



## CASE STUDY: Quillayute Valley School District Biomass Boiler

Few may be familiar with the town of Forks, Washington, but it has a great story to tell. Nestled in a tiny corner of the Olympic Peninsula, this town's claim to fame is much larger than its population of 3,700. Forks calls itself the "Logging Capital of the World" and is the historic home of many of the legendary sawmills of the Pacific Northwest. It also has the most rainfall in the continental United States, averaging over 100 inches of precipitation annually. This environment created the perfect setting for the Twilight book and film series, and now droves of vampire aficionados flock to the town each year for the Forever Twilight festival.

Forks has not only a bold slogan and a place on the silver screen; it can also claim another unique status known to few outside the local community. The middle school and high school are heated by the only woody biomass boiler in the state of Washington.

### A new era

The great cedar sawmills of northwest Washington are the things of literary legend, carving the rugged

and pioneering image of the Pacific Northwest into the American consciousness. While these mills once sustained the economy of Forks, circumstances and practices have since changed. For decades, it was common for mills to burn unused wood waste such as sawdust, chips, and shavings. However in 2009, a new federal air quality regulatory requirement called for an end to this practice. This posed a challenge for the mills, but also presented an opportunity for the community.

Forks and the surrounding area are relatively isolated and lack access to natural gas. As a result, most homes and buildings are heated with propane, diesel, or electricity. In 2009, the cost of these fuels had been climbing for years, and the town was looking for a better alternative to fossil fuels and a way to use the wood waste from the cedar mills. Recognizing this opportunity and looking to adhere to the new federal requirements, the state of Washington provided a \$1 million grant to the City of Forks to improve air quality and offset fossil fuels used for heating.





Following several examples in Europe and a handful of innovators in the United States, community leaders in Forks envisioned an energy system that would provide heat to the entire community using waste from the cedar mills. A team of engineers undertook a detailed study in 2009 to determine if the system was feasible. Wood heat worked, but the assessment showed that the cost of piping the heat throughout the community would far exceed the grant amount, so the idea for a district system was put on the shelf. It was a big idea for a small town but would require a different approach.

### A different school of thought

Coincidentally, the local mills weren't the only ones with a logistical challenge. Forks High School and Forks Middle School in the Quillayute Valley School District serve 600 students in two adjacent buildings, but in 2009 they were having trouble keeping the students warm. The schools were heated by a 50-year-old diesel boiler that was on its last legs. It had to start and stop at odd hours, and took as many as six hours to fully heat up. If you had walked into a classroom before noon, you would have been greeted by students wearing blankets, and your breath would have been visible on some of the coldest days. At a time when diesel costs were skyrocketing, the thousands of dollars consumed by the boiler each



year was a huge loss to the tiny school district that was already experiencing budget cuts.

The district was also pursuing construction of a new high school to be funded by bond dollars. With construction imminent and the need to replace the boiler at the middle and high schools, a timely opportunity emerged to install a new heating system that could serve both facilities. Wood heat may have been too much for the entire town, but for the two schools, the idea was just the right fit. The city made the call to transfer the state grant to the school district to explore installation of a woody biomass boiler that would meet their heating needs and achieve air quality goals for the community.

### A project champion

At first the school district was hesitant about the idea of biomass because there were no wood boilers in any other K-12 institution in Washington State, and the technology was unfamiliar to them. Fortunately, the answers to the district's questions were easily found with a few calls to friends.

When seeking advice on planning for the future, or looking for someone to literally keep the lights on, Forks' community leaders turn to Quillayute Valley School District facilities manager, Bill Henderson when they need reliable assistance. So when it came time to make the right call for the school district, Bill was tasked with learning the ins and outs of woody biomass boilers. He started by contacting his counterparts at biomass projects in Darby, Montana, Craig, Alaska, and numerous facilities on the east coast. They all told the same story. The idea of a wood chip boiler seemed strange at first, but once the project was built, they found it easy to operate and the system functioned smoothly. Most importantly, the schools were saving tens of thousands of dollars a year in heating costs by switching from propane and fuel oil to wood. Bill made the case to the district and demonstrated that the project was not only feasible,

but would save money in the long run. The district decided to proceed.

### It takes a village

With momentum building, Bill and the school district initiated the next steps towards system design and engaging the public. One of the biggest remaining questions was what impact a biomass boiler would have on air quality and the surrounding community. The school district consulted with Olympic Region Clean Air Agency (ORCAA) to address this question. They worked in close coordination on emissions standards, and designed an effective system that met strong air quality requirements and protected community health.

