months in Cordova. This is also the time of year when days are short, and the city operates public lighting. Increasing the efficiency of public street lighting will help reduce the power draw on diesel generators in the winter, and will also have environmental co-benefits for fish and wildlife.

CEC engaged Clanton and Associates, a global lighting design leader headquartered in Colorado, to advise a community-wide streetlight retrofitting. To Clanton's knowledge in an extensive global lighting network, Cordova was the first community in the world to implement a community-wide LED street lighting retrofit from 2010-2012. That retrofit was wholly procured and installed by CEC staff and reduced winter lighting loads by 75%, saving the City of Cordova $35,000 annually on their street lighting costs. This project will improve the quality of lighting for public safety, will further reduce existing LED street lighting loads by 50%, will no longer attract fish, birds, and wildlife to

fixtures which leads to their mortality, can be used for signaling tsunamis and other public purposes to improve the safety and resilience of the community, and will meet new Federal lighting standards (developed by Clanton and Associates for US DOT and US DoD). The original LED fixtures are approaching end of life and need to be replaced. Clanton provided vendor quotes for the fixtures and control systems to manage the lighting, and CEC added estimates for installation of the fixtures, controls, and data gateways to implement the community-wide retrofit to further reduce energy costs and improve quality of life. All Actions in this project are mutually beneficial to other CEC and community objectives by design, and the LED lighting will reduce winter system loads to further expand the availability of renewables that Humpback Creek storage provides in winter. Materials can be procured in 2025, installed and commissioned in 2025-2028.

Technical Details and Value Proposition:

Traditional LED Street lighting is typically a single light spectrum fixture (4100-5000K in Cordova) and are turned on and off by dusk-until-dawn on/off controls that respond to ambient daylight. Advanced LED Street lighting allows real-time control of both the output intensity and color spectrum so that lighting can be designed to be suitable to the community. CEC lighting level measurements in April of 2023 demonstrated backlighting, uplighting, and glare levels (BUG metrics) that exceeded federal standards by as much as 1000% (10x over lit), and color spectrum of 4100-5000K are particularly attractive to migrating species of birds, wildlife, Sealife, and insects leading to high mortality rates in Alaska's largest ocean and land migration corridor with as much of 99% of some species passing through in spring and again in fall. A new, controlled lighting intensity and spectrum not only support reducing of GHG emissions, but offers further environmental benefits to aquatic and terrestrial species (including humans for public safety) as they face new and unique challenges of climate change in this pristine and bio rich and biodiverse environment.

This advanced LED lighting upgrade project is estimated to cost $1.2 mil and reduce community street lighting energy use by 57,000 kWh annually of which 50% is estimated to directly offset diesel fuel use saving approximately 2057 gal of diesel.

Methods for Quantifying the Measure

CEC, NVE, and City of Cordova efforts to date led a globally-leading initiative to convert to LED lighting to reduce community energy use in this rate class by 75% (1/4th the energy use). As these fixtures reach end-of-life, conversion to advanced LED lighting can convert the community to a platform that provides multiple benefits and from lighting models prepared by Clanton Associates, a minimum efficiency gain of 50%. CEC used this minimum 50% efficiency gain as the baseline kWh reduction for GHG reductions. The diesel component of reduced kWh use is based on 75% diesel generation in winter months and 75% of lighting loads in winter months or 56% diesel offset. CEC conservatively used 50% of the 50% kWh reduction or a total diesel offset of 25% of current LED street lighting kWh or 28,380 kWh annually. LEDs are particularly low-hanging fruit in City and private applications due to the prevalence of CEC diesel use in winter (75% of all CEC diesel use is November through April) when lighting demands in our long winter nights are much higher than southerly latitudes. Approximately 30% of electric energy use in the darkest winter months in Cordova is lighting across all rate classes.

Table 9: GHG reductions for the advanced LED lighting upgrade project based on the USDA's 100-year GHG global warming potential conversion factors.

GHG	USDA Factor	Emission Factor (Oil)	CO_2e/MWh	Reduction (MWh)	Annual reduction CO_2e (metric tons)
CO_2	1	1,815	1,815	28	23
N_2O	298	0.015	4.327	28	0.1
CH_4	25	0.073	1.815	28	0
				CO_2e total:	**24**

Sector - Solid Waste

Measure 4 - Composting

Description of project

To maximize the impact of community composting, it is essential to tailor programs to the specific needs and characteristics of each community, considering factors such as the size of the population, available space for composting facilities, and the existing waste management infrastructure. Collaboration with local governments, environmental organizations, and businesses is critical to secure the necessary support, resources, and expertise to design, implement, and maintain successful community composting programs.

