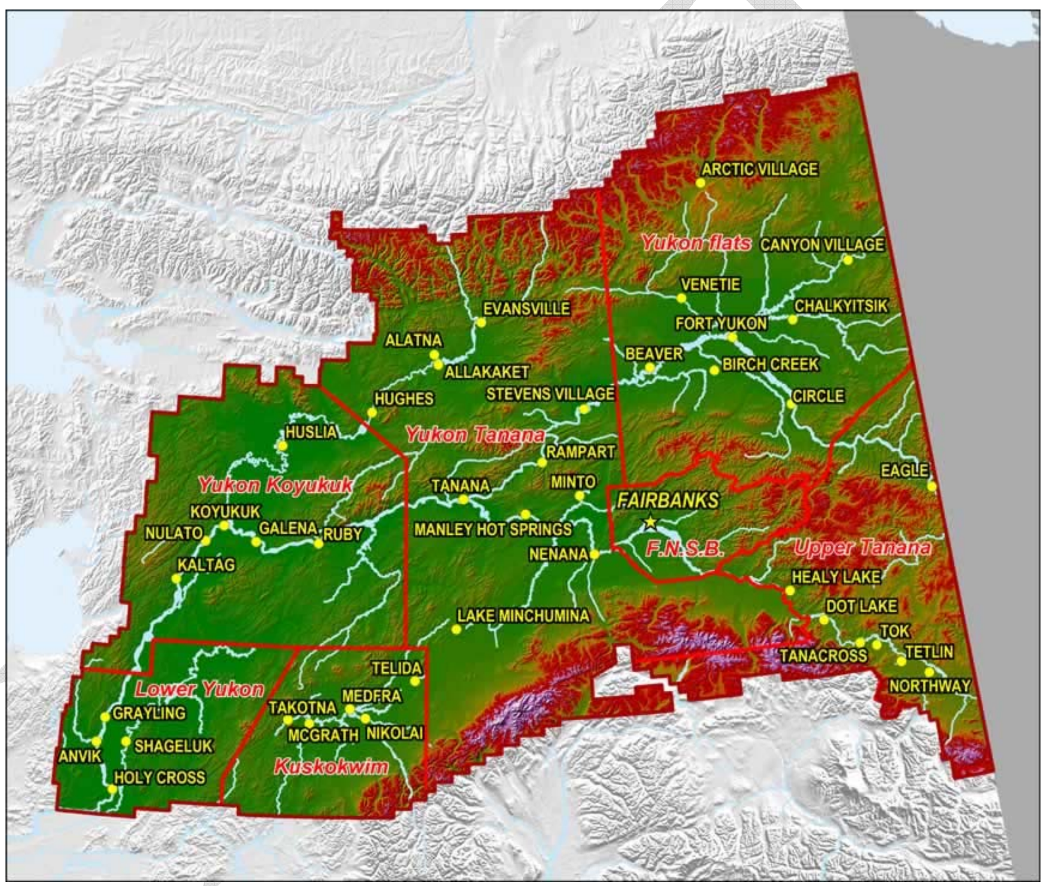
# Interior Regional Energy Plan

# Phase I

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# Interior Regional Energy Plan

# Phase I

**Prepared by the Alaska Center for Energy and Power**
**In collaboration with Tanana Chiefs Conference**



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Alaska Wood Energy Development Taskforce

City, Tribe and Utility of Fort Yukon

City, Tribe and Utility of Galena

City, Tribe and Utility of Holy Cross

City, Tribe and Utility of McGrath

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University of Alaska Fairbanks Tok Center

Tanana Chiefs Conference

Tok Area Forestry

WHPacific and NANA Corporation

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# EXECUTIVE SUMMARY

This energy plan is the first phase of a long-term regional planning process in which Interior stakeholders identify and respond to the challenges and opportunities that impact energy services in the 21st century. Phase I has been a collaborative process involving Interior community leaders, Tanana Chiefs Conference, and energy stakeholders from around the state. Community meetings were held to discuss the Plan in five of six Interior subregions. A questionnaire was distributed to all tribal administrators, city managers and utility operators in the forty-two Interior communities. Finally, a steering committee composed of energy stakeholders from multiple regions and organizations met three times to discuss this five-month, Phase I planning process. Together, these actions reflect a vision in which possibilities are realized for developing a sustainable, affordable and reliable energy future.

This plan identifies numerous challenges that Interior villages currently face:

- Power plants with oversized and inefficient generators are in need of upgrades
- State funding for weatherization improvements is not reaching all rural communities
- Energy inefficient school and public buildings are not being addressed by State weatherization programs
- The vast woody biomass resource in the Interior has not been assessed for sustainable energy development
- Reduced river levels are interfering with the transport of diesel fuel to villages
- Increasing fire potential poses a threat to infrastructure, lives, and a developable energy resource

Interior communities rely primarily on diesel fuel for heating and power generation. Based on a medium cost projection from the Institute of Social and Economic Research, the Interior region is on track to spend close to half a billion dollars on electric, heating and transportation fuel in the next twenty years. Interior communities cannot afford to maintain the status quo and continue paying such high energy costs. Perhaps the worst possible energy strategy for the Interior would be to maintain the existing energy systems without attention to the above mentioned challenges.

This plan offers a vision for the Interior region—to sustain healthy communities through a collaborative regional planning process that increases energy efficiency, expands the use of local energy resources in a sustainable manner, and develops the regional capacity to design and maintain new and existing power systems. The future of the region depends on innovation and long-term solutions. Such solutions require a multi-faceted examination of the viability of current fuel delivery systems and community dependency on imported diesel fuel, the benefits of hazardous fuel mitigation strategies versus current fire management strategies, the potential for renewable energy development, the applicability of new energy technologies, and the development of local capacity to operate and maintain new energy systems.



The challenges in energy provision identified by Interior stakeholders give rise to new opportunities to address local and regional energy needs:

- Retrofits and weatherization of existing buildings and power plants create opportunities to address the cost of energy by reducing the amount of diesel fuel consumed in a community. New designs for old systems make use of waste heat from power plants for greenhouse-based, local food production.
- Renewable resources such as woody biomass, wind, solar and hydro provide supply-side solutions that reduce dependency on imported diesel fuel.
- Existing State energy programs establish a framework for the development of an effective State energy policy that addresses the rural context.

This plan offers 25 recommendations for local, regional, and statewide decision-makers based upon the input received from Interior stakeholders through surveys, community meetings and teleconferences. Phase II of the Interior Regional Energy Planning process is needed to develop a more comprehensive, long-term plan for Interior Alaska.

# RECOMMENDATIONS

## Building Efficiency

1. Expand State Weatherization Program to Accommodate Rural Residents
2. Design Home Energy Rebate Program to Accommodate Rural Residents
    a. Train Rural Energy Raters
    b. Identify Energy Raters Who Are Available to Rural Communities
3. Amend Weatherization Programs to Include Electrical Energy and Safety Upgrades
4. Improve Village End Use Efficiency Measures (VEUEM) Program
    a. Expand VEUEM to Include Full Energy Audits
    b. Ensure That Rural Power System Upgrade (RPSU) and VEUEM Programs Work Together
5. Conduct Energy Audits on all Interior Schools
6. Perform Efficiency Upgrades on all Public Buildings: Support Senate Bill 121

## Power Generation

7. Complete Power Plant Upgrades Within Five Years Through Expanded RPSU Program
8. Support Research, Development and Deployment of Village-Scale Combined Heat and Power Systems
9. Support Initiatives to Utilize Waste Heat for Greenhouse-based Food Production
10. Support Local Assessments of Solar Resource through Program Modeled After Alaska Wood Energy Development Task Group

## Heating

11. Identify the Biomass Resource in the Region
    a. Support Biomass Resource Assessments in Region
    b. Support Biomass Economic Feasibility Assessments in Region
12. Support the Deployment of Efficient Wood-Fired Boilers Where Appropriate

13. Support Initiatives to Develop Pellet Production Facilities in the Interior

## Transportation

14. Collect Data on the Fuel Used in the Transportation Sector
15. Address Increasingly Intermittent and Expensive Barge and Air Shipments by Diversifying the Fuel Stock

## Education and Outreach

16. Develop an Energy Education and Outreach Program for Interior Alaska
17. Develop Operator Training Program for Existing and New Energy Technologies

## Planning for the Future

18. Support Integrated Planning for New Construction
19. Support the Development and Implementation of Community Energy Plans
20. Support Research, Development and Deployment of Enhanced Energy Efficiency Methods and New Energy Technologies that are Relevant to Rural Alaska Communities
21. Conduct an Economic Analysis of PCE
22. Reevaluate PCE Structure to Incentivize Renewable Energy Development
23. Provide Technical Assistance for PCE Reporting
24. Revise the Renewable Energy Fund Eligibility Structure to Include Tribal Service Providers
25. Implement Phase II of Regional Energy Planning Process

**Note: Detailed descriptions of the above recommendations begin on page 33.**

## INTRODUCTION

The goals of the Phase I Interior Regional Energy Plan are to identify the opportunities for energy development, efficiency improvements, and policy creation, and to provide a process in which residents and communities can work towards an energy vision for their region. Phase I is ancillary to efforts put forth by the Alaska Energy Authority to develop a statewide energy plan. The planning effort was facilitated by the Alaska Center for Energy & Power at the University of Alaska and the Tanana Chiefs Conference, with oversight from a Steering Committee comprised of individuals from the private and public sector. The initial planning process took place from July through November 2009. During this phase, data was collected and analyzed, interviews with key informants were conducted, and five subregional community meetings were held. Phase I is anticipated to be the first step in an ongoing, long-term process to develop an Interior Regional Energy Plan. Such a plan is intended to address the cost of energy in the region, as well as to look beyond the costs and examine energy as a tool for attaining and sustaining a quality of life for residents and communities.

