



# Rough and Ready

## 1.5 MW Wood-fired Combined Heat and Power Plant

### Project Overview

In February 2008 Rough and Ready Lumber, located in Josephine County, Oregon, began commercial operation of a new 1.5 MW wood-fired combined heat and power (CHP) plant. The plant produces power and captures waste heat to dry lumber in 12 kilns. Rough and Ready sells all of the power to the utility, PacifiCorp, and buys back what they need to run their plant. They sell more than 10 million kWh of electricity per year.

### Reasons for Installing CHP

Until recently, Rough and Ready air-dried their lumber on a variety of drying schedules, which created gaps in sawmill production. To stay in business and remain competitive, Rough and Ready needed to make changes at their mill. They went from a three-shift, two-mill operation to a one-mill, single-shift operation with a focus on high-quality, low-production specialty items. This transition necessitated a different sort of retooling. In order to dry more lumber, Rough and Ready could no longer rely on air-drying. They needed greater boiler capacity to heat their kilns and decided to replace their 30-year old boiler. They decided that it was time to invest because increased emphasis on thinning nearby national forests to reduce wildfires and insect infestations meant the federal government would be supplying a lot more wood than they could burn in their existing plant.

### Quick Facts

**TYPE OF INDUSTRY:** Lumber mill  
**LOCATION:** Cave Junction, OR  
**TYPE OF SYSTEM:** Wood waste combined heat and power  
**STEAM BOILER:** Wellons water tube  
**PRIME MOVER:** Coppus Murray backpressure steam turbine (Model "U")  
**ELECTRIC GENERATING CAPACITY:** 1.5 MW  
**AVG. ELECTRIC LOAD:** 1.28 MW  
**AVG. THERMAL LOAD:** 58.5 MMBtu/hr.  
**FUEL:** Hog fuel (50%), forest thinnings and logging debris (50%)  
**USE OF THERMAL ENERGY:** Heat for 12 double-track dry kilns to dry more lumber  
**SYSTEM EFFICIENCY:** 68%  
**NET CAPACITY FACTOR:** Approx. 80%  
**EMISSIONS OFFSET:** Power sold to grid - 7182 MT/yr CO<sub>2</sub>e and an 85% particulate reduction with new electrostatic precipitator (Source for CO<sub>2</sub> calculation: EPA website)  
**ENVIRONMENTAL BENEFITS:** Natural gas offset by wood waste  
**INSTALLED COST:** \$6 million  
**SIMPLE PAYBACK:** 4 years  
**OPERATION START:** February 2008



Rough and Ready's CHP Biomass Plant

## Equipment

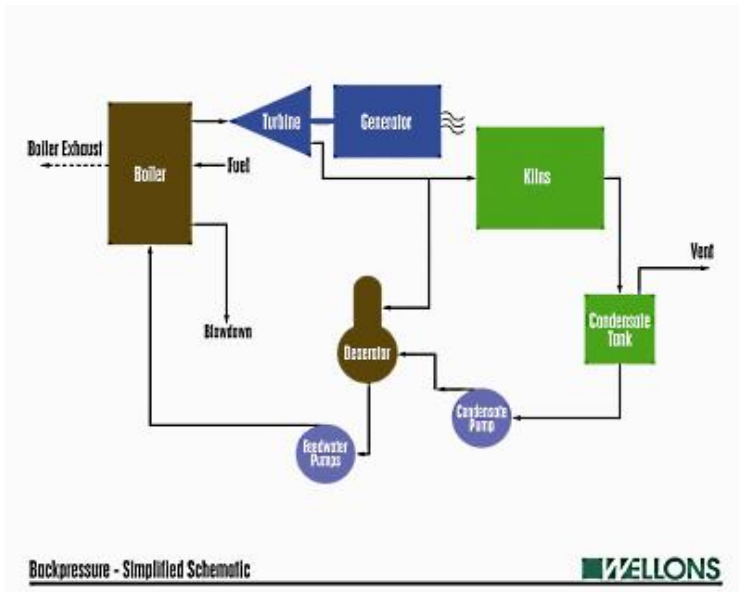
### Main components of the CHP system

- Steam boiler: Wellons 40,000 PPH 300 psig water tube, Model #1D1C8.0A
- Turbine: Coppus Murray 1.5 MW backpressure, Model "U"
- Gen-set: Kato Reliance generator, Model # A2484200000, Type 24842

The CHP system has a 40,000 PPH (pounds per hour) wood-fired 300 psig (per square inch gauge) water-tube boiler that feeds saturated steam into the 1.5 MW backpressure steam turbine. The turbine is harnessed to a Kato Reliance generator. Discharge steam is reduced to 20 psi and used to heat 12 double-track dry kilns. Kiln condensation is then returned to the boiler to be reheated.