In Cordova, there is ample opportunity to reduce greenhouse gas emissions and improve local air quality through a community-wide composting program that diverts food waste and paper products, including compostable paper and cardboard, away from the burn pile and landfill. Cordova currently has two permitted solid waste facilities; a landfill at 17-mile that accepts municipal solid waste and construction waste, and a burn pile located at mile 1 of Orca Road that accepts burnable solid waste such as cardboard and yard scrap. The burn pile is unmonitored with little data about the type and quantity of materials that are burned. A 2008 study by the Native Village of Eyak observed the burn pile for 20 days in summer and observed 61% of the waste deposited at the burn pile was allowable burnable waste. The study only observed types of materials disposed of in the burn pile, not quantity, and assumed 500 lbs. of material burned per day (308 lbs. of allowable burned material per day).[34] There is no current data looking at overall burn pile use.

A composting program in Cordova would reduce local greenhouse gas emissions in several ways. Utilizing cardboard and other burnable materials diverted from the burn pile as brown material for the compost would reduce greenhouse gas emissions and other air pollutants in Cordova's waste stream. Food waste from restaurants, fish processors, and the local schools, as well as kelp from NVE's research farm, would contribute green materials to the compost. In addition to directly reducing emissions from food waste, this composting project would help promote local food security by providing gardening material in a community where there is very little arable land. A local source of heavy gardening soil would reduce shipping costs and emissions for local gardeners, and locally

[34] Cordova Biomass Feasibility Study https://www.eyak-nsn.gov/wp-content/uploads/2020/05/Cordova-Biomass-Feasibility-Study.pdf

grown sources of food also reduce greenhouse gas emissions from importing fresh fruits and vegetables.

By focusing on the transformation of organic waste into valuable compost, this strategy not only diminishes the volume of waste destined for landfills but also significantly mitigates the production of methane, a potent greenhouse gas released during the anaerobic decomposition of organic material in landfill environments. The process of community composting involves an organized collection of organic waste, including food scraps, yard debris, and other biodegradable materials, from residential areas, schools, businesses, and public spaces. This collected waste is then subjected to controlled aerobic decomposition, a method that accelerates the natural breakdown process, turning these materials into nutrient-rich compost.

Implementing community composting has multiple environmental and social benefits. Firstly, it contributes to soil health and fertility when the finished compost is applied to gardens, parks, and agricultural lands, thereby reducing the reliance on chemical fertilizers and enhancing the ability of soils to sequester carbon. Secondly, it promotes a circular economy approach by turning waste into a resource, encouraging sustainable practices among community members and fostering a sense of collective responsibility towards environmental conservation.

Moreover, community composting programs can serve as educational platforms, raising awareness about the importance of waste reduction and recycling. Through workshops, school programs, and community events, residents can learn about the benefits of composting, how to separate organic waste at the source, and the broader implications of their actions on global climate change and sustainability.

Methods for Quantifying the Measure

Using the EPA's Waste Reduction Model to understand current baseline and alternative waste management scenarios, the above scenario was projected to decrease CO_2 emissions by 205.7-218.1 metric tons of CO_2. As there is no option in the WARM model to compost corrugated containers, the tons combusted was moved to the tons source reduced option. To understand how composting a significant portion of food waste, yard trimmings, and cardboard could affect methane emissions, the LandGem model was rerun to include the reduction of these categories. Methane emissions under these conditions were reduced by 641-767 CO_2eMT over the lifetime of the landfill. In total, the implementation of this project would reduce landfill emissions by 847-985.1 CO_2eMT.

This model does not include the potential GHG emissions saved by households that garden in Cordova. The region lacks any arable land for traditional land-based agriculture with an average annual precipitation of 82 inches of water and 217 days of precipitation per year (NOWData). The poorly drained, fine, silty soil is classified as moderately alkaline and is only useful as wildlife habitat (Soil Survey Staff). For gardening, community members must purchase bags of soil from gardening centers in Anchorage and transport them back to Cordova. If we assume that 10% of Cordova households garden (88 households), this will equate to approximately 4.2 mt CO_2 emissions from driving to Anchorage from the Whittier ferry terminal. This figure does not include the reduction in GHG emissions by not using the AMHS ferry.