## ENERGY VISION

Sustain healthy communities through a collaborative regional planning process that increases energy efficiency, expands the use of local energy resources in a sustainable manner, and develops the regional capacity to design and maintain new and existing power systems.

## OBJECTIVES

1. Identify regional priorities for energy research and development.

2. Increase the collaboration between Interior region stakeholders on energy policy, programs, infrastructure, and capacity for the region.

3. Increase the understanding of energy options available to Interior region stakeholders for improved energy decision making.

## STRATEGIES FOR MEETING THE OBJECTIVES

- Develop a viable Interior Region Energy Steering Committee
- Hold community and subregional energy planning meetings
- Develop energy program metrics for improved monitoring of IREP implementation
- Provide procedural guidelines for the development of a variety of renewable energy resources
- Provide a list of recommendations based upon input from Interior residents
- Initiate Phase II of the IREP process

## BENCHMARKS

**Within Three Years:**

- Complete community energy plans for all Interior communities
- Develop comprehensive 25-Year Interior Region Energy Plan
- Improve energy efficiency of buildings and power plants within region
- Develop energy education and outreach program for Interior Alaska

**Within Five Years:**

- Complete audits on all Interior schools and develop plan to conduct improvements
- Complete power plant upgrades in all communities
- Complete weatherization projects in all communities

- Complete assessment of woody biomass resource in region

**Within Ten Years:**

- Reduce the use of fossil fuels in the region 25% below 2010 levels by 2020
- Increase the use of renewable sources of energy by 25% over 2010 levels by 2020
- Reduce diesel and electricity consumption through efficiency improvements 15% below 2010 level by 2020

## METHODOLOGY

### Literature review: Energy Plans

The Alaska Center for Energy and Power staff conducted a literature review of existing community, regional, state, and provincial energy plans. This review uncovered a number of documents that informed this planning process. Amongst the documents that were reviewed are the NANA Region Strategic Energy Plan, Lake and Peninsula Borough Regional Energy Plan, the Southwest Alaska Municipal Conference (SWAMC) Comprehensive Energy Policy, the Cold Climate Housing and Research Center's Alaska Energy Efficiency Program and Policy Recommendations, the Capital Region Community Energy Plan, and the energy plans of four Interior Alaskan communities.

### Key informant interviews

Key informant interviews were conducted with utility managers, energy program staff, Tanana Chiefs Conference staff, local government officials, utility operators, and community leaders. Information from these interviews was instrumental in providing background information and defining the scope of the issues addressed in this plan.

### Existing data collection and analysis

Data was collected on power plant upgrades, cost of energy, energy efficiency for school districts and public buildings, existing and future energy project costs, and renewable energy project proposals and feasibility studies. Data was collected through questionnaires, existing databases and contacting organizations and agencies. The questionnaires were mailed to tribal administrators, city managers, village corporations, and electric utilities in Interior communities. The mailing announced the TCC/ACEP partnership, and invited all interested parties to participate in the upcoming subregional meetings and teleconferences that would be held as part of the planning process. The questionnaires collected information on local power plants, including the size, make, and model of existing generators, upgrades, system automation, and installed heat recovery technologies.

### Establishment of a Steering Committee

A steering committee was established to guide the energy planning process. Committee meetings were held monthly at the Alaska Center for Energy and Power beginning September 8, 2009. Most participants joined the meetings via teleconference. The committee members represent the following organizations and communities:

- Alaska Center for Energy and Power
- Alaska Energy Authority
- Alaska Power & Telephone Company
- Alaska Village Electric Cooperative
- Alaska Wood Energy Associates
- Alaska Wood Energy Development Taskforce
- Cold Climate Housing Research Center
- Huslia, Community of
- Interior Regional Housing Authority
- National Renewable Energy Laboratory
- Renewable Energy Alaska Project
- Ruby Marine, Inc.
- Tanana Chiefs Conference
- University of Alaska Fairbanks, Cooperative Extension Services
- University of Alaska Fairbanks, Geophysical Institute

**Subregional meetings**

The Interior region is comprised of six subregions: Upper Kuskokwim, Yukon Koyukuk, Lower Yukon, Upper Tanana, Yukon Flats, and Yukon-Tanana. Community meetings were held in five out of the six subregions and followed an open format. ACEP and TCC staff introduced the regional planning process and the goal of the statewide energy plan. A staff member from the Alaska Energy Authority was also present at the majority of the meetings. Community members were encouraged to provide feedback regarding their energy concerns, needs, and proposed solutions. Meetings were held in the following communities:

| | | |
|---|---|---|
| Upper Kuskokwim Subregion: | McGrath | August 26, 2009 |
| Yukon Koyukuk Subregion: | Galena | September 29, 2009 |
| Lower Yukon Subregion: | Holy Cross | October 6, 2009 |
| Upper Tanana Subregion: | Tok | October 14, 2009 |
| Yukon Flats Subregion: | Fort Yukon | October 19, 2009 |
| Yukon-Tanana Subregion: | Tanana | unable to be scheduled |

**Initial Draft for Review**

An initial draft of the IREP was provided to tribal administrators and steering committee members in mid-November, 2009. A two-week review period ensued, providing ACEP staff members the opportunity to gather feedback on the Plan and to make necessary revisions and additions.

**Final Interior Regional Energy Plan**

A final draft of the first iteration of the IREP was presented to Interior stakeholders and the Alaska Energy Authority on November 30, 2009. This plan is intended to be a working document that provides a foundation for a long-term Interior regional energy planning process.

## WHY AN INTERIOR REGIONAL ENERGY PLAN

In early 2009, the State of Alaska released *Energy Alaska: A First Step Toward Energy Independence*. The document was intended to identify energy needs and local resources for electrical generation, heating, and transportation for each community in Alaska. *Energy Alaska* is considered the first step in an ongoing effort to develop a statewide energy plan. The State is currently engaged in the next phase of this process, in which it is revising the community inventory, proposing financing options, and is planning to generate regional energy recommendations. To this end, the State has requested that each region develop a regional energy plan. These regional planning processes are intended to directly engage citizens in a discussion concerning the development of local energy solutions. These regional plans will be used as building blocks for the development of a statewide energy plan. The Alaska Center for Energy & Power (ACEP) was asked by the Alaska Energy Authority to facilitate the development of an Interior Regional Energy Plan.

ACEP has worked with the Tanana Chiefs Conference (TCC) to host community energy meetings and to compile data on the past, present and future energy projects, project assessments, and community energy plans for the Interior region. The Interior Regional Energy Plan is a first step towards developing a comprehensive energy plan for the region.

## BACKGROUND: CURRENT CONDITIONS IN THE INTERIOR

### I. Interior Regional Context

For the purpose of the Interior Regional Energy Plan, the Interior region is defined as the communities serviced by the Tanana Chiefs Conference, excluding the community of Nenana since it is included in the Railbelt regional energy plan. Additionally, the communities of Bettles, Central, Chicken, and Livengood are included in the plan. In total, the Interior Regional Energy Plan encompasses 42 communities.

The Interior region of Alaska covers approximately 235,000 square miles and is comprised of communities with populations varying from three to almost 1,400 people. According to the 2000 census, the population of these 42 communities is 7,610. Approximately 71% of the population is Alaska Native. Several of the communities are accessible by road; however, the majority is accessible only by air, or by river during the summer months. Such transportation limitations and their associated costs have contributed to the prohibitively high cost of power throughout most of the region.

The Interior region is characterized by extreme temperature variability. Winter temperatures can be severe with extended cold snaps at forty-below. However, the summer experiences some of the warmest temperatures in the state, hovering at or above 80°F for extended periods of time. The latitude in the Interior creates a high degree of seasonal variability in sunlight, creating long summer days and long dark winters.

The region is characterized by vast mountain ranges and major rivers, including the Yukon, Kuskokwim, and Tanana Rivers. The majority of Interior communities are situation along rivers and depend on barges for the transportation of good, supplies and fuel oil for electricity, heating and transportation needs. In recent decades, the level of many rivers has dropped, making barge travel unpredictable and at times even impossible. The Interior is dominated by black and white spruce trees, and intermixed with alder, willow, birch, and aspen stands. In large portions of the region, the land is categorized as discontinuous permafrost, increasing the challenges and costs for development, infrastructure and construction projects.

The Interior is becoming warmer and drier[1]. As air and soil temperatures increase, permafrost is melting and the length of the annual growing season is expanding. The immediate impacts of these climatic shifts on Interior villages are lower river levels,

[1] Chapin FS, III, M Sturm, et al. (2005).

increased incidence and intensity of forest fires[2], changing habitat for subsistence resources, increased potential for local food production, and reduced wintertime access via snow and ice[3]. One of the primary challenges posed by climatic change is that the rivers upon which Interior communities have depended for the delivery of fuel, food, and materials, are no longer as navigable by barge as they were in the past. A second major challenge is developing a sustainable strategy to utilize a vast local biomass resource before they are consumed by fire.

## II. State of Energy in the Interior

With the exception of two electric interties connecting nearby villages, stand-alone diesel generators power the majority of Interior communities. These diesel generators require additional facilities and additional infrastructure to support the power systems, including bulk fuel storage facilities and backup generators in almost every rural village.

In 2005, the Alaska Housing Finance Authority conducted the Alaska Housing Assessment Study in order to determine housing conditions and needs throughout Alaska[4]. The study found that many housing units in rural Alaska are in the need of replacement due to substandard living conditions and overcrowding. The study found that rural areas have a significantly higher incidence of substandard housing conditions than do urban areas, often resulting in a disproportionate percentage of household incomes allocated to electricity and heating costs.

