United States Environmental Protection Agency

Affordable and Reliable Options for Meeting Energy Needs and Reducing Emissions

A Report to Congress as Directed by the Alaska Remote Generator Reliability and Protection Act

Prepared by the U.S. Environmental Protection Agency
in Consultation with the U.S. Department of Energy

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Remote Areas of Alaska: Affordable and Reliable Options for Meeting Energy Needs and Reducing Emissions

U.S. Environmental Protection Agency
Office of Air Quality Planning and Standards
Sector Policies and Programs Division
Research Triangle Park, NC

A Report to Congress as Directed by the Alaska Remote Generator Reliability and Protection Act of 2019

Table of Contents

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Introduction

The Alaska Remote Generator Reliability and Protection Act, Public Law 116–62 (October 4, 2019), requires the U.S. Environmental Protection Agency (EPA) to submit a report assessing options for the federal government to assist remote areas of Alaska with meeting the energy needs of those areas in an affordable and reliable manner using existing emissions control technology or other technology that achieves similar emissions reductions. This report fulfills that mandate. In this report, an overview of energy generation in remote areas of Alaska and potential energy-saving and emission control measures is provided. Those measures include replacement of older diesel generators with lower-emitting generators, fuel switching, add-on emission controls for diesel generators, installation of renewable energy generation, energy efficiency, new electric transmission interties, and community collaboration. This report also provides a discussion of ways that the federal government can assist in implementing those measures. Several federal government programs already provide assistance, including programs overseen by EPA, U.S. Department of Energy (DOE), Denali Commission, U.S. Department of Agriculture (USDA), and the U.S. Department of the Interior, Bureau of Indian Affairs (BIA). Continued support of those programs likely provides the best pathway for assisting the remote areas of Alaska. This report is submitted in consultation with the DOE, as required by the Alaska Remote Generator Reliability and Protection Act.

In Summary

These resources facilitate the production of affordable and reliable electricity in remote areas of Alaska while also promoting the reduction of emissions:

Measures
- Diesel generator replacement
- Fuel switching
- Add-on emission controls
- Renewables
- Energy efficiency
- New electric transmission interties
- Community collaboration

Agencies and Programs
- **EPA:** Diesel Emissions Reduction Act Grants
- **DOE:** Office of Indian Energy, Tribal Energy Loan Guarantee Program, Weatherization and Intergovernmental Programs Office, Grid Modernization Laboratory Consortium - Alaska Microgrid Partnership
- **USDA:** Rural Energy for America Program, High Energy Cost Grant
- **BIA:** Energy and Mineral Development Program Grant, Tribal Energy Development Capacity Grant
- **Denali Commission**

Energy Needs and Generation in Remote Areas

More than 190 communities in remote areas of Alaska are scattered over long distances and are not connected to population centers by road and/or power grid. For purposes of this report, remote areas are generally those areas that are not accessible by the Federal Aid Highway System (FAHS), or whose only connection to the FAHS is through the Alaska Marine Highway System. Remote areas also include those that are connected to

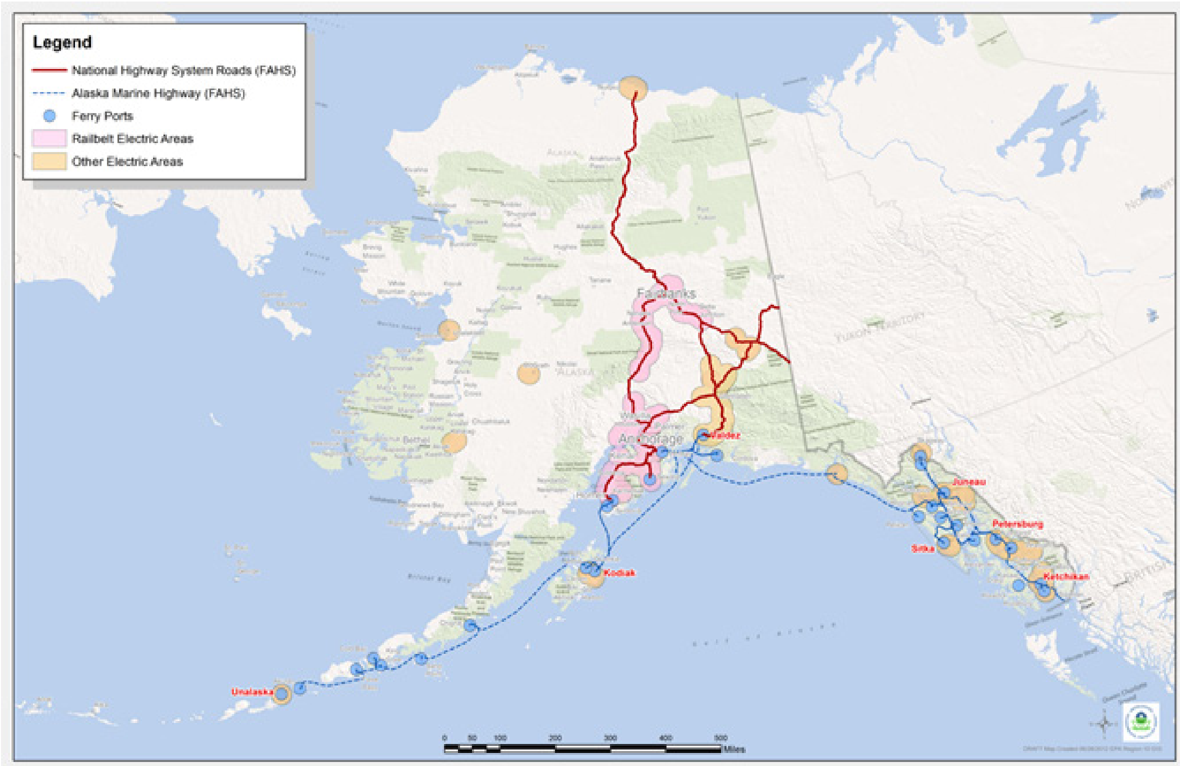

Figure 1: Alaska's Federal Aid Highway System (FAHS) and Railbelt Grid (2012).

the FAHS but have an isolated grid that is not connected to the statewide Alaska Railbelt Grid, which runs from Fairbanks through Anchorage and the Kenai Peninsula. A map of Alaska showing the FAHS and Railbelt Grid as of 2012 is shown in Figure 1. According to data from the Alaska Department of Labor and Workforce Development Research and Analysis Section, the population size of remote communities varies between seven and 8,100, with 75 percent of communities having a population of less than 500.[1]

Many of the communities in these areas are in severe sub-arctic and arctic environments. The U.S. Energy Information Administration (EIA) reports that while Alaska's total energy consumption is among the 10th lowest by state, its per capita consumption of energy is the fourth highest, due in part to its harsh winters.[2] The communities in remote areas typically face higher energy costs as compared to the rest of the United States. According to the EIA, prices for retail electricity in remote areas of Alaska can be 3 to 5 times higher than rates in urban areas.[3] Remote areas of Alaska correspond roughly to the communities that are eligible for the Power Cost Equalization (PCE) Program, a state-run program which reduces the cost of electricity for eligible customers in rural Alaska. PCE serves 83,000 residents in 194 communities.[4] The power generation ownership in remote communities is usually either tribal, municipal, electric cooperative, or investor-owned utility. Most utilities are nonprofits. Many power plants are not continuously staffed, and operators have minimal technical training.