Sector – Blue Economy

Measure 5 - Improve commercial fishing and mariculture operational efficiency

Description of project

Commercial fishing is the backbone of Cordova's economy. In 2022, 686 gillnet, set net, and purse seine permit holders harvested over 33 million fish from Prince William Sound and the Copper River District's waters, with an estimated value of over $96 million.[35] Yet changing ecosystem conditions driven by climate change are already degrading local fisheries. Due to unexpected and dramatic declines in salmon stocks, fisheries disaster declarations were made for PWS pink salmon in 2016, PWS chinook and sockeye salmon in 2018, and for all five species of salmon, chinook, sockeye, coho, chum, and pink, in both PWS and the Copper River District for the 2020 season. Threats to the fisheries that have been the lifeblood of the region, along with other stressors such as lack of affordable housing, increasing food and water insecurity, and the lack of alternative employment options compound with changes to the environment to threaten community well-being, health, and resilience throughout the region.

Improving fleet and operational efficiency would have economic as well as environmental, and GHG reduction benefits, improving boat owner's bottom lines while decreasing emissions from the fleet. Climate-friendly fisheries marketing could also help increase the value of Copper River fisheries products in certain markets. Fleet efficiency measures differ depending on the age and type of vessel, what fisheries it's used in, and any onboard processing or storage equipment such as refrigeration units, grinders, etc.

Boat Energy Audit and Efficiency Program

We propose to establish a commercial boat energy audit program to identify efficiency improvements that will lead to operational savings, reductions in fuel consumption and air emissions, and greater resiliency in Cordova's fishing industry.

Expected cost and performance for the proposed program is based on a proprietary database of 70 commercial fishing boat audits that were conducted during the last five years by Energy Audits of Alaska[36], a firm with a substantial track record in both maritime and commercial building efficiency throughout the state. Audited boats ranged from 29 to 82 feet in length but included a 22-foot welded aluminum skiff used for salmon setnetting. 70% of the boats were 32-foot Bristol Bay salmon drift fishing boats, but 24% were seine boats ranging from 32 to 58 feet that fish Alaska Peninsula, Kodiak and Prince William Sound waters.

Most of the energy efficiency measures (EEMs) in the database addressed improvements to the vessel's chilling and storage system, which is critical to maintaining seafood product quality and value. These include:

- retrofitting slush ice to refrigerated seawater systems (RSW)
- add more insulation in fish holds

[35] Alaska Department of Fish and Game. 2022 Prince William Sound Salmon Season Summary. 2022. https://www.adfg.alaska.gov/static/applications/dcfnewsrelease/1442856406.pdf

[36] Dataset was provided by Jim Fowler, Energy Audits of Alaska to DeerStone Consulting, Feb 19, 2024.

- upgrade existing RSW (e.g. to direct drive unit, add zones)
- retrofit to LED lighting
- upgrade circulation pump to variable frequency drive
- replace generator set with more efficient unit

Plotting modeled annual fuel savings from EEMs in the database against vessel length shows that savings appear to be unrelated to vessel length– except for the two largest vessels that are used as tenders (Figure 15). Therefore, we simply average yearly fuel savings by boat in the audit database, while removing the two longest boats as outliers and separating out the smallest entry (a 22 foot skiff). Rounding to nearest 10 gallons, this yields an average annual fuel savings of 640 gallons of fuel per boat longer than 25 feet. EEMs for the one audited skiff totaled 150 gallons of fuel saved.

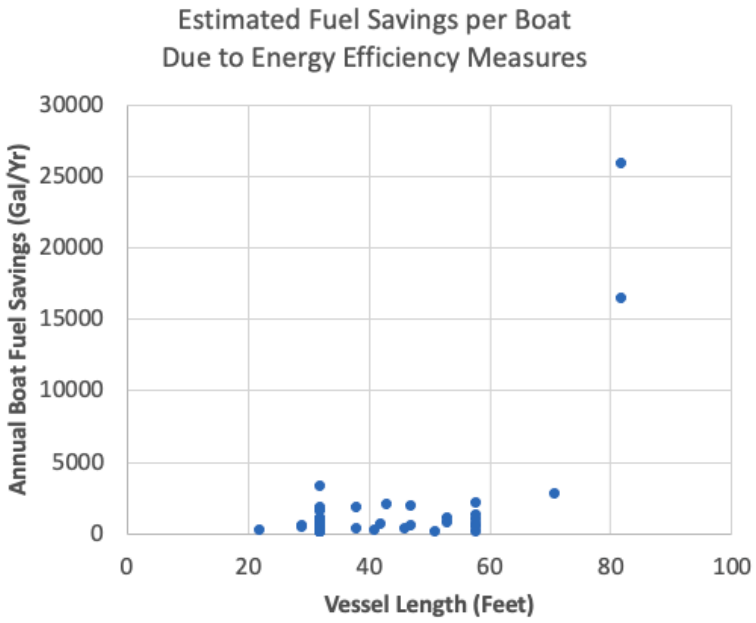

Figure 15: Estimated fuel savings due to energy efficiency measures by boat size.