Energy prices in the Interior communities have risen dramatically in the past several years, peaking during the summer of 2008 when the price for a barrel of crude oil spiked to an all time global high of $147. This rise in global crude oil prices heavily impacted the electricity, heating, and transportation costs across Alaska. Although rural Alaska has seen unprecedented rises in the cost of electricity and heating in the past two years, the costs are inherently higher due to the baseline costs associated with transporting and storing fuel, and maintaining diesel generators and bulk fuel farms.

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[2] Chapin, F. S., III, A. L. Lovecraft, et al. (2006).
[3] Huntington HP, Trainor SF, et al.(2006).
[4] AHFC. (2005). Alaska Housing Assessment Study.

## III. Energy Resources in the Interior

### Biomass

The Interior region is vastly covered by black and white spruce trees, and intermixed with alder, willow, birch, and aspen stands. This large resource has the potential to provide an alternative heat and power source for communities throughout the Interior region. Traditionally, wood has been an important renewable energy source, with over 41% of Interior households utilizing biomass as a form of heat. Biomass fuels can include whole trees, cut firewood, compressed sawdust pellets, or gasified wood. These fuels can be used for electricity generation, heating, or a combination of both. In the Interior Tanana and Dot Lake have installed wood boilers to offset diesel costs to heat community buildings and selected households. Moreover, positive environmental and economic impacts may be realized through forest thinning to reduce the risks of forest fires to property and long-term ecosystem services.

### Solar

Solar power uses radiation from the sun and converts it into thermal (heat) or electric energy. The solar resource in Alaska is significant, but it varies significantly depending on the season, weather and latitude. Alaska's Interior region presents the challenge of minimal solar energy during the winter months, when home energy demand is greatest. However, the Interior has a viable solar resource for well over half of the year, which can be captured for solar hot water, space heating, and power generation.

### Hydro

Hydroelectric power is the largest renewable source of energy in Alaska, supplying over 24% of the state's power. Most of the hydro resources are in the Southeast and no commercial hydropower resources have been developed in the Interior. The majority of existing hydropower facilities store energy by impounding water in a reservoir by constructing a dam. However, "run-of river" power, which diverts a portion of the natural river flow through turbines to make power before returning the water to the river downstream, is another option. In the end, this form of power produces less electricity than dam projects, but it maintains water levels downstream for salmon runs and riparian habitat.

Many Interior communities are located on large rivers, which have the potential to generate power by hydrokinetic systems. In the summer of 2008, Ruby installed a 5 kW experimental hydrokinetic turbine to test the feasibility of hydrokinetic power generation. A similar system is scheduled to be installation in Eagle in 2010 and in Nenana in 2011. This technology is experimental and there are still numerous environmental and maintenance concerns, but hydrokinetics may be a viable alternative for many Interior villages in the future. ACEP is currently researching hydrokinetic power and it potential environmental impacts at a research center located in Nenana.

**Wind**

The greatest areas of class seven, "superior" wind resources in the entire United States are located in Alaska. These areas are primarily the western and coastal regions of the state. In the Interior, the average wind speed is often much lower; however, there are localized wind resources that are potentially developable, mostly along ridgelines above 1800ft. Wind power in Alaska is often used for small, off-grid home applications or in village wind-diesel hybrid system. Several commercial-scale wind projects have been developed across the state in the last decade, including in Kodiak, Nome, Kotzebue and Delta. However, there have not been any projects developed in the Interior region covered in this plan.

**Table 1: Locations in the Interior with publicly available wind resource data**

| Community | Wind Class | Wind Description |
|---|---|---|
| Anvik | 1 | Poor |
| Arctic Circle | 1 | Poor |
| Bettles | 1 | Poor |
| Ft. Yukon | 1 | Poor |
| Galena | 1 | Poor |
| McGrath | 1 | Poor |
| Northway | 1 | Poor |
| Tanana | 1 | Poor |

### Geothermal

Geothermal resources are present at multiple locations within Alaska's Interior, in the region running east-west across central Alaska from the Seward Peninsula to the Yukon Territory. The majority of the geothermal sites are within zones of discontinuous permafrost and have low to moderate hydrothermal reservoirs. Geothermal resources may be used for electricity production or direct uses such as district heating, greenhouses, and absorption chillers. Geothermal resources are widespread in the Interior, yet most are located in remote areas that lack large population centers, or are isolated from potential users by rugged terrain and a lack of electric transmission lines. For these reasons, the construction of geothermal power plants has been limited. In the Interior, the only developed geothermal resource for power generation is at Chena Hot Springs Resort. However, recent assessments of existing wells were conducted by TDX Power at Manley Hot Springs and by ACEP for the North Star Borough to map and log the temperature gradient.

### Coal

Coal is a nonrenewable resource that is primarily used to produce electricity and heat. Alaska possesses roughly half of the nation's coal resource, but there is only one operational coalmine in Alaska, the Usibelli mine. The bulk of Alaska's coal deposits lie above the Arctic Circle and are currently unable to be developed due to limited infrastructure, remote and rugged terrain, and the low to medium grade of the available resource. Although little exploration has been conducted in the Interior, the western Arctic Slope, Cook Inlet and Matanuska Valley areas are exploring their local coal resources. Additionally, research is being conducted to reduce the emissions and increase the efficiency of creating electricity from coal. Doyon Ltd., along with the State and the U.S. Department of Energy, conducted a feasibility study of developing the coal resource near McGrath. The study was turned over to McGrath Light and Power in 1995.

**Coalbed Methane**

There is currently no developed coalbed methane resource in Alaska. An important coalbed methane study was conducted in Fort Yukon in 2004. An exploratory hole was drilled into an existing hole to explore the gas content of two low-rank lignite seams. The results revealed that the gas content of the seams was low, demonstrating that Alaska's prevalent low-rank lignite coal seams are not necessarily suitable for development.

**Propane**

Propane is being considered as a potential alternative to diesel fuel for rural communities across Alaska. Several entities, including the Alaska Natural Gas Development Authority, City of Tanana, Institute of Social and Economic Research, and Bart Englishoe and Associates are researching the potential for propane to be used in rural communities and transported via trucks, river barges or oceangoing barges. In 2007, the Alaska Natural Gas Development Authority funded a propane demonstration project in Tanana, Alaska. The project intends to study the economics of extracting propane from North Slope gas and transporting it to rural villages. Potential benefits of using propane are that it is a low-maintenance technology, relatively efficient, and is governed by stringent safety regulations[5].

However, several challenges have been identified. A major challenge is that the current propane shipping containers are too large to be off-loaded in rural villages with existing

[5] Bartz Englishoe and Associates (2008)

equipment. Additionally, there are not commercially available propane storage tanks sized to meet the needs of rural communities[6]. The Denali Commission recently invested millions in diesel infrastructure with the development of diesel bulk storage facilities. Developing new propane facilities and infrastructure would be a significant additional cost. Another challenge of using propane is the transportation. Oceangoing barges are being researched as a potential economic option for transporting propane; however, the Interior region relies primarily on river-going barges to transport fuel. Additionally, there has not yet been an economic analysis of propane as a substitute for diesel fuel.

## IX. Future Energy Costs in the Interior

In 2008, The Institute for Social and Economic Research issued a report on Diesel and Heating Oil Price Projections from 2008-2030[7]. The document created a model that assumes the continuation of diesel fuel use for electricity production, transportation and heating and generated a low, medium and high case for fuel projections. Based on this model, we calculated how much money the Interior region is anticipated to spend on combined heating, electric and transportation fuel costs for residential use over the next 20 years. Such figures may be useful when considering the economics of alternative fuel projects and determining where to invest money in energy projects.

**Table 2: Cumulative heating, electric and transportation costs for the Interior region over the next 20 years**

| Low | Medium | High | $110 per barrel |
|---|---|---|---|
| $326,805,327 | $461,026,546 | $633,078,350 | $504,604,532 |

***Based on a low, medium, high and $110 per barrel of oil projections***

[6] Personal communication with Dennis Whitmer, Alaska Center for Energy and Power
[7] Colt, S., Saylor, B., & Szymoniak, N. (2008).

# EXISTING PROGRAMS AND POLICIES

Historically, the majority of state energy policies have been directed at subsidizing and equalizing energy costs and supporting existing diesel systems throughout rural Alaska. However, in the last two years, the state has started to invest in the development of renewable and local energy resources and infrastructure. Below is information on several state programs that provide economic relief, funding opportunities and technical assistance to Interior communities.

**Power Cost Equalization:** The goal of the Power Costs Equalization program, administered by the Alaska Energy Authority, is to provide economic assistance to customers in rural areas of Alaska that are not connect to the road system and therefore are subject to high costs of purchasing and transporting diesel fuel. PCE pays a portion of approximately 30% of all kWh's sold by the participating utilities; commercial customers are not eligible for the subsidy. The PCE subsidy has drastically reduced the costs of electricity for residents and public entities and has attempted to equalize power costs to those costs in urban areas.

**Bulk Fuel Upgrades:** The Bulk Fuel Upgrade program is sponsored by the Alaska Energy Authority, with substantial contributions from the Denali Commission. The program provides funding for the design, engineering, business planning, and construction management services to build code-compliant bulk fuel tank farms in rural communities.

**Rural Power Systems Upgrades:** The Alaska Energy Authority administers the Rural Power Systems Upgrade program, which upgrades the local diesel generators in rural communities. Upgrades may include efficiency improvements, powerhouse upgrades or replacements, line assessments, lines to new customers, demand-side improvements, and repairs to existing generation and distribution systems.

