

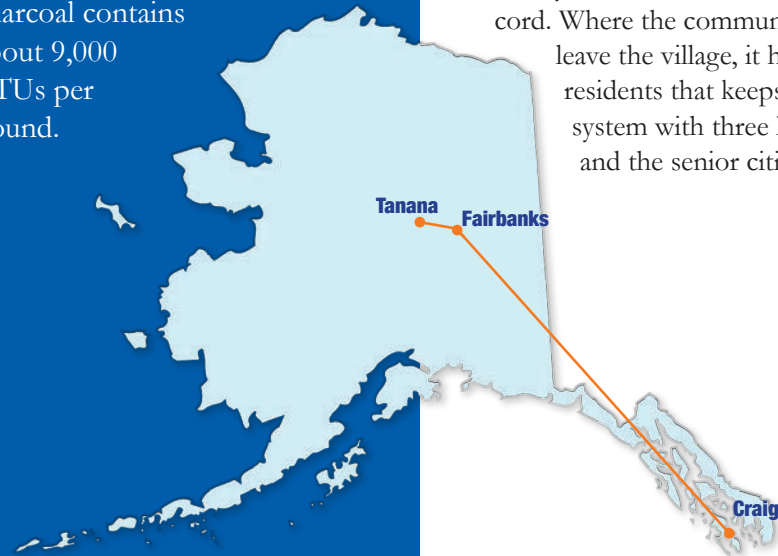


Photo courtesy of Amanda Byrd

### What is a BTU?

A British Thermal Unit (BTU) is a unit of measure used to express the amount of energy a fuel contains (similar to how inches or miles can be used to express distance) as well as the output of any heat-generating device. Technically, one BTU is equal to the heat energy needed to raise the temperature of one pound of water by one degree Fahrenheit.

All combustible materials have a BTU rating. One pound of dry wood contains about 7,000 BTUs. Propane contains about 15,000 BTUs per pound, while charcoal contains about 9,000 BTUs per pound.



## Case Study: Tanana Washeteria

The washeteria in Tanana is more than a place where local residents can do laundry and take a shower—it's a prime example of energy-efficient technology matched with local, sustainable energy resources.

In 2007, the Interior Alaska community installed two wood-fired Garn boilers to heat the washeteria and adjacent buildings. By stoking each unit with cordwood just a few times during the day, the system produces enough BTUs to heat the buildings and the 280,000-gallon water storage tank. Heating oil consumption has dropped by 30%, saving the community tens of thousands of dollars a year. Photovoltaic solar panels were also installed on the roof of the washeteria to help reduce electric costs.

The city obtains wood for the boilers by paying local woodcutters \$250 per cord. Where the community used to buy diesel fuel and watch that money leave the village, it has now created an economic opportunity for residents that keeps the money local. There are plans to expand the system with three larger wood-fired boilers to heat tribal buildings and the senior citizen center.



