State of Alaska Comprehensive Sustainable Energy Action Plan

Meeting the requirements of the Comprehensive Climate Action Plan for EPA's Climate Pollution Reduction Grant Program

Prepared by the Alaska Municipal League
for the Alaska Department of Environmental Conservation

Acknowledgements

The Alaska Department of Environmental Conservation (DEC), in carrying out this planning effort on behalf of the State of Alaska, recognizes the significant contributions of state agencies, local governments, and federally recognized Tribes in advancing the goals of the EPA's Climate Pollution Reduction Grant (CPRG) Program and the State's commitment to energy affordability and sustainability. This collaborative, intergovernmental effort reflects Governor Mike Dunleavy's priority to ensure reliable and sustainable energy for all Alaskans.

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GEOGRAPHY, DEFINITIONS, & ACRONYMS

Geography

As the largest state in the country, there are many ways that regions can be defined, and the specific definitions often depend on the context. There are two important general categories as it relates to energy:

Urban vs. Rural – While there are many competing definitions of urban and rural, the Power Cost Equalization (PCE) program defines populated areas of the state, the Railbelt and Juneau as the basis of an urban definition given relatively large and low-rate electric grids. In contrast, most of the hundreds of microgrids that serve the rest of the state see funding from the PCE program and should be considered rural as it relates to energy. Other definitions are used throughout this document.

Maritime Climate vs. Continental Climate – The southern coast of Alaska, especially from Kodiak Island to Ketchikan, enjoys a relatively moderate and humid environment compared to the rest of the state, which sees colder, sub-Arctic continental and Arctic environments. Sustainable energy strategies, in part thanks to this difference and in part due to historical investments, can look quite different in Alaska's maritime, south coastal environment versus the rest of the state. The greater availability of utilized hydroelectric resources and the moderate environment make beneficial electrification, especially heat pumps, more economical.

Additionally, there are three main ways that Alaska is subdivided for general purposes are:

- **ANCSA Region** – Defined by the Alaska Native Claims Settlement Act of 1971; these regions follow the boundaries of the twelve Alaska Native Regional Corporations. These regions tend to correspond with Alaska Native cultures and languages.
- **Borough/Census Area** – Where county-level governments (boroughs) have formed, these statistical areas correspond to their boundaries; otherwise, they follow Census Bureau defined regional statistical areas known as Census Areas.
- **Economic Regions** – The following table defines some of the broader geographic regions that are used in general discussions of Alaska's regions.

Economic Region	Geographic and/or Economic Description
Interior Alaska	Bounded by the Alaska Range to the south and the Brooks Range to the north.
Northern Alaska	Areas on, or close to, the Arctic Ocean include the North Slope Borough, Northwest Arctic Borough, and the Nome Census Area.
Railbelt	Defined by the Alaska Railroad, stretching from Seward, through Anchorage, to Fairbanks. This region shares an electric grid and other infrastructure and acts as an economic center of the state.
Southcentral Alaska	Includes Anchorage, the Mat Su Valley, and the Kenai Peninsula.
Southeast Alaska	Generally, it is considered to stretch from Yakutat to Ketchikan.
Southwest Alaska	Includes the Alaska Peninsula, as well as the Aleutian and Pribilof Islands.

For this report, it is also relevant to name the regions where tribal planning processes are taking place for CPRG. The Alaska Native Tribal Health Consortium (ANTHC), with its statewide service, has the largest coverage for producing tribal PCAPs, with much of Southwest and Southeast Alaska included in their scope of work. Working through their Rural Energy program, they are collaborating closely with Nuvista and Kodiak Alaska Native Association (KANA), as well as other tribal organizations.

Other tribal consortia engaged in CPRG directly are Tanana Chiefs Conference covering their Interior region, Bristol Bay Native Association, and Kawerak in the Bering Strait region. Tribal partnerships advance work with the Village of Solomon, King Island Native Community, Native Village of Council, and Nome Eskimo Community in Nome, as well as the Chugach Regional Resources Commission and the Native Village of Eyak in Cordova. Chickaloon, Metlakatla, and Unalakleet are all working independently on tribal PCAPs.

Definitions

The following terms are defined here for reference, to help ground the reader in either Alaska-specific or technical language that is helpful to understand in advance.

Alaska Department of Environmental Conservation (DEC)
The State agency designated by the Governor to lead CPRG planning and oversee the development of Alaska's CSEAP through its Division of Air Quality. DEC coordinates with state, local, and Tribal partners to implement statewide emissions reduction and monitoring efforts.

Alaska Municipal League (AML)
A statewide nonprofit committed to strengthening Alaska's local governments. Under contract with DEC, AML coordinated stakeholder engagement, Tribal collaboration, and plan production for the CSEAP.

Beneficial Electrification
The process of replacing direct fossil fuel use (e.g., heating oil) with electricity in a way that reduces overall emissions and energy costs, improves grid efficiency, or provides other societal benefits.

Biochar
A stable, carbon-rich material produced by heating biomass in low-oxygen environments. Used in Alaska's CSEAP as a mitigation measure to sequester carbon and improve soil health while reducing wildfire and smoke impacts.

Borough
The county-level equivalent regional government for Alaska.

Business-as-Usual (BAU) Scenario
A projection of greenhouse gas emissions assuming no additional mitigation measures are implemented beyond existing policies and trends. Used as a baseline for evaluating potential reductions under the CSEAP.

Carbon Dioxide Equivalent (CO_2e)
A metric unit used to compare the global warming potential of different greenhouse gases by expressing them in terms of the equivalent amount of CO_2 that would have the same warming effect.

Climate Pollution Reduction Grant (CPRG) Program
A federal grant program administered by the U.S. Environmental Protection Agency to support state, Tribal, and local governments in developing and implementing plans to reduce greenhouse gas emissions and co-pollutants. Alaska's CPRG planning effort is led by the Department of Environmental Conservation (DEC).

Commercial Property Assessed Clean Energy and Resiliency (C-PACER)
A financing mechanism enabled by Alaska statute allowing commercial property owners to finance energy efficiency, renewable energy, and resiliency improvements through property-assessed loans.

Comprehensive Sustainable Energy Action Plan (CSEAP)
The State of Alaska's comprehensive plan developed under the U.S. Environmental Protection Agency's Climate Pollution Reduction Grant (CPRG) Program. The CSEAP identifies strategies, investments, and partnerships to reduce greenhouse gas emissions, enhance energy affordability, and strengthen community resilience.

Emission Factor
A coefficient that quantifies emissions per unit of activity or fuel consumption (e.g., kilograms of CO_2 per gallon of diesel burned), used in calculating emissions within the CSEAP inventory.

Emissions Inventory
A quantitative accounting of greenhouse gas emissions by source, sector, and fuel type. Alaska's CSEAP uses 2022 as its baseline inventory year for statewide and community-level analysis.

Global Warming Potential (GWP)
A relative measure of how much heat a greenhouse gas traps in the atmosphere compared to carbon dioxide over a specific time period, typically 100 years. Methane and nitrous oxide have GWPs of approximately 25 and 298, respectively.

Greenhouse Gas (GHG)
Any gas that traps heat in the atmosphere and contributes to environmental change, including carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O). Emissions are quantified as carbon dioxide equivalent (CO_2e) using standard conversion factors established by the Intergovernmental Panel on Climate Change (IPCC).

Intergovernmental Coordination
Collaborative governance among federal, state, Tribal, and local entities to align emissions reduction, funding, and implementation activities under the CSEAP framework.

Methane Leak Detection and Repair (LDAR)
A programmatic approach to identify, monitor, and repair methane leaks from oil and gas infrastructure. The CSEAP identifies LDAR as a high-impact measure for emissions reduction and public health improvement.

Microgrid
A localized energy network that can operate independently or in conjunction with the main electric grid. Microgrids are particularly important for energy resilience and decarbonization in rural Alaska communities.

Mitigation Measure
A policy, project, or technology that reduces or avoids greenhouse gas emissions. The CSEAP organizes mitigation measures by sector, including residential, non-residential, solid waste, transportation, electric generation, and industrial uses.

Monitoring, Reporting, and Verification (MRV)
A standardized framework used to quantify, track, and verify emissions reductions. Under the CSEAP, DEC and AML maintain a statewide CPRG reporting platform to aggregate data from agencies, municipalities, and Tribes.

Municipal government
The 164 city and borough governments incorporated under state law, as well as the Metlakatla Indian Community incorporated under federal law.

Power Cost Equalization (PCE)
A program administered by AEA and the Regulatory Commission of Alaska to reduce high electricity costs in rural communities by offsetting the difference between rural and urban rates.

Power Cost Equalization (PCE) Eligible Community
A rural community that meets statutory and regulatory criteria for participation in the Power Cost Equalization Program, benefiting from reduced residential electricity rates.

Renewable Energy Fund (REF)
A grant program administered by the Alaska Energy Authority (AEA) providing cost-shared capital funding for renewable energy projects that reduce reliance on diesel and enhance local energy resilience.

Renewable Portfolio Standard (RPS)
A policy that requires utilities to obtain a specified percentage of their electricity from renewable sources. While Alaska does not currently have a statewide RPS, the CSEAP references it as a potential policy mechanism for future consideration.

Retro-commissioning
A process of analyzing and optimizing building systems so that it operates more closely to original designed energy usage parameters.

Sustainable Energy Transmission and Supply Development Fund (SETS)
A financing program managed by the Alaska Industrial Development and Export Authority (AIDEA) that provides loans and bond financing for large-scale energy infrastructure projects critical to decarbonization.

Tribal government
Sovereign, self-governing, and distinct political entities within the geographic bounds of the United States; for the purposes of CPRG, the 228 federally recognized tribes in Alaska.

Weatherization
The modification of buildings to reduce energy consumption through improvements in insulation, air sealing, and heating systems. The CSEAP highlights weatherization as a key strategy for residential energy efficiency and cost reduction.

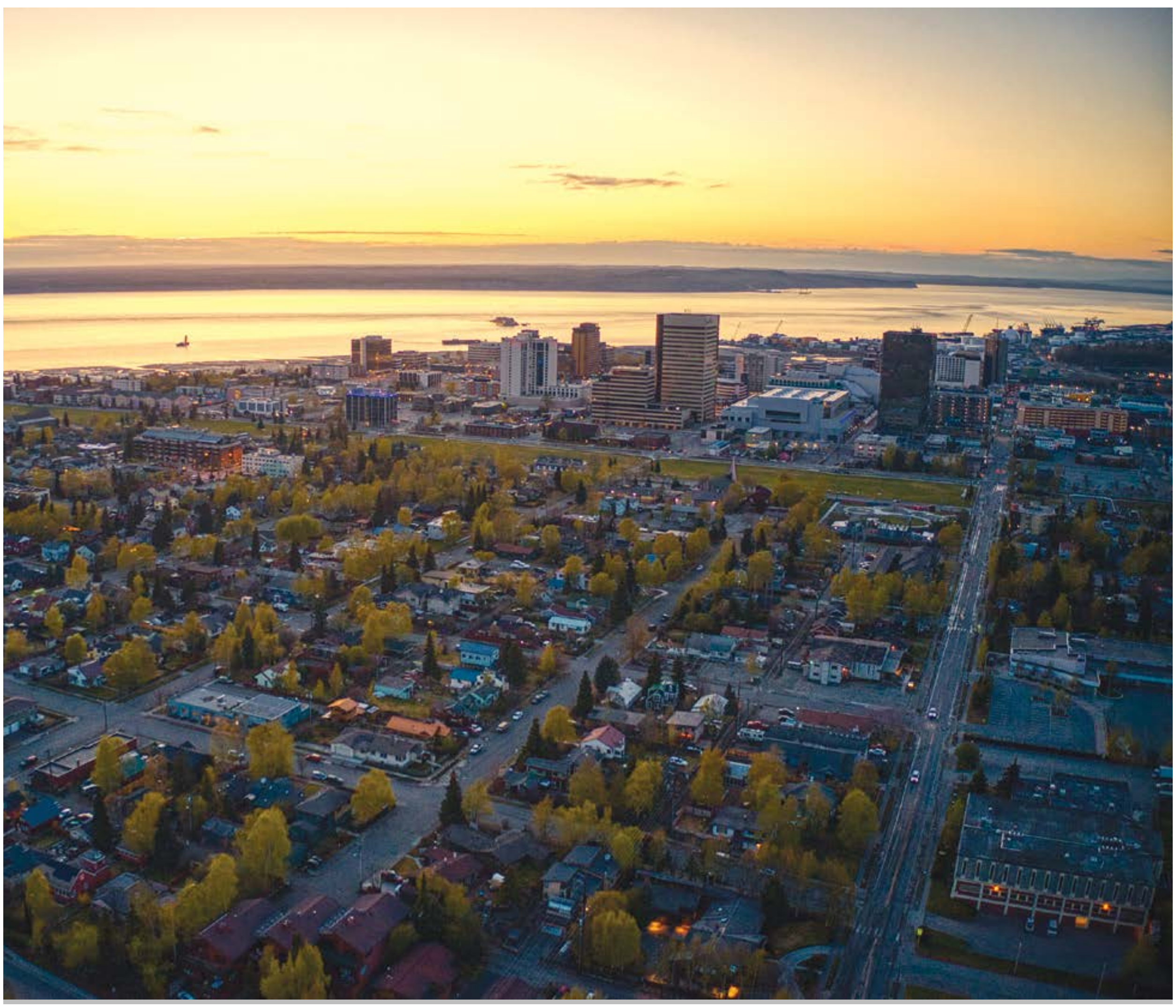
Workforce Development
Strategies and programs designed to train and retain skilled workers for Alaska's sustainable energy transition, including trade, technical, and engineering occupations critical to project implementation.

Acronyms

The following acronyms are used throughout this document, and this review serves as a guide in advance.

ACS	Census Bureau American Community Survey
AEA	Alaska Energy Authority
AELP	Alaska Electric Light & Power
AHFC	Alaska Housing Finance Corporation
AHS	Alaska Heat Smart
AML	Alaska Municipal League
ANCSA	Alaska Native Claims Settlement Act
ANTHC	Alaska Native Tribal Health Consortium
ARDOR	Alaska Regional Development Organization
ARIS	Alaska Retrofit Information System
AWIB	Alaska Workforce Investment Board
AWP	Alaska Workforce Partnership
BBNA	Bristol Bay Native Association
BTU	British Thermal Unit
CAP	Climate Action Plan
CBJ	City and Borough of Juneau
CCS	Carbon Capture and storage
CCUS	Carbon capture, utilization, and storage
CEJST	Climate and Economic Justice Screening Tool
CO2e	Carbon Dioxide Equivalent
CSEAP	Comprehensive Sustainable Energy Action Plan
CPRG	Climate Pollution Reduction Grant
DCRA	Division of Community and Regional Affairs
DEC	Alaska Department of Environmental Conservation
DEED	Alaska Department of Education and Early Development
DERA	Diesel Emissions Reduction Act
DNR	Alaska Department of Natural Resources
DOE	U.S. Department of Energy
DOL&WD	Alaska Department of Labor and Workforce Development
DOT&PF	Alaska Department of Transportation and Public Facilities
ECI	Energy Cost Index
EIA	U.S. Energy Information Administration
EPA	Environmental Protection Agency
EVSE	Electric Vehicle Supply Equipment
GHG	Greenhouse Gas
GPC	GHG Protocol for Cities – ICLEI framework for conducting GHG inventories
GWh	Gigawatt hour
GWP	Global warming potential
ICLEI	International Council for Local Environmental Initiatives
IPCC	Intergovernmental Panel on Climate Change
IPP	Independent Power Producer
IRA	Inflation Reduction Act
KPB	Kenai Peninsula Borough
LIHEAP	Low Income Home Energy Assistance Program
MMBTU	Million BTU

MSW	Municipal Solid Waste
MT	Metric Ton
MWh	Megawatt hour
NOFO	Notice of Funding Opportunity
OBBBA	One Big, Beautiful Bill Act
PCAP	Priority Climate Action Plan
POW	Prince of Wales Island
PSEAP	Priority Sustainable Energy Action Plan
QAPP	Quality Assurance Project Plan
REAA	Regional Education Attainment Area
REF	Renewable Energy Fund
SBDC	Small Business Development Center
SEC	Southeast Conference
TCC	Tanana Chiefs Conference
UA	University of Alaska
USDA	U.S. Department of Agriculture
VEEP	Village Energy Efficiency Program



Tables and Figures

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I. EXECUTIVE SUMMARY

Congressional Direction to Implement

From the Inflation Reduction Act, the EPA released formula planning grants to states, municipalities, and tribes under the CPRG program. These grants fund the creation of three types of planning documents through 2025—a Priority Climate Action Plan (PCAP), a Comprehensive Climate Action Plan (CCAP), and a Status Report.

In Alaska, several tribes and tribal consortia are creating plans at the community level, while the State is producing its plans—starting with a Priority Sustainable Energy Action Plan (PSEAP) to meet the requirements of the PCAP in 2024—via collaboration between the Department of Environmental Conservation and the Alaska Municipal League.

The State of Alaska has produced its Comprehensive Sustainable Energy Action Plan (CSEAP) in accordance with the guidance of the Climate Pollution Reduction Grant (CPRG) program, which satisfies the requirements of a Comprehensive Climate Action Plan (CCAP). The scope of the CSEAP is focused on a robust suite of mitigation measures that are consistent with CPRG guidelines to ensure as broad an opportunity as possible to deliver benefits to Alaska communities.

The CSEAP is organized into chapters that align with CPRG CCAP guidance. It includes external sources of information, including and especially as it relates to Alaska's Greenhouse Gas (GHG) Emissions Inventory. The CSEAP also includes a robust analysis of community benefits and workforce development needs as they relate to the measures described. This planning effort included extensive literature review, data analysis, and active stakeholder engagement throughout 2024 and 2025.

Scope of Plan

This plan contains a list of quantified GHG reduction measures that could be implemented by state agencies, municipalities, tribal consortia, and councils of government. In line with EPA guidance for this document, measures do not have to address all sectors nor meet a specific target for reductions. Measures for this plan are required to be "near-term, high-priority, implementation ready measures."

These measures generally focus on a statewide and regional scope that complement the community-level planning effort being conducted by grantees under CPRG tribal planning. Some of these measures are explained in greater detail where there is higher availability of information and likelihood of agency applications to implement.

Given the impetus to identify high impact measures that are ready to implement, this plan looks at existing programs or projects that can be boosted or completed with CPRG funding to deliver significant, long-lasting emissions reductions are ideal for the priority CPRG plan since they may be able to more easily complete a quality CPRG implementation grant application and receive funding.

Responsible Agency

The Governor designated the Alaska Department of Environmental Conservation (DEC) to lead the CPRG planning effort, and the DEC Division of Air Quality has been responsible for the development of the PSEAP. DEC contracted with the Alaska Municipal League (AML) to conduct the greenhouse gas emissions inventory (produced by Constellation Energy), collaborate with Tribal governments conducting their parallel planning efforts, facilitate stakeholder engagement, and work with technical experts at Launch Alaska, state agencies, and HDR to produce the CSEAP.

Special Considerations

For the purposes of the CPRG program, DEC also adopts and supports any mitigation measure available as of November 2025 contained within:

- Alaska DOT&PF's Carbon Reduction Strategy, which includes multiple lines of effort that support transportation-related emission reduction strategies.
- Municipal Climate Action Plans, including those of Juneau, Anchorage, Homer; and where relevant findings from Sitka and Fairbanks' CAP development processes.
- Tribal Climate Action Plans, produced by the CPRG planning efforts of the various tribes and tribal consortia under the program.

DEC recognizes the opportunity to collaborate with Tribal governments through the PSEAP development and implementation process, and the Department's comprehensive planning will advance ways in which complementary, non-duplicative efforts can achieve mutually beneficial goals. Tribal mitigation measures that also advance the State's goals of affordability and energy security will be prioritized, and the potential for multi-jurisdictional implementation will be leveraged to the greatest extent possible.

Vision, Goals, & Objectives

Vision Statement

Alaska's vision is for a sustainable energy action plan that results in improved economic development, community resilience, public health, and affordability for residents while delivering transformative and beneficial emissions reductions.

Goals

This vision can be met with goals that are realistic and consistent with Alaska's current conditions and aspirational future. The State of Alaska's goals are to:

1. Leverage available federal funding to achieve a widespread and impactful transformation at the residential, commercial, and public sector levels, and across sectors.
2. Deliver equitable benefits such that disadvantaged communities have access to resources that decrease their vulnerability and improve resilience.
3. Align activities with beneficial economic impacts that include improving job quality, increasing workforce opportunity, and strengthening business development.
4. Achieve corresponding environmental and public health benefits, including improving air quality.
5. Significantly diversify power generation with an emphasis on local, reliable, and affordable energy.

In aiming to increase energy efficiency, the state is focusing on key sectors like transportation and energy production that contribute significantly to emissions. Recognizing the complexities in managing emissions, the State highlights the following goals which are aspirational with metrics and timelines to be refined with sector-level quantified metrics.

- Emissions reductions of 7.3% by 2030: This milestone reflects the potential impact of reducing GHG emissions from 2022 levels by 7.3%. This would entail targeting high-emission sectors with immediate measures to reduce emissions.
- Emissions reductions of 14.6% by 2050: This milestone represents the challenging goal of cutting GHG emissions by 14.6% from 2022 levels. Achieving this would likely require a comprehensive transformation of the state's energy infrastructure, adopting sustainable practices across all sectors, and harnessing Alaska's natural resources for carbon sequestration.

Objectives

A review of Alaska's energy policy and input from agencies, political subdivisions, and tribes revealed several strategic goals—energy independence, economic diversification, and environmental and fiscal stewardship—which guided the development of this plan. Based on the review, these objectives are grouped into four core thematic areas:

Energy Affordability and Efficiency

- Support and incentivize energy efficiency, renewable energy, decarbonization, and beneficial electrification across all sectors.
- Increase the financing opportunities available for affordable and low-carbon clean energy and energy efficiency activities, especially those with supportive federal funding like geothermal.
- Establish programs to finance and support energy efficiency retrofits for residential, commercial, and public buildings.
- Support rural Alaska communities and at-risk urban Alaskans to eliminate their energy burden, which is largely driven by the high cost of space heating and the cost of imported liquid fuels.

Energy Independence and Infrastructure Modernization

- Improve electric generation efficiency in the Railbelt through a regionwide system operator and economic dispatch.
- Improve electric generation efficiency in rural Alaska through optimized power generation maintenance, improved renewable integration strategies, and reduced line loss.
- Increase the efficiency of and reduce carbon emissions in air, rail, road, and marine operations and transportation to reduce the cost of shipping and transportation for rural communities.
- Prepare for and promote a rapid transition to electric vehicles (EV) and lower-carbon fuels for transportation; this includes providing the requisite EV charging infrastructure, as well as shared bulk purchasing of EVs.

Economic Diversification and Workforce Development

- Sustainably increase value-added economic activities (e.g., fisheries, transportation, agriculture, mariculture and marine biotechnology, and petrochemicals) that leverage clean energy and maximize in-place opportunity for residents.
- Develop new carbon-neutral models of community economic development that support diversification, leverage local investment, and strengthen the clean energy economy.
- Promote and export technological and process innovation related to carbon emission reduction and sequestration.
- Increase and promote growth opportunities in careers that contribute to addressing carbon reduction, including engineering, architecture and design, business, and entrepreneurship.
- Explore the state's ability to access or leverage venture capital funds, reinsurance programs, green bond markets, and other innovative opportunities for funding.

Sustainable Resource Management and Energy Security

- Consider mechanisms to ensure that oil and gas development is conducted more efficiently and with decreased emissions, and with continued private investment.
- Identify ways to reduce fugitive emissions and increase carbon capture, use, storage, and sequestration.
- Set a target of renewable energy that should be included in new oil, gas, mining, and industrial projects.

Proposed Targets and Strategies

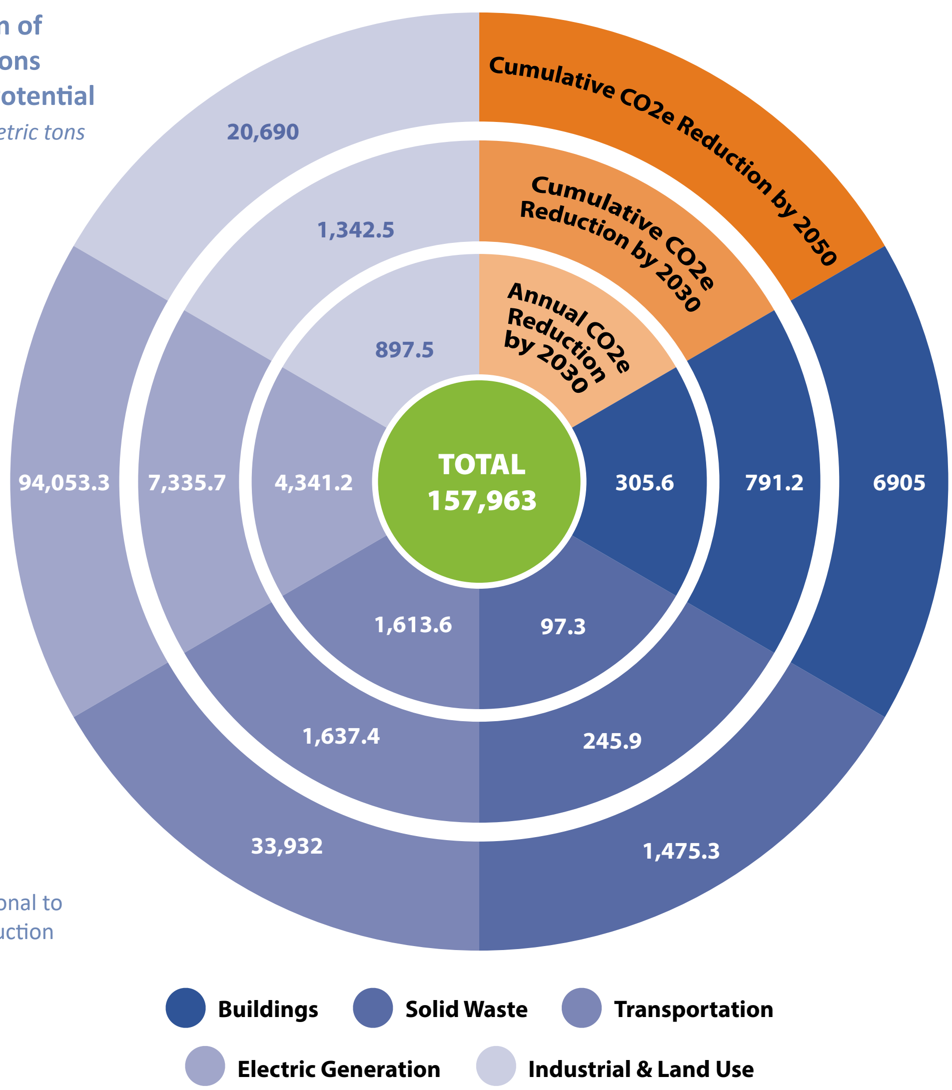
To satisfy the above objectives, the Alaska Comprehensive Sustainable Energy Action Plan (CSEAP) provides a coordinated, evidence-based framework for reducing greenhouse gas (GHG) emissions while advancing Alaska's long-term economic, energy, and community priorities. Developed under the U.S. Environmental Protection Agency's Climate Pollution Reduction Grant (CPRG) program, the plan outlines practical, fiscally responsible strategies to strengthen community resilience and ensure that emissions reduction actions support—rather than compromise—energy reliability, affordability, and state prosperity.

Grounded in a 2022 GHG inventory and trend analysis, the CSEAP identifies Alaska's principal emission sources across the energy, transportation, industrial, waste, and land-use sectors. It recognizes the state's unique challenges (including reliance on diesel microgrids, high energy intensity in industrial operations, and dependence on oil and gas revenues) while highlighting opportunities to modernize infrastructure and diversify the economy.

The plan outlines 27 mitigation measures that are both technically and economically viable, including strategies for energy efficiency, electrification, renewable energy integration, industrial process improvements, carbon management, and waste reduction. The potential emissions reduction benefits associated with each project are summarized in the chart below.

Visualization of Total Emissions Reduction Potential

In thousand metric tons



* Not proportional to % of Total Reduction

In addition to emissions reduction, these projects are designed to advance the four core objective themes:

Energy Affordability and Efficiency – By targeting efficiency improvements and beneficial electrification, the CSEAP aims to lower household and community energy costs, enhance system reliability, and deliver public health benefits through reduced exposure to diesel and methane emissions.

Energy Independence and Infrastructure Modernization – Investments in renewable generation, storage, and transmission strengthen Alaska's energy security, reduce dependence on imported fuels, and modernize infrastructure in both interconnected and rural microgrid systems.

Economic Diversification and Workforce Development – The plan emphasizes local job creation and skills training, supporting employment transitions within traditional energy sectors and positioning Alaska as a hub for cold-climate energy innovation and sustainable technology development.

Sustainable Resource Management and Energy Security – Carbon management, waste reduction, and responsible resource development ensure that environmental stewardship aligns with long-term energy stability and fiscal resilience.

To finance implementation of these projects, the CSEAP suggests a three-tiered framework:

- **Foundational Pathway –** Delivers near-term, high-visibility results through CPRG and existing federal and state programs.
- **Integrated Pathway –** Promotes regional coordination and blended financing through public–private partnerships.
- **Transformational Pathway –** Establishes lasting institutional mechanisms, including the proposed Alaska Sustainable Energy Corporation (ASEC), to mobilize capital and support large-scale innovation.

These pathways integrate grants, loans, and private investment through revolving funds, layered financing, and risk-sharing mechanisms, leveraging Alaska's financial institutions and Native community development organizations to build a resilient funding ecosystem.

A robust monitoring, evaluation, and reporting framework will be required to ensure transparency and accountability. Annual reporting, quantitative metrics, and independent evaluations can track progress toward GHG reductions, cost savings, job creation, and energy affordability improvements. A centralized data platform will harmonize reporting across federal and state programs, reducing administrative burden and supporting adaptive management.

The CSEAP presents a balanced, pragmatic approach that recognizes Alaska's dependence on natural resource revenues, high infrastructure costs, and the need for equitable cost distribution. Programs will include cost-sharing and technical assistance to protect rural, tribal, and at-risk communities while aligning with the state's priorities for regulatory efficiency and infrastructure acceleration.

The strategy is intended to provide a roadmap for sustainable development and energy independence. Through coordinated action, innovative financing, and inclusive partnerships, Alaska can reduce emissions, strengthen its economy, and secure reliable, affordable energy for future generations. The plan demonstrates how a resource-dependent state can lead in emissions reduction actions while upholding the principles of self-reliance, sustainability, and stewardship.

II. INTRODUCTION TO CSEAP

Summary of Plan Engagement

The development of this comprehensive plan included substantial engagement with state agencies, local governments, and Tribes. The process included facilitated bi-weekly calls with the state's CPRG Working Group, which includes all Tribal planning awardees and consortia, to ensure close coordination.

A series of targeted meetings, workshops, and interviews were held throughout 2024 and 2025 with entities including housing authorities, local governments, state agencies, and rural energy conference attendees to identify needs, solicit measures, and gather feedback on workforce challenges and opportunities. Further details on engagement in the development of this plan are given in section III.

Plan Elements and Key Takeaways

The CSEAP represents a thorough analysis of the potential for emission reduction in Alaska, with corresponding mitigation measures.

Key takeaways include:

- The State's collaboration with tribes and tribal consortia is critical to successful implementation.
- A comprehensive suite of mitigation measures across all major sectors has been identified, with the potential to leverage over $4 billion in investment to advance Alaska's vision for sustainable energy.
- Successful implementation will require a coordinated investment strategy that braids CPRG funds with other federal, state, and private capital to meet the unique needs of Alaska's communities—especially as federal funding becomes more limited.
- Addressing workforce challenges, especially retention of skilled labor in rural communities, is essential for the successful implementation of the measures outlined in this plan.

2022 Greenhouse Gas Inventory

Section IV of this plan contains a summary of the statewide GHG inventory completed for calendar year 2022. This inventory work has also produced Alaska's first comprehensive set of community-level emissions inventories summarized in Appendix C, resulting in opportunities to evaluate GHG reduction measures broadly at the local, regional, and statewide levels. The emissions inventory and community reports include:

- Stationary Combustion by fuel type, and percentages by sector.
- Transportation by fuel type, and percentages by road and non-road activity.
- Purchased Electricity by energy type, with percentages contributed.
- Industrial Processes will be addressed during comprehensive planning.
- Methodology, consistent with the approved QAPP.

The methodology used in the inventory involved the collection or modeling of energy, fuel, and vehicle data, and the calculation of GHG emissions based on fuel types and uses from different sources and sectors. The inventory uses EPA's standard GHG emissions factors (Assessment Report 5) and GPC framework to determine metric tons of carbon dioxide equivalent (MTC02e) for three greenhouse gases: carbon dioxide (CO2), methane (CH4), and nitrous oxide (N2O).

CO2e is an abbreviation for carbon dioxide equivalent, the internationally recognized measure of greenhouse gas emissions. Converting emissions of non-CO2 gases to units of CO2e allows greenhouse gases (GHGs) to be compared on a common basis: the ability of each GHG to trap heat in the atmosphere. In this report, non-CO2 gases have been converted to CO2e using internationally recognized Global Warming Potential (GWP) factors from Intergovernmental Panel on Climate Change (IPCC) assessment reports.

The IPCC developed GWPs to represent the heat-trapping ability of each GHG relative to that of CO2. For example, the GWP of methane is 25[1] because one metric ton of methane has 25 times more ability to trap heat in the atmosphere than one metric ton of carbon dioxide. The GWP of nitrous oxide is 298. The CO2e measure is used worldwide to report the equivalent weight of carbon dioxide in metric tons (MTCO2e) (1,000 kilograms or 2,205 pounds). The global warming potential from each greenhouse gas is based on the amount of carbon dioxide that would have the same global warming potential measured over a specified time period.

Emissions Reduction Strategies & Measures

The State has identified more than $4 billion in potential mitigation measures that could be advanced by state agencies, local governments, tribes, utilities, and others. This could easily be expanded in the development of the comprehensive planning process, and with measures applied at a more micro level. The State's PSEAP has focused on broadly applicable measures that have maximized the impact of federal investment. Some measures with limited statewide emissions are included as stand-out examples of programs or technologies that could be greatly impactful if implemented on a greater scale. Programs with this transformative impact include C-PACER and AHFC's weatherization program. Emerging technologies with this potential for transformative impact include the Department of Public Safety's hybrid-electric aircraft pilot project and Kotzebue Electric Association's long-duration energy storage system.

Measures in this plan, sorted by sector are:

- **Residential:** Includes expanding the AHFC Weatherization Assistance and Home Energy Rebate programs, supporting beneficial electrification with heat pumps in Southeast and statewide, and developing a statewide framework for modern building codes.
- **Non-Residential:** Focuses on energy efficiency, weatherization, and electrification for public buildings and assets, including University of Alaska campuses, DOT&PF facilities, and municipal buildings like the Mendenhall Wastewater Treatment Plant.
- **Solid Waste:** Features methane capture at the Central Peninsula Landfill and establishing a regional composting program for Southeast Alaska tribal communities.
- **Transportation:** Includes port electrification in Juneau and Seward as part of the "Green Corridor" initiative, deploying statewide EV charging infrastructure, developing Sustainable Aviation Fuel (SAF), and piloting hybrid-electric aircraft.
- **Electric Generation:** Proposes major projects like the Bradley Lake (Dixon Diversion) hydropower expansion, support for community-scale renewable generation, expanding AEA's DERA and VEEP programs, recapitalizing the Renewable Energy Fund (REF), and deploying battery energy storage systems (BESS) in communities like Unalaska.
- **Industrial & Land Use:** Includes establishing a C-PACER financing program in Unalaska to support industrial energy efficiency and advancing the State's carbon capture, utilization, and storage (CCUS) and carbon offset programs.

Benefits Analysis

The CSEAP includes a comprehensive analysis of the benefits and disbenefits of the proposed measures. Measures are expected to improve public health by reducing harmful emissions, lower energy costs for residents and businesses, create and preserve high-quality local jobs, and enhance community resilience to environmental impacts and disasters. The plan also acknowledges potential disbenefits, such as the high implementation costs in remote and harsh conditions and the state's economic dependence on fossil fuels; measures that create more disbenefits than benefits are not included in this plan.

Review of Authority to Implement

All reduction measures have been evaluated for the proponent's authority to implement. Key state agencies like the Alaska Housing Finance Corporation (AHFC), Alaska Energy Authority (AEA), and DOT&PF, as well as municipal and Tribal governments, possess the necessary statutory authority to implement the GHG reduction measures proposed in the CSEAP. The plan also outlines in Section IX, Government Policies and Regulation, a framework for Monitoring, Reporting, and Verification (MRV) to track progress and ensure accountability.

Intersection with Other Funding Availability

CSEAP details a sophisticated investment strategy to align CPRG funding with a broad suite of other federal, state, Tribal, and private resources. Key opportunities include leveraging programs from the Denali Commission, state initiatives like the Renewable Energy Fund (REF) and Power Cost Equalization (PCE) program, Tribal funding from the BIA and DOE, and private and philanthropic capital. The strategy is designed around three flexible implementation pathways—Foundational, Integrated, and Transformational—to help communities of varying sizes and capacities access and braid these diverse funding streams.

Workforce Planning Analysis

The CSEAP includes a comprehensive analysis to understand the workforce needed to meet Alaska's sustainable energy goals. It identifies critical occupations, significant challenges unique to Alaska's geography and economy, and strategic recommendations for building a robust, resilient, and local sustainable energy workforce.

After analyzing major sustainable energy-related occupations as they relate to the plan's measures, the analysis identifies ten priority occupations based on their relevance, projected high demand, and potential to provide a living wage. The process identified key workforce challenges that include worker retention, rural workforce needs, geographic barriers, and cyclical, grant-based activities.

Despite the challenges impacting workforce development, Alaska has unique assets and is already implementing innovative solutions to build its sustainable energy workforce, including hub community training, flexible apprenticeships, tapping into new worker pools, and considering seniors as a training resource.

The analysis provides a set of actionable recommendations to guide the state's workforce development efforts in Section VII of this document.

Conclusion

The CSEAP includes a final review of the outcomes of the planning effort, highlighting key considerations for future planning, monitoring, and next steps in Section XI.

Appendices

In addition to supplementary materials, the CSEAP includes Community Sustainable Energy Roadmaps, structured by census area to identify risks and vulnerabilities affecting communities, and offering a suite of options for communities to consider as mitigation strategies.

Workforce Regional Findings Appendix

This appendix provides a region-by-region overview of Alaska's workforce capacity for key sustainable-energy-related occupations, highlighting how training availability and on-the-job training ratios vary across the state's diverse geographies and influence each region's ability to meet future labor demand.

Technical Appendix

This appendix includes detailed information about the calculations and material used to produce emissions reduction estimates and projections.

Community Roadmaps Appendix

This appendix presents a series of census area–level roadmaps that communities can use as guides for developing their own Sustainable Energy Action Plans (SEAPs). These roadmaps synthesize multiple data sources—including statewide greenhouse gas emissions, federal social vulnerability indicators, and generative AI–assisted analysis—to identify mitigation opportunities and strategies tailored to local conditions. Their purpose is to translate the findings of this statewide plan into community-scale insights that can support local planning, funding applications, and policy development.

Each census area roadmap provides a technical foundation with a baseline profile, a vulnerability assessment, mitigation opportunities, and implementation considerations. These are not prescriptive but are designed as adaptable starting points for local governments, Tribal entities, and regional organizations to use in their own resilience, hazard mitigation, and infrastructure planning. By aligning an at-risk community framework with emissions and energy data, the roadmaps help ensure that investment decisions advance both equity and efficiency, connecting statewide strategy with community-level action.

III. OVERVIEW OF EXISTING CONDITIONS AND METHODOLOGY

Alaska's Grid Conditions

There are two distinct grid categories in the State of Alaska: Railbelt and remote. Most of the state's population (~70%)[2] resides in urban areas of what's known as the Railbelt. This relatively small interconnected electrical system is home to significant Department of Defense assets, tribal governments, highly diverse populations, and a remarkable variety of carbon and non-carbon energy resources.

Alaska's Railbelt is serviced by five electric utilities (four cooperatives and one municipal utility) and is an interconnected grid that loosely follows the route of the Alaska Railroad. The State of Alaska, through the Alaska Energy Authority (AEA), owns significant transmission and generation infrastructure on the Railbelt system. The residents and businesses along the Railbelt consume approximately 75%[3] of the state's electricity across a service area like the distance from West Virginia to Maine. On an annual basis, the Railbelt generates approximately 5000 GWh[4]. Interconnection between regions is by single transmission lines, which limits economic transfers and negatively affects system resiliency. The opportunity for residential solar in new builds and retrofitting existing buildings is high in this market.

The remaining ~30% of the state's population resides in over 200 rural and tribal communities and rely on local and regional power generation. These remote, islanded grids are owned and operated by approximately 100 utility operators, including cooperatives, tribal, and municipal entities. Most of these rural Alaska communities are only accessible by plane or marine vessel, with over half classified by the Denali Commission as distressed communities.

A recent analysis[5] by the University of Washington Center for Environmental Health Equity and partners reveals that Alaska faces the highest energy burden in the United States, with rural, low-income, and Indigenous communities disproportionately affected. The statewide average energy burden—defined as the percentage of household income spent on electricity, heating, and fuel—is 4.3%, compared to 2.7% in the Lower 48. In Southwest Alaska, the median burden reaches a severe 12%, while households earning less than 30% of Area Median Income face a staggering 22.9% burden. These costs are driven by geographic isolation, reliance on diesel-powered microgrids, and inefficient housing stock.

The consequences of high energy burden are far-reaching: families face trade-offs between heating and essentials like food or medicine, renters lack agency to improve efficiency, and cultural practices such as subsistence hunting and fishing are disrupted. The report recommends expanding weatherization programs, improving access to Power Cost Equalization (PCE), and supporting Tribal Independent Power Producers (IPPs) to promote energy sovereignty and resilience. These findings underscore the urgent need for equitable, community-driven energy solutions across Alaska's diverse grid systems.

Except where utilities have legacy hydroelectric generation, such as in large portions of Southeast Alaska, rural communities[6] are generally supported on the Power Cost Equalization (PCE) program that subsidizes electric rates for rural consumers to bring them in line with those paid by consumers in Anchorage, Fairbanks, and Juneau. Since 1985 when it was implemented to spread the benefit of subsidized energy projects in urban Alaska to rural Alaska, PCE has been a critical feature of Alaska's energy landscape that has helped soften the energy burden faced by rural communities.

To move towards a resilient economy, characterized by less reliance on fossil fuels for energy, the State must embrace local, clean energy that can power value-added economic development. Diversification in this way will strengthen the State's economy overall and increase opportunities for residents. Private sector innovation is increasingly driving economic development in the state. This trend can be supported within priority industries, with incentives in places where clean energy is used. Supporting centers of innovation such as business accelerators and incubators that assist start-ups focused on value-added activities is critical to creating private sector innovation and fomenting entrepreneurship. The State and other entities involved with the regulation and implementation of Alaska's electric grids might consider soliciting investment from private industry to support local energy generation goals. For energy technologies that are emerging and have high upfront costs, the State might consider how they can improve access to funding for potential high benefit technologies; for example, geothermal might be supported with forgivable loans that support exploration.

Review of Existing Local Climate Action Plans (CAPs)

Since Homer completed the state's first CAP in 2007[7], five other Alaska communities have worked to produce CAPs and their associated emissions inventories. As a planning document, a local CAP must be developed by the local or tribal government, reviewed by the public in a stakeholder engagement process, and finally adopted by the entity's governing body. Only three Alaska communities have completed this process, with three others in progress.

Most communities who engaged in a CAP process produced some version of an emissions inventory. Both Anchorage and Homer used the ICLEI ClearPath Tool following ICLEI U.S. Community Protocol standards. Anchorage modeled their Emissions Inventory after the *Ann Arbor 2019 Community-Wide Greenhouse Gas Inventory Report*[8]. Emissions inventory documentation often focuses primarily on a municipal scope rather than a community scope, such as in Homer and Sitka.

Likely because of the relatively labor-intense process behind developing an emissions inventory, additional inventories have been challenging. Juneau, which has inventories for 2007, 2010, and 2021, is the only community with more than two years of inventories on record.

Beyond the plans discussed above, relevant planning efforts in Alaska have largely focused on either 1) affordable, sustainable solutions for rural microgrids or 2) adaptation efforts to respond to the impacts of greenhouse gases. Importantly, they provide decisional support for advancing community goals. All Alaska municipalities with planning commissions are required to submit comprehensive plans under Alaska statute as a "compilation of policy statements, goals, standards, and maps for guiding the physical, social, and economic development, both private and public, of a community… [including] statements of policies, goals, and standards; a land use plan; a community facilities plan; a transportation plan; and recommendations for implementation of the comprehensive plan."[9] As the primary document guiding the actions of municipal officials, comprehensive plans have many implications for emissions reduction efforts.

A review of borough-level comprehensive plans found many emissions reduction measures with relevance to this plan. For example, the projects in Juneau's 2011 Climate Action Plan were adapted into the Sustainability section of the 2013 Comprehensive Plan, which now serves as the foundation for more relevant planning efforts such as the 2018 Juneau Renewable Energy Strategy. Comprehensive plans provide the authority for municipal officials to pursue emissions reduction projects. The Kodiak Island Borough Plan put alternative energy solutions for rural communities in the borough as high priority actions. In the Energy chapter of the North Slope Borough's Comprehensive Plan, energy efficiency technologies like weatherization, waste heat recovery, and innovative housing technology are included. The Northwest Arctic Borough Comprehensive Plan establishes the goal to "invest in renewable energy, promote energy efficiency, and reduce reliance on imported fuels," which is furthered via proposed actions and community-level data review via their regional energy plan.

Hazard mitigation planning, which is often a FEMA-funding requirement for many localities, may lead communities to consider some similar efforts as natural hazard adaptation planning. While these do not pertain directly to GHG reduction measures, there may be overlap between proposed adaptation measures and CPRG projects—e.g., projects that increase micro-grid resilience and reduce emissions in these communities. A review of Alaska adaptation plans revealed lack of funding as a major implementation issue and emissions reduction actions projects may help alleviate this.

Working with the Office of Indian Energy, many communities around Alaska have created Strategic Energy Plans[10] that set renewable generation goals. These plans are confidential, proprietary information belonging to the entity (primarily tribal governments and native corporations) that have completed them, so they are not available via any public repository. Those entities completing CPRG planning for Alaska's tribal governments might benefit from requesting and reviewing them.

Planning Process & Methodology

The State's planning process included a Public and Stakeholder Engagement Plan that implemented efforts to work with state agencies, tribes, and local governments, evaluating emissions sectors (buildings, electric generation, transportation, land use, and industrial) for opportunities to reduce emissions while providing community benefits.

Stakeholders were primarily infrastructure decision-makers at state, regional, and community levels and included:

- State agencies (AEA, DNR, DOT&PF, AHFC, primarily)
- Tribal consortia
- Boroughs
- Cities
- ARDORs
- Energy efficiency organizations
- University of Alaska
- Regional Utilities
- Non-governmental organizations
- General public

Outreach Activities

Stakeholder engagement is a systematic process designed to provide clear and consistent information and engage stakeholders at key phases of project development. The CSEAP process included the following activities to engage key constituents in identifying needs and opportunities relative to the CPRG program.

Community Engagement
CPRG Working Group. Given the short timeline and need to avoid duplication of effort, AML and DEC have focused on coordinating their outreach and engagement efforts with the CPRG Working Group, which includes all Tribal planning awardees and consortia. Regular participants in this group include those working on tribal planning grants for ANTHC, TCC, Kawerak, and BBNA.

State Agencies. The development of the Priority Sustainable Energy Action Plan (PSEAP) required intensive engagement with state agencies that had not previously been engaged in or prioritized carbon reduction activities, which required new effort to understand and respond to this opportunity, such as DEED. Scoping of this plan is also informed by recent state energy planning efforts for agencies like the Alaska Energy Security Task Force Report.

Political Subdivisions. Much of the communication about this program, and soliciting potential measures, has been completed with city and borough governments, who regularly engage with AML's infrastructure programming. Outreach has also been conducted with school districts, tribes, and other public entities. These anchor institutions will have the greatest ability to implement wide-ranging and impactful emission reduction measures.

Public Awareness. Several public presentations about CPRG and the development of this plan have been given by AML staff and in coordination with ANTHC's planning team at major events like the Infrastructure Symposium and Alaska Local Government Conference. There have also been several smaller virtual and in-person presentations to groups including the Alaska Municipal Climate Network and the Alaska Environmental Health Association.

Additional activities kept stakeholders informed and engaged throughout the project, including:

- Regular project updates to municipal and state partners
- Dedicated project website
- Public hearings and consultations
- Reporting mechanisms for feedback and concerns

Presentations and Small Group Meetings

November 16, 2023 – Alaska Housing Authorities

AML hosted a zoom meeting on November 16, 2023, which was attended by approximately twelve participants, representing most of the housing authorities around the state. The meeting focused on the CPRG grants and opportunities to support weatherization programs in the communities. Participants also discussed workforce needs and evaluation measures such as demonstrating savings and emissions reductions.

December 15, 2023 – Local Government Conversation

AML met with approximately 20 interested elected and appointed borough officials from around Alaska's boroughs and state agencies to identify potential partnerships for CPRG grants. This included input from municipal representatives of Juneau, Anchorage, the Lake & Peninsula Borough, and the Kodiak Island Borough.

April 3, 2024 – PSEAP Sustainability and Affordable Planning

About 35 representatives from state agencies, local governments, and civic groups attended a Sustainability and Affordability Planning session at the Alaska Infrastructure Symposium. The meeting focused on strategic planning, with six breakout groups identifying key themes for continued progress, including:

- Energy Efficiency and Renewable Energy Adoption: Implement measures to improve energy efficiency and transition to renewable energy.
- Workforce Development: Workforce development and training are crucial for implementation, building local capacity for installation, maintenance, and management of energy systems.
- Collaboration and Stakeholder Engagement: Collaboration among stakeholders is essential for effective planning and implementation of sustainable energy initiatives.
- Infrastructure Modernization: Modernizing infrastructure, including upgrading transmission networks, water treatment plants, and power generation systems is essential for integrating renewable resources.

- Financial and Regulatory Considerations: Implementation is limited by financial constraints, regulatory barriers, and the availability of funding.
- Community Resilience: Community resilience building must be incorporated into design, funding allocation, and infrastructure development for long-term sustainability.
- Education and Awareness: The benefits of sustainable energy, available incentives, and the importance of long-term investments in infrastructure can support informed decisions.
- Policy and Planning Coordination: Coordination between state and local governments, regulatory bodies, and industry stakeholders is crucial for effective energy planning, prioritization, and policy implementation.

October 4, 2024 – Rural Energy Conference

A work session following the Rural Energy Conference invited statewide and tribal entities to participate in a more detailed conversation about what sorts of measures would benefit their communities. With six participants, feedback focused on the importance of lowering energy costs to improve the sustainability of communities and improve food security. A particular example that was raised was the efforts by a Western Alaska community to develop greenhouses that was primarily held up by the high cost of heating the space; the group discussed how this case would be improved with abundant, cheap heat sources (such as what can be supplied by geothermal or biomass), in addition to cheaper electricity.

December 2024 – Annual Local Government Conference

21 community leaders joined CPRG planning staff to discuss their energy needs, including attendees from Northwest Arctic Borough, Elim, King Cove, Kotik, Scammon Bay, Houston, Soldotna, Sitka, and Seward. Discussion focused on identifying what sectors were most important to municipal leaders as well as identifying examples of current projects and programs that could be used to model measures.

April 28, 2025 – Workforce Planning Analysis

Breakout groups identified the following priorities:

- Operations and maintenance of energy systems
- Opportunities for partnerships with Anchorage School District and University of Alaska Engineering Department, Iligsagvik College, NACTEC, University of Alaska Bristol Bay campus to improve training capacity and develop rural, regional workforces.
- Need for local HVAC, mechanics, technicians, and project managers in rural communities
- Need for grand writers and administrators in the communities.

Interviews – April to June 2025

AML contacted 20 training programs, state experts, and implementing agencies requesting interviews as part of the CSEAP Workforce Development Analysis. The purpose of the interviews was to identify workforce challenges and opportunities relative to the CSEAP's goals. By identifying barriers, perspectives and current training needs, the survey was designed to help the state know which occupations are most needed and suggest recommendations for expanding workforce capacity.

Specific questions included:

- What skills are needed in rural communities to support a sustainable energy workforce?
- What workforce is needed to implement Alaska Energy Authority's Tier 2 and 3 diesel engine replacement program?
- Comments on the Alaska Vocational Technical Center's (AVTEC) ability to meet current training needs?
- Need for and challenges to use solar photovoltaic systems in Alaska.

Tribal Planning Efforts

All the priority plans for Alaska tribal recipients of the CPRG planning grant were submitted to EPA in early 2024, and a review of their work was critical to the direction of the state's CPRG planning. Since then, additional work has been completed by tribal planners, including the finalization of several comprehensive plans; meanwhile, other tribal planning efforts have received extensions to 2027. These plans, while diverse in their specific priorities and approaches, collectively underscore the urgent need for localized, culturally relevant solutions to the sustainable energy challenges facing Tribal communities. A review of these plans reveals several major highlights and recurring themes that are integral to a comprehensive statewide strategy.

A predominant focus across most Tribal plans is the critical need to reduce reliance on diesel fuel for both electricity generation and heating. This is driven by the high and volatile cost of fuel in remote communities, which places a significant economic burden on households and Tribal governments, as well as a desire to reduce greenhouse gas emissions and improve local air quality. Consequently, the development of renewable energy projects is a cornerstone of nearly every Tribal plan. Solar energy, often paired with battery energy storage systems (BESS), emerges as a leading strategy, with numerous plans detailing ambitions for community-scale solar arrays to offset a significant portion of diesel consumption. Several plans also explore the potential for wind energy, particularly in coastal regions, and some identify opportunities for biomass and hydropower projects where local resources permit.

Energy efficiency is another major highlight, with a strong emphasis on weatherization for both residential and community buildings. Many Tribal plans recognize that reducing energy demand is as crucial as developing clean energy sources. Initiatives to upgrade insulation, install energy-efficient windows and doors, and adopt more efficient heating systems are common priorities aimed at lowering energy costs for residents and improving the comfort and longevity of housing stock. These efforts are often coupled with calls for energy audits to identify the most impactful and cost-effective retrofits.

Beyond energy, the Tribal plans highlight a holistic approach to emissions reduction actions that is deeply intertwined with community well-being and cultural preservation. Waste management is a frequently cited concern, with many communities seeking to improve solid waste disposal practices and explore composting and recycling initiatives to reduce landfill methane emissions and protect local ecosystems. Additionally, the plans emphasize the importance of building local capacity through workforce development and training programs, ensuring that the transition to a clean energy economy creates sustainable employment opportunities for Tribal members.

Tribal PCAPs emphasized the importance of Indigenous knowledge in determining a path forward for their work. Many plans explicitly link action to the protection of subsistence resources and traditional ways of life, recognizing that a healthy environment is fundamental to cultural identity and community resilience. This perspective underscores the importance of collaborative, community-driven planning processes that respect Tribal sovereignty and prioritize the unique needs and values of each community.

These tribal CPRG plans not only lay out a path for local communities to achieve greater energy independence, but they lay out a blueprint for creating healthier, more resilient, and self-sufficient communities for generations to come. The State of Alaska recognizes the immense value of these Tribal-led efforts and is committed to fostering a collaborative partnership to achieve our shared goals of a sustainable and prosperous future for all Alaskans.

IV. ALASKA GREENHOUSE GAS (GHG) INVENTORY

Methodology

This inventory summarizes scope 1 GHG emissions for Alaska in calendar year 2022. It uses activity data for energy, fuel, and vehicle use, combined with EPA emission factors, to calculate metric tons of CO2e for CO2, CH4, and N2O. The methodology is consistent with the Global Protocol for Community-Scale GHG Emissions Inventories (GPC) and uses GWP factors from the IPCC 5th Assessment Report.

This inventory's methodology utilizes activity data and emission factors to calculate emissions.

Emissions (CO2) = Activity Data (MMBTU) x Emission Factor (CO2 per MMBTU)

Activity data represents the relevant measurement of energy use, such as fuel consumption by fuel type (propane, heating oil, diesel, gasoline, jet fuel, etc.) and metered electricity use, and is collected from a variety of sources, listed below. To translate energy use data, factors from the EPA's 2022 GHG Emissions Factors Hub[11] were used.

Table 2 provides an overview of data on energy use total emissions by sector and source (fuel type) because of the emissions inventory process. MMBtu represents one million British thermal units and is a unit of energy used to compare across different fuel quantities, like diesel vs. electricity - all units of fuels, electricity, and wood have been converted to MMBtu for purposes of comparison.

CO2e is an abbreviation for carbon dioxide equivalent, the internationally recognized measure of greenhouse gas emissions. Converting emissions of non-CO2 gases to units of CO2e allows greenhouse gases (GHGs) to be compared on a common basis: the ability of each GHG to trap heat in the atmosphere. In this report, non-CO2 gases have been converted to CO2e using internationally recognized Global Warming Potential (GWP) factors from Intergovernmental Panel on Climate Change (IPCC) assessment reports for 2022 per EPA.[12] The IPCC developed GWPs to represent the heat-trapping ability of each GHG relative to that of CO2.

This report used the 2022 calendar year for the reporting year; a standardized emissions inventory report comprises all GHG emissions occurring during a calendar year. Among others, the United Nations Framework Convention on Climate Change, the Kyoto Protocol, the European Union, The Climate Registry, and the California Climate Action Registry all require GHG inventories to be tracked and reported on a calendar year basis.

In calculating emissions from stationary combustion using fuel use activity data and emission factors by fuel type involves the following steps. First, the inventory process determined the total annual consumption of each fuel combusted at community-level sectors, as well as facilities and assets whenever available. Then, we determined the appropriate CO2, CH4 and N2O emission factors for each fuel using EPA's factors.[13] Finally, we calculated each fuel's CO2, CH4 and N2O emission contributions, and lastly converted CH4 and N2O emissions to MTCO2 equivalent to determine total emissions. Then based on community membership the data was aggregated at the borough level and then at the state level.

Residential and commercial electricity and fuel consumption were estimated for Alaska communities using a similar spatial refinement methodology previously performed by the National Renewable Energy Laboratory (NREL) from the DOE Leading through Energy Analysis and Planning (Cities-LEAP)[14] project.

This methodology represents a revised model using newly available data sets to estimate community-level data for the 2022 calendar year. Modeling was conducted at the U.S. Census tract level and then aggregated accordingly to the community level. For stationary combustion, a number of datasets were used to conduct the analysis, principally the Residential Energy Consumption Survey, and Energy Information Administration's Commercial Buildings Energy Consumption Survey (RECS and CBECS); although data from ARIS, PCE, and other localized datasets was used as well.

The estimates also use EIA's SEDS totals, which itself is based off of regionally aggregated energy consumption surveys, such as for surveys of energy consumption by residential households from the Residential Energy Consumption Survey (RECS, Form EIA-457) and by commercial buildings from the CBECS (Form EIA-871) provide detailed information about the energy end users, their size, their assumed stock of energy-consuming equipment and appliances, and their total energy consumption and expenditures.

Although MECS (Form EIA-846) collects consumption by type of use and fuel switching capability from manufacturing establishments grouped by manufacturing classification, usually 3-digit NAICS codes, the FLIGHT database of the GHGRP was used instead at the reporting facility level.

Transportation emissions were modeled using EPA's Motor Vehicle Emission Simulator (MOVES) model for on-road (passenger vehicles, motorcycles, trucks, buses, etc.) and non-road (equipment, recreational or other crafts) assets at the borough level and downscaled using ACS and NAICS factors. MOVES models had specific fuel-types per vehicle type.

Most electricity generation emissions came from Power Cost Equalization Program (PCE) for rural energy generation and consumption, whereas utility territory specific details from EIA form 861 and downscaled by communities within the territories. Only source and sector emissions were covered with grid-losses assumed to be the difference between upstream generation and downstream consumption.

TABLE 2: 2022 Statewide GHG Emissions (MT CO2e) by source and sector for calendar year 2022.

Sector	Fuel type	Energy in Billion BTU	MT CO2e
Residential	Distillate fuel oil	7,955	582,704
	Propane	419	25,752
	Electricity consumption	7,110	670,260
	Natural gas	21,054	1,117,125
	Wood energy	6,080	570,304
Commercial	Distillate fuel oil	8,604	630,243
	Motor gasoline	536	37,638
	Propane	816	50,151
	Electricity consumption	8,730	822,977
	Natural gas	16,439	872,253
	Waste energy	397	36,008
	Wood energy	1,091	102,336
	Coal	7,367	687,194
Industrial	Still gas (industrial)	13,930	1,313,181
	Unfinished oils	463	43,647
	Asphalt and road oil	13,425	1,011,708
	Lubricants	904	67,140
	Distillate fuel oil	15,171	1,111,276
	Propane	126	7,744
	Motor gasoline	524	36,795
	Electricity consumption	4,527	426,760
	Natural gas	321,064	7,035,656
	Wood and waste	71	6,660
	Coal	22	2,052
Transportation	Aviation gasoline	1,037	71,812
	Propane	6	369
	Distillate fuel oil	29,651	2,171,936
	Jet fuel	126,719	9,151,646
	Lubricants	417	30,971
	Motor gasoline	30,930	2,171,905
	Natural gas	484	25,681
	Biodiesel	865	63,872
Total emissions			**40,955,755**

Alaska's 2022 Emissions by Sector:

The 2022 statewide GHG inventory totals 41 million metric tons of CO_2-equivalent (MT CO_2e). Alaska's emissions profile is dominated by the industrial sector (51%)—largely oil and gas production, processing, and mining—followed by transportation (33%), with smaller contributions from the commercial (8%) and residential (7%) sectors. (Remaining sources such as waste, agriculture, and other sectors contribute roughly 1% and are included as "Other" in Figure 1.) This sectoral breakdown underscores Alaska's unique context: a low population but energy-intensive economy with a large petroleum industry and dispersed communities in a harsh environment.

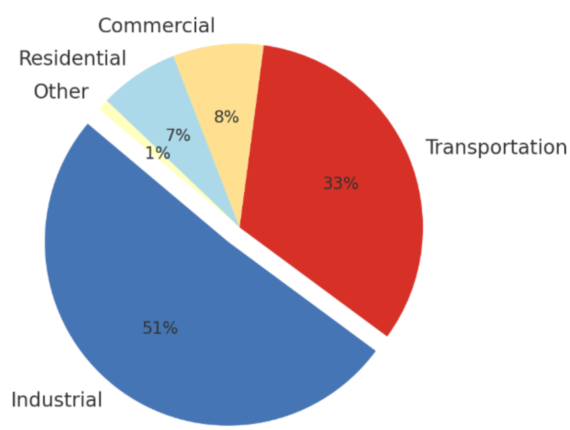


FIGURE 1: Alaska's 2022 GHG emissions by sector (percentage of 41 million metric tons CO_2e).

Comparison to 2020: The 2022 emissions represent a notable increase from the 33.4 MMT CO_2e reported for 2020, despite using the same EPA State Inventory Tool methodology. This ~22% rise is attributed to post-pandemic rebounds in activity—transportation fuel use and industrial operations surged as COVID-19 restrictions eased—coupled with higher oil prices stimulating oil production. The transportation sector in particular saw renewed aviation and marine travel in 2022 after 2020's slowdown. Alaska's experience mirrors global trends in 2021–2022, when emissions bounced back from 2020 lows. This rebound effect underscores the importance of understanding sector-specific dynamics when setting mitigation targets.

Comparison of National and Global Emissions Trends

National Context – Emissions Profile: In absolute terms, Alaska's emissions are small on the U.S. scale. The state's 2020 GHG emissions (most recent nationwide comparison) were about 0.66% of total U.S. GHG emissions. Alaska ranked only 39th among states in total CO_2 emissions as of 2021, far below more populous and industrialized states. However, Alaska's per capita emissions are among the highest in the nation. With only ~730,000 residents, Alaska's 40+ MMT CO_2e translates to very high emissions per person. In 2021 Alaska emitted 53 metric tons of CO_2 per capita, the 3rd-highest of any state. (Only Wyoming and North Dakota have higher per capita emissions, owing to their own low populations and large fossil fuel industries.) By contrast, the U.S. average was about 15 tons per capita in 2021.

Alaska's per-person emissions are more than triple the U.S. average. This disparity is rooted in Alaska's unique circumstances—a sparse population, Arctic environment, and major energy extraction sector—which drive high energy use per person.

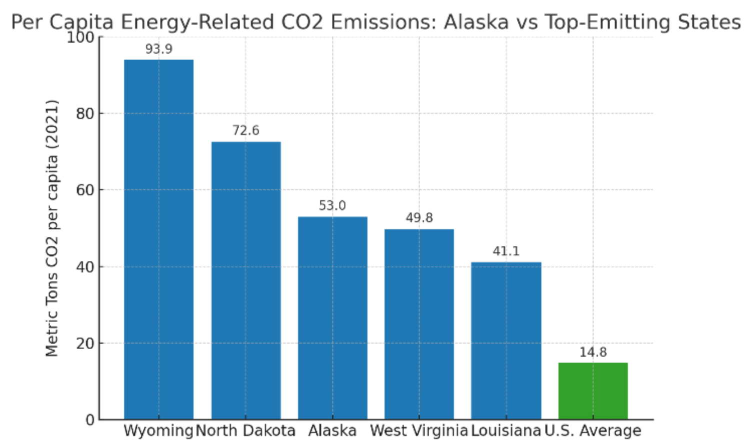


FIGURE 2: Per Capita Energy-Related CO_2 Emissions in Alaska vs. Top-Emitting States (2021)

In terms of sectoral breakdown, Alaska's emissions profile diverges from national patterns. Nationally, transportation is the largest U.S. GHG sector (28% of 2022 emissions), followed closely by power generation (~25%) and industry (~23%). The remainder of U.S. emissions come from the commercial/residential building sector (~13%) and agriculture (~11%). Alaska's profile, by contrast, is dominated by industry (51%), reflecting the outsized impact of oil, gas, and mining activities, meaning that the investments that reduce energy burden, such as those on the grid and built environment, are targeting a relatively smaller piece of Alaska's total emissions.