The communities in remote areas primarily rely on generators powered by diesel engines. According to the Alaska Energy Authority's (AEA) fiscal year (FY) 2019 Power Cost Equalization report, 79 percent of kilowatt-hours (kWh) in rural Alaska are generated with diesel.[5] Only two communities use generators powered by natural gas. In 2010, a statewide energy policy was enacted setting a goal for 50 percent of Alaska's electricity to come from renewable sources by 2025.[6] Renewable energy resources that have been deployed in remote areas include hydroelectric, wind, solar, and geothermal. Many of the best opportunities for renewable energy projects in remote areas of Alaska were developed after 2008 with grants from the Renewable Energy Fund, which was created and administered by the AEA.

The AEA is the statewide energy office and has a mission of reducing the cost of energy in Alaska. It also has a long history of constructing bulk fuel tank farms and powerhouses in remote areas of Alaska. Many of the AEA's powerhouse design innovations, such as using marine manifolds to increase output from heat recovery systems, have provided benefits in terms of reduced fuel use and emissions. In recent years, the AEA has assisted numerous rural villages in obtaining EPA Diesel Emissions Reduction Act (DERA) funds to replace older, less-efficient, and high-emission diesel engines in rural powerhouses with cleaner new engines. The AEA is involved in Alaska energy issues that range from potential nuclear development to biomass boilers for space heating and power generation. It owns the largest hydropower project in Alaska, Bradley Lake Hydro, as well as the Alaska Intertie, a 170-mile transmission line that transmits power from the southcentral region to Fairbanks.

Emission Control Technologies and Pollution Prevention Alternatives

This section discusses available emission control and pollution prevention technologies that could be deployed in remote areas of Alaska. If available, information on the availability and cost of the technologies is provided, as well as the expected emissions reductions that can be achieved. As discussed in this section, many of these technologies already have a history of being successfully installed in Alaska, in some cases through the funding mechanisms described in the next section.

Photos courtesy of Dave Messier, Rural Energy Coordinator for Tanana Chiefs Conference

Before (top) and after (bottom) of the Chalkyitsik Power Plant Tribal DERA generator replacement project. The two new generators are painted white.

Replacement of Older Diesel Generators with New Tier 3 Diesel Generators

One option to reduce emissions that is already in use is the replacement of older diesel generators with generators powered by newer, lower emitting engines certified to meet "Tier 3" emission standards required for new stationary diesel engines.[7] Improvements in engine design, such as high-pressure common rail fuel injection, electronic governors, exhaust gas recirculation, and combustion optimization, have led to significant reductions of particulate matter (PM), hydrocarbons (HC), carbon monoxide (CO), and nitrogen oxides (NO_X) as compared to engines built in the late 1980s to the mid-1990s. Emissions of NO_X, PM, HC, and CO from Tier 3 engines generally range from 50 to 80 percent lower than emissions from older engines.[8] Many of those older engines are still in service in remote areas of Alaska; a listing of the population of generators at power plants in the remote communities of Alaska provided by the AEA indicates that a number of generators that are more than 20 years old are still in use today.[9] Information provided by the AEA indicates that the costs for a new Tier 3 engine installed in a remote area of Alaska range from $185,000 for a 65-kilowatt (kW) engine to $330,000 for a 350-kW engine.

New Tier 3 engines also provide numerous other advantages in addition to significant emissions reductions. For example, new engines generally are more reliable than older, non-certified engines. New engines also have advanced electronic controls that continuously monitor engine operating parameters, which enhance onsite engine operation and maintenance and facilitates remote access for monitoring and troubleshooting. Remote community powerhouses frequently use new engines designed for use on marine vessels because they have water-jacketed exhaust manifolds and turbo chargers, which improve heat recovery output by as much as 50 to 100 percent and reduce fire risk. Engine parts are more readily available and new engines include engine manufacturer's warranties, which provide financial security and technical support to keep the engine operating.

Within the next decade, nuclear microreactors could become an alternative to the installation of new diesel generation. Nuclear microreactors are being promoted as the combination of small size and megawatt scale. With simplicity of design, small footprints, passive safety features, and factory fabrication and assembly, nuclear microreactors are planned to be highly integrated and transportable systems. They would have the ability to provide both electricity and process heat, would have multi-year operational lifetimes with minimal refueling requirements, and would not emit greenhouse gases, criteria pollutants, or air toxics while operating.[10] While the technology is not yet commercially available in the United States, a number of private-sector nuclear technology providers have microreactor designs under development and hope to begin initial deployment of the technology within the next decade. Many are specifically targeting applications and customers in locations such as Alaska.[11, 12] The cost for this emerging technology is unknown, so the economic feasibility in remote areas of Alaska is still to be determined.

Fuel Switching

Fuel switching reduces emissions from stationary diesel generators. For example, the transition to ultra-low sulfur diesel (ULSD) fuel, which can reduce PM emissions by approximately 20 percent[13] and results in lower emissions of sulfur dioxide, is already widespread in remote villages according to the AEA. Therefore, there are not likely to be significant opportunities for additional emission reductions from the use of ULSD.

Switching to biodiesel or renewable diesel is another way to reduce emissions. Studies have shown that switching to 100-percent biodiesel can reduce emissions of PM and CO by at least 45 percent and HC by greater than 65 percent. Slight increases in NO_X emissions can occur.[14] A vendor of renewable diesel indicates that its use can reduce emissions of PM and HC by approximately 30 percent, CO by approximately 20 percent, and NO_X by 9 percent.[15] Commercial availability of biodiesel and renewable diesel is limited or nonexistent in remote areas of Alaska; therefore, switching to these fuels is not likely to be an available option for emissions reductions at this time.