**Anemometer Loan Program:** The Alaska Energy Authority administers the Anemometer Loan Program by supplying meteorological "met" towers, data logging equipment, and technical support to utilities and communities interested in wind power production. Funding for this program is from the Denali Commission and U.S. Department of Energy.

**Weatherization:** In 2008, the Alaska legislature appropriated $300 million to the Alaska Housing and Finance Corporation (AHFC) Weatherization and Home Energy Rebate Program, designating $200 million for weatherization and $100 million for rebates. The Weatherization Program provides free weatherization assistance to all eligible Alaskans who make under 100% of median income in their region. The Home Energy Rebate Program will rebate homeowners for up to $10,000, based on a final energy star rating, for making energy efficiency improvements to their homes.

**Renewable Energy Fund:** In 2008, the state legislature allocated $300 million over five years for renewable energy projects with the creation of the Renewable Energy Grant Program. The program is administered by the Alaska Energy Authority and provides assistance for feasibility studies, energy resource monitoring, and renewable energy construction. During the first two rounds of funding, the program invested $125 million in over 107 projects.



## EXISTING DATA, ENERGY SERVICES & INFRASTRUCTURE

### I. Community Energy Plans

Although the regional approach to energy planning is relatively new to the Interior, many communities have developed, or are in the process of developing, community-level energy plans. With assistance from a Department of Energy grant, the Interior Regional Housing Authority (IRHA) has facilitated the development of community energy plans in several Interior communities, including Alakaket, Birch Creek, Hughes, and Huslia. During the summer of 2009, energy plans were developed in the Lower Yukon river villages of Grayling, Anvik, Shageluk, and Holy Cross. Following the creation of these plans, local residents were hired to collect 10-12 months worth of energy data, including energy consumption and cost of energy, from each community.

In addition to the AHFC sponsored plans, several other villages have developed community energy plans including Huslia, Galena, Allakaket, Tanana, Anvik, Tanacross, and McGrath.   Other communities may have developed and implemented plans; however, these were the only ones that were identified during the planning process.

## II. Efficiency

Increasing energy efficiency is a way to use less energy while still providing the same quality of service.  It is also considered the cheapest, easiest, and most immediate way in which individuals, businesses, and agencies can reduce energy consumption and greenhouse gas emissions.  One of the best ways to increase the energy efficiency of homes, commercial, and public buildings is by conducting an energy audit.  The energy audit generates recommendations and solutions for becoming more efficient.

In Alaska, the Alaska Housing Finance Corporation (AHFC) administers the primary energy efficiency programs, which are the Weatherization Program and the residential Home Energy Rebate Program.  In the Interior, the primary agencies that perform these services are the Interior Regional Housing Authority and Tanana Chiefs Conference, although several individual communities operate their own housing authorities.

Tanana Chiefs Conference has provided weatherization services in the Interior since 1991 and has weatherized homes in over 18 villages.  Historically, Tanana Chiefs Conference's weatherization program prioritized homes that housed elders, children under the age of six, and handicapped or disabled people.  However, the TCC weatherization budget increased to $1.4 million in 2008 and $4.6 million in 2009, enabling TCC to weatherize all eligible homes in a given community.  Beginning in 2009, the Interior Regional Housing Authority began sharing weatherization responsibilities.  The two organizations created a 5-year weatherization plan, which determined which communities would receive weatherized services in the upcoming years.

**Table 3: Home weatherization projects in the Interior communities (blue = completed projects, green = future projects)**

| Community | Year | Service Provider |
|---|---|---|
| Northway | 1991 | Tanana Chiefs Conference |
| Nikolai | 1991 | Tanana Chiefs Conference |
| Stevens Village | 1992 | Tanana Chiefs Conference |
| Kaltag | 1993 | Tanana Chiefs Conference |
| Manley Hotspring | 1994 | Tanana Chiefs Conference |
| Evansville | 1994 | Tanana Chiefs Conference |
| Venetie | 1996/1997 | Tanana Chiefs Conference |
| Holy Cross | 1996 | RuralCAP |
| Arctic Village | 1997/1998 | Tanana Chiefs Conference |
| Nulato | 1999 | Tanana Chiefs Conference |
| McGrath | 2000 | Tanana Chiefs Conference |
| Ruby | 2001 | Tanana Chiefs Conference |
| Galena | 2003/2004 | Tanana Chiefs Conference |
| Tanana | 2005 | Tanana Chiefs Conference |
| Fort Yukon | 2007/2008/2009 | Tanana Chiefs Conference |
| Hughes | 2009 | Interior Regional Housing Authority |
| Huslia | 2009 | Interior Regional Housing Authority |
| Shageluk | 2009 | Interior Regional Housing Authority |
| Allakaket | 2009 | Tanana Chiefs Conference |
| Alatna | 2009 | Tanana Chiefs Conference |
| Grayling | 2010 | Interior Regional Housing Authority |
| Rampart | 2010 | Interior Regional Housing Authority |
| Koyukuk | 2010 | Tanana Chiefs Conference |
| Nulato | 2010 | Tanana Chiefs Conference |
| Minto | 2010 | Tanana Chiefs Conference |
| Manley Hotsprings | 2010 | Tanana Chiefs Conference |
| Stevens Village | 2011 | Interior Regional Housing Authority |
| Kaltag | 2011 | Interior Regional Housing Authority |
| Holy Cross | 2011 | Tanana Chiefs Conference |
| Anvik | 2011 | Tanana Chiefs Conference |
| Ruby | 2012 | Interior Regional Housing Authority |
| Takotna | 2012 | Interior Regional Housing Authority |
| Chalkytsik | 2012 | Tanana Chiefs Conference |
| Venetie | 2012 | Tanana Chiefs Conference |
| Arctic Village | 2013 | Interior Regional Housing Authority |
| Nikolai | 2013 | Tanana Chiefs Conference |
| Beaver | 2013 | Tanana Chiefs Conference |

## III. Power Generation

***Cost of Power:*** The cost of power ranges drastically across the Interior. This variation in costs is a result of multiple factors, including:

- How fuel is transported
- Transportation difficulty (especially by river)
- Number of times that fuel is transferred en route
- Year-round versus seasonal delivery
- Local moorage and unloading equipment
- Distance the fuel is transported
- Local storage capacity
- Quantity of fuel per delivery
- Competition among transporters

**Table 4: Cost of Electricity per kWh in the Interior**

| | **Low** | **High** | **Average** |
|---|---|---|---|
| **Cost of Electricity before PCE** | $0.40 | $1.07 | $0.60 |
| **Cost of electricity after PCE** | $0.13 | $0.71 | $0.25 |
| **Nonfuel costs** | $0.08 | $0.47 | $0.21 |

***Based on 2009 Power Cost Equalization data***

**Table 5: Non-Fuel costs and the costs of power (before and after the PCE) for individual Interior communities[8]**

| Community | NF cost per kWh | Rate (before PCE) | Rate (after PCE) |
|---|---|---|---|
| Alatna | $0.19 | $0.78 | $0.40 |
| Allakaket | $0.19 | $0.78 | $0.40 |
| Anvik | $0.24 | $0.56 | $0.18 |
| Arctic Village | Unknown | Unknown | Unknown |
| Beaver | $0.11 | $0.50 | $0.13 |
| Bettles | $0.23 | $0.69 | $0.32 |
| Birch Creek | Unknown | Unknown | Unknown |
| Central | $0.29 | $0.51 | $0.13 |
| Chalkyitsik | Unknown | Unknown | Unknown |
| Chicken | Individual generators | Individual generators | Individual generators |
| Circle | $0.29 | $0.41 | $0.29 |
| Dot Lake | | $0.47 | $0.17 |
| Eagle | $0.22 | $0.70 | $0.32 |
| Evansville | $0.23 | $0.69 | $0.32 |
| Fort Yukon | $0.03 | $0.45 | $0.18 |
| Galena | $0.14 | $0.40 | $0.13 |
| Grayling | $0.24 | $0.53 | $0.16 |
| Healy Lake | $0.47 | $0.81 | $0.43 |
| Holy Cross | $0.24 | $0.52 | $0.16 |
| Hughes | $0.20 | $0.61 | $0.23 |
| Huslia | $0.24 | $0.53 | $0.16 |
| Kaltag | $0.24 | $0.51 | $0.16 |
| Koyukuk | $0.15 | $0.45 | $0.13 |
| Lake Minchumina | Unknown | Unknown | Unknown |
| Livengood | Individual generators | Individual generators | Individual generators |
| Manley Hot Springs | $0.41 | $0.60 | $0.22 |
| McGrath | $0.18 | $0.48 | $0.16 |
| Minto | $0.24 | $0.46 | $0.16 |
| Nikolai | $0.23 | $0.60 | 40.23 |
| Northway | $0.08 | $0.69 | $0.31 |
| Nulato | $0.24 | $0.54 | $0.17 |
| Rampart | Unknown | Unknown | Unknown |
| Ruby | $0.08 | $0.98 | $0.71 |
| Shageluk | $0.24 | $0.58 | $0.25 |
| Stevens Village | $0.10 | $1.07 | $0.76 |
| Takotna | $0.29 | $0.58 | $0.20 |
| Tanacross | $0.09 | $0.47 | $0.17 |
| Tanana | $0.32 | $0.57 | $0.20 |
| Telida | Unknown | Unknown | No |
| Tetlin | | $0.47 | $0.17 |
| Tok | $0.09 | $0.47 | $0.17 |
| Venetie | $0.13 | $0.51 | $0.28 |

[8] AEA. (2009). Statistical Report of the Power Costs Equalization Program: Fiscal Year 2008.