If one isolates energy-related CO_2 only, Alaska's industrial share is even higher relative to the U.S. (where much industrial fuel use occurs in other states to process Alaska's exported oil). Meanwhile, transportation's share in Alaska (33%) is comparable to the U.S. share, but the composition is different—aviation and marine make up a larger fraction of Alaska's transport emissions than they do nationally. Alaska's power sector emissions (included partly in industrial) are relatively modest in share, in line with the state's small electricity market (Alaska produces less than 1% of U.S. electricity).

Notably, Alaska and states like Hawaii are atypical in their heavy use of petroleum for electricity, whereas most states' power emissions come from coal or gas. Alaska also stands out for relying on diesel-based microgrids in rural areas, a situation the Lower-48 does not face at scale. Finally, Alaska's high per-capita emissions parallel those of other sparsely populated, energy-producing regions globally—for example, petrostates and mining regions in Arctic Canada or the Middle East—even though its total emissions are negligible globally (~0.1% of world GHG).

Global Patterns: At ~41 MMT, Alaska's annual emissions are a tiny fraction of global anthropogenic GHG emissions (36.4 billion tons CO_2e). In percentage terms Alaska contributes on the order of 0.00009 of global GHG, practically a rounding error. Nevertheless, Alaska's trends echo certain global developments. For instance, the post-2020 rebound in emissions was experienced worldwide as economies recovered. The shift in Alaska from coal to natural gas for power mirrors the global trend of gas growth replacing some coal (though coal use ticked up in Alaska after 2013, counter to the broader decarbonization push).

Alaska's oil production decline is consistent with maturing conventional oil fields globally, while its increased focus on natural gas (including potential LNG export projects) aligns with global energy markets prioritizing gas. Moreover, Alaska's challenges with methane emissions (from oil/gas and thawing permafrost) occur against a global backdrop of growing attention to methane as a potent short-lived pollutant.

Globally, the energy sector (electricity and heat) and transport are top emitters, but Alaska's profile underscores that oil and gas extraction emissions—which in global inventories are often counted under energy or industrial processes—can be a dominant source for jurisdictions rich in hydrocarbons. This means Alaska's emissions trajectory is partially tied to global demand for fossil fuels: as long as world demand for oil and gas remains high, Alaska's industrial emissions may remain robust or even grow with new projects (e.g., the Willow project expected by 2029).

Conversely, global emissions reduction actions that decrease fossil fuel use could significantly impact Alaska's future emissions and economy. In terms of environmental impacts, Alaska is already experiencing amplified warming; this does not directly increase Alaska's inventory, but warming-driven wildfires and permafrost carbon release are potential feedback of global significance that the state is closely monitoring.

Inventory and Trends Analysis

Alaska's emissions profile is unique due to its low population, energy-intensive environment, and extensive oil and gas industry. Although the state's total emissions are small on a global scale, its per capita emissions are the third highest in the nation. The transportation sector is heavily reliant on aviation and marine travel due to vast landscapes and limited road networks.

Alaska's GHG inventory highlights a state dominated by industrial and transportation emissions, with residential and commercial heating also contributing significantly. Waste and other sectors are smaller but increasingly important given methane's impact and wildfire trends. Efforts to decarbonize power generation and reduce industrial emissions are critical if Alaska is to meet long-term emissions reduction goals. Future policy must balance the state's energy-intensive economy with investments in renewable energy, efficiency, and carbon sequestration to reduce its per capita emissions—currently among the highest in the nation. Below are the general breakdowns of sectoral emissions. This 2022 total of 41 MMT CO_2e serves as the baseline for this plan and represents a notable increase from the 33.4 MMT of CO_2 reported for 2020, even though both of these plans are based on the State Inventory Tool (SIT). This difference is likely attributable to a combination of factors, including a post-pandemic rebound in transportation and industrial activity (with increased oil prices).

Emissions from buildings (home heating, commercial facilities, etc.) are a smaller but important share (roughly 7% residential, 8% commercial in 2022). Space heating needs drive these emissions—Alaska's Arctic environment and long winters necessitate substantial fuel use for warmth. Homes and businesses primarily burn natural gas in urban areas (Anchorage, Fairbanks' gas network) and fuel oil or diesel in rural and off-grid areas. The long-term trend since 1990 shows steady or slightly rising emissions in the building sector. Notably, natural gas use has grown significantly (especially in Southcentral Alaska) as gas distribution expanded, while fuel oil use has gradually declined in some regions.

Efficiency improvements in new construction have helped limit emissions growth, but overall demand for these measures remains high due to environmental severity and the aging housing stock. Per capita residential emissions in Alaska remain well above U.S. averages because of extreme heating requirements and relatively low adoption of alternatives like electric heat pumps or biomass. Encouragingly, programs like the Alaska Heat Smart initiative and the proposed Statewide Oil-to-Heat-Pump incentive aim to accelerate the shift from heating oil to efficient electric heat pumps, which could significantly cut residential CO_2 over time. The Weatherization Assistance Program and energy efficiency retrofits (led by AHFC and others) are likewise expected to curb residential/commercial fuel use growth.

Overall, building emissions have been relatively flat since ~2013, but a recent uptick in residential natural gas usage (2019–2020) added about 0.43 MMT CO_2e, reflecting new gas hook-ups. Continued focus on beneficial electrification and weatherization is needed to bend this curve downward.

Residential Emissions

Residential energy use includes all living quarters for private households. Energy consumption data are collected from utility sales, supplier data, and surveys such as RECS (Residential Energy Consumption Survey). End uses include space heating, water heating, appliances, EV charging, and lighting. Units are reported in physical form (e.g., cubic feet of natural gas, gallons of fuel oil) and converted to Btu using EIA conversion factors.

Residential emissions in Alaska stem primarily from fuel combustion for home heating and hot water. Natural gas, fuel oil, and diesel dominate as heating sources, reflecting the state's Arctic and sub-Arctic environmental conditions. Emissions in this sector have shown a steady increase since the early 2000s, particularly from natural gas use in Southcentral Alaska. In 2020, residential CO_2e emissions reflected heavy reliance on fossil heating fuels, with natural gas emerging as the leading contributor. Per capita residential emissions remain higher than the U.S. average due to extreme heating needs during long winters and limited adoption of renewables or electric heating.

Commercial Emissions

The commercial sector includes service-providing facilities such as offices, schools, hospitals, government buildings, and retail establishments. Data sources include CBECS (Commercial Building Energy Consumption Survey), utility billing, and supplier sales. Energy is primarily consumed for heating, cooling, lighting, and equipment operation. Consumption is reported by fuel and converted to BTU. The commercial sector includes office buildings, schools, hospitals, and retail establishments.

Like residential energy use, heating is the dominant driver of emissions, with natural gas serving as the primary fuel in urban hubs, while diesel and heating oil are used in rural communities. Between 1990 and 2020, commercial emissions followed a similar trajectory to residential emissions, with natural gas consumption rising and petroleum-based heating fuels declining. Despite efficiency gains in newer buildings, commercial energy demand remains substantial due to Alaska's harsh environment and long operating hours of facilities.

Industrial Emissions

Industrial energy consumption covers manufacturing, construction, mining, agriculture, and the oil & gas industry. Data sources include MECS (Manufacturing Energy Consumption Survey), refinery and gas plant reports, and other EIA forms. Emissions include process heating, machine power, and feedstock use. Non-energy use of fuels is tracked separately. Reported in both physical units and converted Btu values.

Industrial emissions are the largest component of Alaska's GHG inventory, driven overwhelmingly by the oil and natural gas industry. This sector includes fuel combustion at production facilities, refining, pipeline operations, and fugitive methane. Long-term trends show a mixed picture: natural gas withdrawals have steadily increased since 1990, while crude oil production has declined from peak levels in the 1980s. Consequently, CO_2 emissions from oil refining and production have slightly fallen, but methane leakage and flaring from expanding gas activities have grown in significance. By 2020, industrial sources accounted for nearly 60% of Alaska's GHGs—a share that dipped to ~51% in 2022 as other sectors rebounded. These trends highlight that reducing industrial emissions—especially methane—is paramount. Measures like methane leak detection and repair (LDAR) and electrification of oilfield operations are identified as high-impact strategies to curb this sector's footprint. Notably, Alaska's industrial emissions trajectory (natural gas up, oil down) reflects broader industry patterns, and continued decline in oil-related CO_2 has been offset by increased associated gas use and venting. Without intervention, the industrial sector remains the single biggest barrier to achieving statewide GHG reductions.

Power Generation Emissions

This sector includes utilities and independent power producers whose primary activity is generating electricity for sale. Data sources include EIA-923 and EIA-860 utility reports. Fuel inputs include coal, natural gas, petroleum, and renewables. Consumption is tracked by physical fuel units and reported in Billion Btu using standard conversion factors.

Emissions from electricity production in Alaska are captured partly in industrial statistics (for captive power at industrial sites) and partly as their own category in analysis. In 2022, power generation remains a major source of CO_2 given Alaska's reliance on fossil fuels for electricity. Most grid power comes from natural gas (in Southcentral) and coal (Interior Alaska), with extensive diesel generation in rural microgrids.

Trend analysis indicates that total power-sector emissions have plateaued since the mid-2000s. Coal use, after declining in the 1990s, saw an uptick after 2013 due to new coal plant capacity, whereas diesel generation has slowly declined as some rural communities integrated renewables or efficiency upgrades. Natural gas generation peaked in the early 2010s (with new gas plants in Anchorage) and has declined slightly since, partly as some older units retired.

Despite modest growth in wind, hydro, and solar projects, renewables remain a small fraction of Alaska's electricity mix, so coal and gas still produced the vast majority of power-sector GHG emissions in 2022. Notably, Alaska ranks 2nd (after Hawaii) in petroleum-fueled power generation and has among the lowest total electricity generation in the nation (small population).

The state's heavy use of diesel for electricity (especially in isolated villages) and continued coal reliance present opportunities for substantial emission cuts through renewable energy deployment (e.g., wind-diesel hybrid systems, hydro expansions) and potential grid connectivity improvements. Decarbonizing the power sector will be critical for Alaska to achieve emissions reduction goals, as cleaner electricity also enables deeper reductions in the building and transport sectors through electrification. Given current federal funding structures, geothermal and hydroelectric both stand out as major potential resources for this, though there are substantial wind and solar resources in the state as global pricing for these projects drops.

Transportation Emissions

Transportation energy includes on-road vehicles, aviation, marine, rail, and pipeline operations. Data comes from fuel sales, DOT travel data, FAA aviation statistics, and allocation models such as MOVES. Motor gasoline, jet fuel, and diesel dominate Alaska's transportation sector. Consumption is reported in gallons, barrels, or cubic feet and converted to Btu. Transportation is the second-largest source of emissions in Alaska, totaling 12.2 MMT CO_2e in 2019.

Alaska's transportation emissions are the second-largest source (~33% of 2022 total). However, Alaska's transportation profile is distinct from the national norm. Aviation and marine travel make up a disproportionate share of Alaska's transport GHGs, whereas on-road vehicles dominate in most states. With limited road networks across vast terrain, aircraft and marine vessels are essential for moving people, goods, and resources. Major hubs like the Ted Stevens Anchorage International Airport (a key trans-Pacific cargo refueling stop) and the Port of Anchorage drive significant jet fuel and marine fuel consumption. Indeed, Alaska is the largest jet fuel consumer per capita among states and a top-eight state in total jet fuel use. On-road vehicles (highway traffic) contribute comparatively less—many rural communities rely on snow machines, off-road ATVs, and small planes instead of cars.

Trends in state transportation emissions show relative stability or modest increases over recent decades, with gasoline vehicle emissions remaining consistent and diesel vehicle emissions rising due to more diesel trucks and equipment. Aviation and marine emissions peaked in the mid-2000s, declined slightly before 2020, but are rising again after the pandemic. In 2022, the resurgence of air travel and freight operations contributed significantly to the overall inventory increase. Electrification and efficiency gains in surface transportation are starting to emerge (e.g., EV adoption in urban areas) but have not meaningfully altered Alaska's transport emissions profile. These trends imply that Alaska's transport mitigation strategies must extend beyond road vehicles to include marine and aviation—for example, investing in port electrification, cleaner aviation fuels, and improving rural connectivity to reduce flight dependence.

Waste, Agriculture, and Other Sectors

In 2022, non-energy sectors accounted for a relatively small share of the inventory, comprising approximately 1% in total. Alaska's waste sector GHGs come mainly from landfill methane and wastewater treatment. These emissions have grown slightly with population but contribute <0.5% of statewide CO_2e. New initiatives in solid waste management—like landfill gas capture at the Anchorage Regional Landfill and nascent composting programs—aim to curb methane releases. Agricultural emissions (e.g., livestock methane, soil nitrous oxide) are negligible on the state scale (<0.5% of emissions) given Alaska's small agriculture industry. Nonetheless, efforts to support environment-friendly farming (manure management, fertilizer optimization) can provide co-benefits.

It's also worth noting the role of wildfires and land sinks: In extreme fire years, wildfire CO_2 can be very large (though not counted in the inventory's anthropogenic emissions), and Alaska's vast forests and tundra serve as significant carbon sinks in some years. However, with environmental change driving more frequent, large wildfires and permafrost thaw, Alaska's natural carbon balance is volatile. From a planning perspective, protecting and enhancing carbon sinks (through forest management, ecosystem restoration) will be increasingly important to counteract the hard-to-eliminate portions of Alaska's emissions.

Inventory Analysis

Alaska's greenhouse gas (GHG) emissions profile is distinct due to its unique geographical, environmental, and economic conditions. In 2020, Alaska's total CO2 emissions were reported at 33.4 million metric tons (MMT), an increase from previous years but still lower than the peak of 45.4 MMT in 2005[15].

Alaska spends dramatically on energy on a per capita basis. In 2021, Alaska ranked first with a per capita energy expenditure of $8,711, amounting to nearly 11.15% of its GDP[16]. This ranking has remained consistent since 2015. The EIA attributes this to factors such as Alaska's Arctic environment, which results in long and harsh winters, and the presence of a large and developed oil and natural gas industry.

In 2021, Alaska ranked 39th out of all states in terms of energy-related CO2 emissions. In comparison, states with larger populations and economies, such as Texas and California, recorded 2021 emissions of 663.5 MMT and 324 MMT[1], respectively. On a broader scale, Alaska's GHG emissions for 2020 constituted approximately 0.66% of the total nationwide GHG emissions. When considering global anthropogenic GHG emissions, which account for 36.44 billion tons[18] per year (TPY), Alaska contributes a mere 0.000092672% of CO2e to these global emissions.

Despite Alaska's relatively minor role in overall national and global greenhouse gas emissions, the state stands out for its high per capita emissions, ranking third out of all states in 2021 with 53 MT per capita energy-related CO2 emissions . This contrast is deeply rooted in Alaska's distinctive context. On one hand, its small population size typically leads to a lower total emissions output. However, Alaska's vast and rugged Arctic environment significantly elevates per capita energy and fuel needs, especially during prolonged, harsh winters.

The state has a well-developed and mature oil and natural gas industry in both the North Slope and Cook Inlet which provides fossil fuel energy resources for interior markets and is exported to the contiguous United States. Thus, Alaska's unique combination of a low population, an energy-intensive climate, and a major energy industry culminates in its high per capita emissions despite its smaller overall emissions contribution.

On a national scale, the U.S. transportation sector is the largest contributor to greenhouse gas emissions[20], primarily driven by road vehicles like cars and trucks. However, Alaska's transportation emissions profile is distinct due to its heavy reliance on aviation and marine transportation. While road vehicles dominate the transportation emissions in the contiguous U.S., Alaska's vast landscapes and limited road networks necessitate a more diverse transportation mix. While Alaska's transportation emissions trends reflect its unique geographical and infrastructural challenges, its contribution to the nation's overall transportation emissions is relatively small.

Understanding Alaska's emissions trends over the past three decades is pivotal for shaping future policies and strategies. These trends reflect the state's evolving economic activities, technological advancements, and policy measures. While some sectors have seen increases in emissions, others have witnessed declines, emphasizing the need for a comprehensive approach to achieve broader environmental and sustainability goals.

Implications for Sustainable Energy Planning and Policy

Alaska's 2022 GHG inventory and sector trends have important implications for state policy, especially under the EPA's Climate Pollution Reduction Grant (CPRG) framework. The CPRG program requires states to develop comprehensive climate action plans that target their largest emission sources while aligning with federal goals.

For Alaska, the inventory highlights priority areas for mitigation: namely, the oil and gas industry, transportation (aviation and marine in particular), and stationary heating in buildings. These are the sectors where targeted policies can yield the greatest emission cuts.

Oil & Gas Industry: Given that industrial emissions (largely oil/gas) form half of Alaska's profile, decarbonizing this sector is critical. This can include CPRG-supported measures such as Methane Leak Detection and Repair (LDAR) programs to reduce fugitive methane from pipelines, wells, and infrastructure. Strengthening regulations or incentives for flaring reduction and gas capture will directly lower Alaska's CO_2 and CH_4 totals. The state can also explore carbon capture, utilization, and storage (CCUS) for major facilities (e.g., gas processing plants) as part of its long-term strategy. Importantly, Alaska's policy must balance emissions reduction with the reality that oil and gas are pillars of the state economy and energy supply.

The CPRG planning recognizes this tension—emphasizing improvements in efficiency and leak prevention to cut "waste" emissions first, and deployment of clean energy alternatives where feasible (for example, powering North Slope operations with renewable energy or grid electricity instead of onsite diesel). The

State's energy priorities of reliability and affordability mean any transition must ensure communities and industries have stable energy; thus, reinvesting CPRG funds into modernizing oilfield power systems (to use cleaner fuels or waste heat) and diversifying the economy will be key.

Transportation: Alaska's unique transportation needs call for innovative environmental solutions. Standard approaches like electric vehicles, while applicable in cities, address only a slice of Alaska's transport emissions. The inventory shows aviation and marine transport as dominant sub-sectors. Therefore, the state's plan is focusing on measures such as port electrification (e.g. the "Green Corridor" project to electrify Juneau's docks for cruise ships), expansion of the electric ferry and vehicle charging infrastructure (with support from AEA and DOT), and sustainable aviation fuel initiatives for airline hubs.

Under the CPRG, Alaska can leverage federal support to pilot low-carbon aviation programs at Anchorage and Fairbanks airports and develop shore power systems in coastal ports. Additionally, encouraging a modal shift where possible—e.g., improving road connections or digital infrastructure to reduce the need for flights—can result in emissions reduction. The trend of rising diesel and freight emissions also underscores the need for cleaner on-road heavy vehicles: the state could adopt incentives for electric or hydrogen fuel cell buses and trucks and strengthen programs like Diesel Emissions Reduction Act (DERA) grants for replacing old diesel engines. Every ton of transport emissions reduced also yields public health gains (less particulate and sulfur pollution), aligning with CPRG's emphasis on co-benefits for communities.

Buildings and Power: The high heating demand in Alaska's residential and commercial sectors suggests significant wins through energy efficiency and electrification—which are major components of the State's Comprehensive Sustainable Energy Action Plan. Expanding weatherization programs (as run by the Alaska Housing Finance Corporation) and scaling up the new heat pump deployment incentives will directly slow growth in heating fuel consumption.

CPRG funding is already being directed toward these building efficiency measures, which cut emissions and reduce energy costs for Alaskans—a key state priority. On the power side, the inventory's plateaued emissions indicate that clean energy investments can make a dent. The plan calls for bolstering the Renewable Energy Fund and pursuing projects for wind, solar, hydro, and geothermal where viable. For rural communities, replacing aging diesel generators with lower-emitting generators or renewable hybrids is highlighted as both an emissions reduction and an energy cost-savings strategy.

The 2020 EPA report to Congress, Remote Areas of Alaska: Affordable and Reliable Options for Meeting Energy Needs and Reducing[21], identified many such opportunities (e.g., wind or hydro in lieu of diesel, advanced microgrid controls). By improving rural energy infrastructure through grants and technical assistance, Alaska can reduce petroleum use in power generation (it already dropped slightly pre-2020) and improve community resilience—aligning with CPRG's goals. Notably, nearly the entire state qualifies as underserved or disadvantaged under federal definitions, so investments in clean energy for rural Alaska fulfill the CPRG mandate that 40% of benefits flow to disadvantaged communities.

Long-Term Planning and Targets: The 2022 inventory will serve as the baseline for Alaska's forthcoming GHG reduction targets. Using this baseline, the CPRG-funded planning process is developing emissions projections and identifying policies to hit near-term (2030) and long-term (2050) goals in line with national commitments. The sector analysis above indicates that most of Alaska's "low-hanging fruit" reductions lie in a few areas—especially methane mitigation, diesel displacement, and efficiency improvements. These actions can be taken without fundamentally altering the state's energy supply in the short term, thus respecting the priority of energy reliability.

However, meeting deeper decarbonization goals (e.g., 80%+ reduction by 2050) will likely require transformative changes, such as widespread electrification of heating and transport, large-scale renewable deployment with storage, and possibly transitioning the economy away from export petroleum dependence. Alaska's plan acknowledges this, stressing that strategies must be integrated with economic development plans to ensure a just transition for industries and workers.

The CPRG framework encourages states to also consider carbon removal and sequestration, which Alaska is well positioned to do through its forests, wetlands, and potential geological CO_2 storage projects. For example, the Department of Natural Resources is exploring a carbon capture and sequestration program on state lands to sequester CO_2 and generate offset revenue. In summary, Alaska's emissions trends inform an environmental policy approach that is pragmatic and sector-specific, focusing on the biggest contributors with solutions tailored to Alaska's context (like methane leak repair, rural renewable energy, and electrification of heat and transport), all while ensuring energy remains affordable and secure.

Recommendations for Future GHG Data Collection and Methodological Improvements

The 2022 inventory exercise also revealed areas where data collection and methodology can be improved, especially for Alaska's unique sectors and rural regions. Accurate inventories are the foundation of sound policy; future data collection and analysis could include the following considerations.

Granular Data for Rural Energy Use: Alaska's rural communities often lack precise fuel-use data in state and federal databases. Many villages are off the road system and obtain fuel via barge or air, and their electricity comes from independent microgrids. The current inventory relies on proxies and allocations (e.g., using census data and surveys like RECS, CBECS) to estimate rural residential/commercial fuel consumption. We recommend expanding direct data collection in these areas. This could include improving the Power Cost Equalization (PCE) reporting to capture not just electricity generation but also heating fuel sales in each community or establishing a statewide fuel delivery reporting system. Partnering with tribal and local governments to conduct household energy use surveys in remote areas would also yield better estimates (building on the DOE Cities-LEAP methodology already used). Such efforts will reduce uncertainty in the residential and commercial sector estimates and ensure that mitigation measures (like distributing heat pumps or weatherization funds) are guided by accurate, community-specific data.

To help improve our understanding of community-level emissions data in Alaska, we completed an inventory verification project as part of the concurrent IRA CAA 103 program to attempt to better understand rural emissions. We identified several representative rural communities who have seen emissions inventories previously and did collection and analysis of additional primary data. Data included collection and analysis of fuel purchase data at community bulk fuel farms in communities with islanded energy and transportation systems. In addition to bulk fuel, we used tailored survey questionnaires designed to capture granular, on-the-ground data on fuel consumption, heating devices, and other activities across key sectors like residential, commercial, power generation, and transportation. A key takeaway was that for communities with major seasonal activities, such as energy-intensive fisheries, we may expect a large variance from what would be expected based on simpler downscaling methodology.

Enhance Tracking of Off-Road and Non-Highway Transportation: Because aviation, marine, and off-road vehicles play an outsized role in Alaska, the state should invest in better tracking of these emissions. For instance, aviation fuel sales data at major airports (Anchorage, Fairbanks, regional hubs) could be systematically compiled to validate the FAA-based estimates. Marine fuel use (diesel and bunker fuel for ships) in Alaska's ports and for fishing fleets is another data gap—coordinating with the Coast Guard or the maritime industry to gather fuel consumption data would improve the inventory's accuracy for water transport.

For off-road mobile sources (mining equipment, snowmachines, etc.), the EPA MOVES model was downscaled with assumptions; conducting targeted field studies or leveraging telematics data from large operators (like mining companies or the Alaska Railroad) could refine these estimates. Improved data here will help evaluate the impact of initiatives such as electric ferries or more efficient bush planes in the future.

Integration of Facility-Reported Emissions (GHGRP data): The inventory currently uses EPA emission factors and statewide activity data, supplemented by large facility reports in some cases. To increase accuracy, Alaska DEC should continue to integrate data from the EPA's Greenhouse Gas Reporting Program (GHGRP) FLIGHT database, which provides actual emissions from major facilities (those emitting >25,000 MT).

In the 1990-2020 inventory, DEC compared the State Inventory Tool results with GHGRP data and identified discrepancies (in some years GHGRP totals were higher). For future inventories, we recommend an automated cross-check: for each reporting oilfield, refinery, power plant, mine, or landfill, use the GHGRP number as a quality control benchmark. This will ensure no large source is underestimated. It also allows Alaska to track facility-level progress—useful for policies like emissions permits or sector-specific targets.

Regular Updates and Methodological Transparency: Going forward, Alaska should aim to update its GHG inventory annually or biennially (as capacity allows) to track trends, rather than waiting for multi-year intervals. Regular updates will capture the impact of new policies (e.g., a surge in EV adoption or a major renewable project coming online). Each update should incorporate the latest IPCC global warming potentials and any improved emission factors (for example, black carbon accounting if included in future).

Methodological improvements should be documented in a public methodology report or technical appendix to maintain transparency. Given Alaska's evolving energy landscape (e.g., potential LNG exports, new mines, etc.), the methodology may need adjustments—for instance, if a large new source appears, creating a custom category for it rather than lumping into "industrial" could be warranted.

Address Underreporting in Land Use, Waste, and Industrial Sectors: Although difficult to assess the exact scope of missing data, sectors that have high potential for methane emissions could benefit from better data. Permafrost carbon emissions (methane and CO_2 from thawing organic matter) are an emerging concern—while not part of official inventories yet, the state could support research to monitor these fluxes to inform adaptation strategies. For waste, requiring large landfills to report annual methane emissions (modeled or measured), and verifying these reports, could supplement the current approach. In the industrial sector, additional verification and monitoring of methane emissions throughout the lifecycle of natural gas could help ensure that the fugitive emissions seen in other producing areas are not occurring here; this should include satellite-based monitoring, which would require an assessment of the high latitude capabilities of existing systems like GHGSAT.

In summary, continued enhancement of GHG data collection—especially in Alaska's rural and industrial domains—will support more effective environmental policy. Better data will enable the state to track progress under the CPRG program, quantify reductions from implemented measures, and adjust strategies as needed. Alaska's 2022 GHG inventory provides a strong foundation; by implementing the above recommendations, future inventories will be even more robust and reflective of on-the-ground reality. This will ensure that Alaska's Sustainable Energy Action Plan remains grounded in sound science and that the state can credibly demonstrate its emissions trajectory as it pursues its environmental and energy goals.

V. EMISSIONS REDUCTION STRATEGIES

Emissions Reduction Measure Overview

The following table provides an overview of emissions reduction for each measure in this chapter.

TABLE 3: Emissions Reduction Measure Overview

Emissions Reduction Strategy	Annual CO2e Reduction by 2030 (Metric Tons)	Completion date	Cumulative CO2e Reduction by 2030 (Metric Tons)	Cumulative CO2e Reduction by 2050 (Metric Tons)
Residential				
AHFC Weatherization & Energy Rebate	66,380	2030	239,873	1,567,473
ACES-AK (Coastal Heat Pumps)	27,680	2030	80,253	633,858
Building Codes Framework Adoption	52	2030	157	3,399
Heat Pump Beneficial Electrification	150,000	2029	225,000	3,225,000
Residential Subtotal	**244,112**		**545,283**	**5,429,730**
Non-Residential				
Public Building Retrofits	60,761	2030	243,044	1,458,264
Wastewater Treatment Plant Improvements	711	2027	2,844	17,064
Non-Residential Subtotal	**61,472**		**245,888**	**1,475,328**
Solid Waste				
Landfill Methane Capture Project	49,067	2026	196,268	1,177,607
Southeast Composting	48,206	2028	241,030	1,205,162
Solid Waste Subtotal	**97,273**		**437,298**	**2,382,769**
Transportation				
Green Corridor - Juneau Port Electrification	7,795	2028	23,385	179,285
Green Corridor - Seward Port Electrification	3,180	2027	7,517	94,099
Electric Vehicle Equipment Installation	1,836	2029	3,672	40,392
SAF & Renewable Diesel Refinement	1,600,080	2030	1,600,080	33,601,680
Hybrid-electric Aircraft Pilot Project	686	2027	2,742	16,455
Transportation Subtotal	**1,613,577**		**1,637,396**	**33,931,911**

Electric Generation				
Bradley Lake Expansion Project	131,094	2030	262,188	2,884,068
Electric Generation and Transmission (Railbelt)	555,601	2030	798,645	11,910,665
Electric Generation and Transmission (Rural)	31,248	2030	829,893	1,454,853
AEA DERA, VEEP, and Rural Distribution	11,472		22,943	146,846
AEA Renewable Energy Fund	3,560,571	2030	5,340,857	76,552,277
Emerging Energy Technology Fund	48,600	2031	72,900	1,044,900
Unalaska Battery Energy Storage System (BESS)	2,221	2027	7,218	51,635
Long Duration Energy Storage Pilot Project	120	2026	360	2,700
Merrill Field Combined Heat & Power	233	2027	699	5,359
Electric Generation Subtotal	**4,341,160**		**7,335,703**	**94,053,303**
Industrial & Land Use				
Carbon Capture, Storage, and Offset	Ind.	Ind.	Ind.	Ind.
Railbelt Industrial Energy Efficiency Challenge	80,000	2029	120,000	1,720,000
Statewide Forest Carbon and Biochar Program	60,000	2029	90,000	1,290,000
Methane Leak Detection and Repair (LDAR)	750,000	2030	1,125,000	16,125,000
Unalaska C-PACER	7,494	2029	7,494	1,555,000
Industrial & Land Use Subtotal	**897,494**		**1,342,494**	**20,690,000**

RESIDENTIAL

AHFC Weatherization Assistance Program & Energy Rebate Program

Summary

Weatherization has been a priority of housing policy throughout Alaska for many years, due to its ability to address multiple community challenges, such as poor-quality housing and high energy costs, in one fell swoop. Residential energy use accounts for 7.6% of Alaska's energy use[22], and can be a major household expense, with Alaska's average household spending $4,186 which is over 1.8 times the national average; however, there is significant variation between regions, with rural and northern communities often facing higher costs. Approximately 14,600 housing units in Alaska are considered very inefficient, which is most pronounced in rural communities. Many rural communities in Alaska rely primarily on diesel fueled electric generators for power, Alaska ranks second only to Hawaii in the total share of electricity (14% in 2022) generated from petroleum[23]. On a per capita basis, Alaska ranks third in the nation in emissions due to its small population and harsh winters.

AHFC has operated Alaska's Weatherization Assistance Program since the early 90's, which provides direct assistance to low-income Alaskans to make their homes more energy efficient, reducing energy consumption and energy costs while increasing comfort and durability of the home. This program was greatly expanded in 2008, when the state invested $200 million into the program. From 2008 through 2018, the program invested $402.1 million to retrofit 20,917 homes[24] across the state, creating 5,460 jobs in the process. Investment in residential energy projects has shown a substantial socioeconomic benefit[25] over the past 15 years, and renewed investment can continue to provide these benefits.

New programs, originally part of the Inflation Reduction Act, are beginning to emerge, such as the DOE Home Energy Rebate Program which AHFC will administer. Alongside weatherization, this new program will help create a deeper transformation of residential energy landscape in Alaska that reduces emissions and provides more affordable, livable housing.

AHFC administered a state funded Home Energy Efficient Rebate program from 2008-2018 which funded energy efficiency retrofits in 26,587 homes across the state. Homes that participated in the state rebate program saw an average annual energy savings of 34%, with their Carbon Dioxide emissions being reduced from 41,090lbs/year to 28,910, a reduction of 30%. A lifecycle analysis of the State's Home Energy Rebate program showed a savings to investment ration of 1.8, meaning energy cost saving experienced by the homeowner will earn nearly double the money back spent on installing the measures.

Alaska also benefits from agencies like the Alaska Cold Climate Housing Research Center and the National Renewable Energy Laboratories Fairbanks campus who innovate new solutions to make weatherization and energy efficiency in Alaska communities more affordable and effective.

Proposed Measure

The Weatherization Assistance Program is implemented primarily through regional entities like housing authorities, and non-profits including Interior Weatherization, Inc., RurAL CAP, and the Alaska Community Development Corporation. Implementation of this measure would require funding to be boosted for this program to allow an additional 3650 homes to be weatherized. The participation of regional housing authorities has been essential to completing weatherization work in the more than 200 communities off the road system that often face lack of local capital, contractors, and materials.

The Alaska Housing Finance Corporation has a range of programs that have served homeowners and renters around Alaska for decades—the Home Energy Rebate Program will likely join the portfolio in 2026, adding the potential to bring transformative home energy savings and emissions reductions for thousands of residences around the state. This measure would add to planned Home Retrofit Rebates allowing for additional scope of rebates so that 3,650 more households can receive deeper energy retrofits with the rebate program.

The program would provide extra funding for households in Alaska's remote communities to perform energy efficiency retrofits under the upcoming DOE Rebate Programs. This allows households with incomes above the weatherization threshold but would still struggle to pay for their own retrofits to access the benefits and infrastructure provided under that program. AHFC anticipates offering 1,800 expanded energy retrofit rebates. It would also subsidize household energy assessments, which are required to access portions of the Rebate Program, enabling as many as 1,800 households to receive ratings.

If funded, allocation for the Weatherization Assistance Program will need to be increased gradually and annually over the five years of the project. Weatherization providers are currently staffed to provide services at the rate required by current annual funding. Increasing that funding will need to happen gradually and predictably, so they can increase their workforce to meet it. The Alaska Housing Finance Corporation and other statewide organizations are working to support this anticipated workforce growth via emerging workforce development programs, which are described in Section VII.

To enable the additional retrofits that deliver emissions reductions, this program will provide funding for 1,800 additional household energy assessments and provide extended retrofits for 1,800 homes, allowing homeowners that would struggle to fund their improvements to make deeper and more efficient retrofits.

Similar Initiatives

More intensive weatherization may be completed on a regional level by housing authorities and other community organizations. This plan supports these local efforts.

Funding Landscape

Alaska's Weatherization Assistance Program is currently funded by DOE, LIHEAP, and State Funds. Funding has been steady but limited, only allowing between 200-300 homes to be weatherized annually. Over the 2008-2018 period, over 96% of the programs funding came from state investment.

AHFC is in the process of developing a Home Energy Rebate Program; the proposed action in this section would expand upon that emerging program, allowing more Alaskans to participate.

TABLE 4: AHFC Measure Budget

Household Energy Assessment Subsidies to support Home Retrofit Rebates	Home Retrofit Rebates – increased incentives	Additional home weatherization assistance
$1,500,000	$7,200,000	$91,200,000

Transformative Impacts

Based on the historical performance of the Weatherization Assistance Program, households that go through weatherization experience an average reduction of energy consumption of an equivalent of 6,740lbs of carbon dioxide a year, a 21 percent reduction. A reduction of 61.7 million BTU's or 453 gallons of fuel oil per year representing an average of 29% energy cost savings per household.

The Weatherization Assistance Program has historically delivered substantial benefits to economically vulnerable communities.

TABLE 5: Alaska Weatherization Assistance Program Statistics

Median household income	$28,263
Households in rural Alaska communities	42%
Alaska Native households	38%
Households with elderly members	34%
Households with children under 6	24%

A life-cycle cost analysis of the program indicates a savings-to-investment ratio of 1.5, demonstrating that the energy cost savings generated by Alaska's weatherization initiative will recover the initial expenditures and yield an additional return of 50 percent over the anticipated service life of the improvements. During the 2008-2018 period when the Weatherization program had a state surplus of funds to work with, the program created an estimated 5,460 annual jobs.

These savings are especially significant in rural Alaska, where in Winter 2023 heating fuel in 92 unsubsidized communities had an average cost of $6.72 per gallon[26] in contrast to the national average of $4.60 during the same period. In Alaska's Western region, which has some of the lowest average household incomes in the country, the 2023 average heating fuel price rises to $7.50. While diesel use for electricity is supported by Power Cost Equalization (PCE) funds, this is not the case for household heating fuel. Given these statistics, it's evident why reducing the residential fuel needs in rural Alaska has such a disproportionate impact in reducing the economic burden of energy on individual households.

An important function of properly done residential weatherization is making homes more livable and comfortable for residents. Residential weatherization can help prevent moisture management issues that, left untreated, can lead to mold growth, poor indoor air quality, and costly health outcomes.

Less fuel consumption also means that fuel deliveries do not have to happen as regularly, resulting in greater resilience to freight disruption by weather and disaster that might delay fuel shipments. Over the long-term reduced residential dependence on diesel may mean that bulk fuel systems in some rural Alaska communities will not need to maintain as much capacity.

Estimated Emissions Reduction

The following table shows the emissions reduction for the discussed measure above. For action beyond 2050 not discussed here, this estimate assumes continued weatherization for the same amount of effort from other funding sources, possibly through revised federal funding formulas. This is seen in continued efforts in the Targets section, which assumes 1000 homes weatherized over baseline, requiring ~$24M in additional annual funding, or $216M over nine years. This would address approximately 12,650 of the 14,600 housing units considered very inefficient around the state.

TABLE 6: AHFC Measure Estimated Emissions Reduction

Action	CO2e Reduction (Annual Metric Ton, by 2030)	CO2e Reduction (Through 2030, cumulative metric tons)	CO2e Reduction (Through 2050, cumulative metric tons)
1,800 Households receive subsidized Energy assessments supporting Energy Efficiency Retrofit Rebates	21,640	81,751	514,551
3,650 additional homes are weatherized	44,740	158,122	1,052,922

Accelerating Clean Energy Savings in Alaska's Coastal Communities (ACES)

Summary

Thanks to factors like the moderate climate, high cost of delivered fuels, and substantial legacy hydroelectric generation, Southeast Alaska, as well as much of Alaska's gulf coast, is well-positioned for the adoption of heat pumps. The ACES Program will accelerate the adoption of heat pumps to significantly reduce the quantity of delivered fuels used for heating, and the associated GHG emissions from the use of these fuels. Installing heat pumps in an estimated 6,000 buildings in 43 communities will cost-effectively eliminate 3.3 million gallons of heating oil and 80,000 MTCO2e through 2030. Longer term, this effort will have a greater cumulative impact by transforming the regional heating market to make heat pumps the default residential heating system.

As a designated Economic Development District (EDD) and Alaska Regional Development Organization (ARDOR), Southeast Conference serves as the state and federally designated regional economic development organization for Southeast Alaska. Their membership includes most municipalities and tribes in the region, serving as a common resource and a shared voice for these governments. In this role, Southeast Conference plans to work with the Juneau-based nonprofit Alaska Heat Smart (AHS) and the Alaska Municipal League (AML) to accelerate the adoption of heat pumps in Alaska's southern coastal communities, significantly reducing the quantity of oil used for heating, and its associated GHG emissions, while increasing local energy independence and reducing cost of living.

Alaska Heat Smart's six years of experience in assisting over 1,500 households using a 'concierge service' with comprehensive education and advice, combined with a diverse slate of financial incentives and remediation programs, has demonstrated this style of programs' success in shifting significant numbers of homes from heating oil to heat pumps. Educational efforts will lay a foundation of understanding beneath the financial incentives provided by the ACES Program that will accelerate heat pump uptake substantially.

The Alaska Municipal League is a statewide nonprofit dedicated to strengthening local governments and meeting the needs of state agencies and Tribes to ensure that Alaska can make the most of federal infrastructure investments, including through CPRG investments. AML will continue to convene and facilitate information sharing, and work with partners to help deliver community benefits and overcome barriers to implementation. AML will assist with project tracking and progress measurement, workforce development initiatives, and sub awardee support.

ACES Measures

To achieve its goals, the ACES program will implement the following six strategies:

1. **Reduce friction.** Currently households must navigate a complex web of technical details, incentives, tax credits, and contractors associated with unfamiliar technology. Our goal is to simplify the process and experience of heat pump installations for households, and to provide incentives that significantly reduce the barrier of upfront cost.
2. **Provide consumers with reliable and actionable information about the realities of heat pumps.** Long term success of the program depends on happy heat pump owners.
3. **Aggregate consumer demand.** Work with communities, non-profits, tribes, local governments, utilities, financial institutions, and contractors to bundle opportunities to create market leverage, reduce project prices, and transform heating system markets.
4. **Coordinate affordable financing solutions.** Built on previous experience and existing relationships with regional community development financial institutions, the program will establish transparent, fair, and affordable financing solutions to make loans easier to obtain.
5. **Support a more equitable and sustainable future** by reducing heating costs, improving air quality in homes, and coordinating development of the workforce, local businesses and jobs that provide direct benefits to Alaska Native communities, and disadvantaged communities and households.
6. **Create a wide range of partnerships.** Leveraging the experience of AHS, SEC, and AML in working with a diversity of other organizations to attract additional resources to the effort to decarbonize even more Alaska homes over the long term.

Similar Initiatives

Municipalities, tribes, and other related entities may consider advancing regional and community-wide incentive programs that support weatherization and beneficial electrification using heat pump systems like proposed for Southeast Alaska. These efforts could follow the model set in communities like Juneau to quickly support beneficial heat pump installations in their jurisdiction.

While systems designed for cold weather are still advancing towards wide commercial availability in Alaska, and the electric grid is not substantially decarbonized in many communities, there are comparable examples of widespread air and ground source heat pump adoption in Arctic environments, namely in Norway and Finland.

Funding Landscape

Current funding for AHS programs delivering similar work is derived from grants made by the City and Borough Juneau, from the Departments of Energy and Housing and Urban Development, and corporate and private donations made to the Alaska Carbon Reduction Fund, which to date has focused primarily on providing services in Juneau, Sitka, and Ketchikan. With additional funding from federal programs like the EPA's Climate Pollution Reduction Grants, AHS programs will expand to serve a greater geographic range, and more deeply accelerate regional energy transformation.

Transformative Impacts

Over the next five years, acceleration of air source heat pump adoption spurred by the ACES Program will significantly slash GHG emissions, reduce the cost of living, improve indoor air quality and health, reduce household and community vulnerability to oil price shocks, and reduce the risks of oil spills in sensitive coastal environments across Alaska's coastline and in the homes of thousands of Alaskan families.

Breaking Down Barriers

This transformative potential of the ACES Program is well demonstrated by Juneau, Sitka, and Ketchikan's experience with systematic acceleration of heat pump adoption. Over the past six years, AHS has led the promotion of regional heat pump adoption through a diversity of programs designed to overcome the major barriers to heat pump adoption: uncertainty and confusion about 'new' technology; unknown potential economic benefits; high upfront costs; lack of understanding of integration with legacy home heating systems; and lack of available workforce and installer capacity.

With relatively modest levels of program funding and incentives, Juneau has experienced an almost ten-fold increase in the number of heat pumps in the past decade. In smaller and more remote communities within the program service area the barriers to heat pump adoption are amplified by higher electric rates, lack of utility incentive programs, less familiarity with the technology and an even more constrained workforce. The ACES program will work to mitigate these barriers through site specific education and outreach, workforce training opportunities, and collaborative partnerships with local leadership organizations.

Market Transformation

ACES is designed to transform local markets for heat pumps sequentially across the coastal Alaska program region. Initial program roll-out will begin in key hub communities to capitalize on existing industry momentum. This will send an immediate market signal to both community contractors, unions, and workforce development organizations and provide necessary assurances that investments in training, inventory building, and marketing efforts will be sustainable and long-lasting. Subsequent program efforts will be expanded to adjacent smaller communities having the best economic cases, and finally to those areas with sub-marginal economics and less access to a contractor base or supportive community partners.

To address workforce constraints, ACES will work with statewide and regional partners including the Alaska Housing Finance Corporation, Alaska Vocational Technical Center (AVTEC), the University of Alaska, and others in hopes of developing and aligning workforce training efforts related to the adoption of heat pumps. ACES workforce initiatives will focus on training workers currently engaged in the residential construction market to ensure they develop skills needed to perform high quality heat pump installation. Over time, we expect market signals and demand realities to boost growth in contractor workforces across the region.

Ripple Effect

Successful GHG reduction measures and acceleration of new technology that differ from entrenched norms often require change in individual and organizational behavior. Despite its drawbacks, the use of oil for heating has a long and successful history. Decades of oil heating have made households complacent and comfortable with what is now an expensive and dangerous means to an end. Changes to entrenched building practices, such as home heating systems can be particularly challenging. The concierge services of the ACES Program will help households overcome fears of heating system change. AHS has learned from their successful programs that a strong change agent is the realization of technology in action. When friends and neighbors implement positive changes for others to see and experience, a ripple effect is created, spurring additional change and in this case, the accelerated adoption of heat pumps.

Further emission reductions will result as this new 'behavior' becomes ingrained in societal norms and practices. Research indicates that the two most effective interventions in pro environmental behaviors are social comparisons and financial incentives. The 'Thermalize' concept will be employed as a motivational tool in communities where educational and awareness needs are greatest. This neighborhood-centric approach, based on 'Solarize' campaigns across the country, proved successful in Alaska's first Thermalize program, led by AHS in Juneau in 2021 and 2022. A winning combination of lower costs, economies of scale, and neighbor-to-neighbor support led to the installation of 75 heat pumps and completion of a dozen home energy retrofits.

Collaborative Partnerships

Accelerating heat pump adoption along Alaska's coast will hinge directly on collaborative efforts across different sectors, amongst varied stakeholders, and across diverse jurisdictions. Partnerships are essential to program success and allow the leveraging of collective experience, networks, resources, influence, and support systems not available within each siloed organization. The ACES community navigators will help facilitate these connections and collaborations. Community navigators will engage with project staff and will provide insights, data, and connections to allow staff to hit the ground running in project area communities and to keep abreast of important local issues or concerns.

Cost Savings

In communities with nearly 100% hydroelectricity such as Juneau, Sitka, Wrangell, Petersburg, Ketchikan, Kodiak, and some POW communities, replacement of oil heat with heat pumps can often result in almost complete elimination of carbon emissions for heating. AHS analysis of home energy data for Juneau homes indicates:

- Average household oil space heating annual cost: $3,048
- Average household electric resistance heating annual cost: $2,100
- Projected average annual savings from oil heat to heat pump: $1,802
- Projected average annual savings from resistance to heat pump: $1,226
- Average annual heating fuel elimination from installation of a single head heat pump - 500 gallons
- NOTE: These costs/savings values were calculated assuming oil cost of $3.58/gallon.

Estimated Emissions Reduction

TABLE 7: SEC Measure Estimated Emissions Reduction

Action	CO2e Reduction (Annual metric tons)	CO2e Reduction (Through 2030, cumulative metric tons)	CO2e Reduction (Through 2050, cumulative metric tons)
6,107 coastal Alaska households retrofitted with heat pumps	27,680	80,253	633,858

Building Codes Framework Adoption

Summary

The State of Alaska has not adopted a statewide residential building or energy code; however, local authorities having jurisdiction have adopted building and energy codes at various levels of stringency. The Alaska Housing Finance Corporation (AHFC) is required by law to adopt building and energy codes and ensure real estate investments comply with those standards. To further pursue this obligation, AHFC proposes to lead a consensus-based process to develop a statewide building and energy code framework. This initiative is not a top-down mandate but a collaborative effort to create a suite of model codes that local jurisdictions can adopt and adapt to their unique needs.

The project will bring together state and local authorities, builders, tribal entities, and other stakeholders to establish baseline code components that can be adopted by any jurisdiction. Building on this foundation, the framework will outline additional, optional layers for enhanced energy efficiency, reduced energy burden, and healthier housing stock. This layered approach allows communities to implement codes that are responsive to their specific geographic characteristics and local priorities, from the Southeast coast to the Interior and the Arctic.

The final product will be a comprehensive toolkit that includes model codes, a clear process for local adoption, and a scalable framework to help communities meet their long-term goals. This effort will clarify the current state of building practices in Alaska and provide a clear path for implementing meaningful changes.

Estimated Emissions Reduction

TABLE 8: Building Codes Framework Adoption Estimated Emissions Reduction

Action	CO2e Reduction (Annual metric tons)	CO2e Reduction (Through 2030, cumulative metric tons)	CO2e Reduction (Through 2050, cumulative metric tons)
Four hub communities adopt new building codes	52.3	156.9	3399.46

For initial emission reduction estimates, we assume that at least four of Alaska's major hub communities will adopt more stringent building and energy codes as a direct result of this project's technical assistance and framework development. From there, we assume that 0.34% of the building stock square footage receives deep retrofits per year, with an average of 10.46 MTCO2e of emissions reduction per year. By 2030, accumulating years of code implementation would result in 52.3 MTCO2e annual reduction, with a maximum reduction of 3076.43 MTCO2e if the entire building stock is affected.

Community Benefits

By fostering the adoption of modern building and energy codes, this project will deliver significant and lasting benefits to Alaskan communities:

- Reduced Cost of Living: New homes built to higher standards will have lower energy consumption, directly reducing high utility bills for residents and increasing long-term housing affordability.
- Increased Home Resiliency: The framework will promote building practices that enhance a home's durability against Alaska's unique environmental challenges, such as extreme cold, heavy snow loads, seismic events, and the impacts of a changing environment like thawing permafrost.
- Simplified and Improved Building Practices: A consistent, yet flexible, framework will create predictability for architects, engineers, and builders operating across multiple jurisdictions, streamlining the design, and permitting process and potentially lowering construction costs.
- Economic Development: The project will help stimulate local economies by increasing demand for high-performance building materials and supporting a skilled workforce trained in modern construction and energy-efficiency techniques.
- Health and Safety: Modern codes incorporate standards for improved indoor air quality and ventilation, leading to healthier living environments for Alaskans.

Ultimately, this project will empower local communities to increase their energy independence, reduce greenhouse gas emissions, and ensure their housing stock is safe, durable, and affordable for generations to come.

Timeline

This project will proceed over multiple phases:

1) Research and Analysis (Year 1) – The project partners will focus in this first year on the research and analysis of building codes in Alaska, as well as codes around the U.S. that include features consistent with Alaska's remote and variable conditions. Project partners will work with stakeholders to identify local codes and practices, distinguishing commonalities, and differences. The partners will collaborate with the Department of Energy (DOE) for national code research, using latest model codes and standards (2021 ICC or later, ASHRAE 62.2 2022, and ASHRAE 90.1-2019). This will serve as a baseline or standard by which to measure and elevate existing codes in Alaska.

2) Developing the Framework (Year 2) – The project partners will focus on developing a responsive framework with active stakeholder engagement. They will develop a best practices framework that is representative yet unique, to Alaskan communities, residents, and building professionals. Ultimately, this framework will allow communities to develop more resilient, sustainable, and safe buildings.

3) Testing and Review (Year 3) – The project team will vet the framework with ICC and national best practices for carbon reduction and energy efficiency, as well as community resilience. The framework will be finalized.
4) Developing the Pathway to Framework (Year 3) – For ease of use by the communities an online platform will be created to assist in the preparation phase, with access to resources and documentation regarding the framework to code adoption.
5) Deployment and Implementation (Year 3) – Access to the completed framework will be distributed to all jurisdictions so that they have a pathway to adopt appropriate, consistent building and energy codes. It is also the intent of project managers to provide training and technical assistance to jurisdictions as they navigate their code adoption process. Outcomes will be assessed.

Project Budget Estimate
The project budget is $800,000, which is currently funded by a Department of Energy grant.

Other Funding Sources
The implementation of building codes will be supported by state and local government spending. Support for homeowners for retrofit and weatherization comes from multiple AHFC and federal programs from the U.S Departments of Energy and Housing and Urban Development.

Statewide Oil to Heat Pump Beneficial Electrification Incentive

Summary
This measure would establish a statewide incentive program aimed at significantly reducing greenhouse gas (GHG) emissions from residential heating by transitioning homes from high-carbon oil furnaces to cold-climate air-source or ground-source heat pumps. Modeled on the highly successful statewide heat pump program in Maine, which resulted in the deployment of over 100,000 heat pumps, this initiative would provide direct homeowner rebates, low-interest financing options, and critical contractor training support. To maximize early emissions reductions and cost-effectiveness, the program would prioritize conversions (and addition of heat pumps as a supplement to reduce use of diesel stoves) in oil-dependent households in rural Alaska communities where oil costs are high and electricity costs are reduced compared to heating fuel by a combination of PCE and clean energy generation. This would complement measures like ACES-AK discussed earlier in this plan.

Implementation of this incentive could rely on AHFC's expertise in integrating rebate, weatherization, and other broadly available housing incentives. AEA, Railbelt utilities, and the Regulatory Commission of Alaska (RCA) would be necessary to consult to ensure grid interconnection, tariff structures, and capacity issues are well-addressed.

For the Railbelt, heat pumps could be very important to displacing natural gas use—a recent policy brief[27] found that a heat pump installation could reduce the average household's gas use by 24%. Despite this, because natural gas for home heating is relatively cheap compared to current Railbelt electric rates, heat pumps cost an average of $2,300 more per year for the average Railbelt household. While economics are largely dictated by changes in the relationship between these two energy sources, creative rate design can help advance this technology. This includes incentivized rates specifically for heat pumps and time-of-use rates that take advantage of heat pump systems designed for demand-response (such as hydronic systems that use heat stored in water heated during off-peak times).

The Railbelt is served by Chugach Electric Association (CEA), the state's largest electric utility. CEA's 2024 Integrated Resource Plan (IRP) sets a strategic goal to reduce its carbon intensity by over 50% from 2012 levels by 2040. Displacing natural gas use in home heating runs alongside this goal by decreasing overall system carbon intensity. Chugach's IRP also indicates that CEA possesses significant surplus generation capacity under its preferred plan. This is a key finding, as it suggests that the initial, moderate load growth from heat pump adoption can be absorbed without immediate major capital investment in new generation, mitigating concerns about grid strain and large cost increases associated with initial electrification efforts.

Emissions Reduction

Heating oil is one of the highest carbon heating fuels. Replacing it with efficient heat pumps (Coefficient of Performance ≥ 2.5) substantially reduces emissions when powered by increasingly clean electricity. Modeling indicates that if 20% of oil-heated homes statewide convert by 2030, annual reductions could reach ~150,000 $MTCO_2e$. On grids where electricity is increasingly provided by clean energy projects, the emission reductions per home are particularly significant.

On the Railbelt, results are more nuanced as of the writing of this report. Emissions reduction will be better estimated in Railbelt communities when the served households are determined. The program can focus initial effort on the Railbelt by prioritizing conversions in areas not served by natural gas for home heating and multifamily housing stock, where centralized systems and bulk purchasing improve cost-effectiveness and aggregate reductions.

Community Benefits

Implementing oil-to-heat-pump conversions yields substantial co-benefits that support economic and social objectives across Alaska. Chief among these is energy cost stability for households, as the program reduces exposure to volatile global oil price spikes. Eliminating on-site oil combustion also leads to improved air quality and public health by reducing particulates, SO2, and indoor air pollutants, thereby addressing health risks such as asthma and respiratory illness.

The program is specifically structured to support low-income Alaskans, who often face some of the nation's highest home-heating costs due to reliance on imported fuel oil. By reducing household fuel consumption by 40–60%, the program has the potential to drastically lower monthly energy bills in communities where relative fuel prices exceed electric prices. Prioritizing low-income households for incentive eligibility and offering no-cost energy assessments will ensure equitable access to cost savings, healthier indoor environments, and long-term energy security, in full alignment with CPRG community benefits requirements.

Timeline and Estimated Costs

The timeline for the program is phased for success and scale: Program design, contractor training, and a pilot phase targeting 1,000 to 2,000 homes are scheduled for 2025–2026. This will be followed by a scale-up to the full incentive program, aiming to convert 3,000 to 4,000 homes per year between 2027 and 2030. The final phase, 2030–2035, will involve expansion to reach the 20% statewide conversion target, delivering the estimated 150,000 MTCO2e/year reduction. The estimated total program cost from 2025 to 2035 is $160 million to $180 million, covering $5 million to $10 million for two years of design and administration (staffing, training, and outreach), and an estimated $8,000 to $12,000 per household provided through a mix of direct rebates and low-interest financing.

NON-RESIDENTIAL

Public Building and Asset Weatherization, Energy Efficiency, and Beneficial Electrification

Summary

Weatherization, energy efficiency measures, and beneficial electrification of Alaska's public, non-residential facilities like schools, universities, and state and city/tribal office buildings have great potential to provide emissions reduction and broader statewide community benefits through money saved on energy expenses. The implementation of public building energy efficiency can also establish local expertise and serve as can also provide proof of concept for rollout across the private sector. Importantly, these measures are among the short list of efforts that can be undertaken with expediency and expertise by resource-limited governmental entities. In Alaska, government is one of the largest economic sectors. This is reflected in many small communities where public facilities, such as schools, are critical to human infrastructure, serving a changing role as lodging for out-of-town guests, emergency shelter, and community gathering space. AHFC's 2014 Energy Efficiency in Public Buildings Analysis[28], among other evidence, points clearly to the economic and environmental benefits

These facilities are also a major driver of costs for governments that are already fiscally distressed or lack access to sufficient revenue to meet growing costs, especially when the buildings are not energy efficient and use expensive heating oil, which in some communities is priced as high as $13/gallon.[29]

Proposed Measures

The proposed actions support programs by public entities that promote greater energy efficiency through weatherization, energy efficiency measures, and beneficial electrification in public facilities across Alaska. Other public assets, like vehicle and equipment fleets, may be considered as part of this measure as well. They would be implemented by the University of Alaska, Department of Transportation & Public Facilities, Department of Education and Early Development, municipal school districts, and other public entities like municipal and tribal governments.

University of Alaska

The University of Alaska was established in Fairbanks in 1917. Now the University of Alaska System includes three universities and 13 community campuses and extended learning centers located across the state. With more than 20,700 students, UA is essential to preparing the state's workforce. The proposed UA projects would address deferred maintenance, energy efficiency, and alternative energy projects (including some related to circulation, pedestrian improvements, and vehicle fleets) with the greatest potential for emissions reductions in the immediate future. UA's measures are well positioned to be implemented within 1-3 years.

Department of Transportation & Public Facilities

The Alaska Department of Transportation and Public Facilities (DOT&PF) designs, constructs, operates and maintains the state's transportation infrastructure systems, buildings, and other facilities used by Alaskans and visitors. The proposed measure would conduct energy audits, condition assessments, and implement feasible energy efficiency upgrades at major State of Alaska facilities. It would also mean implementing already identified energy savings opportunities from other public assets, such as adjusting using LED streetlights on a portion of the state-owned Glenn Highway between Anchorage and the Mat-Su Borough. The majority of DOT&PF actions, in particular those that don't require energy audits, can be completed by the end of 2026.

Department of Education and Early Development

The Alaska Department of Education and Early Development manages state and federal funding for Alaska's schools to ensure an excellent education for every student every day. Benefits are particularly significant because school districts have both high levels of deferred maintenance and funding shortages. Energy efficient upgrades can both reduce energy-related operational costs and reduce the state's carbon footprint.

The proposed measure would fund major maintenance projects with substantial emissions reduction potential that have been identified through the department's Capital Improvement Project (CIP) program. Projects on the CIP major maintenance list represent the most important capital projects for schools across the state. Of particular priority are projects in the Rural Education Attainments Areas (REAAs) of the unorganized borough, where the State of Alaska assumes the responsibility for providing K-12 education that would normally be shared with local governments. These REAA school districts operate with their own administration and school boards. The logistical ability to implement these measures varies by location, but they all ought to be implementable within a five-year period. Importantly, most of the projects that districts would consider for this program have been identified, scoped, and even partially designed/engineering as part of their submission to the state's CIP process.

Agencies, Tribes, Municipalities, and School Districts

Alaska's other state agencies, tribes, municipalities, and school districts provide essential services and maintain the critical infrastructure that supports even Alaska's smallest communities. The proposed measure would support these entities in advancing basic energy efficiency retrofits and retro-commissioning of public buildings to reduce emissions via improvements in HVAC systems, insulation, beneficial electrification of space and water heating, rooftop solar systems, and other emissions-reducing modifications. The timeline for implementation of these measures varies based on the entity, but generally these retrofits can generally be made within a five-year period.

With respect to school districts, retro-commissioning should be considered as a cost-effective initial effort for energy conservation. AHFC's analysis found that "[s]ince every school district except Anchorage has an average ECI of greater than $2 per square foot and some schools have issues with deferred maintenance, retro-commissioning is likely to be very cost effective." This report includes data on ECI, a number of other recommendations that are still relevant to Alaska's public facility managers.

Measures that would be considered by these entities are substantially similar to what has been described for other entities in this section.

Funding Landscape

The cost of materials and labor can make major maintenance prohibitively expensive in Alaska, especially in rural communities. In addition to these economic drivers, access to funding for major maintenance has become more limited due to the ongoing state fiscal crisis which has exacerbated the maintenance condition of both state and municipal facilities.

Even when federal and state grants allow facility managers to consider implementing energy efficiency upgrades, finding non-federal match funds can be a major barrier to these projects. While some home rule municipalities may issue bonds, generally revenue conditions are not sufficient to pay back this debt in a reasonable period.

TABLE 9: Non-Residential Budget Estimates

Action	Estimated Cost
UA - Campus Energy Projects	$50,000,000
DOT&PF - State Facilities Retrofits	$50,000,000
DEED - CIP Program Support	$66,296,653

Green Bonds

A potential solution to addressing the difficulty of accessing funding for public building improvements would be implementing a statewide green bond program that would make debt-funded improvements more accessible for agencies, especially for projects with reasonable cost paybacks. In other localities, green bonds function like traditional municipal bonds but are designated specifically for funding projects with positive environmental outcomes, such as public building retrofits. In Alaska, they would also complement grant funding by providing the required non-federal match for projects, with the debt repaid through the energy cost savings generated by the upgrades themselves rather than relying on a limited local tax base. See further discussion on green bonds in Chapter X.

Transformative Impacts

For state facilities, reduced energy usage means operational savings. These operational savings give state agencies more space in their budgets to provide their core public services. For the University of Alaska, these projects provide a direct benefit to students, faculty, and staff by producing savings that support other services and offset the need for revenue such as increased tuition. Actions that produce reduced fuel combustion in Fairbanks help reduce criteria pollutants which could help address that community's status as a PM2.5 nonattainment area.

Reduced fuel consumption can mean big differences for rural communities in Alaska. First of all, revenue for municipal governments in rural Alaska can be quite limited as communities can have a very restricted tax base; by reducing a reliably costly expense like heating oil, these essential governments may have greater fiscal resilience to economic shock and they may have more flexibility to invest in other needed areas. Reduced fuel use also may mean that fuel deliveries do not need to happen as regularly, resulting in greater resilience to freight disruption by weather and disaster that might delay fuel shipments. Over the long-term reduced residential dependence on diesel may mean that bulk fuel systems in some rural Alaska communities will not need to maintain as much capacity. This reduced reliance on importation of fossil fuels can make a huge difference for the most remote communities in Alaska.

Estimated Emissions Reduction

There is varying degree of certainty regarding emissions reduction, depending on whether the energy project is already scoped or if it needs to be identified with an energy assessment or similar tool.

To capture the potential emissions reduction from significant investment in non-residential energy efficiency that these measures represent, quantification was completed by modeling the impact of energy efficiency upgrades for 1050 geo-coded public buildings around the state, representing roughly 25% of all public buildings across the state.

TABLE 10: Non-Residential Estimated Emissions Reductions

CO2e Reduction (Annual Metric Tons by 2030)	CO2e Reduction (Through 2030, cumulative metric tons)	CO2e Reduction (Through 2050, cumulative metric tons)
60,761	243,044	1,458,264

Government Cost Savings and Fiscal Impact

Across the measures outlined above, investments in energy efficiency and beneficial electrification not only reduce greenhouse gas emissions but also generate direct cost savings for government entities. Residential programs such as the AHFC Weatherization Assistance Program and Home Retrofit Rebates have historically demonstrated a savings-to-investment ratio of 1.5–1.8, meaning every $1 invested returns $1.50–$1.80 in energy cost savings to households and indirectly reduces state energy assistance expenditures (AHFC Weatherization Assistance Program, Table 5). Non-residential public building retrofits, including state facilities, schools, and university campuses, yield operational energy savings that free up budgets for core government services and reduce reliance on volatile heating fuel purchases. While a formal fiscal multiplier for the broader economic impact has not been calculated, these measures provide a tangible, quantifiable benefit to government finances and highlight the dual environmental and fiscal value of emissions reduction programs.

Wastewater Treatment Plant Energy Improvements

Summary

Wastewater treatment plants are high energy consumers. Throughout Alaska, where WWTPs are planned or require maintenance or rebuilding, measures to reduce energy efficiency can have significant impacts on a community, especially where the facility can transition to renewable energy sources. The

Mendenhall Wastewater Treatment Plant stands out as the largest and most energy-inefficient municipal facility within the City and Borough of Juneau (CBJ). A crucial hub for the community's waste management, this facility has been a stalwart but increasingly inefficient in its energy consumption. Its two fuel oil boilers, now in their 38th year of service, have been the primary workhorses behind the plant's operations, requiring 214,000 gallons of oil annually to power the municipally owned utility.

The passage of time has taken its toll on these boilers, which have reached the end of their 35-year service life and are in need of replacement. Recognizing the imperative for a sustainable energy shift, this measure calls for the replacement of one of the two aging boilers with an electric boiler. This transformation is projected to yield substantial savings, estimated at approximately 80,000 gallons of oil each year over the electric boiler's 35-year life cycle, amounting to an impressive 2.8 million gallons saved. While the replacement of a single boiler might initially appear as a modest endeavor, its impact is anything but insignificant.