Another potential option that can reduce emissions of carbon dioxide (CO_2), NO_X, and PM is switching to natural gas fuel. However, the infrastructure needed to deliver natural gas to remote areas of Alaska by pipeline is currently in place for only two communities, Nuiqsut and Barrow, which are near existing oil and gas fields on the North Slope that provide natural gas. Delivery of liquefied natural gas (LNG) by ship or truck is an option that has been studied but has not been implemented in remote areas. A study of the viability of small-scale distribution of LNG in remote Alaskan coastal villages conducted by the Alaska Center for Energy and Power found that costs for ice-bound communities may be too high for LNG to be economically feasible. The viability for ice-free communities is dependent on the rate design of the electricity demand.[16] Conversion of existing diesel-fired power plants to run on LNG would require the installation of equipment for storage and regasification of the fuel as well as conversion of existing diesel engines to run on natural gas or replacement with new natural gas-fired engines. Information on the costs for these modifications was not available for this report. There are also technical considerations that would need to be addressed, such as the effect on engine power output and difficulty in training operators in new engine maintenance procedures such as replacing spark plugs.

Add-On Emission Controls for Diesel Generators

Emission control devices that can be added to the exhaust of an engine to reduce emissions are also available for stationary diesel generators. Among the most commonly used emission controls for diesel engines are selective catalytic reduction (SCR) for NO_X control; diesel oxidation catalyst (DOC) for CO, HC, and PM control; and diesel particulate filter (DPF) for PM control. SCR systems can reduce NO_X emissions by 90 percent or more, according to vendors of the systems.[17] DOC have been shown to reduce emissions of CO and HC by more than 70 percent and PM by up to 30 percent.[18] DPF can reduce emissions of PM by 85 to 90 percent.[19] Capital costs of DPF in remote areas of Alaska range from approximately $40,000 for a 150-horsepower (HP) engine to $200,000 for a 1,000-HP engine. Annual costs range from approximately $15,000 for a 150-HP engine to $70,000 for a 1,000-HP engine.[20] EPA estimated the capital and annual cost for SCR to be $98/HP and $40/HP, respectively. For DOC, the capital cost is estimated to be approximately $5,600 for a 240-HP engine, with an annual cost of $1,700. The DOC capital cost for a 1,000-HP engine is estimated to be $26,500, and the annual cost is estimated to be $5,500.[21] Note that these costs are not specific to remote areas of Alaska, and the operation and maintenance costs for the remote areas, which are a component of the annual cost, would likely be higher than these estimates due to the remote location and severe arctic climate.

Although these technologies are in widespread use on both mobile and stationary engines across the United States, EPA has acknowledged that there are specific challenges associated with deploying the technologies on stationary engines in remote areas of Alaska. As discussed in the June 28, 2011[22] and November 13, 2019,[23] final amendments to EPA's emission standards for new diesel engines, several impediments have resulted in a lack of experience with these control technologies in remote areas of Alaska. Due to the remote locations and severe climate, the costs for acquisition, operation, and maintenance of the controls are higher than for other areas of the United States, and there is also the difficulty of maintaining a supply of diesel exhaust fluid needed for proper SCR operation. Another barrier to implementation

Add-On Emission Controls for Diesel Generators

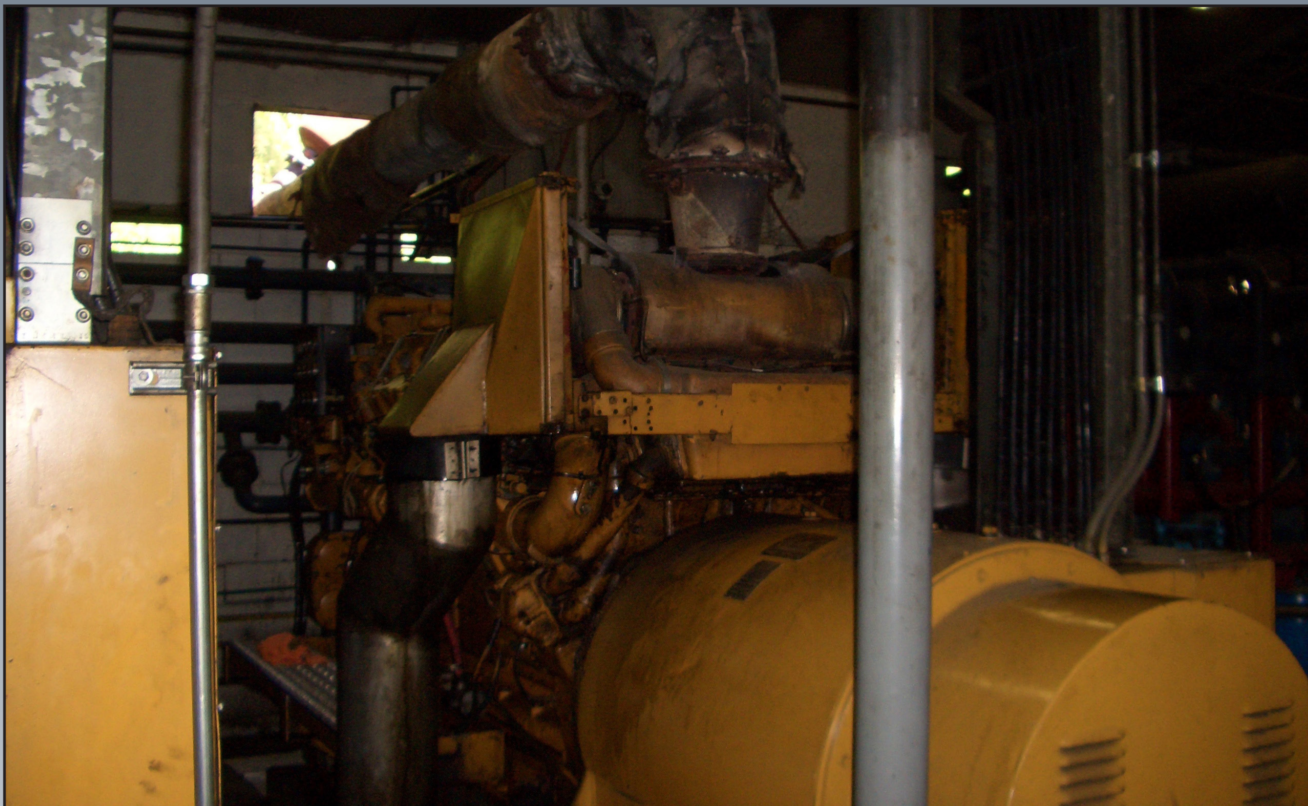

Photo courtesy of John Pavitt, U.S. EPA Region 10

Emission Control Technology	Pollutant Reductions	Capital Cost	Annual Cost
Selective Catalytic Reduction (SCR)	At least 90-percent NO_x [1]	$98 per HP	$40 per HP
Diesel Oxidation Catalyst (DOC)	More than 70-percent CO and HC; Up to 30-percent PM [2]	$5,600 for 240-HP engine $26,500 for 1000-HP engine	$1,700 for 240-HP engine $5,500 for 1000-HP engine [3]
Diesel Particulate Filter (DPF)	85-90-percent PM [4]	$40,000 for 150-HP engine $200,000 for 1000-HP engine	$15,000 for 150-HP engine $70,000 for 1000-HP engine [5]

