



Bioenergy Reference Project 1

Blue Mountain Lumber Energy Facility



Overview

In July 2000 a major expansion of the Blue Mountain Lumber (BML) Sawmill in Southland was completed. The expanded sawmill processes approximately 160,000t/y sawlogs, and requires significant quantities of process heat to dry timber, heat buildings and to preheat resins. The expanded sawmill also generates significant quantities of wood waste residues.

BML and Meridian Solutions (MS - a business unit of Meridian Energy) formed a Build, Own, Operate and Transfer (BOOT) type energy partnership for MS to supply all of the steam required by the site and incinerate surplus wood residues for electricity generation. MS developed a new energy facility to provide BML with this energy supply.

The MS facility consists of a 10 MW_{th} steam boiler fuelled by the sawmill wood residues and a 1.4 MWe steam turbine generator to utilise any surplus steam for electricity generation.

The partnership also includes for the supply of imported electricity to the sawmill and provision for MS to identify and take up performance contracting opportunities at the sawmill site.

Prior to this expansion the sawmill operated at a smaller scale with several small wood residue fuelled boilers that were fire risks and at the end of their economic life. The site was dumping significant quantities of wood waste into a local landfill. The objective of the new facility was to improve the steam quality, and provide capacity for proposed increased steam loads, while completely fuelling the new boiler from site generated wood residues.

Project Parties

The energy facility is owned and operated by Meridian Solutions who are contracted to supply heat to BML for a period of 15 years. The heat is used for kiln drying of timber. If there is surplus heat after supply to the kilns has been met the surplus heat is put through a steam turbine / generator set to produce electricity for on-site use. In periods when heat is not required for the kilns and site electricity demand is low excess electricity is exported from the site and sold to Meridian Energy.

BML are responsible for supplying waste wood to the energy facility for fuel.

Easteel Industries were contracted by Meridian Solutions to design and build the energy facility, with fuel storage and handling equipment subcontracted to Brightwater Engineers. The contract was for a turnkey plant engineered and built to comply with MS performance requirements and engineering standards, with full manufacture and installation of the energy facility. The construction contracts were signed in April 1999 with the boiler commissioned in April 2000 and the turbine generator in July 2000.

Description

Fuel Supply

The energy facility has been designed to take all wood waste from the site including green saw dust, dry shavings, dry sawdust, sawmill slivers, off-cuts, bark or pulp chips, but excluding treated timber. Analysis of the on-site fuel available and the total heat required for kiln drying with average co-generation to best match site requirements indicates that there is adequate woodwaste available if dry blocks are hogged and used as fuel. No bark or wood chips need be burned.

Sawmill wood wastes are difficult to burn and the BML combustion technology is well suited to this difficult application. Despite this the technology has limitations and the boiler fuel specification is an accurate reflection of these limitations.

The boiler Fuel Specification agreed at the start of the project by BML, MS and Easteel is summarised below.

Boiler Fuel Specification

Characteristic	Data
Design moisture content	55% w/w
Dry fuel content - minimum	30% w/w
Ash content - maximum	10% w/w
Bark content - maximum	20% w/w
Green wood fuel moisture content	63 – 65% w/w
Dry wood fuel moisture content	12 – 15% w/w
Bark fuel moisture content	33 – 60% w/w
Gross fuel efficiency of boiler	58%

The boiler is rated at 10MW output when the combined fuel moisture content is less than 55% moisture content.

If the combined fuel moisture content is above 55% w/w the boiler will be derated and if it is above 58% w/w, serious operability and safety problems are likely. Operability issues are also likely when the combined fuel moisture content changes rapidly (say because of a layer of very wet or very dry material in one of the fuel silos) and these types of changes require operator intervention.

Fuel Handling and Storage

Material from the sawmill is received from an existing conveyor onto a new vibrating screen. Wet sawdust accepts are conveyed by pneumatic ducting to the Saxlund International wet fuel silo (550m³). Rejects from the screen such as slivers are dumped on to a concrete slab where they are picked up by front end loader and taken to be hogged.

Depending on sawmill operating times and timber drying schedules, this level of storage generally allows sufficient fuel to be stored for boiler operating during the weekend when the sawmill is not operating.

The boiler needs a mixture of dry and green wood fuel. Simultaneously fuel feed from both storage silos is therefore required. The two silos have the appropriate storage ratio to achieve this.

The live floor receives mostly hogged dry wood waste and is used as a backup and to feed in hogged dockings. The hog has a capacity of approximately 3 tonnes/hour and the live floor has the capacity to run the boiler close to it's MCR.

By nature, the wood waste fuel supply mixture is highly variable depending on time of year, BML processing parameters and the batch nature of the sawmilling operation. This can cause problems in maintaining relatively steady boiler combustion conditions.

Given the realities of operating this type of plant, the fuel storage system is effective and well matched to BML available fuel supplies, albeit that management of appropriate fuel deliveries is at times challenging.

Dry sawdust from the wood processing plant is pneumatically conveyed to the Saxlund International dry fuel silo (275m³). Dry blocks are front end loaded by BML staff to the Brightwater Engineering Hog feed to be fed into the Montgomery Hog.

The hog is suitable for chipping all wood waste, dockings, blocks, offcuts, fillet sticks, bark and yard waste up to 1m long. Material from the hog is stored in a Saxlund International moving floor reclaim bin (20M³). A covered fuel conveyer transfers the fuel from the fuel silos and the reclaim bin to the boiler firing hopper.

The fuel storage, with the addition of hogged blocks, has been optimised to maximise waste disposal, maximise kiln heat, optimise site electricity requirements, minimise fuel storage costs and provide fuel through a normal weekend.

Boiler

The boiler is a 10 MW_{th} Babcock & Wilcox wood residue fired water tube boiler producing superheated steam at 28.5 bar and 400 deg C for direct use by the turbine, pressure reduced and desuperheated to 10 bar for kiln drying requirements. The boiler incorporates a vibrating grate with the under grate air preheated, has a 3:1 turndown ratio, is designed to be an unattended boiler in terms of the regulations, and an automatic ash handling system to effectively remove ash.

Steam turbine / Generator

During project development it was identified that the boiler would only use 60% of its capacity and that a heat dump would have to be added to dispose of excess steam. (BML subsequently put in more kilns so this surplus is now being used for more timber drying.) Various heat dump options were considered until BML chose the 1.6 MW_e cogeneration option. BML considered their cost of waste disposal to be very high and chose the cogeneration option to assist reduce the amount of waste being dumped.

The turbine alternator set is a 1.4 MWe Brotherhood machine relocated from Ravensdown's Timaru site and marginally derated because of the different inlet steam and condenser conditions selected. The turbine is of the condensing type with inlet steam conditions of 28.5 bar and 400 deg C. The 11 kV alternator is a four pole machine with brushless exciter. A new cooling tower and water circulation system also had to be installed.

Operation

The energy facility is operated to match BML's steam requirements. Priority for steam is to heat the kilns with additional steam available being passed through the steam turbine to produce electricity.

Meridian Solutions provides a boiler operator and is responsible for all operating and maintenance activities relating to its assets. At night and over weekends the facility alarms are diverted by pager to the operator who can remote dial into the facility and interrogate the control system and identify the reason for the alarm. Automatic shut down of the boiler occurs for a serious event.

Remote monitoring of alarms is also undertaken by Meridian Energy operators at Twizel. The Twizel operators however have no fuel or boiler control functions.

The plant operates continuously for a full week except for planned mill shutdowns and occasional unplanned boiler repairs. Plant availability for supply of steam is typically in excess of 97%.



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