In fact, this conversion to clean and renewable hydro-powered electricity carries profound implications, extending beyond the walls of the Mendenhall Plant. In its inaugural year of operation, this transition promises to reduce the collective carbon dioxide (CO_2) emissions from all CBJ-managed facilities—excluding schools and hospital buildings—by 11%. This significant reduction underscores the project's significance in both environmental and community terms, marking a pivotal step toward greener and more sustainable municipal operations.

CBJ, with its proven track record and systematic approach to energy efficiency enhancements, stands well prepared to implement this transformative measure. It is part of a broader strategy that aligns seamlessly with CBJ's Juneau Renewable Energy Strategy[30] (JRES). As a cornerstone of JRES, this project contributes to the overarching goal of increasing renewable energy usage to a remarkable 80% of the total community energy consumption by the year 2045. Thus, it not only addresses the immediate energy efficiency needs of the Mendenhall Plant but also reflects CBJ's steadfast commitment to a more sustainable and eco-friendly future for Juneau and its residents.

Estimated Emissions Reduction

TABLE 11: CBJ Estimated Emissions Reduction

Metric	Emissions Reduction
Fuel Oil Savings	80,000 gallons per year
CO_2e Reduction	711 metric tons per year
Percentage of Total CBJ Emissions	Over 11% of CBJ facility emissions (2021, excluding schools and hospital buildings)
Overall CBJ Emissions Reduction	More than 5% reduction in CO_2 emissions (2021 GHG Emissions Inventory Update) when considering all operational emissions (buildings, equipment, fleet, etc.)

Community Benefits

Community benefits stemming from this project encompass both tangible and long-lasting advantages for the residents of Juneau. One of the primary benefits lies in the reduction of energy costs, a factor that directly impacts the economic well-being of the community residents. By mitigating the potential for long-term fuel cost increases, this project holds the promise of curbing the necessity for future rate hikes by the water utility. This is particularly significant for lower-income residents, it should be noted that this initiative extends its reach to benefit those residing in the federally designated disadvantaged community of Lemon Creek, represented by Census tract 4.

The City & Bureau of Juneau has already conducted an evaluation of replacement options for Mendenhall Plant's outdated boilers. This evaluation estimates that with an electric boiler there would be a projected energy use cost savings of $5 million over the 35-year life cycle of this sustainable infrastructure. Replacement of the current boiler with an electric boiler also offers significant potential for emissions reduction, aligning with environmental goals and promoting cleaner air for the entire community. It is crucial to acknowledge that the initial capital costs for bringing an electric boiler online amount to nearly $10 million, a financial commitment that surpassed CBJ's fiscal capacity without substantial grant funding assistance.

In the absence of support from programs like the CPRG (Community and Project Renewable Generation) or equivalent grant funding, CBJ would be compelled to proceed with the installation of two new fuel oil boilers. This scenario is driven by the fiscal realities faced by the community, and it underscores the challenges of funding such crucial projects independently, especially within the constraints of a municipality like Juneau. The reliance on external grant funding becomes not just an option but a vital lifeline for realizing both the economic and environmental benefits that this project promises to deliver to the community for generations to come.

Timeline

The timeline of this project is dependent on the procurement equipment lead times. Installation of electric boilers could be completed within one year if funded.

Project Budget Estimate

TABLE 12: CBJ Budget Estimate

Item	Cost
Electric Boiler (equipment, parts, construction, etc.)	$5.5 million
Escalation, Contingencies, Design, CBJ Admin, etc.	$1.6 million
CBJ-side Electrical Upgrades	$2.5 million
AELP-side Electrical Upgrades	$150,000
Total Budget	**$9,750,000**

Other Funding Sources

CBJ is committed to funding both the purchase and construction/installation expenses associated with the secondary fuel oil boiler, which will serve as a crucial backup to the electric boiler. This proactive measure not only enhances the facility's resilience but also aligns sustainability goals by introducing a significantly more efficient alternative to the aging fuel oil boilers. The addition of this new boiler is anticipated to yield even greater reductions in greenhouse gas (GHG) emissions. The estimated cost for the acquisition and implementation of the new fuel boiler is projected at $3 million, reflecting CBJ's commitment to investing in cleaner and more energy-efficient solutions for its municipal facilities.

SOLID WASTE

Central Peninsula Landfill Methane Capture Project

Summary

The Central Peninsula Landfill (CPL) has been actively receiving Municipal Solid Waste (MSW) in its lined landfill cells since 2006. Presently, there are three open cells, with Cell 3 currently in active use. Given the landfill's size, the Kenai Peninsula Borough has not been obligated to actively collect landfill gas from these cells. Instead, passive horizontal gas vents have been installed throughout the cells to release any landfill gas into the atmosphere. An ongoing project is in progress to install a new leachate concentrator at CPL, which will have the capability to utilize landfill gas, resulting in significant savings on natural gas consumption. Furthermore, the local electrical energy cooperative is exploring the feasibility of installing a landfill gas-powered generator. This generator not only holds the potential to provide sustainable energy to the Borough but also to capture waste heat from its operation for use in the concentrator.

The Central Peninsula Landfill is the MSW landfill serving the Kenai Peninsula that is accessible by road. The Central Peninsula Landfill processes waste from a range of communities, spanning from Homer to Hope and Seward. Currently, the methane produced from the waste degradation process is passively released into the atmosphere. However, it's well-established in the industry that collecting and burning methane through a flare is a standard practice that mitigates methane emissions.

Beyond the environmental benefits of reducing methane emissions, CPL recognizes the opportunity to put this valuable resource to practical use within our facility. KPB has initiated a project to introduce a new leachate concentrator at CPL, specifically designed to handle the leachate generated within the landfill cells. This concentrator will be equipped with a flare capable of burning both natural gas and landfill gas to power its equipment processes. Additionally, it can utilize waste heat to drive its operations. With this state-of-the-art concentrator installed, the KPB will be equipped to directly utilize landfill gas to power the evaporator, thereby significantly reducing our reliance on purchased natural gas. This, in turn, will lead to substantial utility cost reductions for both the landfill and the Borough.

The regional electric cooperative, Homer Electric Association, is actively exploring the feasibility of introducing a landfill gas-powered generator at the CPL site. There is potential to provide a renewable energy source for the Peninsula, further contributing to the emissions reduction potential of this project. Additionally, the waste heat generated by this generator could be captured and channeled into the leachate concentrator, further reducing waste and diminishing the need for gas consumption in the concentrator's operations. Although this project is currently in the design phase, it presents a promising avenue for a mutually beneficial partnership that aligns with our commitment to environmental stewardship and resource efficiency.

Community Benefits

The first notable benefit of this project is its capacity to significantly reduce the release of methane into the atmosphere within the Kenai Peninsula Borough. Historically, landfills have been a substantial source of greenhouse gas emissions. By mitigating methane venting, this project would actively address localized environmental concerns and contribute to sustainable waste management for the Kenai Peninsula Borough.

In tandem with the reduction in methane emissions, another crucial advantage lies in the decreased reliance on natural gas at the landfill site. The new leachate concentrator is rated to use 18,000 CFH of natural gas. Any offset of this usage is a benefit in reducing emissions, saving taxpayer funds and reduction in usage of natural gas that is projected to be in short supply in coming years[31]. By optimizing the Central Peninsula Landfill's energy usage and minimizing the consumption of natural gas, this project embraces both fiscal responsibility and proactively responds to the challenges posed by an evolving energy landscape.

Estimated Emissions Reduction

Landfill gas, a byproduct of the decomposition of organic waste, comprises a complex mixture of gases. It typically contains approximately 50-55% methane, 45-50% carbon dioxide, and less than 1% of non-methane organic compounds, along with trace amounts of inorganic compounds. Methane, a predominant component of landfill gas, is a particularly potent greenhouse gas, possessing the ability to trap heat in the atmosphere 28 to 36 times more effectively than carbon dioxide over a 100-year period. Understanding the composition of landfill gas and the environmental implications of its emissions is critical in developing strategies to mitigate its impact.

Gas to energy initiatives, such as this proposed project, are designed to capture a substantial portion of the methane generated by landfills, with capture rates typically ranging from 60% to 90%, contingent on the efficiency and effectiveness of the system in place. The captured methane can then be repurposed, typically by burning it to produce electricity or heat, converting it into water and carbon dioxide in the process. This not only mitigates the release of methane, a potent greenhouse gas, into the atmosphere but also harnesses it as a valuable energy resource.

In the context of the Central Peninsula Landfill, the significance of landfill gas management becomes apparent when examining the emissions data. In 2022, the existing leachate concentrator was responsible for producing 2,255.3 metric tons of carbon dioxide (CO2) through the combustion of natural gas. With the introduction of the new unit, it is anticipated that this figure will surge by approximately 250%, resulting in the generation of 5,638.3 metric tons of CO2. Concurrently, the landfill itself was estimated to emit 2,125.96 metric tons of methane in 2022, a value that is expected to increase annually as waste continues to be deposited in the landfill. Implementing a landfill gas capture system with a capture rate of 60-90% could have averted the release of 1,275.6 to 1,913.4 metric tons of methane into the atmosphere while reducing natural gas usage for necessary operation of the leachate concentrator, a significant reduction with important environmental implications.

The following total CO2e reduction was calculated using the LFG Benefits Calculator, pulling from EPA's Landfill Methane Outreach Program (LMOP) database.

TABLE 13: CPL Estimated Emissions Reduction

CO2e Reduction (Annual metric tons)	CO2e Reduction (Through 2030, cumulative metric tons)	CO2e Reduction (Through 2050, cumulative metric tons)
49,067	196,268	1,177,607

Implementation Schedule

TABLE 14: CPL Implementation Schedule

Project Phase	Duration
Grant acceptance and pre-planning	1 month
Design procurement	3 months
Design of project	6 months
Construction procurement	2 months
Construction, installation, and startup	12 months
Project Close out	1 month
Total project duration	**25 months**

This table outlines the estimated duration for each phase of the project, as well as the total project duration, which ranges from 24 to 30 months based on project scheduling variability.

Proposed Metrics

The proposed project encompasses a multifaceted approach to maximize the efficient utilization of landfill gas at the Central Peninsula Landfill (CPL). Central to this initiative is the installation of gas meters strategically placed along the gas lines. Complementing the installation of gas meters, the project also includes the implementation of a Supervisory Control and Data Acquisition (SCADA) system. By monitoring gas flow rates, pressures, and other critical parameters, the SCADA system will track the usage and gas volumes over the lifetime of the project.

Funding Landscape

The total construction cost of this project is estimated to be $4,160,000.

There are currently no funds appropriated for this stand-alone project. The Homer Electric Association is actively searching for funds for construction of the proposed combined heat and power project mentioned in the above measure narrative.

Southeast Alaska Composting Program

Summary

Southeast Alaska tribal communities face an urgent solid waste management crisis, with most tribal communities relying on environmentally risky Class III landfills or shouldering the economic burden of shipping waste to the lower 48 states. The pressing need for immediate action arises to reduce greenhouse gas emissions, protect local resources, mitigate and alleviate the economic strain on these underserved and overburdened communities. Additionally, recognizing the significance of composting emerges as a crucial aspect in this comprehensive, region-specific emission reduction measure. Composting not only reduces greenhouse gas (GHG) emissions but also reduces the volume of waste sent to landfills, enriches the soil, and contributes to the preservation of local ecosystems while promoting sustainable agricultural practices. Implementation of composting initiatives alongside other waste management strategies becomes imperative in addressing the urgent challenges faced by Southeast Alaska tribal communities, ensuring the protection of our local drinking water sources, subsistence resources, and overall health of our tribal communities.

The Central Council of The Tlingit and Haida Indian Tribes of Alaska (Tlingit & Haida) is proposing a measure to design and construct composting facilities tailored specifically for four tribal communities (Wrangell, Hoonah, Petersburg, Yakutat, or similar) and one urban city (Juneau) in the Southeast Alaska region. The proposed measure to establish composting facilities within tribal communities under the stewardship of Tlingit & Haida presents a robust and sustainable solution to mitigate greenhouse gas emissions while fostering environmental stewardship and community resilience. By strategically partnering with tribal communities, this measure aims to address solid waste management challenges while simultaneously reducing greenhouse gas emissions through composting organic waste.

Tlingit & Haida's expertise in collaborative stewardship projects and its established government-to-government relationship uniquely positions the organization to spearhead this initiative effectively. Their leadership ensures the smooth execution of the proposed measure, from establishing partnership agreements with tribal communities to developing comprehensive scope of work reports and service agreements with contractors.

Additionally, Tlingit & Haida's recent success in securing the EPA Solid Waste Infrastructure for Recycling (SWIFR) grant underscores its capacity to leverage funding opportunities and implement large-scale environmental initiatives. With the support of the Horticulture Coordinator, and Environmental Specialist, the organization is well-equipped to navigate the complexities of composting infrastructure development and optimization.

By integrating composting facilities into tribal communities and providing training on proper composting techniques, Tlingit & Haida not only facilitates substantial reductions in greenhouse gas emissions but also fosters community empowerment and capacity building. The proposed measure aligns with the organization's commitment to enhancing and protecting land, environment, and culture while promoting sustainable development and resilience within tribal communities. Through collaborative efforts and strategic partnerships, Tlingit & Haida aims to establish a model for sustainable waste management that can be replicated and scaled across regions, ultimately contributing to significant, long-term emissions reductions and environmental stewardship.

Community Benefits

The Central Council of the Tlingit & Haida Indian Tribes of Alaska is a federally recognized tribal government representing 37,000 tribal citizens in 18 villages and communities in Southeast Alaska—most of which are not connected to a road system and are only accessible by boat or plane. Being remote and often isolated, Southeast Alaska Native Villages and the areas of Wrangell, Prince of Wales, and Metlakatla are underserved and identified as being disadvantaged. These tribal communities in Southeast Alaska often have inadequate and unsustainable management of organic resources.

The proposed measure goes beyond immediate environmental concerns and GHGs emission reduction; this measure is geared towards fostering collaboration, capacity building, and information exchange throughout the region. By establishing a network for cooperation among tribes, government entities, non-profits, and other groups, the measure seeks to strengthen the collective ability of tribal communities in Southeast Alaska to implement and sustain effective organics recycling programs. Additionally, the proposed measure emphasizes the cultural and economic significance of the region's lands, waters, and wildlife, aiming to connect and restore these vital elements that form the foundation of the communities' cultural existence and economic welfare. Overall, this measure represents an inclusive approach, aligning with Tlingit & Haida mission, and positioning the tribal government as a regional coordinator for collaborative stewardship projects that address the unique challenges of organic resource management in Southeast Alaska.

Communities shipping waste to out-of-state landfills can attain cost savings by locally diverting heavy food waste and producing compost on-site, thereby reducing dependence on expensive soil amendments. Communities with landfills near or at capacity have the added benefit of reducing waste stream to their facilities, thereby extending facility lifespan, and delaying relocation or the need to divert growing waste streams to other facilities. Composting programs can be scaled up more quickly and are less expensive than landfills or incinerators. These incentives encourage active engagement in this effort, fueled by the potential for localized waste management solutions and economic benefits tied to compost production.

The benefits of this measure will extend to the entire Southeast Alaska region, including tribal communities, municipalities, residents, businesses, and the environment. Community gardens, food producers, gardeners, school gardens, and the entire region can benefit from locally sourced compost for local agriculture, food security, and food sovereignty. The local economy will benefit through revenue generation, job creation and cost savings through organics recycling, and extended landfill lifespan. This regional measure will help to safeguard drinking water sources, protect subsistence resources, enhance community aesthetics, and promote the overall well-being and sustainability of our region.

Estimated Emissions Reduction

TABLE 15: CCTHA Estimated Emissions Reduction

CO2e Reduction (Annual metric tons)	CO2e Reduction (Through 2030, cumulative metric tons)	CO2e Reduction (Through 2050, cumulative metric tons)
48,206	144,618	1,205,162

This quantification is based on a Waste Reduction Model (WARM)[32] using data from the following reports: Wrangell Integrated Solid Waste Management Plan Updated December 2021, Yakutat Tribe Environmental Department Soil Security Stewardship (Compost) Data January 20,2021, Municipality of Skagway Solid Waste and Recycling Management Plan February 28, 2013. Additionally estimates for Juneau were based on the Juneau Commission on Sustainability (JCOS) Juneau Solid Waste Factsheet dated March 12, 2021. The tonnage of compostable items for each community was calculated using the percentages of food, yard trimmings, paper, and cardboard identified in the waste characterization studies and the annual total tonnage disposed of in the landfills or shipped to the lower 48 states. The calculated total CO2E reduction value represents the maximum potential for 100% diversion of all compostable items for 5 communities in Southeast Alaska.

Implementation Schedule

Phase 1: Planning and Design

- Milestone 1. Establishing Partnership Agreements with Tribal Communities (MOAs/MOUs) – Outline roles and responsibilities for collaboration.
- Milestone 2. Developing Scope of Work Report – Conduct site assessment and feasibility studies to evaluate potential locations for composting facilities.
- Milestone 3. Service Agreements with Contractors – Identify qualified contractors with experience in composting facility design, construction, and operation.
- Milestone 4. Developing Initial Composting Infrastructure Design Options – Site layout, equipment specifications, waste handling process. Present design to tribal communities for review and feedback.

Phase 2: Implementation

- Milestone 5. Procurement – Issue Request for Proposals (RFPs) for composting equipment, infrastructure, and solid waste management consulting.
- Milestone 6. Installation of Composting Infrastructure – Begin construction of composting facilities based on approved designs, site inspections to verify design specifications and timelines.
- Milestone 7. Develop Comprehensive Standard Operating Procedures (SOPs) – Detailing the protocols for operating and managing the composting facilities. These SOPs will outline guidelines for waste segregation, composting processes, equipment maintenance, safety procedures, and quality control measures.
- Milestone 8. Equipment Testing and Optimization – Testing composting processes, training staff and community members on proper composting techniques.
- Milestone 9. Reporting and Documentation – Compile data on composting performance, including waste diversion rates, greenhouse gas emissions reduction, and compost quality.

Phase 3: Data Collection and Sustainability

- Milestone 10. Long-Term Monitoring and Evaluation – Collect data on key indicators such as waste diversion rates, greenhouse gas emissions reductions, and community engagement levels.
- Milestone 11. Sustainability Planning and Capacity Building – Identify funding sources and opportunities for revenue generation. Build capacity within tribal communities to independently manage and operate composting facilities. Roadblocks: Regulatory compliance, community engagement, funding constraints.

Proposed Metrics

The proposed measure for establishing composting facilities within tribal communities in Southeast Alaska under the stewardship of the Central Council of The Tlingit and Haida Indian Tribes of Alaska (Tlingit & Haida) will be tracked using various metrics to gauge progress and effectiveness. These metrics include:

- Type of equipment installed for each community: This metric will track the actual implementation of composting infrastructure within tribal communities and urban areas, including Wrangell, Hoonah, Petersburg, Yakutat, and Juneau.
- Volume of organic waste diverted from landfills: Tracking the amount of organic waste diverted from Class III landfills or shipments to the lower 48 states will indicate the effectiveness of the composting facilities in reducing the burden on existing waste management systems.

- Reduction in greenhouse gas emissions: Quantifying the reduction in greenhouse gas emissions resulting from the implementation of composting initiatives will provide insight into the environmental impact of the measure. This could include metrics such as tons of CO2 equivalent emissions avoided through composting.
- Number of community members trained in composting techniques: Monitoring the number of community members trained in proper composting techniques will demonstrate the level of engagement and capacity building achieved within tribal communities.
- Investment in composting infrastructure: Tracking the investment made in designing, constructing, and optimizing composting facilities will provide insight into the financial commitment and resource allocation towards waste management solutions.
- Job creation and workforce development: Assessing the number of jobs created and workforce development opportunities generated through the implementation of composting initiatives will demonstrate the economic benefits and community empowerment achieved.

By tracking these metrics, Tlingit & Haida can effectively monitor progress, identify areas for improvement, and demonstrate the tangible benefits of the proposed measure in addressing solid waste management challenges, reducing greenhouse gas emissions, and fostering environmental stewardship within Southeast Alaska tribal communities.

Funding Landscape

- The estimated cost for this program is just under $15M.
- Tlingit & Haida has been awarded the following grants for work related to solid waste:
- EPA Solid Waste Infrastructure for Recycling (SWIFR) grant – currently in awarding process for $1,499,999 to establish a regional recycling hub and expand Tlingit & Haida's current composting program which will help bolster this measure.
- USDA Composting Food Waste Reduction (CFWR) grant – awarded in 2023 for $375,000 for composting infrastructure including an in-vessel composting and storage building.
- Alaska Native Tribal Health Consortium (ANTHC) funding for $75,000 – awarded to support Tlingit & Haida's internal composting program, which will reduce organic waste generated by Tribal enterprises and office spaces while supply compost to the Tribe's Taay Hít Urban Farm.

TRANSPORTATION

Green Corridor – Juneau Port Electrification

Summary

The cruise industry is a major economic feature along the southern coast of Alaska. In 2001, the world's first shore power facility for cruise ships was installed at one of the two private cruise ship docks serving Juneau's visiting cruise ships with success, continuing to serve ships over twenty years later. Communities like Juneau receive as many as seven ocean-class cruise ships daily.

Juneau is one of three communities in Alaska to have an approved climate action plan addressing emissions reduction measures, with a goal of reducing emissions by 25% by 2032. There is greater public ownership of shoreside infrastructure in Juneau than some other communities, as two of the four cruise ship berths in Juneau are municipally owned.

The development of shore power in Juneau serves as just a portion of the Green Corridor project[33] being led in collaboration with the Port of Seattle and other partners. The Port of Seattle says that "A green corridor is a shipping route where zero greenhouse gas solutions are considered, demonstrated, and supported. Green corridors—through collaboration across sectors—establish the technological, economic, and regulatory feasibility needed to accelerate implementation of low and ultimately zero GHG emission vessels."

As an early adopter of the Green Corridor concept, Juneau serves as an example for infrastructure being developed in other early adopter communities in Southeast Alaska, like Sitka, Haines, and Skagway as well as other communities who are exploring cruise terminal shore power like Ketchikan and Whittier.

Proposed Measure

City & Borough of Juneau

The City and Borough of Juneau's objective is seeking to install equipment at their two cruise docks to provide shore power to the ships moored there, thus substantially reducing the emissions produced by the on-board generators during the "hoteling" that occurs while the ship is at port. This electrification would greatly reduce criteria pollutant emissions in one of the densest areas of Juneau, while also greatly reducing greenhouse gas emissions by shifting energy use to the Alaska Electric, Light, & Power (AEL&P) grid which has 100% of its firm electrical needs supported by hydroelectric power.

Other Alaska communities and ports along the green corridor could develop projects to a similar scope and scale of what has been proposed in Juneau—especially if they have available and dispatchable renewable generation resources available.

Timeline

The engineering effort for Juneau's project will require a 12-month period to be completed, which will also be used to apply for additional funding. With the completion of design and development of construction documents, as well as the final acquisition of funding, the project will be bid. The project may be segregated into two phases, allowing one shore power facility to be constructed before full acquisition of funds needed to complete the second facility. The bid period is anticipated to require a 2-month period. After the construction contract is received, the acquisition of transformers, high-voltage switchgear, stationary or floating support structure at the dock, and shore power deployment equipment will take 12 to 24 months. Construction can be completed within 12 months.

TABLE 16: Green Corridor - Juneau Implementation Timeline

Design and Construction Documents	12 Months
Grant Applications (concurrent with design)	18 Months
Bidding	2 Months
Procurement	12 to 24 Months
Construction	12 Months

Similar projects in other communities may have longer timelines than Juneau due to additional time needed for feasibility and other initial scoping.

Funding Landscape

An application seeking $1,500,000 in funding for this project via the 2022-2023 Diesel Emissions Reduction Act (DERA) National Grants was submitted.

In 2022, the City and Borough of Juneau committed $4,900,000 to this project and additional funding will be contributed using local funds generated by cruise industry fees and additional grants.

Transformative Impacts

The proposed cruise ship dock electrification will reduce exposure to criteria pollutants in the downtown business district and nearby residential neighborhoods. The reduced air emissions and health impacts will further benefit Juneau's efforts to provide a cleaner environment to the elderly, under-served, and children residing in the downtown Juneau port area. Juneau was a PM-10 nonattainment area in 1987 and a redesignated maintenance area in 2013.

Juneau is also home to two federally recognized tribes. The Douglas Indian Association includes over 700 tribal members, with its historic townsite located across the water from the cruise docks. The Central Council of Tlingit & Haida Indian Tribes of Alaska, which is headquartered in downtown Juneau, has 24,000 active enrolled citizens with a portion of this population residing in the community. Juneau's population is 19% Alaska Native, with a substantial younger population representing 25% of all Juneau youth.

The broader Green Corridor project could help address environmental and economic opportunity needs along the entire corridor proposed.

Estimated Emissions Reduction

The electrification of both the north and south berth of the Juneau project would likely produce the following emissions reduction.

TABLE 17: Green Corridor Estimated Emissions Reduction

CO2e Reduction (Annual metric tons)	CO2e Reduction (Through 2030, cumulative metric tons)	CO2e Reduction (Through 2050, cumulative metric tons)
7,795	31,180	187,080

Green Corridor – Seward Port Electrification

Summary

The Port of Seward is looking to become a green port and reduce mobile source emissions associated with port operations. The cruise industry is a significant economic driver in the region, and as the cruise industry continues to grow, the Port recognizes its responsibility to balance economic growth with sustainability. Eliminating at-berth emissions by utilizing clean electricity is a major strategy for reducing greenhouse gas emissions and meeting this goal of becoming a green port. While ships are docked, they still need energy to run lights, chill food, operate equipment, and power a myriad of other onboard services. A shore power connection will allow cruise ships to plug into cleaner, landside electrical power and turn off their diesel engines, reducing both diesel fuel consumption and related emissions.

This project supports the long-term sustainability of the Port of Seward by establishing shore power than not only reduces local and total emissions now but provides a first-step on the path towards establishing a "green corridor" for shipping and cruise lines as is being explored by the Port of Seattle and partners. By engaging the Alaska Vocational Technical Center (AVTEC), the premier vocational school in the state, to support workforce needs of using the shore-power equipment, this project may support further usage of advanced shore-power equipment throughout Alaska.

Estimated Emissions Reduction

TABLE 18: Green Corridor - Seward CO2e Emissions Reduction

CO2e Reduction (Annual metric tons)	CO2e Reduction (Through 2030, cumulative metric tons)	CO2e Reduction (Through 2050, cumulative metric tons)
1,482	7,517	94,099

With an 80% clean grid, the annual emissions reduction increases to 4,925 metric tons CO2e.

TABLE 19: Green Corridor - Seward CAP Emissions Reduction

Metric	Emissions Reduction
Local NOx Reduction (Annual metric tons)	81.79
Local SO2 Reduction (Annual metric tons)	17.97

Community Benefits

Shore power systems increase Railbelt electrical demand, which supports Priority A of the Alaska Energy Security Task Force's report which aims to "spread fixed costs over a larger base, drive down prices for all consumers and spur economic development." This is particularly important for the Seward Electrical System, given its proportionally high fixed costs compared to other Railbelt electric utilities. Being the only municipally owned utility serving the smallest number of customers of the utilities, the relative impact on rates from this project is quite large for residents of Seward.

By increasing the Railbelt grids capacity for peak shaving, the associated Battery Energy Storage System (BESS) supports the stability and renewables use of the entire Railbelt grid; it would also potentially increase the community's resilience by providing back-up power via the integrated Battery Energy Storage System (BESS) during emergencies where their single transmission line is disrupted.

Local criteria pollutants from vessels hoteling are completely eliminated by this project. With current grid mix, total NOx emissions are reduced by 70% and total SO2 emissions are reduced by 87%.

Timeline

Starting procurement in 2025, this project will see the shore power and BESS systems operating in mid-2027. Continuing monitoring, community engagement, and workforce development will continue through 2030.

Project Budget Estimate

The complete project, including community engagement, monitoring, and workforce development, will cost $56.8M by 2030. Excluding necessary site work and transmission upgrades, the shore power handling system will cost approximately $17.8M and its associated 12 MW BESS system will cost $9.6M.

Other Funding Sources

This project received $45.7M in funding from the 2024 Clean Ports Program and $11M in matching funding and in-kind support for the project sponsors.

Electric Vehicle Supply Equipment Installation Program

Summary

The proactive installation of Electric Vehicle Supply Equipment (EVSE) in both urban and rural Alaska communities will serve as a vital step in bridging the existing funding gaps between private and public programs, with a primary objective of alleviating range anxiety among electric vehicle (EV) drivers and promoting EV adoption throughout Alaska. This project aligns seamlessly with the state's comprehensive NEVI strategic plan, which through thorough evaluation sited both Level 2 and Level 3 charging stations at key locations. Level 2 chargers cater to urban areas, providing convenient daily charging solutions, while Level 3 chargers are more conducive to locations along major long-distance routes, facilitating quick recharges during extended journeys.

In a collaborative effort alongside the Department of Transportation and Public Facilities (DOT&PF), the Alaska Energy Authority (AEA) actively spearheads the implementation of Alaska's share of the National Electric Vehicle Infrastructure (NEVI) funding. This joint endeavor is driven by the shared goal of maximizing resources and efficiently developing a comprehensive and robust EV charging network that is designed to meet the unique needs and challenges of Alaska's diverse landscape.

The significance of this infrastructure development cannot be overstated, as it directly addresses the critical funding gaps that have hindered the expansion of EV infrastructure. By strategically placing charging stations, this measure aims to reduce range anxiety, thus creating a market environment conducive to increased EV adoption. In essence, this initiative plays a pivotal role in fostering seamless charging experiences and removing existing barriers to EV adoption, ultimately contributing to a cleaner and more sustainable transportation sector in Alaska. Furthermore, an infusion of funding into this endeavor follows a similar model to the NEVI funding program, ensuring a streamlined and efficient allocation of resources to further accelerate the growth of EVs across the state.

Community Benefits

The program aims to achieve several key objectives including enhancing clean transportation access and addressing environmental concerns. One of its primary goals is to enhance clean transportation access by strategically siting charging stations. This effort is designed to alleviate the burden of transportation energy costs by providing reliable access to affordable charging and lowering the burden of EV ownership for all.

Additionally, the program seeks to bolster the clean energy job pipeline, offering job training and establishing job-creating enterprises within disadvantaged communities. This initiative aims to generate new clean energy jobs and related opportunities, thus contributing to economic growth in these areas. Simultaneously, the program intends to reduce environmental exposures to transportation-sector emissions, benefiting the health and well-being of those communities where stations are directly sited, and those communities along impacted roadways.

Moreover, there are positive economic impacts anticipated by business owners through increased retail and site sales owing to visitation by patrons charging their electric vehicles. The program emphasizes knowledge sharing and program awareness, encouraging community engagement and fostering opportunities for dialogue. Lastly, it underscores the direct air quality improvements brought about by the deployment of charging ports. Cleaner air benefits everyone, and the transition to electric vehicles showcases these advantages, particularly in urban areas like Fairbanks, of which a portion is classified as a PM2.5 nonattainment area, where reduced vehicle emissions can substantially improve the generally poor air quality, especially during winter months where temperature inversions trap airborne pollutants near the ground. This program represents a multifaceted approach to creating a more sustainable and healthier transportation ecosystem for all Alaskans.

Estimated Emissions Reduction

With an average Grid intensity for the Railbelt (eGRID "AKGD") of 1,052 lb. CO_2/MWh or 0.477 kg CO_2/kWh, the assumed tailpipe CO_2 per gallon for gasoline as 8.89 kg/gal, and for diesel as 10.16 kg/gal, given vehicle efficiencies (typical light-duty) EV at 3.0 mi/kWh; gasoline car at 30 mpg; diesel at 25 mpg, we can assume charger nameplate & utilization, or the average delivered power and capacity factor, CF for Level 2 to be 6.6 kW avg; CF scenarios 5% / 12% / 25%, and for Level 3 to be 100 kW avg; CF scenarios 5% / 10% / 20%. From these, per kWh delivered the avoided CO_2 vs gasoline approximately 0.412 kg: vs diesel at approximately 0.742 kg. Annualized electricity use at collective charger levels are presented below:

TABLE 20: EVSE Emissions Reduction

Utilization scenario	MWh/year delivered	Miles enabled (million)	Gasoline avoided (gal)	Diesel avoided (gal)	CO_2 avoided vs gasoline (MT/yr)	CO_2 avoided vs diesel (MT/yr)
Low use (L2 5% CF, L3 5%)	773	2.318	77,263	92,716	318	573
Moderate (L2 12%, L3 10%)	1,592	4.775	159,152	190,982	655	1,181
High use (L2 25%, L3 20%)	3,206	9.618	320,616	384,739	1,320	2,379

Implementation Schedule

This measure has an anticipated project timeline of three years. Key project activities will consist of reaching out to specific communities, managing the application process within those areas to choose charger site hosts, conducting a competitive selection, and handling the installation and commissioning of associated EVSE.

Proposed Metrics

At the highest level, the metric for the success of this measure will be the number of EV charging stations installed. Each site will follow the requirements and standards set in Title 23 for the National Electric Vehicle Infrastructure (NEVI) program with four ports deployed at each site. It is estimated that each site will provide a reduction of CO2 emissions up to 2,144 tons annually. After installation, the usage of these ports can be tracked to record activity and measure the actual emissions reduction each year.

Cost Estimate

TABLE 21: EVSE Cost Estimate

Budget Component	Estimated Cost (Per Site)	Number of Sites	Total Estimated Cost
Level 3 Charging	$600,000	15	$9,000,000
Level 2 Charging	$15,000	40	$600,000
Total Project Budget			**$10,000,000**

Funding Landscape

While no other funding for this measure has been committed to date, potential funding to leverage in support of this project includes the National Electric Vehicle Infrastructure (NEVI) Program, the Charging and Fueling Infrastructure (CFI) Program, and the potential of a site host/ community match from those communities targeted in this effort.

Sustainable Aviation Fuel & Renewable Diesel

Summary

This measure describes the development of a bio-refinery in Southcentral Alaska for implementation of Sustainable Aviation Fuel (SAF) at Ted Stevens Anchorage International Airport (TSAIA), a major hub for air cargo and passenger transport and implementation of renewable diesel in ground vehicle operations. The airport's adoption of SAF aligns with the global aviation industry's move towards sustainable fuels and could catalyze a broader shift in the sector, especially considering its extensive network of air routes. With the aviation industry responsible for around 2% of all human-produced carbon emissions and 12% of transportation emissions globally, SAF's adoption could lead to a significant reduction in lifecycle emissions. Every jet going into TSAIA emits approximately as much carbon dioxide per traveler as the entire annual footprint of a single person that lives in more than one-fourth of the world's countries.

In 2023, TSAIA handled 5.4 million passengers and ranks as the fourth-largest air cargo airport in the world, making it a critical hub for both passenger and freight operations.

TSAIA's defining feature is its massive air cargo throughput. In 2023, the airport processed approximately 3.4 million tons of freight, equivalent to over 7 billion pounds annually. Dozens of major international cargo airlines operate through Anchorage, including:

- Integrator carriers: FedEx Express and UPS Airlines (both with hub facilities at ANC)
- All-cargo carriers: Atlas Air, Cathay Pacific Cargo, Korean Air Cargo, China Airlines Cargo, Nippon Cargo Airlines, DHL, and others
- Combination carriers: China Southern and EVA Air, which occasionally make technical stops

SAF is a safe, certified drop-in fuel that meets the jet fuel standards to reduce carbon emissions by as much as 80% of lifecycle emissions. SAF production employs various pathways such as Fat-to-Fuel, Waste-to-Fuel, Air-to-Fuel, Crop-to-Fuel, and Sun-to-Fuel, involving the transformation of diverse resources like waste oils, fats, municipal solid waste, and non-food crops into jet fuel. Developing SAF and renewable diesel in Alaska for use in international and domestic aviation and domestic ground vehicles will harness Alaska's vast renewable resources, expand local and regional economic development opportunities, and greatly improve environmental performance in the largest transportation sector emissions category in Alaska.

Emissions Reduction

Full-scale operations of the Sustainable Aviation Fuel (SAF) facility are anticipated in 2030, following phased construction, equipment installation, and commissioning.

Approximately 1,600,080 metric tons of CO_2 equivalent per year, based on projected production of 150 MGY SAF, 54 MGY renewable diesel, and 11 MGY renewable naphtha, with corresponding carbon intensities of 30–40 gCO_2/MJ.

Assuming ramp-up begins in 2030 and full operations are achieved that year, cumulative reductions by 2030 would be equivalent to the first full year of operation: approximately 1,600,080 $MTCO_2e$.

TABLE 22: SAF Emissions Reduction

CO2e Reduction (Annual Metric Tons by 2030)	CO2e Reduction (Through 2030, cumulative metric tons)	CO2e Reduction (Through 2050, cumulative metric tons)
1,600,080	1,600,080	33,601,680

The facility is expected to reduce particulate matter (PM), NOx, and SOx emissions relative to conventional petroleum-based jet fuel and diesel, particularly through cleaner-burning SAF and renewable diesel. Exact estimates will depend on final feedstock sourcing, production methods, and displacement rates, but reductions in criteria pollutants are anticipated to contribute to improved local and regional air quality.

Project Implementation Schedule

Given the scale of this project, the timeline is influenced by financing, permitting, and the planned phased approach. The proposed schedule includes the following key milestones:

- 2024–2026: Preconstruction
  - Complete final feasibility studies and secure financing/investment
  - Obtain necessary permits and environmental approvals
  - Conduct front-end engineering design (FEED)
  - Procure long-lead equipment
- 2027: Site Preparation and Early Works
  - Conduct geotechnical and site surveys
  - Site clearing, earthwork, and foundation construction
  - Install underground utilities and prepare tank farm
  - Receive delivery of long-lead equipment
- 2028–2029: Major Equipment Installation
  - Erect structural steel and assemble major process equipment
  - Install hydrogen production systems
  - Construct rail spur, dock improvements, and blending/storage facilities
- 2030: Commissioning and Ramp-Up
  - Conduct system integrity testing, equipment flushing/drying, and ASTM certification
  - Perform performance testing and ensure compliance
  - Ramp up operations to full production capacity

This timeline is realistic and achievable given the project's complexity, with each phase allowing sufficient time for engineering, construction, and commissioning. The phased structure also provides flexibility to align work with available funding and supply chain constraints while maintaining progress toward full operational capacity.

Metrics

Success will be measured across multiple dimensions:

- Production and emissions reductions: Achieving full-scale production of 150 MGY SAF, 54 MGY renewable diesel, and 11 MGY renewable naphtha, resulting in approximately 1.6 million metric tons of CO_2 avoided annually.
- Project milestones: Completion of preconstruction, site preparation, equipment installation, and commissioning according to the phased timeline.
- Economic and community benefits: Job creation, workforce development, and regional economic growth in the Matanuska-Susitna Borough and surrounding areas.
- Regulatory compliance: Meeting all environmental permitting requirements, ASTM certification for SAF, and federal/state reporting obligations.

Progress will be tracked through quarterly project reports, milestone verification, production metrics, and emissions accounting in alignment with state and federal reporting standards, ensuring transparency and accountability.

Community Benefits

In addition to substantial emissions reductions, this project provides a range of non-emissions benefits that support Alaska's economy, workforce, and quality of life:

Local and Regional Economic Impact:

The SAF refinery will be located at Port MacKenzie in the Matanuska-Susitna Borough, one of Alaska's fastest-growing regions that has actively sought new economic drivers beyond Anchorage's metropolitan economy. The project will support both short-term construction employment and long-term operational jo[b]s:

- Construction phase (2026–2030):
  - Approximately 200–300 direct construction jobs in civil, electrical, and mechanical trades
  - Significant local hiring from within Alaska, injecting income into the community
  - Additional induced jobs in supporting sectors such as transportation, surveying, and equipment rental, creating broader economic stimulation
- Post-construction operations:
  - An estimated 50–60 permanent jobs in plant management, control room operations, field operations, laboratory analysis, electrical and mechanical maintenance
  - Opportunities for workforce development and skill-building in advanced energy technologies

Other Benefits:

- Supports energy security and local supply of low-carbon fuels
- Contributes to noise and air quality improvements relative to conventional jet fuel operations and transportation
- Provides a strategic economic diversification opportunity for the region, enhancing overall community resilience

While the facility's SAF production reduces greenhouse gas emissions by an estimated 70% relative to Jet-A, these additional economic, workforce, and quality-of-life benefits further underscore the project's value to Alaska and beyond.

The Alaska Department of Transportation and Public Facilities (DOT&PF) is the right entity to implement this project. The Department has both the statutory authority and the institutional capacity to advance large-scale transportation and energy infrastructure initiatives. DOT&PF's experience in planning, permitting coordination, construction management, and long-term operations ensures it is well-positioned to bring this project to fruition in alignment with state and federal objectives.

DOT&PF has the capacity to scale and implement this project. The Department has been advancing the concept for several years and has already completed an initial Sustainable Aviation Fuel (SAF) feasibility report, funded through a prior grant. That study confirmed that sufficient feedstock is available to support production at a scale capable of serving the Ted Stevens Anchorage International Airport (TSAIA).

Project Budget Estimate

Building on this foundation, DOT&PF is prepared to move from planning to implementation, leveraging its project management expertise, statewide infrastructure role, and established partnerships. Implementation could include the procurement of specialized professionals and an Engineering, Procurement, and Construction (EPC) firm to execute detailed engineering, equipment installation, and construction, ensuring the project is delivered safely, efficiently, and on schedule.

The primary element of this project that may be adjusted is the implementation approach. With capital costs estimated at $3 billion, full build-out will require significant funding. To address this, DOT&PF is planning a phased development strategy that allows the project to begin operations on a smaller scale and expand as additional resources become available. Following is an overview of the project budget:

TABLE 23: SAF Cost Estimate

Fischer-Tropsch Refinery Cost	
Feedstock Logistics & Handling	$83,252,414
Gasification & Syngas Production	$609,417,673
Fischer–Tropsch Synthesis & Product Upgrading	$492,514,283
Utility Systems (CHP, SMR, ASU)	$649,618,838
Product Storage & Distribution	$62,401,810
CO2 Management	$191,205,545
Site Infrastructure	$69,302,010
Direct Costs	**$2,157,712,572**
Contingency (15%)	**$323,656,886**
Preconstruction Costs (14%)	**$302,079,760**
Total	**$3,000,001,567**

A diversified funding strategy reduces financial risk and accelerates the project's implementation timeline.

Funding Landscape

Given the project's size, a phased implementation approach is planned to align expenditures with available funding, manage risk, and allow incremental scaling toward full production capacity.

In addition to CPRG support, the project may be eligible for a range of funding sources, including:

- Federal programs such as the Department of Energy's SAF grants, FAA and FHWA infrastructure funding, and USDA renewable energy incentives
- State funding through capital budgets, economic development grants, or energy programs

- Private-sector investment via public–private partnerships, equity financing, and offtake agreements with airlines or fuel distributors
- Environmental credit markets including Low Carbon Fuel Standard (LCFS) or Renewable Energy Credits (RECs) for SAF and renewable diesel production

Hybrid-Electric Aircraft Pilot Project

Summary

The proposed measure aligns with the Climate Pollution Reduction Grant (CPRG) framework by piloting a hybrid-electric aircraft with the Department of Public Safety (DPS), Division of Alaska State Troopers. An aircraft from Ampaire, a California based developer of hybrid-electric aircraft, will be used by the Alaska State Troopers for a one-year demonstration project. Data will be collected on performance, emissions reduction, operational feasibility, and scalability across diverse conditions.

- **Project Scope:** Deploy one Ampaire hybrid-electric Cessna Caravan to the Troopers for operational testing.
- **Objectives:**
  - Quantify emissions reductions and fuel savings.
  - Assess aircraft performance in cold-weather and bush flying operations.
  - Build understanding of adoption pathways for state and regional fleets.
- **Long-Term Vision:** Retrofit service model for existing turboprop fleets statewide and beyond.

This pilot project is representative of a broader opportunity for Alaska aviation with emerging, electrified air powertrains. A number of Alaska air operators have recently been exploring electric aircraft; in particular, regional cargo carrier Ryan Air has placed an early order for a fully electric aircraft, the Beta Technologies Alia.

Project Implementation Schedule and Budget

This measure is highly aligned with the Alaska State Troopers' mission of providing reliable and versatile aviation services in challenging environments. By piloting a hybrid-electric aircraft, the Troopers would test a technology that promises to cut fuel costs and emissions in half while maintaining operational reliability. Their high utilization rates make them an excellent candidate to demonstrate the benefits of hybrid-electric propulsion.

The Alaska State Troopers have the infrastructure and expertise to scale adoption once FAA certification is achieved. The Troopers operate a diverse fleet and have experience with the Cessna Caravan platform. Scaling would require investment in maintenance training, pilot certification, and procurement processes. Additional funding would likely be required for retrofits, new acquisitions, or use of aircraft and systems.

The pilot will start with a single aircraft to reduce complexity and maximize learning. Over time, the scope could be expanded to include multiple aircraft in different regions. This would allow evaluation across varied operating conditions, including Arctic missions, coastal patrols, and search-and-rescue operations.

The measure has strong potential to deliver long-term emissions reductions. A 50% reduction in fuel burns applied across even a fraction of the Troopers' fleet would translate into significant cumulative savings. If scaled, the program could become a cornerstone of Alaska's aviation emissions reduction strategy.

The pilot could begin as early as 2026 under a provisional FAA certificate. Key milestones would include delivery of the aircraft, training for pilots and maintenance staff, commencement of operations, mid-pilot performance reviews, and final reporting. Decisions on broader adoption could follow in 2027, aligned with FAA certification.

It may be beneficial to include other state agencies, corporations, and regional carriers that also operate Cessna Caravans. Their participation could broaden the dataset and strengthen the case for broader adoption. Ampaire has relationships with Alaska Air Carriers Association and multiple regional carriers in Alaska.

A reasonable cost estimate would include the purchase of an aircraft and hybrid-electric engine, and training, maintenance support, and data collection expenses. The expected budget range is between $2.252 million and $3.145 million.

TABLE 24: Hybrid-Electric Cost Estimate

Budget Estimate	$ Low	$ high
Airplane	$800,000	$1,300,000
AMP-H570	$1,250,000	$1,500,000
Training	$30,000	$50,000
Maintenance	$22,500	$45,000
Data Collection Expenses	$150,000	$250,000
TOTAL	**$2,252,500**	**$3,145,000**

Potential non-CPRG sources of funding include federal grants (FAA FAST-Tech, Dept of Energy, Dept of Transportation, Dept of Defense dual-use technology programs), state clean energy funds, partnerships with ANCSA corporations, and Ampaire investment in the program.

Success will be measured by validated emissions and fuel savings, reliable performance in cold-weather and bush environments, and seamless integration into Trooper missions. Tracking will combine quantitative data (flight hours, fuel usage, emissions) with qualitative feedback (pilot and maintenance experiences). A comprehensive final report will define adoption readiness and provide a roadmap for scale-up.

Emissions Reduction

Fleet Composition and Utilization:

The Alaska State Troopers operate a diverse fleet of approximately 50 aircraft to support law enforcement and public safety missions across the state. This includes 3 Cessna 208B Grand Caravans, a Beechcraft King Air 350i, and a range of smaller piston aircraft such as the Cessna 206, Cessna 185, and Piper PA-18 Super Cub. Collectively, the fixed-wing fleet flies about 10,000 hours per year and conducts more than 20,000 takeoffs and landings, reflecting the frequent short-haul operations required for bush flying and remote community service.

Baseline fuel consumption across the full fixed wing aircraft fleet for 2024 was 148,123 gallons, with the turboprops consuming 111,573gal Jet-A and pistons consuming 36,550 gal 100LL Avgas. The emissions reduction calculations below are based on the assumptions that the emissions efficiency of the standard turboprop aircraft is 21.1 lbs. CO2 per gallon of JetA fuel and the emissions efficiency of the standard piston aircraft is 18.3 lbs. CO2 per gallon of 100LL avgas; this fuel also contains up to 2 grams of lead per gallon, meaning that reduced fuel use reduces environmental lead emissions.

Impacts of Upgrading to Ampaire Hybrid Engines:

Ampaire's hybrid-electric propulsion system is designed to cut fuel use by roughly 50%. The emissions reduction estimates below are based on the scenario that the Troopers expand beyond the initial pilot project with one aircraft and apply the hybrid engine retrofits across the Troopers' operating fixed wing fleet. This fleet hybridization would reduce annual fuel consumption by 74,062 gallons. Beyond direct cost savings, this upgrade enhances fleet resilience by lowering exposure to volatile fuel supply chains in Alaska and improving the range of operations with quieter, lower-emission aircraft.

TABLE 25: Hybrid-Electric Emissions Reduction

Action	CO2e Reduction (Annual Metric Tons by 2030)	CO2e Reduction (Through 2030, cumulative metric tons)	CO2e Reduction (Through 2050, cumulative metric tons)
Demo aircraft	144	574	3,445
Full fleet conversion by 2027	686	2,742	16,455

These reductions are significant for a single state law-enforcement fleet, comparable to removing more than 150 passenger vehicles from the road each year (based on EPA's ~4.6 tCO_2e/vehicle/year benchmark).

In addition to carbon, hybrid-electric propulsion reduces combustion of both Jet-A and Avgas by 50%. This translates into substantial reductions in NO_x, CO, unburned hydrocarbons, and lead emissions (the latter from Avgas in piston aircraft). These improvements directly benefit air quality around remote communities and airports where the Troopers operate, supporting both environmental and public-health objectives.

Community Benefits

Aviation is essential to life in Alaska in a way that is unmatched almost anywhere else in the world. For many communities, aircraft are the only reliable means of transportation for goods, services, and emergency response. Because flying is woven so deeply into the daily fabric of Alaska life, introducing hybrid-electric aircraft has the potential to deliver benefits that extend far beyond emissions reduction, it can redefine how aviation supports the state's economy, environment, and people.

The pilot program will provide measurable economic benefits for the Alaska State Troopers and the communities they serve. Reducing fuel consumption by half will significantly lower operational costs, enabling resources to be redirected to other critical areas such as personnel, training, and mission support. Additionally, the efficiency of hybrid-electric systems is expected to reduce maintenance costs over the long term, improving the sustainability of aviation operations in a state where aircraft are indispensable for connectivity.

From an environmental standpoint, the program will contribute directly to reduced greenhouse gas emissions and lower the release of harmful pollutants including nitrogen oxides and particulates. These reductions are especially important for rural Alaska communities, many of which already face challenges related to air quality and limited healthcare access. Lowering both emissions and noise pollution enhances quality of life for residents living near airports and frequent flight paths.

The project also supports workforce development by creating new opportunities for pilots, mechanics, and technical staff to gain experience with hybrid-electric aviation systems. Training and certification programs developed alongside the pilot will build long-term local capacity in advanced aviation technology, ensuring that Alaska remains at the forefront of sustainable aviation. This capacity-building will have ripple effects across the state, supporting both public sector and private industry.

Socially, the introduction of hybrid-electric aircraft improves the resilience and reliability of the Troopers' aviation operations. This technology will be evaluated not only for cost and emissions savings but also for critical mission scenarios such as search-and-rescue, emergency medical flights, and disaster response. Ensuring that these missions can be performed with lower operating costs and improved efficiency, strengthens public safety and community trust.

Strategically, this project is more than a pilot for the Troopers, it is a gateway for broader adoption of beneficial solutions across Alaska's aviation system. By being one of the first regions to deploy hybrid-electric aircraft in state-level operations, Alaska positions itself as a global leader in sustainable aviation. The state can serve as a beacon for where the future of aviation and sustainable mobility is headed, demonstrating to the world how hybrid-electric technology can thrive even in the most demanding environments.

ELECTRIC GENERATION

Bradley Lake Expansion Project

Summary

The Dixon Diversion project is a significant expansion of the Alaska Energy Authority (AEA)-owned Bradley Lake Hydroelectric project. This project aims to divert water from the Dixon Glacier through a diversion dam and a five-mile underground tunnel into Bradley Lake. From there, the water will flow into an existing hydroelectric power plant connected to the main Railbelt electric grid. The Railbelt is the electrical system serving 75% of the state's population stretching from Homer to Fairbanks. This project also includes modifications to Bradley Lake Dam, increasing its full pool height by up to 28 feet.

The Bradley Lake Expansion Project will harness renewable energy with minimal localized environmental impact, making it a promising step towards a more sustainable energy future for Alaska. The addition of this project is a key assumption shared across all feasible scenarios in long-term Railbelt grid energy planning completed by NREL (National Renewable Energy Laboratory) and ACEP (Alaska Center for Energy & Power) that was conducted in 2022 and 2024, respectively.

Emissions Reduction

The Bradley Lake Expansion Project will convey water from the Dixon Glacier Basin into Bradley Lake, resulting in an estimated increase of 190,000 MWh per year in energy production resulting from the additional inflows to the lake and from higher head pressures associated with the dam raise. This remarkable surge in energy equates to a 50% boost to the Bradley Lake hydroelectric project, which currently supplies about 10% of the Railbelt's electric demand.

The increased capacity of hydro generated electricity for the Railbelt can be achieved with a limited environmental footprint. This project includes the construction of only one mile of new road, utilization of less than five acres for the diversion dam, an underground tunnel, and the inundation of up to 400 acres due to a higher lake level. Importantly, Bradley Lake is an alpine lake that is not an existing fish habitat, minimizing ecological impact.

AEA has a proven record of accomplishment in managing projects of similar scope. In 2020, the AEA successfully completed the Battle Creek Diversion project, a similar expansion to the Bradley Lake project. With its experience and expertise, the AEA is well-positioned to implement the Dixon Diversion project.

Proposed Implementation Schedule

Table 26: Dixon Diversion Implementation Schedule

Year	Project Activity
2024	Geotechnical investigations near the entrance and exit of the Dixon Tunnel
2024 -2026	Comprehensive study activities
2027-2030	Construction

Community Benefits

The benefits of this project will positively impact all Alaskans. Bradley Lake Expansion stands as one of the largest renewable projects ever undertaken in the state, promising cheaper and more reliable hydroelectric power that will lower electricity costs for Railbelt consumers. This, in turn, will indirectly reduce energy costs for Power Cost Equalization (PCE) ratepayers throughout Alaska by reducing the Railbelt electric rates that PCE is pegged to. The project's storage component offers a significant advantage over other renewable resources like solar and wind, allowing Railbelt utilities to reliably dispatch renewable power throughout the year—with the additional water storage capacity, utilities will be able to regulate non-firm energy generators more easily on the grid, indirectly fostering additional non-firm generation development.

The project would offset 190,000 MWh/year of natural gas-generated electricity on Alaska's Railbelt electric grid, resulting in substantial CO2e emissions and a more resilient grid. This does not account for the potential emission reductions as a result of intermittent renewable generation projects that are newly dispatchable by utilities thanks to the project's increased energy storage component. Additionally, the Bradley Lake Expansion project is expected to displace at least 1.5 billion cubic feet of natural gas annually, offsetting a portion of anticipated Cook Inlet natural gas supply shortages in the coming decade.

TABLE 27: Dixon Diversion Estimated Emissions Reduction

CO2e Reduction (Annual metric tons)	CO2e Reduction (Through 2030, cumulative metric tons)	CO2e Reduction (Through 2050, cumulative metric tons)
131,094	262,188	2,884,068

Funding Sources

The current total project budget for completion of the project stands at $342,000,000, which includes a contingency fund. The following funding has already been committed:

TABLE 28: Dixon Diversion Budget Estimate

Funding Source	Amount
State of Alaska (FY24 Funds)	$5,000,000.00
Renewable Energy Fund Grant	$1,000,000.00
Utility Contributions	$1,360,000.00

Community Electric Generation and Transmission Projects

Summary

Railbelt Electric Grid

Alaska's Railbelt grid is the largest electric grid in Alaska, supplying power to approximately 70% of Alaska's population. This system stretches from Homer to Fairbanks and consists of a number of intertied, member-owned utility cooperatives. In recent years, two detailed studies[34,35] have been conducted to assess the feasibility and impacts of decarbonizing the Railbelt grid over the next 25 years. These reports have presented and analyzed potential scenarios and timelines but generally consider it feasible to achieve 80 percent clean generation within the Railbelt by 2040. This measure supports generation projects that work towards that goal.

Remote, Islanded Electric Grids

Through tribal CPRG planning and other previous energy planning work, a significant number of emissions reducing projects across rural Alaska have conducted and completed feasibility, conceptual design, and advanced-stage design work. High logistics costs often leave planned projects unfinished, negatively affecting local communities. These projects should not be expected to deliver complete replacement of diesel generation, but rather they can reduce reliance on aging diesel equipment and gradually increase renewable electric generation. This measure would seek to support these remote, islanded electric grid projects that aren't otherwise captured in a tribal PCAP.

Proposed Measure

Alaska's tribes and municipalities provide essential services in the maintenance of the critical energy infrastructure that support Alaska's communities; their role is especially important in the state's most geographically remote communities. Even in communities where they do not operate the utility, they will often work closely with the utility as a major customer and landowner.

This measure would support projects delivered by a municipality, tribe, or related entities (including state agencies) directly as well as in partnership with electric cooperatives or Independent Power Producer (IPP) which delivers renewable generation that offset fossil fuel generation. These projects include (but are not limited to) wind, solar, hydroelectric, hydrokinetic, nuclear, and geothermal and must be able to be integrated, and interconnect into the local electric grid both effectively and beneficially.

The electric utility landscape in Alaska is diverse and is generally operated and maintained by entities within the local community. To incorporate new, clean generation in an effective manner, upgrades relating to existing diesel generation, transmission, and distribution may be as important to emissions reduction as the generation themselves. Components of these projects may include diesel power plant improvements, such as switch-gear upgrades, which are necessary for the successful integration of other generation types but are severely limited in their eligibility for other sources of funding. Transmission and distribution projects that enable greater access and deployment of affordable, reliable, and emissions-reducing generation are also considered as part of this measure.

This measure envisions funding for projects that are appropriate and scale for their given locations. Potential project archetypes include:

1. Rural Solar + Storage Integration: Co-locating utility-scale solar or wind with battery storage to enable “diesels-off” operation in remote communities[36].
2. Railbelt Wind Farm Development: Supporting mid-scale (10-50 MW) wind projects totaling 300 MW of new capacity[37] to diversify the Railbelt grid.
3. Hydrokinetic Riverine Power: Piloting and deploying in-river turbines for communities not suited for solar or wind.

Funding Landscape

Many federal and state programs provide funding for eligible electric generation projects, including the Renewable Energy Fund, as mentioned later in this plan. Unfortunately, national competitive funding opportunities are frequently difficult to access for Alaska projects, especially for remote, islanded grid communities. Beyond the limited nature of funding, there are a combination of factors that make federal funding for Alaska rural energy projects difficult to access. These include logistical hurdles—which increase costs and timelines—and administrative burdens—which decrease the ability of short-staffed utilities to respond. Additionally, with inability to fully-substitute diesel fueled electric generation with renewable generation owing to considerations for life and safety, with many potential renewable generation types characterized as intermittent in their ability to deliver power when it is needed, many of the critical projects regarding operational and efficiency upgrades to diesel-generation related infrastructure are found to be ineligible for such national, competitive opportunities and otherwise.

Transformative Impacts

Railbelt Electric Grid

In response to a natural gas shortage that is the result of declining production and availability of known supply in the Cook Inlet, in January 2024[38] a coalition of eleven mayors throughout the Railbelt region began convening together to assess their respective communities’ energy needs. They began to chart a path through this crisis which threatens high-cost burdens associated with higher input costs for Railbelt electric utilities. More costly utility bills would reduce both the discretionary income of both residents and businesses alike, with potentially deleterious effects including a reduction in local consumption and consequently, overall decreased available capital for business reinvestment.

With electric utility costs being a primary factor in cost-of-living expenses, there also remains additional risk that cost escalations may result in further out-migration from Alaska to other places in the nation. Large-scale renewable energy projects that seek to offset the predominantly natural-gas-fueled Railbelt generation may help delay this crisis coming to a head, support greater adoption of beneficial electrification in the buildings and transportation sector, and ultimately make Alaska’s energy system more resilient in the face of global economic disruptions that would add to the already volatile markets for carbon-based fuels.

Remote, Islanded Electric Grids

The characteristics of remote, islanded electric grids in Alaska can differ substantially depending on factors such as community size, the utility owner and/operator, and geographic location. While benefits are best understood on project level basis, reduced diesel generation can improve air quality, strengthen community resilience, and reduce operating costs associated with the power plant.

While most scenarios don't allow communities to entirely substitute all diesel generation, projects that allow significant reductions in plant runtime can have a substantial impact on all of these factors. When projects are implemented by IPPs, there are proven mechanisms whereby PCE subsidies can be maintained in such a way that utilities can remain financially solvent as they are faced with the added expenses related to the renewable energy infrastructure.

Less fuel consumption also means that fuel deliveries do not have to occur as regularly, resulting in greater resilience to disruptive events concerning fuel conveyance such as freight disruption by weather and disaster that may materially delay fuel shipments. Over the long-term, reduced dependence on diesel may mean that bulk fuel systems in some rural Alaska communities will not need to maintain such high levels of available fuel, reducing a community's exposure to risks regarding spills such as surface water contamination, fire, and/or personal injuries.

Greater resilience and community energy independence are critical needs that can be met by electric generation and transmission projects for remote grids in Alaska.

Measure Quantification

Railbelt Grid

For the sake of quantifying potential emissions reduction for the offset of fossil fuel consumption, we presumed a 1000 GWh/year reduction of fossil fuel generation (primarily natural gas) across Railbelt communities. This quantification also presumes that this generation is replaced by zero-emission generation, such as (but not limited to) wind, solar, hydroelectric, hydrokinetic, and geothermal. This quantification also presumes a gradual ramp-up of generation capacity towards a 10% reduction between 2025 and 2030.

Remote, Islanded Electric Grids

For the sake of quantifying potential emissions reduction for the off-set fossil fuel usage, we presumed a 10% GWh reduction of fossil fuel generation (primarily Diesel #1) across non-Railbelt communities. This quantification also presumes that this generation is replaced by zero-emission generation, such as (but not limited to) wind, solar, hydroelectric, hydrokinetic, and geothermal. This quantification also presumes a gradual ramp-up of generation capacity towards a 10% reduction between 2025 and 2030.

TABLE 29: Community Generation & Transmission Estimated Emissions Reduction

Measure	CO2e Reduction (Annual Metric Tons by 2030)	CO2e Reduction (Through 2030, cumulative metric tons)	CO2e Reduction (Through 2050, cumulative metric tons)
Railbelt	555,601	798,645	11,910,665
Non-Railbelt	31,248	829,893	1,454,853

These measure quantifications are hypothetical. Many communities may look to reduce their diesel usage and increase their energy resilience by integrating renewable energy generation, while retaining generators as a safety measure in case of disasters. The State of Alaska views renewable energy options as an opportunity to grow strength and capacity within our isolated communities.

AEA DERA, VEEP, and Rural Distribution Programs

Summary

The Alaska Energy Authority (AEA) is spearheading a comprehensive measure proposal aimed at addressing critical energy challenges faced by rural communities in Alaska. This proposal encompasses three key components: Diesel Emissions Reduction Act (DERA) Program Expansion, Distribution System Upgrades, and the Village Energy Efficiency Program (VEEP). AEA is committed to making substantial, long-term emissions reductions while simultaneously delivering numerous benefits to these remote communities.

The State DERA program, in which the Alaska Energy Authority (AEA) participates, relies on annual funding from Congress, with states applying for DERA funds based on population. Additionally, EPA oversees a competitive tribal DERA program that awards funds nationwide.

DERA encompasses a variety of project types, ranging from replacing school buses to upgrading railroad engines. AEA, on behalf of the State of Alaska, exclusively utilizes DERA funds to replace prime power diesel engines in rural Alaska. These engines typically operate 24/7 and have a substantial impact on air quality in rural communities.

In most rural Alaskan communities, the absence of a larger electric grid requires them to generate electricity locally. Small diesel power plants are used for this purpose, creating isolated grids. These diesel engines emit pollutants and are inefficient, which results in both increased fuel consumption and higher power costs. Installing newer, certified, and more efficient engines helps reduce emissions per unit of fuel and improves electricity generation efficiency. AEA's existing annual DERA work plan includes specific estimates for each community.

The Alaska Legislature established the Village Energy Efficiency Program (VEEP) in 2010 as an Alaska Energy Authority (AEA) grant program aimed at reducing per capita consumption through energy efficiency. VEEP's objective is to actively implement energy and cost-saving efficiency measures in buildings and facilities within small, high-energy-cost Alaska communities.

Proposed Measure

AEA will issue sub-award grants to replace diesel engines in rural Alaska communities, expanding the scope of the EPA's DERA program. These communities rely on small diesel power plants to generate their electricity, and many of these plants use older, high-emission engines. AEA's program aims to replace non-certified and lower-tier diesel engines with cleaner Tier 2 and 3 marine engines and low particulate matter (PM) emitting nonroad engines. These upgrades enhance performance and reduce emissions.

AEA compiles a priority list for engine replacements within communities, highlighting eligible ones.

AEA will issue sub-award grants to upgrade distribution systems in rural Alaska communities, enhancing efficiency and sustainability. These microgrids, predominantly diesel-generated, are over 50 years old and in need of modernization.

The upgrades will reduce line losses, diesel fuel usage, and ensure readiness for renewable energy integration.

AEA will work in coalition with tribal consortia, including Tanana Chiefs Conference, to advance qualified high-energy cost communities for energy-efficient upgrades to public buildings and infrastructure. AEA will also issue sub-award grants through an RFA for Alaska communities, not part of the coalition effort.

Measure Activities

DERA

The replacement of older engines with certified marine engines is expected to result in immediate fuel savings and emissions reductions. Over the long term, DERA engines are estimated to provide fuel savings, emission reductions, and health benefits for many years.

Distribution

Upgrades are anticipated to significantly reduce line losses, improving energy efficiency and environmental impact. Reduced reliance on diesel generators will lead to lower emissions, better air quality, and lower costs.

VEEP

Over past VEEP solicitations, 56 communities have offset a total of 1,189,463 kWh/year, demonstrating the effectiveness of energy efficiency in reducing diesel consumption. The program not only saves costs but also enhances community safety through improved community/street lighting.