There are two primary categories of expenses, fuel and non-fuel costs, which are used to determine the cost per kWh and the PCE level for a given community. The fuel costs include the actual cost of purchasing and transporting diesel fuel. The non-fuel costs include expenses such as salaries, insurance, taxes, power plant parts and supplies, interest, and other reasonable costs. Nonfuel costs vary greatly between communities and can comprise a significant percentage of the overall costs per kWh. When compared to the eleven other regions in the state, the 2008 Power Costs Equalization data revealed that the Interior (Doyon) region has the fourth highest non-fuel cost at $0.21.

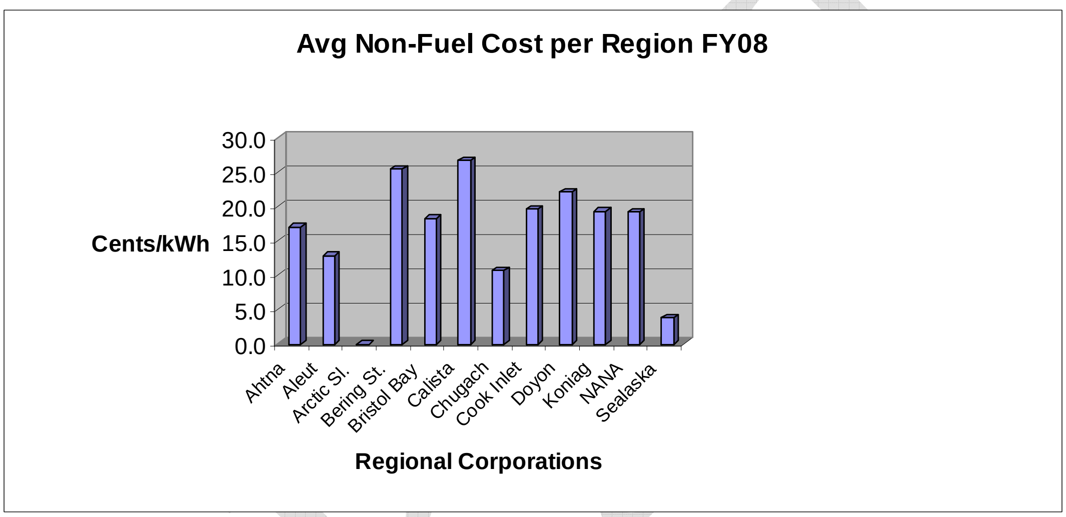


**Figure 1: Average Non-Fuel Costs in 2008 for Different Regions in Alaska**

***Electric Utilities in the Interior:*** Electricity providers in the Interior comprise public, private, and cooperatives utilities. Over half of the communities receive electricity services from the Alaska Village Electric Cooperative and private utilities, most commonly the Alaska Power & Telephone company. The other communities are serviced by local utilities owned by village councils, city governments, village corporations, and community non-profits. Two communities rely solely on individual generators.

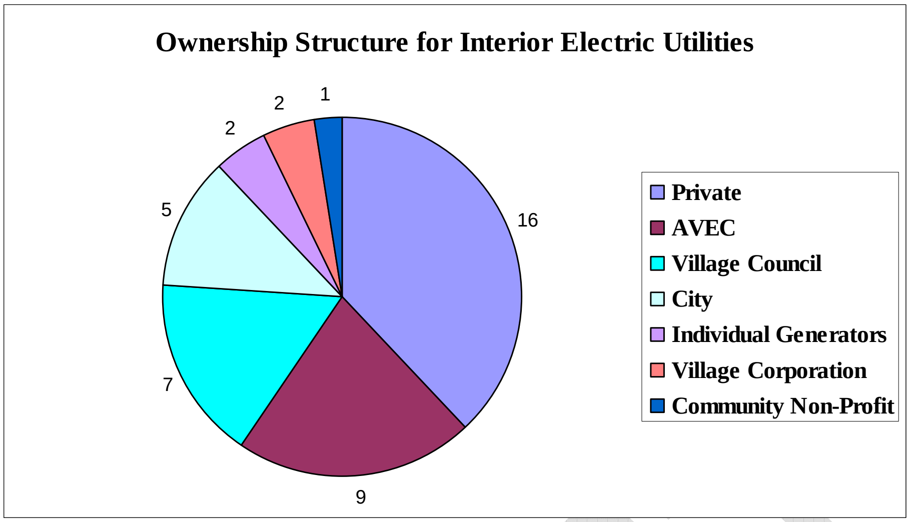


**Figure 2: Interior Electric Utilities Ownership Structure**

***Fuel Transportation:*** Diesel fuel is transported to Interior villages by multiple methods, including by trucks, barges and planes. For communities that rely solely on air and/or barge transportation, the delivered costs of diesel fuel is often higher than the delivered cost of transporting fuel by truck. Over the past several years, several communities that once received fuel by barges are now dependent on air transportation. This switch is due to myriad factors, including:

- drops in the river level, making barge transportation unfeasible part or all of the summer;
- inability to pay for bulk fuel shipments during the summer season;
- administrative difficulties, causing delayed fuel orders

## Table 6: Methods of transporting fuel to individual Interior communities since 2005

| Community | Barge | Road | Ice Road | Air | Plane/Barge |
|---|---|---|---|---|---|
| Alatna | | | | X | |
| Allakaket | | | | X | |
| Anvik | X | | | | |
| Arctic Village | X | | | | |
| Beaver | | | | X | |
| Bettles | | | X | | |
| Birch Creek | Unknown | Unknown | Unknown | Unknown | Unknown |
| Central | | X | | | |
| Chalkyitsik | | | | X | |
| Chicken | Unknown | Unknown | Unknown | Unknown | Unknown |
| Circle | | X | | | |
| Dot Lake | | X | | | |
| Eagle | | X | | | |
| Evansville | | | X | | |
| Fort Yukon | | | | X | |
| Galena | X | | | | |
| Grayling | X | | | | |
| Healy Lake | | | X | | |
| Holy Cross | X | | | | |
| Hughes | X | | | | |
| Huslia | X | | | | |
| Kaltag | X | | | | |
| Koyukuk | Unknown | Unknown | Unknown | Unknown | Unknown |
| Lake Minchumina | | X | | | |
| Livengood | | X | | | |
| Manley Hot Springs | | X | | | |
| McGrath | | | | | X |
| Minto | | X | | | |
| Nikolai | Unknown | Unknown | Unknown | Unknown | Unknown |
| Northway | | X | | | |
| Nulato | X | | | | |
| Rampart | Unknown | Unknown | Unknown | Unknown | Unknown |
| Ruby | Unknown | Unknown | Unknown | Unknown | Unknown |
| Shageluk | X | | | | |
| Stevens Village | Unknown | Unknown | Unknown | Unknown | Unknown |
| Takotna | Unknown | Unknown | Unknown | Unknown | Unknown |
| Tanacross | | X | | | |
| Tanana | X | | | | |
| Telida | Unknown | Unknown | Unknown | Unknown | Unknown |
| Tetlin | | X | | | |
| Tok | | X | | | |
| Venetie | Unknown | Unknown | Unknown | Unknown | Unknown |

***Current Power Generating Systems:*** Throughout rural Interior communities, electricity is primarily produced by small, stand-alone diesel generators. Since they were first implemented, diesel generators have been the most reliable and economical option for rural Alaska. However, the recent increase in diesel prices has created financial difficulty for many rural communities and utilities. Additionally, many of the rural power systems were developed two to three decades ago and need up upgrades to improve the generator efficiency and operations. Upgrades may include demand-side improvements, repairs to generation and distribution systems, efficiency improvements, powerhouse replacements and rebuilds, line assessments, lines to new customers, and bringing power generation systems up to State and Federal codes.

***Power Plant Upgrades:*** Diesel efficiency upgrades are considered an extremely effective method for creating more efficient, reliable, and cost-effective energy production in rural communities. Upgrades will vary based on the community and the age and condition of the system, yet they are most likely to consist of the following demand-side improvements and installations: heat recovery systems, used oil blending equipment, automatic load sensing switchgears, and SCADA systems and electronic controls.

In 2000, the state conducted an assessment of the majority of tank farms and power plants in Alaska. Based on this assessment, the state developed a priority list of power plant upgrades. The list is constantly changing and is based on a combination of needs including power plant status, population, geographic location, and whether or not the utility owes money to the IRS.

As a result of this assessment and funding from the state, upgrades have been completed in six Interior communities[9] since 2000. These communities include Allakaket (Alatna), Arctic Village, Hughes, Kaltag, Koyukuk and Stevens Village. The average cost of these upgrades, from the conceptual design to project close out, is $1,950,656.00. The average project time, from conceptual planning to project closeout, for the six completed upgrade

[9] based on the Denali Commission Project Database System, power plant upgrades information

projects is 61.8 months. Additionally, upgrades are in progress in four other Interior communities and are either in the conceptual planning, final design or construction phase. These communities include Fort Yukon, Nikolai, Ruby and Takotna.