Annual fuel consumption of the nine vessels over 25 feet that were surveyed in Cordova averaged 2,824 gallons per year. Thus efficiency savings are estimated here as 640/2824 = 23%. Similarly, annual fuel consumption of the two skiffs that were surveyed in Cordova averaged 583 gallons of fuel per boat, yielding efficiency savings of 150/583 = 26%.

Project Implementation

An experienced boat energy auditor would be hired by NVE to perform audits of vessels whose owners opt into the program. We assume cost per audit will range from $2500 to $3500; however, volume discount and subsidy could bring down the cost. Assuming half the fleet opts in and half of the audited boat owners implement the EEMs, emission reductions can be roughly estimated as follows:

> Emission Reduction = Total Emissions * 50% fleet audited * 50% implement EEMs * 23% efficiency increase = 8571 tons * 50% *50% * 23% = 493 tons (448 metric tons).

Following the audit, there would be a range of options for financing of the retrofits, including out-of-pocket, Commercial Fishing and Agriculture Bank loans and USDA REAP grants. A logical add-on to the program would be a training component similar to those offered by Alaska SeaGrant for instruction in conducting audits and designing refrigeration system improvements.

Sector – Other

This sector presents additional measures of interest that will help reduce greenhouse gas emissions and provide environmental and economic co-benefits to increase local resilience. The measures identified below were not quantified for GHG reduction and are merely listed as potential measures that could be quantified in the future:

Measure - Community Resilience Hubs

Community Resilience Hubs initiative establishes multifunctional facilities equipped with renewable energy and storage to ensure reliability during disasters. These hubs offer critical services like shelter, emergency medical care, and food distribution in crises, and transition to provide community amenities and support local energy grid improvements in stable times. The strategic placement of these hubs targets the most vulnerable communities, enhancing preparedness and response to climate-related emergencies while fostering sustainability and equity. The success of these hubs relies on collaborative efforts among local governments, community organizations, utility companies, and residents, ensuring that they meet the specific needs of each community. Community Resilience Hubs represent a comprehensive approach to bolstering community resilience, emphasizing the importance of sustainable development and social equity in disaster preparedness and recovery strategies.

Community Resilience Hubs significantly contribute to the reduction of greenhouse gas (GHG) emissions through a multifaceted approach centered on renewable energy, energy efficiency, and sustainable community practices. By integrating grid-interactive, carbon-free distributed energy resources such as solar panels and wind turbines, these hubs not only generate clean energy but also diminish reliance on fossil fuels, directly cutting GHG emissions linked to traditional energy production. The incorporation of energy-efficient technologies alongside long-duration energy storage systems enables these facilities to optimize energy consumption and store excess renewable energy, thereby reducing the overall demand from the electrical grid, particularly during peak times when the most carbon-intensive power plants are in operation. Furthermore, resilience hubs aid in local grid improvements through services like demand response programs, enhancing grid reliability while decreasing the need for fossil fuel-based energy production during high demand periods. Beyond their operational benefits, these hubs serve as educational and engagement centers, promoting sustainable practices among community members—ranging from energy conservation to sustainable transportation and waste reduction—thereby encouraging environmentally friendly lifestyles. Additionally, by providing localized access to essential services, these hubs can reduce the necessity for long-distance travel, cutting down transportation-related emissions. Some hubs may also support circular economy practices, such as recycling and composting, further mitigating waste and the emissions from waste management and new material production.

Measure - Restoration of degraded lands (e.g., brownfields, mine reclamation), forested lands, and ocean ecosystems to enhance carbon sequestration

The measure focusing on the restoration of degraded lands, including areas previously utilized for industrial purposes such as brownfields or sites of former mining operations, along with the rehabilitation of forested territories, plays a crucial role in enhancing carbon sequestration capabilities. This involves several strategic actions:

1. **Brownfield Restoration**: Transforming brownfields—previously developed lands that are not currently in use due to the presence of hazardous substances, pollutants, or contaminants—into green spaces, parks, community gardens, or other productive uses. This not only revitalizes the land but also contributes to carbon capture as vegetation grows.

2. **Mine Reclamation**: Rehabilitating land disturbed by mining activities involves contouring the land surface, stabilizing soil, planting native vegetation, and restoring ecosystems. This process helps in the recovery of the area's natural carbon-absorbing capacity, reducing the overall carbon footprint.

3. **Forested Land Rehabilitation**: Focusing on forested lands, this measure includes reforestation (planting trees on land that has lost its forest cover), afforestation (planting trees on land that has never been forested), and forest management practices aimed at increasing biomass density, diversity, and health. Healthy, well-managed forests are significant carbon sinks, absorbing carbon dioxide from the atmosphere during the process of photosynthesis.

