

Success Story: Seneca Sustainable Energy

Markets Served
Forest products

The new co-generation plant has demonstrated an overall net reduction in emissions as a result of the newly installed processes.

Seneca Sustainable Energy calls on Eaton to help build a new high-efficiency biomass power plant

Location:

Eugene, Oregon

Segment:

Forest products

Problem:

Economic and environmental pressures to run a more energy-efficient plant

Solution:

Using Eaton power distribution assemblies and components to power a 20 MW biomass-based co-generation plant on-site

Results:

Maximized plant efficiency, reliability and electrical workplace safety

Contact Information

For more information on this case study, contact Dave Durocher at DavidBDurocher@eaton.com

Background

The Energy Independence and Security Act of 2007 defined the importance of biomass as a feedstock for alternative fuel. Requirements state that by the year 2025, electric utilities must derive at least 25 percent of the energy they produce and sell to the public from renewable energy sources.

A company that has revitalized its renewable energy potential is Seneca Sawmill of Eugene, Oregon, established in 1953. During its nearly 60-year history, the company has grown from just 25 employees and a production rate of 18 million board-feet of lumber to more than 350 employees and more than 350 million board-feet of lumber products.

Beginning in 2007, economic conditions weakened, new housing starts plummeted, and market demand for lumber diminished. At the same time, although the business owned and managed 165,000 acres of forests, raw materials, transportation and energy costs were increasing.

Emission rates also posed a serious concern for local environmental groups—annually, the mill released 3,500 tons of carbon into the atmosphere and burned 70 billion BTUs of natural gas to produce the steam used to dry lumber.

Challenge

The answer to reduced demand and rising costs was to devise a plan that would significantly improve the efficiency of the lumber mill—adding a biomass-based co-generation plant at the existing site.

The new Seneca Sustainable Energy biomass power plant was commissioned in April 2011 and today generates enough electricity to power 13,000 homes annually. Timberland slash, limbs and treetop materials from logging operations, were historically burned in the field. Today, about 30 equivalent truckloads of this material is transported to the mill daily and used for fuel, along with existing sawmill wood waste, to power the 19.8 MW biomass plant.

Description of the new operation

The Seneca Sustainable Energy plant process works to ensure the highest and best use of each log harvested—no part of the log goes to waste. Biomass enters the system and material

is moved to a storage facility that holds enough biomass material to power the generator for 10 to 12 days.

Next, biomass travels to the boiler. The energy released from combustion creates the steam used to drive a steam turbine-generator that creates approximately twice as much energy as the lumber mill needs. One hundred percent of generator-produced energy, which is classified and priced as alternative energy, is exported to the local grid and sold to the local utility as part of a long-term power purchasing agreement.

The environmental performance of the new Seneca facility is impressive. The plant owners spent in excess of U.S. \$12.5 million of the total \$50 million project cost to install the best available technologies for boiler emission controls. Forest protection laws require the burning of slash to reduce the risk of fire, insects and disease. The EPA estimates that benzene, greenhouse gasses, hydrocarbons and emissions of other organic air toxics (for example: styrene, toluene, etc.) emitted when slash is burned in the emissions-controlled renewable energy facility are hundreds of times lower than the previous approach when open burning was applied. The new co-gen plant has demonstrated an overall net reduction in emissions as a result of the newly installed processes.

EATON

Powering Business Worldwide

Solutions

The Seneca Sustainable Energy biomass plant applies Eaton technologies throughout the electrical power system to maximize plant efficiency, reliability and electrical workplace safety. Primary power enters the new biomass plant at 12.47 kV. Eaton medium voltage metal-enclosed switchgear distributes electrical energy to a lineup of fused load-break switches installed in a central location at the new power plant. Each switch is cable-connected to one each of five outdoor secondary unit substation liquid-filled transformers with both primary and secondary air-terminal chambers. The transformers are supplied with an environmentally friendly vegetable-based FR3 fluid that was specified by Seneca's design engineers. The transformers are located near the serviced load, with secondary cables pulled underground into electrical equipment rooms.

Eaton's unique low voltage, front-access switchgear solved a pivotal planning conflict between Seneca engineers responsible for operating and maintaining the new plant and the primary contractor. Contrary to the Seneca engineers' preference for low voltage metal-enclosed switchgear assemblies, the primary contractor designed the electrical rooms for group-mounted switchboards that would be mounted against the wall without rear access. Fortunately, Eaton's switchgear design allowed Seneca to maintain the existing mill standard of switchgear with withdrawable low voltage power circuit breakers, while requiring a space similar to a low voltage switchboard assembly. Applying the same circuit breaker used in the existing sawmill systems simplified facility maintenance and reduced active spare parts.