This leaves 32 communities that have not received upgrades since 2000. However, it is unclear how many of these communities actually need upgrades and what specific works is required. The first step in determining the needs in these communities is to conduct assessments of existing power plant. These assessments may include an[10]:

- Evaluation of the current power generation facilities;
- Evaluation of proposed efficiency measures;
- Evaluation of options for alternative and renewable energy development;
- Analysis of the community power usage compared with the capacity of the current generators;
- Calculation of the fuel usage and system efficiency;
- evaluate transmission capacity;
- evaluate current heat capture systems or the potential to development;
- Power plant system upgrades (i.e. automatic switchgears)

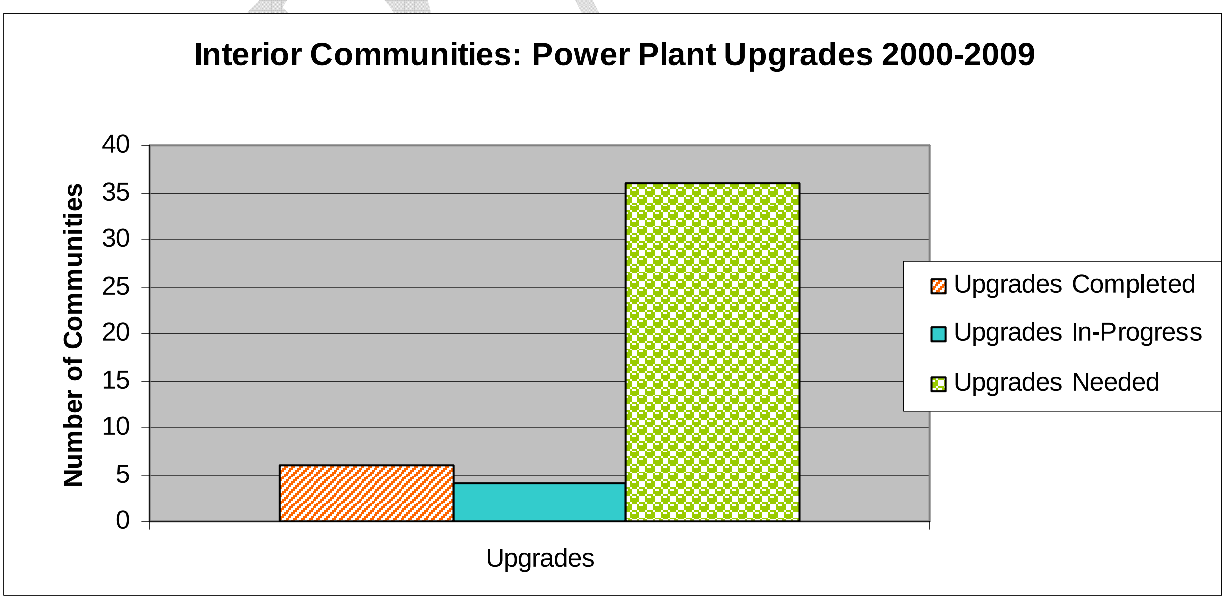


**Figure 3: Power Plant Upgrades, 2000-2009**

[10] AEA. (2009). Energy System Upgrades.

***Sub-regional Interties:*** Electric interties allow a single generator to produce electricity and to deliver the electricity to nearby communities. It also allows utilities to connect to new energy resources. Based on the distance and terrain, interties have the potential to reduce the overall cost of delivering energy. Currently, the two electric interties in the Interior region are between Allakaket and Atna, and Bettles and Evansville. Both interties were constructed and are maintained by the Alaska Power & Telephone Company. The small number of interties is due to geographic, financial, and technical limitations, which often cause the construction of interties unfeasible.

## IV. Heating

***Heating Sources:*** Currently, diesel fuel provides the majority of all electricity, heat, and transportation needs for Interior communities. According to the 2000 census data, 58% of the Interior households utilize fuel oil and kerosene to heat their homes, 41% utilize biomass, and less than one percent use electricity or a different fuel source. However, biomass resources have been developed in selected communities. In the Interior, the communities of Tanana and Dot Lake have installed wood boilers to offset diesel costs in several community buildings and selected households.

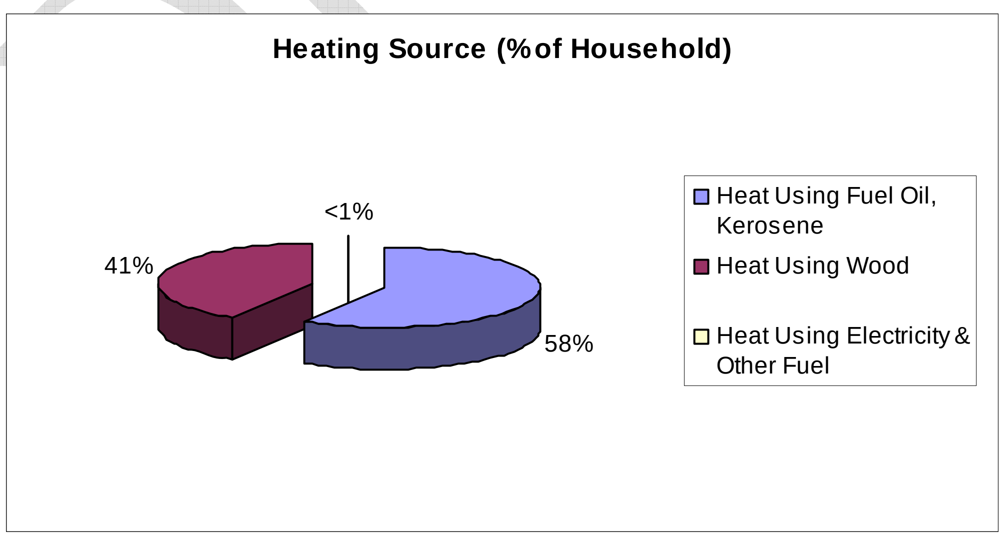


**Figure 4: Heating Source for Interior Communities**

***Cost of Heating:*** There is limited information regarding the actual costs and consumption of heating fuel in Alaska.  The most commonly used data is a community-wide estimate by the Institute of Social and Economic Research, which is based on a small sample size. The data includes the following variables: population, number of households, square footage of household and heating degree days.

## V. Transportation

At this time, there is limited information regarding transportation costs for the Interior communities and the state.  In *Alaska Energy: A First Step Toward Energy Independence,”* thee estimated diesel costs for each community are extrapolated from data used in a previous Institute of Social and Economic Research (ISER) model. However, the model is not considered robust and should be used with caution, but it represents the best available data at present.

Currently, the Denali Commission, Alaska Housing Finance Corporation, Alaska Department of Commerce, Community and Economic Development, the Alaska Energy Authority, Cooperative Extension, RuralCap, and other agencies are working to develop a consistent survey tool for collecting statistically accurate fuel price and quantity data from individual communities. Additionally, the working group aims to develop a database, which will make the information readily available for researchers, the legislature and the public.

# RECOMMENDATIONS

## Building Efficiency

### 1. Expand State Weatherization Program to Accommodate Rural Residents

The State Weatherization program is available to homeowners and renters who meet specified income guidelines within communities that are targeted by one of the regional weatherization service providers. The Tanana Chiefs Conference and the Interior Regional Housing Authority are the two weatherization service providers for the Interior region. Each organization has the capacity to weatherize homes in two to three communities per year. With forty-two communities, the Interior region lacks the capacity to provide weatherization services to all of its communities in the next five years.

It is recommended that the State expand the Weatherization Program to ensure that all communities receive equal access to this program over the next five years.

### 2. Design Home Energy Rebate Program to Accommodate Rural Residents

The State Home Energy Rebate Program is only available to homeowners who have access to the services of a certified energy rater. While there is currently one certified rater in Tok and one in Nenana, most rural Interior communities do not have energy raters located in their communities or in nearby hub communities. Most rural Interior residents are thereby precluded from the benefits of the Home Energy Rebate Program.

#### a. Train Rural Energy Raters

It is recommended that comprehensive energy rater training programs are organized to accommodate interested rural residents.

b. **Identify Energy Raters Who Are Available to Rural Communities**

It is recommended that a list of certified energy raters who are willing and able to travel to rural Interior communities be generated and distributed to these communities.

**3. Amend Weatherization Programs to Include Electrical Energy and Safety Upgrades**

Weatherization funds cannot currently be applied to electrical work. Electricians run into line safety and end use efficiency measures that should be completed when new work is completed. It is recommended that weatherization funding programs be amended to include electrical energy and safety upgrades.

**4. Improve Village End Use Efficiency Measures (VEUEM) Program**

Under contract with the Alaska Energy Authority, the Alaska Building Science Network (ABSN) currently performs end use efficiency upgrades on community buildings in select villages.

a. **Expand VEUEM to Include Full Energy Audits**

It is recommended that ABSN staff conduct full energy audits of the community buildings while they are on site. This would greatly improve the capacity of decision-makers to plan for future energy improvements while maximizing the utility of staff and equipment that are already on site.

**b. Ensure That RPSU and VEUEM Programs Work Together**

In an effort to maximize energy savings, the VEUEM program was designed to coincide with upgrades made to power systems through the Rural Power System Upgrade (RPSU) program. The coordination of the two programs has not always occurred. It is recommended that upgrades to rural power systems are conducted prior to the end use efficiency upgrades of the VEUEM program.

5. **Conduct Energy Audits on all Interior Schools**

   Many schools in Interior rural villages are in need of energy efficiency improvements. An audit of each school should be conducted so that decision-makers can develop informed energy planning strategies. It is recommended that all schools in the Interior receive an energy audit in the next five years.

6. **Perform Efficiency Upgrades on all Public Buildings: Support Senate Bill 121**

   A comprehensive effort must be made to perform efficiency upgrades on all state and federal buildings in rural Interior communities. It is recommended that this be accomplished through support of Senate Bill 121.

## Power Generation

7. **Complete Power Plant Upgrades Within Five Years Through Expanded RPSU Program**

   Six of the 42 Interior communities have received upgrades to their power systems through the State Rural Power System Upgrade (RPSU) Program. Four additional upgrades are in progress. Many communities rely upon old and oversized generators for their power generation, unnecessarily inflating their diesel consumption and cost of electricity. It is recommended that the power systems in all Interior villages are assessed and upgraded in the next five years through an expanded RPSU program. Waste heat recovery systems, multi-sized generation and automated switch gear should be installed where appropriate.

