

## 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.



## Case Study: Igiugig

Igiugig is located on the south shore of the Kvichak River. The population is under 100 and depends on commercial fishing and a subsistence lifestyle. Sport fishermen visit the area in the summer months.

Using \$47,000 in borough funds, Iliamna Lake contractors installed a small wood boiler to heat the village council office and hangar. It began operations in September 2012. Between the end of September and the beginning of March, the boiler saved the village between 600 and 700 gallons of fuel, or roughly \$5,000.

## Case Study: Kokhanok

Kokhanok is located on the south shore of Lake Iliamna. The population is just under 200 and subsistence activities are the focal point of the culture and lifestyle. The village provides bulk fuel, electric, public safety, water and landfill services.

Using \$250,000 of Alaska Energy Authority grant funds, the borough contracted for the installation of a large boiler to heat the village council offices and community building. The Garn boiler operated throughout the 2012-2013 winter and saved approximately 1,000 gallons of fuel, or about \$9,500. The council paid villagers to cut approximately 12 cords of wood at \$300 per cord for a cost of \$3,600. The numbers underestimate the benefits of the boiler because it burned very inefficiently in December (until a zone valve was replaced), and somewhat inefficiently through March (when the controller of the air-intake valve was replaced). These were start-up problems and are now fixed. Next year's benefits should be larger.

### References

*Wood Heat Boiler Design and Permitting.* 2010. RBA Engineers for Lake and Peninsula Borough.

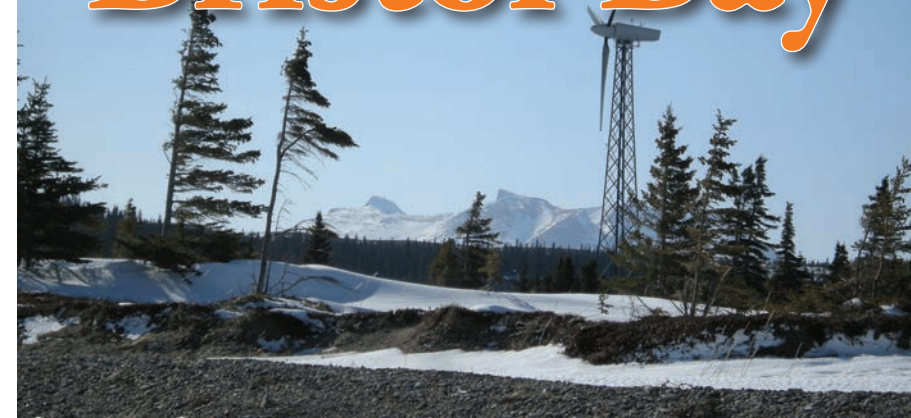
*Home Heating, Steam Baths, Smoke Houses and Wood Harvest Practices: Current Conditions in Aleknagik and Dillingham.* 2013. Bristol Bay Native Association.



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## Biomass in Bristol Bay



Kokhanok, Alaska

Biomass as a source of energy is not new to the Bristol Bay region. The people there have been using wood to heat their homes, steam baths and smokehouses for generations. The application of biomass as a major source of heat for a community, however, is a recent development and depends on established and new technology as well as a well-managed resource. As the price of heating oil continues to rise, communities in the Bristol Bay region are looking more and more to sources of biomass to help offset the cost. Biomass projects have the potential to solve some of the region's heating needs and contribute to the local, subregional and regional economies.

### How Can Biomass Be Used?

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 directly through combustion or by capturing the heat from burning wood and transferring it to a heat-storage medium such as water.

One example of a heat-storage device is the Garn boiler — a wood stove housed inside a water tank. The water absorbs the heat produced by the wood stove; this stored heat is then ready for distribution. This type of system can be used to heat adjacent buildings by piping heated water through an interconnected or “district” loop, and it can reduce or even eliminate the amount of heating oil needed in each building.



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

Biomass Fuel Types

There are three main types of woody biomass: cordwood, wood chips and wood pellets.

Cordwood

Cordwood boilers are fairly simple systems since the only wood-processing steps are chopping the tree into large pieces and then splitting and stacking the pieces. Most cordwood boilers are manually operated and must have a dedicated operator for loading and cleaning.



Wood chips

Wood chip boilers have the advantage of being partly, or fully, automated. Most wood-chip boilers are larger and

require more feedstock per day than cordwood boilers. The size of trees used for wood chips can vary from small, 3-inch-diameter trees to large trees. This allows more options in harvesting. Chipping equipment needs to be purchased, and chipping can be done in the field when harvesting or close to the boiler.



Wood pellets

Wood pellets are uniform in size and are very easy to handle. However, there are no pellet mills in the Bristol Bay region and it is expensive to ship pellets in, so we do not recommend pellets for this region.



Several communities in Bristol bay, including Igiugig and Kokhanok, currently use biomass resources for heat in community buildings. Many other communities are good candidates for community heating (see Table 1).

Table 1: Results of a wood boiler study for proposed installations in Bristol Bay (table by RBA Engineers, 2010)

Village	Potential Wood Boiler Site	Fuel Consumption Gallons/Year	Suggested Boiler System/Manufacturer	Investment Cost in \$\$	Payback Years
Igiugig	School, Teacher’s Housing, and Village Council	4,627	Cord Wood/ Central Boiler–E Classic 2400	\$117,000	5
Iliamna	Maintenance Shop, Firehall, and Shed	4,336	Cord Wood/ Central Boiler–E Classic 2400	\$185,000	8
Kokhanok-I	Firehall	4,600	Cord Wood/ Central Boiler–E Classic 2400	\$149,000	6
Kokhanok-II	KVC Office and Community Building	3,000	Cord Wood/ Central Boiler–E Classic 2400	\$143,500	9
Newhalen	School	18,000	Wood Chip/ Boiler–Viessmann or Chiptec	\$650,000	7
Nondalton-I	Option1: City Hall	10,400	2 x Cord Wood/ Central Boiler–E Classic 2400	\$199,500	4
Nondalton-II	Option 2: School, Houses (1-10), City Hall	30,810	Wood Chip Boiler/ Viessmann or Chiptec	\$950,000	6
PedroBay	Village Council & School	4,575	Cord Wood/ Central Boiler–E Classic 2400	\$188,500	8
Port Alsworth	School and Improvement Center/Firehall	2,000	Cord Wood/ Central Boiler–E Classic 2400	\$192,000	19

Is Your Community Ready to Heat With Biomass?

Various factors must be considered before you consider using biomass for heat in your own community:

- Have you completed all energy-efficiency measures in the community to reduce the energy demand?
  - AHFC’s Alaska Energy Efficiency Revolving Loan Program (AEERLP): <http://www.ahfc.us/efficiency/energy-programs/energy-efficiency-revolving-loan-fund-aeerlp/>
  - AEA’s Biomass Program: <http://www.akenergyauthority.org/Programs/AEEE/Biomass>
- Which buildings will be heated? Do you need to supply domestic hot water, too?
- How much fuel does each building use monthly/annually (look at fuel purchase records)?
- Does your community have a sustainable wood resource close to town?
- Who will supply the wood and what will be the cost (per cord equivalent)?
- How will the wood be harvested, delivered and stored?
- Does your community have a forest harvest plan?
- Will a larger biomass project compete with residential demand for fuel?
- What biomass boiler (model, size, fuel) are you interested in? Will it meet your base-load requirements?
- Will you retain your diesel boiler for back-up and supplemental heat?
- Who will be in charge of the boiler operations and maintenance? How will training be conducted?
- How will this energy option be financed?
- Who are the people, organizations and agencies to be included in the decision-making process?
- 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 your community ready and willing to tackle this project?

These questions must be addressed to make sure that heating with biomass will be successful in your community.

Biomass Resource Management and Planning in Bristol Bay

*Forest and Fire Management Plan For Native Allotments in the Bristol Bay Region of Alaska* presents an initial assessment of forest resources on the 1,762 Native allotments occurring within the region (18,098 acres). The plan gives a broad perspective of issues and concerns impacting the region’s forest resources while also analyzing data at the subregion level. It is meant to help guide forest management plans and future decisions affecting forest land uses, sustainable harvesting levels and wildfire fuel reductions on Native lands. If managed properly, the timber volume on many of the allotments may provide a sustainable fuel source. The Bristol Bay Native Association’s Forestry Program will use the plan as a basis for continued work on fire reduction practices, calculating economic values, installing wood boilers and supporting a regional fuel supply program.

The high price of fuel has been a problem for many years, prompting action by local and regional leaders to investigate alternatives. The Lake and Peninsula Borough hired engineers to look at the potential for wood boilers in select communities to help offset heating fuel costs. They examined a variety of manufacturers and fuels (cordwood, chips and pellets). The sites with low fuel consumption can be equipped with high-efficiency cordwood boilers. Larger installations, with higher fuel consumption, need a larger, automated boiler system that burns wood chips or pellets. For the cordwood boilers, the simple payback time per boiler is estimated to be 4 to 19 years. For wood chip boilers, the payback time is estimated at 6 to 7 years.

The study served as a basis for installing high-efficiency wood boilers in public buildings in the communities of Igiugig and Kokhanok, which are highlighted in the case studies, and may still be used to support further projects in other communities. Iliamna, Newhalen, Nondalton, Pedro Bay and Port Alsworth are also examined in the report.



Garn boiler system. Photo by Amanda Byrd