Dual Garn WHS 2000 boilers in Tanana. Photo courtesy of AEA

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## BIOMASS

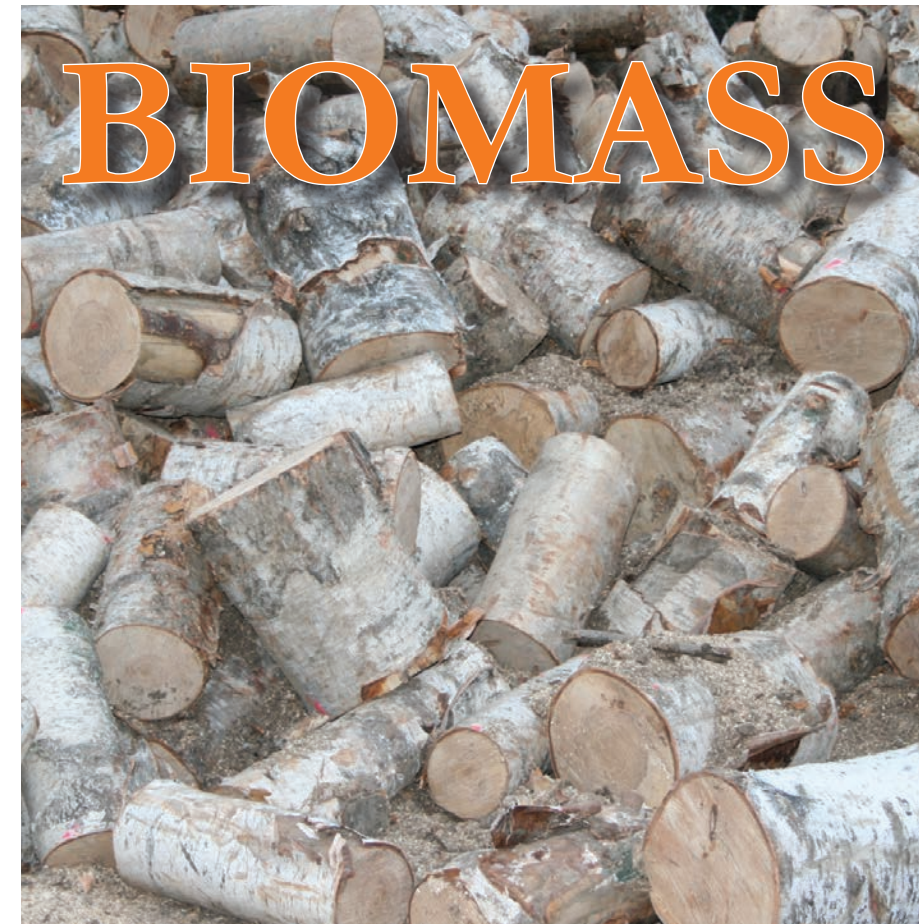


Photo courtesy of Amanda Byrd

As the cost of fossil fuels continues to rise, communities are looking to biomass as a potential energy source.

### Biomass in Alaska

Biomass as a source of energy is not a new idea in Alaska. People have been using wood, coal, and other organic fuels for thousands of years. The application of biomass as a major source of heat and power for an entire community, however, is a recent development that depends on established and new technology. As the cost of oil and gas continues to rise, communities are looking to biomass as a potential energy source. This is particularly true in rural Alaska, where energy costs are among the highest in the nation. Biomass has the potential to solve some of the heat and power needs of Alaska's residents—as well as contribute to the economy and sustainability of their communities.



Photo courtesy of Jeff Fay



Wood scraps are prime material for wood boilers. Photo courtesy of Karen Petersen

Harnessing the energy potential of Alaska's natural resources.

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Wind

Water

Biofuels



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### What is Biomass?

Biomass as an energy resource is defined as any living matter that can be burned to provide energy. Woody biomass is the most commonly used form of biomass, but other forms include agricultural products like grains, animal and municipal waste, fish oil, coal, and peat. If managed properly, biomass can be available on a renewable basis.

Woody biomass can be as simple as logs cut to length and fed into a wood stove. Wood can also be chipped, dried, and compressed into pellets or bricks. Wood byproducts, such as lumber off-cuts, chips, and shavings, can also be used effectively. Woody biomass, in whatever form, must have very low moisture content to burn efficiently.

Willows and alders can provide an excellent source of biomass. These fast-growing species that thrive in Alaska are known as “short-rotation woody biomass” and can be grown and harvested like a crop to provide a sustainable source of fuel.

### How can biomass be used for HEAT?

Burning wood is a traditional form of home heating in Alaska. Conventional wood stoves can be found in homes and community buildings across the state. Recent technological advances have resulted in a new generation of efficient wood-fired heating systems. These systems work by producing heat through combustion directly, or by creating transportable heat by capturing the heat from burning wood in a heat-storage medium such as water.

One example is the Garn® Boiler—a wood stove housed inside a water tank. The water absorbs the heat that can then be used for heat storage and transfer. This type of system can be used to heat multiple adjacent buildings by piping heated water through an interconnected or “district” loop. This system can reduce or even eliminate the amount of heating oil needed in each building.