4. **Mariculture**: Kelp mariculture has the potential to sequester carbon and provide a number of co-benefits, including water quality improvement, habitat creation, and as a buffer for local ocean acidification. There is also a strong interest in the commercial potential for kelp mariculture in the Chugach region, but the costs of shipping wet kelp from rural communities combined with the current lack of a market for raw kelp or kelp products at the price point of production has thus far limited kelp mariculture adoption to a few research sites and early adopters interested in the environmental benefits more than the economic ones. There is a significant need for further research that quantifies the carbon sink potential of kelp, biodiversity benefits of kelp, and potential markets for kelp products from this region to realize the potential economic and environmental benefits of this aspect of the blue economy.

These actions not only contribute to carbon sequestration but also provide numerous co-benefits, including biodiversity enhancement, improved soil health and water quality, economic development opportunities from reclaimed lands, and enhanced community recreational spaces. By restoring these lands to their natural or new productive states, significant amounts of carbon can be sequestered annually, making this measure a pivotal component of climate action plans aimed at reducing greenhouse gas emissions and combatting climate change.

Implementation Milestones & Schedule

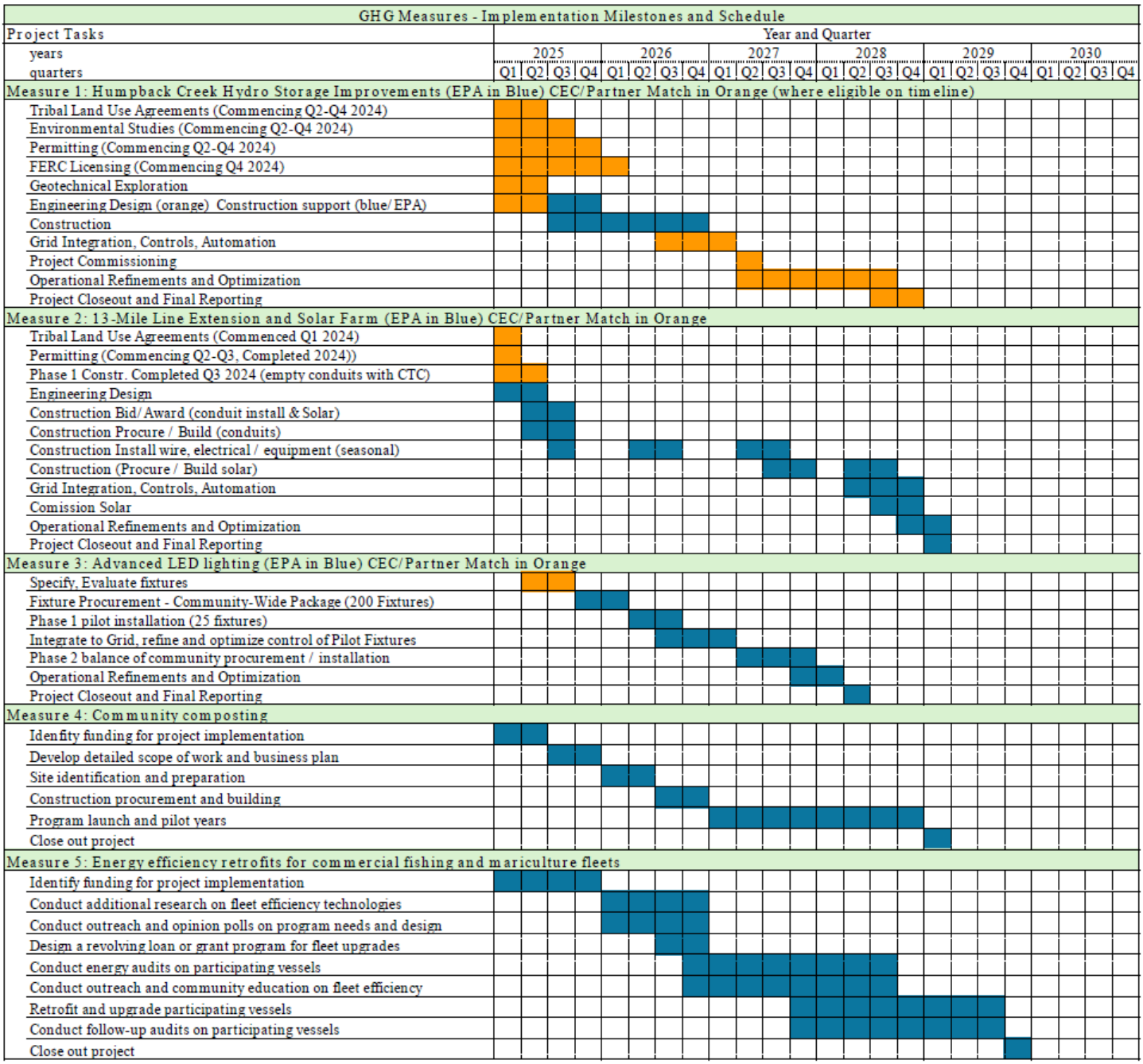

Table 10: Timeline for project implementation.

