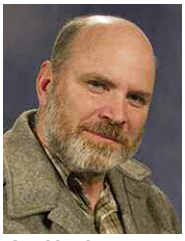
Enhancing Forest Health and Powering Alaska Native Communities

By Dave Nicholls, Art Nash, and Daisy Huang

Dave Nicholls



Art Nash

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In Alaska and other regions of the country, Native villages have pursued wood energy for wide-ranging benefits including greater local employment, student education opportunities, reduced wildfire risk, and climate change mitigation. As a result, communities realize greater independence and resilience.

This wood energy is found in the use of locally harvested, low-value forest residues for community heating. In many cases forest health is enhanced by removal of wildfire prone fuels for energy. Each village has unique energy needs, which has been fulfilled by installing wood burners capable of burning different types of wood biomass, such as chips, cordwood, and wood pellets. Native communities in interior Alaska have often served as testing sites for innovative new technologies, being in a land where winter temperatures can reach -50°F. Innovation is likely to continue as more and more communities gain internet access, which will open more doors for creative energy solutions.

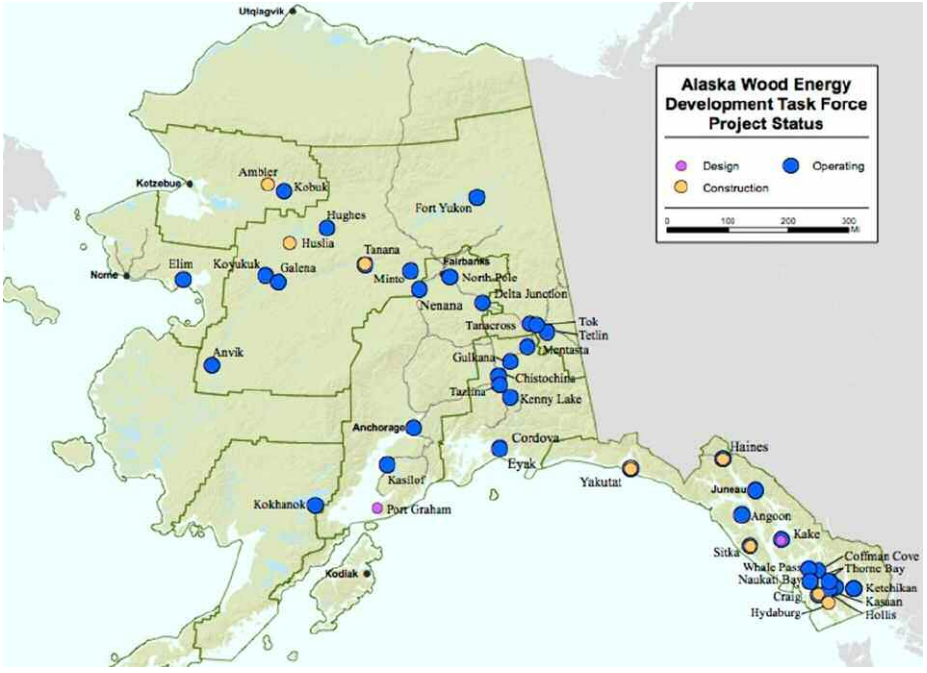

IMAGE SOURCE ALASKA WOOD ENERGY DEVELOPMENT TASK GROUP https://www.alaskawoodenergy.com/projects

There are nearly 30 community-scale wood energy locations in Alaska. Funding for many of these wood-burning systems has been provided by the state of Alaska and Alaska Energy Authority.

Since 2003, more than 30 community-scale wood energy systems are now in operation. Here we will summarize a few of these success stories and how their forest management is providing a sustainable source of wood energy.

Tanana

Location: interior Alaska
Installation date: 2007
Fuel type: cordwood

A $1.5-million grant funded the installation of two cordwood burners to heat three community buildings, which resulted in a heating oil reduction of 30 percent. In cordwood burner operation, wood is loaded about two times a day, and rapid combustion transfers heat to a water reservoir, which is then circulated to destination buildings. A simple payback period has been estimated at 6.5 years, and more than 9,000 gallons of diesel is avoided annually.