After discussing ideas for upgrading electrical workplace safety standards with Eaton, Seneca's design engineer decided early on to continue the practice of installing high resistance grounding (HRG) systems mounted at each of the low voltage PDCs. Seneca engineers were particularly interested in applying HRG in order to eliminate the possibility of a shock or an arc-flash hazard in the event of a phase-to-ground fault on the 480V systems. An incident of a motor phase-to-ground fault during operations with solidly grounded systems would disrupt operations by shutting down the plant. More important, this could threaten the lives of operators who could be subjected to an arc-flash event.

A unique functionality added to the co-gen electrical system is an Eaton-designed maintenance switch used for arc-flash reduction at the main circuit breakers of the 480V PDCs. The Eaton Arcflash Reduction Maintenance System™ includes an integral circuit breaker tripping system with two protective modes—one for operation using standard selective coordination and the other used for a maintenance mode. Should an arc-flash event occur in the downstream system during maintenance, the breaker will clear the fault instantaneously, reducing the incident energy and the chance of personal injury or equipment damage. Fast total clearing time—on the order of 40 ms—reduces the downstream arc-flash energy and allows maintenance personnel to wear less personal protective equipment (PPE) while withdrawing feeder breakers in the PDCs or performing other downstream electrical work, improving workplace safety and reducing the chance of equipment damage should an accidental fault be initiated during energized work.



Biomass enters the system via a "truck dump" that tips a tractor-trailer rig on end to empty wood slash into a hopper. (Photo courtesy of *The Register-Guard*)



New turbine room with 19.8 MW steam turbine-generator. (Photo courtesy of *The Register-Guard*)

Eaton power systems engineers who were already familiar with the site completed a short-circuit, coordination and arc-flash study. Prior to the new plant being energized, Seneca personnel affixed the proper labels to the new equipment, and Eaton conducted training for facility maintenance.

Electrical systems to support the export of the alternative energy-classified megawatts produced by the new generator were also supplied by Eaton. A medium voltage metal-clad generator switchgear rated at 13,800V is connected at the generator terminals and used in conjunction with a utility-supplied transformer to step up to the utility transmission voltage for export onto the utility grid.

Eaton maintains a local switchgear assembly plant within 30 miles of the contractor's office and within 100 miles of the project site. Seneca's use of this facility allowed the easy inclusion of their engineer and the project contractor in factory acceptance witness testing. The entire protection and transfer system was simulated at Eaton's local plant prior to shipment to the site. All issues with current transformer polarities, relay settings, special wiring, etc., were identified and resolved ahead of shipment, ensuring that these were not problems found later in the field.

Results

The North American dimension lumber business is very cyclical in nature. As demand is linked closely with new housing starts, many sawmills across the region have been struggling to maintain profitable operations. The issue has been exacerbated by some sawmills focusing on simply producing more lumber, resulting in an imbalance of supply and demand and depressed prices for dimension lumber.

Biomass generation is a unique form of renewable energy. Unlike wind and solar, which depend on atmospheric conditions, megawatts generated by biomass fuels can be generated when needed. The U.S. Department of Energy has called for the doubling of electrical power generated from biomass plants, and the European Union has identified biomass co-generation as a primary means of decreasing greenhouse gas emissions.

After years of study, mill leadership successfully identified and leveraged “adjacent spaces” in their business, including efficient use of wood waste to generate renewable energy, and application of secondary steam from the new co-gen facility to deliver kiln-dried lumber to their customers: a value-added product. The company aligned with Eaton to ensure that electrical systems for the co-gen plant were designed and installed to improve both workplace safety for their employees and operational efficiency of the new processes. The new plant site is an impressive display of Seneca’s vision of the future: today a vision that has become reality.



The new front-accessible low voltage switchgear assembly for PDC-2 is shown above. The main circuit breaker includes a lockable Maintenance Mode Switch and a blue indicating light. The switch can be locked in the NORMAL or the ENABLED mode. In the ENABLED mode, the blue light is illuminated and the breaker responds to the instantaneous maintenance setting.

Eaton
1000 Eaton Boulevard
Cleveland, OH 44122
United States
Eaton.com

© 2013 Eaton
All Rights Reserved
Printed in USA
Publication No. CS083003EN / Z13788
July 2013

Eaton is a registered trademark.

All other trademarks are property of their respective owners.