Methods for Tracking Progress

General metrics for measuring progress towards reducing greenhouse gas emissions were contemplated broadly for each measure. These metrics are intended to measure effectiveness of the measure once implemented and do not consider interim, pre-implementation milestones.

Measure 1 – Hydro Dam Storage

- Diesel Fuel Reduction: Diesel usage is measured with high resolution, temperature compensated fuel meters at each diesel generator, their daily supply tank, at the bulk tank, and at the delivery to bulk tank. These are reconciled monthly to each other and to fuel purchases for accuracy. They are referenced frequently for reductions in fuel consumption and evaluated monthly and annually. In addition, the percentage of diesel vs. hydropower consumption is measured and logged in real time. CEC is highly vigilant in measuring diesel fuel use as the single largest cost driver of electricity prices. We report the fuel use and emissions to state and federal agencies and certify their accuracy. We will analyze the reduction in diesel fuel used to generate electricity between pre-implementation and post-implementation and include detailed data in final (and periodic if preferred) reporting.

- Renewable Energy Generated: CEC automation system continuously logs the electricity generation from each hydro turbine, the battery energy storage system, and any new assets added to the CEC grid. All renewable energy production is recorded in 1-second intervals which can graph or tabulate hourly, daily, weekly, monthly and annual values. CEC typically records and reports monthly production records for CEC Board and State and Federal agencies. CEC is experienced in calculating and differentiating fuel reductions and renewable energy production improvements from incremental changes in our system and will apply those approaches for this project. We will include detailed renewable energy production in final (and periodic, if desired) reporting.

Measure 2 – 13 Mile Transmission Line and Solar Production

- Measurement of progress for diesel/gasoline fuel reductions from EV and ASHP will require voluntary reporting by individuals of their pre and post electrification energy consumption. CEC meters the electricity consumption and maintains those records and has been very successful in engaging consumers for their fuel savings data which many track for measured savings and are willing to share to advise the rest of the community. Similar approaches will be used for the trap and gun club and gravel pit electrification; comparison of pre-implementation data from customers to post-implementation metered electrical use by CEC. These records can be included in reporting.

- Renewable Energy Generated: CEC automation system will continuously log the electricity generation from the solar array. CEC will record and report monthly production records for the CEC Board and State and Federal agencies. CEC will include detailed renewable energy production in final (and periodic, if desired) reporting. Data will be available in graphical and/or tabular form.

Measure 4 – Community Composting Program

- Waste Audit Logs: Maintain simple logs to record weekly or monthly amounts of organic waste collected for composting, using basic scales or volume measures.
- Carbon Calculation Tools: Utilize EPA-endorsed online calculators to convert composted waste volume into estimated greenhouse gas emissions avoided, ensuring accuracy and adherence to best practices.
- Amount of Kelp Dried: As a secondary co-benefit, we will track the amount of kelp dried in the facility to track how well it is supporting the development of Cordova's mariculture industry.

Measure 5 – Commercial fishing fleet and mariculture fleet efficiency upgrades

- Number of Vessels & Retrofit Type: We will track the number of fishing vessel and mariculture vessel owners who utilize a retrofit program and the type of retrofit completed.
- Fuel Reduction: We will ask volunteer captains to opt into fuel tracking programs to monitor fuel usage before and after upgrades and test the effectiveness of those upgrades in their fishing vessel use cases.

Authority to Implement

Many of the entities in the region work together to carry out projects in communities within the region. This is explained in more detail in the *Entities in the Region* section within the *Introduction* to this report. For a particular measure, the identified authority may be required to get permission from the building or system owner through a formal document such as a Cooperative Project Agreement.

Table 11: Analysis of key partners and funding sources for the priority measures listed in this PCAP.