[1] Stationary Reciprocating Internal Combustion Engines, Updated Information on NOx Emissions and Control Techniques. Revised Final Report. Prepared for: Mr. David Sanders, Ozone Policy and Strategies Group, Air Quality Strategies and Standards Division, Office of Air Quality Planning and Standards, U. S. Environmental Protection Agency. Prepared by: Stephen W. Edgerton, Judy Lee-Greco, Stephanie Walsh, EC/R Incorporated. September 1, 2000.

[2] Control Technologies for Stationary Reciprocating Internal Combustion Engines. See Docket Item Number EPA-HQ-OAR-2002-0059-0064. *https://www.regulations.gov/document?D=EPA-HQ-OAR-2002-0059-0064*.

[3] Alternative Control Techniques Document: Stationary Diesel Engines. Final Report. Prepared For: Energy Strategies Group, U.S. EPA Office of Air Quality Planning and Standards, Sector Policies and Programs Division, Research Triangle Park, NC. Prepared By: Bradley Nelson, EC/R Incorporated. March 5, 2010.

[4] Technical Bulletin: Diesel Particulate Filter General Information. National Clean Diesel Campaign. EPA-420-F-10-029. May 2010. *https://www.epa.gov/sites/production/files/2016-03/documents/420f10029.pdf*.

[5] Impacts of the Amendments to the New Source Performance Standards (NSPS) for Stationary Compression Ignition Internal Combustion Engines. Memo from Melanie King and Larry Sorrels, EPA/OAR/OAQPS. May 10, 2019. Document Item Number EPA-HQ-OAR-2018-0851-0006.

is a shortage of operators experienced with the emission controls, which could result in operational problems with the engines due to lack of proper control device operation and maintenance. Since the engines are used for heating and electricity, operational problems could present a risk to human life. For these reasons, EPA has not required stationary diesel engines in remote areas of Alaska to meet emission standards that require the use of these add-on emission controls. According to the AEA, only one remote community has installed DPFs on the engines in its power plant.[24]

Additional Renewables to Replace Diesel Generation

Alaska presents significant renewable energy opportunities to offset diesel generation. For example, the island of Kodiak has produced more than 95 percent of its energy through a combination of hydro, wind, and solar resources since 2014, and, during times of peak wind and hydro production, has surpassed its clean energy goals with 99-percent production from renewables.[25] Additionally, communities such as Cordova have ambitious goals to increase the share of renewable energy contributing to electricity generation and are taking steps to develop renewable energy-based microgrids that supply power at a reduced cost compared to diesel generation.[26] The 2016 report, *Solar Energy Prospecting in Remote Alaska*, notes that the move to incorporate more renewable energy resources "has been driven from at least three primary factors: (1) the economic exposure of many Alaskan communities to oil price fluctuations and other petroleum market influences, (2) technological advancements and reductions in the cost of renewable energy

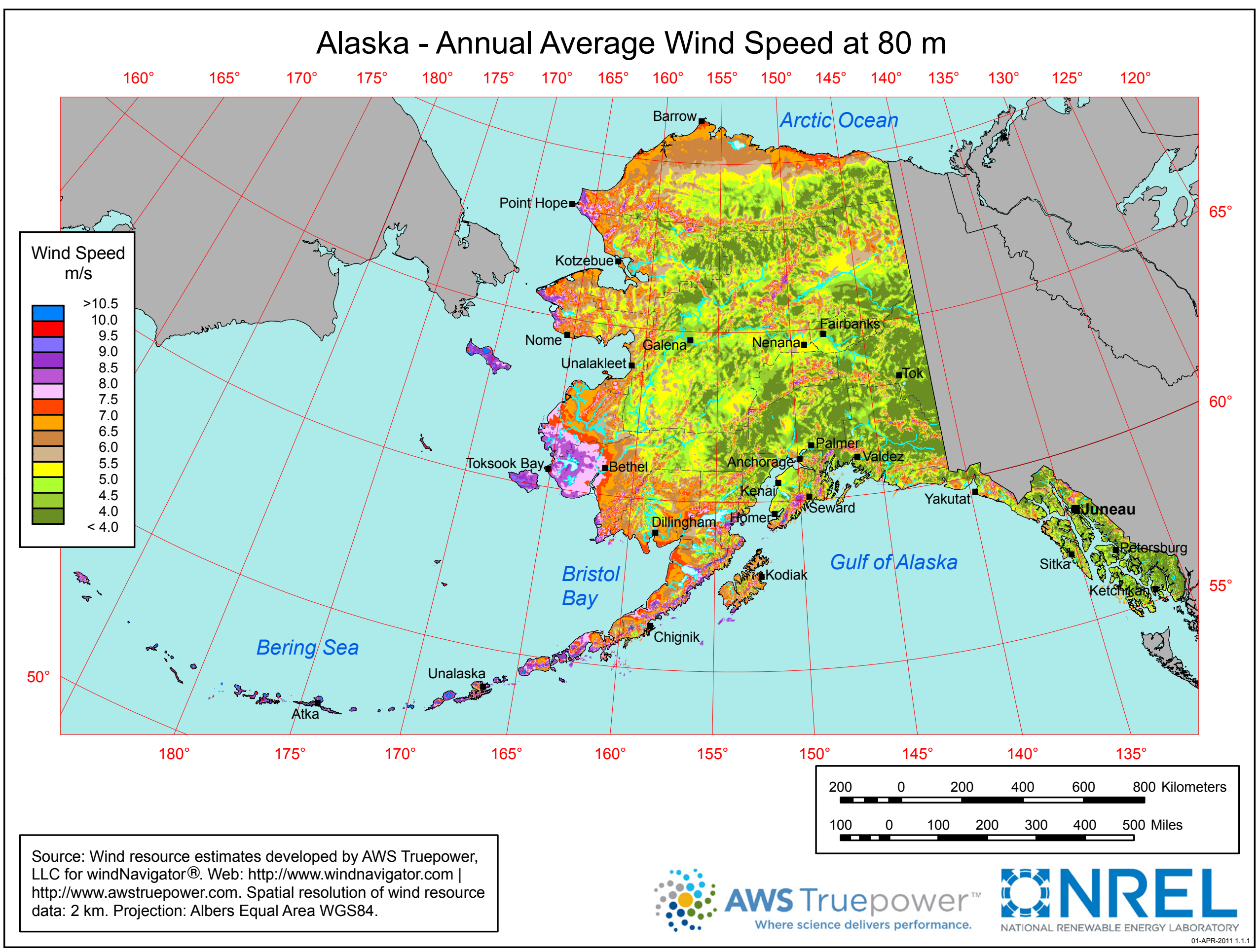

Figure 2: Wind Resources of Alaska.[42]

equipment, and (3) efforts to improve self-sufficiency for remote Alaskan communities."[27]