Capacity to Implement

AEA has a strong track record in rural energy infrastructure development, with projects spanning power generation, bulk fuel facilities, distribution systems, renewable energy integration, and maintenance. Recent powerhouse upgrade projects and VEEP solicitations illustrate AEA's commitment to rural energy solutions.

Estimated Emissions Reductions & Community Benefits

TABLE 30: DERA/VEEP/Distribution Estimated Emissions Reduction & Benefits

Program	Emissions Reductions	Community Benefits
DERA	Replacement engines in Akiachak have demonstrated the following reductions: • 23% NOx reduction • 93% PM2.5 reduction • 75% HC reduction • 46% CO reduction • 7% CO2 reduction • Over a 10-year lifespan, substantial emissions reductions.	• Improved air quality in communities • Reduced fuel costs for residents due to increased engine efficiency
Distribution	Reduced line losses through distribution upgrades	• Cost savings for residents and businesses through energy efficiency upgrades • Environmental benefits, including reduced emissions, promoting sustainability and improved health
VEEP	Collectively offset a substantial amount of kWh annually, leading to long-term emissions reductions.	• Economic benefits to communities through cost savings from energy efficiency improvements • Enhanced safety in public areas with improved lighting

Implementation Schedule

TABLE 31: DERA/VEEP/Rural Distribution Implementation Schedule

Program	Duration	Justification
DERA	Approximately 2 years	Project span includes complexities, construction season, and supply chain challenges
Distribution	Approximately 2 years	First year focused on planning, design, permitting, and procurement
VEEP	5 years	Administering $10 million over five years for VEEP projects

Proposed Budget

TABLE 32: DERA/VEEP/Rural Distribution Budget

Program	Cost Estimation	Description
DERA	$10 million	Engine replacements in over 150 communities
Distribution	$10 million	Distribution upgrades in communities in need
VEEP	$10 million	VEEP programs over five years

Funding

This measure would leverage existing funding sources and partnerships including State of Alaska matching funds, the Denali Commission, BIA and EPA grants, community matching funds, and DOE programs.

Expanding the DERA program, upgrading distribution systems, and enhancing energy efficiency through VEEP will address rural Alaska's energy challenges in a multi-prong effort. These activities promise long-term emissions reductions, economic benefits, and improved quality of life for rural communities while leveraging multiple funding sources to achieve these benefits.

AEA Renewable Energy Fund

The Alaska Energy Authority (AEA) is looking to augment its Renewable Energy Fund Grant Program[39] (REF). The REF is a proven grant program which provides critical financial assistance in support of the feasibility, design, construction, and integration of renewable energy projects throughout the state. The REF provides financial support and incentive for sustainable renewable energy development in Alaska, enabling the harnessing of Alaska's vast potential of renewable energy potential. Under AEA leadership and administration, this measure will continue to deliver substantial, long-term reductions in emissions, bolster the capacity to scale renewable projects, and provide immense benefits to Alaskan communities statewide.

Summary

The Renewable Energy Fund was established in 2008 and has been a beacon of success in the journey towards renewable energy adoption. With over $317 million in state-appropriated grants, it has achieved remarkable results. An independent impact analysis revealed that the REF offset approximately 85 million gallons of diesel fuel cumulatively, equivalent to 5% of all petroleum consumed in Alaska in 2021. It also reduced 2.2 million cubic feet of natural gas and mitigated 1,063,500 net metric tons of carbon dioxide emissions since inception.

This initiative has not only saved an estimated $53 million in net energy costs but has also had a significant impact on employment, generating an estimated 2,931 additional jobs across the state. Beyond direct state investment, the REF has leveraged over $300 million in external funding, supporting federal opportunities, local contributions, and additional capital for projects. Moreover, the REF program was renewed indefinitely in May 2023, showcasing its importance to Alaska's energy landscape.

Administered by AEA, the REF boasts a dedicated team with experience in managing grant awards. A 9-member advisory committee has successfully overseen the program since its inception, ensuring its continued effectiveness.

Estimated Emissions Reduction

The REF has a proven track record in reducing electric generation and transmission-related emissions. Through its awarded projects, the REF has helped to offset millions of gallons of diesel fuel, natural gas, and carbon dioxide emissions. For Round 16, AEA evaluated 28 applications, with 24 passing economic and technical feasibility evaluations. In that round, wind and hydroelectric were well-represented. These projects are estimated to reduce emissions by 1,186,857 tons of CO2 annually, or a total of 24,278,625 tons of CO2 over their lifespan. Even with conservative estimates, the emissions reduction potential is significant.

Assuming the same cost-efficiency as the Round 16 investment, a $100M commitment to the Renewable Energy Fund is estimated to reduce annual emissions by about 3,560,571 metric tons once all projects are running.

TABLE 33: REF Estimated Emissions Reduction

Measure	CO2e Reduction (Annual Metric Tons by 2030)	CO2e Reduction (Through 2030, cumulative metric tons)	CO2e Reduction (Through 2050, cumulative metric tons)
Single year, fully funded	1,186,857	1,780,285	25,517,425
Three years, fully funded	3,560.571	5,340,856	76,552,276

Community Benefits

The REF focuses on supporting rural communities who face an outsized energy burden, with 80% of past awards granted outside the Railbelt region. It delivers numerous advantages, including reducing reliance on carbon-based fuels, thereby stabilizing energy costs, improving air quality by offsetting diesel generation, enhancing energy security, and creating new jobs in the renewable energy sector. It is an inclusive initiative that benefits those diverse communities across Alaska.

Proposed Timeline

TABLE 34: REF Proposed Timeline

Activity	Time Period
Allocation of $100 million	Ongoing
Solicitation for projects	Summer 2024 (occurs annually)
Recommendations to Alaska State Legislature	January 2025 (occurs annually)
Grant awards for funded projects	Beginning July 2025 (ongoing)
Procurement, installation, construction	Beginning Fall 2025 (ongoing)
Allocation of $100 million	Ongoing

Metrics

To assess measurable progress, AEA will employ various metrics, including program expenditures, renewable capacity deployed, battery storage capacity, renewable power produced, CO2 emissions avoided, and diesel fuel reduction.

Proposed Budget

TABLE 35: REF Proposed Budget

Program	Proposed Budget	Implementation Period
Renewable Energy Fund	$100 million	Five-year period

This table outlines the proposed budget of $100 million for the Renewable Energy Fund and the intended implementation period of five years for CPRG measures.

Funding Sources

The REF is primarily funded through state appropriations by the Legislature, with no statutory obligation to fund the program. Historically, funding availability has been linked to the state's fiscal health, resulting in years when the program went unfunded owing to budgetary constraints. Despite these challenges, the REF has persevered and remains a vital tool in Alaska's renewable energy development toolkit.

The Alaska Energy Authority's Renewable Energy Fund has a proven track record of reducing emissions, creating jobs, and advancing renewable energy development in Alaska. With dedicated leadership, community benefits, and a substantial capitalization, the REF remains poised to continue making significant strides in building a sustainable energy future for Alaska.

Reestablishing the Alaska Emerging Energy Technology Fund

Summary

Reestablishing the Alaska Emerging Energy Technology Fund (EETF) would serve to strengthen research and development of energy technologies that are responsive to Alaska's particular needs. With the support of a varied advisory council including representatives across Alaska's energy sector, this program would build off the success of its predecessor, which started in 2010 and expired in 2020. Since the end of this program, there has been a gap in state funding for energy research into technologies that have advanced beyond basic research but have not reached commercialization. By placing this iteration of the program within the Alaska Center for Energy and Power (ACEP), it would benefit from strong support due to the available expertise there.

Based on the original EETF, the program would fund projects that "test emerging energy technologies or methods of conserving energy; improve existing technology; or deploy an existing technology that has not previously been demonstrated in the state." Additionally, EETF grants would be required to be "demonstration projects of technologies that have a reasonable expectation of becoming commercially viable within five years."

Applications were scored and ranked on a range of criteria including the quality of the innovation, the method of validation, and the public benefit and market potential for the proposed technology. Priority is given to projects demonstrating potential for widespread deployment, partnerships with postsecondary institutions, Alaska entities, projects committing in-kind or matching funds, and alignment with any focus identified in the solicitation.

The project portfolio for a reestablished EETF could include projects of different sizes and commercial readiness. The original program funded nineteen projects that resulted in critical advancements in technologies from diesel efficiency to hydrokinetics, biomass, and more. While decisions would be made by the advisory council, the modern state of energy research and funding in Alaska could be especially strong for geothermal systems, creative heating applications, tidal electric generation, and/or micronuclear.

Proposed Measure

The proposed action is to re-capitalize the Emerging Energy Technology Fund with a combined $27 million in funding to be administered by the Alaska Center for Energy and Power (ACEP). The fund will issue competitive grants through three funding rounds occurring every two years, beginning in 2027.

Estimated Emissions Reduction

TABLE 36: EETF Emissions Reduction

Measure	CO2e Reduction (Annual Metric Tons by 2030)	CO2e Reduction (Through 2030, cumulative metric tons)	CO2e Reduction (Through 2050, cumulative metric tons)
Reestablish the EETF	48,600	72,900	1,044,900

The emissions estimations are based on calculations using the LCOE for different energy sources, presuming a rough split between current emerging technologies. Emissions reduction varies greatly depending on technology and application.

Community Benefits

The original EETF helped provide strong demonstration projects that showed early success for what today have become key Alaska approaches to supporting rural energy independence, namely air-source heat pumps that greatly reduce heating costs in legacy hydroelectric communities and wind-diesel battery hybrid systems that resulted in diesels-off in communities like Kwigillingok.

Thanks to the remoteness of communities and programs like EETF, Alaska has often shown leadership in microgrid research. Reestablishing this funding source would help support continued growth and innovation, even if federal energy research dollars become scarcer. This program could help serve a key role, alongside existing work at ACEP and other organizations like Launch Alaska, in producing a thriving energy technology ecosystem in the state by investing in manufacturing, data collection, and other key work that does not receive significant non-federal investment currently.

Funding through a reestablished EETF should focus on technologies that continue to support rural energy independence, namely through reduction in diesel reliance that promotes bulk fuel farm consolidation and reduced maintenance costs. Demonstration projects that would be especially well aligned with this plan's goals include:

- Long-duration energy storage solutions for remote and Railbelt grids.
- Advanced geothermal systems for heat and power.
- Innovative heating applications, including waste heat recovery and biomass systems for rural communities.
- Marine hydrokinetic and tidal energy technologies.

Timeline

The original program saw three separate grantmaking periods (2010, 2012, and 2016) followed by project monitoring and compliance through 2020. In this framework, a renewed program would see four grantmaking solicitations at two-year intervals in 2027, 2029, and 2031 with project administration through 2035.

Project Budget Estimate

A $27M budget would adjust for inflation and provide a 50% increase in funding over the small original program. This budget could help fund larger, more capital-intensive efforts like advanced geothermal systems. This could follow a three-phased approach like the original program, with a budget of $9M enabling an initial round of projects.

Other Funding Sources

The original Emerging Energy Technology Grant (EETG), which became the EETF with $6.8M in state funding, was initially funded by $250k in Congressionally Directed Spending (CDS) and $4.8M in Denali Commission funding. Since the end of the original program, U.S. Department of Energy funding has played a key role in funding energy technology R&D in Alaska.

Unalaska BESS

Summary

The City of Unalaska (COU) is located in the Aleutian Islands in Alaska, 800 miles southwest of Anchorage and just 50 miles from the North Pacific Great Circle Route. As of the most recent census, it is home to 4,254 people, and also the hub for commercial fishing activity in the Bering Sea and Aleutian Islands.

City of Unalaska is the utilities service provider in Unalaska, providing water, wastewater, and electricity generation and distribution services to the community. Electricity is generated using a combination of diesel-fuel power gensets across two power production facilities with a combined total rated power production capacity of 20.6MW.

Due to the high cost of transporting and storing diesel-fuel, utility electricity rates are high, both for residential and industrial/commercial customers. In 2024, residential rates were $0.2483/kWh (with an added cost of power adjustment charge to recover fuel costs extra), and commercial/industrial rates were between $0.1527/kWh - $0.1846/kWh (with added cost of power adjustment charges and demand charges extra).

City of Unalaska seeks to deploy a battery energy storage system (BESS) at a COU facility to help optimize the operation of the powerhouse and reduce fuel consumption required to meet grid demand. The decrease in fuel consumption and enhanced powerhouse efficiency will lead to reduced emissions as well as significant cost savings, particularly with respect to the power adjustment charge component of utility bills for both community members and businesses.

Preliminary study and planning have identified that a 3MW/6MWh rated BESS system would be well sized to COU's operational needs. With a system of this size, COU would be able to run their generation assets at more efficient outputs and reduce the number of online engines required to meet load and spinning reserve requirements.

Details

The BESS would additionally be able to provide some peak shaving services which would reduce the necessity to bring additional generation assets online during short periods of high electricity demand (for example, during heavy crane operations), further reducing fuel consumption.

Additional use cases like grid smoothing and emergency backup power will also be possible with this BESS.

It is expected that the engineering, procurement, construction, installation, and commissioning for the project will take 1-2 years based on lead time estimates from the BESS supplier market and seasonal construction windows in Unalaska.

The estimated cost for this project is between $3.6M-$4.2M. There will be some expected maintenance and upkeep costs annually depending on the exact technology and system selected during the procurement process.

Complexities with this deployment which may add to project cost or schedule include environmental challenges (extreme cold weather temperature ratings, high corrosion environment, etc.), and logistics (high cost of shipping, limited construction period, etc.).

Some permitting will be required to ensure that the system meets industry specific, statewide, and local codes and standards. Limited environmental review will be required as the system is planned to be installed on COU-owned property.

In addition to the use-cases described above, implementation of an energy storage system would enable COU to pursue renewable generation projects (wind, solar, etc.) in the future. These non-dispatchable generation sources can result in instability and operational challenges for an islanded grid system as renewable energy contribution rises.

Emissions Reduction

During the 2023 fiscal year (July 1, 2022 - June 30, 2023), City of Unalaska produced 42,695,436kWh of electricity consuming a total of 2,756,745 gal of diesel fuel. The reported emissions during a similar 1-year period (January 1, 2023 - December 31, 2023) by that facility were 29,611 metric tons of CO2 equivalent.

The exact savings that can be achieved with the battery energy storage system are dependent on a variety of factors including the nature of the demand, actual genset output efficiencies which can vary with age among other factors, and operational strategy to ensure system resilience and reliability.

Reference cases (published research, whitepapers, industry knowledge) for BESS projects to optimize diesel power plants report savings in fuel (and subsequently emissions) ranging anywhere between 5-25%. Because this grid system is islanded, and grid reliability is of utmost importance, a base case estimate of 5% emissions reduction will be considered, with an optimal case of 10% emissions reduction.

No other projects (related to load growth, changes in generation assets, etc.) are considered in these calculations.

Project commercial operation is considered to be October 1, 2027.

TABLE 37: Unalaska BESS Emissions Reduction

Scenario	Annual MTCO2e Reduction	Cumulative MTCO2e Reduction (2030)	Cumulative MTCO2e Reduction (2050)
Base Reduction	1,481	4,812	34,423
Optimal Reduction	2,961	9,624	68,846

Any future renewable projects enabled by this BESS would result in considerably higher emissions reductions but have not been included as part of the measure at this time as there are no immediate plans for such a project.

Community Benefits

Electricity rates for residential and industrial customers in Unalaska are currently made up of standard usage (kWh) and a fuel surcharge (Cost of Power Adjustment). Industrial and commercial customers additionally incur charges related to power factors and demand.

Implementation of this measure will help to lower electricity rates for both residential and commercial/industrial customers and provide more predictability and less price volatility. Reduction of energy cost burden on both residential and commercial customers, particularly in rural communities in Alaska where this often represents an oversized portion of budgets is of high importance to the community at large. The BESS will also help to reduce outages and necessary load-shedding by COU.

The reduction in utility rates, and improved reliability and resilience of the city operated power grid may also encourage other co-generators on the island (including some of the major seafood processors) to reduce their on-site production and utilize more city produced power. This would result in localized noise reduction and additional economic benefit for these major employers in the community.

Kotzebue Long Duration Energy Storage

Summary

Kotzebue, Alaska is a rural community situated above the Arctic Circle on a spit of land alongside the Kotzebue Sound. It is home to roughly 3,200 residents and serves as a regional hub for many of the smaller villages in northwest Alaska.

Kotzebue Electric Association (KEA) is the member-owned, non-profit cooperative that generates and distributes electricity in Kotzebue. KEA serves more than 1,200 metered customers across residential, commercial, and industrial sectors. KEA owns and operates a variety of generation assets including diesel gensets, wind turbines, solar photovoltaic systems, and a battery energy storage system. They were an early adopter of renewable energy, installing their first wind turbine in 1997.

Cache Energy is an Illinois based technology company that has developed a long duration energy storage system, capable of achieving seasonal storage of energy in an inert, low cost, solid fuel. Excess energy (in the form of heat, or electricity) can be stored in their limestone-based pellets for extended periods of time (months to years) and then simply converted back into heat when desired.

The planned project is to deploy Cache Energy's thermal storage solution to capture excess renewable energy in Kotzebue and convert it to reliable space heat for KEA facilities. The system will be initially sized to provide heat to the KEA administration building, the two shop facilities, and to provide supplementary heat to the diesel generation plant.

Traditionally the diesel generation plant was kept warm by the diesel gensets that were running to serve KEA's load. However, KEA's mandate to replace diesel generation with renewable alternatives have meant that these gensets are now running less frequently and are producing less waste heat. This has resulted in the potential for the generation plant to get too cold, particularly during winter, and required KEA to supplement the heat using electric boilers, or heating fuel, both of which are new sources of emissions.

By shifting excess renewable electricity (largely sourced in the summer when demand is lower, and solar production is much higher) into stored heat, and then using that heat to provide facility heat, this measure directly displaces diesel or heating fuel required for thermal management.

Emissions Reduction
All heat which is produced using the pellets will be directly offsetting heat which would otherwise need to be produced using heating fuel, or diesel-produced electricity in an electric boiler, and this can be directly mapped to emissions reductions. Cache Energy is committed to supporting this data collection to continue to improve and demonstrate the capability of their technology.

Engineering estimates performed by Cache Energy and their partner engineering firm have indicated that the 100kW system they plan to provide will be able to offset about 300MWh of heating in KEA facilities each year. This represents a reduction of about 120MTCO2e annually.

The expected cumulative reduction in emissions, assuming no other changes to the system (heating needs, availability of excess renewables, etc.) is about 360MTCO2e by 2030, and 2,700MTCO2e by 2050. However, it is expected that if this initial pilot installation proves successful, that KEA will be able to expand the installation as they continue to increase the amount of renewable generation on their system (and subsequently, the amount of excess renewable generation available to be stored and used for heating). This would allow expansion to provide heating to other municipal and community buildings or provide KEA with the opportunity to further reduce their dependence on the gensets to provide generation hall heating, driving further emissions reduction.

TABLE 38: Kotzebue LDES Emissions Reduction

CO2e Reduction (Annual Metric Tons by 2030)	CO2e Reduction (Through 2030, cumulative metric tons)	CO2e Reduction (Through 2050, cumulative metric tons)
120	360	2,700

Project Implementation Schedule and Budget
Implementation of a 100kW Cache Energy system including installation and integration with KEA's systems is expected to take between one to two construction seasons. During this time, KEA may leverage support from other entities that have deployed Cache Energy systems in the state to apply best practices.

<u>Overall Duration:</u> One to two construction seasons (conservative plan: two seasons). First season may begin as early as summer 2026, subject to funding and procurement.

- Season 1: Detailed design, procurement, site prep, initial installation at one priority building (admin or diesel plant).
- Season 2: Complete installation, expanding to additional buildings (two shops and/or NVK admin), commissioning, and performance monitoring.

KEA continues to work with Cache Energy to determine the business model and contract details for this project. It may be a lease of the system with associated fees, a capital expenditure for KEA, or some alternative approach. The expected Net Present Cost over a 10-year operation window is expected to be about $300,000 including some nominal operations and maintenance work which can be performed by KEA staff once trained.

KEA is exploring potential sources of funding to enable this project, including a $11.6M Grid Resilience and Innovation Partners (GRIP) program grant from the Department of Energy along with other state and federal energy programs.

Successful deployment of this project will be validated based on regular data collection and reporting. Measurement of the excess renewable energy stored in the pellets, and the energy extracted as heat at the end will give indication of the success of this technology at storing energy and provide information on losses over time.

Community Benefits
Deploying Cache Energy's controllable electric-thermal storage (ETS) with Kotzebue Electric Association (KEA) delivers practical, near-term benefits for the community of Kotzebue. By converting surplus renewable electricity into stored heat for KEA's priority buildings (administration, diesel plant, and shops), the project directly replaces diesel used for space and process heating—particularly important as generator waste heat declines with higher renewable penetration. Less diesel burned means cleaner local air, reduced noise and odors around industrial facilities, and lower exposure to fuel price volatility that can ripple through household and business budgets. Because ETS charges when renewable generation is available and discharges when buildings need heat, it improves comfort and reliability during extreme cold snaps while easing operational stress on diesel systems.

The economic benefits are community wide. Stabilizing KEA's thermal needs helps control operating costs, which supports rate stability over time and reduces the risk of service disruptions caused by fuel logistics or weather delays. Installation and integration work creates demand for local electricians, HVAC technicians, and controls specialists, keeping project dollars circulating in Kotzebue. Modernized heating at KEA facilities also reduces unplanned outages and maintenance, freeing staff time for other community priorities. As the approach is proven at KEA sites, it can be expanded to additional buildings—such as community or tribal facilities—spreading savings, reliability, and air-quality gains more broadly.

The project builds durable capacity. Metering and performance tracking embedded in the deployment will document avoided fuel use and emissions in a way that meets external program and funder expectations. That evidence positions Kotzebue to pursue follow-on funding and scale similar measures, reinforcing resilience where reliable heat is essential to public health, safety, and economic activity.

Merrill Field Landfill Combined Heat & Power System (CHP)

Summary
This measure leverages recent upgrades performed on the Municipality of Anchorage's landfill gas (LFG) collection system at the former Merrill Field Landfill in Anchorage by proposing to use the captured gas for combined heat and power (CHP) generation. Recent upgrades will improve gas capture and monitoring and reduce methane emissions. The proposed measure takes the benefits captured by the newly completed project a step farther by putting LFG collected at the site to beneficial use.

The proposed project would install CHP equipment sized to the available gas resource to produce both electricity and heat for nearby users, displacing grid power and natural gas. This would reduce greenhouse gas emissions, improve local energy security, and create potential cost savings or revenue for the Municipality of Anchorage.

In addition to emissions reductions, the measure supports resilience by turning waste into energy, keeping value in the local economy, and reducing exposure to fuel price volatility.

Emissions Reduction
EPA modeling was used to estimate the environmental impact of the gas collection system improvements and proposed CHP measure. Assumptions used to calculate emissions reductions are shown below. Emissions reduction in this case is primarily driven by the reduced GHG intensity of emissions as methane from Landfill Gas is burned instead of being vented (in lieu of grid energy supplied primarily by gas).

TABLE 39: Merrill Field Emissions Reduction

CO2e Reduction (Annual Metric Tons by 2030)	CO2e Reduction (Through 2030, cumulative metric tons)	CO2e Reduction (Through 2050, cumulative metric tons)
233	699	5,359

Project Implementation Schedule and Budget

The Merrill Field Landfill closed in 1987. Until its closure, the site was used as Anchorage's primary municipal landfill. Following the landfill's closure, the site was redeveloped to expand Merrill Field Airport.

To manage the gases produced through the ongoing decomposition processes at the site, SWS operates a gas collection and flare system. The measure described here includes two stages of infrastructure investment.

Stage 1: Gas Collection System Improvements and Flare Upgrades. Landfill gas produced through decomposition processes at the former Merrill Field Landfill is migrating, requiring retrofitting, and replacing the aging infrastructure at the site and drilling new wells to more effectively capture the gas that would otherwise be released into the atmosphere. In addition, the flare, which had been damaged in a windstorm, requires repairs.

SWS completed emergency repairs to the system in Fall 2025, totaling $2.9 million in capital expenditure. Including installing updated measurement systems to track gas composition and volumes. This infrastructure investment was required by regulators to improve management of the resource, but it also enables a better understanding of the resource through improved tracking systems. It is also improving the quality of the gas collected, improving flow rates, and capturing greater amounts of methane. This could improve the potential for beneficial use projects utilizing the gas.

Estimates of the environmental benefits of the improved gas collection system include:

- 454.7 million cubic feet of methane collected and destroyed over a 15-year period.
- 0.244 MMTCO2 direct methane reduced.

Stage 2: Beneficial Use/Combined Heat and Power. One of the potential beneficial uses of the Merrill Field Landfill gas resource is combined heat and power production using microturbines. This measure is still in the early stages of exploration; however, early modeling indicates the MFL gas resource could support 250 kW of installed power generation capacity, producing an estimated 1,565,295 kWh annually in electricity generation and 9,079 mmBtu heat production. Estimated capital costs range between $2.5 and $3 million.

This measure is one of a handful of options SWS is exploring. The success of the proposed measure will depend on identifying the right end user for the energy produced. Given the relatively limited scale of the landfill gas (LFG) resource at the Merrill Field site, any solution will need to minimize new infrastructure requirements to maximize the return on investment. While SWS controls the landfill gas asset at Merrill Field, it does not currently maintain other operations at that location. As a result, the project will require a third-party partner to utilize the heat and power generated. Potential off takers are under consideration, including retrofits at existing on-site facilities or nearby off-site users such as Alaska Regional Hospital. The distance between the gas collection system and potential users, along with the scope of infrastructure upgrades needed to capture and distribute heat and power, will influence project feasibility. Economic scenarios for these options are currently being evaluated.

SWS currently operates CHPs at the Central Transfer Station, operates LFG collection and primary treatment systems at both Anchorage Regional Landfill and MFL, and has the capacity to implement a project on this scale. At this stage, nearly all aspects of the measure could be refined, with the exception of the underlying landfill gas (LFG) resource, which has a fixed capacity. SWS's principal criteria continue to be attaining a minimum net-zero return on investment and ensuring that the project does not result in substantial impacts on existing SWS infrastructure. Within those parameters, SWS is open to exploring a range of approaches.

Two elements are most likely to be adjusted:

- End users of the energy resource. We are currently evaluating other nearby facilities—either existing or with immediate energy needs—might be suited to use the power and heat. An end-user has not yet been selected.
- Implementation model. While SWS could own and operate a combined heat and power (CHP) system, another option would be to sell the LFG directly to a third-party owner/operator or to the end user. This approach could provide additional benefits since a non-SWS operator would likely have a more consistent on-site presence for system operation and maintenance. SWS's current gas collection system at Merrill Field is a passive system, with staff visiting the flare approximately once a week.

These adjustments would allow us to align the measure with both the scale of the resource and the most viable economic and operational use cases.

Given the size of the landfill gas (LFG) system at Merrill Field, the overall emissions reduction potential is relatively modest compared to larger projects. Preliminary calculations, based on current flow rates, suggest the resource could support approximately 250 kW of generation capacity. Additional data and validation will be needed to refine these estimates.

In addition, the LFG resources at Merrill Field are experiencing declining output given the elapsed time since closure of the landfill in 1987. The declining output from the resource will impact the scale of the proposed measure and the longevity.

While a project of this scale is unlikely to deliver substantial, long-term emissions reductions on its own, it can still provide meaningful benefits. First, it ensures beneficial use of LFG that would otherwise be flared or released directly into the atmosphere, thereby reducing localized greenhouse gas emissions. Second, by using combined heat and power (CHP) technology, the project can displace a portion of local natural gas consumption with a more efficient energy source, maximizing heat recovery and improving overall system efficiency.

Proposed Timeline:

Stage 1:

- LFG collection system upgrades – Completed Fall 2025

Stage 2:

- LFG analysis – Winter 2025/2026
- Project feasibility – Spring 20256
- Permitting and design – Summer 2026
- Construction complete – Summer 2027

Depending on siting, the FAA will likely have permitting requirements and should be engaged at an early development stage. Merrill Field Airport (MRI) and commercial businesses at MRI or adjacent to the site are also organizations that should be included.

Early estimates of capital costs from the EPA model show $2.5 - $3 million for microturbines, balance of plant, and facility heat/power retrofits. The distance between the gas collection system and the heat and power user, additional pumps and gas cleaning systems that might be needed to improve gas quality, and the amount of system upgrades the end user's heating system could all potentially inflate preliminary cost estimates.

SWS capital funding or MOA bond financing could be used to support project costs not directly supported by CPRG. There could be options for lease financing or gas sales to a third-party developer depending on project structure.

Success metrics include measuring and tracking:
- The reduction in gas volumes flared.
- The offsetting costs associated with flaring to positive revenue generation.

Community Benefits
This project offers significant benefits that extend well beyond emissions reductions. By creating a reliable source of energy from local waste streams, it directly supports energy security at a time when Anchorage faces uncertainty around natural gas supply for both heat and power.

Developing alternative sources also helps shield communities and utilities from price volatility, reducing exposure to unpredictable fuel markets.

In addition, converting waste into energy ensures the beneficial use of local resources, keeping value in-state while reducing reliance on imported fuels. Depending on the ultimate end user, the project can also generate economic benefits by supporting new commercial activity.

Finally, by reducing waste and enhancing local energy options, the project has the potential to lower costs for SWS ratepayers while improving quality of life and community resilience.

Industrial & Land Use

Carbon Capture, Storage, and Carbon Offset Program

Summary
The State of Alaska has enacted legislation and implemented regulations to make its abundant sub-surface resources available for the purpose of carbon capture and storage (CCS). Spearheaded by the State of Alaska's Department of Natural Resources (DNR), this initiative aims to make these state-owned resources accessible for CCS projects, thereby contributing to global efforts to sequester emissions associated with energy generation and industrial activity. To realize this vision, Governor Mike Dunleavy signed HB 50 into law in 2024, and the DNR followed with implementing regulations that are now fully promulgated and effective. This program's administration falls under the oversight of the Division of Oil and Gas within DNR. The Alaska Oil and Gas Conservation Commission (AOGCC) has also been authorized and is in the process of seeking primacy for class VI wells—the specially reviewed and designed wells needed to inject carbon dioxide underground for permanent storage—from the U.S. Environmental Protection Agency (EPA). With this framework in place, a range of activities may follow, including in-depth research and characterization of subsurface resources, negotiations for commercial access terms, and the permitting and approval of projects situated on state-owned land. Collaboration with other state agencies, the University of Alaska system, and regulators will be pivotal in ensuring these kinds of projects can be successful.

In addition to the CCS-focused program, DNR also administers the Carbon Offset Program. Legislatively enacted in 2023, the program enables the State to implement carbon offset projects on state land. Authorized under AS 38.95.400 - AS 38.95.499 and managed by the DNR Office of Project Management & Permitting, these state-led, nature-based projects generate revenue through carbon offset credit sales while providing other environmental, social, and economic co-benefits and an opportunity for businesses to meet voluntary carbon-reduction targets.

Examples of nature-based projects that may be developed under the Carbon Offset Program include projects that increase carbon storage through enhanced forest growth; that restore or make use of fire- and disease-damaged forestlands (e.g. reforestation, biochar production, and woody biomass burial);

that reduce wildfire emissions and protect carbon stocks by mitigating catastrophic fire risk; and marine-based projects that grow or restore kelp and seagrasses.

A third program, DNR's Carbon Leasing Program (also enacted in 2023), allows DNR to lease state land to private parties for a carbon management purpose (i.e., a carbon offset project or other project that mitigates greenhouse gases). Carbon management leases are administered by the DNR Division of Mining, Land & Water. This program is designed to attract private investment in carbon sequestration while maintaining public oversight and ensuring ecological integrity.

By engaging staff from various divisions within DNR, such as Forestry & Fire Protection, Mining, Land, & Water, and the Office of Project Management & Permitting, and by leveraging the capacity to collaborate with project developers and secure additional state funding when necessary, DNR is well-equipped to implement these initiatives efficiently.

Community Benefits

Carbon sequestration and carbon removal projects in Alaska present employment opportunities, potential value enhancements for Alaska's commodity resources, improved air and water quality, improved fish and wildlife habitat, improved access for recreation, hunting, fishing, and other subsistence uses, fostering of a kelp industry, and other environmental and cultural benefits.

Implementation Schedule

The Carbon Offset Program was authorized by the Alaska Legislature in May of 2023, and the program hired staff, enacted a regulatory framework, retained contractors, and been engaged with the market. The program has also been working to understand the dynamic voluntary credit markets and changes to registry protocols that drive project details.

For CCUS, the DNR program is similarly underway. Regulations were enacted in February 2025 and the AOGCC class VI well described above is underway, with primacy negotiations with the EPA to potentially continue through next year before primacy is ultimately granted to the State.

Measure Metrics

The most direct metric for the Carbon Offset Program will be the number of in-development and accredited carbon removal projects on state lands. Secondary metrics would include the number of miles of forested roads and bridges constructed that improve access to carbon removal project areas.

For the carbon capture and storage (CCS) program, while there may be many other intervening measures of success (resource assessment data gathered, etc.) the establishment of carbon capture facilities that intend to sequester carbon dioxide in State-owned subsurface resources is the most direct metric.

Cost Estimate

This program is in a preliminary stage. Assessments to confirm subsurface resources are available for sequestration are scalable to any cost level and would result in more expansive and/or definitive information about potential to sequester carbon dioxide.

For infrastructure improvements that would support carbon and other greenhouse gas removal projects under the Carbon Offset Program, costs would be dependent upon additional assessments of the number of road miles and bridges that would need to be constructed to access the areas with the highest potential for carbon and GHG removal projects and biochar equipment needed to address the most critical and prospective carbon-reducing areas of the 5+ million acres of beetle-killed and fire-affected state forestlands.

Funding Landscape

State funds may be allocated to CCS efforts. The University of Alaska may pursue characterizations efforts as well, along with federal agencies, such as the U.S. Geological Survey, and/or private industry entities.

For the Carbon Offset Program, $447,000 in ongoing operating funding is appropriated annually for staff, and other program-related costs and $425,000 in capital funding was appropriated in FY24 for carbon removal project development over the next five years.

For the Carbon Leasing Program, $142,000 in ongoing operating funding is appropriated annually for staff and other program-related costs.

Railbelt Industrial Energy Efficiency Challenge

Summary

This measure creates a voluntary, performance-based challenge for the Railbelt's largest industrial and commercial energy users (e.g., fish processing, cold storage, mining support) to identify and capture cost-effective energy savings.

The Challenge is based on proven "efficiency excellence" network models used in other states (like Vermont's Efficiency Excellence Network) and is designed to capture deep energy reductions through:

1. Audits: Requiring third-party, ASHRAE-level baseline audits.
2. Planning: Developing facility energy-management plans.
3. Optimization: Implementing operational tune-ups, process optimization, waste-heat recovery, controls upgrades, and strategic electrification where cost-effective.
4. Verification: Requiring submetering for major loads and verified annual reporting.

Proposed Measure

The program could be administered by a state agency like the Alaska Industrial Development and Export Authority (AIDEA) or the Alaska Energy Authority (AEA). AEA has a strong track record with commercial building energy audits and energy efficiency programs, which would position them well to lead program administration, facility benchmarking, and Measurement, Reporting, and Verification (MRV) protocols. The Alaska Industrial Development and Export Authority (AIDEA) could support project financing through its Sustainable Energy Transmission and Supply (SETS) fund, providing low-cost capital for efficiency upgrades identified in audits. Depending on the facility identified, this may include electrified repowering of systems, weatherization, and/or waste heat systems. The Department of Environmental Conservation (DEC) would coordinate reporting on resulting emissions reductions for Comprehensive Climate Action Plan (CPRG) compliance.

Savings would be tracked through energy-management plans, facility-level submetering, and verified annual reporting. This approach is designed to align with Alaska stakeholders' calls for practical, in-state administration and streamlined compliance, focusing on clear measurement and accountability over unnecessary paperwork. Embedding standardized MRV and simple, well-scoped requirements reduces the administrative load that often keeps smaller Alaska entities from participating in complex federal programs.

Emissions Reduction

Industrial and large commercial loads are among the Railbelt's most energy-intensive users. Persistent, metered savings reduce both grid electricity consumption and costly on-site fuel use. Alaska's planning materials assume approximately 15% average savings at a first cohort of ~25 large facilities, yielding an estimated ~80,000 MTCO2e/year by 2030 and scaling thereafter.

TABLE 40: Railbelt Industrial Efficiency Challenge Emissions Reduction

CO2e Reduction (Annual Metric Tons by 2030)	CO2e Reduction (Through 2030, cumulative metric tons)	CO2e Reduction (Through 2050, cumulative metric tons)
80,000	120,000	1,720,000

Community Benefits & Metrics

The Industrial Energy Efficiency Challenge delivers economic and public health co-benefits across the Railbelt region. By significantly lowering industrial and large commercial energy intensity, the program improves the operational competitiveness of private industry and the financial resilience of service providers, like hospitals and utilities. Stabilizing these operating costs helps secure existing jobs and vital regional economic activity. There is also an imperative to address industrial emissions, as they are the largest sector of emissions in Alaska.

Reducing fossil fuel consumption also leads to critical improvements in regional public health; specifically, it cuts the emissions of co-pollutants like Particulate Matter (PM) and Nitrogen Oxides (NOx) from boilers and diesel equipment, mitigating disproportionate exposure risks where industrial facilities are located near residential neighborhoods. Lowering facility operating costs can help stabilize local food prices and preserve year-round jobs in rural communities. The measure aligns with CPRG community benefits objectives by requiring participating companies to report local hiring and training statistics, guaranteeing that disadvantaged residents benefit directly from cleaner, lower-cost operations.

Projected Timeline

- 2025: Program design, recruitment of the first cohort, and completion of baseline audits.
- 2026–2027: Implement major efficiency upgrades at the initial 10 to 12 facilities.
- 2028–2030: Expand to the remaining facilities and fully deploy MRV protocols.
- By 2030: Achieve estimated annual reductions of ~80,000 MTCO2e.

Estimated Costs

The total cost of this program would be between $25M and $45M through 2030. This investment covers three main areas: facility audits, capital upgrades, and program administration. Baseline audits and assessments are estimated to cost $50,000 to $100,000 per facility, potentially increasing to $1.5M to $2.5M for the largest industrial sites. The total capital investment for efficiency upgrades, including controls, motors, and waste heat recovery, is estimated at $20M to $40M across the cohort, with costs per facility ranging from $500,000 to $2M. Finally, program administration and MRV protocols will require an additional $2M to $3M over the five-year period.

Statewide Forest Carbon and Biochar Program

Summary

The State could scale sustainable forest management and distributed biochar production, converting logging residues, thinning slash, beetle-killed, and fire-affected biomass into a stable carbon product for long-term storage and soil benefits. This approach draws on peer programs (e.g., Minnesota/Montana pilots) and aligns with Alaska's active Carbon Offset Program and DNR's planned investments in portable biochar equipment and related access improvements. Expected benefits include durable carbon storage, reduced wildfire risk, local job opportunities in harvesting and processing, and improved soil productivity for food security.

Alaska already has enabling legislation through its Carbon Offset Program, early feedstock assessments, and planned procurement of mobile biochar kilns. These factors, combined with strong federal support for forest carbon projects and emerging carbon credit markets, give the program multiple funding pathways (state appropriations, federal grants, and offset revenues). Projects create skilled local jobs in biomass collection, kiln operation, and soil application, and revenues from carbon credits can be shared with participating tribal and rural communities. By aligning with federal Monitoring, Reporting, and Verification (MRV) protocols and leveraging proven technology from other states, the program can transition quickly from pilots to full implementation, ensuring transparent and verifiable emission reductions.

This measure could be conducted in conjunction with cultural burns, increased fuel management, and more aggressive fire suppression that would seek to reduce emissions from wildland fires. Though there is substantial potential community benefit from these efforts, we do not include these in the measure given the complexity of quantifying emissions reduction.

Emissions Reduction

Forest biomass left to decay or burn releases large amounts of carbon dioxide and methane. Converting this material to biochar locks roughly 0.3–0.5 metric tons of CO_2-equivalent ($MTCO_2e$) per dry ton of feedstock into a stable carbon pool, while avoiding emissions from open burning or slash decomposition. Using feedstock availability data from the Alaska Division of Forestry and applying the mid-range factor of 0.4 $MTCO_2e$ per dry ton, Alaska can estimate annual reductions by multiplying recoverable biomass (in dry tons) by participation rate and permanence factor. For example, if 200,000 dry tons of forest residue are processed each year at a 30% participation rate, the program would sequester roughly 24,000 $MTCO_2e$ annually; at a 60% participation rate, reductions rise to nearly 48,000 $MTCO_2e$ annually. These figures are consistent with results from Montana and Minnesota biochar pilot projects, providing a defensible benchmark for planning in Alaska.

Table 41: Biochar Emissions Reduction

CO2e Reduction (Annual Metric Tons by 2030)	CO2e Reduction (Through 2030, cumulative metric tons)	CO2e Reduction (Through 2050, cumulative metric tons)
60,000	90,000	1,290,000

Community Benefits & Metrics

The program delivers numerous non-carbon benefits. Removing dead or overstocked biomass lowers wildfire fuel loads and reduces smoke exposure for nearby communities. Applying biochar to soils improves moisture retention, enhances nutrient cycling, and can boost yields for local agriculture and community gardens, helping to reduce food costs in rural areas. Biochar production also reduces emissions of particulate matter and volatile organic compounds compared to open burning, improving regional air quality and respiratory health outcomes.

Timeline

- 2025–2026: Scale pilot projects, procure initial mobile biochar kilns, and initiate workforce training.
- 2027–2028: Expand operations across Interior, Southeast, and Tribal forestry lands.
- 2029–2030: Achieve stable annual throughput of 200,000 dry tons of feedstock.
- By 2030: Achieve a sequestration rate of 24,000–60,000 MTCO2e per year.

Estimated Program Costs

TABLE 42: Biochar Cost Estimate

Category	Estimate	Notes
Equipment Capital Investment	\$3M - \$4M	Assumes procurement of 6–8 mobile biochar kilns at approximately \$500k each.
Operations and Feedstock Logistics	\$200 - \$400 per dry ton	Covers collection, transport, and processing. At 200,000 tons/year, this equates to \$60M annually.
Program Administration & MRV	\$5M total over 5 years	Includes Monitoring, Reporting, and Verification protocols.
Total Program Cost (2025–2030)	\$300M - \$350M	Offsets may be realized through carbon credit revenues, estimated at \$20–\$40 per ton.

Methane Leak Detection and Repair (LDAR) for Oil and Gas Infrastructure

Summary

The State of Alaska should implement mandatory or incentivized programs for continuous methane monitoring and rapid leak detection (LDAR) across all oil and gas infrastructure, including upstream production, transmission pipelines, and compressor stations. This establishes a mandatory (or strongly incentivized) program requiring continuous monitoring at high-priority facilities and rapid LDAR response across upstream production, gathering/processing, transmission pipelines, and compressor stations. Monitoring tools may include fixed continuous monitors at well pads/central facilities, optical gas imaging (OGI), aerial LiDAR or hyperspectral surveys, and quantification via high-flow samplers or site-level mass-balance.

This measure conserves the state's mineral estate by retaining saleable gas and providing operators with verifiable, near-real-time data to reduce operational risk and regulatory uncertainty. Additionally, state agencies like DNR, DEC, and AOGCC gain verifiable, near-real-time data for compliance and reporting.

Proposed Measure

The Alaska Oil and Gas Conservation Commission (AOGCC) would serve as the lead state agency for establishing detection and rapid repair requirements at production wells, pads, and gathering infrastructure, and for collecting and verifying facility-level leak reports.

The Alaska Department of Environmental Conservation (DEC) implements Alaska's air quality regulations and greenhouse-gas inventory. It would coordinate Monitoring, Reporting, and Verification (MRV) protocols so that methane reductions are captured in the state's GHG inventory and reported to EPA under CPRG. DEC would also integrate leak detection and repair obligations into air permits for compressor stations, processing plants, and other midstream facilities.

The Environmental Protection Agency (EPA) provides the national performance requirements for detection technologies, inspection frequency, repair timelines, and annual emissions reporting. Alaska operators must meet these standards in addition to any state rules.

The Pipeline Hazardous Materials Safety Administration (PHMSA)'s authority complements AOGCC and DEC by ensuring that methane leak detection and repair are fully embedded in pipeline safety plans.

Emissions Reduction

Methane's 100-year Global Warming Potential (GWP100) is greater than 25 times that of CO2, making rapid detection and repair especially impactful. Empirical programs in other basins have shown reductions of 50–80% in facility methane emissions when continuous monitoring, combined with tight repair timelines, replaces periodic surveys. Such a program would pair detection with enforceable time-to-repair standards (e.g., 24–72 hours by leak size class) and recurring performance audits.

To quantify emissions reductions, a baseline is established using GHGRP Subpart W data (supplemented by AOGCC/DEC inventories) and scaled by asset coverage (70% in Year 1, 90% by Year 5). Reduction estimates apply detection performance by technology against a strict repair standard (e.g., major leaks ≤ 72 hours) and are computed using a conservative band of 50–80% reduction. Avoided methane (ton CH4) is converted to CO2e for annual and cumulative reporting, with uncertainty bands and a persistence factor applied to reflect sustained monitoring.

TABLE 43: LDAR Emissions Reduction

CO2e Reduction (Annual Metric Tons by 2030)	CO2e Reduction (Through 2030, cumulative metric tons)	CO2e Reduction (Through 2050, cumulative metric tons)
750,000	1,125,000	16,125,000

Community Benefits & Metrics

LDAR programs provide significant benefits to Alaskans by enhancing local air quality and mitigating health risks, particularly for low-income and Indigenous communities that frequently reside near production fields or compressor stations where pollutants accumulate. Reducing methane leaks also lowers co-emissions of volatile organic compounds (VOCs) and hazardous air pollutants (HAPs), which are known contributors to respiratory illnesses. Beyond environmental and health improvements, the measure delivers economic and social benefits.

The program supports skilled Alaska jobs for technicians, instrument specialists, UAV pilots, and data analysts. Furthermore, it would prioritize serving infrastructure adjacent to residential neighborhoods, implementing community monitoring and public dashboards to increase transparency for those affected. From an economic standpoint, the program also reduces product loss by capturing saleable gas, creating immediate value for operators and the state.

Timeline

The proposed implementation timeline will span six years, ensuring a phased and systematic rollout:

- 2025 will focus on foundational work: establishing state and federal rules, identifying high-priority sites, and launching continuous monitoring pilots.
- 2026–2027 will be dedicated to scaling the program, rolling out monitoring to 50% of assets and enforcing a 24–72-hour repair timeline.
- 2028–2030 will see the program expand to 90% asset coverage and integrate community transparency dashboards.
- By 2030, the measure is expected to achieve 50–80% methane reduction for covered assets, resulting in an estimated 0.5–1.0M MTCO2e/year avoided.

Estimated Costs

The total estimated cost for the initial implementation phase (2025–2030) is projected to be between $70M and $100M.

Capital costs for technology and monitoring systems are estimated at $20M–$30M to cover 70% of state assets. This setup includes fixed sensors, with a cost of $25k–$50k per site, and annual aerial campaigns, costing $1–$2M annually.

Annual operations and maintenance (O&M) costs—covering repairs, inspections, and data management—are estimated to range from $10M–$15M/year.

Unalaska C-PACER

Summary

Commercial Property Assessed Clean Energy and Resiliency (C-PACER) financing is a form of low interest financing enabled by local and state governments to drive investment in the private sector focused on clean energy and energy efficiency.

In Alaska, the C-PACER framework is authorized by state legislation, facilitated by the Alaska Energy Authority, and supported by an advisory group of stakeholders. The Alaska Sustainable Energy Corporation, a subsidiary of Alaska Housing Finance Corporation, is available to support communities that establish C-PACER programs as well.

The City of Unalaska is the hub for commercial fishing activity in the Bering Sea and Aleutian Islands. The International Port of Dutch Harbor consistently lands the greatest volume of fish in the country and often ranks among the highest value of catch each year (~$160M in 2022). A number of major fish processors operate land-based seafood processing facilities in Unalaska.

By establishing a C-PACER program, the City of Unalaska would create the opportunity for these commercial organizations, as well as others in the city, to access financing for energy projects and resiliency projects with smaller down payments (C-PACER financing typically covers 100% of retrofit project costs), at lower and competitive interest rates, payable over longer repayment windows than traditional financing options.

The combination of smaller downpayments, longer repayment windows, low interest rates, and non-debt project financing will enable fish processors to see improved cash flows and project economics on clean energy projects which might not otherwise be feasible due to limited working capital for these types of initiatives and organizational payback and ROI targets.

C-PACER financing can also be used to support a portion of qualified costs as part of new construction projects, based on the market value of the property.

Emissions Reduction

The seafood processing facilities in Unalaska are either islanded from a larger electrical grid, operating with their own power production facility on site, or connected to the electrical grid operated by City of Unalaska and served by the 20.6MW power production facility. In both cases, power is produced entirely using diesel fuel.

During the 2023 fiscal year (July 1, 2022 - June 30, 2023), City of Unalaska produced 42,695,436kWh of electricity consuming a total of 2,756,745 gal of fuel. The reported emissions during a similar 1-year period (January 1, 2023 - December 31, 2023) the reported emissions by that facility were 29,611 metric tons of CO2 equivalent.

Processing facilities vary in size, and in production of emissions resulting from power production, however, estimates can be drawn from the publicly reported greenhouse gas emissions from one of these Unalaska based facilities. In 2023, the total reported emissions by that facility were 37,470 metric tons of CO2 equivalent.

Predictions on emissions reductions will be made using a high and low scenario reduction for this reference facility, however, it is likely that other organizations, including other processors, as well as other types of industrial consumers of power could also implement similar energy projects using the C-PACER financing and achieve considerable additional emissions reductions.

Assumptions:

- C-PACER program fully implemented by Jan. 1, 2027.
- Total 10% emissions reductions from C-PACER eligible projects in the low reference case scenario (projects in service 2 years after C-PACER implementation - Jan 1, 2029)
- Total 30% emissions reductions from C-PACER eligible projects in the high reference case scenario (10% emissions applied after 2 years, additional 10% each year achieved for two subsequent years until 30% threshold is reached)

TABLE 44: C-PACER Emissions Reduction

Scenario	Annual MTCO2e Reduction	Cumulative MTCO2e Reduction (2030)	Cumulative MTCO2e Reduction (2050)
Low Reduction	3,747	7,494	82,434
High Reduction	11,241	7,494	228,567

Project Implementation Schedule and Budget

Implementation of a C-PACER program is expected to take between 6-12 months. During this time, the implementing agency may leverage support from partner organizations including ASEC and AEA to capture lessons learned from other C-PACER programs that have been implemented in the state, and to apply best practices.

It is expected that initial deployment of a C-PACER program will cost about $50,000 in staff time for the implementing organization. Costs associated with operating and maintaining the program will be recoverable through administrative and servicing fees passed on to applicants and energy project owners.

The table below provides some examples of the types of projects fish and seafood processors could seek to implement or accelerate as a result of having access to low-cost financing for energy efficiency retrofit projects.

TABLE 45: C-PACER Emissions Examples

Project Category	Emissions Impact	Typical Deployment Timeline
Heat Recovery (Refrigeration, Boilers, Wastewater and energy)	High (direct fuel consumption reduction)	1-5 Years
Refrigeration Optimization	High (direct fuel consumption reduction - large electric load)	1-2 Years
Worker Housing (Domestic Hot Water. Space Heating)	High (direct fuel consumption reduction)	1-2 Years
Motors and Drives	Medium (plant and equipment age dependent)	1-2 Years
Building Envelope	Medium (age and existing condition dependent)	1-2 Years
Lighting	Low	< 1 Year

Many of these projects also provide operational benefits to the plant owners, in addition to emissions reductions. Upgrading equipment and streamlining processes can reduce operating, maintenance, and fuel costs. Additionally, these improvements boost output and minimize product waste, providing advantages not only to processors, but also to fishers and consumers of the end products.

As part of the C-PACER program, project owners would be required to obtain a review of the expected energy and emissions reduction achieved by a proposed project, as well as quantification of other benefits including improvements in air quality, resilience. A project auditor will review this documentation to ensure that a project meets the minimum required qualifications for C-PACER financing.

Community Benefits

Implementing a C-PACER program in Unalaska delivers tangible, near-term benefits for residents, workers, and local businesses—well beyond the private savings realized by seafood processors. By unlocking 100% long-term, low-cost financing for energy efficiency and resiliency upgrades, Unalaska can accelerate projects that reduce diesel consumption for building heat, refrigeration, and process loads. The result is cleaner local air and reduced exposure to diesel exhaust near homes, schools, and workplaces concentrated around Dutch Harbor on Amaknak Island.

Lower fuel use also reduces noise and odors associated with diesel equipment, improving quality of life for year-round residents and seasonal workers alike. Because program administration costs are recoverable through project fees, the City can stand up the program without burdening ratepayers or the municipal budget.

C-PACER directly supports Unalaska's economic resilience. Processors operate on thin margins and face volatile energy costs and supply-chain risk due to weather and shipping constraints; energy upgrades financed through C-PACER stabilize operating costs, protect throughput, and help maintain Dutch Harbor's national leadership in landings and value.

Modernized equipment and heat-recovery projects can reduce downtime and product loss, supporting steady employment across the fishing season and in the shoulder months for local electricians, HVAC technicians, controls specialists, and contractors. Those wages circulate in the community—supporting small businesses and expanding the local tax base—while upgraded worker housing (e.g., efficient space heat and domestic hot water) improves comfort, safety, and retention for seasonal and permanent residents.

Community resilience also improves. As Unalaska's grid and large facilities rely entirely on diesel generation, efficiency and thermal storage projects funded via C-PACER reduce exposure to fuel price shocks and logistics disruptions, while targeted resiliency measures (e.g., controls, backup thermal capacity, and critical-load upgrades) help essential services stay online during severe weather.

The program design is inclusive: although seafood processors are the near-term focus, other commercial buildings—lodging, warehousing, retail, and service businesses—can access the same tool, spreading benefits beyond the industrial waterfront. Finally, by requiring third-party review of project savings and emissions, the program builds a credible record of local CO_2 reductions. Even the conservative scenario in this report (on the order of several thousand metric tons reduced annually from a single large facility) signals meaningful community-scale air-quality and emissions reduction within a partially disadvantaged census area—positioning Unalaska to compete for additional state and federal resources aligned with measurable community outcomes.

VI. EMISSIONS PROJECTIONS, SCENARIOS, AND TARGETS

This section outlines the State of Alaska's greenhouse gas (GHG) emissions projections under a business-as-usual scenario, summarizes the potential GHG reductions from various implementation scenarios, and establishes the state's near-term and long-term emissions reduction targets.

BAU GHG EMISSION PROJECTIONS

A detailed business-as-usual (BAU) projection, which assumes no new energy sustainability policies or mitigation actions beyond those already in place, has been developed for this plan and is further detailed in the technical appendix. A graph combining these projections with implementation scenarios can be found in the Implementation Scenario Projections section.

Under a BAU scenario, Alaska's GHG emissions are projected to continue on their current trajectory, driven by the state's energy-intensive economy. Preliminary analysis for the Railbelt electric system, which serves nearly 75% of Alaska's population, offers a stark illustration of this trend. Without significant new policy interventions, fossil fuels are projected to account for approximately 89% of energy generation by 2050, with renewables contributing only 11%. This represents a decrease from the current 20% renewable share, primarily due to a projected increase in electricity demand from electrification without a corresponding increase in clean energy generation.

The Business-as-usual (BAU) scenario was established using the most recent population projections from the Alaska Department of Labor & Workforce Development given the per capita emissions at the time of the baseline year of the GHG inventory. While this is a strong projection method in most localities, this could be a less ideal method here given that Alaska's emissions are dominated by industrial and transportation sectors activities that are driven by global economic and political trends, and not resident population; namely the oil & gas industry, military activity, and international air freight. The projection team considered a mixed method that used population for all sectors except industrial which would use oil & gas production estimates, but opted for a simpler, population-based method. The "Other Potential Baseline Projection Methods" section has discussion of this potential method for estimating future oil & gas emissions based on future production projections.

The table below shows the 2030 and 2050 population dynamics for each of the boroughs of the State, and the total statewide growth for 2030 and 2050 (in percentage of population) from 2022.

TABLE 46: Population Projections

Borough/Census Area	2022 Estimate	2030 Projection	Pct change	2050 Projection	Pct change
Aleutians East Borough	3,398	3,727	9.68%	4,038	18.83%
Aleutians West Census Area	5,122	5,138	0.31%	5,486	7.11%
Anchorage, Municipality	287,145	285,931	-0.42%	260,093	-9.42%
Bethel Census Area	18,257	18,815	3.06%	20,619	12.94%
Bristol Bay Borough	865	761	-12.02%	639	-26.13%
Chugach Census Area	6,874	6,625	-3.62%	5,745	-16.42%
Copper River Census Area	2,589	2,685	3.71%	2,629	1.54%
Denali Borough	1,585	1,570	-0.95%	1,324	-16.47%
Dillingham Census Area	4,723	4,441	-5.97%	4,047	-14.31%
Fairbanks North Star Borough	95,356	94,976	-0.40%	88,835	-6.84%
Haines Borough	2,056	2,478	20.53%	2,134	3.79%
Hoonah-Angoon Census Area	2,287	2,269	-0.79%	2,006	-12.29%
Juneau, City and Borough	31,685	30,975	-2.24%	27,184	-14.21%
Kenai Peninsula Borough	60,690	63,138	4.03%	61,784	1.80%
Ketchikan Gateway Borough	13,741	13,006	-5.35%	10,790	-21.48%
Kodiak Island Borough	12,720	11,909	-6.38%	9,566	-24.80%
Kusilvak Census Area	8,278	8,667	4.70%	10,186	23.05%
Lake and Peninsula Borough	1,381	1,324	-4.13%	1,217	-11.88%
Matanuska-Susitna Borough	113,325	123,548	9.02%	146,262	29.06%
Nome Census Area	9,835	9,527	-3.13%	9,285	-5.59%
North Slope Borough	10,805	11,203	3.68%	12,586	16.48%
Northwest Arctic Borough	7,423	7,271	-2.05%	7,031	-5.28%
Petersburg Borough	3,360	3,297	-1.88%	2,928	-12.86%
Prince of Wales-Hyder Census Area	5,650	5,639	-0.19%	4,771	-15.56%
Sitka, City and Borough	8,382	7,831	-6.57%	6,266	-25.24%
Skagway, Municipality	1,081	1,147	6.11%	1,031	-4.63%
Southeast Fairbanks Census Area	7,021	7,465	6.32%	8,315	18.43%
Wrangell, City and Borough	2,070	1,845	-10.87%	1,349	-34.83%
Yakutat, City and Borough	700	668	-4.57%	650	-7.14%
Yukon-Koyukuk Census Area	5,179	4,882	-5.73%	4,010	-22.57%
Total	**733,583**	**742,758**	**1.25%**	**722,806**	**-1.47%**

Other Potential Baseline Projection Methods

Although various factors could influence the trends of emissions trajectories, population is considered to be a more suitable and thorough metric. For example, while sectoral growth or GDP growth by state might have been options to consider, the non-linear relationship between these variables and the inventory could lead to bias. It is also important to note that certain emissions trends may not be coupled to population growth, such as tourism or the production of oil, or transportation of goods. One of the primary ones is the general dynamics of the Alaskan oil and gas industry.

Alaska's oil and gas industry is projected to experience notable changes in both production levels and development activities from 2022 to 2050, shaped by regulatory shifts, new field developments, technology, global market forces, and environmental considerations. Alaska remains highly dependent on oil and gas, which provide roughly half of the state's economic activity and significant state revenues through taxes and royalties. Natural gas development, particularly the Alaska LNG pipeline project, is pivotal but remains subject to financial viability and legal challenges; if realized, it could further boost oil drilling activities and create export revenue streams.

In general, oil production is expected to rise significantly, with state forecasts estimating increases to over 600,000 barrels per day by the early 2030s, largely driven by new projects such as Willow, Nuna, and Pikka on the North Slope. This would mark the highest production levels in over two decades. Based on past reports, the continued investment and legislative support have maintained a more attractive environment for oil and gas companies, stimulating both direct employment and indirect economic impacts across Alaska. New field developments, especially in the National Petroleum Reserve–Alaska (NPR-A), will help offset natural declines in legacy fields, though challenges remain from environmental regulation and opposition, as well as fluctuating oil prices. Major oil producers forecast spending upwards of $14 billion on construction and expansion in the next five years, boosting local economies and infrastructure.

After peaking in the early 2030s, Alaska's oil production is expected to stabilize and then decline, with projections suggesting a gradual decrease to approximately 275,000 barrels per day by 2040, absent significant new discoveries or technological breakthroughs. Production increases after 2030 are anticipated from fields in the Arctic National Wildlife Refuge (ANWR), subject to economic viability, regulatory approval, and environmental considerations; low oil price scenarios could slow or halt development in ANWR. The Ugnu heavy oil deposit and viscous oil projects offer long-term possibilities, but recovery rates remain low and depend on future advancements in extraction technology. The Trans-Alaska Pipeline System (TAPS) will remain critical but faces operational challenges with lower throughput and potential risks to reliability as volumes decline.

The proportion of biofuels in Alaska's energy mix is projected to increase, particularly after 2040, as renewable alternatives gain competitiveness and regulatory support nationwide. Associated gas reserves could be used for LNG exports if infrastructure is developed, potentially moderating declines in oil drilling activities and Alaska may see periodic boosts to production from unconventional and offshore discoveries, but overall output is expected to be on a downward trajectory beyond 2040 barring transformative events. As a result, the impact of in-boundary emissions for Alaska over this period is uncertain.

Based on the most recent data, Alaska's oil production is expected to grow significantly from 2022 through 2030, followed by a plateau and then a decline by 2050. In 2022, Alaska's oil production was around 430,000 barrels per day. By 2030, production is projected to peak at about 660,000 barrels per day, largely due to new projects like Willow and Pikka coming online - about 54% from 2022 to 2030[40]. After peaking, production is expected to decline. By 2050, projections estimate daily output will fall to approximately 275,000 barrels per day—or a projected 58% decrease from the 2030 peak to 2050. Most Alaskan natural gas is reinjected to maintain oil pressure and help with oil recovery; thus, marketed gas production is not expected to change dramatically without new export infrastructure. The LNG export project could shift the market, but specific percentage changes in gas production volumes are not available as most forecasts are tied to oil production trends. In summary, Alaska's oil output could increase by 54% from 2022 to 2030, then decrease by 58% from the 2030 peak to 2050, with gas development stable unless export projects proceed[41]. Since it is challenging to know if this trend is likely, and also uncertain on whether these would impact the domestic emissions for the state, versus being exported out, the choice of population was retained for projecting reasonable BAU trajectories.

IMPLEMENTATION SCENARIO PROJECTIONS

The *emissions reduction scenarios chart* illustrates how Alaska's greenhouse-gas (GHG) emissions evolve from base year 2022 through 2030 and 2050 under two contrasting pathways: a Business-as-Usual (BAU) projection assuming no new mitigation policies and population-driven emissions changes, as well as a Target scenario showing cumulative reductions from all measures, largely implemented before 2030, along with continuing shifts through 2040 based on assuming continuing energy programs like weatherization and the Renewable Energy Fund. Collectively, these would lower total emissions to meet a 2050 target of 35 million mt CO_2e, or approximately 14.6% of 2022 baseline.

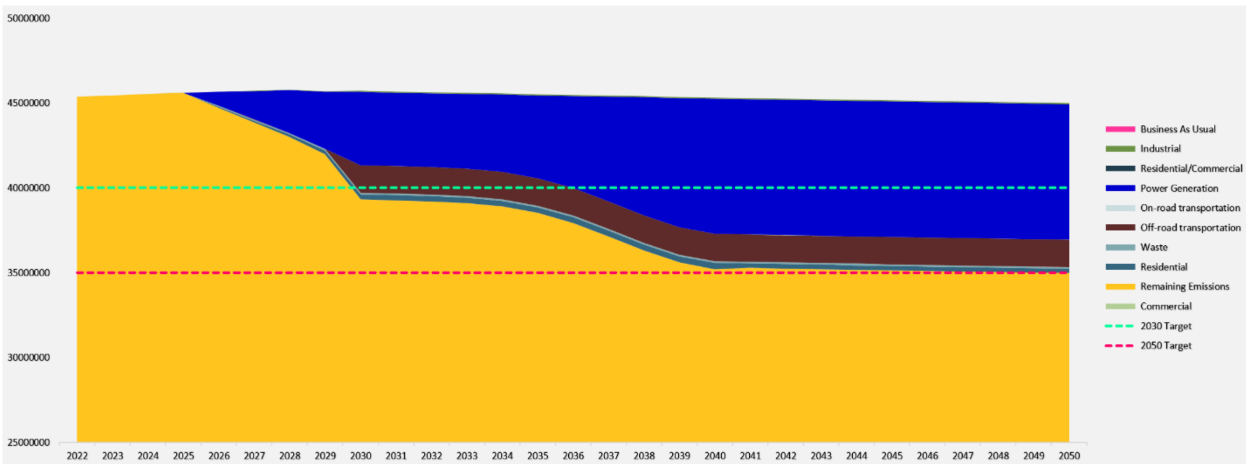


FIGURE 3: Emissions Reduction Projection Throughout 2050

All emissions reductions prior to 2030 are driven by measures as described and suggested for funding in Chapter V: Emissions Reduction Strategies. For continued reductions after this period, we presumed the continuation or expansion of existing programs and efforts, namely the implementation of clean generation projects and the deepening of weatherization and energy efficiency investments.

To inform Railbelt electric generation projections, we interpreted the results of two different studies related to this major source of emissions, one by the National Renewable Energy Laboratory and one by the Alaska Center for Energy and Power, have analyzed different scenarios for decarbonization of the Railbelt Grid in coming decades. We also assumed that economic incentives would support the continuation of programs that support projects with short payback periods, such as rural electric generation and AHFC's weatherization program.