Measure	Key Implementing Agencies	Land Ownership	Other Partners	Other funding sources
Measure 1: Hydro dam battery storage	Cordova Electric Cooperative	Cordova Electric Cooperative, Eyak Corporation, Chugach Alaska Corporation	Chugach Alaska Corporation, The Eyak Corporation, Native Village of Eyak, Cordova Telephone Cooperative	State of Alaska, Cordova Electric Cooperative Financing, US Department of Energy, USDA, RUS
Measure 2: Line extension and solar farm	Cordova Electric Cooperative	Eyak Corporation	Chugach Alaska Corporation, The Eyak Corporation, Native Village of Eyak, Cordova Telephone Cooperative	State of Alaska, Cordova Electric Cooperative Financing, US Department of Energy, USDA, RUS
Measure 3: LED City Lighting Upgrades	Cordova Electric Cooperative, City of Cordova	City of Cordova	City of Cordova, State DOT	USDA, State of Alaska
Measure 4: Community Composting Program	Native Village of Eyak, Prince William Sound Economic Development District	Eyak Corporation	Native Village of Eyak, local restaurants, local fish processors	NVE kelp research program (BIA) for inputs, community garden funding (PWSEDD; USDA)
Measure 5: Commercial fishing fleet and mariculture fleet efficiency upgrades	Native Village of Eyak	n/a	Cordova District Fishermen United, local fishing captains and processors, Trident Seafoods, Chugach Regional Resources Commission	Trident seafoods operates a revolving loan fund for efficiency upgrades for vessels in their fishing fleet.

The tables above (by measure) capture current authorities to implement proposed measures based on ownership or historical project development and implementation and lines of formal or informal responsibility of the entities in the region. Broadly this climate action plan identified the entity in the region or in the community that has authority to carry out a proposed measure such as the City, the Tribe, the Power Utility, the Housing Authority, etc. It also identifies additional sources of funding that the key implementing agencies are pursuing concurrently to the development of this report.

Intersection with Other Funding Availability

The table below aims at identifying likely Federal, State and other funding sources that cover a majority of the proposed measures including energy efficiency, electric utility upgrades, and renewable energy integration.

FUNDING OPPORTUNITY	ELIGIBLE PROJECTS
Department of Energy's Office of Energy Efficiency and Renewable Energy (EERE) Tribal Energy Program Various grants available for energy efficiency and renewable energy projects: https://www.nrel.gov/docs/fy13osti/54396.pdf http://www.energy.gov/indianenergy/office-indian-energy-policy-and-programs	Biomass, energy efficiency, geothermal, hydropower, solar photovoltaics, solar water heat, wind, and other renewable energy projects.
Department of Energy Office of Indian Energy (DOE-OIE) Federal agencies provide grant, loan, and technical assistance programs to support Tribal energy projects: https://www.energy.gov/indianenergy/current-funding-opportunities	Weatherization, technical assistance, economic development, community facilities, community water, energy audits, renewable energy development, and energy efficiency.
Department of Energy (DOE) – Other Grants available for energy efficiency, renewable energy, technical assistance, pilot projects, and Tribal government energy projects: https://www.energy.gov/energy-economy/funding-financing	Weatherization, biomass, energy efficiency, geothermal, hydropower, solar photovoltaics, solar water heat, wind, other renewable energy projects, and education & outreach.
Denali Commission Grants Improve the effectiveness and efficiency of government services, to develop a well-trained labor force employed in a diversified and sustainable economy, and to build and ensure the operation and maintenance of Alaska's basic infrastructure: https://www.denali.gov/grants/ https://www.denali.gov/funding-requests/	Energy reliability, bulk fuel safety, infrastructure protection, transportation, sanitation, health facilities, housing, broadband, and economic development.

Alaska Energy Authority (AEA) Supports the State's communities and energy infrastructure by administering grant funding programs and a loan program: http://www.akenergyauthority.org/What-We-Do/Grants-Loans AEA Renewable Energy Grant Fund: http://www.akenergyauthority.org/What-We-Do/Grants-Loans/Renewable-Energy-Fund	Solar water heat, photovoltaics, landfill gas, wind, biomass, hydroelectric, geothermal electric, fuel cells, geothermal heat pumps, combined heat and power/cogeneration, hydrothermal, waste heat, transmission or distribution infrastructure, anaerobic digestion, tidal energy, wave energy, fuel cells using renewable fuels, and geothermal direct use.
Alaska Housing Finance Corporation (AHFC) Financing for permanent energy-efficient improvements to public buildings owned by regional educational attendance areas, by the University of Alaska, by the state or by municipalities in the state: Alaska Energy Efficiency Revolving Loan Program: https://www.ahfc.us/efficiency/non-residential-buildings/energy-efficiency-revolving-loan-fund-aeerlp/	Borrowers obtain an Investment Grade Audit as the basis for making cost-effective energy improvements, selecting from the list of energy efficiency measures identified.
USDA Rural Development High Energy Cost Grant: https://www.rd.usda.gov/factsheet/high-energy-cost-grants	Funds may be used to acquire, construct, extend, upgrade, or otherwise improve energy generation, transmission, or distribution facilities and to establish fuel transport systems that are less expensive than road and rail.
Rasmuson Foundation Capital projects and technology upgrades for eligible Alaska organizations: Tier 1 Grants: https://www.rasmuson.org/grants/tier-1-grants/	Capital projects, technology updates, capacity building, program expansion and creative works, including building construction/renovation/restoration, technology upgrades in community facilities, and capacity building grant support.
Housing and Urban Development (HUD) http://portal.hud.gov/hudportal/HUD?src=/topics/grants	Energy efficiency and housing weatherization.