This consultation also resulted in some changes to the project. ORCAA required that the school use the cleanest fuel possible. At first they contemplated wood pellets as the most efficient option, but couldn't find a local supplier. The school also wanted to support the local community and forest health by using the available waste cedar, but the chips and shavings were lower quality and generated higher emissions. Bill's research into other projects showed that fuel quality was absolutely essential to success and couldn't be compromised. As a result, they ended up deciding on a chip mix of clean hemlock, spruce, and fir. These species are readily available from nearby thinning projects that support small landowners and local contractors, and boost forest health and productivity.

There was also concern among community members that the district was eager to address. They held a number of community forums and shared data from ORCAA to verify that impacts from the system would be very minimal. They also assured the community that deliveries of wood chips would occur once every three to four weeks and wouldn't affect safety or traffic congestion. Waste would also not be a problem, as the highly efficient boiler and high quality wood chips would produce only half a wheelbarrow load of ash for

**Location:** Forks, Washington. Quillayute Valley School District.

**Installed:** 2010

**Boiler type:** Wood chip

**Gross boiler capacity:** 2.9 mmBtu

**System type:** Hot water heating system with diesel backup

**Manufacturer:** Hurst; Combustion system and controls: Messersmith

**Emissions controls:** Advanced Metals cyclone; Filter Technology baghouse

**Fuel storage:** Wood chip bin: 28 tons. Diesel fuel tank: 2,000 gallons

**Square heating footage:** 70,000 square feet

**Total cost:** \$2.6 million (boiler system, building, and HVAC upgrades)

**Funding sources:** \$1 million state grant, \$1.6 million local school bond

**Annual wood chip consumption:** 350 green tons

**Energy savings:** 50% of average diesel cost at construction

every ton of chips consumed. School Superintendent Diana Reaume noted, "this was a true partnership and took everyone working together." With buy-in from the community, and sign-off from the state, construction could finally commence.

### Breaking ground

Bill discovered in his research how imperative good partnerships are for system design and construction. Like any major construction project, unseen obstacles are certain, and effective response is invaluable. For these reasons, the district turned to boiler manufacturer Messersmith, who had strong experience with woody biomass systems and had completed similar projects in rural communities across the country. Messersmith's expertise paid off immediately as they surveyed the facilities and realized that more than just the diesel boiler needed to be replaced. The school's heating and ventilation system was outdated and in poor shape, and to connect the new boiler to both the middle school and high school would require an overhaul. The new biomass boiler was state of the art, efficient, and powerful, and the old system was no match. Just as you wouldn't put a Ferrari engine in an old station wagon, you can't connect slick new equipment to old pipes. Project costs rose from \$1.6 million to \$2.6 million, but the increase would pay off in the long run and ensure years of smooth performance.



The timing on the project was also challenging. The old diesel boiler was no longer operational, but the middle school still needed to be heated while the high school was being built. To address this, engineers staged plans to build the boiler and its surrounding facility before construction on the new school was complete. A small new backup diesel boiler was also installed for heating at the start of the school year during mild months. The school would then transition to wood heat for the remainder of the year.

### Reaping the rewards

Construction wrapped up in 2010. The exterior of the boiler facility is one-of-a-kind, resembling a teepee burner with a tall pointed roof. This design reflects the community's logging traditions, but also has a practical purpose of covering the 50-foot stack, which is necessary to control emissions. To maintain system reliability and prevent build up of hardened debris from combustion – or “clinkers” – an advanced metals cyclone was installed. To meet ORCAA's stringent air quality standards, the system has a baghouse to remove particulate matter and additional pollutants. With strong and advanced pollution controls in place, little escapes the chimney but steam.

Today the wood boiler runs 24 hours a day, 7 days a week from November to May, heating the school facilities and providing hot water. The new system generates less stress for maintenance staff, provides consistent comfort to students and teachers, and has improved overall facility efficiency. The result is a more comfortable environment for teaching and learning. The community has embraced the boiler as part of the unique culture of Forks; tours regularly bring in interested parties, and the facility is open for viewing by the general public.

At the time of installation, the wood system cost half as much as diesel to operate. Energy savings for the first three years was \$50,000 - \$60,000 per year, meeting the district's goal of saving one full time

teacher salary annually. Today in 2016, the low cost of diesel makes the biomass system less competitive, but costs are still comparable, and the district wouldn't give up the benefits of the new wood boiler anyway. “The system runs smoothly and the heat just feels warmer,” says Bill Henderson. “I'm proud to show this system to anyone.”

The Forks biomass boiler story is about a tiny town that came together for a big undertaking. It seemed unlikely at first, but with a little creativity, perseverance, and commitment from local leaders, the community turned a challenge into a winning solution for everyone. They also created a model for similar communities across Washington and the West, and they want others to know about it. As Bill Henderson says, “we're a small school district. If we can do it, anyone can.” Other small timber towns may have different stories and slogans, but they would still be wise to follow the lead of Forks, Washington.

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