### Operational experience and results

The old system was less efficient: it did not produce electricity, the steam was low-pressure, and lumber was air-dried instead of kiln-dried. The new CHP system produces electricity as well as discharge steam which is used to heat the dry kilns.



Wellons lumber dry kilns



Wellons boiler

## Environmental Profile

- Switched from natural gas to wood waste
- Installed new electrostatic precipitator (Wellons, Model #2W-091-1419) to collect particulates; this resulted in an 85% particulate reduction
- Air quality gains from not burning the waste wood/slash in the forest
- Received FSC (Forest Stewardship Council) certification in Spring 2009. *FSC certification is meant to provide consumers with assurances that the wood products they are buying come from forests managed to protect water, soil and wildlife*

## Project Benefits

- Mill survival and creation of up to 12 jobs
- Will help the company stay competitive
- Mitigation of potential gaps in sawmill production caused by different drying schedules of ponderosa, sugar pine and Douglas fir
- Additional revenue streams: custom-drying for other lumber producers and sale of electricity
- Contribution to forest health (thinning the forest reduces wildfires and insect infestations)
- Adds renewable energy to Oregon's electrical grid
- Public perception of biomass plants has improved

## Financial Analysis

As a small business, Rough and Ready could not afford the cost of the CHP plant until the U.S. Congress created financial incentives supporting renewable power from burning biomass. Leaders in the timber industry realize that energy production can help finance widespread thinning of forestlands in order to combat wildfires and insect infestations. Reducing dependence on fossil fuels is an added benefit.

Rough and Ready is a Federal Energy Regulatory Commission (FERC) Qualifying Facility.

Rough and Ready is in a Federal Empowerment Zone and an Oregon Enterprise Zone; these are intended to stimulate economic development in areas of high unemployment.

Total installed cost: \$6 million

Payback period: 4 years (without the tax credits and incentives, payback would have been 15 years)

### Project capital

- \$2,350,000 USDA Rural Development Section 9006 Loan Guarantee
- \$500,000 USDA Rural Development Section 9006 Grant
- \$243,000 Woody Biomass Grant from U.S. Forest Service
- \$1.7 million grant from the Energy Trust of Oregon, administered in the form of a power production premium paid out over a minimum of four years (based on forecasted energy production). This averages out to approximately \$42/MWh.

### Financial incentives

- Federal production tax credit: 35% credit for pollution control equipment (\$210,000)
- \$1,350,000 Oregon Business Energy Tax Credit (BETC) – 10% credit over five years on 50% of eligible project costs
- R & R Lumber sold their BETC to a pass-through partner (as planned) for 33.5% of their certified construction costs of the project

### Revenue streams

- Sale of electricity
  - Rough and Ready sells approximately 10 million kWh/yr to the utility (PacifiCorp)  
Power Purchase Agreement (PPA)
    - Buy all, take all contract (the mill sells all their power to the utility and buys back what it needs)
    - Rough and Ready sells 10 million kWh/yr to PacifiCorp
    - \$65/MW, escalates at about 3% per year
    - Length of PPA: 5 years
      - Power Purchase Contract electric rate:  
Peak = \$.0721/kWh

## Collaborative Business Arrangement

The project was a successful collaboration between several organizations:

- The system is owned and operated by Rough and Ready.
- PacifiCorp handled the interconnection. The utility purchases the electric output of the system through a 5-year Power Purchase Agreement (PPA) and uses it to meet its 20% by 2025 Renewable Portfolio Standard.
- The Energy Trust of Oregon provided a grant, administered in the form of a power production premium.
- A Business Energy Tax Credit was provided by the State of Oregon.
- USDA Rural Development of Oregon provided a loan guarantee and grant.
- Northwest Farm Credit Services was the lender for the USDA loan guarantee.

## Partner Profiles

### PacifiCorp

This investor-owned utility, based in Portland, Oregon, is one of the West's leading utilities. Serving approximately 1.7 million customers in six western states, PacifiCorp has approximately 15,700 miles of transmission line, 61,085 miles of distribution line, more than 900 substations and 68 generating plants across the West.

### Energy Trust of Oregon

Energy Trust is a non-profit corporation charged by the Oregon Public Utility Commission with using revenues collected by Oregon's PUDs to encourage innovative, renewable energy production. Its mission includes finding and funding renewable energy projects.

### USDA Rural Development

The Office of Community and Economic Development (CED) administers rural community and regional development programs within USDA Rural Development, encouraging local involvement and decision making.

### Northwest Farm Credit Services

Northwest Farm Credit Services is a cooperatively owned lending association specializing in financing farmers, ranchers, agribusinesses, commercial fishermen, timber producers, and country home owners in Idaho, Montana, Oregon, Washington, and Alaska.

## Lessons to Share

- Wood fuel costs are always higher than expected!
- Focus on interconnection early

## For More Information

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