8. **Support Research, Development and Deployment of Village-Scale Combined Heat and Power Systems**

   It is recommended that initiatives designed to facilitate the research, development, and deployment of village-scale combined heat and power systems be supported.

9. **Support Initiatives to Utilize Waste Heat for Greenhouse-based Food Production**

   The development of greenhouse-based food production programs in the Interior is an innovative response to the high cost of importing food and fuel, the need for healthy food options, and the desire to utilize existing local resources. A greenhouse project that uses waste heat from the power plant in Galena to enable local food production was recently funded through the Environmental Protection Agency. It is recommended that other proposals for greenhouse projects that utilize waste heat also be funded.

10. **Support On-Site Assessments of Solar Resource through a Program Modeled After Alaska Wood Energy Development Task Group**

    Interior residents would like to know more about their solar resource. It is recommended that an assessment program modeled after the Alaska Wood Energy Development Task Group be developed. This program would request statements of interest from Interior stakeholders and then provide preliminary on-site assessments of the local solar resource, including a discussion of equipment options, project costs, and investment payback period.

## Heating

### 11. Identify the Biomass Resource in the Region

Woody biomass is one of the primary local fuel sources available to Interior communities. Numerous communities have identified the potential for local biomass development, located applicable technologies, and conducted preliminary feasibility assessments. To date, no detailed, in-depth study of the availability and economic viability of woody biomass fuels from the forests in the vicinity of communities has been conducted. Such a study is necessary as a foundation for determining the engineering and economic feasibility of biomass energy projects for the villages and communities of rural Alaska.

#### a. Support Biomass Resource Assessments in Region

The Alaska Wood Energy Development Task Group has conducted preliminary feasibility assessments in twelve Interior communities. These assessments consider existing infrastructure and demand, but do not consider the sustainability of the biomass resource, the economic viability of developing the resource, or the capacity of the community to develop and maintain the resource.

It is recommended that biomass resource assessments are conducted in and around all Interior communities.

#### b. Support Biomass Economic Feasibility Assessments in Region

It is recommended that a rigorous, site-specific assessment of the economic viability of developing woody biomass in Interior communities is conducted.

### 12. Support the Deployment of Efficient Wood-Fired Boilers Where Appropriate

Two communities, Tanana and Dot Lake, have installed Garn wood-fired boilers to heat one or more buildings. The Alaska Gateway School District is in the process of installing wood-fired boilers in the Tok School. It is recommended that the deployment of wood-fired boilers in areas where a sustainable biomass resource has been identified be supported.

### 13. Support Initiatives to Develop Pellet Production Facilities in the Interior

Several Interior communities are moving forward with pellet stove pilot projects or wood stove change-out programs that incorporate new pellet stoves. Pellet stoves are appealing due to their high levels of efficiency and automated feeder systems. Elders on fixed incomes are often the focus of attention when rural leaders speak of the benefits of pellet stoves. A small-scale pellet producer is now situated in Dry Creek outside of Delta Junction. Most pellets in the state are imported from the Lower 48 states. In areas where a sustainable biomass resource has been identified, it is recommended that initiatives to develop wood pellet production facilities be supported.

## Transportation

Transportation relates to energy in the Interior in two distinct and important ways. The amount of fuel consumed for the transport of people and materials is one facet of the transportation picture. The second facet is the network of barges and planes that deliver diesel fuel to most of the power plants for the 42 rural Interior communities.

### 14. Collect Data on Fuel Used in the Transportation Sector

Little is known about the amount of fuel that is used for transportation in the Interior. It is recommended that a data acquisition system designed to record the amount of fuel consumed for transportation in the Interior be implemented and maintained. This standardized method for recording and compiling fuel data should be designed in collaboration with barge operators, air freight companies, and fuel retailers.

### 15. Address Increasingly Intermittent and Expensive Barge and Air Shipments by Diversifying the Fuel Stock

Numerous communities of the Interior are experiencing new constraints to barge delivery services due to dropping river levels. Some villages no longer receive barge deliveries and must fly all fuel and supplies in by plane. Other villages receive undependable or partial barge deliveries because the barges cannot travel fully loaded or cannot travel at all when the river levels are low.

It is recommended that initiatives to diversify the fuel stock and develop the local energy resources of Interior communities be supported in an effort to reduce dependence on increasingly intermittent and expensive barge and air shipments. This includes the research and development of appropriate energy technologies for rural Alaska.

## Education and Outreach

### 16. Develop an Energy Education and Outreach Program for Interior Alaska

One of the primary needs identified by rural Interior residents is the need for the dissemination of information on energy options. Residents are curious about a variety of alternative energy resources and technologies, and would like to know where they can obtain more information. Additionally, as communities develop local resources and install new energy technologies, expertise that is applicable throughout the region will expand. It will be imperative that communities have an accessible and actionable method of communicating their energy-related experiences so that newly developed information and expertise is shared.

It is recommended that an Energy Education and Outreach Program be designed in collaboration with Tribal Administrators and other community leaders to facilitate the communication of energy-related information between researchers, agency personnel, and village residents. A distinct program designed to coordinate energy-related communications will be instrumental as the region seeks to reduce its dependency on imported diesel fuel and develop sustainable solutions to complex energy issues.

### 17. Expand Existing Operator Training Program to Better Serve Interior Alaska

Operator training for energy systems has been identified by multiple Interior stakeholders as a growing need. It is recommended that the operator training program for existing and new energy technologies be expanded to better serve rural Interior residents. This would include local training after installation, so that system-specific skills are developed.

## Planning for the Future

### 18. Support Integrated Planning for New Construction

Cost savings are realized when complementary processes are integrated in the design and construction of new infrastructure. This often requires the establishment of collaborative relationships between multiple entities that do not generally work together. One example is a proposed sewer, water, and district heating project in McGrath that was recently funded through the Alaska Renewable Energy Fund. This project is a collaborative effort between McGrath Light and Power and Village Safe Water. It realizes cost savings by integrating the installation of sewer, water, and energy infrastructure.

It is recommended that integrated planning for new construction be further supported.

### 19. Support the Development and Implementation of Community Energy Plans

It is recommended that the development and implementation of energy plans for each community be supported.

**20. Support Research, Development and Deployment of Enhanced Energy Efficiency Methods and New Energy Technologies that are Relevant to Rural Alaska Communities**

It is recommended that Senate Bill 150, “An Act establishing an emerging energy technology fund,” be supported.

**21. Conduct an Economic Analysis of PCE**

**22. Reevaluate PCE Structure to Incentivize Renewable Energy Development**

**23. Provide Technical Assistance for PCE Reporting**

Six communities in the Interior are eligible for PCE, but do not have the technical expertise to complete PCE reports. It is recommended that technical assistance for PCE reporting be made available to Interior communities.

**24. Revise the Renewable Energy Fund Eligibility Structure to Include Tribal Service Providers**

Many of the entities that have received funding through the Renewable Energy Fund are boroughs. The Interior region does not have a borough and is therefore underrepresented in the RE Fund selection process. It is recommended that current regional inequities in the RE Fund selection process are addressed through the inclusion of regional tribal service providers in the list of eligible applicants.

**25. Implement Phase II of the Interior Regional Energy Planning Process**

Phase II of the IREP process will utilize the framework developed in Phase I to design and implement energy solutions for the Interior region. Phase II goals include the establishment of a viable Steering Committee to help guide the process; the organization of community and subregional energy planning meetings; the development of a 25-Year IREP; and the establishment of energy program metrics for improved monitoring of IREP implementation.

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# Appendix I

## Developing Your Energy Resources: How to Start

## Procedures for Pursuing Biomass Development

Woody biomass is an excellent heat source, particularly in the forested areas of the Interior. A variety of stove options, including conventional wood stoves, pellet stoves, and wood-fired boilers, are available. Tanana and Dot Lake have installed GARN wood-fired boilers to heat larger community buildings or multiple homes in a district heating configuration. If you would like to investigate the possibility of developing your local biomass resource, the following steps are recommended:

**1) Initial Questions to Answer:**

- Will it be acceptable to the village to clear cut harvest 10 to 50 acres or more a year?
- What is the land ownership within a logical radius of the village? Less than 10 miles is ideal. 50 miles is maximum. This should include all ownerships including native allotments. Ask whether the land owner is **able** to and **willing** to sell biomass resource on a multiyear or long-term contract, and get it in writing.
- What is the local labor pool, interest and experience? Will they need to bring in help for harvesting biomass?

**2) Information to Collect:**

- **Facility Information**
    - Approximate size of building(s)
    - Type of construction
    - Approximate age
    - Amount of usage
- **Current Fuel Situation**
    - Type of fuel used to heat the building(s)
    - Average annual consumption (gallons, etc)
    - Fuel cost per unit ($/gallon, etc)
    - Cost of electricity per kilowatt-hour
- **Presence of high-hazard forest fuels**
    - Describe any forest fires or insect outbreaks in the past 5 years.
    - Discuss any activities to utilize dead/dying material.
    - Discuss any activities or programs that would mitigate the effects of future fires or infestations.
    - Discuss the ownership of nearby forest lands and any agreements there may be to harvest trees (live or dead) from those lands.

  - Discuss the extent and sustainability of local forest resources and wood supply

- **Availability of wood processing residues (e.g., slabs, chips, bark, sawdust, shavings, etc.)**
  - List any known wood processors within 35 miles of your location.
  - What do those processors currently do with their residues?
  - Approximately how much residue is available in each of its various forms?