The cordwood is sourced from nearby stands of white spruce, and this village has set an example of sustainable forest management for other cordwood burners in Alaskan Native villages.

Tanacross Village

Location: interior Alaska
Installation date: 2016
Fuel type: cordwood

Three cordwood burners supply more than 2MM BTUs per hour to heat a hydronic loop for two multi-use community buildings, a fire hall, and a sewer system. The total area served is close to 18,000 square feet, and as a result more than 26,000 gallons of heating oil have been displaced. The total cost was $590,000.

Hydaburg

Location: southeast Alaska
Installation date: 2019
Fuel type and use: cordwood (200 cords per year, purchased for $200 per cord)
Job creation: Four part-time workers (including paid student help)

Ease of operation and ease of maintenance is a key feature of this system. Typically, wood is loaded once daily, which is sufficient to produce heat for an entire school day. Electrical energy is used to run blower fans, however relatively little is needed. Most wood is locally sourced from a total of three suppliers. Plans are to install an integrated 800-square feet greenhouse to serve as a community vegetable garden.

Mentasta Lake

Location: interior Alaska
Installation date: 2014
Fuel type and use: wood chips

A small wood chip burner provides heat for five community buildings via a small district heating loop that circulates water in insulated underground tubing. Constructed at a cost of $460,000, this 500,000 BTUs per hour system could become an example for other communities since most burners utilizing wood chip burners are designed to be considerably larger and more expensive.

Minimal labor is required for chip systems because wood is automatically augered into the burner, and ash is automatically removed. By

Continued on page 20

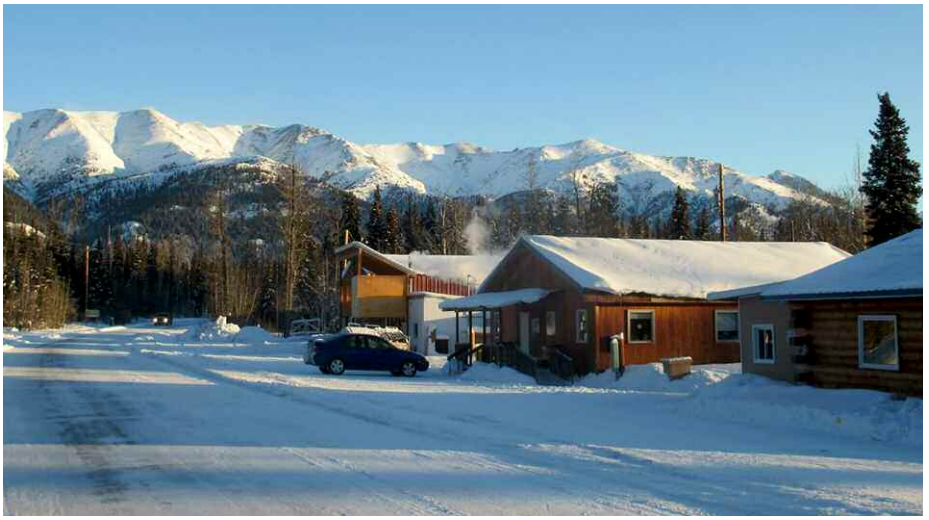

PHOTO COURTESY OF DAVE NICHOLLS

In 2014, Mentasta Lake installed a wood chip burner to provide heat to five community buildings that has displaced the 13,000 gallons of fuel oil that had to be purchased annually to meet heating needs.

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Continued from page 17

installing this system, 13,000 gallons of fuel oil is displaced annually by the use of wood energy. The use of wood chips, rather than cordwood which requires larger stems, could facilitate new uses for small diameter fire-prone trees near the village.