Renewable energy resources vary greatly across Alaska. Wind resources are greatest in the Aleutian Islands and along the western and northern coasts (Figure 2). Additionally, limited wind resources are found around the state based on local topography. Large wind development is unlikely in many of the rural communities due to limited size of the load as well as transportation challenges related to large turbines. However, distributed scale wind development has seen success in rural communities across the state. For example, the village of Wales, Alaska, became one of the first communities to reach high-penetration levels of wind energy – that is, energy contribution of 50 to 150 percent on an annual basis – when the community commissioned two 65-kW wind turbines and a 130-amperage hour battery in 2002.[28] The Chaninik Wind Group is also a good example of rural communities collaborating to develop resources and reduce diesel dependence.[29] The consortia of communities has used the development of distributed wind assets to reduce the cost of electricity as well as home heating by installing thermal electric stoves throughout the community. These electric heating devices provide home heating at a reduced cost when compared to traditional heating fuel. With partial DOE funding, Alaska Village Electric Cooperative (AVEC), a generation and distribution utility serving 58 villages in Alaska, has partnered with a number of villages and DOE to install wind turbines that are providing power to Bethel, Oscarville, Napakiak, Stebbins, St. Michael, Pitka's Point, Saint Mary's, and (via a future intertie) Mountain Village, Alaska.[30, 31, 32]

Solar resources in Alaska are comparable to those of Germany on an annual basis. However, solar resources in Alaska are seasonal, and as such, solar resources for electricity and heat

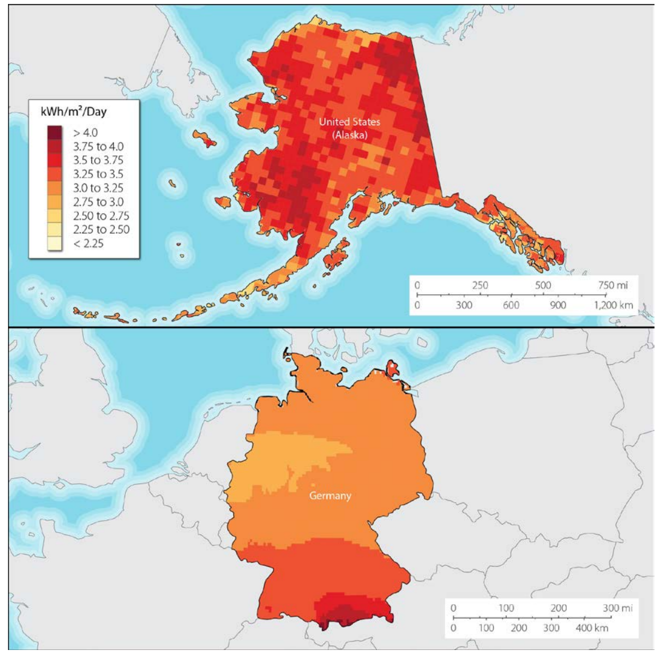

Figure 3: Solar Resources of Alaska and Germany.[43]

generation are primarily used for summer loads such as fish processing or freezing of subsistence foods in late summer and fall. Additionally, solar photovoltaic can offset summer diesel use, providing valuable savings for local communities and reducing dependence on imported fuel products. One example project is the Fort Yukon solar array, installed by the Tanana Chiefs Conference and funded in part by DOE. This 18-kW solar array saves more than 780 gallons of diesel per year.[33] Another example can be found in Hughes, where a recently completed 120-kW solar array co-funded by DOE is slated to save the village 25 percent in diesel use and more than $1 million during the project's 20-year lifespan.[34] Additionally, with partial funding from DOE, NANA Regional Corporation is installing 400 kW of solar in Kotzebue, Buckland, and Deering, which is expected to produce about 420,000 kWh of electricity annually, displacing over 30,000 gallons of diesel fuel.[35]

Finally, Alaska also shows potential for the use of Marine Hydrokinetic (MHK) energy systems. Figure 4 shows the MHK wave and