NEAR-TERM AND LONG-TERM GHG REDUCTION TARGETS

The State of Alaska is pursuing the following aspirational targets, based on the projections in this plan:

- Near-Term Target (2030): Reduce economy-wide emissions by 7.3% from 2022 levels.
- Long-Term Target (2050): Reduce economy-wide emissions by 14.6% from 2022 levels.

These targets represent a "bottom-up" approach, using the measures identified in this plan as the basis for the targets, rather than specific targets established by statute or administrative order. These measures are based on executive priorities and the state energy policy as established in AS 44.99.115, and previous non-binding goals for energy efficiency and clean power generation.

VII. WORKFORCE PLANNING ANALYSIS

ANALYSIS OVERVIEW

Kinetic West's Role

To understand Alaska's sustainable energy workforce needs, the Alaska Municipal League (AML), working on behalf of the state of Alaska Department of Environmental Conservation (DEC), contracted with Kinetic West to perform a workforce analysis. Kinetic West's scope included:

- Identifying up to ten occupations needed in Alaska to complete PSEAP goals[42]
- Developing profiles on the ten occupations that include information on demand, wages, and training opportunities across the state.
- Interviewing up to ten stakeholders to add qualitative insight into findings

The following report serves as the foundation to understand workforce needs related to Alaska's Comprehensive Sustainable Energy Action Plan. Additional information, including regional breakdowns of this analysis is available at the project website.

METHODOLOGY

This report is informed by qualitative and quantitative research performed by Kinetic West from February – May 2025.

<u>Identifying Focus Occupations:</u> The first step in the research process was to identify occupations needed to implement the Priority Sustainable Energy Action Plan (PSEAP) measures, which were used as a proxy for the Comprehensive Sustainable Energy Action Plan (CSEAP) measures. The PSEAP measures represent six domains across which Alaska seeks to reduce greenhouse gas emissions: residential; non-residential; solid waste; transportation; electric generation; and industrial/land use.

In the initial analysis, we identified over 100 occupations that are relevant to Alaska's PSEAP. To help reduce this group to ten occupations, we clustered the occupations at the 3-digit Standard Occupational Classification (SOC) code level, and assessed if the occupational clusters met the following criteria:

- **Is this occupation in high demand in Alaska over the next 10 years?** High demand was defined as an occupation estimated to grow at a rate of 7% *<u>or</u>* higher or that is expected to add more than 500 jobs from 2024-2033 based on public and proprietary data sources, including the U.S. Bureau of Labor Statistics. This benchmark was chosen because overall job growth across the state of Alaska is estimated at 6% between 2024-2033.
- **Does the average hourly wage for this occupation meet or exceed a "living wage" for Alaska?** Living wage was defined in this report as a statewide average hourly wage between \$23.99/hour (for a household with one working adult with no children) and \$44.77/hour (for a household with two adults

and two children, where one adult is working outside the home). Living wage was determined using MIT's Living Wage Calculator.[43]

In addition to using demand and wage criteria at the 3-digit SOC code level to help narrow the dataset, we also leveraged Alaska Municipal League's (AML) knowledge of unique workforce dynamics and preliminary CSEAP goal discussions as important data points. This led to the inclusion of certain occupations in our final priority dataset that did not fully meet the demand/wage criteria listed above but were still seen by AML and stakeholders as important for building Alaska's sustainable energy future based on the measures included in this plan (for example, Refuse and Recyclable Material Collectors).

Developing Profiles: Once we aligned with AML on ten focus occupations, we developed profiles on each occupation. These profiles identified the wages and demand for each occupation across Alaska and in six regions across the state.

In addition, we sought to understand the training landscape for the ten focus occupations. To do so, we catalogued training programs related to the focus occupations and sustainable energy across Alaska. Each occupational profile includes information about training opportunities, and the appendix includes a full catalogue of training opportunities broken out by region. Main training providers include:

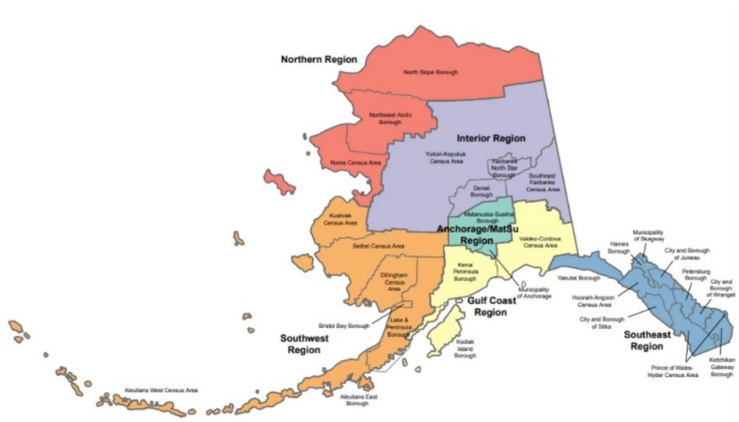


FIGURE 4: Alaska's Six Regions. Source: Alaska Public Media.

- Alaska Metal & Mechanical/Sheet Metal Workers Local 23
- Alaska Technical Center
- Alaska Works Partnership
- Alaska Vocational Technical Center (AVTEC)
- Amundsen Education Center
- Associated Builders and Contractors of Alaska
- Galena Interior Learning Academy
- Ilisaġvik College
- Northwestern Alaska Career and Technical Center (NACTEC)
- Local 7 Insulators
- NECA/IBEW 1547
- Partners for Progress in Delta
- Southeast Alaska Vocational and Education Center (SAVEC)
- UAA – Anchorage
- UAA – Kenai Peninsula College
- UAA – Kodiak College
- UAA – Matanuska-Susitna College
- UAA – Prince William Sound College
- UAF – CTC
- UAF – Fairbanks
- UAF – Rural Campuses
- UAS – Juneau
- UAS – Ketchikan/Sitka
- Yuut Elitnaurviat

Interviewing Stakeholders: The final step was to interview workforce development stakeholders from across the state to better understand their views on the opportunities and challenges for growing these focus occupations. These interviews provided a more nuanced understanding of how workforce development for these roles is happening on the ground and how it could be better supported in the future. We sought input from employers, training providers, community action programs, labor unions, and statewide workforce entities—prioritizing perspectives from both population centers and rural areas. Through conversations, we learned about workforce needs related to the ten focus occupations as well as the sustainable energy workforce needs in rural communities that are not large enough to support full-time roles in focus occupations.

Organizations interviewed include:

- Alaska Energy Authority
- Alaska Safety Alliance
- Alaska Workforce Alliance
- Alaska Workforce Investment Board
- Alaska Vocational Technical Center (AVTEC)
- DeerStone Consulting
- IBEW 1547
- RurAL CAP
- Southeast Conference
- Alaska Heat Smart
- University of Alaska, Anchorage – Transportation and Power Division
- University of Alaska, Fairbanks – Sustainable Energy Program
- Zender Environmental Group
- 2025 Alaska Infrastructure Development Symposium – Energy Workforce Session

ALASKA WORKFORCE CHALLENGES AND OPPORTUNITIES

Alaska's unique geography and economy provide challenges and opportunities for workforce development that are distinct from those faced in other states. For example, while it is the largest U.S. state by area, it has one of the smallest populations. With only ~730,000 residents, it outranks only the District of Columbia, Vermont, and Wyoming in terms of population.[44] 82% of Alaska's communities have no access to a road network, and 251 communities are exclusively accessed by air,[45] meaning weather, distance, and ability to spend time away from home can significantly impact a worker's ability to train for a new job or improve their skills. In addition, many people in Alaska's rural communities rely on seasonal subsistence hunting and fishing to meet their needs and those of their families, which means "seasonality and subsistence must be built into both training calendars and employment contracts."[46]

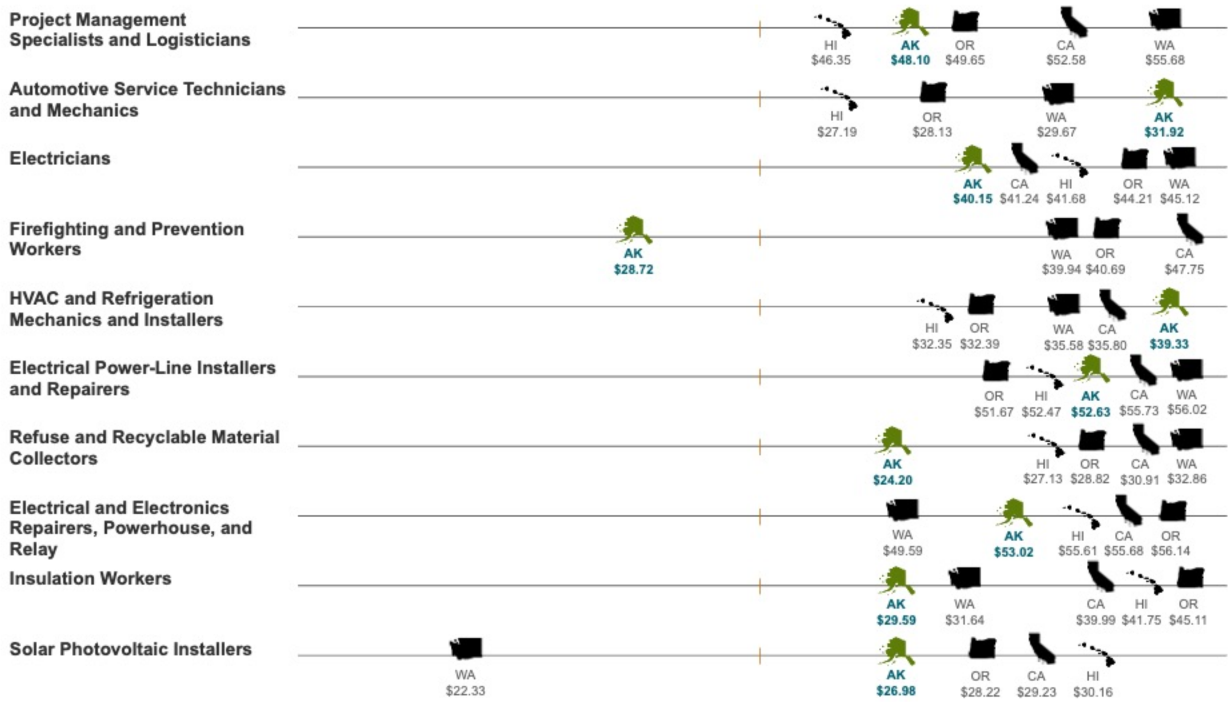
Even with these challenges, which we will explore more fully in this chapter, Alaska offers many unique opportunities for developing a sustainable energy workforce. Alaska is an energy-rich state with vast hydropower in the southeast, solar potential in the north, and wind in regions throughout. While power sources are rich, Alaska continues to face challenges with the storage and integration of that power. As another asset, Alaska has unique Alaska Native Corporations—a structure of Indigenous government that exists only in Alaska and is focused on supporting the economic development and workforce opportunities of Alaska Native people and communities.[47] Additionally, Alaska has a large seasonal and immigrant workforce and a large population of active duty military service members, many of whose skills can be converted to meet the demand of the sustainable energy future.

Challenges to Growing Alaska's Sustainable Energy Workforce

Through our research, the main workforce development challenges that emerged include the following.

Retaining Workers: Expert interviews conducted for this report repeatedly identified the challenge of not only finding and training sustainable energy workers but retaining them once they were trained. For example, interviewees in both Anchorage and Dillingham spoke about the difficulty of finding electricians. Maintaining skilled workers in Alaska is difficult, given that the lower 48 can attract skilled and in-demand workers to the same jobs, with often a lower cost of living, fewer geographic barriers, and, in some cases, higher wages.

FIGURE 5: Comparison of Average Hourly Wages in Alaska vs. Others States
Data Sources: Lightcast.io and Bureau of Labor Statistics.



At the 2025 Alaska Infrastructure Development Symposium, experts confirmed that the high cost of living and challenging lifestyle can lead workers to depart for better pay in urban areas—in Alaska or elsewhere—once trained. One interviewee reported that a local employer "now seeks to only hire people who own a house and are married," to reduce turnover and the need to constantly train new workers. This challenge of maintaining workers is reflected in Alaska's state labor statistics. 2024 marked Alaska's 11th year of net-migration losses, meaning that more people left the state than moved to it in that year.[48]

<u>Maintaining a Sustainable Energy Workforce in Rural Areas:</u> Maintaining a sustainable energy workforce can be particularly difficult in rural areas, where there may not be enough full-time work to support a specialized sustainable energy occupation. Zender Environmental Group, a nonprofit dedicated to waste and water quality challenges in Alaska, explained: "Rural communities need a "jack-of-all-trades" because they can't support a full-time collector, wastewater operator, etc. … There are so many responsibilities and hats, and not a consistent need for any one particular responsibility."[49] Attendees at the 2025 Alaska Infrastructure Development Symposium echoed this concern, noting that in some communities, there may not be enough work for a trained sustainable energy occupation, such as a heat pump installer, so workers must be prepared to move around regionally. Still, there is strong interest in growing sustainable energy skills within rural communities rather than relying on expensive and infrequent contractors from urban areas to travel out to each place.[50]

<u>Alaska's Geographic Challenge:</u> Bringing Trainees to Courses, Bringing Trained Talent to Job Sites. Given its immense size, introducing workers to careers and training opportunities outside of their immediate community is difficult. Speaking about the HVAC/R workforce, Andy Romanoff, the Executive Director of Alaska Heat Smart, explained, "Alaska's capital city Juneau sees one, maybe two, installer trainings annually. The trainer and equipment are flown in from the Pacific Northwest at their expense and for local attendees the training courses are free. For all outside of Juneau that wish to attend, they must

either pay to fly or boat to Juneau, plus pay for lodging and meals, and give up a few days of work. The expense of such an endeavor is typically prohibitive, meaning that the majority of the region offers no meaningful training opportunities for many of the communities that likely need training and educational opportunities the most."

Training requirements that can seem standard or simple in the lower 48 states can pose huge hurdles to skill development in Alaska. For example, in a state where less than 20% of communities connect to a road network, it is not easy to get a driver's license, unless a trainee travels to a large city like Juneau, Anchorage, or Fairbanks. Testing sites for GEDs or other academic qualifications are similarly not easy for rural workers to access. Several training providers interviewed for this report also noted that in addition to the physical challenge of reaching the training site, maintaining the safety of rural trainees when they are outside of their home communities is an additional obstacle they have to manage.

Bringing trained workers to job sites is also a challenge given Alaska's spread-out settlement. RurAL CAP, the Rural Alaska Community Action Program, noted that they're competing with urban areas for "the same limited pool of qualified resources" who are trained to meet the technical skills villages need for weatherization, electrification, and other key tasks. Those trained workers do not always have an easy visit to rural areas either—interviewees noted that if housing isn't available for visitors, workers from urban areas may have to sleep on the floors of homes or in HeadStart centers. This can make travelling to rural communities for much needed installation and repair work a difficult sell for in-demand sustainable energy workers.

<u>Cyclical, Grant-Based Workforce, and Energy Projects:</u> Many Alaskan communities are experienced with receiving grants to address immediate energy challenges, but they have also seen how those projects fall apart when grants end and administrators and paid trainees move on. When communities are frequently cycling through grant-funded projects, "it's hard to get excited about federal [sustainable energy] projects coming in because communities are worried about how they'll maintain the project," explained the Alaska Safety Alliance. DeerStone Consulting also shared about the challenges of grant-funded efforts that don't focus on long term viability: "It's not that communities are fatigued by projects—it's that they've seen too many grant-funded efforts come and go without building local capacity or long-term viability," said DeerStone Consulting. "Grant funding is essential, but it must be paired with efforts to ensure local operators understand the systems they're managing, and with financial models—like reserve accounts or independent power producer (IPP) revenue structures—that support ongoing operations and maintenance. Sustainability depends on both the capacity to operate systems effectively and the resources to maintain them over time."

The challenge of ensuring long-term maintenance compounds the challenges Alaska communities already face in attracting and keeping trained workers. According to the Alaska Energy Authority, "Even if you're [a trained worker], you can go back to work and find there are no reserve accounts to do the preventive maintenance, which leads to working through crisis, then there's a burnout, and then we're losing institutional knowledge."

Opportunities to Grow Alaska's Sustainable Energy Workforce

Despite challenges, Alaska has many unique assets that can help build the sustainable energy workforce.

Many municipal governments, nonprofits, training partners, and tribal corporations in Alaska are keen to partner to address the workforce and sustainable energy needs of the state. Instead of fighting against Alaska's unique workforce challenges, local governments, and their workforce training partners (e.g., labor unions, vocational and technical educators, workforce nonprofits) are leaning into innovative solutions to meet their sustainable energy needs. Some examples of innovative workforce development approaches include:

- Several "hub communities" (towns close to rural areas but outside of major urban centers) have training programs related to construction, small engine repair, and other energy-related courses. Program design varies, but many structure courses so students can attend in-person for a few weeks at a time, and they aren't required to relocate entirely to either the hub school or a larger urban center. In addition, several of these programs provide targeted support to rural and Alaska Native students. Examples include NACTEC, Alaska Technical Center, Amundsen Educational Center, UAF Rural Campuses and CTC.
- The IBEW is creating flexibility in apprenticeship requirements to reduce barriers for those in rural communities. For example, removing driver's license and GED requirements for apprenticeships and helping applicants achieve those requirements after they start as an apprentice.
- Organized labor is setting aside apprenticeship positions on jobs closer to rural communities specifically for rural apprentices so they can train while working on projects closer to home.

Alaska has a large immigrant, seasonal, and veteran workforce that can be converted into longer-term state residents. For the past 30 years, about 20% of Alaska's annual labor force has been made up of nonresident workers, and since the pandemic that number has only increased.[51] According to the Alaska Department of Labor and Workforce, even industries that have traditionally employed Alaskans are hiring more outside workers since 2020 to meet their labor shortages. In the construction industry, which is closely aligned to sustainable energy occupations, non-resident workforce growth grew by 24% from 2022 to 2023.[52] Top construction roles filled by non-residents of Alaska include carpenters, electricians, plumbers and pipefitters, boilermakers, and construction managers. These nonresident workers represent a potential pool of permanent sustainable energy talent, if they can be converted to full-time Alaska residents.

At the same time, Alaska is home to over 20,000 active-duty military personnel,[53] and one of the highest levels of veterans per capita—in 2016, one in ten adult Alaskans had served in the military.[54] Tapping into this population, especially those trained in sustainable energy adjacent skills, management skills, and/or construction work during their time in the armed services, can be a meaningful source of new talent for Alaska's sustainable energy future.

Another potential opportunity for Alaska is tapping into its significant immigrant and refugee population. Over 2000 people moved to Alaska from other countries in 2022, including more than 500 Ukrainian refugees.[55] The increase in refugee admissions led the state government to re-open the Office of Citizenship Assistance, led by the Alaska Department of Labor and Workforce Development,[56] specifically to focus on supporting the transition of immigrants and refugees into lifelong Alaskans. This represents another pool of potential talent for the sustainable energy future.

Growing senior population could be a strong source of training instructors. As of 2025, 16% of Alaska's population is over the age of 65, with the highest concentration of seniors in Southeast Alaska, the Kenai Peninsula, and the Copper River areas. Around 22% of Alaska's seniors remain in the labor force, making up approximately 6% of all Alaskan workers.[57] While the growing number of seniors in Alaska can be a workforce development challenge—with retirements driving workforce shortages that are difficult to backfill—they could also be a workforce development opportunity. One of the major challenges in training a new workforce in an economically active state like Alaska is getting enough trainers to leave higher-paying jobs to become workforce educators. Seniors, who may be exiting full-time employment but are still interested in sharing their skills, could help fill this gap with experienced talent to train the next generation of workers. The 65 years and up population in Alaska is projected to grow over the next decade, potentially creating an ongoing pool of workforce trainers to draw on.[58] Training program administrators can consider incentives for this segment, like improved late retirement benefits or strong health care benefits, as a means to utilize this segment.

Abundant room to grow, and producers are looking to expand energy production. Alaska's large landmass, while a challenge for moving workers from settlement to settlement, provides an opportunity for the siting and growth of new energy projects. In addition to simply being the largest state in the union—1/5th the size of all the lower 48 states combined—Alaska has over 33,000 miles of shoreline and over 3,000 rivers, offering extensive capacity for growing wind, solar, wave, and hydroelectric energy projects.

According to the University of Alaska Fairbanks, independent power producers are taking notice of what Alaska has to offer. For example, as of 2023 Renewable IPP was completing an 8.5 MW solar farm near Houston, Alaska, and Alaska Renewables had proposed up to 450 MW of wind power capacity at two potential sites.[59] With one of the highest energy costs in the nation, along with major infrastructure and mining operations throughout the state, the demand for these new forms of potentially cheaper energy from residential and commercial customers could be high and allow Alaska to achieve meaningful economies of scale.[60]

TEN FOCUS OCCUPATIONS

To help Alaska prioritize its sustainable energy workforce development efforts, our first step was to narrow the large field of all sustainable energy occupations to ten occupations most relevant to the PSEAP/CSEAP goals. Based on our analysis, the State of Alaska's workforce development efforts should be focused on:

- Electricians (47-2111)
- Solar Photovoltaic Installers (47-223)
- HVAC and Refrigeration Mechanics and Installers (49-9021)
- Insulation Workers (47-2130)
- Electrical Power-Line Installers and Repairers (49-9051)
- Electrical and Electronics Repairers, Powerhouse, Substation, and Relay (49-2095)
- Automotive Service Technicians and Mechanics (49-3023)
- Firefighting and Prevention Workers (33-2000)
- Refuse and Recyclable Material Collectors (53-7081)
- Project Management Specialists and Logisticians (13-1080)

In addition to these ten focus occupations, AML identified two additional occupations as important to track in interview conversations. Those occupations are Engineers and Urban and Regional Planners.

As described in the methodology section, while demand and wages were considered when narrowing to ten focus occupations, the most important criterion was importance to the Priority Sustainable Action Plan (PSEAP) measures (as a proxy for the future CSEAP goals). The following table shows how the ten focus occupations and two secondary occupations align with PSEAP measures.

TABLE 47: Focus Occupations Aligned to Priority Sustainable Energy Action Plan Measures

Occupation Name	Residential	Non-Residential	Solid Waste	Transporta-tion	Electric Generation	Industrial & Land Use
Electricians	x	x		x		
Solar Photovoltaic Installers	x	x			x	
HVAC / R Mechanics and Installers	x	x				
Insulation Workers	x	x				
Electrical Power-Line Installers and Repairers		x	x		x	
Electrical and Electronics Repairers, Powerhouse, Substation, and Relay				x	x	
Automotive Service Technicians and Mechanics				x		
Firefighting and Prevention Workers						x
Refuse and Recyclable Material Collectors			x			
Project Management Specialists and Logisticians	x	x	x	x	x	x
Engineers	x	x		x	x	x
Urban and Regional Planners	x	x	x	x	x	x

After narrowing to ten occupations, we initially set out to determine which of the ten occupations should be further prioritized based on need and likelihood to grow in Alaska. However, throughout the course of the research, it became clear that given Alaska's aging workforce and unique workforce dynamics described above, all ten focus occupations are essential to Alaska's sustainable energy future, albeit to varying degrees.

The following table summarizes the key findings at a statewide level for each of the ten occupations. The occupations that are most in-demand are listed first.

TABLE 48: Statewide Findings for Focus Sustainable Energy Occupations

Occupation Title	10yr Job Growth and Retirement (2024 – 2033)	Average Hourly Wage	Training Investment Needed to Add or Scale Programs
Project Management Specialists and Logisticians (13-1080)	919[61]	$49.26	Minimal
Automotive Service Technicians and Mechanics (49-3023)	603	$28.85	High
Electricians (47-2111)	519	$39.11	High
Firefighting and Prevention Workers (33-2000)	382	$28.19	High
HVAC and Refrigeration Mechanics and Installers (49-9021)	242	$35.97	High
Electrical Power-Line Installers and Repairers (49-9051)	178	$49.29	High
Refuse and Recyclable Material Collectors (53-7081)	169	$23.33	Medium
Electrical and Electronics Repairers, Powerhouse, Substation, and Relay (49-2095)	43	$48.65	High
Insulation Workers (47-2130)	15	$33.25	High
Solar Photovoltaic Installers (47-2231)	15	$34.19	Medium

KEY

Demand
- Highest number of net new workers needed to meet demand over 10 years
- Lowest number of net new workers projected in 10 years

Wage
- Meets living wage criteria for Alaskan household with two adults, one working and two children ($44.77/ hour)
- Meets living wage for Alaskan household with one adult who is working ($23.99/ hour)
- Does not meet living wage standards

Training Investment
- Expanding or starting new programs would require **minimal** level of investment based on no needs for heavy equipment and ability to train virtually
- Expanding or starting new programs would require **medium** level of investment based on some equipment needed and limited virtual training potential
- Expanding or starting new programs would require **high** level of investment based on heavy equipment and lack of virtual training potential

Initially, the quantitative analysis suggested that Alaska should not focus on developing the workforce for solar photovoltaic installers, insulation workers, and electrical and electronics repairers, powerhouse, substation, and relay based on minimal needs across the state over the next ten years. However, based on insights gained through qualitative interviews, we believe these occupations are still needed and should remain a part of the state's sustainable energy planning. More details are in the occupational profile sections, but in brief:

- Solar Photovoltaic Installers: Investments in solar projects and in training are being made around the state and Alaska will need more people trained to install solar photovoltaic systems. However, most of these jobs are not full-time, year-round roles. This means that the labor market data is likely an under-representation of the need and/or may not be capturing the fact that this job may be performed by other occupations that are not solely solar installers (i.e., roofers).
- Insulation Workers: Given the cold environment of Alaska, energy efficiency and weatherization are essential to reducing energy burdens. Organizations like the Cold Climate Housing Research Center help Alaskans construct and maintain sustainable and efficient housing. However, many Alaskans are involved in building their own homes and may not do so with the most energy-efficient methods. We hypothesize that the "do-it-yourself" approach many Alaskans take reduces the measurable demand for insulation workers in formal datasets. Still, insulation workers are one component of a broader set of energy efficiency skills needed in Alaska, both in the general population and in a trained workforce.
- Electrical and Electronics Repairers, Powerhouse, Substation, and Relay (utility workers): Demand for both utility workers and powerplant operators in Alaska is low. However, as we spoke to stakeholders across the state, it became clear that while communities (especially rural communities) struggle to support these occupations, they are crucial to Alaska's energy future.

More details about each occupation, including the training availability, can be found in the occupational profile section.

RURAL SUSTAINABLE ENERGY WORKFORCE NEEDS

Throughout conversations with stakeholders, we frequently heard that rural communities and villages across Alaska face unique workforce challenges to sustainable energy development that are not fully captured through labor market datasets on the ten focus occupations. This section takes a closer look at workforce needs related to rural communities in Alaska. While this section summarizes common findings from qualitative research, it is important to emphasize that rural communities are all unique. As one interviewee put it, “If you’ve been to one Alaskan village, you’ve been to one Alaskan village.”[62]

Rural Workforce Challenges

Lack of Population Density: The population in rural communities is not large enough to support full-time sustainable energy occupations such as electricians or HVAC installers and repairers. Instead, rural communities depend upon itinerant workers who can travel to them.

Subsistence Lifestyle: Many in rural communities have the pleasure and obligations of living a subsistence lifestyle. This means that many people are unavailable to work during key hunting or fishing seasons, further complicating traditional workforce approaches that understand year-round, full-time work as the end goal.[63]

Deferred Maintenance: While depending on outside workers to install systems is often feasible, ongoing maintenance can pose more of a challenge. Rural communities must develop skills to maintain energy systems once they are installed, but do not have the workload to create full-time maintenance positions.

For example, most rural communities still rely on diesel fuel for power. Successful sustainable energy work in rural communities requires skilled power-plant operators, business administrators, and reliable diesel mechanics.[64] Together, these three roles work to maximize power-cost equalization (PCE). However, most rural communities don’t have enough work for a part-time diesel mechanic and depend on mechanics who can travel to them to complete work. Some rural communities have struggled to pay these mechanics on time, leading to challenges in getting diesel mechanics to come to their communities in the future.

Deferred maintenance can further exacerbate workforce issues. A community may only be able to afford to pay a part-time utility worker who is then given responsibility for systems with deferred maintenance. When these systems inevitably run into issues, the part-time utility workers are faced with stressful challenges and the turnover risk for these positions is high. It is difficult to maintain the rural energy workforce, but it’s not about lacking skills necessarily. It’s about the lack of infrastructure, finances, and conditions needed for efficient, affordable, and sustainable energy distribution.[65]

Lack of Rural Infrastructure: Many rural communities are not connected by roadway, making standard prerequisites for apprenticeship programs inaccessible. For example, usually a class C commercial driver’s license is required before becoming a line worker apprentice. However, there aren’t testing sites outside of Anchorage, Fairbanks, and Juneau—meaning aspiring apprentices must travel long distances away from home. Organizations like IBEW are seeking to create flexibility in apprenticeship requirements to reduce these barriers. For example, they’re removing driver’s licenses and GED apprenticeship prerequisites, and instead they’re supporting apprentices to gain those certifications during their apprenticeship. In addition, they are setting aside apprenticeship spots on jobs closer to rural communities for rural applicants. These applicants could take 10 years to complete an apprenticeship if they only want to work closer to their home, but IBEW will work with them to support them through that longer apprenticeship timeline.

Innovative Solutions:

These energy workforce challenges are not new to Alaskans, and there are already a range of approaches to addressing these issues. Example approaches that emerged through research include:

- Rural Power Plant Operator Training: Alaska Energy Authority funds the Alaska Vocational Technical Center (AVTEC) to provide training for rural power plant operators. This is an 8-week hybrid course that takes place mostly online with 1-2 weeks of in-person training in Seward. This course is not open enrollment and is designed specifically to support rural power plant operators who are already employed. While this more flexible approach has helped address the difficulty of training rural plant operators, it faces a few key challenges: 1) it is entirely dependent upon AEA funding and would lapse if that funding were to go away, and 2) the current instructor of that course will retire soon and has a unique skillset that is proving difficult to replace.[66]
- Informal, Small Business-Led Trainings: Given the strong demand for diesel service in rural areas, small businesses like Dillingham's "Statewide Machinery" have taken their own initiative to build relationships with rural communities or villages and train interested individuals when their workers go out to do maintenance on their systems. Over time, they provide opportunities for individuals to come to Dillingham and train as diesel technicians or eventually mechanics.[67] This is a more accessible form of training than relocating to a formal program in Seward or even further away.
- Alaska Energy Authority (AEA) "Circuit Rider" Program: This program assists utilities across the state with diagnosing and troubleshooting of utility systems. Technical staff from AEA use real-time remote monitoring or provide onsite training, technical consultation, assistance, and minor repairs. This support helps train existing utility workers in rural communities without requiring enrollment or attendance at a stand-alone training program. The program does not replace the utility's necessary operations and maintenance budget or provide funding for major repairs or reconstruction of utility systems—however, it does help build capacity within utilities to complete minor repairs independently in the future. The Alaska Energy Authority maintains a priority list to understand energy needs across rural communities that can be used to prioritize maintenance and repair visits.
- RurAL CAP Registered Apprenticeship Program: RurAL CAP is working on becoming a registered apprenticeship so when they're building in rural communities, they can have local apprentices working in their construction team who will gain critical skills to maintain buildings once the RurAL CAP workers have left. This will reduce the need to fly in external workforce and help communities keep their buildings energy efficient.

RECOMMENDATIONS

Throughout this process, we sought to collect recommendations on how Alaska can address workforce development challenges for the sustainable energy workforce. The recommendations below are sourced from qualitative research and interviews with stakeholders and through analysis of quantitative findings.

TABLE 46: Workforce Recommendations

SUPPORTING RURAL COMMUNITIES		
Challenge	**Recommendation**	**Actions to Implement**
Rural communities have diverse daily sustainable energy needs—ranging from improving home weatherization, to maintaining heat pumps, to running small power plants, to efficiently managing solid waste.	Create formal "holistic trades" curriculum for rural communities with an emphasis on energy efficiency. This would empower individuals to diagnose and perform simple maintenance of building systems (circuit breaker maintenance, weatherizing pipes, insulation, heat pump repairs, basic plumbing) and to diagnose larger system issues and coordinate external repairs as needed.	The Department of Environmental Conservation and Alaska's municipalities should work together with AVTEC and UA to: • Map specific sustainable energy skillsets required within rural communities across Alaska. • Identify training programs related to those skills sets (i.e. AVTEC, UAF Sustainable Energy Program and UAF Facility Maintenance Program, Cold Climate Housing Research Center, UAA/Mat-Su College Occupational Endorsement Certificate in Refrigeration and Heating, etc.). • Identify central entity to help holistic trades trainees secure support for training expenses, and to work with municipalities, tribes, villages, to connect workers to job opportunities. For example, this could be a contracted role performed by a group like RurAL CAP or Alaska Municipal League, with a contract managed by a state agency. • Pilot training program with initial cohort of trainees from rural communities, supporting them with training and connections to contractors that serve rural communities when additional help is needed.
While grant funds can be made available to install more efficient energy systems at the home and industrial level, rural communities struggle to support the skilled labor required to maintain energy systems (solar panels, heat pumps, powerhouses, etc.) once installed. This can reduce the efficacy of these systems and breed mistrust in providers and sustainable energy technologies.	Cultivate a "maintenance first" approach to reduce worker burnout and community fatigue.	All state investment plans for expanding sustainable energy systems should be required to include a plan for system maintenance and a local or regional partner who can assist with maintenance training and support. Contracts should be encouraged to include maintenance training with local staff during installation, require remote monitoring systems, and require third-party system commissioning.

Most rural utilities require power plant operators, business managers, and diesel mechanics to operate, but cannot support a full-time or even part-time position year-round. In addition, it is difficult for people from rural communities to access training due to transportation, lodging, and cost barriers.	Support pilot programs[68] for utility shared service models that allow rural utilities to share resources and streamline their workforce.	Continue testing shared service utility models that allow rural areas to share maintenance and operations roles between multiple locations and/or allow job shares within a single role to reduce employee burnout and accommodate rural seasonal and subsistence needs. This means allocating funding for one or more FTE staff members for the shared services organization (i.e., TCC infrastructure department staff). The overarching staff would work with communities under the umbrella to centralize and coordinate support. Prioritize funding opportunities for regional "hub schools" that mitigate challenges rural communities face when accessing training, including through funding partnerships with Alaska Native Corporations to support shared sustainable energy utility needs. Examples include TVEP funded schools (e.g., Alaska Technical School, Partners for Progress in Delta, Southwest Alaska Vocational and Education Center, Yuut Elitnaurviat), and/or training programs located within each of the ANCSA regions.

TRAINING SYSTEM		
Challenge	**Recommendations**	**Actions to Implement**
Finding trainers to teach courses is difficult given that many of the trades pay much higher wages than a training institution can afford to offer.	1) Tap into the pool of recently retired workers to address instructor gaps. 2) Advertise to attract earlier and mid-career workers who are seeking more stability than trades offer. 3) Tap into the pool of community members who work as part-time power plant operators/managers, or those who have related skills.	Training programs seeking instructors should consider: • Working with employers (especially public sector employers like housing authorities, utilities, etc.), labor unions, and community-based organizations to identify workers who are recently retired or approaching retirement age and socializing the idea of working as a trainer (part or full time) while the retiree's on-the-job skills remain fresh. • Advertising reliable hours and steady work environment to help attract younger instructors who may want to prioritize stability and work-life balance in choosing where to deploy their sustainable energy skills. • Across many communities in Alaska, locals may support utility training informally or may already be operating in part-time operator/manager roles without the most up-to-date training. Programs should consider tapping into this pool of informal or part-time or informally trained assistance by offering small group trainings or 1:1 training. The part time pay that training programs can offer can still be competitive for this pool of workers. • Prioritize expanding training programs that offer "short burst" trainings—2-3 intensive weeks with breaks in between—which stakeholders reported as being more attractive to rural talent and could be more accommodating for non-traditional trainers (such as retirees or community-based folks).

EXPANDING ALASKA'S SUSTAINABLE ENERGY WORKFORCE		
Challenge	**Recommendation**	
Several sustainable energy occupations are facing a wave of impending retirements as well as increasing demand over the next decade. These occupations are: • Electricians • Electrical line workers • Automotive Technicians and Mechanics • Firefighting and Prevention Workers	Prioritize recruitment funds and training dollars for programs with highest projected retirements to maximize workforce potential before knowledge departs.	The Alaska Department of Labor and Workforce Development should: • Develop list of organizations well-positioned to build career awareness (i.e., REAP, Alaska Native Corporations, DOL, etc.). • Work alongside organizations to coordinate promotion of sustainable energy job openings and local training programs to Alaska Native, military, seasonal, and refugee populations in Alaska, emphasizing opportunities for skill-building, community service. • Prioritize pursuit of federal, state, industry and/ or philanthropic funding connected growing the pipeline for and retention of workers in these critical occupations.

OCCUPATION-SPECIFIC RECOMMENDATIONS		
Challenge	**Recommendation**	**Actions to Implement**
Refuse and Recyclable Material Collectors: Despite the critical role they play in communities, refuse and recyclable collectors often experience low pay and negative perceptions. This contributes to high turnover.	Increase positive perception of refuse and recyclable collector jobs. Explore ways for rural solid waste programs to generate their own sustainable revenue streams.	Municipalities and tribal governments across Alaska should: • Develop a statewide campaign that frames solid-waste technicians as community health first responders. • Explore models for manufacturer-funded "take-back" programs for electronics, batteries, and appliances to generate revenue that can support better wages and encourage the creation of more recycling enterprises across rural Alaska. • Continue to raise awareness about programs suchas EPA's Indian Grant Assistance Program (IGAP) to help tribes with solid waste management through grants. • Pursue additional grant funding for backhaul and environmental cleanup. • Set aside budget for community cleanup within municipalities, which would include paying folks for clean-up and backhaul services.
Line Workers: The state of Alaska needs more line workers, but that workforce is constrained by a shortage of apprenticeship opportunities.	Increase the number of apprenticeship spots available to expand the training pipeline for crucial electrical transmission line worker roles.	Municipal, state, and tribal governments should: • Expand use of apprenticeship and pre-apprenticeship requirements for publicly funded projects to build workforce capacity.

Line Workers: Despite big investments from IBEW, there are fewer people applying to become line worker apprentices than there were in the past.	Continue to work with electrical union training programs to lower barriers to apprenticeship participation (e.g., driver's license costs, travel, housing, childcare, etc.).	The Alaska Department of Labor and Workforce Development should: • Consider a revolving loan fund to support housing, other costs for apprentices. • Work with unions to prioritize/promote apprenticeship pathways to seasonal, military, and refugee workforce. • Invest in "return to Alaska" strategy to encourage journey-level electrical workers who have moved out of state to come back to work, including incentives to returnees who agree to support apprentices and/or work in rural areas.
HVAC/R Installers: Poor-quality heat pump installations are common because the workforce lacks training on correct installations. Both workers and homeowners lack basic home energy system awareness that enables people to get the full benefits of heat pumps. In addition, there is a great deal of confusion around what is required of a heat pump installer, with conflicting guidance from the Department of Labor and Workforce and the Department of Commerce, Community, and Economic Development. Programs such as Alaska Heat Pump have their own standards to help ensure quality installations, but these are not upheld at state level.	Consider increasing state-driven requirements and certifications for HVAC/R installers.	The Alaska Department of Labor and Workforce and the Department of Commerce, Community and Economic Development should work together to develop consistent guidance for contractors outlining the steps necessary for an individual to be considered a trained heat pump installer. Municipalities should ensure that permitting and building code requirements incentivize using the best practices for system performance and durability in installations. The Alaska Department of Labor and Workforce Development and the Alaska Department of Environmental Conservation should partner to: • Identify key skills gaps that are leading to heat pumps being installed in homes that are not properly weatherized and therefore do not experience purported efficiency and cost benefits. • Fund initial pilots to train the workforce in skills gaps identified. • Include both installer and homeowner education alongside any heat pump installations. Education should emphasize the importance of home energy audits prior to installation, which can provide the full scope of possible home upgrades and payback timeline.

SUSTAINABLE ENERGY WORKFORCE DEVELOPMENT OCCUPATIONAL PROFILES

The following ten occupations were selected based on an analysis of demand, wages, and relevancy to Alaska's Comprehensive Sustainable Energy Action Plan goals. They represent a snapshot of some of the most important occupations to invest in for sustainable energy workforce development—though growing these occupations in such a geographically and economically diverse state will require coordinated action that takes into account Alaska's unique challenges and opportunities.

Electricians [47-2111]

Description

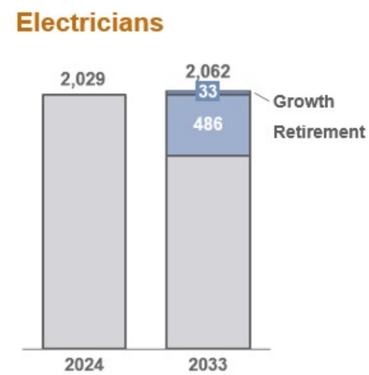
Job Description: Install, maintain, and repair electrical wiring, equipment, and fixtures. Ensure that work is in accordance with relevant codes. May install or service streetlights, intercom systems, or electrical control systems.

Common Job Titles:

- Journeyman Electrician
- Electrician
- Maintenance Journeyman Electrician
- Apprentice Electrician

Sample Employers in Alaska:

- Arctic Slope Regional Corporation
- NANA Regional Corporation
- Samson Electric
- State of Alaska
- Supreme Electric



Projected 10-Year Growth

Growing Electricians in Alaska

Alaska is projected to need at least 519 new electricians over the next 10 years; this demand will be primarily driven by retirements. 519 represents roughly a quarter of the current workforce—underscoring the need to invest in electrical talent. The retirement challenge is particularly acute in the Northern, Anchorage/Mat-Su, Gulf Coast, and Southwest regions of the state.

Relative to the size of the current workforce, the need is the greatest in the Interior and Southeast regions.

- In the Interior, there are approximately 420 electricians in the workforce, and an estimated 140 new electricians are projected to be needed over the next 10 years. This means there are approximately three electricians in the workforce for every new one that must be trained in the next ten years.
- In Southeast, there are approximately 248 electricians in the workforce, and an estimated 67 new electricians are projected to be needed over the next 10 years. This means there are approximately 3.7 electricians in the workforce for every new one that must be trained in the next ten years.

The high volume of projected retirements in the electrical industry is particularly concerning given that Alaska already lacks a sufficient number of journey-level electricians to train apprentices. Yet despite high demand and paid on-the-job training during the apprenticeship program, stakeholders reported struggling to attract new applicants to the profession. One possible challenge may be the length of time needed to complete an apprenticeship. Organizations like IBEW and the Alaska Works Partnership have been investing in increasing opportunities for pre-apprenticeships and career exploration programs to incentivize workers to explore electrical apprenticeships as a career opportunity.

Rural areas especially face the challenge of retaining enough trained electricians to meet community needs and train the next generation because there is not always the demand to justify a single full-time electrician in each town or village. Multiple stakeholders in our research recommended that Alaska focus on a fractional training model for electrical skills most needed in rural areas, rather than solely investing in a traditional multi-year apprenticeship pipeline. This could look like a certificate in "holistic trades"—electrical, HVAC repair, automotive repair, home weatherization—needed for daily rural living and maintenance. It could also look like greater access to a "hub school" model—which would offer short bursts of concentrated training at a site near rural communities and allow trainees to build skills over time, returning to their home communities in between training sessions.

TABLE 50: Electricians: Occupation Wages and Estimated Growth

ELECTRICIANS [47-2111] Occupation Wages and Estimated Growth					
Region	**Average Hourly Wage 2024**	**10-year growth Percent (%) 2024-2033**	**10-year growth Count (n) 2024-2033**	**10-year Retirement 2024-2033**	**Need-to-current worker ratio[69]**
Statewide	$39.11	1.63%	33	486	1: 3.9
Anchorage/Mat-Su	$38.71	(1.17%)	(11)	230	1: 4.3
Interior	$39.96	8.76%	36	101	1: 3.1
Southeast	$39.05	5.38%	13	54	1: 3.7
Gulf Coast	$37.81	(0.24%)	(1)	40	1: 5.0
Southwest	$40.14	(9.65%)	(8)	21	1: 6.4
Northern	$44.21	0.29%	0	32	1: 3.9

Training Availability IN ALASKA

Relevant Training Programs in Alaska:

General Construction Courses:

- Construction Craft Laborers Pre-Apprenticeship, Alaska Works Partnership (Anchorage/Mat-Su)
- Apprenticeship Technology Program, University of Alaska, Anchorage (Anchorage/Mat-Su) and University of Alaska, Fairbanks (Interior)
- Construction Trades, Galena Interior Learning Academy (Interior)
- Construction Trades Program, Partners for Progress in Delta (Interior)
- Construction Occupational Endorsement Certificate, University of Alaska Southeast (Southeast)
- Construction Skills Occupational Endorsement Certificate, University of Alaska, Prince William Sound College (Gulf Coast)
- Construction Technology, AVTEC (Gulf Coast & Statewide)
- Construction Course, Yuut Elitnaurviat (Southwest)
- Construction Technology, Southwest Alaska Vocational and Education Center (SAVEC) (Southwest)
- Construction Technologies, Ilisagvik College/ Northslope Training Education Cooperative (Northern)
- Construction Trades Technology Program, Alaska Technical Center (ATC) (Northern)

- Industrial Electricity, AVTEC (Gulf Coast & Statewide)
- Residential Electric Short Course, Alaska Technical Center (ATC) (Northern)

Electrician Programs:
- Electrical Wiring, Alaska Works Partnership (Anchorage/Mat-Su and Gulf Coast)
- Electrician Apprenticeship, Department of Labor and Workforce Development Registered Apprenticeship Program (Statewide)
- Electrician Apprenticeship, NECA IBEW (Anchorage/Mat-Su and Interior)
- Electrician Apprenticeship, Associated Builders and Contractors (Statewide)

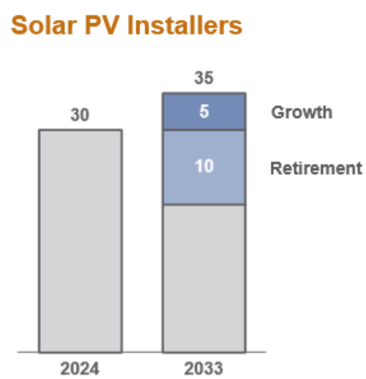
Solar Photovoltaic Installers [47-2231]

Description

Job Description: Assemble, set up, and maintain rooftop systems or other systems that convert sunlight into energy.

Common Job Titles:
- Solar Installers
- Solar Technicians
- Installers
- Construction Crew Leaders
- Solar Sales Managers

Sample Employers in Alaska:
- Sunrun
- Invenergy
- Solar United Neighborhoods



Projected 10-Year Growth

Alaska is projected to need 15 new solar photovoltaic installers over the next 10 years based on current demand projections. However, our qualitative interviews reflect that solar energy remains one of the most in-demand new sustainable energy technologies in the state, and new projects coming online could increase the labor market demand significantly.

Based on our findings in interviews, many solar installer roles within communities are not full-time, long-term positions—the work waxes and wanes around construction/installation projects. The project-based nature of these roles leads to variable work demand, but they are still important workforce development

TABLE 51: Solar Photovoltaic Installers: Occupation Wages and Estimated Growth

SOLAR PHOTOVOLTAIC INSTALLERS [47-2231] Occupation Wages and Estimated Growth					
Region	Average Hourly Wage 2024	10-year growth Percent (%) 2024-2033	10-year growth Count (n) 2024-2033	10-year Retirement 2024-2033	Need-to-current worker ratio[70]
Statewide	$34.19	15.78%	5	10	1: 2
Anchorage/Mat-Su	Insf. Data	Insf. Data	Insf. Data	Insf. Data	Insf. Data
Interior	Insf. Data	Insf. Data	Insf. Data	Insf. Data	Insf. Data
Southeast	Insf. Data	Insf. Data	Insf. Data	Insf. Data	Insf. Data
Gulf Coast	Insf. Data	Insf. Data	Insf. Data	Insf. Data	Insf. Data
Southwest	Insf. Data	Insf. Data	Insf. Data	Insf. Data	Insf. Data
Northern	Insf. Data	Insf. Data	Insf. Data	Insf. Data	Insf. Data

opportunities. We expect that this is part of why the projected demand for solar photovoltaic installers appears low. Other occupational categories may also be installing solar panels—roofers, for example—without their data being captured in the datasets for the solar photovoltaic installer specific occupation.

Further, while installers were the focus occupation in our statistical analysis, qualitative interviews highlighted the need for workers who can maintain solar photovoltaic systems as being critical seeing this technology grow in Alaska.

Training Availability IN ALASKA

Relevant Training Programs in Alaska:

General Construction Courses:

- Construction Craft Laborers Pre-Apprenticeship, Alaska Works Partnership (Anchorage/Mat-Su)
- Construction Trades, Galena Interior Learning Academy (Interior)
- Construction Trades Program, Partners for Progress in Delta (Interior)
- Construction Occupational Endorsement Certificate, University of Alaska Southeast (Southeast)
- Construction Skills Occupational Endorsement Certificate, University of Alaska, Prince William Sound College (Gulf Coast)
- Construction Technology, AVTEC (Gulf Coast & Statewide)
- Construction Course, Yuut Elitnaurviat (Southwest)
- Construction Technology, Southwest Alaska Vocational and Education Center (SAVEC) (Southwest)
- Construction Technologies, Ilisagvik College/ Northslope Training Education Cooperative (Northern)
- Construction Trades Technology Program, Alaska Technical Center (ATC) (Northern)

Other Relevant Training Programs:

- Basic Carpentry Occupational Endorsement Certificate, University of Alaska, Fairbanks (Interior)
- Residential Construction, Amundsen Educational Center (Gulf Coast)
- Roofer Apprenticeship, Associated Builders and Contractors (Statewide)
- Sustainable Energy, University of Alaska, Fairbanks— Bristol Bay Campus (Southwest)

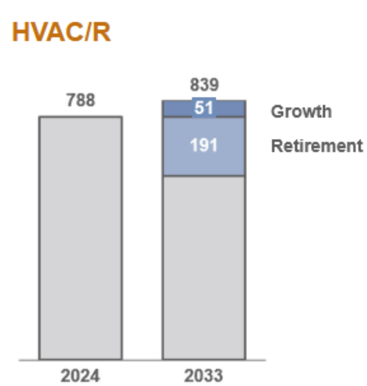
HVAC and Refrigeration Mechanics and Installers [49-9021]

Description

Job Description: Work on heating, ventilation, cooling, and refrigeration systems.

Common Job Titles:

- Refrigeration Operators
- HVAC Technicians
- Refrigeration Technicians
- HVAC Refrigeration Technicians
- HVAC Service
- Technicians

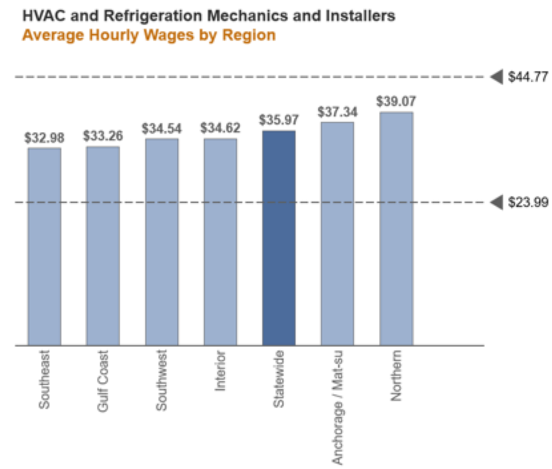


Sample Employers in Alaska:

- Trident Seafoods
- Discount Mechanical Heating and Plumbing Services
- Silver Bay Seafoods
- Northern Management Services
- Walmart

Projected 10-Year Growth

Alaska is projected to need 242 new HVAC and Refrigeration workers over the next 10 years, particularly for installing heat pump technology, a high-demand energy efficiency tool. Stakeholders noted, however, that there is less consistent work for heat pump installations in rural areas. However, pairing heat pump and HVAC skills with basic electrical training could help increase the utility of local workers to take on the ability to turn part-time repair demands in multiple skill areas into a single full-time role.



HVAC installation, especially for heat pumps, has a low barrier to entry. However, maintaining systems once they are built requires deeper expertise, and there are few qualified repair technicians in a field that is also hampered by a lack of standardized quality measures. This can lead to distrust in the entire technology, as systems that are poorly installed break down and lack service support to replace or repair them.

Retaining entry-level talent in the HVAC space can be difficult, as stakeholders report the workforce is highly transitory. Younger workers enter and work for a season, only to leave for other positions, while across the state, the training needs exceed the availability of the current workforce to mentor or train incoming workers.

Similar to electricians, pairing training in this role with other holistic trade skills and encouraging communities to share technician FTEs—rather than expecting every community to carry a full-time year-round technician role—could help this occupation gain a stronger footing in rural Alaska. Stakeholders also recommended pairing training opportunities with maintenance roles connected to local housing authorities that can more consistently support trained maintenance technicians across their properties.

TABLE 52: HVAC and Refrigeration Mechanics and Installers: Occupation Wages and Estimated Growth

HVAC AND REFRIGERATION MECHANICS AND INSTALLERS [49-9021] Occupation Wages and Estimated Growth					
Region	Average Hourly Wage 2024	10-year growth Percent (%) 2024-2033	10-year growth Count (n) 2024-2033	10-year Retirement 2024-2033	Need-to-current worker ratio[71]
Statewide	$35.97	6.50%	51	191	1: 3.3
Anchorage/Mat-Su	$37.34	4.47%	18	104	1: 3.4
Interior	$34.62	2.28%	3	30	1: 3.9
Southeast	$32.98	14.68%	13	21	1: 2.6
Gulf Coast	$33.26	12.68%	9	14	1: 3.1
Southwest	$34.54	3.52%	1	11	1: 3.1
Northern	$39.07	13.31%	5	10	1: 2.5

Training Availability IN ALASKA

Relevant Training Programs in Alaska:

General Construction Courses:

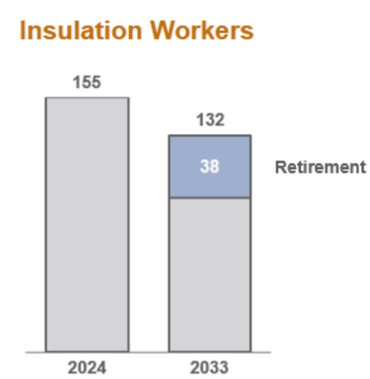
- Construction Craft Laborers Pre-Apprenticeship, Alaska Works Partnership (Anchorage/Mat-Su)
- Construction Trades, Galena Interior Learning Academy (Interior)
- Construction Trades Program, Partners for Progress in Delta (Interior)
- Construction Occupational Endorsement Certificate, University of Alaska Southeast (Southeast)
- Construction Skills Occupational Endorsement Certificate, University of Alaska, Prince William Sound College (Gulf Coast)

- Construction Technology, AVTEC (Gulf Coast & Statewide)
- Construction Course, Yuut Elitnaurviat (Southwest)
- Construction Technology, Southwest Alaska Vocational and Education Center (SAVEC) (Southwest)
- Construction Technologies, Ilisagvik College/ Northslope Training Education Cooperative (Northern)
- Construction Trades Technology Program, Alaska Technical Center (ATC) (Northern)

Refrigeration and Heating Training:
- Commercial Refrigeration Systems Occupational Endorsement Certificate, University of Alaska, Matanuska-Susitna College (Anchorage/Mat-Su) *suspended at time of analysis*
- Facility Maintenance Occupational Endorsement Certificate, University of Alaska Fairbanks, Rural Campuses and CTC
- Refrigeration, AVTEC (Gulf Coast & Statewide)
- Refrigeration and Heating Occupational Endorsement Certificate, University of Alaska— Matanuska-Susitna College (Anchorage/Mat-Su)[72]
- Refrigeration and Light Commercial Heating and Ventilation Occupational Endorsement Certificate, University of Alaska— Matanuska-Susitna College (Anchorage/Mat-Su) *suspended at time of analysis*

HVAC & Sheet Metal Training:
- HVAC Technician Apprenticeship, Associated Builders and Contractors (Statewide)
- Sheetmetal & HVAC courses, Alaska Works Partnership (Anchorage/Mat-Su)
- Sheetmetal, HVAC & Mechanical Training & Apprenticeship, Alaska Metal and Mechanical Apprenticeship (Anchorage/Mat-Su)

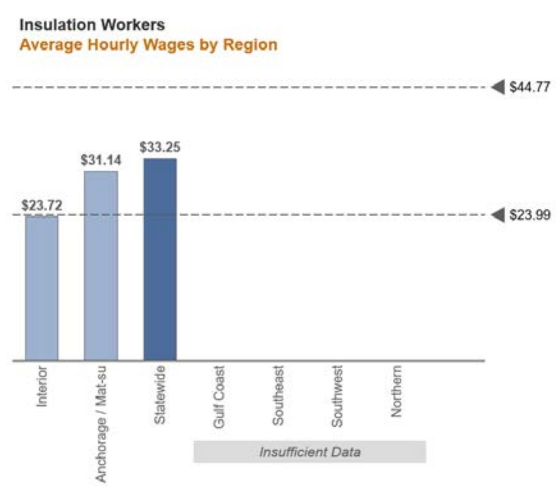
Insulation Workers [47-2130]



Description
Job Description: Install and replace the materials used to insulate buildings or mechanical systems.

Common Job Titles:
- Mechanical Insulators
- Insulation Installers
- Composite Technicians
- Laborer Journeyman

Sample Employers in Alaska:
- Delta Constructors
- A-1 Insulation
- Altrad Services
- Arctic Slope Regional Corporation



Projected 10-Year Growth
While overall Alaska is projected to need fewer insulators in the future than today, the state will still need approximately 15 new insulation workers over the next 10 years to account for retirements. Stakeholders noted that in addition to just insulation workers, there's a demand for people with skills to help manage whole home energy systems—those that can address individuals' needs for heat pumps, insulation, and overall weatherization, and home energy rating and testing.

These skills have receded in Alaska, with one stakeholder noting that in the 1970s, a generation of weatherization workers answered the call to improve energy efficiency during a time of oil shortages. Today, recruiting younger workers into the insulation and weatherization field is a challenge, especially because an insulation worker who serves residential customers must possess not only technical expertise but also cultural competency to work inside a customer's home—a highly personal environment. The availability of weatherization workers also rises and falls with unpredictable funding cycles. For example, one stakeholder noted that when weatherization funds were more available, there were over 240 Alaska Home Finance Corporation-certified home energy rates; now, the stakeholder estimated there are only about 30.

Stakeholders recommend growing the insulation and weatherization workforce in tandem with HVAC and heat pump installers, ensuring that those working on home heating also have strong weatherization skills. They also recommended weatherization curriculum as part of a possible "holistic trades" skills certificate that could be developed to help people in rural areas gain more access to trained knowledge around daily sustainable energy needs.

TABLE 53: Insulation Workers: Occupation Wages and Estimated Growth

INSULATION WORKERS Floor Ceiling Wall [47-2130] Occupation Wages and Estimated Growth					
Region	**Average Hourly Wage 2024**	**10-year growth Percent (%) 2024-2033**	**10-year growth Count (n) 2024-2033**	**10-year Retirement 2024-2033**	**Need-to-current worker ratio[73]**
Statewide	$28.65	(14.84%)	(23)	38	1: 10.3
Anchorage/Mat-Su	$25.00	(10.57%)	(13)	30	1: 7.2
Interior	$23.49	(34.48%)	(10)	10	Insf. Data
Southeast	Insf. Data	Insf. Data	Insf. Data	Insf. Data	Insf. Data
Gulf Coast	Insf. Data	Insf. Data	Insf. Data	Insf. Data	Insf. Data
Southwest	Insf. Data	Insf. Data	Insf. Data	Insf. Data	Insf. Data
Northern	Insf. Data	Insf. Data	Insf. Data	Insf. Data	Insf. Data

Training Availability IN ALASKA

Relevant Training Programs in Alaska:

General Construction Courses:

- Construction Craft Laborers Pre-Apprenticeship, Alaska Works Partnership (Anchorage/Mat-Su)
- Construction Trades, Galena Interior Learning Academy (Interior)
- Construction Trades Program, Partners for Progress in Delta (Interior)
- Construction Occupational Endorsement Certificate, University of Alaska Southeast (Southeast)
- Construction Skills Occupational Endorsement Certificate, University of Alaska, Prince William Sound College (Gulf Coast)
- Construction Technology, AVTEC (Gulf Coast & Statewide)
- Construction Course, Yuut Elitnaurviat (Southwest)
- Construction Technology, Southwest Alaska Vocational and Education Center (SAVEC) (Southwest)
- Construction Technologies, Ilisagvik College/ Northslope Training Education Cooperative (Northern)
- Construction Trades Technology Program, Alaska Technical Center (ATC) (Northern)
- Facility Maintenance Occupational Endorsement Certificate, University of Alaska Fairbanks, Rural Campuses and CTC

Home Energy Courses:

- Home Energy Basics, University of Alaska, Fairbanks— Bristol Bay Campus (Southwest)

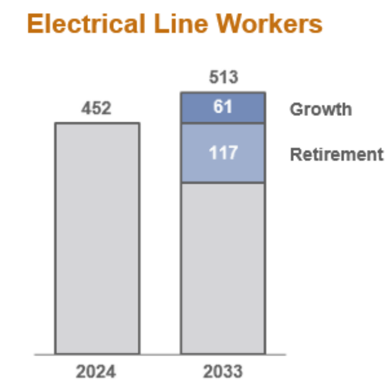
Apprenticeship:
- Mechanical Insulator Apprenticeship, Local 7 Insulators (Statewide)
- Heat & Frost Insulators Apprenticeship, Alaska Apprenticeship Training Coordinators Association (Statewide)

Electrical Power-Line Installers and Repairers [49-9051]

Description

Job Description: Install or repair cables or wires used in electrical power or distribution systems. May erect poles and light or heavy-duty transmission towers.

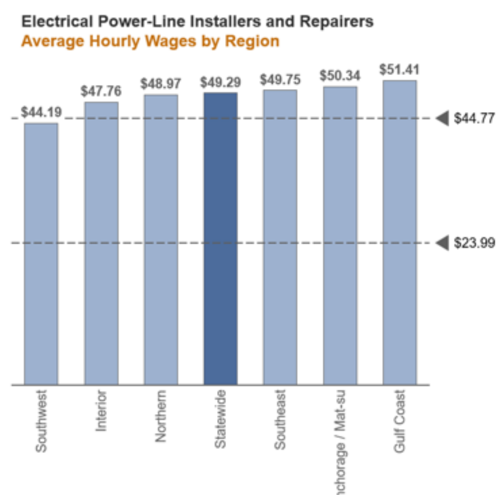
Common Job Titles:
- Journey linemen
- Line locators
- Line technicians
- Aerial linemen
- Journeymen



Sample Employers in Alaska:
- Enstar Natural Gas Company
- Alaska Village Electric Cooperative
- Alaska Electric Light and Power Company
- Anders Group
- City and Borough of Sitka
- Homer Electric Association
- State of Alaska

Projected 10-Year Growth

Alaska is projected to need 179 new electrical line workers over the next 10 years. Competition for these workers is fierce nationwide, especially in wildfire-prone states like California, where some stakeholders estimate a skilled line worker can earn more than $7,000 per week. Stakeholders shared that while electricians tend to stay closer to home after training and could work on a single job for many years, it's common in the line worker profession to move around, making it hard to keep workers and journey-level training professionals in-state. Stakeholders noted that Alaska will need to out-compete the lower 48 in either wages or retention incentives in order to keep its line workers.



Furthermore, because of the dangerous nature of linework, there is a need for a high ratio of journey-level talent to apprentices on job sites, meaning 4 to 8 journey workers for each apprentice. Unfortunately, most of the state of Alaska does not have this concentration of trained line worker talent to train the future workforce. Based on our research, only in the Interior region were there close to 4.4 current workers for every new worker needed. This is in part because demand for line workers in the Interior region is projected to slightly decrease over the next 10 years, so more journey-level line workers in the current workforce may become available to support training needs for a new workforce.

TABLE 54: Electrical Power-Line Installers and Repairers: Occupation Wages and Estimated Growth

ELECTRICAL POWER-LINE INSTALLERS AND REPAIRERS [49-9051] Occupation Wages and Estimated Growth					
Region	Average Hourly Wage 2024	10-year growth Percent (%) 2024-2033	10-year growth Count (n) 2024-2033	10-year Retirement 2024-2033	Need-to-current worker ratio[74]
Statewide	$49.29	13.37%	60	117	1: 2.5
Anchorage/Mat-Su	$50.34	22.37%	50	53	1: 2.2
Interior	$47.76	(4.90%)	(3)	19	1: 4.4
Southeast	$49.75	(1.04%)	(0)	10	1: 2.6
Gulf Coast	$51.41	9.43%	6	21	1: 2.5
Southwest	$44.19	16.08%	7	12	1: 2.3
Northern	$48.97	1.58%	0	10	1: 1.4

Training Availability IN ALASKA

Relevant Training Programs in Alaska:

General Construction Courses:

- Construction Craft Laborers Pre-Apprenticeship, Alaska Works Partnership (Anchorage/Mat-Su)
- Construction Trades, Galena Interior Learning Academy (Interior)
- Construction Trades Program, Partners for Progress in Delta (Interior)
- Construction Occupational Endorsement Certificate, University of Alaska Southeast (Southeast)
- Construction Skills Occupational Endorsement Certificate, University of Alaska, Prince William Sound College (Gulf Coast)
- Construction Technology, AVTEC (Gulf Coast & Statewide)
- Construction Course, Yuut Elitnaurviat (Southwest)
- Construction Technology, Southwest Alaska Vocational and Education Center (SAVEC) (Southwest)
- Construction Technologies, Ilisagvik College/ Northslope Training Education Cooperative (Northern)
- Construction Trades Technology Program, Alaska Technical Center (ATC) (Northern)

Linemen Apprenticeship:

- Lineman Apprenticeship, NECA IBEW (Anchorage/Mat-Su) (Interior)

Electrical and Electronics Repairers, Powerhouse, Substation, and Relay [49-2095]

Description

Job Description: Inspect, test, repair, or maintain electrical equipment in generating stations, substations, and in-service relays.

