

Thorne Bay School Wood-Fired Boiler



Thorne Bay, Alaska



Wood-fired boiler fosters local economy and education

Project Overview

In partnership with the Alaska Energy Authority (AEA), the Southeast Island School District designed and constructed a cordwood boiler system for the Thorne Bay School. The system was integrated with the existing hydronic heating system in the school and later expanded to heat a greenhouse. By using cordwood as a heating fuel, the school district has created local jobs and started to develop a cordwood economy on Prince of Wales Island.

Objectives

The objective of this project was to reduce the cost of heating for the Thorne Bay School by using a local wood fuel. A secondary objective of the project was to integrate forest products into the school curriculum.

Product Selection

The GarnPAC is a factory designed “boiler in a box” developed to reduce the cost and complexity of construction in rural Alaska. This skid-mounted connex can be placed on a gravel pad and only requires piping and electrical connections on site. The Garn boilers are third party certified for their emission levels and are selected for the simplicity of operation and maintenance. Each boiler unit has about 2,000 gallons of thermal storage, resulting in very efficient combustion.

Economic Feasibility

The system became operational in 2013. In 2014, it provided 1,633 MMBtu of thermal energy and displaced 15,000 gallons of fuel oil. This displacement saved Thorne Bay School \$36,000. Over its 20 year projected life span, the project has a calculated benefit/cost ratio of 3.18.

Quick Facts

Total Project Costs: \$516,686

Funding: Renewable Energy Grant Fund: \$414,686
Local Funds: \$102,000

Capital Costs

Design: \$63,510
Construction: \$453,176

Equipment

Make/Model: (2) Garn WHS 2000
Output: 325,000 btu/hr each
Thermal Storage: 1,830 gallons each

Fuel Oil Offset

Estimated annual: 17,500 gallons
Actual annual: 15,000 gallons

Fuel Savings

Estimated annual: \$39,450
Actual annual: \$36,000

Benefit/Cost Ratio: 3.18

Jobs Created: 6 part-time



Boiler storage facility, photo courtesy of Jonathan Fitzpatrick.

Thorne Bay School Wood-Fired Boiler

Fuel and Storage

The school is located in the heart of the Tongass National Forest, the largest national forest in the United States. Wood is supplied by local sawmills and small local firewood cutters. Once the cordwood is purchased, students are paid to stack the wood in a storage building. Wood is stored for at least a year to ensure that the moisture is less than 20 percent. Burning wood with moisture content greater than 20 percent is less efficient and creates more emissions.

Learning Experiences/Challenges

The Garn boiler systems operate most effectively at a temperature range of 140 to 180 degrees F. The hydronic system in the school was designed to operate at the upper end of this range. On the coldest days, the Garn system is unable to fully meet the school's heating demand. Additional heating registers in the school and added wood boiler capacity will solve this problem.

Initial design of the integration of heating systems allowed heat to flow from the oil boiler to the biomass boiler when the biomass system was not in use. This wasted expensive fuel oil and was remedied with small changes to the piping and controls.

The concept of this prototype portable boiler in a box was very successful at simplifying the installation. The next step in its development is to "value engineer" the unit to reduce its cost, currently \$125,000 per unit.



Student-built wood crates, photo courtesy of Dan Bihn.

Community Benefits

With money saved on displaced fuel oil the school district built a greenhouse that is heated using the biomass system. Students learn science, math, business, and horticulture; they also grow fresh vegetables for the cafeteria and to sell in Thorne Bay and neighboring Communities.

The biomass boilers have become an integral part of education at Thorne Bay School. Students are hired to stoke the boilers between their classes and after school and they designed and built the cribs to hold the cordwood.

Six part-time jobs have been created to support the biomass boilers in the Southeast Island School District, including boiler operation, wood harvest/processing, and wood handling.



Greenhouse vegetables, photo courtesy of Dan Bihn.

Project Contact Information

Parties Involved:

Jonathan Fitzpatrick, SISD
Email: jfitzpatrick@sisd.org

Lauren Burch, SISD superintendent
Email: lburch@sisd.org
Phone: 907-828-8254

Case Study Author:

Zoe Tressel, AEA Intern
Website: Akenergyauthority.org

Updated February, 2016