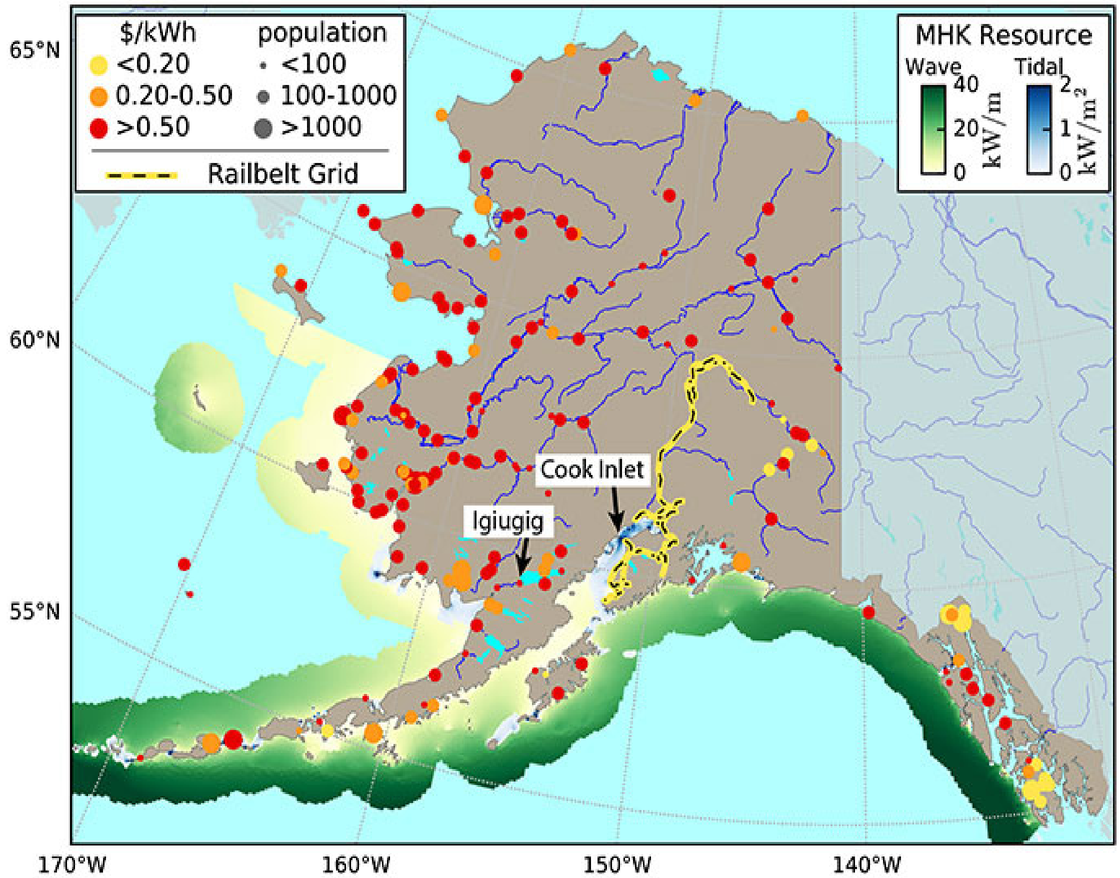

Figure 4: Rural Alaskan Energy Prices (red, orange, yellow dots) and Marine Energy Resources (green, blue).[44]

tidal resources for Alaska. This technology is not as commercially mature as wind or solar generation. However, MHK systems are being deployed in the state. A recently commissioned project in Igiugig is licensed for testing through 2029 and is being used to demonstrate the viability of MHK technologies partially funded by DOE[36] in rural locations in Alaska.[37]

Energy Efficiency

Another option for reducing emissions from energy generation is the adoption of energy efficiency measures, which result in reduced consumption of energy (both electricity and heating fuel). Implementation of energy efficiency programs has already been ongoing in remote areas of Alaska for several years. From 2008 to 2018, the state of Alaska invested $629 million in state funds into residential energy efficiency in the form of two programs.[38] One was the Home Energy Rebate Program, which had no income restrictions but required people to pay for the energy efficiency retrofits to their homes and apply for a rebate. The other, the Weatherization Program, had income limitations for the state funding contribution set at or below 100-percent Area Median Income but paid for the entirety of the work done. In practice, the Home Energy Rebate Program predominantly served the road-connected (and Marine Highway) areas of the state. The Weatherization Program served some low-income areas on the road-connected areas of the state and all rural remote areas.

During the 10-year period, the Weatherization Program received $386.4 million from the state. It served 20,917 households, reduced energy use for participating households by 29 percent, saved an estimated $319 million in health and safety costs and reduced CO_2

Current demand-side energy efficiency programs

- **Rural Alaska Communities Energy Efficiency (RACEE):** Objective of this competition is to significantly accelerate efforts by rural Alaska communities to adopt sustainable energy strategies and technologies through outreach, technical assistance, project development, and the power of competition.
Fund Source: Federal – DOE.

- **Strategic Technical Assistance Response Team (START):** Objective of this program is to provide technical assistance to Alaska Native villages in the development of community energy plans and renewable energy and energy efficiency projects.
Fund Source: Past – Federal – DOE.[45]
Current – Federal – Denali Commission.

- **Village Energy Efficiency Partnership (VEEP):** Goal of these grant projects is to reduce the cost of energy in a community through upgrades that result in lower operation costs. Energy efficient lighting upgrades are typically the first measures undertaken. Due to a specific award, VEEP currently has an active outdoor lighting replacement project.
Fund Source: Past – Federal – DOE.
Current – Private, State Capital, Federal – Denali Commission.

emissions by an estimated 700,000 tons.[39]

The energy efficiency measures implemented as part of the state of Alaska's Weatherization Program focused primarily on reducing space-heating and water-heating energy consumption and not on electrical consumption. Outside of the two main urban centers (Anchorage and Fairbanks), primary space heating is done with #1 or #2 heating oil. As a result, emissions reductions from the program are primarily from reduced heating oil consumption. While regional differences exist within the programs for which energy efficiency measures were implemented, certain measures were still fairly common regardless of the region of Alaska. These included: tightening the home against air leakage; increasing insulation in the ceiling; installing a programmable thermostat; replacing the heating system; replacing doors and windows; increasing the insulation of the floors and walls; and installing some form of ventilation.[40]

The estimated average lifespan of the energy efficiency measures implemented through the state's Weatherization Program is 21 years with an estimated CO_2 emissions reduction impact of 1.47 million tons. While the primary foci of the program were energy efficiency and health and safety instead of greenhouse gas emissions reductions, the cost per reduced ton of CO_2 for the program is estimated to be approximately $263 per ton.

Electric Transmission Interties

One of the most straightforward and sustainable methods for reducing diesel consumption in rural areas of Alaska is to construct electrical interties between communities. Interties allow smaller powerplants to be shuttered and larger powerplants to be used more efficiently. Across the state, utilities have shown that the cost of operating efficient, larger, appropriately staffed powerplants is less than the cost of maintenance on the transmission lines. The challenges with implementing additional transmission lines include the remote nature of much of the state, the lack of roads, and the high financing costs associated with building out expensive infrastructure for small populations, which is a significant barrier.

Community Collaboration

Numerous studies have identified the benefits of a regional approach to providing electricity services in remote areas of Alaska, rather than smaller independent systems in individual communities.[41] Regional collaboration has been demonstrated to provide benefits that result in improved operating efficiency at a community's diesel power plant, which would result in reduced diesel emissions. For example, a regional approach facilitates infrastructure improvements such as the following:

- Installation of automated switchgear, which allows correctly sized diesel engines to run for changing loads and also allows for implementation of renewable energy;
- Addition of waste heat recovery systems which utilize waste heat that could offset diesel fuel burned for heating in community buildings;
- Distribution line upgrades which allow for use of large-scale renewable projects; and
- Bulk tank farms which allow for additional tanks to hold ULSD rather than #1 diesel.

Additional strategies at a regional level that could result in reduced diesel emissions could include multi-community collaboration and technical support, since individual utilities may be under-performing because of limited training of staff and constrained financial and technical resources. Pooling utility operation and maintenance services for several communities can create economies of scale, lower costs, and improved efficiencies, thus, reducing emissions.

Past demand-side energy efficiency programs

- **Commercial Energy Building Energy Audits:** Provided high-quality energy audits or energy assessments to private commercial building owners to help identify and quantify the value of energy efficiency measures that could be implemented specific to their building.
Fund Source: Federal – DOE and USDA Rural Energy for America Program (REAP).