Common Job Titles:

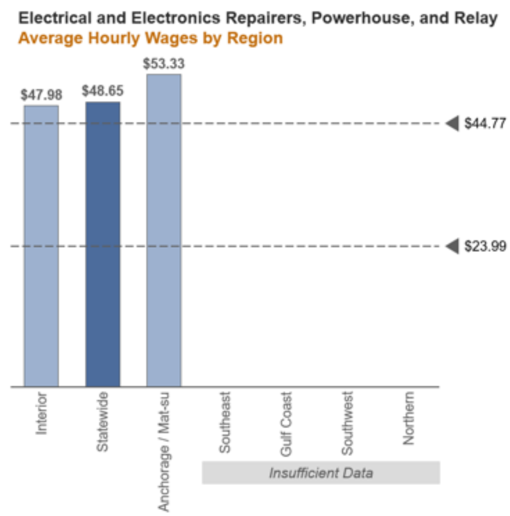
- Commissioning Managers
- Commissioning Technicians
- Utility Workers
- Power Technicians
- Substation Technicians
- Wiring Technicians

Sample Employers in Alaska:

- Electric Power Systems
- Electric Power Constructors
- Lower Peninsula Power Sports
- Chugach Electric Association

Projected 10-Year Growth

Alaska is expected to need 43 new powerhouse, substation, and relay workers, also known simply as utility workers, over the next 10 years. Demand is driven by a combination of growth and retirement, primarily in the Anchorage/Mat-Su and Interior regions of the state.



One pathway into this work is the Industrial Electricity program offered by AVTEC in Seward. The program has a huge demand, and graduates of this program are qualified to work in fields where they could earn $80,000 - $110,000 salaries. However, with current instructor capacity, the program is designed to serve only 15 students at a time. To do their best to meet strong demand, AVTEC is currently pushing capacity to 18 students, usually with an additional waitlist of 8-10 people. If AVTEC could locate a second instructor the program could expand to serve up to 30 students, but trained talent is reluctant to leave the industry.

Like other types of electrical workers, growing powerhouse, substation, and relay workers require existing workers who are available to train new talent on the job, as well as classroom learning. The current ratio of existing workers to trainees in both Interior and Anchorage/Mat-Su regions is low (2.2 workers for every potential trainee in Interior; 3.1 workers for every potential trainee in Anchorage), which could create an additional barrier to growing this occupation.

TABLE 55: Electrical & Electronics Repairers, Powerhouse, Substation, & Relay: Occupation Wages & Estimated Growth

ELECTRICAL & ELECTRONICS REPAIRERS, POWERHOUSE, SUBSTATION, & RELAY [49-2095] Occupation Wages and Estimated Growth					
Region	Average Hourly Wage 2024	10-year growth Percent (%) 2024-2033	10-year growth Count (n) 2024-2033	10-year Retirement 2024-2033	Need-to-current worker ratio[75]
Statewide	$48.65	12.95%	18	25	1: 3.3
Anchorage/Mat-Su	$53.33	14.41%	12	14	1: 3.1
Interior	$47.98	10.72%	3	10	1: 2.2
Southeast	Insf. Data	Insf. Data	Insf. Data	Insf. Data	Insf. Data
Gulf Coast	Insf. Data	Insf. Data	Insf. Data	Insf. Data	Insf. Data
Southwest	Insf. Data	Insf. Data	Insf. Data	Insf. Data	Insf. Data
Northern	Insf. Data	Insf. Data	Insf. Data	Insf. Data	Insf. Data

Training Availability IN ALASKA

Relevant Training Programs in Alaska:

General Construction Courses:

- Construction Craft Laborers Pre-Apprenticeship, Alaska Works Partnership (Anchorage/Mat-Su)
- Construction Trades, Galena Interior Learning Academy (Interior)
- Construction Trades Program, Partners for Progress in Delta (Interior)
- Construction Occupational Endorsement Certificate, University of Alaska Southeast (Southeast)
- Construction Skills Occupational Endorsement Certificate, University of Alaska, Prince William Sound

College (Gulf Coast)
- Construction Technology, AVTEC (Gulf Coast & Statewide)
- Construction Course, Yuut Elitnaurviat (Southwest)
- Construction Technology, Southwest Alaska Vocational and Education Center (SAVEC) (Southwest)
- Construction Technologies, Ilisagvik College/ Northslope Training Education Cooperative (Northern)
- Construction Trades Technology Program, Alaska Technical Center (ATC) (Northern)

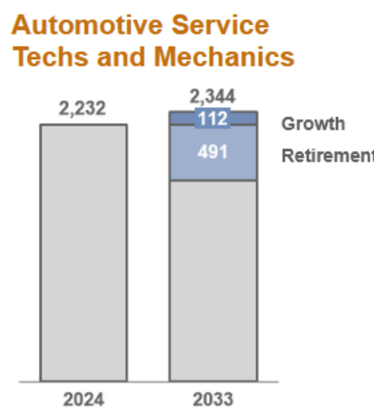
Other Relevant Programs:
- Associate of Applied Science in Process Technology, University of Alaska, Kenai Peninsula College (Gulf Coast)
- Industrial Electricity, AVTEC (Gulf Coast & Statewide)
- Industrial Process Instrumentation AAS, University of Alaska, Kenai Peninsula College (Gulf Coast))

Automotive Service Technicians and Mechanics [49-3023]

Description

Job Description: Diagnose, adjust, repair, or overhaul automotive vehicles.

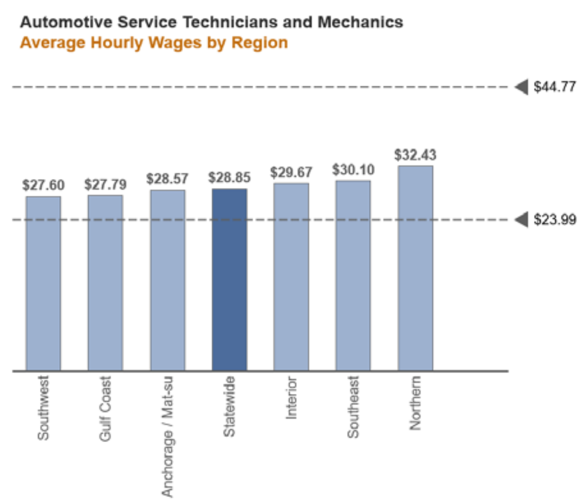
Common Job Titles:
- Automotive Technicians
- Mechanics
- Lube Technicians
- Motor Vehicle Customer Support



Sample Employers in Alaska:
- State of Alaska
- Walmart
- Kendall Automotive Group
- Lithia Motors

Projected 10-Year Growth

Alaska is expected to need over 600 new automotive service technicians over the next 10 years, driven primarily by retirements statewide. The Gulf Coast region shows the highest percentage growth in demand for new automotive service technicians and mechanics over the next ten years (11%). However, retirements loom large for this region as well, and approximately two-thirds of job openings on the Gulf Coast over the next 10 years will be driven by retirements.



The demand for these workers is high. University of Alaska Transportation & Power Division shared that students training as automotive technicians are almost always employed before they graduate, and some employers are even reimbursing for education costs. UAA has integrated electrical knowledge into their program to prepare students to work on EVs—a decision driven by industry demand.

The automotive landscape is changing, as electric and hybrid vehicles become a larger part of the vehicles on the road, auto technicians need to understand high-voltage electronics and diagnostic testing. This is particularly important in the Juneau area, which has the largest fleet of electric vehicles in the state, according to industry stakeholders interviewed for this report.

UAA has been able to do some experimentation on rural-specific training programs, bringing smaller two-day trainings to rural areas, but there is more opportunity for investing in these auto service roles in rural spaces, at least those that are connected to a sufficient road network.

TABLE 56: Automotive Service Technicians & Mechanics: Occupation Wages & Estimated Growth

AUTOMOTIVE SERVICE TECHNICIANS AND MECHANICS [49-3023] Occupation Wages and Estimated Growth					
Region	Average Hourly Wage 2024	10-year growth Percent (%) 2024-2033	10-year growth Count (n) 2024-2033	10-year Retirement 2024-2033	Need-to-current worker ratio[76]
Statewide	$28.85	5.02%	112	491	1: 3.7
Anchorage/Mat-Su	$28.57	2.56%	33	286	1: 4.1
Interior	$29.67	8.72%	38	95	1: 3.3
Southeast	$30.10	7.82%	13	37	1: 3.4
Gulf Coast	$27.79	11.00%	24	47	1: 3.1
Southwest	$27.60	2.35%	2	10	1: 4.2
Northern	$32.43	1.36%	1	11	1: 4.2

Training Availability IN ALASKA

Relevant Training Programs in Alaska:

- Automotive Technician Apprenticeship, Department of Labor and Workforce Development Registered Apprenticeship (Statewide)
- Applied Mechanics, Galena Interior Learning Academy (Interior)
- Automotive Engine Performance Occupational Endorsement Certificate, University of Alaska, Anchorage (Anchorage/Mat-Su)
- Automotive Specialist Occupational Endorsement Certificate, University of Alaska, Anchorage (Anchorage/Mat-Su)
- Automotive Technology Certificate, University of Alaska, Anchorage (Anchorage/Mat-Su)
- Automotive Technology Certificate, University of Alaska, Fairbanks (Interior)

Firefighting and Prevention Workers [33-2000]

Description

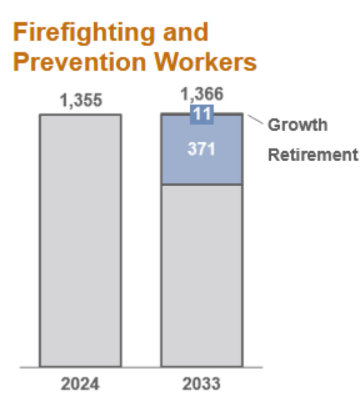
Job Description: Control and extinguish fires or respond to emergency situations where life, property, or the environment is at risk. Duties may include fire prevention, emergency medical service, hazardous material response, search and rescue, and disaster assistance.

Common Job Titles:

- Wildland Firefighters
- Firefighters
- Fire Investigators
- Firefighters/ Paramedics

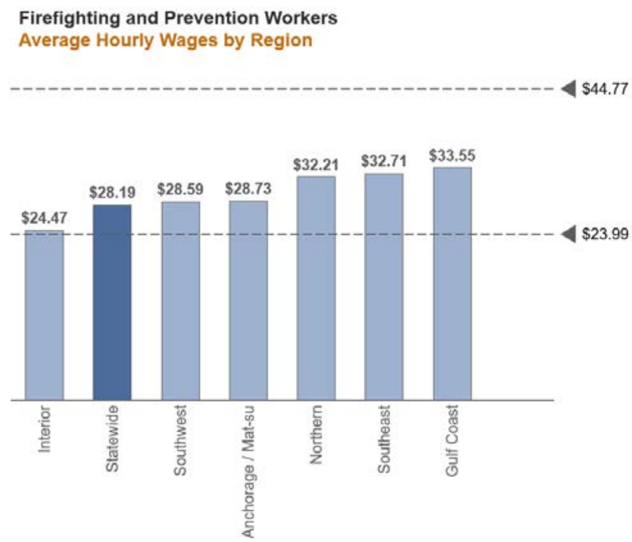
Sample Employers in Alaska:

- United States Department of the Interior
- State of Alaska
- National Park Service
- United States Fish & Wildlife Service
- City and Borough of Juneau
- Denali Universal Services



Projected 10-Year Growth

Alaska is projected to need 382 new firefighters and fire prevention workers over the next 10 years, and demand will grow at a relatively steady pace. Given retirements and regional differences, there is a need to support this workforce. The most striking regional differences are in the Southeast and Anchorage/Mat-Su regions.



Southeast: In 2024 there were an estimated 162 firefighting and prevention workers in the Southeast region. The demand for firefighting and prevention workers will increase by 40% over the next decade, adding an estimated 60 new positions. In addition, an estimated 50 individuals are set to retire, requiring approximately 110 new workers to meet regional demand.

Anchorage/Mat-Su: In 2024, there were an estimated 580 firefighting and prevention workers in Anchorage/Matsu region. The demand is expected to decline 19% over 10 years, which is a loss of an estimated 110 workers. However, an estimated 160 members of the current workforce are expected to retire, so there is a need for about 50 new workers to meet demand over 10 years.

Firefighting and prevention occupations have a low current worker to trainee ratio across most regions of the state, meaning there are limited current workers available to train the incoming workforce. In Southeast Alaska for example, there are 1.5 trained current firefighting and prevention workers for every one trainee.

TABLE 57: Firefighting & Prevention Workers: Occupation Wages & Estimated Growth

FIREFIGHTING AND PREVENTION WORKERS [33-2000] Occupation Wages and Estimated Growth					
Region	Average Hourly Wage 2024	10-year growth Percent (%) 2024-2033	10-year growth Count (n) 2024-2033	10-year Retirement 2024-2033	Need-to-current worker ratio[77]
Statewide	$28.19	0.83%	11	371	1: 3.5
Anchorage/Mat-Su	$28.73	(18.86%)	(110)	156	1: 12.7
Interior	$24.47	8.13%	20	67	1: 2.8
Southeast	$32.71	39.57%	64	46	1: 1.5
Gulf Coast	$33.55	15.78%	15	26	1: 2.3
Southwest	$28.59	10.37%	14	38	1: 2.6
Northern	$32.21	3.85%	4	31	1: 3.1

Training Availability IN ALASKA

Relevant Training Programs in Alaska:

- Anchorage Fire Department Training, City of Anchorage Municipal Trainings (Anchorage/Mat-Su)
- Fire Accreditation Standards and Training, State of Alaska (Statewide)
- Fire and Emergency Services AAS, University of Alaska, Anchorage (Anchorage/Mat-Su)
- Fire Science AAS, University of Alaska, Fairbanks (Interior)
- Training and Recruitment, State of Alaska (Statewide)
- Wildlife Biology and Conservation BS, University of Alaska, Fairbanks (Interior)

Refuse and Recyclable Material collectors [53-7081]

Description

Job Description: Collect and dump refuse or recyclable materials from containers into truck. May drive truck.

Common Job Titles:

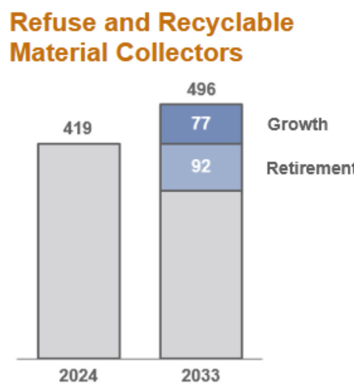
- No top posted job titles data available

Sample Employers in Alaska:

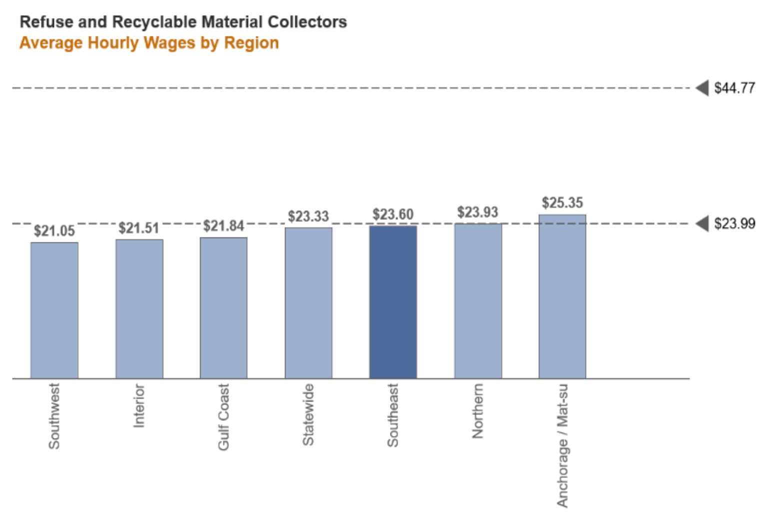
- No top companies posting data available

Projected 10-Year Growth

Alaska is projected to need 169 new refuse and recyclable collectors over the next 10 years, Across the state, the need for new refuse and recyclable material collectors is equally driven by both increased demand for refuse and recyclable material collectors as well as retirements over the next decade.



The parameters of this occupation vary significantly between rural and urban Alaska. In cities or communities on urban road systems, collection fees pay the wages for full-time refuse workers, and waste is hauled to lined, covered landfills. In rural areas however, unlined open dumps and trash burning can be the norm, though regional centers that are reachable by air or boat will typically have covered dumpsites. In rural areas this job is seasonal or only a few hours a week, and communities need people who can perform a wide range of tasks, rather than full-time garbage and recycling. Turnover in rural areas is also high, so there's a need to constantly train new cohorts to meet environmental service needs.



One of the stakeholders interviewed for this report, Zender Environmental Group, noted that they have success offering training programs in two-week, Anchorage-based blocks with curriculum that is specifically adapted to village realities. That allows trainees to learn more efficiently, while providing space for subsistence hunting and fishing that is essential to rural life.

Some areas for potential future growth include supporting rural communities to develop takeback programs for electronics, batteries, and appliances to create a revenue stream to fund more full-time waste management positions. Rural areas could also consider sharing a single waste manager either between villages or sharing a single job between multiple residents, which could help reduce burnout and allow for coverage during subsistence seasons.

TABLE 58: Refuse & Recyclable Material Collectors: Occupation Wages & Estimated Growth

REFUSE AND RECYCLABLE MATERIAL COLLECTORS [53-7081] Occupation Wages and Estimated Growth					
Region	Average Hourly Wage 2024	10-year growth Percent (%) 2024-2033	10-year growth Count (n) 2024-2033	10-year Retirement 2024-2033	Need-to-current worker ratio[78]
Statewide	$23.33	18.30%	77	92	1: 2.5
Anchorage/Mat-Su	$25.35	18.83%	29	30	1: 2.6
Interior	$21.51	36.31%	11	10	1: 1.5
Southeast	$23.60	25.83%	21	19	1: 2.0
Gulf Coast	$21.84	17.12%	12	17	1: 2.3
Southwest	$21.05	3.86%	1	10	1: 3.1
Northern	$23.93	(4.72%)	(2)	10	1: 4.6

Training Availability IN ALASKA

Relevant Training Programs in Alaska:

- Rural Alaska Environmental Community Environmental Job Training, Zender Environmental Group (statewide)
- Rural Waste Management and Spill Response Occupational Endorsement Certificate, University of Alaska Fairbanks (Interior)
- Rural Waste Management and Spill Response Occupational Endorsement Certificate, University of Alaska, Fairbanks— Bristol Bay Campus (Southwest)
- Set of tools (Landfill operator tools) and training courses (Solid Waste Training Videos, Boot Camps, etc.) provided by DEC, State of Alaska - Division of Environmental Health (Statewide)
  - Solid Waste Bootcamp and Solid Waste Bootcamp Detailed Outline

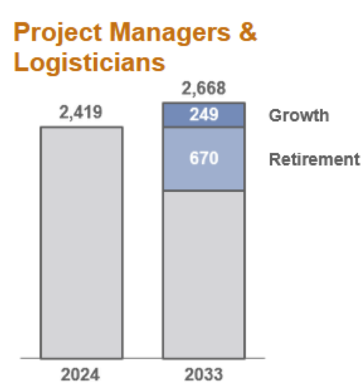
Project Management Specialists and Logisticians [13-1080]

Description

Job Description: Project managers analyze and coordinate the schedule, timeline, procurement, staffing, and budget of a product or service on a per project basis. Logisticians analyze and coordinate the ongoing logistical functions of a firm or organization. They are responsible for the entire life cycle of a product, including acquisition, distribution, internal allocation, delivery, and final disposal of resources.

Common Job Titles:

- Project Managers
- Project Coordinators
- Supply Chain Specialists
- Environmental Project Manager
- Supply Chain Analyst

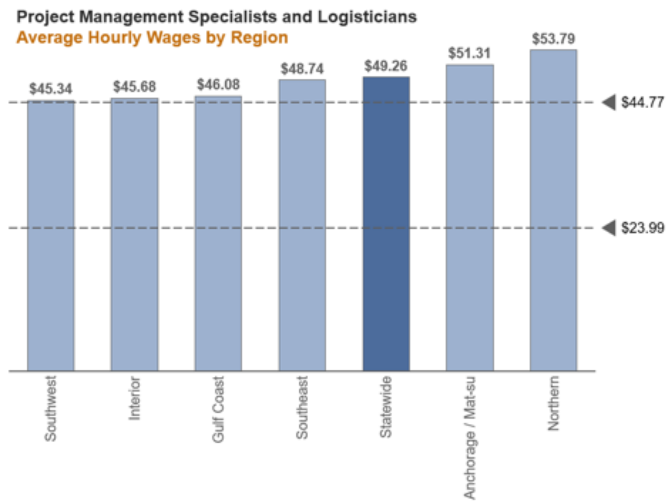


Sample Employers in Alaska:

- CBRE
- GovCIO
- GCI Communication Corp
- United States Department of the Treasury
- Providence
- Alaska Native Tribal Health Consortium

Projected 10-Year Growth

Alaska is expected to need 919 new project management specialists and logisticians over the next 10 -years, though existing occupational data makes it difficult to assess precisely how many of these roles will be related to sustainable energy occupations.



Creating new training programs in project management is anticipated to be easier than other sustainable energy occupations, as this training does not require access to heavy equipment and can be conducted in remote or virtual settings.

However, when speaking to DeerStone—a consulting firm that focuses on enhancing the infrastructure landscape for Alaska's rural and Tribal communities—they emphasized the unique skill sets needed by energy-related project managers. This includes subject matter expertise in energy, social and cultural awareness to meet communities where they are, a robust understanding of federal and state grant management process, and creative problem solving. Training programs like the [Sustainable Energy Occupational Endorsement] are essential for building energy knowledge, while other parts of the role are often learned on the job and over time.

TABLE 59: Project Management Specialists & Logisticians: Occupation Wages & Estimated Growth

PROJECT MANAGEMENT SPECIALISTS AND LOGISTICIANS [13-1080] Occupation Wages and Estimated Growth					
Region	Average Hourly Wage 2024	10-year growth Percent (%) 2024-2033	10-year growth Count (n) 2024-2033	10-year Retirement 2024-2033	Need-to-current worker ratio[79]
Statewide	$49.26	10.29%	249	670	n/a
Anchorage/Mat-Su	$51.31	7.06%	95	368	n/a
Interior	$45.68	11.67%	52	128	n/a
Southeast	$48.74	14.13%	27	53	n/a
Gulf Coast	$46.08	13.56%	20	40	n/a
Southwest	$45.34	9.21%	7	20	n/a
Northern	$53.79	12.19%	15	36	n/a

Training Availability IN ALASKA

Relevant Training Programs in Alaska:

General Education and Business Programs, Inclusive of Project Management Courses:

- Associate of Science, University of Alaska—Anchorage, Matanuska-Susitna College, Kenai Peninsula College, Kodiak College, Prince William Sound College (Anchorage/Mat-Su, Gulf Coast)
- Associate of Science, University of Alaska, Fairbanks (Interior)
- Associate of Science, University of Alaska, Southeast (Southeast)
- General Business, University of Alaska— Kenai Peninsula College, Kodiak College, Matanuska-Susitna College (Gulf Coast and Anchorage/Mat-Su)
- Management BBA, University of Alaska, Anchorage (Anchorage/Mat-Su)
- Applied Business AAS, University of Alaska, Fairbanks (Interior)

- Applied Business Certificate, University of Alaska, Fairbanks (Interior)
- Business Administration BBA, University of Alaska, Fairbanks (Interior)
- Business Management AAS, Ilisagvik College/ Northslope Training Education Cooperative (Northern)
- Business BBA, University of Alaska Southeast (Southeast)
- Construction Management AAS, University of Alaska Fairbanks (Interior)
- Public Administration Master's Degree, University of Alaska Southeast (Southeast)

Project Management and Logistics Specific Training:

- Sustainable Energy Occupational Endorsement, University of Alaska, Fairbanks – Bristol Bay Campus (Southwest)
- Logistics and Supply Chain Operations Undergraduate Certificate, University of Alaska, Anchorage (Anchorage/Mat-Su) *program suspended at time of analysis*
- Global Logistics and Supply Chain Management BBA, University of Alaska, Anchorage (Anchorage/Mat-Su) *program suspended at time of analysis*
- Project Management Minor, University of Alaska, (Anchorage (Anchorage/Mat-Su)

Secondary Occupations

While the 10 focus occupations detailed in this report represent what our research found to be the most important areas of future sustainable energy workforce investment, two secondary occupations—Engineers and Urban and Regional Planners—were also included in our interview conversations with sustainable energy stakeholders. These roles are often foundational in helping cities, towns, and villages to establish sustainable energy systems, so we included questions about them in relevant stakeholder interviews.

Stakeholders noted that engineers are easiest to recruit for work in Alaska when they are early in their careers and willing to travel across multiple sites. Unfortunately, much of the sustainable energy work for engineers is grant funded, so stakeholders noted that the uncertainty of funding cycles tends to push mid-career engineers into the oil and gas industry where pay is higher and work more certain.

Urban and regional planners face a similar dilemma—when grant funding is available, planning and program management positions are created to meet demand, but stakeholders reported that sustaining those positions when funding elapses proves difficult. This makes it difficult to carry out planning efforts in the long-term without more reliable funding. Stakeholders also wondered how many urban and regional planners are required within individual communities given the size and sprawl of much of the state.

VIII. BENEFITS ANALYSIS

The portfolio of greenhouse gas (GHG) mitigation measures and programs identified can generate substantial economic, financial, public health, environmental, and community resilience benefits across the State of Alaska. The suite of measures included in this CCAP is provided in the table below, along with an assessment of how they will likely impact health, jobs generation, and accessibility. In addition, the table indicates which projects are expected to support broader resilience considerations, as well as reduce energy costs. A more detailed description of benefits is provided below the table.

TABLE 60: Benefits Summary Table

#	Measure	Health	Costs	Jobs	Access	Resilience*
1	Alaska Housing Finance Corporation (AHFC) Weatherization Assistance Program & Energy Rebate Program	X	X	X	X	X
2	Southeast Conference Residential Beneficial Electrification Program (ACES-AK Coastal Heat Pumps)	X	X	X	X	
3	Public Building and Asset Weatherization, Energy Efficiency, and Beneficial Electrification	X	X			X
4	Mendenhall Wastewater Treatment Plant	X	X			
5	Central Peninsula Landfill Methane Capture Project	X	X			
6	Southeast Alaska Composting Program	X	X	X	X	
7	Green Corridor – Juneau Port Electrification	X			X	
8	Electric Vehicle Supply Equipment (EVSE) Installation Program	X	X	X	X	
9	Dixon Diversion Hydropower Project (Bradley Lake Expansion)	X	X		X	
10	Community Electric Generation Projects (Railbelt Electric Grid and Remote, Islanded Electric Grids)	X	X		X	X
11	AEA DERA, VEEP, and Rural Distribution Programs	X	X		X	
12	AEA Renewable Energy Fund	X	X	X	X	
13	Long Duration Energy Storage (LDES) System for Kotzebue	X	X	X	X	X
14	C-PACER for Unalaska	X	X	X	X	X

15	Hybrid-electric aircraft pilot (Trooper Fleet)	X	X	X	X	
16	Landfill Gas Combined Heat & Power for Anchorage	X	X		X	
17	SAF & Renewable Diesel Refinement	X		X	X	
18	BESS for Unalaska	X	X			
19	Seward Port Electrification	X	X			X
20	Alaska Emerging Energy Technology Fund	X	X	X		
21	Building Codes	X	X		X	X
23	Statewide Oil to Heat Pump Conversion Incentive	X	X			X
24	Railbelt Industrial Energy Efficiency Challenge	X	X	X		
25	Statewide Forest Carbon and Biochar Program	X	X	X		X

* Resilience: Improves the capacity of communities and socioeconomic systems to respond to and prepare for disasters such as floods, fires, and landslides.

IMPROVED PUBLIC HEALTH AND ENVIRONMENTAL OUTCOMES

Reducing emissions exposure directly benefits Alaskan communities by improving air quality, reducing air pollutant concentrations, and mitigating localized environmental degradation. The cumulative impact of these reductions is expected to yield measurable improvements in public health, environmental quality, and community well-being, especially in regions where vulnerable populations and disadvantaged communities are disproportionately affected by pollution and high energy costs. Measures that improve the quality and resilience of rural building stock and reduce local wildfire risk are particularly beneficial for health equity concerns in rural Alaska.

Alaska's emission reduction measures collectively target sources that contribute to both greenhouse gas emissions reduction and local air quality degradation. Many greenhouse gas mitigation strategies also lower emissions of co-pollutants such as fine particulate matter ($PM_{2.5}$), volatile organic compounds (VOCs), sulfur oxides (SO_x), nitrogen oxides (NO_x), and black carbon—all of which are associated with adverse respiratory, cardiovascular, and neurological health outcomes. Reductions in these pollutants will provide immediate and quantifiable public health benefits, in addition to long-term environmental advantages.

Methane Reduction Measures

Methane is a potent greenhouse gas with a global warming potential more than 25 times greater than carbon dioxide over a 100-year period. It also contributes to ground-level ozone formation, which exacerbates respiratory and cardiovascular diseases. Methane capture and diversion projects therefore deliver both global environmental and local air quality benefits.

Central Peninsula Landfill Methane Capture Project: This project will collect and convert landfill gas to energy, significantly reducing fugitive methane emissions and minimizing odors and volatile organic compounds in nearby communities such as Soldotna and Kenai. Captured methane can be flared or utilized for power generation, displacing fossil fuels and reducing CO_2 emissions from conventional energy sources. The project will improve air quality, mitigate explosion and odor risks, and provide renewable energy that offsets diesel use in the region.

Southeast Alaska Composting Program: By diverting organic waste from landfills into aerobic composting systems, methane generation from anaerobic decomposition is avoided. Composting further reduces leachate contamination risks to local waterways—supporting salmon habitat and community subsistence resources—and provides soil amendments that enhance local food production. These outcomes contribute to environmental health, economic resilience, and food security, particularly in rural and island communities where waste disposal costs and logistics are challenging.

Gasoline and Diesel Emission Reduction Measures

Combustion of gasoline and diesel fuels is a major source of both CO_2 and health-damaging pollutants such as particulate matter, NO_x, and black carbon. These pollutants are linked to higher incidences of asthma, bronchitis, cardiovascular disease, and premature mortality. Measures that displace or reduce fossil fuel combustion will produce substantial near-term improvements in community air quality and public health—particularly in transportation corridors, port cities, and regions with limited air dispersion due to topography or winter inversions.

Juneau Port Shore Power-Green Corridor: The installation of shore power infrastructure at cruise ship berths in Juneau allows vessels to shut down diesel engines while docked, eliminating emissions of diesel particulates, SO_x, and NO_x in the downtown waterfront area. Modeled after similar projects in Seattle and Vancouver, shore power can reduce localized particulate emissions by up to 80 percent during the cruise season. This measure benefits not only residents and port workers but also thousands of seasonal visitors exposed to port air quality. By reducing visible smoke and odor, it improves both environmental conditions and community perception of the tourism sector.

Statewide Electric Vehicle Supply Equipment (EVSE) Deployment: Expanding EV charging infrastructure will accelerate adoption of electric vehicles, reducing tailpipe emissions of CO_2, NO_x, and particulates in urban areas such as Anchorage, Fairbanks, and Juneau. Reductions in localized pollution will have direct respiratory health benefits, particularly for populations living near high-traffic corridors. Electrification of municipal and commercial vehicle fleets (e.g., transit buses, delivery vehicles) will provide additional benefits through lower operational noise and maintenance emissions.

Community Electric Generation and Transmission Upgrades: Replacing outdated diesel generators with modern, efficient units—or hybridizing them with renewable sources—reduces emissions of black carbon and sulfur oxides in rural communities reliant on microgrids. Many rural Alaskans live near generation sites, where diesel exhaust contributes to indoor and outdoor pollution. Improved generation efficiency reduces both emissions and fuel costs, supporting energy affordability and air quality in tandem. Transmission upgrades also reduce line losses, improving overall system efficiency and lowering the fuel required for generation.

Railbelt Industrial Energy Efficiency Challenge: Industrial facilities participating in energy efficiency upgrades will reduce both GHGs and co-pollutants from combustion processes. Common improvements—such as waste heat recovery, motor upgrades, and process optimization—can decrease NO_x and SO_x emissions, while enhancing worker safety and reducing operational costs. Industrial energy efficiency improvements near population centers, such as the Cook Inlet basin, also mitigate regional haze and deposition impacts on sensitive ecosystems.

AEA Renewable Energy Fund, DERA, VEEP, and Rural Distribution Programs: The Alaska Energy Authority's suite of programs accelerates the replacement of diesel-fired generation and vehicle engines with cleaner, more efficient alternatives. The Diesel Emissions Reduction Act (DERA) program replaces or retrofits older diesel engines, often achieving 50–90% reductions in particulate emissions. The Village Energy Efficiency Program (VEEP) upgrades public facilities with efficient lighting, heating, and ventilation, reducing both emissions and operating costs. These initiatives collectively reduce exposure to combustion byproducts that contribute to asthma and respiratory illness, particularly among children and elders in rural Alaska.

Building Efficiency and Indoor Environmental Quality Measures

In Alaska's cold environment, residents spend a disproportionate amount of time indoors, making indoor air quality and building performance critical determinants of public health. Measures such as boosting funding for the AHFC weatherization program directly improve the built environment by enhancing insulation, air sealing, and ventilation in aging housing stock.

These retrofits reduce fuel consumption and GHG emissions by decreasing heating demand while simultaneously improving air quality and comfort. Better insulation and controlled ventilation reduce the infiltration of outdoor pollutants, prevent condensation and mold formation, and lower exposure to indoor combustion byproducts from stoves or fuel heaters. Studies in Alaska have shown that improved ventilation and moisture control can reduce respiratory symptoms and asthma incidence, particularly among children in low-income housing. In multifamily buildings, these upgrades also reduce noise, drafts, and heat loss—contributing to tenant stability, lower energy costs, and improved community health outcomes.

Cumulative Community Benefits

Collectively, implementation of these measures will result in:

- Reduced Exposure to Pollutants: Decreases in particulate matter, sulfur oxides, nitrogen oxides, volatile organics, and black carbon—yielding lower rates of respiratory and cardiovascular disease, especially in urban centers and rural hubs with diesel-based systems.
- Enhanced Environmental Quality: Lower emissions contribute to cleaner air and water, reduced acid deposition, and improved ecosystem health, particularly in coastal and subsistence regions dependent on fisheries and traditional foods.
- Improved Energy Affordability: Many measures (e.g., renewables, efficiency, electrification) lower fuel use and operational costs, which in turn reduce household energy burdens—supporting economic resilience in rural and low-income communities.
- Community Resilience and Quality of Life: Cleaner energy systems reduce dependence on imported fuels, lower environmental risk, and strengthen public trust in local and state governance. These benefits align directly with Alaska's statutory priorities for public health, energy affordability, and environmental stewardship.

In combination, the mitigation measures described here deliver a triple benefit—addressing greenhouse gas emissions reduction, protecting public health, and enhancing the sustainability and livability of Alaskan communities.

COST REDUCTIONS

Reducing greenhouse gas emissions in Alaska yields not only environmental and health benefits but also tangible economic and cost-of-living benefits for households, local governments, and businesses. Implementation of mitigation measures such as efficiency upgrades, renewable energy investments, methane capture, and electrification directly lowers fuel consumption, reduces maintenance and operating costs, and improves energy system reliability. These changes collectively strengthen community resilience and contribute to the State's overarching goal of ensuring energy affordability and economic sustainability across regions.

Mechanisms for Community Cost Reduction

Several interrelated mechanisms explain how mitigation measures translate into lower community costs:

1. **Fuel Cost Avoidance:** Many Alaskan communities—particularly those off the Railbelt—depend on imported diesel and heating fuel, where transportation costs can add $2–$5 per gallon to delivered prices. Reducing fuel use through efficiency, electrification, or renewable substitution avoids these expenses, immediately lowering household and institutional energy bills.
2. **Reduced Price Volatility and Supply Risk:** Local generation from renewables or waste heat reduces exposure to global petroleum price fluctuations and seasonal supply disruptions. Stabilized energy prices protect household budgets and municipal operations from fuel cost spikes, improving long-term economic predictability.[80]

3. **Operational Efficiency and Deferred Infrastructure Costs:** Efficiency upgrades to generation, transmission, and building systems lower demand for fuel and maintenance, extending the lifespan of infrastructure, and reducing the need for costly replacements or emergency repairs.
4. **Health-Related Cost Savings:** Lower exposure to combustion-related pollutants reduces community healthcare burdens. Fewer asthma attacks, respiratory illnesses, and cardiovascular events translate to reduced medical costs and fewer missed workdays, particularly in communities with limited healthcare access.
5. **Local Economic Retention:** Energy efficiency and renewable energy investments keep dollars circulating within local economies rather than exporting capital for imported fuels. Local construction, installation, and maintenance jobs multiply the benefits of energy savings through increased local income.

Measure-Specific Cost Reduction Pathways

Twenty-three of the 25 identified GHG mitigation measures are expected to reduce energy costs through energy efficiency improvements and financial assistance programs. These actions will decrease total energy and fuel consumption for program participants. Three specific measures are described here to give context for mechanisms that lead to cost savings for communities.

Accelerating Clean Energy Savings in Alaska's Coastal Communities (ACES)

The Accelerating Clean Energy Savings in Alaska's Coastal Communities (ACES) program will expand an appropriate suite of home energy and heat pump educational and advisory services of Alaska Heat Smart throughout Southeast Alaska's "partial hydro" communities. These communities rely on a mix of energy sources, such as solar, diesel generators, or grid electricity, alongside hydropower. Hydropower usually contributes to the overall energy mix within a community but doesn't fully meet the community's energy demand. These areas face higher electrical rates than their 100% hydro-powered counterparts and require updated utility-specific grid-mix data to calculate avoided emissions. The program will incorporate guidance on tax credits and financial incentives to reduce heat pump costs.

Hybrid-Electric Aircraft Pilot Program

The Alaska State Troopers Hybrid-Electric Aircraft Pilot Program is expected to reduce fuel consumption by half, significantly reducing operating costs and enabling limited resources to be redistributed to other critical areas such as personnel, training, and mission support. The efficiency of these systems is also expected to reduce long-term maintenance costs. This program demonstrates the potential for this technology to reduce fuel use, and thus transportation costs, which are a primary driver of high costs for rural Alaska communities.

Renewable Energy Fund (REF)

REF projects that replace diesel generation with wind, hydro, or solar reduce the cost per kilowatt-hour in rural communities over time. While capital costs are front-loaded, renewable systems have minimal ongoing fuel expenses. Over a 20-year project life, renewable installations can cut lifetime generation costs by 30–60% compared to diesel, leading to long-term rate stabilization.

Broader Economic and Fiscal Impacts

At scale, the combined impact of these measures can substantially lower Alaska's aggregate energy costs, which currently exceed $5 billion annually statewide. The Alaska Energy Authority estimates that efficiency and renewable energy programs have already saved consumers over $1 billion since 2008 through the Renewable Energy Fund and weatherization programs. Expanded implementation under the Sustainable Energy Action Plan could double those cumulative savings by 2035, depending on oil price trends and technology adoption rates.

For rural communities, where energy costs can exceed 40% of median household income, even modest efficiency improvements yield transformative benefits.[81] Reduced energy expenses free up household resources for food, healthcare, and education, strengthening overall community well-being. Municipalities similarly benefit from reduced operational costs for schools, water treatment, and public facilities—enhancing fiscal sustainability and lowering the demand for state subsidies. This helps ease the fiscal strain currently faced by many public entities in Alaska.[82]

In the longer term, shifting toward locally produced, non-fuel energy reduces vulnerability to supply chain disruptions and supports economic diversification through renewable energy jobs, engineering services, and local maintenance contracting. Each dollar saved on imported fuel represents capital retained within Alaska's economy, compounding through local spending and reinvestment.

Through direct fuel savings, avoided maintenance and health costs, and local economic retention, Alaska's greenhouse gas mitigation measures deliver substantial community cost reductions. These economic benefits reinforce the State's central priorities of energy affordability, reliability, and self-sufficiency. As implementation proceeds, continued tracking of energy expenditures, avoided fuel imports, and local economic multipliers will provide clear metrics of success—demonstrating that emissions reduction actions and cost reduction are mutually reinforcing components of Alaska's sustainable energy future.

JOB CREATION/PRESERVATION

Implementation of Alaska's greenhouse gas mitigation measures is expected to generate and sustain employment across multiple sectors, delivering both short-term and long-term community benefits. Investments in energy efficiency, renewable generation, electrification, and infrastructure modernization stimulate direct, indirect, and induced job creation while supporting the preservation of existing positions in Alaska's energy and construction industries. These outcomes contribute directly to the State's priorities for economic stability, workforce development, and local self-reliance.

Mechanisms of Employment Generation

1. **Direct Employment:** Most mitigation measures require skilled labor for design, permitting, construction, installation, and maintenance. This includes electricians, mechanics, plumbers, engineers, technicians, and construction laborers—occupations already present in Alaska's labor market. By increasing demand for these trades, mitigation investments provide sustained employment opportunities within local communities. Projects such as microgrid modernization, building retrofits, and renewable energy installations generate direct construction-phase employment and longer-term operational roles in monitoring, maintenance, and system optimization.
2. **Indirect Employment:** The supply chains associated with mitigation projects—such as the procurement of materials, equipment, and services—create indirect jobs in manufacturing, logistics, and professional support industries. For example, purchasing heating systems, insulation materials, or renewable energy components stimulates regional and national supply networks, many of which employ Alaskan workers in fabrication, distribution, or technical sales. Local contracting requirements further ensure that project spending circulates within the state economy.
3. **Induced Employment:** Workers employed directly and indirectly through mitigation projects spend income on housing, food, healthcare, and other services, supporting additional local jobs. This induced effect reinforces community economic resilience, particularly in rural areas where few other industries provide stable employment. Each dollar of clean energy investment has been shown—based on national multipliers from the U.S. Department of Energy—to generate between 1.5 and 2.5 additional jobs per million dollars invested, depending on project type.

Job Preservation and Workforce Stability

In addition to creating new jobs, these measures help preserve existing employment in key sectors. Alaska's construction and utility workforces are subject to seasonal variability and project-driven layoffs. Environmental and energy transition investments provide a counter-cyclical stabilizing effect by ensuring a consistent pipeline of infrastructure and maintenance projects. Workforce continuity is critical for retaining skilled tradespeople and reducing the outmigration of experienced workers to other states.

Energy efficiency retrofits, renewable installations, and grid modernization rely on the same core competencies as conventional energy projects—electrical, mechanical, and civil engineering trades. As the state and private sector invest in these new systems, existing energy workers can transition smoothly to emerging roles without substantial retraining. Programs coordinated through the Alaska Vocational Technical Center (AVTEC), the University of Alaska system, and regional training centers already provide pathways for upskilling workers in renewable energy, efficiency technologies, and advanced system controls.

Moreover, investments in local energy systems preserve community-level jobs that might otherwise be lost due to declining economic activity in fossil fuel sectors. Maintaining skilled employment in energy-related fields ensures that expertise, tax revenue, and purchasing power remain within Alaskan communities.

Rural and Regional Workforce Benefits

For remote and off-grid communities, mitigation projects often deliver the first sustained local employment opportunities in the energy sector. Construction of renewable energy systems, weatherization of public facilities, and maintenance of microgrids create recurring technical positions and reduce dependence on imported labor. Local hiring requirements embedded in state and federal grant programs ensure that a significant share of project expenditures translate into community income.

By integrating workforce development with project implementation—through apprenticeships, internships, and on-the-job training, Alaska can strengthen local capacity to operate and maintain advanced energy systems. These skills are transferable, supporting broader community resilience and employment beyond the initial project lifespan.

Long-Term Economic and Fiscal Implications

As mitigation measures expand across the state, cumulative workforce effects become significant. The clean energy and efficiency sectors typically generate more jobs per dollar invested than fossil fuel extraction because they are labor-intensive rather than fuel intensive. For example, energy efficiency retrofits employ approximately eight to ten times more workers per unit of energy saved than conventional fuel supply chains. Renewable projects, while capital-intensive, require sustained operations and maintenance staffing in regions where few other year-round opportunities exist.

These employment gains yield secondary fiscal benefits: expanded payrolls increase local tax revenues, reduce reliance on state and federal assistance programs, and support local businesses. Over time, a more diversified and stable energy workforce contributes to economic resilience, allowing Alaska's communities to better withstand global energy price shocks or declines in traditional extraction industries.

Review of Measures

Twelve of the 25 identified GHG mitigation measures will directly stimulate job growth or preserve existing jobs in industries or occupations that have experienced recent job loss. Several programs directly incorporate workforce training and staff development programs, while others can be directly attributed to past job growth. According to the Cold Climate Housing Research Center's Weatherization Program Impacts Report, from 2008 through 2018, the AHFC Weatherization Assistance Program & Energy Rebate Program invested $402.2 million to retrofit 20,917 homes across the state and was responsible for 5,460 annual jobs[83], including 2,352 direct jobs, 849 indirect jobs, and 2,259 induced jobs.[84]

Job growth is also expected to be stimulated through specific workforce development or training programs. For example, the Southeast Conference Residential Beneficial Electrification Program will benefit lower-income communities by offering workforce development training to support growth of high-quality jobs locally.[85] Projects will also require operations and maintenance personnel, further leveraging the capabilities of the existing local workforce.

The Southeast Alaska Composting Program is expected to generate additional revenue and create jobs by diverting food waste from out-of-state landfills to local on-site composting facilities. As this program is being implemented, progress will be tracked using various metrics, including the number of jobs created and workforce development opportunities generated through the implementation of composting initiatives. The Railbelt Industrial Energy Efficiency Challenge requires participating companies to report local hiring statistics, share savings with host communities, or reinvest a portion of energy cost savings into workforce training programs.

Certain measures will also generate job growth in new industries. Programs involving electric vehicles like the Electric Vehicle Supply Equipment (EVSE) Installation Program is expected to provide new clean energy jobs, offer job training, and create enterprises within disadvantaged communities. The Statewide Forest Carbon and Biochar Program is expected to directly create new, local jobs in feedstock collection, milling, and biochar programs. The Hybrid-Electric Aircraft Pilot Program will create new opportunities for pilots, mechanics, and technical staff to gain experience with hybrid-electric aviation systems, along with training and certification programs to stimulate long-term local growth.

Summary

Job creation and preservation through environmental and energy measures deliver tangible, community-scale benefits that extend beyond environmental outcomes. By stimulating employment in construction, operations, and maintenance; supporting local supply chains; and stabilizing rural economies, these investments advance the State's dual objectives of economic vitality and sustainable energy development. Integrating workforce planning with project implementation ensures that every dollar invested in greenhouse gas mitigation contributes not only to emissions reduction but also to the long-term prosperity of Alaskan communities.

IMPROVED ACCESS TO SERVICES

Implementation of greenhouse gas mitigation measures under the Alaska Comprehensive Sustainable Energy Action Plan would yield substantial co-benefits in access to essential community services, particularly in rural and remote regions. These measures enhance the reliability, affordability, and resilience of critical infrastructure systems—including energy, transportation, communications, and public facilities—thereby strengthening community connectivity and quality of life. Improved access to services is both a direct and indirect outcome of strategic energy investments that reduce emissions while increasing the reliability and reach of Alaska's infrastructure.

Mechanisms for Service Access Improvement

The primary pathways by which GHG mitigation measures improve access to services include:

1. **Energy Reliability and Availability:** Clean and efficient energy systems reduce power outages, improve voltage stability, and expand the reach of electrical infrastructure. This reliability supports continuous operation of health clinics, schools, water and wastewater systems, and emergency services. In many rural communities, unreliable or high-cost electricity constrains hours of service or limits equipment use; efficiency and renewable measures alleviate these barriers.
2. **Reduced Transportation Barriers:** Electrification of vehicles and marine systems, paired with port and grid upgrades, enhances physical access by lowering operational costs, increasing service frequency,

and reducing maintenance downtime. In turn, communities experience more reliable transport of goods, fuel, and emergency supplies.

3. **Enhanced Digital and Administrative Capacity:** Electrification, microgrid stabilization, and transmission improvements enable sustained access to digital services, including telemedicine, online education, e-government, and remote work. Stable, affordable power is a prerequisite for broadband infrastructure operation in many off-grid or microgrid communities.
4. **Operational Savings Reinvested in Services:** Energy cost reductions for public facilities and utilities free up local and regional budgets for reinvestment in other services such as education, public safety, and health care. Municipalities and Tribal governments benefit from lower operational expenditures and can extend service hours or improve equipment quality.

Measure Analysis: Contributions to Improved Access

Fifteen of the identified GHG mitigation measures would directly improve access to clean energy services for project or program beneficiaries. For example, the AHFC Weatherization Assistance Program & Energy Rebate Program would enable an additional 1,800 households to receive ratings. In addition, this program would allow households with incomes above the weatherization threshold, but who still struggle to pay for their own retrofits, to access the benefits and infrastructure provided under the program.

On the equipment side, the Southeast Conference Residential Beneficial Electrification Program would increase access to clean energy and home retrofit technologies such as high-quality heat pumps, ventilation, and insultation. Another example, the C-PACER Program to Support Seafood Processors in Unalaska features modernized equipment and heat-recovery projects to reduce downtime and productivity loss, leading to an overall improvement in service access.

Two of the GHG measures directly improve access to electric generation. The EVSE Installation Program would expand clean transportation access by strategically locating charging stations, especially in disadvantaged areas. The Community Electric Generation Projects include transmission and distribution projects that enable greater access and deployment of affordable, reliable, and emissions-reducing generation.

Additional Measure Level Analysis

1. Community Electric Generation and Transmission Upgrades

Upgrades to rural generation and distribution systems provide more stable, efficient, and affordable electricity, enabling consistent operation of critical community services. For example, improved microgrid performance reduces the likelihood of power interruptions that affect schools, clinics, and water treatment systems. Transmission upgrades along the Railbelt and in regional hubs (e.g., Bethel, Kotzebue, Nome) support the integration of new renewable resources and facilitate future grid interties, thereby extending reliable electricity access to communities currently dependent on aging diesel infrastructure.

Increased grid stability and lower fuel costs reduce reliance on emergency generator operation, improving the availability of public services while cutting operating expenses. Enhanced electrical reliability also supports communications and broadband infrastructure, as routers, cellular towers, and community data centers can operate more efficiently and continuously.

2. Renewable Energy Fund (REF) and Distributed Renewable Projects

REF-funded renewable projects such as wind-diesel hybrids, hydroelectric expansions, and solar-battery systems extend energy access to communities where diesel logistics constrain fuel availability. By providing consistent local generation, these projects prevent service interruptions due to weather-related fuel delivery delays. Reliable local energy supply ensures year-round access to health and emergency services, critical communications, and educational facilities.

These systems also reduce the need for scheduled fuel barge deliveries, improving transport access and safety—particularly for coastal and river communities that depend on limited summer delivery windows. Over time, renewable deployments enhance community autonomy, enabling consistent operation of essential infrastructure even when transportation routes are disrupted by storms or ice conditions.

3. Juneau Port Shore Power-Green Corridor

The Green Corridor project enhances access to port services for both cruise operators and local residents. Electrified dock facilities reduce engine noise and emissions in populated port areas, improving air quality for adjacent neighborhoods and reducing public health impacts that constrain outdoor activity. Beyond environmental benefits, shore power infrastructure strengthens port reliability by integrating local utilities and grid systems. This integration improves freight handling and transportation services, ensuring goods and supplies can move more efficiently through Alaska's maritime corridors.

Enhanced port infrastructure also enables future electrification of ferries and other marine vessels, supporting the Alaska Marine Highway System's long-term service continuity goals and improving transportation access for remote communities.

4. Statewide Electric Vehicle Supply Equipment (EVSE) Deployment

Expanding EV charging infrastructure improves mobility access by extending the range and reliability of electric transportation across Alaska's highway and regional road networks. For residents and visitors, expanded charging coverage between major hubs (Anchorage, Fairbanks, the Kenai Peninsula, and Southeast communities) facilitates travel for work, health care, and education. In smaller communities, public EVSE installations provide access to low-cost transportation for municipal fleets, health service providers, and school districts.

Reliable transportation access supports continuity of services such as home health visits, mail delivery, and emergency response. Over time, EVSE deployment would enable electrified logistics operations that improve supply chain reliability and reduce the costs of goods and services delivered to remote regions.

5. Building Efficiency and Electrification Measures

Building efficiency measures—including deep energy retrofits, weatherization, and the adoption of electric heat pumps—improve indoor air quality, comfort, and reliability of public service facilities. Schools, clinics, and administrative buildings benefit from stable indoor temperatures and reduced maintenance requirements, supporting year-round service delivery. In communities where heating system failures or fuel shortages have historically forced facility closures, improved building performance ensures continuous access to health, education, and civic services.

Electrification of heating systems in public facilities also supports the integration of renewable generation, allowing communities to leverage local power resources instead of imported fuel. This creates a more resilient network of service delivery points that remain operational during fuel disruptions or supply delays.

6. Methane Capture and Waste Diversion Initiatives

Methane capture and composting programs improve environmental health services and waste management capacity. By reducing landfill methane and leachate, these measures minimize contamination risks to water sources used for drinking, sanitation, and fisheries. Clean, stable water quality directly benefits community health systems and reduces the burden on local utilities to treat contaminated water.

In addition, composting programs support local agriculture and landscaping, increasing access to locally produced soil amendments and food. Enhanced local food systems contribute to community resilience by reducing dependence on imported goods and improving access to nutritious, affordable produce.

Cross-Sector Benefits: Reliability, Connectivity, and Resilience

Collectively, these measures enhance Alaska's infrastructure resilience and expand access to essential services through:

- Energy Security: Reliable power enables continuous operation of health care, communications, and education systems in both urban and rural areas.
- Service Continuity: Reduced dependence on fuel shipments lowers the risk of service disruptions caused by supply delays or weather conditions.
- Digital Inclusion: Stable and affordable power allows for greater broadband reliability, enabling access to telehealth, online education, and remote employment.
- Economic Fairness: Reduced energy and service delivery costs narrow the gap between rural and urban communities, improving fairness in access to state and federal resources.

Summary

Improved access to essential services is a fundamental community benefit of Alaska's energy transition. By strengthening the reliability, efficiency, and affordability of local energy systems, mitigation measures enable continuous delivery of health, education, transportation, and digital services across the state. In this way, Alaska's energy and environment investments not only reduce emissions but also build the foundation for more connected, self-reliant, and resilient communities.

IMPROVED COMMUNITY RESILIENCE

Implementation of greenhouse gas (GHG) mitigation measures under the Alaska Comprehensive Sustainable Energy Action Plan would substantially strengthen community resilience—defined as the ability of local governments, households, and organizations to anticipate, withstand, and recover from disruptions to energy, supply, and service systems. While emissions reduction is the primary objective, the same measures provide critical co-benefits that improve the stability, self-reliance, and adaptability of Alaska's communities in the face of economic, environmental, and operational challenges.

Community resilience in Alaska is deeply tied to energy reliability, affordability, and local control. Many communities—particularly rural and coastal—depend on imported fuel, single transportation routes, and aging infrastructure. Disruptions from severe weather, transportation delays, or price volatility can rapidly escalate into service interruptions or economic hardships. Mitigation measures that reduce fossil fuel dependence, diversify local generation, and improve efficiency directly enhance a community's capacity to maintain essential functions and protect public welfare under stress.

Mechanisms of Enhanced Community Resilience

<u>Energy Security and Reliability:</u> Diversified and modernized energy systems reduce the risk of extended power outages or heating failures. Integration of local renewable generation, advanced controls, and storage systems ensures communities can maintain essential functions even during transportation disruptions or grid instability.

<u>Economic Stability:</u> Lower and more predictable energy costs buffer households and institutions against global fuel price fluctuations. Reducing energy expenditures frees resources for health, education, and infrastructure, strengthening long-term fiscal resilience.

<u>Operational Continuity:</u> Improved building performance and electrification ensure that schools, clinics, and public facilities remain operational during extreme weather, cold snaps, or logistical interruptions.

<u>Local Capacity and Self-Reliance:</u> Community-based energy systems and efficiency programs build technical capacity, create local jobs, and embed skills necessary for system maintenance and repair, reducing dependence on outside labor or emergency assistance.

Measure-Specific Contributions to Community Resilience

1. AHFC Weatherization Assistance and Energy Rebate Programs

Weatherization measures—improved insulation, air sealing, and energy-efficient appliances—strengthen household and institutional resilience by reducing heating fuel requirements and improving indoor comfort during severe cold. In regions dependent on bulk fuel shipments, these programs lower the frequency of deliveries, reducing exposure to supply disruptions caused by storms, sea ice, or transportation delays. Households with weatherized homes are less likely to experience dangerous indoor temperatures during outages, reducing the risk of displacement or health emergencies. Energy savings also translate into greater economic resilience, allowing families to allocate more income to food, healthcare, and education during periods of high fuel cost volatility.

2. Public Building and Asset Weatherization, Energy Efficiency, and Beneficial Electrification Program

Upgrades to schools, clinics, emergency shelters, and administrative buildings improve thermal stability, reduce energy demand, and enable sustained service delivery during cold weather or disaster events. Electrification and controls provide redundancy by allowing facilities to operate on backup power systems or renewable sources. For example, integrating heat pumps or thermal storage allows critical-load maintenance during outages, ensuring continued operation of emergency shelters or communication centers. The program also extends asset life, reducing deferred maintenance liabilities that often constrain small community budgets.

3. Community Electric Generation and Transmission Projects

Local generation projects, particularly renewable or hybrid microgrids, are central to community resilience. By reducing reliance on imported fuel, communities gain energy independence and can sustain power supply even when barge deliveries or transportation routes are disrupted. Systems incorporating battery storage and intelligent controls can maintain grid stability during voltage fluctuations or generator failures. In regional contexts, modernized transmission lines and interties reduce line losses, improve grid efficiency, and create redundancies that mitigate the impact of localized outages. This improved reliability directly supports essential services such as water treatment, health care, and communications.

4. C-PACER Program and Industrial Energy Efficiency Measures

The Commercial Property Assessed Clean Energy and Resiliency (C-PACER) Program facilitates private-sector investment in building upgrades that enhance both energy efficiency and resilience. The Unalaska Seafood Processor Program, for example, integrates backup thermal capacity, load controls, and system redundancies that preserve critical operations during weather events or grid disruptions. Industrial and commercial resilience measures ensure the continuity of employment, maintain local food processing capacity, and protect supply chains that are vital to regional economies. Energy efficiency improvements within industrial facilities also reduce strain on local power systems, stabilizing service for surrounding communities.

5. Statewide Forest Carbon and Biochar Program

Forest management and biochar initiatives contribute to community resilience by reducing wildfire risk, protecting critical infrastructure, and preserving air quality. Wildfires pose a dual threat to communities: immediate risk to lives and property, and secondary impacts through power outages, transportation interruptions, and degraded air quality. Improved forest management—thinning, prescribed burns, and utilization of biomass for carbon products—reduces fuel loads and supports sustainable economic activity. Biochar production and soil enhancement also improve agricultural productivity and stormwater retention, contributing to food security and ecosystem stability.

6. Renewable Energy Fund and Distributed Generation Initiatives

Investments from the Renewable Energy Fund (REF) increase local generation capacity and reduce dependence on single sources of imported fuel. Projects such as wind-diesel hybrids, hydroelectric upgrades, and solar-battery systems provide operational flexibility and reduce vulnerability to global fuel market volatility. In several rural communities, REF projects have enabled continuous electricity during storm-related transportation disruptions, demonstrating the resilience value of locally controlled, modular energy infrastructure.

Broader Dimensions of Community Resilience

Beyond energy infrastructure, these measures reinforce social and institutional resilience by enhancing local control and building adaptive capacity:

- Public Health Protection: Stable, affordable heating and reliable power prevent exposure-related illness and ensure continuous operation of medical and public health facilities.
- Continuity of Governance and Services: Electrified and efficient public buildings serve as operational centers during emergencies, maintaining communications, coordination, and service delivery.
- Economic Resilience: Predictable energy costs, preserved industrial activity, and reduced maintenance expenses contribute to long-term community fiscal stability.
- Environmental Integrity: Programs such as the Forest Carbon and Biochar initiative maintain natural systems that buffer against extreme events, reducing community vulnerability to environmental degradation.
- Local Empowerment: Technical training, employment in energy projects, and ownership of local systems strengthen community agency and institutional knowledge—critical components of long-term resilience.

Summary

Collectively, the identified GHG mitigation measures transform Alaska's energy and infrastructure systems into more resilient, self-reliant, and economically sustainable community assets. By lowering dependency on imported fuels, stabilizing essential services, and reinforcing local capacity, these measures address the underlying factors that determine how communities withstand and recover from disruption—whether environmental, economic, or operational.

This approach to resilience aligns with Alaska's priorities for energy independence, public safety, and equitable development. As implementation proceeds, each measure contributes not only to emissions reduction but to the broader goal of ensuring that Alaska's communities remain secure, connected, and capable of adapting to future challenges.

CO-POLLUTANT REDUCTION ESTIMATES

Reducing pollutants like carbon dioxide and methane has the additional benefit of reducing co-pollutants such as nitrous oxide (NOx), sulfur dioxide (SO2), and carbon monoxide (CO). These reductions are impactful for both local and regional air quality. The following table, based on methods in the technical appendix, estimates the co-pollutant emissions reduction for the measures in this plan.

TABLE 61: Co-Pollutant Reductions for Identified Measures

Measure	NOx (kg)	SO2 (kg)	CO (kg)	VOC (kg)	PM10 (kg)	PM2.5 (kg)
AHFC EE Retrofit Rebates	22,622	2	4,713	283	1,885	1,885
AHFC Weatherization	46,770	4	9,744	585	3,898	3,898
ACES-AK (Coastal Heat Pumps)	28,936	3	6,028	362	2,411	2,411
Public Buildings	63,518	6	13,233	794	5,293	5,293
Mendenhall Wastewater Treatment Plant	743	0.066	155	9	62	62
Central Peninsula Landfill Methane Capture Project	2,561	407	11,677	21,471	-	-
SE Composting	2,517	400	11,472	21,095	-	-
Juneau Port Electrification	209,627	13,785	45,158	11,884	14,736	14,736
EVSE Program	19,265	993	11,701	24,820	1,182	1,182
Bradley Lake Expansion	709,309	65,434	-	-	29,576	29,576
Railbelt Grid Energy Projects	3,006,187	277,324	-	-	125,350	125,350
Remote, Islanded Electric Grids	840,336	55,260	181,025	47,638	59,071	59,071
DERA	4,384	0.389	913	55	365	365
AEA VEEP	10,313	678	2,222	585	725	725
AEA Rural Distribution	185,397	12,192	39,938	10,510	13,032	13,032
Renewable Energy Fund	95,752,537	6,296,652	0,626,964	5,428,148	6,730,904	6,730,904
LDES for Kotzebue	3,227	212	695	183	227	227
C-PACER for Unalaska	3,917	0.348	816	49	326	326
Hybrid-electric aircraft pilot	4,306	187	2,367	4,638	247	247
Landfill Gas CHP for Anchorage	639	1	164	1	24	24
SAF & Renewable Diesel Refinement	10,042,710	435,210	5,520,915	0,817,338	576,812	576,812
BESS for Unalaska	59,728	3,928	12,867	3,386	4,199	4,199
Seward Port Electrification	85,518	5,624	18,422	4,848	6,011	6,011
Emerging Energy Technology Fund	1,306,974	85,946	281,548	74,091	91,873	91,873
Building Codes	33	0.003	7	0.410	3	3
Statewide Oil to Heat Pump Conversion Incentive	156,807	14	32,668	1,960	13,067	13,067
Railbelt Industrial Energy Efficiency Challenge	2,151,397	141,475	463,453	121,961	151,232	151,232
Statewide Forest Carbon and Biochar Program	-	-	-	-	-	-
Methane Leak Detection and Repair (LDAR) Program	-	-	-	-	-	-

DISBENEFITS OF GHG MITIGATION MEASURES

Implementing greenhouse gas (GHG) mitigation measures in Alaska presents several challenges and disbenefits (negative trade-offs) due to the state's unique geography, economy, and existing infrastructure. Alaska's policy priorities emphasize continued resource development as well as energy reliability, affordability, and security for its residents. At the same time, the state and its communities operate under fiscal constraints and harsh environmental conditions. Below, we detail key disbenefits and challenges associated with GHG mitigation efforts in Alaska, keeping in mind the need for economic development, limited budgets, community impacts, and the overarching goals of dependable and affordable energy.

High Implementation Costs in Remote and Harsh Conditions

One major disbenefit of pursuing GHG mitigation in Alaska is the high cost of implementation, driven by the state's remoteness and extreme environment. Alaska's vast, rugged terrain and sparse road network make it logistically difficult to transport materials and equipment for clean energy projects. Many project sites are accessible only by air or seasonal barge, raising transportation and construction costs significantly. The short construction season (due to long, severe winters) further constrains project timelines.

These factors mean that building and maintaining renewable energy infrastructure or energy-efficiency upgrades is far more expensive in Alaska than in more temperate, connected regions. For example, routine operation and maintenance costs run higher in remote Alaskan locations due to the remote location and severe arctic environment. Similarly, extending transmission lines or other infrastructure to small, isolated communities entails high financing costs for relatively few beneficiaries, which is a significant barrier in Alaska. In short, the challenging geography and environment translate into steep upfront capital costs and ongoing expenses for GHG mitigation projects.

These high implementation costs create a strain on limited budgets. The State of Alaska has finite financial resources, and every dollar spent on new energy projects must compete with other urgent needs. Likewise, local and tribal governments in rural areas have very small tax bases and limited revenue, making it difficult for them to co-fund or maintain clean energy installations. Without outside grants or subsidies, many communities simply cannot afford the large capital investments required to replace diesel generators with renewables or to retrofit buildings for energy efficiency. This cost burden on public entities means that ambitious GHG mitigation measures could divert funds from essential services or require new funding sources. Overall, the remote and harsh conditions in Alaska inflate the cost of GHG-reducing projects and pose a significant economic hurdle to implementation; due to this higher cost, government support for all energy systems in Alaska is necessary to make projects possible.