- **Wood Fuel**
  - If possible, estimate the amount of firewood consumed locally on an annual basis
  - List any local individuals or companies that are in the firewood business
  - Describe the type of tree harvesting systems used locally
  - Describe the way(s) in which firewood is processed
  - Describe the forms in which firewood is sold (log/long length, short lengths, split, seasoned, green, etc.)
  - List firewood costs ($ per cord) for the various forms in which it is sold

**2) Get an experienced professional forester to do the following:**

- Timber type the acres by ownership that will be sold as biomass. Use established inventory data per timber type to determine volume per acre.
- Rough out a harvest plan with transportation locations into timbered stands. Are there major physical obstacles to harvest areas such as rivers, mountains, swamps?
- Determine season limitations for harvest.
- Determine harvest methods for timber stands.
- Determine rough transportation and harvest cost for biomass

**3) People to contact for further information:**

- **Alaska Center for Energy and Power**
  http://www.energy-alaska.com/
  *This website has a lot of great information about biomass.*

- **Alaska Division of Forestry**
  Chris Maisch, State Forester
  (907)451-2666
  chris.maisch@alaska.gov
  www.dnr.state.ak.us/forestry

- **Alaska Energy Authority**
  Peter Crimp, Alternative Energy and Energy Efficiency Program Manager
  (907)771-3039
  pcrimp@aidea.org

- **Alaskan Heat Technologies**
  Dave Frederick, President
  (907)882-2000
  Dave@AlaskanHeatTechnologies.com
  *Alaskan distributor of GARN Wood Heating Systems*

- **Alaska Wood Energy Development Task Group**
  Dan Parrent
  (907)747-5688
  dparrent@alaska.net
  *Dan has conducted many feasibility biomass assessments in Interior communities.*

- **Cold Climate Housing Research Center**
  (907)457-3454
  www.cchrc.org
  *CCHRC tests biomass technologies, including a variety of wood stoves. They have an outreach department that answers questions.*

- **Tanana Chiefs Conference**
  Will Putman, Forestry Director
  (907)452-8251 ext. 3373
  will.putman@tananachiefs.org
  *Will is developing a model for conducting a sustainability assessment of the local biomass resource.*

## Procedures for Pursuing Geothermal Development

There are several initial steps that a community can take in order to help determine the viability and size of a geothermal resource. If you are interested the possibility of developing your local geothermal resource, the following steps are recommended:

1. Gather information on the locations of all surface expressions, which include hot springs, hot water seepages, or water wells with abnormally high temperatures. GPS coordinates of the surface expressions are preferred.

2. Gather information on well locations in the vicinity of the geothermal resource. Determine whether the wells are able to be shut off for several days for testing.

3. Contact a geothermal development group that tests wells and surface expressions. This group will conduct test that measure the temperature at various depths in the wells. Additionally, holes may be drilled in the area around the well or resource in order to determine the total surface area of the geothermal resource.

After these steps are completed, the community and the development group will decide whether the resource is viable for power production. A viable resource must be large enough to payoff the costs of installing a geothermal plant in a reasonable time period. Developing a resource that is too small will result in rapid resource depletion. The next steps include drilling and geophysical testing in order to define the resource in preparation for deep drilling. These last steps are extremely expensive and the development group will advise whether to continue with exploration. If the resource is too small, another option is to construct a winter green house that is powered by geothermal waters. An example in the Interior is at Chena Hot Springs.

**<u>Additional Information</u>**

**Alaska Center for Energy and Power**
www.uaf.edu/acep

## Procedures for Pursuing In-River Hydrokinetic Electrical Generation

If you would like to investigate the possibility of developing your local hydro resource, it is recommended that you first ask the following questions:

**1) Technology availability**

- Has there been a successful long term technology demonstration for projects similar in scale to the one being considered?
    - If not, then an installation project is a research project with unanswered questions and uncertain economic risks.

**2) Resource availability**

- Is there a place in the river that is moving at the pace of a fast walk? This is the minimum speed for extracting useful energy.
- Is there a place near the fast part of the river to moor a floating support for an electrical generator?
- Is the user of the electrical power near the generator?
    - This could be the utility connection to the hydrokinetic device, or a single end user such as a lodge, cabin, or fish camp.
- Can the floating generator be protected from floating debris without slowing the current?
- It is likely that a hydrokinetic resource is only available between May and late September.

**3) Energy needs**

- What are the present energy needs?

**4) Additional Resources:**

- **Alaska Center for Energy and Power**
  http://www.energy-alaska.com/
  *This website has a lot of great information about hydro power.*

## Procedures for Pursuing Solar Energy Development

The solar resource in Alaska is significant, but it varies significantly depending on the season, weather and latitude. Alaska's Interior region presents the challenge of minimal solar energy during the winter months, when home energy demand is greatest. However, the Interior has a viable solar resource for well over half of the year, which can be captured for solar hot water, space heating, and power generation. Performing a solar site assessment helps determine how a solar system best fits your location, budget, and goals. Numerous site-specific steps are required to determine whether a site is suitable for the installation of a system. The site assessment should include the following considerations:

### Orientation & Shading

The angle and direction of solar collector is of great importance because it will effect the efficiency of the solar collector. South-facing collectors are ideal in order to receive the maximum amount of sunlight each day and throughout the year. However, it is still possible to achieve near optimal production with a southeast or southwest site. A solar panel's output can be significantly reduced even with partial shading. The location of the solar collectors should have little to no shading from trees, shrubs, buildings, telecommunication equipment, and fixtures like chimneys or pipes.

***Questions to consider:***

- How much shade does the site receive throughout the day at various times of the year?
- What direction is the site facing?

### System Size

The size of a system depends on several factors, including type of system (solar hot water vs. solar electric), the site-specific sunlight level, and the daily consumption of your electrical or hot water loads.

***Questions to consider:***

- What will the system be used for (i.e. hot water, heating or electricity)?

- How much sunlight does the site receive?
- What will the electric and/or hot water loads be on the system?

## Roof-Mounted vs. Ground-Mounted

Solar systems can be mounted on roofs or installed at ground level on rack structures. In the case of roof-mounted systems, the condition of the roof must be considered. Considerations include the age of the roof, whether it needs repair, and the material that the roof is constructed of. It is also important to consider the distance from the solar collector location to the water storage tank or electric meter.

***Question to consider:***

- Is there enough space at the physical location?
- Will the sunshine be maximized on the roof or on the ground?
- What are the potential hazards to the system on the ground versus the roof at the specific site?

## Additional Resources

**UAF Cooperative Extension**
*Provides newsletters, publications, and personal consultations in energy-related issues in Alaska.*
www.uaf.edu/ces/

**AlaskaSun**
*Alaska-specific resources and publications on solar.*
www.alaskasun.org

## Procedures for Pursuing Wind Energy Development

Deciding to develop local wind resources is an exciting step for any community or utility; however, it comes with many considerations and a significant amount of planning. This document is designed to give community organizations and utilities practical knowledge regarding the initial steps in assessing local wind resource.

<u>**Local Wind Resources**</u>

This step helps to determine a potential wind project site. Through utilizing past wind resource maps, information from local residents about strong wind areas, and data from nearby weather stations and airport, a site may be identified. Once a potential site is determined, an anemometer (the meteorological tower that measures and records wind speed) is erected and wind data is logged for at least a year. This information is used to determine whether the site has a wind resource that is adequate for development. The Alaska Energy Authority sponsors and anemometer loan program that supplies meteorological towers, data logging equipment, and technical support to utilities and communities interested in wind power production.

<u>**Detailed Site Characteristics**</u>

***Minimal Wind Obstacles*****:** Open space and clearance from buildings, homes, trees and other potential obstructions minimizes turbulence, which alters the wind turbines performance. A common "rule of thumb" is to situate turbines at a minimum height of three times that of the tallest upwind barrier.

***Access to distribution/transmission lines*****:** When considering a site, it is important to minimize the amount of new transmission and distribution lines by taking into account the existing lines. There may be an ideal wind resource several miles from your community, but the intertie and road construction may end up being cost prohibitive.

***Noise:*** Background noise from turbines can be a primary concern for landowners that live closest to the project site. Noise concerns may also arise if the project site is in a location that is frequented for recreation, subsistence or cultural purposes. Being sensitive to these issues and addressing them with landowners and the community early on will create a smoother planning process.

***Minimal environmental concerns:*** Environmental considerations with wind projects may include the likelihood of flooding, vicinity to migratory bird routes and nesting grounds, and the vicinity to special-status wildlife or vegetation species. Such concerns should be considered during the site selection process.

***Subsistence/Cultural Resources*:** It is important to work with the community to better understand significant cultural and subsistence sites. This may be achieved by conducting subsistence use survey and studies on sensitive cultural resources, including migratory bird monitoring and surveying berry harvesting sites and hunting grounds to determine the potential level of impact.

## Additional Resources

**Alaska Energy Authority**
*Anemometer Loan Program*
www.akenergyauthority.org/programwindanemometerloan.html

**American Wind Energy Association**
*Wind Energy Siting Handbook*: Inform about environmental siting issues relevant to land-based commercial-scale wind energy project development.
www.awea.org/pubs/factsheets/Wildlife_FAQ.pdf

**National Wind Coordinating Committee**
*Permitting of Wind Energy Facilities Handbook :* Information about the permitting process
www.nationalwind.org/publications/siting/permitting2002.pdf

**National Renewable Energy Laboratory: Wind Powering America**
hwww.windpoweringamerica.gov/index.asp

**Alaska Center for Energy and Power**
www.uaf.edu/acep

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