- **Energy Efficiency and Conservation Block Grant:** Funded energy efficiency and conservation improvements. Eligible projects included: energy efficiency audits of public buildings, energy efficiency measures in public buildings, energy efficiency measures to other public facilities, and energy conservation measures including replacing insulation, doors, windows, streetlights, etc.
Fund Source: Federal – DOE.

- **Whole Village Retrofit:** Collaborative pilot project undertaken in 2008-09 with the intention to test what would happen if all available energy cost-saving resources were deployed in the same place at one time. Originally tested in Nightmute and tried in about four other communities. It was a branch of VEEP.
Fund Source: Federal – DOE, Denali Commission; State – Capital Funds and Multiple Agencies.

Assistance Options for the Federal Government

Our review found that several federal government programs are already in place that assist the remote areas of Alaska in meeting their energy needs in an affordable and reliable manner using existing emissions control technology or other technology that achieves similar emissions reductions. These EPA, DOE, Denali Commission, USDA, and BIA programs have a proven track history of working collaboratively with stakeholders in Alaska to implement the strategies for reducing emissions and pollution prevention outlined in this report. The continuation of, and possible expansion of, funding for these programs is likely the most effective option for the federal government to promote energy savings and emission reductions for energy generation in remote areas of Alaska. A short overview of the existing programs is provided in this section.

EPA DERA Programs

The DERA Program was created under the Energy Policy Act of 2005. This Act gave EPA new grant and loan authority for promoting diesel emission reductions. Through the DERA statute, EPA funds projects that reduce diesel emissions from the 10 million existing older, higher polluting on-highway, nonroad, and stationary engines across the country through replacement, idling reduction, and retrofit technologies. The Act stipulates that 70 percent of the DERA appropriation is to be used for national competitive grants and rebates to fund projects that use verified diesel emission reduction technologies, with the remaining 30 percent of the DERA appropriation allocated to the states and territories to fund programs for diesel emissions reduction projects.

A brief overview of the state and tribal programs and their implementation in Alaska is provided below. More detailed information about the DERA program is available at this link: https://www.epa.gov/dera.

DERA State Program: The DERA legislation requires EPA to offer 30 percent of the annual appropriation to government agencies in states and territories to implement their own clean diesel programs. Agencies run their own funding programs to implement projects and offer funding to fleets within their states. State agencies must select projects according to EPA's eligibility and cost-share requirements, but the selections are made entirely by the states and territories to best fit state and local needs. Per the DERA statute, EPA offers states and territories a base funding amount, and if they match this amount dollar-for-dollar, EPA offers additional DERA funds equal to 50 percent of the base amount.

The AEA is a State DERA Grant Recipient currently working in partnership with tribes and native villages to provide subawards and contracts for generator replacement projects throughout remote areas of Alaska. Such projects are needed as primary sources of heat and electricity within these communities.

DERA Tribal Program: Since the beginning of the DERA Tribal Program in 2009, EPA funded eight Alaska tribal grants totaling approximately $2.1 million between 2011 and 2019, including three grants totaling over $1 million in the 2018-19 fiscal year.[46] Since the program's inception, EPA has listened to and incorporated feedback from tribes about the program and made changes based on that feedback. For example, EPA began issuing a tribes-only Request for Proposals in 2014 in response to tribes making that request. For the FY20 Tribal DERA Request for Applications, $2 million will be awarded under the competitive solicitation. A tribal agency or intertribal consortium with jurisdiction over transportation or air quality is eligible to

Photo courtesy of John Pavitt, U.S. EPA Region 10

The Yakutat Power Plant provides electricity to approximately 600 people in the area. As an added innovation, the black tubes attached to the stacks utilize waste heat from the generators to heat the neighboring school.

apply. Tribal agencies are defined as federally recognized Indian tribal governments, which are any Indian tribe, band, nation, or other organized group or community (including native villages) certified by the Secretary of the Interior as eligible for the special programs and services provided through the BIA as well as any organization or intertribal consortium that represents federally recognized tribes. "Intertribal consortium" is defined as a partnership between two or more tribes that is authorized by the governing bodies of those tribes to apply for and receive assistance under this program. Intertribal consortia are eligible to receive assistance under this program only if the consortium demonstrates that all members of the consortium meet the eligibility requirements for the program and authorize the consortium to apply for and receive assistance by submitting to EPA documentation of (1) the existence of the partnership between Indian tribal governments, and (2) authorization of the consortium by all its members to apply for and receive the assistance.

DOE

The DOE has several offices and programs that provide assistance to remote areas of Alaska. One such office is DOE's Office of Indian Energy, which provides Alaska Native villages with resources, technical assistance, skills, and analytical tools needed to develop sustainable energy strategies and implement viable solutions to community energy challenges. Alaska Native villages and regional and village corporations can apply to receive no-cost technical assistance to address a specific challenge or fulfill a need that is essential to a current project's successful implementation by providing technical analysis, financial analysis, and strategic energy planning. Specifically, for Alaska, the Office has entered into an interagency agreement with the Denali Commission to provide technical assistance using local expertise. Additionally, through a recent collaboration between DOE's National Renewable Energy Laboratory and Alaska's Cold Climate Housing Research Center, additional energy efficient design and integration expertise can be tapped to support Alaska Native communities. More information about technical assistance is available here: https://www.energy.gov/indianenergy/technical-assistance. The DOE Office of Indian Energy also provides competitive financial assistance to support tribal energy projects. Between 2010 and 2018, the Office invested $22 million in nearly 50 energy development and energy efficiency projects.[47] For more on projects funded, see the Tribal Energy Projects Database at https://www.energy.gov/indianenergy/maps/tribal-energy-projects-database. Current funding opportunities through DOE and other agencies and entities are available at this link: https://www.energy.gov/indianenergy/funding/current-funding-opportunities. Webinars, workshops, and trainings are also provided to help educate tribal leaders and staff on renewable energy project development and financing. For more information, see https://www.energy.gov/indianenergy/alaska-native-villages.

The Tribal Energy Loan Guarantee Program (TELGP), authorized under title XXVI of the Energy Policy Act of 1992, as amended, is implemented through DOE's Loan Programs Office. TELGP is a partial loan guarantee program that can guarantee up to $2 billion in loans to support economic opportunities to tribes through energy development projects and activities. For more, see https://www.energy.gov/lpo/tribal-energy-loan-guarantee-program.