Economic Dependence on Fossil Fuels and Transition Risks

Alaska's economy is heavily dependent on fossil fuels, which creates a major disbenefit or risk when pursuing GHG mitigation (which often involves reducing fossil fuel extraction and use). Oil and gas production has been the engine of Alaska's economy for decades, funding public services and providing employment. In fact, petroleum revenues historically supplied as much as 90% of the state's unrestricted General Fund in many years, and the oil and gas industry (directly and indirectly) accounts for roughly one-quarter of all Alaska jobs and about half of the overall economy. This means any rapid transition away from fossil fuels, if not carefully managed, could shock the state's economy. Without robust alternatives in place, curtailing oil and gas production would threaten significant job losses, both in the industry itself and in supporting sectors, and could shrink household incomes in regions that rely on oil and gas activity.

Crucially, Alaska's government finances are tied to the fossil fuel sector. Oil royalties and taxes feed the state budget and underwrite services like education, healthcare, and infrastructure. If those revenues decline without replacement, the state faces fiscal shortfalls that can harm public services. There is evidence of this vulnerability: after oil prices collapsed in 2014, Alaska experienced a budget crisis that led to steep cuts in spending. Governor Mike Dunleavy noted that "the price of oil has gone down; therefore, our revenue is going down," underscoring that Alaska "doesn't have enough money to pay for all of our obligations" when oil income falls. In the context of GHG mitigation, transitioning away from oil and gas could similarly result in reduced state revenue, unless new sources of income are developed (such as new industries or taxes). This could force painful cuts to essential services or infrastructure maintenance if not offset.

At the same time, many Alaskans' livelihoods and local economies depend on the fossil fuel industry. Entire communities (for example, on the North Slope and in the Kenai Peninsula) rely on oil and gas jobs and the local business activity they generate. Without comprehensive transition strategies—such as workforce retraining programs, economic diversification initiatives, and fiscal reforms to replace oil revenue—a pivot to low-carbon energy could leave many workers unemployed and communities economically distressed. The disbenefits here include the risk of economic disruption and social hardship in the short-to-medium term. In summary, Alaska's dependence on fossil fuels means that GHG mitigation measures, if not paired with strong transition support, carry the disbenefit of economic instability, including job losses, lower state income, and consequent reductions in public services. The findings of the workforce planning analysis help address this disbenefit.

Limited Energy Infrastructure in Rural Communities

A significant challenge for GHG mitigation in Alaska is the limited energy infrastructure in the state's many remote communities. Outside of the "Railbelt" (the relatively populated corridor from Fairbanks to Anchorage to the Kenai Peninsula), most Alaskan communities are not connected to any road system or centralized electrical grid. Approximately 200+ rural villages operate with isolated microgrids, nearly all of which rely on diesel-fueled generators for electricity (and often for heating via fuel oil). In fact, as of 2019, roughly 79% of all kilowatt-hours generated in rural Alaska came from diesel power plants.

Few alternatives exist in these areas: only two remote communities (Nuiqsut and Utqiaġvik/Barrow) have access to natural gas via pipeline from nearby oil fields—all others must import fuel. This heavy dependence on diesel means that energy costs in rural Alaska are extremely high (diesel is expensive to ship in, and generators are inefficient at small scale). The U.S. Energy Information Administration data show rural Alaskans pay 3 to 5 times more for electricity than the national average, and in some cases, even with state subsidies, communities face electricity rates of $0.50–$1 per kWh or higher.

The disbenefit here is that implementing renewable energy or other GHG-reducing measures in such rural settings is technically challenging and costly. Small, isolated grids have limited capacity to integrate intermittent renewables like wind or solar without advanced (and expensive) storage and control systems. Many of these villages also have aging infrastructure—old diesel generators, antiquated distribution networks, and minimal technical staff—which complicates the addition of new technologies. Simply delivering and constructing renewable energy equipment in remote villages (which might be accessible only by plane or summer barge) is logistically complex. For instance, constructing a wind turbine or solar array in a roadless village requires chartering special flights or barges for components, building local expertise to maintain the systems, and often maintaining a diesel backup for reliability.

All of this means the initial investment and ongoing maintenance costs for clean energy in rural Alaska are very high, often prohibitively so without external funding. Even energy efficiency upgrades (like weatherizing homes or installing heat pumps) face challenges: many rural homes are old and in poor repair, and contractors must be flown in to do the work, driving up costs. Thus, while GHG mitigation projects could greatly benefit rural communities by lowering long-term energy costs and pollution, the short-term disbenefit is the technical difficulty and expense of implementation in areas with limited existing infrastructure. Methods for navigating this disbenefit are found throughout this plan.

Social Risks, Vulnerabilities, and Fairness Considerations

GHG mitigation measures can also carry social disbenefits in Alaska related to issues of risk, vulnerability, and fairness. One concern is that the burdens of transition may fall unevenly on certain populations, exacerbating existing vulnerabilities. For example, rural and Indigenous communities in Alaska already endure some of the highest energy cost burdens in the nation—nearly 1 in 10 Alaskan communities faces an energy burden over 10% (i.e., households spending more than 10% of their income on energy bills). In Southwest Alaska, typical energy burdens reach ~12% of income, and for the lowest-income households statewide, energy costs can consume 22.9% of household income.

These figures are far above the U.S. average and reflect longstanding inequities (due to remote geography, reliance on diesel, and inefficient housing). Because so many families are already stretched thin by high energy bills, any emissions mitigation policy that raises consumer energy prices in the short run (for instance, a carbon price on diesel, or requiring expensive new equipment) would disproportionately hurt these households. In other words, without careful design, mitigation measures could increase the cost-of-living for Alaska's most vulnerable residents—an unfair outcome unless offset by subsidies or support.

High energy costs in rural Alaska are more than an economic inconvenience; they have profound implications for health, safety, and economic stability, as one analysis notes. Families facing unaffordable electricity or heating must make painful trade-offs (e.g., cutting back on food or medicine to pay for fuel), and frequent power outages or fuel shortages (common in remote villages) can threaten food storage, access to medical devices, and even life during extreme cold. This means any transitions that jeopardize reliability or affordability in these communities carry significant human risk.

Fairness considerations also arise in terms of who benefits versus who bears costs. Many remote Indigenous communities have contributed little to global GHG emissions, yet they risk shouldering high costs to convert their energy systems or adapt to new technologies. It is a question of inter-community and inter-generational fairness to ensure that Alaska's emissions reduction actions do not leave these communities worse off. The state does provide programs like Power Cost Equalization to alleviate rural electricity costs, but mitigation projects would require sustained investment to ensure remote areas are not left behind. Additionally, the workforce and regions currently benefiting from the fossil fuel industry are vulnerable during the transition.

If oil production is scaled down in the name of GHG reduction, workers on the North Slope and in petroleum support services stand to lose good-paying jobs. Many of these workers are based in urban centers like Anchorage or Fairbanks (or commute from elsewhere in the U.S.), but the revenues and economic activity from their work support public services and infrastructure statewide.

In summary, the risk is that without equitable strategies, GHG mitigation could impose higher costs or reduced services on Alaska's most vulnerable populations (rural, low-income, and Indigenous communities) and on workers in legacy industries, raising issues of fairness and potentially sparking resistance to such policies. Mitigation plans thus need to explicitly address these social dimensions to avoid unfair outcomes; this plan represents measures that strike this balance.

Regulatory and Permitting Challenges[86]

Even when there is political will and funding for GHG mitigation projects, regulatory and permitting processes can be a significant hurdle in Alaska. Large energy infrastructure projects—whether renewable energy installations, transmission lines, or even carbon capture and storage facilities—often require a web of approvals from local, state, federal, and sometimes tribal entities. In Alaska, many projects also occur on federal lands or waters (given the large federal land ownership in the state and the involvement of agencies like the Bureau of Land Management, National Park Service, etc.), which triggers federal environmental reviews (e.g., NEPA). The permitting timeline for major projects can be extensive, causing delays that are effectively a disbenefit (lost time and higher cost).

It's common for energy projects to spend years in the review process, navigating environmental impact statements, public comment periods, and potential legal challenges. A recent study by McKinsey found that across the U.S., more than 650 infrastructure projects were waiting on federal approval, and on average each dollar of capital expenditure took 4–5 years to move through the federal permitting process. This translates into billions of dollars of investment stuck in limbo, with delayed benefits (including delayed emissions reductions and energy improvements). Alaska is no exception—projects here can easily get "caught up in years of red tape" due to complex permitting requirements.

These regulatory delays are a disbenefit because they increase project costs (as developers must spend more on studies, consultants, and holding costs while waiting) and can deter private investment or federal funding if timelines seem too uncertain. The State of Alaska recognizes this challenge; Governor Dunleavy's administration has been actively working to streamline permitting.

In 2023, the state created an Office of Project Permitting and in 2025 signed a first-of-its-kind Memorandum of Understanding with the federal Permitting Council to expedite approvals. The goal is to coordinate early and avoid duplicative reviews so that important projects (whether renewable energy projects in rural villages or mining projects supplying materials for clean energy) aren't unnecessarily stalled. Nonetheless, as of now, anyone attempting a GHG mitigation project in Alaska must contend with a lengthy regulatory gauntlet. This includes environmental reviews to ensure wildlife, fisheries, and subsistence resources are protected—vital steps, but ones that add time and uncertainty.

There are also often regulatory gaps or misfits for new technologies; for example, there may not be clear rules for integrating offshore wind in Alaska's waters or for small modular nuclear reactors, which some see as a future solution. Navigating these complexities requires expertise and persistence, and smaller communities or developers may find it overwhelming. In short, permitting challenges pose a non-trivial disbenefit by slowing down the implementation of GHG mitigation measures and potentially jeopardizing timely achievement of emissions reduction goals, despite the state's efforts to reform the process.

Reliability, Affordability, and Energy Security Concerns

Finally, Alaska must weigh any GHG mitigation measures against the core concerns of reliability, affordability, and energy security—areas where poorly executed changes could create disbenefits. The state's leaders have repeatedly emphasized that keeping energy dependable and affordable is the top priority. As Governor Dunleavy stated when forming the Energy Security Task Force, even though Alaska is an energy producer, "the cost of energy in Alaska, especially in our rural communities, is extremely high," and global events can threaten supply, so the goal is to "secure dependable and affordable energy for Alaskan residents".

Similarly, the Alaska Energy Authority's mission centers on improving energy safety, reliability, and affordability for all communities. These priorities highlight a potential disbenefit of certain GHG mitigation strategies: if a mitigation measure compromises the reliability of energy delivery, makes energy noticeably more expensive for consumers, or reduces the security of Alaska's energy supply, it would be unacceptable to policymakers and the public.

One concern is electrical reliability. Many renewable energy sources (solar, wind) are intermittent and must contend with Alaska's unique environment. For instance, solar power output is negligible during the long dark winters in northern Alaska, and wind turbines can face icing or mechanical stress in extreme cold and storms. If Alaska rapidly increases its reliance on intermittent renewables without sufficient battery storage, backup generation, or grid upgrades, there is a risk of power instability or outages—a serious issue in a state where winter power loss can be life-threatening.

Small grids (as in rural areas) are especially sensitive: integrating renewables past a certain threshold requires advanced controls to keep frequency and voltage stable. Thus, a disbenefit of pushing renewables could be grid reliability challenges, requiring expensive mitigation (like energy storage or maintaining diesel generators as backup) to avoid blackouts.

Affordability is another key consideration. While renewable energy can lower operational costs in the long run (e.g., no need to buy diesel fuel), the transition period might see higher costs. If the state implements measures like carbon pricing, renewable portfolio standards, or requires new emissions-control equipment, these could raise the cost of electricity or fuel in the short term. Given that Alaskans already pay high energy bills (especially in rural areas), any further increase could be burdensome. The state would not want to impose policies that cause electric rates or gasoline prices to spike dramatically. From the state's perspective, mitigation measures should ideally align with lowering energy costs, not raising them. If certain GHG mitigation options are too expensive and drive-up rates, that is a disbenefit that could undermine public support for emissions reduction actions.

Finally, energy security—the assurance that Alaska has stable, secure sources of energy—is a critical factor. Ironically, as a major oil producer, Alaska's internal energy supply is not as secure as one might think: the Railbelt region faces a looming natural gas shortage as Cook Inlet gas fields decline, and rural areas depend on fuel deliveries that can be disrupted by weather or global price swings. The war in Ukraine's effect on global fuel prices was cited as a reminder of Alaska's vulnerability to outside events.

The state's energy security strategy includes developing local resources (renewables, gas, perhaps nuclear or imported LNG) to ensure resilience. In this context, a poorly managed move away from local fossil fuel production could hurt energy security. For example, if Alaska curtailed oil production but then needed to import more fuel from elsewhere for its own use, it might become more exposed to external supply disruptions. Likewise, if the state doesn't invest in domestic clean energy and efficiency, rural communities will remain dependent on imported diesel whose supply and price are not guaranteed. Thus, any GHG mitigation plan must avoid creating new dependencies or single points of failure in energy supply.

The disbenefit to avoid is a situation where Alaska's energy becomes less secure—whether through over-reliance on one energy source, inadequate backup for renewables, or lack of diversity in generation. The challenge (and measure of success) is to reduce emissions while strengthening reliability and keeping energy affordable. Failure to do so would pose both practical and political problems for Alaska's energy strategy. Maintenance of diesel power systems for backup is a common method for offsetting this disbenefit.

Summary

In conclusion, while there are many benefits to mitigating greenhouse gas emissions, in Alaska these efforts come with significant trade-offs or disbenefits that must be navigated. High costs in a tough environment, potential economic disruption due to fossil fuel dependence, infrastructural and social challenges in remote communities, regulatory hurdles, and critical needs for reliability and affordability all complicate the picture. Any GHG mitigation measures for Alaska need to be tailored to its unique context—balancing emissions reduction with the State's priorities of resource development, economic stability, and energy security. By acknowledging these disbenefits upfront, policymakers can work to minimize them (for example, by securing funding to offset high costs, investing in workforce transition programs, ensuring equitable outcomes for vulnerable communities, streamlining permitting, and reinforcing grid reliability). Ultimately, Alaska's path forward will involve carefully managing these challenges to achieve emissions reduction goals without undermining the very foundations of the state's economy and well-being.

IX. GOVERNMENT POLICIES AND REGULATIONS

Alaska enters this Climate Pollution Reduction Grant (CPRG) planning process with a strong foundation of legal authority, technical expertise, financial capacity, and equity commitments needed to implement and track the greenhouse-gas (GHG) reduction strategies identified in the CSEAP. State agencies, including the Alaska Energy Authority (AEA), the Alaska Housing Finance Corporation (AHFC), the Department of Environmental Conservation (DEC), and partner municipal and Tribal governments, possess the statutory authority to design, fund, and implement the mitigation measures outlined in this plan.

These agencies also maintain robust technical frameworks, including established data systems, monitoring protocols, and engineering expertise, which enable accurate quantification of energy savings and emissions reductions. Complementary financial mechanisms—such as the AEA Renewable Energy Fund, AHFC weatherization and rebate programs, and state match programs—provide pathways to braid CPRG dollars with federal and private funding.

Together, these legal authorities and implementation frameworks provide Alaska with the capacity and accountability structure necessary to carry out the mitigation measures outlined in the CCAP, monitor and verify results, and report progress transparently to the U.S. Environmental Protection Agency (EPA) and the public.

Review of Authority[87]

Alaska Housing Finance Corporation

AHFC is a quasi-state entity that makes mortgages accessible to Alaskans and provides affordable housing and energy efficiency programs. AHFC's mission is to provide Alaskans with access to safe, quality, affordable housing. AHFC delivers a variety of programs to meet this mission, including the development of building codes. AHFC has administered several code processes and programs since 1992, making the organization uniquely qualified to perform the tasks required for this project. AHFC established the Building Energy Efficiency Standards (BEES) to promote the construction of energy-efficient buildings. AHFC facilitates training and education for Energy Raters and Home Inspectors to become certified to sign off on BEES compliance. As an enforcement tool, AHFC has established a process for state inspectors to conduct inspections during the construction of new homes that AHFC finances. Internal auditing and quality control policies and procedures have been developed and followed to ensure compliance.

AHFC's authority to implement the Weatherization Assistance Program, along with other energy efficiency programs, comes from Alaska Statute 18.56.850, which is part of Alaska Housing Finance Corporation's larger enabling legislation—AS Chapter 18.56.

AHFC is Alaska's agency implementing the Department of Energy's two Home Energy Rebate programs, including the Electrification and Appliance Rebate program, which offers point-of-sale rebates for electrification improvements to help households prepare for a successful solar installation. The program includes up to $4,000 for a load center/service panel upgrade and up to $2,500 for household wiring upgrades. AHFC works with an established network of professional energy raters and building inspectors to administer its Home Energy Rating System and its Building Energy Efficiency Standards on any home financed by AHFC (such as those through its tax-exempt first-time homebuyer and veterans' loans for income-qualified households). AHFC anticipates being able to leverage its weatherization program, allowing solar installation to occur alongside broader residential improvements.

At the same time, AHFC has a variety of program experiences that have established its methodology for customer acquisition. AHFC developed and administered the U.S. Treasury's COVID-19 Emergency Rental Assistance and Homeowner Assistance Fund Programs, providing the critical infrastructure that allowed all Alaskans to check their eligibility and apply through a single portal. The process pooled resources from Anchorage, Alaska's largest city, and tribal entities, resulting in an efficient application process for Alaskans and allowed AHFC and its partners to evaluate applications and issue payments quickly. This effort resulted in a national award in 2022 for management innovation from the National Council of State Housing Agencies, as well as first-place communications awards in the categories of community relations and special electronic and printed promotional materials from Alaska's Public Relations Society of America.

Alaska Energy Authority

The Alaska Energy Authority (AEA) is an independent and public corporation of the State of Alaska. 1976, and is governed by a board of directors with the mission to "reduce the cost of energy in Alaska." AEA is the State Energy Office and the leading agency for statewide energy policy and program development. AEA's core programs aim to diversify Alaska's energy portfolio, lead energy planning and policy, invest in Alaska's energy infrastructure, and provide technical and community assistance to rural Alaska. AEA's enabling legislation, which includes the authority to implement the programs described in this plan, is found in AS Chapter 44.83.

The impact of AEA's programs extends to the construction of rural power generation and bulk fuel facilities, distribution systems and transmission lines, renewable energy asset construction and integration, as well as ad-hoc maintenance and improvement of aging infrastructure. Rural Electric Utility Workers continuously travel to rural communities to administer itinerant training to rural utility operators and diligently maintain an inventory and assessment record for nearly every rural powerhouse in the state by conducting comprehensive on-site assessments. This record informs the powerhouse construction schedule and ensures alignment with community needs.

AEA is committed to advancing and sustaining rural power systems across rural Alaska and commenced the construction of powerhouses for rural and tribal communities upon its inception in 1976. Since then, AEA has impacted power generation systems and collaborated with stakeholders from nearly every community in the state to provide supply and demand energy services. In the past two years, AEA has overseen ten rural powerhouse upgrade projects at different stages of development in the communities of Akhiok, Napaskiak, Nikolai, Venetie, Rampart, Nelson Lagoon, Manokotak, Circle, Akiachak (DERA), and Arctic Village (DERA). AEA maintains a strong commitment to delivering energy improvements for communities and often seeks additional project funding beyond what is provided by the Denali Commission and the State. Recently, AEA sought funding on behalf of the communities of Napaskiak and Nelson Lagoon through the USDA High-Cost of Energy program and the Aleutian Pribilof Island

Community Development Association's Infrastructure Fund to support rural powerhouse construction projects. AEA was awarded over $3 million through these efforts. Relationships and partnerships are established with all Alaska energy stakeholders, including small rural nonprofits and utilities, large regional and village Alaska Native Corporations and tribal governments, conservation organizations, municipal governments, and technology- or solution-oriented working groups. Many organizations contribute to the development and support of infrastructure in rural Alaska, including DOT&PF, which is responsible for airport infrastructure, ANTHC, focused on water and sanitation, local school districts, which support K-12 public school facilities, and others. However, when it comes to rural energy infrastructure, AEA indisputably takes the leading role.

As the market progresses toward a clean energy future, AEA's efforts have adapted accordingly. Rural utilities and powerhouses that were once exclusively powered by diesel are now seeking transitions to solar energy solutions. This shift demands careful consideration. Diesel generators in rural communities are sensitive to load fluctuations, as they can impact the efficiency of the gensets, and excessive fluctuations can result in damage to the diesel generators, which serve as the backbone of the rural microgrid. Integrating renewables into diesel microgrids is a complex undertaking that requires the expertise of qualified and responsible entities with a track record, such as AEA's, of reliable energy infrastructure deployment across the state.

Between 2008 and 2023, the state legislature appropriated $317 million for Renewable Energy Fund (REF) grants, which AEA has managed. Those state monies leveraged over $250 million in private and federal funds to complete project funding. AEA manages the REF in coordination with a nine-member REF Advisory Committee. The program provides grant funding for the development of qualifying and competitively selected renewable energy projects. Since its inception, 289 REF grants have been awarded and funded via legislative appropriations totaling $317 million. These funds have been matched by local and private contributions that have leveraged AEA's investment. One hundred three operating projects have been built with REF contributions, collectively saving more than 85 million gallons of diesel and 2.2 million cubic feet of natural gas since the REF's inception. These investments have resulted in the reduction of 1,110,424 gross metric tons of carbon dioxide since 2008.

AEA has identified nearly a dozen projects that have the engineering and planning already in place to move quickly into construction, if funded. AEA is an active participant in many of the projects, including serving as project manager. The completed studies have shown that many of the projects are viable and ready for implementation. Disadvantaged communities would benefit directly and indirectly from the project's outcomes. By inclusive engagement in project development, scoping, and implementation, disadvantaged communities would be exposed to learning opportunities that would enable them to improve current practices and policies. Upon completion, the projects would provide public health and safety benefits to communities. AEA is engaged in all aspects of consumer energy, from project and resource identification to design, financing, and maintenance. Over the course of decades of experience developing energy projects in Alaska, AEA has continually improved its processes, technology applications, and service delivery. AEA integrates energy technology and advances in grid services into all program areas, both on the supply and demand sides of the energy market.

Diesel Engine Replacement/Rural Power System Upgrades/Distribution Upgrades

The agency works towards that goal by administering a variety of statewide programs, including the Rural Power System Upgrade program (RPSU), the Bulk Fuel Upgrade program (BFU), and the Renewable Energy Fund (REF), which integrates renewable energy into generation facilities. AEA also administers end-use efficiency grants, educational programs, and technical assistance programs that train local operators to monitor their local diesel-based power plants and maintain efficient operations. Per the AEA Bylaws, included in Supplemental Materials, and Alaska Statute 44.83.080 subsection 10, AEA has the legal authority to receive funds and grant them to sub-recipient utilities.

Under 3 AAC 108.100 – 130, the Alaska Energy Authority's Rural Power Systems Upgrade (RPSU) program may provide financial assistance and technical assistance, including construction management and training, to eligible recipients.

AEA consults with the Alaska Department of Environmental Conservation (ADEC) Division of Air Quality to ensure compliance with applicable emissions regulations. ADEC requested that AEA take over as the lead granting authority to administer Alaska's State Clean Diesel Program, as per the letter from State Commissioner Larry Hartig to Gina McCarthy, dated April 15, 2016. EPA approved this request by letter dated May 11, 2016.

Village Energy Efficiency Program (VEEP)

Regulations for this program can be found in Title 3 of the Alaska Administrative Code, specifically sections 3 AAC 108.400 – 3 AAC 108.499.

Electric Vehicles

In 2018, Alaska was chosen as a beneficiary of the Volkswagen (VW) Environmental Mitigation Trust, and the Governor's Office appointed AEA to lead the state's efforts in electric vehicle (EV) planning and execution. At that time, AEA adopted a secondary mission to reduce barriers to EV adoption. AEA has taken the leading role in developing and implementing the NEVI program.

Since the designation of AEA as the State's lead agency for EVs by the Governor's Office, AEA has conducted public outreach and education and has worked towards reducing range anxiety by strategically installing EV chargers. In 2020, AEA facilitated the development of the AKEVWG, comprising representatives from utilities, state and local governments, researchers, EV owners, and stakeholder industries. AEA's experience administering the VW Settlement grants for DCFC in Alaska provides the agency with the necessary background and expertise to implement the NEVI program.

AEA developed the State of Alaska Electric Vehicle Infrastructure Implementation Plan in collaboration with the Alaska Department of Transportation and Public Facilities (DOT&PF).

Department of Early Education & Development

The Department of Early Education & Development maintains several programs related to the financing of school construction and maintenance, both for the REAA school districts established by AS 14.08.031(a), which receive most of their revenue from the department, and for municipal school districts. The major maintenance program referenced in this plan was established by AS Chapter 14.11.

Department of Transportation & Public Facilities

The Alaska Department of Transportation and Public Facilities (DOT&PF) has clear statutory authority under Alaska law to plan, design, construct, own, operate, and maintain transportation infrastructure projects. Specifically, AS 19.05.010 assigns DOT&PF responsibility for the state highway system, and AS 44.42.020 empowers the Department to oversee all state transportation modes and facilities, including highways, railroads, docks, and airports.

For the proposed Sustainable Aviation Fuel (SAF) plant project, DOT&PF's existing authority encompasses the planning, permitting coordination, and infrastructure development activities required. No new statutory authority is anticipated. However, implementation may require supplemental administrative approvals or interagency agreements related to land use, environmental permitting, or utility interconnections, depending on final project design and siting.

In addition to DOT&PF, successful implementation of this project may involve partnerships with:

- State agencies such as the Alaska Energy Authority (AEA) and Department of Environmental Conservation (DEC) for permitting, environmental review, and energy program coordination.

- Federal agencies including the Federal Aviation Administration (FAA), Federal Highway Administration (FHWA), and the U.S. Department of Energy (DOE) for funding opportunities, regulatory guidance, and compliance with SAF standards.
- Private-sector partners such as fuel off-takers, technology providers, and engineering, procurement, and construction (EPC) contractors.
- Local communities and ANCSA entities for stakeholder engagement, land use coordination, and workforce development.

DOT&PF has established an MOU with the Matanuska-Susitna Borough (MSB) for use of land space at Port MacKenzie, an area owned by the MSB, for the siting of the bio-refinery which would be used for synthetic fuel production.

Other State Agencies

This plan identifies priority measures for improving energy efficiency in facilities under the purview of the University of Alaska and the Department of Transportation & Public Facilities. These agencies receive their authority from various areas of the Alaska Statutes. These agencies would implement their measures as a part of their regular facilities and operations obligations and authority.

Alaska Municipalities and Tribes

Most microgrids in Alaska are operated by local utilities, with over 100 certificated utilities active in the state, each serving a relatively small population. This stands in contrast to the continental U.S., where most microgrids are deployed by third parties serving critical facilities (such as military bases) and commercial and industrial customers. While nearly two dozen electric utilities in Alaska are municipally owned, cooperative utilities are the predominant model in Alaska, a feature that aligns with much of the world's utility structures, which lean toward non-profit and government entities.

Since Homer completed the state's first Climate Action Plan (CAP) in 2007, there have been four other communities that have worked to produce CAPs and their associated emissions inventories. Of those, only three have been finalized and approved by their respective governing bodies. In addition to CAPs, several other common planning documents share certain characteristics. These communities first adopted CAPs in the following years: Homer (2007), Juneau (2011), and Anchorage (2019). Additionally, these communities completed work towards a CAP without reaching final adoption: Sitka (2010, restarted in 2020); Fairbanks (2007, restarted in 2019); and Pedro Bay (2022).

Though Juneau's 2011 Climate Action Plan remains relevant, staff attention and resources for emissions reduction actions within the City & Borough of Juneau are largely being allocated via structures that have emerged since the adoption of the plan: namely, via the Juneau Renewable Energy Strategy, a new Sustainability chapter of the Comprehensive Plan, and the ongoing actions of the Juneau Commission on Sustainability (JCOS).

Of the three adopted plans, Anchorage has the most recent. The municipality's plan focuses on co-benefits for public health, the workforce, and vulnerable communities.

In the three communities that have adopted plans, progress has been made and reported in various ways. In Homer, a 2022 Story Map from their Public Works Department relates the progress; In Anchorage, annual reports through 2021 are available; and finally, in Juneau, updated actions have been named in their Renewable Energy Strategy, and the Juneau Commission on Sustainability (JCOS) has been tasked with continuing stewardship of the plan.

Time and governance shifts make it difficult to look to these adopted plans as the primary source for potential GHG reduction projects: in Homer and Juneau, the actions enumerated in the original CAP have largely been implemented, and in Anchorage, the implementation of their CAP has largely been unstaffed and de-emphasized by the current mayoral administration.

The Fairbanks North Star Borough (FNSB) has undergone two separate, incomplete processes aimed at developing a climate action plan. The first process, initiated in 2007, was based on ICLEI, followed by the most recent process, which began in 2021 and reached an impasse in June 2023.

Sitka also has seen two start-and-stop efforts to develop a climate action plan. The most significant effort was initiated through a municipal Climate Action Task Force, which has since folded its work into the newly formed Sustainability Commission. Further action to develop a Sitka CAP is currently pending as the Task Force has been disbanded, and advocates for the plan are no longer involved.

Proposed Actions – Due to the greater ease in accomplishing them legally and politically, local CAPs often prioritize actions affecting municipal facilities and operations. This is highlighted in Homer's CAP, which only covers measures for implementation by the city without "specifically instructing" other actors.

Early plans, such as those of Homer and Juneau, tend to have a narrower, short-term focus compared to those drafted more recently, like those in Fairbanks and Anchorage. A more holistic, sector-based approach to identifying top actions is employed in these plans, which often incorporate longer-term, adaptation-based measures in addition to the more straightforward, short-term municipal actions—this is evident in Anchorage's plan.

Related Planning Documents – Many rural communities have Strategic Energy Plans, which set renewable generation goals. The Office of Indian Energy promulgates standard guidance and provides technical assistance in creating these plans; however, access to them is conditional and on a case-by-case basis, as they contain confidential, proprietary information belonging to the entity (primarily tribal governments and Native corporations) that completes them.

There has been a substantial degree of adaptation planning across Alaska in recent years. While outside the scope of this memo, those interested can find additional resources through the Alaska Center for Climate Assessment and Policy and the University of Oregon. Hazard mitigation planning, which is often a requirement for FEMA funding in many localities, may lead communities to consider similar efforts to those in adaptation planning. While these don't pertain directly to GHG reduction measures, there may be helpful overlap between proposed adaptation measures and CPRG projects—e.g., identifying measures that both increase community resilience and reduce emissions in these communities.

Developing a climate action plan in a small community is a challenging undertaking that is significantly limited by the available expertise within the community. The three adopted climate action plans all have long lists of contributing technical & planning organizations, which enabled them to complete their work successfully. Emissions inventories are one of the more time-consuming technical requirements which has slowed the process in communities like Sitka.

Ultimately, specific authority varies for each municipality; however, for the measures relating to local governments described in this plan, authority stems clearly from existing powers and obligations.

Federally Recognized Tribes and Other Tribal Entities

Many of the tribal governments in Alaska received CPRG planning grants, with most of the work being completed via consortia. As an example of the approaches being taken in these plans, ANTHC's CPRG work plan names three priority sectors: 1) Electric generation, 2) Residential energy efficiency, and 3) Non-residential energy efficiency. These priorities, informed by ANTHC's close work in communities, have been reflected in the approach and development of this plan.

While Comprehensive Climate Action Plans (CCAPs) are being completed by ANTHC and other grantees for approximately 157 tribal governments, there are some small gaps in this coverage, especially in more urban communities. As it does with municipalities not explicitly named, this plan includes measures that may be implemented by interested tribal governments that are not covered under another such plan. Tribal government authority varies, though the measures described fall under their general obligations and powers.

Cross-Jurisdictional Coordination

Successful implementation of Alaska's CSEAP will require deliberate coordination among state agencies, federally recognized Tribes, and municipal governments to avoid duplication of effort, improve efficiency, and maximize the impact of federal CPRG funding.

Building on the relationships described in this chapter, AML would establish a joint implementation framework that:

- Formalizes Roles and Data Sharing – AEA, AHFC, DEC, DOT&PF, and other state agencies would enter memoranda of understanding (MOUs) with municipal governments and Tribal consortia to share emissions data, cost estimates, and project status updates.
- Prevents Redundancy and Reduces Costs – Coordinated project planning and shared procurement would help align funding applications, reduce administrative overhead, and prevent multiple entities from competing for the same CPRG or complementary federal grants.
- Supports Tribal–Municipal Partnerships – Tribes and municipalities would be encouraged to form joint applications for CPRG Implementation Grants and to pool resources for regional projects such as microgrid upgrades, weatherization programs, and community-scale renewable generation.

This coordination framework would be integrated into AML's CCAP, enabling EPA to clearly see how state, tribal, and municipal authorities would collaborate to implement, monitor, and report GHG-reduction measures, while safeguarding public funds and accelerating emission reductions.

Monitoring, Reporting, and Verification (MRV) for CPRG Compliance

EPA's Climate Pollution Reduction Grant (CPRG) program requires each Comprehensive Climate Action Plan to describe how greenhouse-gas reductions would be tracked and reported. To complement the overview of agency roles and statutory authority, this chapter introduces a defined MRV framework that aligns with CPRG reporting requirements.

- <u>Agency-Specific Protocols:</u> Each implementing agency would either reference its existing MRV system or, where protocols are not yet in place, the agency responsible would identify the gap and a timeline for developing the necessary data systems.
  - AHFC is encouraged to report annual energy savings and emissions reductions from weatherization and rebate programs through its Alaska Retrofit Information System (ARIS).
  - AEA is encouraged to aggregate project-level data from the Renewable Energy Fund, Village Energy Efficiency Program, and EV infrastructure programs using its established grant reporting databases.
  - DOT&PF, DEED, and other facility-owning agencies are encouraged to track fuel and electricity use for public buildings through utility billing and performance contracting records.
  - Municipal and Tribal governments are encouraged to document reductions from local projects using standardized templates provided by AML.
- <u>Data Collection Responsibilities:</u> AML would serve as the central coordinator to compile agency reports, ensure consistent emission-factor assumptions, and provide technical assistance to municipalities and Tribes.
- <u>Statewide Reporting Platform:</u> All agency data would roll up into a statewide CPRG reporting platform maintained by AML and the Alaska Department of Environmental Conservation (DEC). This platform would aggregate annual $MTCO_2e$ reductions, co-pollutant benefits, and community benefits metrics for submittal to EPA.
- <u>Timelines:</u> Agencies would provide annual updates to AML by March 31 of each year to meet EPA's CPRG reporting deadlines.

This MRV framework ensures that every mitigation measure can be tracked, verified, and reported transparently, demonstrating to the EPA that Alaska has the institutional capacity to measure progress toward its CCAP targets.

Current Statutory and Regulatory Conditions

Alaska's state energy policy aims for 80% renewable energy utilization in power production by 2040. However, the state has been hindered in meeting this goal due to resource constraints that have limited available funding at the State level. Leveraging federal funding would significantly overcome this hurdle and lead to a transformation that moves Alaska communities closer to this goal than otherwise possible.

Power Cost Equalization

Given the geographically dispersed locations of Alaska's rural communities, electric rates are frequently three to five times greater than those incurred by customers residing in urban areas of the state. AEA, along with the Regulatory Commission of Alaska (RCA), administers the Power Cost Equalization (PCE) program to provide economic assistance and reduce the effective electric rates for rural consumers to those in urban areas of the state. The PCE program serves 82,000 Alaskans in 193 communities that are largely reliant on diesel fuel for power generation. It provides payments to households in high-cost energy communities to effectively lower residential energy costs, up to 750 kWh per month.

Adoption of clean energy projects in Alaska on a substantial scale faces multiple market barriers, both common to the rest of the nation and specific to the state. Barriers such as net metering, third-party ownership (TPO), obscure interconnection processes, and renewable portfolio standards (RPSs) all exist here as they do across the country. Additionally, the substantial variance in seasonal generation and the astronomical cost of installation for remote communities pose geography-specific problems.

Net Metering

The prevailing net metering legislation established by the Regulatory Commission of Alaska (RCA) dictates that all utilities under its economic jurisdiction must provide net metering options to their customers, provided that the total nameplate capacity of all net metering participants does not exceed 1.5% of the previous year's average retail demand. Utilities with annual retail power sales of less than 5,000 MWh or those generating electricity entirely from approved renewable sources are exempt from this requirement.

Several leading utilities in the Railbelt region, notably Chugach Electric Association (CEA) and Golden Valley Electric Association (GVEA), offer net metering limits exceeding the RCA's cap, extending up to 5% of average retail demand. Homer Electric Association (HEA) goes even further, allowing up to 7%. Meanwhile, Matanuska Electric Association (MEA) has not set a specific limit on net metered capacity. Currently, it operates at approximately 3% of retail demand, with no recent refusal of new net metered capacity applications, according to the latest RCA filing. Payment for net metering is made monthly through bill credits, which are determined by each utility's non-firm avoided cost rate, registered quarterly with the RCA. These credits have no expiration date and can be applied to subsequent monthly bills. Individual net metered systems must have a nominal capacity between 400 W and 25 kW. Utilities are prohibited from imposing additional fees, such as standby, interconnection, or capacity charges, unless approved by the RCA.

Utilities can limit the net metering amount if it causes stability or operational issues. In the event of a decrease in retail sales, resulting in the net metering amount exceeding the 1.5% limit, utilities are prohibited from disconnecting the metering of a member. The utilities can require net metering customers to have insurance, provided they are attainable and reasonably priced.

The RCA has not instituted statewide mandates regarding the implementation of virtual net metering or other aggregate/alternative net metering policies. In 2019, the RCA rejected a utility-sponsored proposal for a community solar project, citing specific details regarding the plan's subscription policies. However, they expressed support for innovative renewable energy programs and emphasized that this decision did not set a precedent for community solar. CEA and GVEA have expressed interest in revisiting community solar projects to address the issues raised in 2019. Various public interest groups are actively engaging with the legislature and drafting legislation to encourage and facilitate community solar initiatives. In Senate Bill 152, the state legislature codified the RCA's authority to make rulings on community energy producers, thereby strengthening the existing language regarding small power producers.

Third-Party Ownership

The RCA has made no explicit rulings regarding third-party ownership (TPO). Insofar as small power production facilities are concerned (as would be the case for a community solar installation), the Alaska Administrative Code (AAC) utilizes the definitions for a qualifying facility laid out in 18 C.F.R. 292.101(b). It has protections and guarantees that require RCA-regulated utilities to offer interconnection. Specifically, for any electric utility subject to RCA regulation, interconnection must be offered to a qualifying facility so long as it doesn't cause the utility to become subject to federal regulation under the Federal Power Act (interstate operation) and so long as the qualifying facility complies with safety and reliability standards prescribed in 3 AAC 52.485. This regulation also provides for financing options regarding interconnection fees outlined in 3 AAC 50.760 d/e. The utility can charge interconnection fees, including: the reasonable cost of connection, switching, metering, transmission, distribution, safety provisions, administration, and other costs related to the installation and maintenance of the physical facilities necessary to permit interconnected operations, to the extent that these costs are in excess of the costs that the utility would have incurred if it had not engaged in interconnection. Additionally, the utility must offer the option to pay these fees over a reasonable period of time, with an interest rate specified in their tariff or in a special contract between the qualifying facility and the utility, subject to RCA approval.

In sum, there are protections for third-party ownership, at least of community-scale renewable generators. TPO, as it pertains to rooftop residential solar, would likely be considered individual net metered capacity, with the ownership of the panels and power being a separate issue to be defined by the respective parties, thus outside the purview of RCA. While the regulatory framework doesn't provide explicit support for installations of either type, it at least protects their right to connect and sell power to the grid. As demonstrated by the recent opening of the 8.5 MW solar farm in the Mat-Su Borough by a third party, there is interest from the Railbelt utilities and general support from the RCA, as well as a legislative framework, to add renewable generators. Multiple successful implementations of rural solar IPP systems indicate their viability from regulatory and utility perspectives.

Interconnection processes are not regulated on a statewide basis. Streamlining this is a significant opportunity to reduce the barriers for residential rooftop applications. All four Railbelt Co-ops offer applications and supplementary information via their websites with varying degrees of complexity. CEA has a clause in its application that allows for a combination of some required system drawings and streamlining of approval procedures for "type-tested" or previously approved and installed system designs. Project partners would seek the implementation of similar language by the other Railbelt utilities. For the residential portion of the program, AHFC would provide a standardized system design for households and utilize this language to expedite the approval process, thereby substantially enhancing approval and installation rates. Regarding the rural portion of the program, interconnection would be protected by the RCA rulings related to small power-producing facilities. Grid stability is a significant concern in these scenarios, and early communication and involvement with local utilities would facilitate successful solar integration.

Renewable Portfolio Standard

While there is currently no binding statewide renewable portfolio standard (RPS) in Alaska, pending legislation is considering the implementation of Renewable Portfolio Standards or Clean Energy Standards for the state. These bills propose renewable generation targets of 25% by 2027, 55% by

2035, and 80% by 2040 for Railbelt utilities, which currently operate at approximately 15% renewable generation. The state's overall renewable portfolio is bolstered to around 25% by various small-scale hydro-power projects in southeast Alaska. Notably, any net-meter capacity is currently included in the utilities' generation statistics, potentially incentivizing utility collaboration and investment in distributed solar projects.

Statewide Building Code

Currently, Alaska is one of eight states that do not have a statewide building code. This has left Alaska behind in many important areas, including public health and safety, building resilience, and environmental impacts. The development of a code adoption process would pave the way for the state to identify and overcome the obstacles to code adoption, leading to a better-built environment. As a state without a statewide building code, local jurisdictions are responsible for selecting, setting, and enforcing building and energy codes, if any, within their boundaries. Not all jurisdictions have adopted energy codes, and none are more current than the 2018 International Energy Conservation Code. This diversity, at various levels, results in less-than-effective processes for developing and implementing building and energy codes, presenting a set of unique challenges.

Electric Vehicles

In 2018, Alaska's governor selected AEA to oversee the state's portion of the Volkswagen (VW) Settlement Environmental Mitigation Trust. Through a public process, AEA created a beneficiary mitigation plan, which provided funding for the electrification of certain vehicles and $1,250,000 for the installation of EV charging stations, serving as the primary source of matching funds for this project.

AEA included EVs as a market title for the federal State Energy Program (SEP) funds in 2018. Associated work includes EV outreach and education, the installation of Level 2 charging stations in coordination with the Department of Transportation and Public Facilities (DOTPF), and ongoing assessment of barriers to adoption. AEA has hired a contractor to facilitate a formal Alaska Electric Vehicle Working Group (AKEVWG) that brings together industry stakeholders, including utilities, municipalities, tribal entities, advocacy groups, businesses, researchers, car dealerships, and consumers, to coordinate actions that support EV adoption throughout the state. The contractor also facilitates technical subcommittee meetings to discuss and address technical market and regulatory barriers. The AKEVWG serves as a collaborative forum for pursuing funding opportunities.

AEA is designated as the lead agency for developing and implementing the NEVI program. The NEVI program focuses on the Alternative Fuel Corridor, marine highway system, and connected road system, while the proposed project specifically targets rural communities not covered by the NEVI program. The project would expand on the NEVI program to increase investment in underserved Alaskan communities.

Alaska has one of the most undeveloped EV markets in the United States and has some of the highest transportation-related costs. Its expansive geography, isolated small population, and cold environment amplify the traditional challenges for EV adoption. Most Alaskans do not have reasonable access to EV charging infrastructure to help increase market adoption. Currently, there are only 47 Level 2 and 11 DCFC charging stations in the state. As of June 2022, there are over 1,400 registered full EVs in the state. As of August 2022, Alaska's average rural electricity rate was 60 cents/kWh, six times higher than the national average, and second highest in the country, according to the U.S. Energy Information Administration. The transportation sector accounts for approximately 26.8 percent of the state's energy use, and the costs associated with transportation and energy vary significantly across urban and rural Alaska.

Community-Based Clean Energy Projects

Alaska has the potential for some of the most significant transformations from diesel power generation to renewable energy in the nation and already has communities that have taken these steps. While overall adoption is high and the EIA identifies that 33% of Alaska's electricity generation comes from renewable sources, the isolated nature of its microgrids necessitates a community-by-community approach. Funded projects under this award would utilize technology that has been successfully deployed in Alaska, featuring proven innovations adapted to remote, isolated systems that face challenging weather and operational extremes. The following section describes renewable energy sources suitable for and proven in rural microgrids, as well as battery systems that complement their use, and the integration expertise demonstrated by project partners.

Hydroelectric – Between 2010 and 2020, hydroelectric projects accounted for nearly half of renewable energy project investments in Alaska. Hydroelectric projects such as Blue Lake in Sitka, Allison Creek in Valdez, and the expansion of AEA-owned Bradley Lake in Homer were among the largest projects in Alaska in terms of construction cost and generation capacity. The state also saw projects that utilized "lake tap" infrastructure, requiring no dam, and "run-of-river" hydro.

Wind – Over the past decade, wind projects represented 35% of investment in renewables. Large wind projects developed between 2010 and 2020 include Eva Creek in Healy, Fire Island in Anchorage, Phase II of Kodiak's Pillar Mountain development, and the Snake River project in Nome. Many wind projects developed over the past decade contributed to Alaska's role as a leader in implementing wind-diesel hybrid systems. Investments in wind-diesel hybrid systems in rural communities included efforts such as Chaninik Wind Group's project, which incorporated thermal stoves for residential heating using excess wind generation. Enhancements in energy storage provided an opportunity for further investment.

Solar – Solar projects accounted for 2% of investment in Alaska in renewable energy between 2010 and 2020, including the state's first utility-scale solar farms constructed in Healy and Willow. Solar generation in the spring and fall is often impressive in northern latitudes, where clear skies, cool temperatures, dry air, and bright, reflective snow all contribute to supporting solar energy production. Solar photovoltaic systems can exceed their rated output during these times of year. The Native Village of Hughes recently installed a 120-kW solar photovoltaic system. The project is being developed to help advance the community's renewable energy goal of 50 percent by 2025. Upon completion, it will be the largest solar project in a small rural community in the state.

Battery Storage – Residents in remote regions necessitate a dependable electricity supply, particularly as winter temperatures can reach lows of -50°F. Consequently, robust backup power systems are essential to ensure continuity during outages. Utilities such as Golden Valley Electric and Homer Electric have adopted battery backup solutions due to their cost-effectiveness and lower carbon emissions, implementing comprehensive system design and controls engineering across their operations. In Fairbanks, the prime function of the BESS is to provide spinning reserves. At the end of the spinning reserve sequence, the BESS will automatically reestablish the operation mode that was active before the event. In Homer, the new battery energy storage system will be used to balance system demands with its greater ability to deliver or receive energy. This also allows base-loaded thermal units to be run more efficiently, while enabling increased integration of utility-scale non-dispatchable renewable energy sources (i.e., wind & solar).

The rural application is also demonstrated. Private companies have successfully deployed a hybrid solar + storage microgrid to support the residents of Shungnak, a remote community above the Arctic Circle in Alaska. Funded by the United States Department of Agriculture (USDA) and Northwest Arctic Borough (NWAB), the microgrid was designed to address the numerous challenges of operating in extreme conditions and break the community's dependence on its expensive and polluting diesel generator power plant. The microgrid's 225-kW solar array can offset much of Shungnak's energy needs, while battery systems each store excess energy for later use. Uniquely designed to enable a "diesels off" operation, the system automatically coordinates between solar and energy storage to ensure the lowest cost power and communicates with the utility's power plant about the best times to turn diesel generation off. The microgrid is expected to save approximately 25,000 gallons of fuel per year and $200,000 in fuel costs annually, based on calculations of $7 to $8 per gallon.

System Integration – The Alaska Village Electric Cooperative (AVEC) provides electricity to over 50 remote communities in Alaska, including several with wind or solar power. In 2018, AVEC installed a 900-kW wind turbine in St. Mary's. They connected the two villages with an intertie in 2019, enabling them to share power. Combined, their peak electric load is 1000kW, allowing the 900-kW wind turbine to produce power greater than their electric load. This would enable diesel-off operation if there were another source of regulation and spinning reserves. AVEC identified this need and developed the concept of a Grid Bridging System (GBS) that would provide regulation and spinning reserves. AVEC collaborated with ACEP to develop technical specifications for GBS, as well as identified ideal energy storage technologies that meet the needs. The GBS requires a high-power capacity, the ability to supply a large amount of power, but for a short period, typically around 10 minutes. Therefore, a high-power and low-energy capacity system is needed. The team came up with three systems: 1) Ultracapacitor energy storage systems, 2) Lithium Titanium Oxide (LTO) batteries, and 3) Lithium Iron Phosphate (LFP) batteries.

X. INTERSECTION WITH OTHER FUNDING

Aligning Resources and Investment Strategy

Implementing Alaska's emissions mitigation measures will require weaving together funding beyond the EPA Climate Pollution Reduction Grant (CPRG). The CSEAP recognizes that CPRG funds must be complemented by a broad array of federal, state, tribal, local, and private financing to meet the scale of investment needed.

This chapter outlines how each mitigation measure can be matched with relevant funding sources, and how those sources can be braided or layered to maximize impact. It provides a structured look at funding opportunities at every level—from federal agencies like DOE and USDA to state programs, municipal tools, tribal grants, and private capital—and offers examples of blending these funds in practice.

Key mechanisms (such as green bonds, C-PACER, and community development financial institutions (CDFIs)) are discussed in the Alaska context to illustrate innovative financing solutions. By aligning multiple funding streams and leveraging past program lessons (e.g., one-time ARRA stimulus or Volkswagen settlement funds), Alaska can develop an integrated investment strategy that supports its mitigation measures and ensures benefits for communities across the state.

Funding Landscape Opportunities

Alaska's CSEAP recognizes that CPRG investments must be complemented by a broad suite of federal, state, and private funding sources to accelerate emission reductions and community resilience.[88]

Alaska's rural, remote, and tribal communities face a range of persistent barriers that make it challenging to access federal energy and infrastructure funding. High up-front and matching cost requirements, coupled with reimbursement-only grant structures, place an outsized burden on villages with limited cash economies and no tax base. Complex and inconsistent grant processes—from lengthy applications to multiple online portals and unclear guidance—further disadvantage small staff who must balance many competing responsibilities. Narrow applicant-eligibility definitions, inflexible benefit-cost analysis (BCA) requirements, and Buy America provisions often fail to align with Alaska's unique land ownership, labor, and cost-of-living realities. These hurdles collectively undermine community benefits goals by making it harder for the most disadvantaged communities to compete for funds.[89]

Potential solutions emphasize both structural reform and targeted support. Recommended actions include sliding-scale or waived match requirements, advanced match-waiver decisions, and revolving loan or bridge-financing mechanisms to ease cash flow constraints. Streamlining applications, modeled on HUD's High Energy Cost Grant program, combined with multi-agency shared applications, could reduce administrative duplication and allow for integrated funding of complex projects. Agencies could expand eligibility to include regional tribal consortia, adopt more inclusive definitions of "Indian Tribe," and incorporate cost-of-living adjustments and non-monetary benefits into BCA scoring. Expanding technical assistance, funding in-state capacity builders such as the Denali Commission and investing in local workforce development would further level the playing field while maintaining accountability and transparency.

Recent Changes in Federal Law

Federal Infrastructure and One Big Beautiful Bill [90]

The One Big Beautiful Bill Act (OBBBA) presents a mixed landscape of opportunities and challenges for emissions-reduction projects. On the opportunity side, the law preserves key tax incentives for certain firms and renewable resources—most notably hydropower, marine energy, and energy storage—retaining full production and investment tax credits (Sections 45Y and 48E) through 2033, along with elective pay, transferability, and accelerated depreciation. Fuel cells and alternative fuels also receive favorable treatment, including simplified eligibility and extended production tax credits in some cases. These retained provisions provide stable financing pathways for Alaska communities pursuing waterpower modernization, pumped storage, or emerging clean-fuel projects, and they allow public utilities to benefit directly through elective pay.

The challenges for broad emissions reduction are significant. The OBBBA accelerates the phase-out of many Inflation Reduction Act (IRA) clean energy credits, cutting cumulative clean-energy investment by an estimated $500 billion between 2025 and 2035 and raising national energy costs by as much as $50 billion by 2035.[91] Tax credits for wind, solar, green hydrogen, carbon capture, and advanced manufacturing are curtailed or sunset earlier, with new domestic-content rules and foreign-entity restrictions adding supply-chain uncertainty. Credits for electric vehicles, alternative refueling infrastructure, and residential energy efficiency are either rescinded or sharply limited. These provisions compress project timelines, create financing risk for developers relying on long-term incentives, and are projected to increase U.S. greenhouse gas emissions by roughly 190 million metric tons annually by 2030.

For Alaska municipalities and utilities, the OBBBA therefore demands a strategic shift: projects that qualify for the remaining hydropower, marine, storage, or alternative-fuel incentives should still move forward, but wind, solar, hydrogen, and large-scale manufacturing investments designed for previous incentives must be accelerated to meet near-term deadlines or restructured to remain financially viable. Communities will need to secure matching funds quickly, align supply chains with domestic content rules, and reassess long-range emissions-reduction targets considering a more constrained federal funding environment.

Federal Agency Opportunities

A wide range of federal funding programs can support Alaska's emissions reduction measures. Major federal agencies—including DOE, EPA, DOT, HUD, USDA, FEMA, and BIA—all administer grants, loans, tax incentives, or technical assistance relevant to Alaska's needs. Here we summarize the landscape of federal support for such emissions reduction measures.

Denali Commission: The Denali Commission is a federal agency established in 1998 to address infrastructure needs in rural Alaska. Through strategic partnerships with tribal, federal, state, and local governments, funding from the Denali Commission can strategically complement Alaska's CSEAP program to advance resilient, clean energy projects in rural and tribal communities. While CPRG provides targeted support for reduction of emissions, energy efficiency, and renewable energy deployment, the Denali Commission offers critical infrastructure investment and technical assistance that can help implement these projects on the ground. By leveraging Denali Commission resources—for example, for community-scale energy infrastructure upgrades, microgrids, or diesel displacement initiatives—tribal and local entities can maximize the impact of CPRG grants, ensuring that such investments also enhance energy reliability, community resilience, and long-term sustainability.

Department of Energy (DOE): DOE programs provide critical support for energy efficiency and clean energy projects. For example, the Weatherization Assistance Program (WAP) offers annual formula grants to states (Alaska receives funding each year) to retrofit homes for efficiency. Although DOE WAP funding is steady but limited (only ~200–300 Alaska homes weatherized per year recently), it remains a cornerstone for residential energy upgrades. DOE also administers the State Energy Program (SEP) (used by Alaska to fund state-level efficiency initiatives) and competitive grants for renewable energy, energy storage, and grid modernization.

DOE's Office of Indian Energy provides grants and technical assistance specifically for tribal clean energy projects such as solar, wind, or microgrids in Alaska Native communities. In addition, DOE Loan Programs Office can back large innovative projects (e.g., advanced energy facilities), and ARPA-E grants support cutting-edge energy technology pilots (some Alaska projects have benefited from these in areas like remote energy systems).

Environmental Protection Agency (EPA): EPA funding spans planning and emissions reduction. The Climate Pollution Reduction Grants (CPRG) fund planning (as with this CCAP effort) and will support implementation of priority measures. EPA's Diesel Emissions Reduction Act (DERA) grants are available to Alaska for replacing or retrofitting diesel engines—a key source of funds to cut emissions from generators, marine vessels, or vehicles (the plan proposes expanding AEA's use of DERA). EPA also administers the Clean School Bus program (recently expanded through the Infrastructure Investment and Jobs Act and Inflation Reduction Act) to fund electric or low-emission school buses—a relevant source for reducing transportation emissions in Alaska's school districts. Historical note: EPA managed the Energy Efficiency and Conservation Block Grant (EECBG) program under ARRA, which gave Alaska communities $25.3 million for local energy efficiency projectsenergy.gov—this program ended in 2012 but has recently been revived at a smaller scale, offering another channel for municipalities and tribes to fund emissions reduction actions.

Department of Transportation (DOT): Transportation funding is crucial for measures involving ports, vehicles, and infrastructure. The Federal Highway Administration's Carbon Reduction Program (authorized by IIJA) provides formula funds to states for projects that reduce transportation emissions—Alaska can tap this for projects like EV charging corridors or traffic efficiency improvements. DOT's National Electric Vehicle Infrastructure (NEVI) program is already providing Alaska ~$52 million (over 5 years) to build out EV fast-charging along highway corridors, with AEA as the lead agency.

The CSEAP envisions expanding EV infrastructure beyond the NEVI corridors, potentially using additional DOT grants (such as the Charging and Fueling Infrastructure grants) and state or private co-funding. For port electrification (e.g., shoreside power at the Juneau and Seward "Green Corridor" ports), the Maritime Administration (MARAD) offers Port Infrastructure Development grants, and EPA's Clean Ports Program (funded by the Inflation Reduction Act) provides $3 billion nationally for port emission reduction—a prime opportunity to finance electrified docks and cargo-handling equipment.

In the aviation sector, FAA grants and programs (such as the Continuous Lower Energy Emissions and Noise program) can support airport efficiency and may fund Sustainable Aviation Fuel (SAF) infrastructure pilots. Notably, Department of Defense (DOD) interests overlap in Alaska's strategic hubs—DOD funding or partnerships might support projects like SAF development (for military energy resilience) or microgrids near bases, aligning national security with emissions reduction goals.

Department of Housing and Urban Development (HUD): HUD funding streams can be leveraged for building and community energy projects. Alaska's communities (and tribes) can use a portion of Community Development Block Grants (CDBG) for energy efficiency in public facilities or housing rehabilitation with energy upgrades. In particular, the Indian Community Development Block Grant (ICDBG) is a HUD program that provides funds to tribes for infrastructure and economic development—this has been used for projects like energy-efficient housing, community solar, and sanitation systems.

HUD's HOME Investment Partnerships and NAHASDA (Native American Housing) grants also support housing improvements that could include weatherization, high-efficiency heating, or solar panels on homes. While HUD programs are not solely environment-focused, integrating energy efficiency or renewable components into housing and community development projects is a way to braid these funds into mitigation measures (for example, coupling a tribal housing grant with DOE or USDA funds to install heat pumps in new homes).

Department of Agriculture (USDA): USDA plays a significant role in rural Alaska energy projects. The Rural Utilities Service (RUS) offers low-interest loans and grants for electricity, including the High Energy Cost Grants which have funded rural Alaska microgrids and renewable projects (e.g., the solar + battery microgrid in Shungnak was funded by USDA and local partners). USDA's Rural Energy for America Program (REAP) provides grants to rural small businesses and agricultural producers for renewable energy systems and energy efficiency—in Alaska this could help fisheries, farms, or village businesses install solar, wind, or efficient equipment.

For community facilities, USDA's Community Facilities grants/loans can finance energy-efficient upgrades to clinics, schools, and public buildings in rural areas. USDA programs often require match or loan repayment, so combining them with state grants (like the Renewable Energy Fund) can make projects viable. The agency is also investing in biofuels and wood energy (e.g., biomass heating systems for rural communities) which align with Alaska's forestry resources.

Federal Emergency Management Agency (FEMA): FEMA funding focuses on resilience and hazard mitigation, which intersects with environmental adaptation and energy security. Through the Building Resilient Infrastructure and Communities (BRIC) program and Hazard Mitigation Grants, FEMA was able to fund projects like microgrids, backup power systems, relocation of critical infrastructure, or infrastructure hardening—all of which can reduce GHG emissions indirectly by enabling clean energy and preventing disaster-related emissions. For example, a community could seek BRIC funding for a battery storage system to improve resilience of a renewable microgrid (mitigating reliance on diesel during storms).

FEMA grants typically require a benefit-cost analysis and match, but Alaska's unique needs (e.g., power system resilience for remote villages) fit the intent of these funds, especially if pitched as environmental adaptation. Streamlining applications to blend FEMA funds with energy grants is recommended to achieve both resilience and mitigation aims.

Bureau of Indian Affairs (BIA) and Department of the Interior: BIA administers the Tribal Climate Resilience Program, which provides grants to federally recognized tribes (229 in Alaska) for environmental adaptation planning and implementation. While much of this funding addresses adaptation (e.g., village relocation, erosion control), it can also support energy projects that enhance resilience or reduce natural hazard risks in tribal communities. For instance, a tribe could use BIA resilience funds to develop a community energy plan or to build a renewable energy system that replaces vulnerable fuel supply chains.

The Department of Interior also offered the Tribal Electrification Program (newly created by the Inflation Reduction Act) which would have funded clean energy access for tribes, and it manages programs for ecosystem restoration that can tie into carbon sequestration efforts. Importantly, recent federal policy

(IRA 2022) had expanded "direct pay" tax credits to tribes and other tax-exempt entities, meaning tribal governments could benefit from renewable energy Investment Tax Credits or Production Tax Credits as if they were cash grants. This change allowed tribes (and municipalities) to leverage federal tax incentives for solar, wind, storage, etc., by receiving direct payments or transferable credits, greatly enhancing their financing options for projects through 2032. While these programs may not currently be in place, similar strategies could be applied in the future.

Federal Funding Challenges and Opportunities for Alaska: Despite the abundance of federal programs, Alaska's rural and tribal communities often face barriers in accessing these funds. Many grants require substantial local matching funds or upfront capital which small villages lack, and reimbursement-based funding can strain communities with limited cash flow. Complex applications and strict cost-benefit rules that don't account for Alaska's high costs can further disadvantage remote projects.

The CSEAP recommends pursuing reforms and creative strategies to overcome these hurdles—such as match waivers or sliding-scale matches for high-need communities and using state or private "bridge" financing to cover upfront costs until federal reimbursements arrive. Wherever possible, Alaska will layer multiple federal sources on a single project by aligning their requirements. For example, a community microgrid project might combine DOE grant funding for generation, USDA loans for distribution upgrades, and FEMA funds for backup storage, each covering a piece of the budget.

To facilitate this, the State can encourage multi-agency coordination and joint applications (similar to how HUD's High Energy Cost Grants streamline steps). By packaging projects to meet multiple program goals (emissions reduction, resilience, economic development), Alaska can maximize federal investment while reducing the burden on local communities.

State of Alaska Funding Programs

Alaska's state agencies play a critical role in advancing environmental, energy, and resilience projects across the state. Through targeted grant programs, financing tools, and technical support, these initiatives help communities implement locally appropriate projects that align with statewide and federal emissions reduction goals.

Many Alaska funding mechanisms do not publicly disclose their annual spending in a way that is specific to environmental-related programs or decarbonization outcomes. While some agencies provide high-level budget totals or overall endowment figures, it is often a blend of multiple programmatic purposes—such as general infrastructure, utility subsidies, or operational support—without disaggregating the amounts that directly support greenhouse gas mitigation, renewable energy deployment, or energy efficiency improvements.

Alaska's state agencies and authorities administer several funding programs and financing tools that directly support mitigation measures. While state budgets for energy efficiency programs are limited, Alaska has a track record of investing in energy projects through specialized funds and policy-driven programs. Many of these state funding mechanisms can provide match funding for federal grants or fill gaps where federal dollars are unavailable. Notably, some of Alaska's most successful clean energy initiatives have been driven by state appropriations and institutions. Below we highlight key state funding sources and how they intersect with CCAP measures:

Renewable Energy Fund (REF) – *Alaska Energy Authority (AEA):* The REF is a statewide capital grant program created in 2008 to fund renewable energy projects, from wind and solar in remote villages to hydroelectric upgrades for utilities. It is Alaska's most mature renewable energy fund, having supported over 110 projects with more than $300 million in state funds since inception. REF grants typically require a cost-share and have leveraged additional private and federal investments; they have been instrumental in displacing millions of gallons of diesel fuel annually in rural power systems. This fund is appropriated by the state legislature (the level varies each year, with earlier rounds up to $32 million).

Re-capitalizing the REF is a priority in the CSEAP to ensure continued support for community-scale renewables. For example, expanding wind, solar, and hydro projects (and related battery storage) in communities like Unalaska or Kotzebue would likely rely on a combination of REF grants and federal grants, with REF providing the local match and demonstration capital. The historical success of REF shows the value of sustained state funding: it has validated new technologies in Alaska's harsh conditions and built local capacity by funding feasibility studies through construction. As federal grants become available (IIJA, IRA), a robust REF can layer state dollars on federal awards to fully fund high-cost projects.

Power Cost Equalization (PCE) – *Alaska Energy Authority:* PCE is a longstanding state program that subsidizes the operating costs of rural electric utilities, effectively lowering the price of electricity for residents in high-cost areas. While PCE is not a capital fund, it plays a crucial role in Alaska's energy landscape by making renewable energy viable in communities that otherwise rely on diesel. By reducing the revenue risk for utilities (ensuring they can charge affordable rates), PCE indirectly supports new clean energy projects—for instance, a wind or solar project in a PCE-supported village can use the fuel savings to improve local finances without raising rates. PCE can also be paired with new projects to maximize local benefit: if a community installs solar panels or efficiency measures that cut diesel use, PCE savings can be reallocated to other community needs.

Essentially, PCE "keeps the lights on" at reasonable cost, which is vital for any mitigation measure in rural areas. The CSEAP acknowledges PCE as a complementary tool: while PCE funding (~$32 million annually from a state endowment) doesn't directly reduce emissions, it ensures equity and can be part of a braided funding strategy (e.g., using PCE to maintain affordability while grants pay for new infrastructure).

Sustainable Energy Transmission and Supply Development Fund (SETS) – *Alaska Industrial Development and Export Authority (AIDEA):* SETS is a financing program that offers loans, loan guarantees, and bond financing for energy infrastructure projects that advance decarbonization and energy security. Managed by AIDEA (a state-owned development bank), SETS can finance large-scale projects like transmission lines, microgrids, renewable generation facilities, and even emerging technologies. This tool is designed to bridge funding gaps by providing low-interest capital or credit support, thus attracting private co-investment. For example, if a utility-scale geothermal or hydropower project is partly funded by grants, a SETS loan could cover the remaining cost, to be repaid by project revenues.