Gulkana

Location: interior Alaska
Installation date: October 2010.
Fuel type: cordwood and wood pellets
Job creation: 1 full-time equivalent

This site uses 2 GARN cordwood boilers and 1 TARM pellet burner to heat a total of nine community buildings. More than 10,000 gallons of fuel oil each year is avoided at a cost savings of about $35,000 annually. BTU meters are used so that the energy use can be accurately determined for each building. The total project cost was about $553,000, and one full-time job was created.

PHOTO COURTESY OF DAVE NICHOLLS

At Gulkana, installing the wood energy system resulted in one new full-time job to maintain the two GARN cordwood boilers (shown) and a pellet burner.

PHOTO COURTESY OF DAVE NICHOLLS

In interior Alaska, fuels having high risk of wildfire are harvested and piled adjacent to roads. These piles will then be chipped and then burned for school heating.

A unique feature of this system is that pellets can be produced locally with a small pellet mill, designed and constructed on site. The use of both cordwood and pellets here allows greater flexibility in system operation, creating additional options for harvest methods and species selection from boreal forests near Gulkana.

Koyokuk

Location: interior Alaska
Fuel type: cordwood

The village of Koyokuk is located

about 120 miles south of the Artic circle. Here, a hydronic district heating system uses several innovative adaptions to serve three buildings having quite different needs. The water plant requires heat provided directly from a heat exchanger while the Tribal Office building also features a radiator to heat offices and meeting spaces. The Tribal Health Clinic takes this a step further by including not only a heat exchanger but also an in-floor radiant heating loop. Buried "PEX" piping is used to transport heated water up to 225 feet (and then transport cooler water back to the heating plant). Wood energy use for the cordwood burner is expected to consume close to 100 cords per year. Koyokuk is a great example of innovative heating methods that can be designed into even relatively small wood energy systems.

Huslia

Location: interior Alaska
Fuel type: cordwood
Job creation:
- 5-12 full and part-time jobs for harvesters
- 2 part-time jobs for boiler operators

Three GARN cordwood boilers were installed to heat three community buildings at a cost of $722,000. This wood energy displaces close to $57,000 per year of heating oil. Fuel cost savings over 25 years are projected to be close to $1.5 million.

Looking to the next decade, we anticipate even more villages establishing wood energy systems using new technologies like gasification, cogeneration, microturbines, and battery storage to name a few. Many villages that have wood-based systems are also well positioned to take advantage of other renewables like wind, solar, and/or geothermal. *WF*

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The Triple Benefits of Wood Energy

The use of wood energy has a full range of benefits that can be characterized by the "triple bottom line"—encompassing environmental, social, and economic benefits.

Financial

Although wood energy systems can require higher capital investments versus conventional fossil fuel systems, they often have lower operating and fuel costs, leading to attractive payback periods. Employment opportunities can be found in construction, plant maintenance, fuel collection, and fuel delivery, some of which are ongoing. In rural communities, many of these jobs are part-time or seasonal, yet the cumulative effect is significant. When considering the complete wood energy supply chain, employment benefits can be substantial, while keeping wages within local economies.

Environmental

Over the past decade, wildfires have threatened millions of acres in Alaska. Many villages in interior Alaska are located in areas of high wildfire risk surrounded by dense, small diameter stands. Some locations (for example, Tanana, Alaska) procure most of their wood from a transportation radius of just a few miles. This offers a dual benefit for wood energy utilization: 1) wildfire risk is reduced while forest health is enhanced near community-forest interface, and 2) transportation expenses are minimized due to short haul distances.

Social benefits

Although the use of firewood for home heating has a long history in Native communities, community-scale systems, often heating multiple buildings at once, are relatively new. When wood energy use occurs at schools, there are also vocational learning opportunities for students, including:

- environmental benefits of wood as a renewable energy source
- forestry and wood science practical applications
- greenhouse operation/local foods production
- teamwork building and leadership
- boiler operation and hydronic heating system maintenance

PHOTO COURTESY OF DAVE NICHOLLS

The greenhouse at Tok is heated by wood energy, and greenhouses can serve as both educational opportunities for schoolchildren and to help increase food production.