Bureau of Indian Affairs (BIA) Energy and Mineral Development Program Grant (EMDP): https://www.bia.gov/service/grants/emdp/what-energy-and-mineral-development-program-emdp-grant	Resource assessment, exploration studies, feasibility studies, market, studies, engineering studies, economic evaluation, and defining potential targets for development.
Bureau of Indian Affairs Tribal Energy Development Capacity Grant (TEDC): https://www.bia.gov/service/grants/tedc	Developing the legal infrastructure to create any type of Tribal energy business. Establishing an energy-focused corporation under Tribal or state incorporation codes. Establishing an energy-related Tribal business charter under federal law.
Bureau of Indian Education http://bie.edu/Programs/index.htm	School energy programs.
The Honnold Foundation Grid Alternatives Tribal Program: https://www.honnoldfoundation.org/	Unrestricted grant funding to organizations or projects that use solar energy to increase social and economic equity and reduce environmental impact.
USDA Rural Development Many various grants. Listed below. www.rd.usda.gov/ak	Diverse eligible activities.
Bipartisan Infrastructure Law – Clean Energy & Power 1. Delivering Clean Power ($21.3 billion) 2. Clean Energy Demonstrations ($21.5 billion) 3. Energy Efficiency & Weatherization ($6.5 billion) 4. Funding for Clean Energy Manufacturing & Workforce Development ($8.6 billion) https://www.whitehouse.gov/build/guidebook/ https://www.whitehouse.gov/wp-content/uploads/2022/05/BUILDING-A-BETTER-AMERICA-V2.pdf#page=152	Delivering clean energy, clean energy demonstrations, energy efficiency, clean energy manufacturing and workforce. May be limited in ability to fund upgrades and improvements to existing diesel electric utility systems. This gap may better fit into an EPA Implementation grant.

Bipartisan Infrastructure Law - Electric Vehicles, Buses and Ferries 1. National Electric Vehicle Infrastructure Formula Program ($5 billion) 2. Discretionary Grant Program for Charging and Fueling Infrastructure ($2.5 billion) 3. Clean School Bus Program ($5 billion) 4. Low- and No-Emission Transit Bus Program ($5.6 billion) **5.** Electric or Low Emitting Ferry Program ($250 million)	Building a network of electric vehicle chargers and supporting the transition to electrification across all types of vehicles is critical to reduce emissions and help to combat the climate crisis.

Appendix A: Commercial Fisheries Questionnaire

Commercial Fisheries Vessel Fuel Usage for Emissions Inventory Questionnaire

Did you commercial fish in 2022?

[ ] Yes [ ] No

What commercial fisheries did you participate in?

[ ] Drift Gillnet [ ] Purse Seine [ ] Longline [ ] Set Gillnet [ ] Shrimp

[ ] Crab [ ] Other (specify): _____

What region did you fish?

[ ] Copper River [ ] Prince William Sound [ ] Northern Gulf of Alaska

Vessel type: _____ Vessel length: _____ft Vessel beam: _____ft

Fuel type: [ ] Diesel [ ] Gas [ ] Other: _____

Number of engines aboard: _____ (if more than one, include info for each below)

Refrigeration? Y or N If yes, type: _____ Power Source: _____

Engine(s) Make and Model:

_____

Engine(s) age: _____

Engine hours put on each engine in 2022:

_____

Average gal/hr on step: _____

Average gal/hr overall (idling and traveling): _____

Number of gallons consumed in 2022: _____

Amount of money spent on fuel in 2022: _____

Average gal/mile: _____

Average speed with best fuel efficiency:

_____

Area fished	# of trips	Average distance/trip	Fuel/trip ($ or gal)	Source (memory, tax return, fuel receipts, etc.)	Comments

Was 2022 an average, below-average, or above-average year for the number of hours you put on each engine?

Would you be willing to make any changes to your boat or deck equipment that would reduce fuel consumption?

Would you be willing to make any changes to your boat or deck equipment that would reduce vessel emissions?

Other Comments: