

# Tok Wood Heating Project



## Tok, Alaska



### Biomass project reduces wildfire risk and fosters community growth

#### Project Overview

With a grant from the Alaska Energy Authority's Renewable Energy Grant Fund (REF), Tok School designed and constructed a biomass wood chip heating system in the fall of 2009. A building behind Tok High School houses the chip-fired boiler and a chip storage bin. In 2013, the boiler was modified to produce steam and a steam turbine was installed to provide electricity in addition to heat. Tok is currently the only school in the U.S. to produce electricity using this method.

#### Objectives

The objective of this project was to reduce the energy costs to the Alaska Gateway School District by displacing fuel oil with local wood fuel. Additionally, developing a chip industry in the Tok area would create much needed jobs and use a fuel source that otherwise constitutes a fire hazard.

#### Reason Biomass Was Chosen

200 acres were identified as a wildfire hazard by the Tok Area Wildfire Remediation Plan. Forests surrounding the school and other parts of the community needed to be thinned to create a defensible space in the event of a wildfire. Using this wood as a fuel source could provide heat to the school for at least ten years.

#### Economic Feasibility

The project became operational in October 2010. Between October 2010 and December 2014, the system provided the school with 269 megawatt hours of electricity and 19,286 MMBtu of thermal energy, displacing 180,000 gallons of fuel, and saving the school \$643,200. With proper maintenance, the boiler life is expected to exceed 20 years. This project was one of the first large scale demonstrations of biomass heating in the state. Subsequent projects were completed with lower capital costs.

#### Quick Facts

##### Project Costs

Heating System: \$3.3 million (REF & match)  
Design: \$280,599  
Construction: \$3 million  
Chipper: \$325,000 (State)  
Steam/Electrical Generation: \$725,000

##### Equipment

Boiler Make/Output: 5.5 MMBtu/hr  
Messersmith System  
Chipper Make/Model: Rotochopper MC-266  
Output: 200 yards/hr

##### Fuel Oil Offset

Estimated annual: 64,000 gallons  
Actual annual: 59,000 gallons  
Comprehensive savings: 180,000 gallons  
(Oct. 2010-Dec. 2014)

##### Fuel Savings

Estimated annual: \$126,562  
Actual annual: \$146,000  
Comprehensive savings: \$643,200  
(Oct. 2010-Dec. 2014)

**Jobs Created:** 1 Full-time Operator, 4 Part-time

*"This project has enabled the school to hire a full-time counselor and restart the music program after being put on hold for ten years."*



Tok chip storage, photo courtesy of Dan Bihn.

# Tok Wood Heating Project

## Fuel Supply & Storage

The State of Alaska funded the purchase of the Roto-chopper wood chipper for the Tok Umbrella Corporation. The Rotochopper is leased to local sawmills to process chips for biomass projects. The wood is chipped and stored in a 120-ton chip bunker at the school and in a covered shed. The school currently pays \$50/ton, but hopes to lower the cost in the next negotiated fuel contract.

## Learning Experiences & Challenges

Fuel quality is extremely important to the successful generation of the biomass boiler. Silica-heavy spruce needles, dirt, and other contaminants create clinkers in the combustion chamber and increase maintenance and downtime. Although a common misconception, allowing dirt/contaminants to be burned with the wood even for a short time can be detrimental to the system. To avoid contaminants, Tok stores their wood in a dry, covered area with a concrete foundation.

With the combined heat and power system, there is currently about 30 percent more heat generated than is needed by the school. When sizing a steam turbine for an isolated system, the electrical load should be based on the amount of needed heat. Tok School has, however, been able to add a greenhouse with the excess heat and is pursuing additional heating opportunities.



*Hurst Firebox  
900-300-1,  
photo courtesy  
of Alaska Gate-  
way School  
District.*

## Community Benefits

The extra heat produced by the project allowed the school to develop a greenhouse. Students now have fresh vegetables in their cafeteria and learn about food preservation. They plan to make freezeable school lunches in the future.

Because of the money that the school district is saving, a guidance counselor was hired and the music program was re-introduced after being put on hold for ten years.

Students are learning about fire science and boiler operations, participating in moisture content testing, and continually visiting the boiler facility.

Tok is now a safer from the threat of wildfires. There are defensible areas surrounding the school and other areas of the community.

The chipper, now owned by the Alaska Gateway School District, is leased to other entities that are developing a regional supply of chips for biomass systems, creating economic development and local jobs.



*Tok School Greenhouse, photo courtesy of Dan Bihn.*

## Project Contact Information

### Parties Involved:

Scott MacManus, School Superintendent  
Email: [smacmanus@agsd.us](mailto:smacmanus@agsd.us)  
Phone: 907-883-5151, ext. 115

Jeffrey Hermanns, Division of Forestry  
Email: [Jeffrey.hermanns@alaska.gov](mailto:Jeffrey.hermanns@alaska.gov)  
Phone: 907-883-5134

### Case Study Author:

Zoe Tressel, AEA Intern  
Website: [Akenergyauthority.org](http://Akenergyauthority.org)