Wood-fired heating systems are currently being used with success in Alaskan homes and community buildings, clinics, schools, swimming pools, and greenhouses—even in a washeteria—for heating both space and water.

Several communities in Alaska currently use biomass resources for heat, including Dot Lake, Tanana (see Case Study), and Craig (see Case Study). Persons interested in using biomass for heat in their own communities must first consider several factors:

- Which buildings will be heated? How can they be connected to share the heat?
- Is the interest in heat only or hot water too? How much hot water is wanted?
- How much heat is needed (often called the “load”), and what size boiler is necessary? This is typically a measurement of heat, called BTUs.
- Is an oil stove needed as a back-up option?
- How much wood will be needed and where will it come from? How can it be ensured that current wood resources will last?
- How will wood be collected? Is a road necessary? What about equipment?
- Who are the people, organizations, and agencies to be included in the decision-making process?
- How will this energy option be financed?
- Is this investment worth it? Will the savings in cost and emissions be worth the expense and work?
- How long will it be before the “payback” and savings of the project match the costs?
- Is our community ready and willing to tackle this project?

These questions must be addressed to make sure biomass will be successful in your community. For more information about resources and assistance with your community’s biomass ideas, contact the organizations listed on the back cover of this publication.

### How can biomass be used for ELECTRICITY?

Combined Heat and Power (CHP) systems are attractive because they can produce both heat and electricity for a community, increasing the efficiency of both services.

CHP systems usually consist of large boilers that produce high-temperature steam under sufficient pressure to drive a turbine and generate power. Some CHP systems employ a process called “gasification” that separates the gases released by the wood as it burns. This process creates a fuel called “syngas” that can be used like diesel fuel to run a generator.

Although CHP technology has been well tested in factories and industry in the U.S., the systems available for small-scale applications, such as in rural Alaskan villages, have not been proven to work and are still considered “pre-commercial.” This means that it is still difficult to purchase a system that will work as expected.

Another issue in using CHP technologies in rural commu-

nities is the high cost of purchasing and operating these unproven systems. Maintenance costs are high and, since the systems are very complex, finding someone trained to work on them is difficult. In addition, the fuel requirements are very specific in order for the system to work properly. The biomass resource must be uniform in size, composition, and moisture content. This requirement will create additional work and higher costs to manage.

Researchers hope that many of these initial problems can be solved so that this efficient system can be a better option for rural communities. Extensive research and a few demonstration projects are underway in Alaska to solve the issues with this system and determine if it can meet our unique needs.

## Case Study: City of Craig



Garn flame. Photo courtesy of Karen Petersen



Garn boiler system. Photo courtesy of Karen Petersen



Craig wood chip dryer. Photo courtesy of AEA



Garn boiler shed. Photo courtesy of Karen Petersen

In 2004, the residents of Craig, a fishing community of 1,400 people located in southeast Alaska, looked at the heating bills for the local schools and swimming pool, and knew they needed to make a change. The boilers used 20,000 gallons of diesel and 40,000 gallons of propane annually. The monthly fuel bill for the three buildings was over \$10,000.

With woody biomass as a plentiful resource and a local sawmill able to continually supply tons of wood chips, the community believed the solution could be found locally. In 2008, with support from the U.S. Department of Agriculture and Alaska Energy Authority, Craig installed a wood-fired heating system they hoped would save them money and reduce the amount of fossil fuel needed. Wood chips are dried and fed into a staged combustion chamber that first gasifies the wood and then burns the resultant gas. Hot water is pumped on demand to heat exchangers in the schools and pool.

It is too early to know the exact economic impact of the wood-fired system, but preliminary results show the project is a winner. The wood-fired system displaced 85% of the diesel and propane. With an initial price tag of \$1.5 million, the system is on track to pay for itself in twelve years—using a resource that literally grows in the town’s backyard.