AIDEA's ability to issue bonds and participate in project finance deals makes it a key player for big-ticket mitigation measures (like the Bradley Lake hydropower expansion or new grid interties). In the CCAP context, SETS might be used to support the Bradley Lake (Dixon Diversion) hydropower project by offering bond financing for construction, leveraging the long-term power purchase agreements of Railbelt utilities.

Similarly, for Sustainable Aviation Fuel (SAF) production, AIDEA could use SETS authority to invest in or finance a portion of a biofuel plant, alongside private investors, ensuring the project's economic viability. By using SETS, Alaska can mobilize state-backed debt for environmental projects where grants alone are insufficient, while still expecting projects to be financially self-sustaining (loans are repaid through project revenues or cost savings).

Alaska Housing Finance Corporation (AHFC) Energy Programs: AHFC, the state housing authority, administers Alaska's core energy efficiency programs for buildings. Two flagship programs are the Weatherization Assistance Program (for low-income households) and the Home Energy Rebate program (for moderate-income households). These are critical mitigation measures in the residential sector, aiming to retrofit homes with insulation, air sealing, efficient heating systems, and other upgrades. Funding for these programs historically has come from a combination of DOE funds and state general funds, with the state providing the lion's share. In fact, between 2008 and 2018, over 96% of Alaska's weatherization funding came from state appropriations—during that period, the legislature invested approximately $402 million which improved over 20,900 homes statewide. This massive state investment (aided by a brief infusion of ARRA funds) demonstrates how funding scale can drive results: it created thousands of jobs and cut heating fuel use substantially.

Going forward, the CSEAP calls for boosting funding for weatherization and rebates again, which could be achieved by legislative appropriations (potentially using some federal block grants as well). AHFC also operates loan programs for energy efficiency (such as second mortgage loans for home improvements) and runs public building energy retrofit projects. State funding for AHFC's programs can be layered with federal incentives—for example, the Inflation Reduction Act's Home Energy Rebate programs (HOMES and HEEHRA) will provide federal dollars for residential efficiency and electrification but require states to implement them. Alaska can route those IRA funds through AHFC's existing weatherization/rebate framework, effectively braiding new federal money with the state's experienced delivery network. Additionally, AHFC's nascent subsidiary, the Alaska Sustainable Energy Corporation (ASEC), is poised to support financing for private clean energy projects (acting akin to a green bank) and can assist communities in setting up programs like C-PACER.

<u>Department of Environmental Conservation (DEC) Programs:</u> DEC has managed programs focusing on village energy and environmental health. One example is the Renewable Energy—Village Energy Efficiency Program (RE-VEEP), which provided grants for energy efficiency upgrades in rural public facilities (schools, water plants, tribal buildings). RE-VEEP was funded through a competitive DOE grant in recent years. Although future funding is uncertain, the CSEAP suggests continuing and expanding such programs, potentially by using CPRG implementation funds or state-match dollars to secure new federal grants.

DEC also coordinates the state's involvement in federal grants for diesel emissions reduction (in partnership with AEA for DERA) and monitors air quality improvements from these measures. Another DEC-related mechanism is the Village Safe Water (VSW) program (for water/sewer projects)—while not an energy program, VSW capital projects could incorporate renewable energy or efficiency (for example, efficient water treatment facilities powered by solar), and DEC could prioritize co-funding those elements. In short, DEC's role is often to integrate energy improvements into environmental infrastructure projects, leveraging federal funds like EPA's tribal environmental grants or USDA rural utility grants.

<u>Department of Transportation & Public Facilities (DOT&PF):</u> The state DOT&PF, beyond utilizing federal DOT funds, can contribute state resources or in-kind support for transportation mitigation projects. For instance, DOT&PF is the lead on Alaska's EV infrastructure build-out (NEVI program) and may allocate some state capital for complementary charging stations off the main corridors (e.g., in rural hub communities not covered by NEVI). DOT&PF also could sponsor projects like public transit electrification (using state vehicle funds to match FTA grants for electric buses) or port electrification (providing technical assistance and planning, as they did in the SE Alaska port studies).

While DOT&PF's budget is mostly federal-pass-through, their Carbon Reduction Strategy (recently developed) includes state-supported actions, and they can integrate CCAP measures into the Statewide Transportation Improvement Program (STIP) to secure funding. The Alaska Marine Highway System (state-run ferries) is another area where state investment (e.g., in a pilot electric-hybrid ferry or dock charging infrastructure) could reduce emissions—state bonds or general funds might be needed to match federal ferry grants.

DOT&PF's Sustainable Transportation Program (STP) funds projects that advance low-emission, efficient, and resilient transportation infrastructure. Typical projects include roadway improvements, pedestrian and bike facilities, electric vehicle infrastructure, and adoption of innovative technologies. Eligible applicants include municipalities, tribal governments, and regional authorities. STP complements federal programs like CPRG by reducing transportation-related emissions and enhancing mobility, safety, and environmental resilience across Alaska.

<u>Other State Initiatives and Appropriations:</u> In addition to formal programs, the legislature can appropriate funds for specific projects or to seed new financing mechanisms. For example, the CSEAP identifies C-PACER financing (for commercial building retrofits) as a key strategy—while C-PACER itself uses private capital, the state could support it by funding an outreach/administration program through AEA or ASEC.

The state also recently enabled Carbon Offset and Carbon Capture programs (through 2023 legislation) to generate revenue via carbon credits. While these are revenue-generating programs rather than funding sources per se, they could eventually provide funds that the state could reinvest in environmental projects (e.g. if the state leases land for carbon storage or sells forest carbon credits, some proceeds might bolster the Renewable Energy Fund or an environmental resilience fund).

Finally, the Alaska Municipal Bond Bank Authority (AMBB), though a separate entity, is a state-created mechanism that pools municipal bonds. The state can support environmental projects by authorizing AMBB to issue green bonds (as discussed later) or by backing municipal loans with state credit. Legislative authorization and credit support make these bond financing solutions viable for smaller communities. In summary, state funding in Alaska often comes from strategic capital appropriations and creative use of state financial entities (AHFC, AEA, AIDEA, AMBB). By aligning these tools with federal programs (providing match or bridge funds), Alaska can greatly increase the financing available for CCAP measures.

Municipal and Tribal Funding Sources

Local governments (municipalities and boroughs) and tribal governments have access to additional funding mechanisms that can support or supplement emissions mitigation projects. While many Alaska localities have small tax bases and limited general funds, they can still play a critical role through bonding authority, local revenue, and unique tribal funding avenues:

Municipal Bonds and Capital Funds: Cities and boroughs in Alaska can issue bonds (typically General Obligation or revenue bonds) to finance infrastructure, subject to voter approval. Larger municipalities like Anchorage, Juneau, and Fairbanks have historically used bonding for facilities and could do so for energy projects—for example, Anchorage's local emissions reduction actions include bond-funded energy efficiency retrofits for city buildings.

In the context of the CSEAP, a municipality could propose a "Green Bond" (a bond designated for environment-friendly projects) to its voters, funding solar installations on public buildings or fleet electrification, with debt service potentially offset by energy cost savings. Smaller communities often cannot access low-interest debt on their own due to lack of scale or credit rating; however, the Alaska Municipal Bond Bank (AMBB) allows pooling of local loans. By participating in an AMBB pooled green bond, a small city or tribal entity could finance an energy project through a statewide bond issuance with the state's credit backing. This approach, recommended in the plan, would enable rural and underserved communities to get cheap financing for environmental projects and provide the required non-federal match on grant-funded projects.

Municipal budgets can also allocate capital directly—for instance, the City and Borough of Juneau set aside funds to pursue electric buses and building efficiency upgrades as part of its emissions reduction actions. Local enterprise utilities (like city-owned electric utilities or solid waste utilities) may issue revenue bonds secured by utility rates to invest in renewable generation or landfill methane capture—though in practice, many small utilities in Alaska prefer grants due to limited revenue. Still, as technology costs drop, local utilities might finance projects like solar farms or battery systems through loans if aided by state programs or guarantees.

Municipal Tax Incentives and Fees: In Alaska's tax structure, local governments primarily levy property taxes and sales taxes. They can use these levers to support mitigation measures. For example, a borough could offer a property tax abatement for renewable energy systems (some jurisdictions Outside exempt solar panels or heat pumps from property tax assessments to encourage adoption). A city could also establish local improvement districts or utility fee programs that fund clean energy—e.g., a small surcharge on electric bills dedicated to an efficiency fund, or a "carbon fee" that is reinvested in transit or tree planting (though none exist yet in Alaska, these are possibilities).

Additionally, municipalities can leverage bonding authority for third-party projects: Anchorage and Fairbanks have explored leasing arrangements or performance contracts for energy savings in public buildings, where a private ESCO (Energy Service Company) fronts the cost of upgrades and is repaid from the savings; the city's role is to provide a stable repayment mechanism. The Commercial Property Assessed Clean Energy & Resilience (C-PACER) program ties into municipal tax authority: it allows property owners to repay private clean energy loans via a special property tax assessment. Alaska enabled C-PACER statewide in 2022, but it requires local adoption. When a city like Unalaska establishes a C-PACER program, it doesn't spend its own money but uses its taxing authority to secure loans for projects (like industrial energy efficiency at seafood processing plants). This exemplifies how local governments can facilitate private investment through policy tools.

Tribal Government Funding and Authority: Alaska's federally recognized tribes and tribal consortia have unique funding streams and can lead projects in their communities. Tribes receive federal funds (e.g., BIA programs, HUD NAHASDA for housing, Indian Health Service for health facilities) that can be directed partly toward energy solutions. Many Alaska tribes also benefited from recent one-time funds like the American Rescue Plan (ARPA) and Inflation Reduction Act, which provided direct grants to tribes for infrastructure and environment ($e.g., IRA allocated $235 million specifically for Tribal programs). Tribes can use these funds flexibly—for instance, a tribal government might allocate ARPA recovery funds to install high-efficiency stoves or solar power in tribal housing as an economic relief and environmental measure. The Tribal Climate Resilience and BIA Housing Improvement funds can cover planning and small implementation projects (like a tribe developing a community evacuation shelter that doubles as a solar-powered community center).

Importantly, tribes can partner with state and local governments to braid funding: for example, a borough and a tribal council might jointly seek a grant for a regional composting facility (with the tribe accessing BIA funds and the borough contributing land or equipment). Some tribes in Alaska have formed Tribal energy utilities or consortia—these entities (like AVEC, a cooperative that serves many villages, or regional tribal nonprofits) can apply for larger grants than single communities and then distribute resources or technical support. For example, the Alaska Native Tribal Health Consortium (ANTHC) often secures grants for rural sanitation energy improvements and works with villages to implement them.

Additionally, under IRS rules, tribes (as governments) can now benefit from renewable tax credit direct payments, enabling them to own renewable energy assets outright with subsidy, or enter partnerships where the tribe's land or authority is leveraged to attract developers (for instance, a tribe could lease land for a wind farm and capture the direct-pay tax credit as part of the deal).

Community Development Financial Institutions (CDFIs) and Local Financial Tools: Several Native and community-focused financial institutions in Alaska provide loans and credit enhancements for projects that may not attract traditional commercial financing. Entities such as Alaska Growth Capital BIDCO, Cook Inlet Lending Center, and regional funds can offer low-interest loans to support small renewable energy installations, energy efficiency retrofits for businesses, or startup funding for clean energy enterprises. They often blend capital from federal programs (Treasury CDFI funds or USDA rural development loans) with private bank funds or philanthropic program-related investments. For example, a CDFI might create a revolving loan fund for villagers to purchase efficient freezers or solar PV systems, where repayments recycle to help others.

Municipalities and tribes can collaborate with CDFIs by providing a loan guarantee or seeding such funds with a portion of their own funds. Another tool at the local level is establishing a revolving loan fund or green bank at the city level—while Alaska cities haven't done this yet, models exist (e.g., Portland's Clean Energy Fund). Anchorage has the Anchorage Climate Action Fund, a modest fund that provides small grants for community sustainability projects, showing how local dollars (or donations) can spur grassroots mitigation. Though the Anchorage fund's future is uncertain, it demonstrates the concept of municipal or regional philanthropy-supported funds for emissions reduction actions.

Lastly, local utilities (including electric cooperatives and municipal utilities) can directly invest in projects or institute on-bill financing programs (where the utility fronts the cost of an efficiency upgrade and the customer repays their bill). This has been used outside Alaska effectively; within Alaska, some utilities have provided small-scale programs (for example, an electric coop offering on-bill loans for heat pumps). Utility-driven programs represent local quasi-private funding that can pair with government incentives to increase adoption of clean technologies.

Private and Philanthropic Capital

Purely public funding will not suffice to achieve Alaska's sustainability and energy goals—private investment and philanthropic capital are essential to scale up projects and sustain them long-term. The good news is that interest in Alaska's clean energy and resilience is growing among impact investors, corporations, and foundations. By creatively blending these sources with public programs, Alaska can unlock "market-rate" capital for projects that deliver both economic returns and social/environmental benefits. Key avenues for private and philanthropic involvement include:

<u>Private Investment and Public-Private Partnerships (P3s):</u> Many mitigation measures have revenue-generating or cost-saving potential that can attract private sector financing if initial risks are mitigated. For example, a large wind farm or geothermal plant can eventually turn a profit by selling power, which could interest independent power producers or utilities to invest. Alaska can facilitate P3 structures where the state or federal grants cover early-stage costs (feasibility, exploration, or subsidy) and private partners finance the remaining capital in return for long-term revenues.

The CSEAP suggests using performance guarantees or state-backed insurance to de-risk these opportunities. For instance, a "Diesel Off" solar-storage project in a village might get a guarantee that if the system underperforms, a fund (public or philanthropic) will cover the shortfall—this kind of agreement can give a private developer confidence to invest in a high-renewable microgrid. Impact investors (funds seeking environmental returns alongside profit) are particularly interested in projects like community solar, energy efficiency portfolios, and sustainable fisheries energy improvements in Alaska. If the state packages a portfolio of projects (rather than one-offs), it could attract green investment funds by offering scale and diversification.

Additionally, Alaska's resource corporations (oil, mining, seafood companies) have the opportunity to make investments in local clean energy as part of their goals for reduced costs or locally sourced energy—for example, a mining company might co-fund a renewable energy system that also supplies a nearby village, or an oil company might invest in carbon capture technology in Alaska.

<u>Philanthropic Foundations and Non-Profits:</u> Alaska benefits from active philanthropy, both locally and nationally. The Rasmuson Foundation, the largest Alaska-based foundation, has funded initiatives in rural energy efficiency and community development that align with emissions reduction actions. Rasmuson and others can provide grants or low-interest program-related investments to projects that might not

qualify for government grants—for instance, a foundation could fund a pilot project to insulate homes in an extremely remote village as a proof of concept, or provide matching funds that help a community meet a federal grant requirement.

On the national stage, many organizations have identified the Arctic and sub-Arctic as priority areas for resilience investment. These large philanthropies can inject millions in grants for innovative approaches—such as studying permafrost carbon storage, deploying novel renewable technologies, or building capacity for local sustainability planning. By engaging with these foundations, Alaska can steer philanthropic dollars into supporting CSEAP measures, especially those that yield models replicable in other Indigenous and northern communities.

Non-profit organizations (like Renewable Energy Alaska Project, Alaska Village Electric Cooperative (AVEC) as a co-op, and regional development organizations) also channel private donations and volunteer resources into environmental solutions—they might operate programs to distribute efficient wood stoves or provide training for local energy champions. Such efforts, while smaller in dollar value, are critical for community buy-in and can be paired with larger projects (e.g., a non-profit leads public education and workforce development while the government funds infrastructure).

<u>Corporate and Market-Driven Funding:</u> Private companies operating in Alaska can directly contribute to emission reduction projects. For instance, major electric utilities (Chugach Electric, Golden Valley Electric, etc.) fund renewable projects through their capital improvement plans—Chugach is investing in large solar farms and battery storage financed by utility debt repaid by ratepayers, which complements state efforts. Oil and gas companies might finance methane leak detection and capture technologies on the North Slope as part of regulatory compliance or voluntary methane reduction targets (some of these efforts could tie into CCAP measures on industrial emissions).

The carbon offset market is another private funding avenue: Alaska's new carbon offset program will enable private investors to pay for forest conservation or carbon sequestration projects on state lands in exchange for carbon credits. Similarly, corporations seeking to offset their emissions might partner with Alaska Native corporations or villages to, say, restore wetlands or improve forestry management, generating credits and funding local work. While offsets are not a primary mitigation strategy in the CSEAP, revenue from such projects can be significant and reinvested in direct emission reductions. Finally, technology companies and venture capital are keeping an eye on Alaska for its unique pilot opportunities—e.g., companies developing electric aircraft or marine vessels have interest in testing in Alaska's conditions (we have already seen pilot projects for electric aviation in cold environments). By hosting demonstrations (with some state support), Alaska can attract these companies to invest their own R&D funds here, leaving behind infrastructure and knowledge that benefit Alaskans.

In summary, private and philanthropic capital can be woven into nearly every mitigation measure. The strategy is to use public funds to de-risk and leverage: a modest grant can unlock a larger private investment if structured cleverly (for instance, using CPRG funds as a loan loss reserve or interest buy-down to make a project attractive to lenders). Alaska's Climate Action Investment Plan explicitly calls for such blended models, noting that CPRG funds could serve as seed capital to then attract DOE, EPA, USDA dollars, and private co-funding, enabling larger-scale projects than either could fund alone. A concrete example is pairing CPRG-funded EV charging in remote communities with private utility investments and DOT funds to create a statewide EV network, spanning both the Railbelt and rural hubs. By combining strengths—federal grants, state programs, local initiative, and private innovation—Alaska can finance its emissions reduction actions in a robust, resilient way.

Braiding and Layering Funding for Implementation

Given the diverse funding sources outlined above, a central theme of the CCAP is "braiding" funds from multiple sources to support a single project or program. Braiding refers to coordinating different funding streams (each with its own rules and timelines) so that they collectively cover the needs of a project without duplicating or leaving gaps. Layering similarly means stacking funds—for instance, using one source for initial capital and another for ongoing support. Braiding is especially crucial in Alaska because many projects have high upfront costs that no single grant will fully cover, and because achieving co-benefits (like resilience, cost savings, and emission cuts) often requires blending programs from different sectors.

A well-coordinated investment strategy is essential to braid these funding streams into coherent, high-impact programs. The following approach aligns with CPRG guidance and the CCAP framework:

1. **Leverage and Layer Public Funding.** Utilize CPRG funds as seed capital to unlock complementary federal programs (e.g., DOE, EPA, USDA, DOT) and provide match funding where required. For example, pair CPRG-supported EV infrastructure with DOT Carbon Reduction funds to create a statewide charging network that serves both the Railbelt and rural hubs.
2. **Mobilize Private Capital through De-Risking Mechanisms.** Insights from the Climate Capital Roundtable show that Alaska's "messy middle" between pilot and commercial deployment discourages private investment. Develop performance guarantees or "if-it-fails-we-pay" agreements to reduce risk for early adopters. Encourage public–private partnerships (PPPs) and green bank models to finance demonstration projects with blended capital. Promote community-scale investment vehicles (e.g., revolving loan funds, on-bill financing) to attract local investors.

Mechanisms for Successful Blending: One approach is to leverage flexible funds as match for more restrictive funds. For example, state appropriations or foundation grants (which are flexible) can serve as the required 20% match for a federal grant (which might be very specific but covers 80%). This leverages local dollars to draw down the maximum federal money. Another mechanism is sequencing funds in phases: a project might start with a DOE planning grant, then secure an EPA implementation grant, then use private financing for final scale-up. By planning for multiple phases, project sponsors can ensure each stage's funding builds toward the next.

The CSEAP introduces the idea of "Foundational, Integrated, and Transformational" implementation pathways, which essentially means scaling funding according to community capacity—a small community might start with foundational (grant-only) funding, while a larger project might integrate loans and private capital (transformational) from the outset.

Examples of Braided Funding: Consider the Central Peninsula Landfill Methane Capture project (a CCAP solid waste measure). To implement this, the Kenai Peninsula Borough could braid an EPA grant (for methane mitigation, if available) with USDA funds (for rural utility systems) and possibly private investment if the methane is used to generate electricity (a private firm might invest in the power generator in exchange for electricity sales). The Borough might also contribute some of its solid waste capital budget or even municipal bond proceeds.

Each piece covers a part: EPA might fund gas collection wells, USDA a power generator, the Borough covers interconnection infrastructure, and a private partner operates the system to earn from electricity—together achieving a project no one could do alone. Another example is port electrification in Juneau: funding could come from a DOT MARAD grant for on-dock equipment, an EPA Clean Ports grant for electric cranes, the local utility investing in grid upgrades, the cruise industry contributing funds (as they benefit from shore power), and the city issuing a revenue bond for any remaining capital. The revenue bond can be repaid by fees charged to ships for using shore power, thus integrating public and private benefits. Electric school buses offer a simpler layering: a school district could use a federal EPA Clean School Bus grant to buy a few buses, state DOT funds to build charging stations at the bus barn, utility incentives to manage charging load, and local capital funds to train mechanics—each stakeholder funds what aligns with their mission, resulting in a complete program.

Braiding also means aligning timelines and requirements. Project managers should design projects that meet the most stringent requirement of any funder so that all funds can flow (for instance, following federal procurement rules so that both federal and state money can be spent on the contract). This often requires significant administrative effort—hence the CSEAP calls for technical assistance providers (like the Denali Commission) to help communities navigate multi-source financing. The Denali Commission itself is an expert at braiding funds: it often combines its federal appropriation with other federal agencies' funds and state match to complete rural infrastructure projects. Going forward, such intermediaries can bundle funding from CPRG, Denali Commission, tribal grants, etc., into "one stop" packages for villages.

An important aspect of layering is avoiding funding silos. Rather than viewing each mitigation measure in isolation with one funding source, Alaska is developing a holistic investment strategy for communities. This strategy emphasizes that whenever a community pursues a project (say a wind turbine), they simultaneously plan for complementary funding (like workforce training from one source, grid upgrades from another, and housing retrofits to maximize the benefit of cheaper power from yet another source).

The concept of braided funding is not just stacking cash but coordinating programs so they reinforce each other's outcomes. In practical terms, this means actively convening funding agencies and stakeholders early in project development. The CCAP process has involved such coordination (e.g., the Alaska Energy Authority, AHFC, and AIDEA working together to align REF, weatherization, and financing tools for a community energy project). By continuing this collaborative approach through implementation, Alaska can ensure that each mitigation measure doesn't stall due to a single funding gap.

Spotlight: Integrated Funded Approach to Geothermal

Geothermal energy represents a substantial, largely untapped opportunity to expand Alaska's firm, low-carbon power generation portfolio. The state's unique geologic conditions—active volcanic zones, extensive tectonic activity, and abundant low- to moderate-temperature resources—position Alaska as one of the few U.S. jurisdictions with meaningful geothermal potential across both electric and direct-use applications. However, high up-front exploration and drilling costs, paired with long development timelines and data uncertainty, have historically deterred private investment.

To overcome these barriers, Alaska can implement targeted financial, regulatory, and partnership strategies designed to de-risk exploration, leverage federal momentum, and align with national energy security and defense priorities. The following framework outlines a strategic approach to advance geothermal energy development as part of the state's broader energy and resilience goals.

1. Exploration Risk Mitigation and Loan Loss Reserves

Implementation Strategy: Establish a state-backed exploration risk mitigation mechanism to reduce the financial exposure associated with early-stage geothermal development. This could take the form of a loan loss reserve or a dedicated exploration risk fund administered by the Alaska Sustainable Finance Corporation (ASFC) or the Alaska Industrial Development and Export Authority (AIDEA).

The fund would provide partial guarantees or co-investment in exploration-phase loans, thereby encouraging private capital participation. It would require initial seeding from state appropriations, federal infrastructure or energy funds, or partnerships with institutional lenders. By absorbing a portion of early-stage exploration risk—where well success rates may range from 30–60 percent—the program would unlock otherwise unattainable financing for developers and local utilities interested in geothermal resource assessment.

Precedents and Rationale: While rare in the United States, such instruments are standard internationally, supported by entities like the World Bank, the Inter-American Development Bank, and the African Development Bank. These mechanisms have proven effective in markets where geothermal exploration faces high geological uncertainty but strong long-term potential. Adopting this model in Alaska would send a market signal of state commitment and position the state to leverage global best practices for frontier resource development.

2. Targeted Grants and Tax Incentives (Colorado Model)

Implementation Strategy: Create a mini-grant program and tailored state tax incentives to support geothermal research, pilot testing, and early commercial demonstrations. Modeled on successful efforts in Colorado, this approach would target projects under $1 million that validate resource potential, support drilling of shallow test wells, or pilot direct-use technologies (e.g., district heating or industrial heat applications).

These targeted grants would provide rapid-turnaround, low-barrier funding to encourage university-industry partnerships, community-scale initiatives, and innovative applications. Coupled with modest production or investment tax credits, this program would help overcome the "first-mover disadvantage" that has historically slowed geothermal adoption.

Expected Outcomes:

- Expand the state's geothermal data library and mapping capacity.
- Stimulate local contractor and technical workforce development.
- Create replicable project models in high-potential areas such as the Aleutians, Interior hot springs, and the Railbelt corridor.

3. Leveraging Federal and Defense Opportunities

Implementation Strategy: Align state actions with growing federal and Department of Defense (DOD) interest in geothermal development for energy security and resilience. The U.S. Department of Energy (DOE) has prioritized geothermal exploration and data collection under the Geothermal Technologies Office (GTO), offering grant funding for subsurface characterization and commercial-scale pilot projects.

Simultaneously, the U.S. military—particularly the Army and Air Force—has expressed strong interest in geothermal-powered base resilience to ensure continuous operations independent of fuel supply chains. Alaska's multiple strategic military installations (e.g., Joint Base Elmendorf-Richardson, Eielson AFB, Fort Wainwright, Clear Space Force Station, and others) create a unique opportunity for the state to partner with federal agencies to facilitate development.

The state can support this effort by:

- Coordinating interagency permitting to expedite geothermal projects on or adjacent to federal lands.
- Offering state co-funding or credit support to complement federal demonstration grants.
- Facilitating long-term power purchase agreements (PPAs) between geothermal developers and military facilities.

Strategic Context: While Department of Defense geothermal funding is not yet widely deployed, policy direction from Washington is increasingly favorable. Geothermal retains both Investment Tax Credit (ITC) and Production Tax Credit (PTC) eligibility under the Inflation Reduction Act (IRA, 2022), and DOE has specifically identified Alaska and the Pacific Rim as priority areas for exploration data collection. By aligning state policy and permitting with federal initiatives, Alaska can position itself as a national leader in strategic geothermal development that supports both civilian energy reliability and national security objectives.

4. Permitting Streamlining and Regulatory Reform (Pennsylvania and New Mexico Models)

Implementation Strategy: Simplify and accelerate state and local permitting processes for geothermal resource exploration, drilling, and development. Drawing on best practices from Pennsylvania and New Mexico, Alaska can establish clear, tiered permitting pathways that distinguish between exploratory wells, test wells, and commercial operations.

Specific reforms could include:

- Consolidated state-level oversight, potentially through DEC or DNR, with a single point of contact for geothermal applicants.
- Standardized environmental review templates for geothermal projects to reduce duplication.
- Statutory timelines for permit review and agency coordination.
- Categorical exclusions for low-impact exploratory drilling that does not produce commercial-scale discharge.

Rationale: Streamlining geothermal permitting would align with the Governor's priority to accelerate infrastructure development while maintaining environmental safeguards. By reducing uncertainty and shortening project timelines, Alaska can improve the competitiveness of geothermal investments relative to other renewables. This would also complement the federal government's efforts to expedite clean energy permitting under the FAST-41 framework, enabling co-funded or parallel project review between state and federal agencies.

5. Integration with State Energy and Financing Institutions

Implementation Strategy: To sustain momentum, geothermal development should be embedded within Alaska's existing energy finance and planning architecture. This includes:

- Utilizing the Alaska Sustainable Finance Corporation (ASFC) to manage risk instruments and loan guarantees.
- Leveraging the Alaska Industrial Development and Export Authority (AIDEA) for project financing, credit enhancements, and bond issuance.
- Coordinating with the Alaska Energy Authority (AEA) to align geothermal projects with community energy planning, microgrid modernization, and Power Cost Equalization objectives.

A cross-agency Geothermal Working Group could be established to align these functions, monitor project outcomes, and ensure that geothermal investment contributes to the state's broader priorities of reliability, affordability, and resource development.

<u>Summary:</u> Expanding geothermal development in Alaska will require targeted financial innovation, regulatory coordination, and federal alignment. Establishing an exploration risk fund, offering early-stage grants and incentives, streamlining permitting, and engaging with federal and defense partners can collectively reduce barriers and attract private capital.

These steps would enable Alaska to convert latent geothermal potential into tangible community and economic benefits—supporting local energy independence, diversifying the state's resource portfolio, and reinforcing long-term reliability and affordability goals.

Historical Funding Initiatives and Lessons

Alaska's approach to sustainable energy funding is informed by past experiences with large one-time funding sources and special settlement funds. Two notable examples are the American Recovery and Reinvestment Act (ARRA) of 2009 and the Volkswagen (VW) Environmental Mitigation Trust:

<u>ARRA (2009–2010 Stimulus) –</u> ARRA was a federal stimulus that injected significant funds into energy projects nationwide, and Alaska benefited greatly. Under ARRA, DOE provided $18.1 million to Alaska's

Weatherization Program, allowing AHFC to scale up home weatherization and cut energy use for over 1,500 additional households in a short periodenergy.gov. ARRA also delivered $25.3 million in Energy Efficiency and Conservation Block Grants to 152 Alaska communitiesenergy.gov, funding local projects like LED streetlights in Anchorage, insulation for public buildings in small villages, and energy plans for boroughs.

These one-time funds created a surge capacity: Alaska ramped up training of weatherization crews, employed local labor, and demonstrated that, with enough funding, thousands of homes could be retrofitted in a few years—yielding lasting reductions in heating fuel use and bills. The lesson for the CSEAP is that large-scale investment, even if temporary, can achieve outsized results if there is readiness to deploy.

However, once ARRA funds were spent, activity dipped due to lack of sustained funding. Thus, planning for continuity (e.g., tapering programs rather than cliff-ending) is important. Another ARRA-supported area was renewable energy and grid projects: ARRA funded a major geothermal exploration project in Naknek ($12.4 M) and other renewables, complementing state REF efforts. The geothermal plant did not fully materialize at the envisioned scale, teaching the importance of feasibility and risk management—an upfront risk mitigation fund (like the one CCAP proposes for geothermal) might have increased chances of success.

ARRA also catalyzed inter-agency coordination (federal-state-local) which we aim to replicate with CPRG funds and others. In short, ARRA's impact in Alaska—from weatherizing over 10,000 homes (when combined with state funds) to launching new projects—shows what a transformative infusion of funding can do, and underscores the value of having "shovel-ready" projects and trained workforce to capitalize on such opportunities.

Volkswagen Settlement (2017–2021) – The VW Environmental Mitigation Trust was a legal settlement that provided Alaska about $8.125 million to reduce diesel emissions (compensating for VW's violations). The Alaska Energy Authority was designated to manage these funds. Through a public Beneficiary Mitigation Plan, AEA allocated the money to priority projects: replacing older diesel vehicles with cleaner models, and crucially, installing electric vehicle charging infrastructure. About $1.25 million of the VW funds were devoted to EV fast chargers, which became the primary seed money for Alaska's first EV corridor chargers.

These funds effectively jump-started EV adoption in the state, creating an initial network of charging stations that positioned Alaska to leverage the much larger federal NEVI program. The lesson from the VW settlement is that relatively small, one-time funding pots can be used strategically to lay groundwork for larger efforts. AEA's experience administering the VW funds built expertise and stakeholder networks (e.g., the Alaska EV Working Group) that now serve the state in implementing new EV programs. Another portion of VW funds went to replace diesel buses and trucks, yielding immediate emission reductions in communities.

The settlement also required robust public input and transparency, demonstrating effective governance of a climate-related fund. Going forward, Alaska can apply this model to any future settlements or one-off funds (for instance, if there were a settlement related to shipping emissions or a federal pilot program)—use the funds on catalytic projects that either pilot new technology or fill gaps that other funds don't cover. The VW fund success also suggests Alaska should keep monitoring opportunities for environmental penalty funds or carbon market revenues that could be similarly directed to emissions reduction actions (e.g. if a company pays a fine for pollution, could that money capitalize an air quality or electrification fund?).

Other historical tools include bonds and revolving funds from past decades. For example, Alaska once had access to Qualified Energy Conservation Bonds (QECBs) through ARRA—though utilization was limited, those that were used helped finance energy efficiency in public buildings at very low interest.

While QECBs expired, Congress could enact something similar in the future; Alaska's CSEAP would be ready to deploy such bonds, having learned to aggregate small projects to make bond issuance worthwhile. Clean Renewable Energy Bonds (CREBs) were another federal bond incentive some Alaska utilities used for projects like Kodiak's wind turbines, essentially providing interest-free financing via federal tax credits to bondholders. The expiration of CREBs means we rely now on direct pay credits (IRA) and potentially a state green bond program to fill that role. The lesson is that financing instruments evolve, but the need for low-cost capital remains—Alaska should maintain the capability to use bond financing for such projects, whether through federal programs or its own Bond Bank green bonds.

Lastly, Alaska's significant state-funded efforts in 2008–2010 (when oil revenue was high) serve as a state-level parallel to ARRA. The legislature poured over $400 million into weatherization and energy rebates and created the Renewable Energy Fund with an initial $50 million per year. These investments achieved substantial outcomes (over 20,000 homes upgraded, dozens of renewable projects built) and provide a proof-of-concept that sustained funding yields cumulative benefits. However, when state funds waned after 2015, programs slowed—highlighting the importance of establishing self-replenishing funds or long-term funding mechanisms. That insight is why CCAP emphasizes ideas like a green bank, revolving loans, and leveraging private capital: they can sustain momentum when annual appropriations fluctuate.

In summary, historical funding programs have taught Alaska to strike while the iron is hot (use big infusions to build capacity and infrastructure quickly), to plan bridges between funding cycles (maintain progress as one fund ends and before another begins), and to design programs that maximize leverage (each dollar pulling in additional dollars). These lessons underpin the CCAP's funding strategy, ensuring that new funding—whether regular or one-time—is used effectively to transform Alaska's energy system for the long run.

Innovative Financing Tools in the Alaska Context

Beyond conventional grants and loans, Alaska is deploying and exploring several innovative financing mechanisms to support emissions mitigation. These tools can engage new capital sources and overcome some of the unique financing challenges in our state. Key among them are C-PACER financing, Green Bonds, state/municipal bonding authority, and CDFIs/Green Banks:

Commercial Property Assessed Clean Energy & Resilience (C-PACER)

C-PACER is a financing mechanism that enables commercial property owners to obtain long-term, low-interest loans for energy efficiency, renewable energy, and resilience improvements, and repay them via an assessment on their property tax bill. Alaska authorized C-PACER in 2022 and established a framework whereby the Alaska Energy Authority and Alaska Sustainable Energy Corp (AHFC's subsidiary) assist local governments in setting up programs. The City of Unalaska is a pilot community aiming to use C-PACER to help its large industrial facilities (like seafood processing plants) invest in modern, efficient equipment.

How C-PACER Works in Alaska: A municipality passes an ordinance to participate, then property owners can secure private loans for qualified projects—for example, a fish processor upgrading to energy-efficient refrigeration and waste-heat recovery. The loan is repaid as a special assessment on the property, collected by the municipality just like property taxes and forwarded to the lender. This arrangement gives lenders security (the loan attaches to the property and has priority status), allowing for better terms (often 10–20-year payback at relatively low interest). For the owner, the improvement ideally pays for itself through energy savings, and the assessment can even transfer to a new owner if the property is sold, aligning repayment with property ownership.

In Unalaska's case, the hub of the Bering Sea fishing industry, processors face high energy costs and often rely on diesel generators. C-PACER can finance projects such as insulating cold storage warehouses, installing on-site wind or solar to cut diesel use, or updating equipment to more efficient models. The benefit is that these companies can undertake capital-intensive retrofits without crippling upfront costs, and the energy savings improve their bottom line (important in a competitive industry). From an environmental perspective, these upgrades will reduce fuel consumption and emissions significantly in a sector that is currently energy intensive.

Alaska Context Considerations: Because C-PACER is new, one challenge is attracting willing lenders for remote communities. The state's support (through AEA/ASEC) is critical in standardizing the program and possibly providing credit enhancements as discussed. Another consideration is that many rural facilities are on leased Native corporation land or federal land, which complicates property assessments—the program initially will see more traction in organized boroughs and cities. Nonetheless, as more municipalities (Anchorage, Juneau, etc.) adopt C-PACER, we anticipate a growing pipeline of projects: from downtown building retrofits in urban areas to, eventually, combined heat and power or solar projects at commercial facilities in rural hubs. The CCAP sees C-PACER as a tool to unlock private investment in the private building sector, which has been hard to reach with grants. It leverages local government authority (assessments) to pull in private capital at scale, making it a powerful intersection of public and private effort for clean energy.

Spotlight: Green Bonds and State Bonding Authority

Green bonds are bonds issued to finance projects with environmental benefits, offering an opportunity to tap into debt capital markets for emissions reduction actions. In Alaska, both state entities and local governments have bonding authority that can be harnessed in an environment-aligned way. The CSEAP proposes a Statewide Green Bond Program that would pool projects from multiple communities or agencies and issue bonds through the Alaska Municipal Bond Bank Authority (AMBB). The bonds would be backed by the state's credit and the repayment from the projects (for example, energy cost savings or modest revenue streams) and would carry a "green" label to attract ESG-minded investors.

Implementation in Alaska: The concept is to use AMBB to aggregate, say, a dozen energy retrofit projects from various small municipalities (or school districts), and issue a single bond to fund all of them. Each participant then repays its share to AMBB over time from the savings in their energy bills (or budgeted expenditures). This addresses a big barrier: small municipalities often cannot borrow affordably on their own for such projects. With state backing and pooling, even a village or small city can get the same low interest rate as a large entity would. The Bond Bank already successfully does pool for ordinary infrastructure; doing so with a green designation expands the investor base. Investors worldwide are eager for green bonds (the market is oversubscribed), meaning Alaska could potentially secure slightly better terms or at least ensure strong demand by labeling and certifying these bonds as green (with clear criteria and reporting on environmental outcomes).

Alaska's unique twist is that projects often don't have traditional revenue (many energy projects save money rather than generate it). The Green Bond Program would likely rely on energy savings performance as the "revenue" to repay. For example, if a school retrofit saves $50,000/year in fuel, that $50k is earmarked to pay debt service on the bond that financed the upgrade. The state could also step in with credit support: perhaps the Alaska Sustainable Energy Corp (ASEC) certifies the projects, and the state guarantees that if a community's savings fall short in a given year, there's backup (this might come from a reserve fund). According to the plan, ASEC or AEA would set the technical standards for green projects and ensure they pencil out, while AMBB issues the bond, and Department of Revenue manages proceeds and repayments.

One Concrete Example: A pool of four communities each wants to install solar arrays on public buildings and heat pump systems in some facilities. Individually, each project is $1–2 million, too small to bond. But together, a $6 million green bond is sold, yielding funds to build all projects. Each city agrees to pay back, say, $50k-$100k annually over 15 years. The state backing ensures low interest (<2-3%), and the "green" label is documented by showing expected CO_2 reductions. Over time, the cities see reduced diesel or heating oil purchases, freeing up cash to make bond payments that are roughly equal to or lower than their previous fuel expenditures. After the bond is paid off, the savings accrue fully to the communities. This model operationalizes the leverage principle: it uses relatively small annual payments (affordable within local budgets) to finance large upfront improvements, avoiding reliance solely on grants.

Additionally, municipal green bonds are possible in bigger cities—e.g., Anchorage could issue a Green Bond on its own to fund a suite of projects (the Anchorage 2020 Climate Action Plan even suggested this). A challenge is that municipal bonds require voter approval (for GO bonds) in Alaska. Green framing might increase voter appeal, especially if pitched as economic savings and environmental leadership. Juneau successfully passed bonds for energy efficiency in schools by emphasizing cost savings and maintenance needs. CCAP's push for green bonds might involve educating the public on these benefits so that future bond propositions for environment-related infrastructure gain support.

State Bonding for Larger Projects: We should also note the role of AIDEA's bonding (and credit) for projects like big renewables (e.g., transmission lines, hydro). AIDEA can issue conduit revenue bonds for private or public projects—this could be tapped for things like the Railbelt transmission extension for renewables or large-scale geothermal. The advantage is to get lower-cost financing than private markets alone, with AIDEA often providing guarantees or taking some risk. Using AIDEA/AMBB in tandem with green designations, Alaska can attract institutional investors, including potentially tapping green bond funds globally that might purchase Alaska bonds if they meet appropriate standards (for instance, Europe-based funds that invest only in certified green bonds could become a source of capital for Alaska energy projects). The section on Green Bonds in the plan highlights that this approach can help secure more federal funding and attract private investment, which fits well with our strategy of using multiple funding sources.

State and Municipal Bonding Authority

While green bonds are about the use of proceeds, state and local bonding authority is the underlying ability to raise large sums upfront for infrastructure. Alaska's constitution and statutes give the state broad bonding power (with voter approval for general obligation bonds, or through public corporations like AIDEA and AHFC for revenue bonds). Municipalities similarly can issue bonds for local projects. Historically, this power was used for roads, schools, etc., but applying it to emissions mitigation projects is a strategic shift.

For example, the state could put a General Obligation bond package to voters for resilience and energy—perhaps a $200 million bond that includes funding for community energy projects, electric ferries, etc. If voters approve, it's a way to invest now and pay over 20-30 years. Given Alaska's fiscal constraints, GO bonds need to be palatable, but coupling economic development (jobs building infrastructure) with emissions reduction could gain bipartisan support, much like previous bonds for renewable energy projects (there was precedent: a 2010 bond included $25M for renewable energy). The state's current debt is low (Alaska has room to bond), so this is feasible if politically supported.

On the municipal side, one promising concept is using municipal enterprise revenue bonds for clean energy. For instance, Anchorage's municipally owned electric utility (before it was sold) could have issued bonds for renewable generation and passed costs to ratepayers. Now, Anchorage might use its Solid Waste Services (SWS) enterprise to bond for a renewable project like landfill gas capture. The CCAP noted that without external help, some municipalities can't bond because savings alone aren't enough to cover debt quickly. But if combined with state support or extended terms through Bond Bank pooling, many more can. Essentially, bonding authority allows Alaska to move from pay-as-you-go to invest-now/save-later, which is crucial for mitigation where upfront costs are high but long-term benefits (fuel savings, emissions reduction) are large.

Community Development Financial Institutions (CDFIs) and Green Banks

Alaska's CDFIs and the prospective green bank (ASEC) are the connective tissue to bring private financing to community level. CDFIs, like Native CDFIs (e.g., Cook Inlet Lending Center, Spruce Root in Southeast) and other mission-driven lenders specialize in lending in underserved markets with flexible terms. They often understand local contexts better than big banks and can bundle financing with technical assistance.

CDFIs might make smaller loans that big banks avoid—e.g., a $50k loan for a fishing boat owner to get a more efficient engine, or a $10k loan for a family to install a heat pump (whereas a commercial bank might see that as too risky or too small). By leveraging grant capital and partnerships, CDFIs can offer lower interest and longer terms, making clean technology affordable. For example, Alaska Growth Capital (a CDFI) could partner with AEA to administer a loan program for commercial building efficiency, where state funds cover loan loss reserves and AGC lends its funds to the businesses. This multiplies the impact of state dollars and draws in private capital under CDFI management.

The concept of an Alaska Green Bank is embodied in ASEC—essentially an entity that can blend public funds (state, federal) with philanthropic and private investments to provide financing solutions (loans, credit enhancements, co-investments) for projects that conventional lenders find difficult. Green banks around the country have shown that relatively small amounts of public capital can mobilize 5-10 times as much private capital by taking on certain risks or subordinate positions. For Alaska, a green bank could, for instance, guarantee a portion of a loan for a renewable project in a high-cost community, inducing a bank to finance it, or it could offer low-interest loans to supplement a grant (so a project doesn't stall for lack of full grant).

Native CDFIs also ensure cultural and community alignment. They can help structure financing in ways compatible with subsistence economies or seasonal incomes, etc. The plan specifically mentions engaging Native American Bank and other Native CDFIs alongside state agencies to form a "resilient funding ecosystem." This means including these community lenders in program design so that, say, when the state launches a heat pump incentive, the CDFI is ready with a loan product for the remaining cost that a grant doesn't cover.

Finally, the EPA's Greenhouse Gas Reduction Fund (part of IRA, $27B) is expected to route money to green banks and CDFIs to invest in local projects. Alaska entities have applied—if successful, this could inject tens of millions in capital into ASEC or local CDFIs specifically for clean energy finance. The CCAP positions Alaska to absorb and deploy that capital by having a pipeline of projects and a collaborative network of lenders. Essentially, by combining federal green bank seed funding, state credit support, and CDFI on-the-ground knowledge, Alaska can finance projects that would otherwise be deemed too risky or not profitable enough by mainstream finance, like a wind project in a small village or a community solar for a tribal subdivision.

In summary, these innovative tools—C-PACER, green bonds, bonding authority, CDFIs/green bank—complement traditional grants by engaging private capital and enabling pay-over-time solutions. They address the "messy middle" where grants alone are insufficient but private finance is hesitant due to perceived risk. By implementing these, Alaska will stretch public dollars further and accelerate project implementation, all while building a financial infrastructure that can sustain emissions reduction actions beyond the timeline of any single grant program.

Conclusion

Alaska's CSEAP funding strategy is inherently multi-faceted, reflecting the diverse and ambitious set of mitigation measures we aim to implement. Each measure—from home weatherization to industrial efficiency, from microgrids to electric vehicles—finds its support through a tapestry of funding sources. By categorizing measures by funding need and aligning them with available resources, we ensure no opportunity is missed: federal dollars are leveraged, state programs are targeted where most effective, private capital is invited into the solution, and local/tribal ingenuity and investment are empowered.

Critically, the plan avoids siloed thinking. Instead of viewing each funding source in isolation, we propose an integrated investment strategy where streams converge on priority projects. Funding can be braided—for example, a village renewable energy project might use a DOE grant for solar panels, an USDA grant for battery storage, a state REF grant for the microgrid controls, and a CDFI loan for the remaining cost. The result is a complete project that dramatically reduces diesel use and emissions, achieved by layering support. This approach also builds resilience in financing: if one source is delayed or reduced, others can adjust to keep progress on track.

The chapter also acknowledges that policy and funding landscapes evolve. The sunset of some federal incentives (as signaled by the OBBBA's impact on IRA credits) means we must be agile—accelerating projects to capture available incentives now and devising new mechanisms (like state tax incentives or green bonds) to fill gaps later. By highlighting historical programs like ARRA and the VW Trust, we glean lessons on scalability and the importance of preparation for windfalls.

Going forward, implementing this funding strategy will require coordination across agencies and partners. Regular "funding roundtables" can be held where AEA, AHFC, DOT, DEC, tribal representatives, and major funders (DOE, USDA, etc.) review upcoming project proposals and identify how to jointly support them. The Denali Commission and AML can serve as conveners to match projects with the right funding mix (as they have insight into both federal grants and local needs). Additionally, transparent tracking of funding (via the CCAP's monitoring framework) will help demonstrate success and build the case for continued or increased funding from legislatures and Congress.

In conclusion, by systematically linking mitigation measures with diverse funding sources and employing innovative financing tools, Alaska can transform its emissions reduction goals from plans into reality. The financing pathways outlined here give confidence that every viable mitigation measure can find the resources it requires. With strategic braiding of funds and creative leveraging of public-private partnerships, Alaska will not only meet its emission reduction targets but do so in a way that strengthens communities, creates jobs, and honors the stewardship of our environment for future generations.

IMPLEMENTATION PATHWAYS

Successful implementation of Alaska's CSEAP requires the strategic alignment of the Climate Pollution Reduction Grant (CPRG) program with a broader landscape of federal, state, tribal, philanthropic, and private financing resources. Given Alaska's diverse geography, limited local fiscal capacity, and varying levels of technical expertise, this alignment must be both flexible and adaptive—capable of meeting communities where they are, and scaling as capacity, opportunity, and partnership grow.

The plan envisions three complementary Implementation Pathways that describe how Alaska can deploy CPRG resources and leverage additional funding to achieve measurable greenhouse gas (GHG) reductions, community resilience, and long-term economic benefit. These pathways—the Foundational, Integrated, and Transformational approaches—represent a continuum of ambition and complexity. Each pathway provides a framework for investment that can be tailored to community readiness, available capital, and institutional maturity. Together, they demonstrate how Alaska can sequence and layer funding to accelerate emission reductions while maintaining its core priorities of reliability, affordability, and energy security.

The Foundational Pathway: Early Action and Capacity Building

The Foundational Pathway emphasizes early momentum, visible results, and the establishment of administrative infrastructure that will support long-term resilience and energy investments. Over the first one to three years, statewide implementers—such as the Alaska Municipal League (AML), the Alaska Energy Authority (AEA), and the Alaska Native Tribal Health Consortium (ANTHC)—would focus on rapidly deploying CPRG resources toward projects that yield immediate GHG reductions and tangible community benefits.

The intent is to secure quick wins while laying the groundwork for sustained coordination between state agencies, regional partners, and local implementers. Communities will receive targeted support through grant-readiness toolkits, funding alignment workshops, and technical assistance programs to identify and access overlapping federal and state opportunities. These efforts will enable municipalities, Tribes, and regional organizations with limited capacity to engage early and effectively.

This initial phase focuses on layering CPRG funds with existing federal and state programs such as the U.S. Department of Energy (DOE) Weatherization Assistance Program (WAP), the U.S. Department of Transportation's Carbon Reduction Program, the EPA Clean School Bus initiative, and USDA Rural Energy for America Program (REAP). By combining these resources, communities can reduce the cost of energy upgrades, meet matching fund requirements, and accelerate implementation timelines. State programs—including the Alaska Energy Authority's Village Energy Efficiency Program (VEEP) and Renewable Energy Fund—provide complementary financing and technical validation.

Projects prioritized under this pathway include municipal building retrofits, rural microgrid upgrades, community EV charging infrastructure, and home weatherization in low-income areas. Many of these activities qualify under both CPRG and companion federal programs, enabling Alaska to maximize every dollar spent. Through these early efforts, statewide implementers will also serve as a clearinghouse for information on funding timelines, eligibility criteria, and reporting requirements, ensuring that even the smallest communities can navigate the complex funding environment effectively.

Equity remains a central consideration within this initial phase. Emphasis will be placed on ensuring that rural and tribal communities—which face the highest energy costs, and the most acute infrastructure vulnerabilities—are among the first to receive direct investment. In doing so, the Foundational Pathway builds public confidence in Alaska's energy efficiency strategy while demonstrating that emission reduction and community well-being can proceed hand-in-hand.

The Integrated Pathway: Regional Collaboration and Blended Finance

The Integrated Pathway, envisioned for years three through six, builds on this foundation to establish a more coordinated, multi-jurisdictional approach. It focuses on braiding public, private, and philanthropic funding to achieve regional-scale implementation, enhance cost-effectiveness, and expand Alaska's access to capital markets.

In this phase, Alaska's implementers would establish a Statewide Resilience Investment Network, linking municipalities, Tribes, utilities, and financial intermediaries to pursue large-scale funding opportunities collectively. This network would serve as a coordination platform for major federal competitions such as the DOE's Grid Resilience and Innovation Partnerships (GRIP) program, FEMA's Building Resilient Infrastructure and Communities (BRIC) program, and EPA or DOE industrial efficiency and decarbonization grants. By organizing regional consortia—for example, a multi-community weatherization initiative in Western Alaska or an electrification corridor along the Railbelt—Alaska can present unified, competitive applications that attract larger awards while reducing administrative duplication.

A hallmark of the Integrated Pathway is the introduction of blended finance structures, or "capital stacking," which combine grants, concessional loans, and private investment in a layered risk hierarchy. At the top, CPRG and other grant programs can provide catalytic, non-repayable funding to cover feasibility studies or early-stage costs. Beneath this, concessional loans from Community Development Financial Institutions (CDFIs)—such as Native American Bank or McKinley Capital's Alaska Growth platform—can offer flexible financing for construction or equipment procurement. The lowest tier may include private debt or equity from commercial lenders, supported by loan guarantees or risk-sharing mechanisms administered through the Alaska Sustainable Finance Corporation or the Alaska Industrial Development and Export Authority (AIDEA).

This blended model allows projects with limited direct profitability, such as rural renewable energy or community heat systems, to move forward by de-risking private capital participation. The approach has been proven effective internationally and is increasingly being applied across U.S. infrastructure investments. For Alaska, it ensures that projects in high-cost, low-revenue environments can still attract investment and deliver public benefit.

To support this evolution, the Integrated Pathway envisions the creation of regional finance and implementation hubs hosted by existing regional entities—borough governments, Tribal consortiums, or economic development districts. These hubs would coordinate grant writing, procurement, workforce development, and compliance for multiple communities, thereby reducing administrative overhead and strengthening technical expertise across regions. They would also manage revolving funds that recycle energy savings from earlier projects into new ones, ensuring that initial investments yield sustained local reinvestment.

While private capital plays a critical role, the CCAP acknowledges that many of Alaska's highest-impact projects will never achieve purely market-driven returns. Renewable microgrids, small-scale hydro, and district heating systems provide essential social and economic benefits that far exceed their financial payback. For this reason, Alaska's strategy positions private investment as a complementary, not primary, driver, supported by public and philanthropic capital that absorbs risk and ensures affordability. Impact investors, CDFIs, and philanthropic foundations are expected to play an important catalytic role—supplying early-stage financing or first-loss guarantees to unlock broader participation.

Through this integrated approach, Alaska can achieve greater financial efficiency and scale, expanding project reach while maintaining fiscal prudence. It also strengthens regional collaboration, improving coordination among state, local, and tribal entities and promoting equitable access to resources across Alaska's vast geography.

The Transformational Pathway: Innovation, Institutionalization, and Long-Term Finance

The Transformational Pathway extends the horizon of Alaska's environmental and energy strategy to a ten-year timeframe and beyond. It aims to institutionalize sustainable financing mechanisms and establish Alaska as a leader in cold-climate energy innovation.

At the core of this pathway is the Alaska Sustainable Energy Corporation (ASEC), a state green bank established under the Alaska Housing Finance Corporation. ASEC will serve as the long-term financial engine of Alaska's energy transition, capable of providing low-interest loans, credit enhancements, and bond-backed capital for public and private energy projects. Over time, ASEC is expected to secure capitalization from multiple sources: the EPA's Greenhouse Gas Reduction Fund, state bond issuances, private equity, and philanthropic contributions. By institutionalizing this structure, Alaska will be able to offer enduring financing beyond the lifecycle of federal grant programs, enabling continual reinvestment in clean energy infrastructure.

In parallel, this pathway will expand the use of performance-based procurement and pay-for-success financing, where investors are repaid based on verified energy savings or emissions reductions. Energy Service Companies (ESCOs) and private partners can implement large-scale retrofit programs for public buildings under guaranteed performance contracts, repaid through savings over time. This approach reduces fiscal risk for local governments while attracting private innovation and accountability.

The Transformational Pathway also emphasizes technology validation and workforce development. Alaska's extreme environments offer unique conditions for piloting advanced energy technologies—such as small modular reactors for defense and industrial sites, hydrogen production and storage, long-duration energy storage, and Arctic microgrid controls. Through partnerships with federal agencies, industry innovators, and research institutions, these demonstration projects will generate both local benefits and global visibility. Simultaneously, investment in education and vocational training will ensure that Alaskans gain technical skills to design, build, and maintain these systems—securing long-term employment and fostering in-state expertise.

This final pathway transforms Alaska's environmental policy from a time-limited program into a self-sustaining economic development framework—one that continuously generates new investment, innovation, and opportunity. It ensures that emissions reduction actions are not only compatible with Alaska's resource-based economy but integral to its diversification and modernization.

Evaluation, Metrics, and Adaptive Management

To ensure transparency, accountability, and continuous improvement, the CCAP establishes a comprehensive evaluation and reporting framework consistent with EPA CPRG requirements.

Performance will be tracked through quantitative metrics that measure GHG reductions, energy savings, public and private dollars leveraged, job creation, and the distribution of benefits to disadvantaged communities. The state will develop a centralized data platform to harmonize reporting across CPRG, DOE, EPA, and state-funded programs, allowing communities to enter data once while meeting multiple compliance obligations.

Progress will be reviewed annually, with midterm evaluations conducted after three years to assess performance of the Foundational and Integrated Pathways, and a comprehensive evaluation at year six to inform future policy adjustments. Evaluation reports will include emissions reduction outcomes, cost-benefit analyses, and assessments of financial leverage ratios to ensure public funds are generating maximum impact.

An adaptive management approach will guide implementation adjustments based on evaluation findings. If certain programs underperform—for example, if private investment uptake is lower than expected—funding criteria or risk-sharing mechanisms can be modified. Conversely, successful pilot models can be scaled and replicated through revolving funds or ASEC financing. All evaluations and performance data will be made publicly available through annual CCAP progress reports, ensuring accountability to both the public and federal partners.

Summary

The three implementation pathways provide a structured yet flexible roadmap for aligning CPRG and related funding streams with Alaska's long-term energy and environmental objectives. Together, they create an investment ecosystem that accelerates GHG reductions, enhances energy resilience, and promotes economic development while maintaining fiscal responsibility and local control.

The Foundational Pathway builds early capacity and confidence; the Integrated Pathway scales impact through blended finance and regional coordination; and the Transformational Pathway institutionalizes innovation and long-term financing. Each reflects Alaska's pragmatic approach—prioritizing reliability, affordability, and community well-being as the cornerstones of effective emissions reduction actions.

Through this tiered strategy, Alaska can transform one-time federal investments into lasting economic and environmental value, demonstrating how a resource-dependent state can lead in sustainable development while safeguarding its economic foundation and the resilience of its communities.

XI. CONCLUSION

The *Alaska Comprehensive Sustainable Energy Action Plan (CSEAP)* presents a coordinated, evidence-based framework for reducing greenhouse gas (GHG) emissions, strengthening community resilience, and advancing the State's long-term energy and economic priorities. Developed under the U.S. Environmental Protection Agency's *Climate Pollution Reduction Grant (CPRG)* program, this plan reflects Alaska's commitment to implement practical, locally driven, and fiscally responsible strategies that reduce emissions while maintaining the reliability and affordability of energy systems that underpin the state's economy and quality of life.

Overview of the Plan and Key Elements

The CSEAP builds upon a comprehensive greenhouse gas inventory and trend analysis, establishing a 2022 baseline year against which progress will be measured. Alaska's inventory provides the technical foundation for identifying emission sources across the energy, transportation, industrial, waste, and land-use sectors. It highlights both the opportunities and challenges unique to Alaska—such as the state's reliance on diesel in rural microgrids, the energy intensity of industrial operations, and the importance of oil and gas revenues to the state's fiscal stability.

From this foundation, the plan identifies 25 GHG mitigation measures that are technically feasible, economically sound, and aligned with the State's policy framework. These measures span the full range of Alaska's energy landscape, including efficiency improvements, beneficial electrification, renewable energy deployment, industrial process upgrades, carbon management, and waste reduction. Each measure is analyzed for emission reduction potential, co-benefits, implementation challenges, and contribution to the state's broader policy priorities.

The CSEAP explicitly integrates co-benefit analysis across key domains:

- Public Health and Environmental Outcomes – emphasizing improved air quality and reduced exposure to harmful pollutants through measures targeting methane and diesel reduction.
- Economic and Fiscal Impacts – describing pathways through which efficiency and renewable measures yield long-term cost savings, reduce volatility, and support household and state-level fiscal resilience.
- Community Benefits – detailing gains in local employment, energy affordability, and service reliability across all regions, including benefits from workforce development and job preservation in energy-intensive industries.
- Community Resilience – evaluating components of community resilience, with programs designed to strengthen local capacity, safeguard essential services, and ensure energy security in Alaska's remote and interconnected communities.

Each of these co-benefits reinforces the State's central commitment: to pursue emission reduction strategies that enhance rather than compromise Alaska's long-term economic, energy, and community stability.

Funding and Implementation Framework

Recognizing that sustained implementation depends on reliable financing, the CCAP introduces a multi-pathway funding and investment strategy designed to align federal, state, tribal, and private capital in support of Alaska's energy transition. The three-tiered Implementation Pathways—*Foundational*, *Integrated*, and *Transformational*—provide adaptive models that communities and agencies can employ based on their readiness and capacity:

- The Foundational Pathway emphasizes quick wins, pairing CPRG funds with existing federal and state programs to achieve early, visible results and build capacity.
- The Integrated Pathway focuses on braided funding, regional coordination, and public–private partnerships to achieve scale and financial efficiency.
- The Transformational Pathway establishes long-term institutional mechanisms—notably the *Alaska Sustainable Energy Corporation (ASEC)*—to deliver sustained, low-cost financing and to position Alaska as a leader in cold-climate technology innovation.

These pathways collectively operationalize the State's strategy to blend grants, loans, and private investment through layered capital structures, revolving funds, and risk mitigation tools such as loan-loss reserves and performance-based contracts. They also emphasize the role of Alaska's financial institutions and partners—including the Alaska Municipal Bond Bank, Alaska Industrial Development and Export Authority (AIDEA), Alaska Energy Authority (AEA), Native CDFIs such as Native American Bank, and philanthropic capital—in forming a diversified and resilient funding ecosystem.

Evaluation and Reporting Commitments

Consistent with EPA CPRG requirements, the CSEAP includes a comprehensive framework for evaluation, measurement, and reporting. The plan establishes quantitative metrics and performance indicators to track GHG reductions, energy savings, investment leverage, and co-benefits such as jobs created and reductions in household energy cost burdens.

An annual reporting system will document progress toward interim targets and ensure alignment with federal reporting expectations. A centralized data collection platform will be developed to harmonize reporting across multiple funding sources—minimizing administrative burden for local implementers and ensuring consistency with EPA, DOE, and other agency requirements. Independent evaluations at regular intervals (e.g., years 3 and 6) will assess performance and inform adaptive management, ensuring continuous improvement and accountability.

Balancing Opportunities and Risks

Throughout this plan, Alaska acknowledges both the opportunities and disbenefits associated with implementing GHG mitigation measures. The CCAP does not overlook the high implementation costs driven by Alaska's remoteness, harsh environment, and limited infrastructure. It also recognizes the economic dependence on resource extraction and the need to preserve fiscal and employment stability during the transition. As such, the State's approach remains pragmatic: pursue emissions reduction actions that strengthens—not weakens—Alaska's economic base, energy security, and community well-being.

This balanced perspective extends to fairness and risk distribution. The plan identifies potential cost burdens on rural, low-income, and tribal communities and commits to structuring programs—including cost-sharing and technical assistance—that mitigate these vulnerabilities. It also emphasizes regulatory efficiency, aligning with the Governor's priority to streamline permitting and accelerate infrastructure development while maintaining high environmental standards.

Alignment with EPA Requirements for a CCAP

The CSEAP fulfills all essential components outlined by the EPA for comprehensive climate action planning under the CPRG framework:

1. Updated Greenhouse Gas Inventory and Baseline Analysis (2022): Establishes current emissions levels and identifies major sources and trends.
2. Quantified Mitigation Measures: Evaluates emissions reduction potential, implementation costs, and benefits of identified measures.
3. Co-Benefit Assessment: Analyzes health, environmental, economic, and community benefits associated with each category of mitigation action.
4. Disbenefits and Risk Considerations: Discusses potential challenges, vulnerabilities, and economic implications for key sectors and communities.
5. Funding and Financing Strategy: Provides detailed pathways for integrating CPRG funds with complementary federal, state, tribal, and private capital sources.
6. Implementation Pathways: Outlines tiered, adaptive strategies for project development and scaling, emphasizing community engagement and capacity building.
7. Monitoring, Evaluation, and Reporting Plan: Establishes measurable indicators, baseline data, and a structured process for ongoing performance tracking and adaptive management.
8. Community and Stakeholder Engagement: Incorporates input from statewide implementers (including AML, ANTHC, and Tribal organizations) to ensure inclusivity and local ownership.

Collectively, these elements demonstrate Alaska's compliance with EPA guidance while tailoring the plan to the state's distinct economic, geographic, and institutional realities.

Positioning Alaska for the Future

The CSEAP is not simply a catalog of mitigation measures—it is a roadmap for sustainable development and energy independence. It envisions a future in which Alaska's communities are empowered to manage their own energy resources, businesses and residents enjoy stable and affordable power, and public infrastructure operates efficiently and resiliently in the face of evolving environmental and market conditions.

By leveraging its natural resources, technical expertise, and innovative financing tools, Alaska can lead in responsible resource development while contributing to national and global environmental objectives. The plan's emphasis on blended finance, institutional coordination, and measurable outcomes reflects a mature, implementation-focused strategy that balances ambition with accountability.

Conclusion and Path Forward

In conclusion, this Comprehensive Sustainable Action Plan positions Alaska to achieve measurable progress in emissions reduction, energy diversification, and community resilience. It recognizes that Alaska's path to decarbonization must be distinctly Alaskan—grounded in local realities, economic pragmatism, and respect for the communities that power the state's future. The plan calls for collaboration across all levels of government and society: state agencies providing leadership and technical validation, local governments and Tribes implementing solutions on the ground, private capital supplying innovation and scale, and residents shaping and benefiting from the results.

As implementation advances, Alaska will continue to adaptively manage this strategy—updating data, refining policies, and expanding partnerships to ensure success. Through deliberate action, financial innovation, and steadfast commitment to reliability, affordability, and security, Alaska can demonstrate how a resource-dependent state can pursue meaningful emissions reduction actions without compromising its economic foundation or community well-being.

In this way, Alaska's CSEAP fulfills both the letter and the spirit of the EPA's CPRG program: delivering measurable emissions reduction outcomes while advancing the state's enduring priorities of self-reliance, sustainability, and stewardship.

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