The Weatherization and Intergovernmental Programs Office (WIP), part of DOE's Office of Energy Efficiency and Renewable Energy, enables strategic investments in energy efficiency and renewable energy technologies by a wide range of stakeholders, in partnership with state and local organizations and community-based nonprofits. Additional information about WIP in Alaska is available here: https://www.energy.gov/eere/wipo/downloads/weatherization-and-intergovernmental-programs-office-project-map-alaska. WIP's programs and teams include the following:

- The State Energy Program (SEP) provides funding and technical assistance to states, territories, and the District of Columbia to enhance energy security, advance state-led energy initiatives, and maximize the benefits of decreasing energy waste. State-led activities include energy emergency planning and response, low-cost financing programs for energy efficiency, performance contracting, school and public building retrofit programs, and innovative energy technology demonstration projects among other programs that spur economic development, increase energy efficiency, and expand domestic energy resources. DOE has provided over $31 million in SEP formula grant funds to the state of Alaska over the period of 2008 to 2018. The AEA has used this funding for a variety of energy efficiency and renewable energy investments, including rural community planning and efficiency (such as the VEEP described earlier in this report), remote building energy monitoring in cooperation with the Alaska Housing Finance Corporation (AHFC), and integrating electric vehicles into their transportation infrastructure. AEA also used a portion of its funding to set up a revolving loan fund to support energy upgrades in public facilities. AEA also received a

$300,000 competitive award from DOE to set up a statewide commercial Property Assessed Clean Energy program to increase energy efficiency and building-level renewable energy technology deployments within the state.

- The Weatherization Assistance Program (WAP) reduces energy costs for low-income households by increasing the energy efficiency of their homes while ensuring their health and safety. The program provides funding to states and territories for locally-run weatherization services to approximately 35,000 homes every year. States contract with community action agencies, non-profits, and local governments that use in-house employees and private contractors to deliver services to low-income families. In Alaska, DOE provided $34 million through the AHFC for energy efficiency measures to low-income Alaskans from 2008-2018 (including funding under The America Recovery and Reinvestment Act of 2009). The National Association of State Community Service Providers 2018 Funding Survey indicates substantial state funded activities, as well as, other, non-DOE federal funding services for weatherization activities.
- The Partnerships and Technical Assistance (P&TA) team serves at the nexus of state and local governments to catalyze lead-by-example programs by developing solutions to barriers facing state and local governments, convening and creating peer exchanges to showcase public-sector leadership and effective public-private partnerships, and providing information from leading technical experts. P&TA cultivates diverse partnerships and provides technical assistance through initiatives that include the Better Buildings Challenge, Better Communities Alliance, and Accelerators.
- The Strategic and Interagency Initiatives team leads inter-organizational initiatives that provide states and local governments technical assistance to help underserved communities have access to more energy choices. DOE's Clean Energy for Low Income Communities Accelerator and Remote Alaskan Communities Energy Efficiency Competition initiatives demonstrate replicable, scalable models that address barriers to energy efficiency and renewable energy access in low-income communities.

The DOE Grid Modernization Laboratory Consortium - Alaska Microgrid Partnership is a collaboration between DOE, National Laboratories, the Alaska Center for Energy and Power, Cordova Electric Cooperative, and other Alaska research entities to understand how to better modernize microgrids in Alaska. The over-arching goal of the Alaska Microgrid Partnership is to reduce diesel fuel consumption by 50 percent in Alaska's remote microgrids without increasing system lifecycle costs, while improving overall system reliability, security, and resilience. Data sources and information will be developed and shared with other stakeholders across Alaska and the Arctic. More information is available here: https://www.energy.gov/eere/buildings/downloads/gmlc-1321-alaska-microgrid-partnership.

Denali Commission

The Denali Commission (Commission) was established by the federal government in 1998. The Commission's purpose includes providing job training and other economic development services in rural communities, promoting rural development, and providing power generation and transmission facilities, modern communication systems, water and sewer systems and other infrastructure needs. The Commission funds job training for bulk fuel storage as well as power plant and utility operations through grants to the AEA. The Commission has funded rural power system upgrades, which have included renewable energy projects and electric interties. Sources of funding for the Commission include federal appropriations and other federal agencies. Information provided by the Commission indicates that as of October

2018, the Commission has provided over $245 million for power system and intertie projects based on project priority lists developed in partnership with AEA and the Alaska Village Electric Cooperative. The Commission has provided $50 million for wind/microgrids, hydroelectric, biomass, geothermal, and emerging technologies such as hydrokinetic river turbines. In addition, the Commission has invested approximately $26 million in projects and initiatives specifically related to energy planning, efficiency, and conservation, such as the Alaska Native Tribal Health Consortium's Sanitation Energy Efficiency Program, which strives to reduce energy consumption in rural water supply and wastewater treatment systems. More information about the Commission can be found at https://www.denali.gov/.

USDA

The USDA's REAP offers grants and loan financing for renewable energy and energy efficiency projects to rural small businesses and agricultural producers. Businesses must not be within a city or town with a population of greater than 50,000. The grant funds can be used for the purchase and installation of renewable energy systems such as small and large solar or wind generation, which could reduce emissions by decreasing the reliance on diesel generation in remote areas. More information about the program is available at https://www.rd.usda.gov/programs-services/rural-energy-america-program-renewable-energy-systems-energy-efficiency/ak.

The USDA's High Energy Cost Grant assists power providers in rural areas with extremely high per-household energy costs (275 percent of the national average or higher), including nonprofits such as cooperatives, for-profit businesses, and state, local, or tribal entities. The grants can be used for the acquisition, construction, or improvement of energy-related facilities serving residential customers, including electric generation, transmission, and distribution facilities and renewable energy facilities. See the following link for more information: https://www.rd.usda.gov/programs-services/high-energy-cost-grants.

U.S. Department of the Interior, BIA

The BIA has several energy-related programs for tribes that can support reduced diesel emissions in rural Alaska. Specifically, the BIA's Division of Energy and Mineral Development program provides two grant opportunities, the Energy and Mineral Development Program (EMDP) Grant and the Tribal Energy Development Capacity (TEDC) Grant. The TEDC grant in particular has been used by various Alaska communities and organizations to develop institutional infrastructure that can improve tribal and rural utility operations, thus, reducing diesel fuel consumption and resulting emissions. The EMDP grant has not been applicable to Alaska Tribes (except for Metlakatla) in the past, though this year (FY20) will be the first year in which Alaska Tribes will be eligible.

More information about the EMDP and TEDC grants can be found at the following links: https://www.bia.gov/as-ia/ieed/division-energy-and-mineral-development/tribal-toolbox/tribal-funding and https://www.bia.gov/as-ia/ieed/division-energy-and-mineral-development/tedcp.

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