ATS Ltd

Biomass Boiler Installation at Sewstern Sawmill

Project Highlights

The installation of a 750kW biomass heating system at Sewstern Sawmill has allowed the kilning capacity to expand from 3,000m^3 per year to 8,000m^3 per year, whilst reducing the site's energy costs, this has resulted in 15 additional jobs being created at the site due to the expanded kilning capacity and carbon savings of 900 tonnes per year.

Introduction

Located in the East Midlands, Sewstern Sawmill, owned by ATS Ltd. has been operating for 25 years. The sawmill offers one of the largest ranges of English and European oak, cherry, ash, sycamore, chestnut and beech in the UK and also carries extensive stocks from America and the Tropics. All of the timber is sustainably and responsibly sourced. The main market for the timber produced by ATS is the construction industry. In recent years the sawmill has produced 3,000m^3 of timber product per year, the majority of which was kiln dried via nine oil-fired kilns, operated 24/7 for 365 days of the year. This represented almost all of the 2,000,000kWh/year heat demand at the site.

Aerial View of Sewstern Sawmill

Project Aims

Sewstern wished to explore the potential for replacing the existing 1 MW steam oil boiler with biomass heating, fuelled by wood by-products generated on site. The sawmill produced approximately 1,600tonnes of wood by-products per year with an average moisture content of around 21%. By utilising biomass energy, ATS's main aims were to reduce fossil fuel costs and haulage costs for the removal of the wood co-products from the site, generate an income from the Renewable Heat Incentive and reduce carbon emissions; reflecting ATS's environmental commitment.

ATS also wanted to expand kilning capacity by 250%, whilst reducing operating costs and environmental impact. Given the efficiency gains from installing new kilns, it was determined that a total of 3,170,443kWh of heat would be required per year plus heat losses from the distribution pipe work.

Project Development

Having been identified by the Carbon Trust's Biomass Heat Accelerator as a key site to take advantage of biomass heating, ATS were provided with a feasibility study to assess the viability of a number of different options in terms of plant location, specification, heating medium, size and cost. After much consideration and discussion between ATS and the technical consultant (Sustainable Energy Ltd.), it was concluded that the optimum solution for the

site would be a 750kW biomass Low Temperature Hot Water boiler to provide 100% of both existing heat demand and expanded heat demand (assuming a 250% capacity increase to kilning operations). A smaller auxiliary oil boiler was also installed to provide back up heat if required in the event of biomass boiler shut down without affecting site operations. Outline design of the proposed solution was then presented and planned in a way that would ensure no down time on the site output. The proposed solution was therefore to install new kilns and district heating main across the site prior to converting the existing steam kilns to hot water whilst ensuring full integration of the old and new systems.

The feasibility process provided ATS with sufficient information to make an informed decision to invest further resources to develop the project. In order to ensure that the installation was delivered at lowest optimal cost and at very high levels of technical performance, the project was progressed to the next phase of development through the Carbon Trust's Biomass Heat Accelerator which covered the following activities:

- Detailed system design.
- Technical specification of all plant items.
- Assistance with tendering for boiler supplier and main contractors.
- Assistance with financing (through Carbon Trust loan application to part-finance the capital costs of the installation).
- Planning support.
- Role of 'Client's Engineer' to provide technical support throughout construction, evaluation and handover.

Through the expert technical assistance provided by Sustainable Energy Ltd supported by the Carbon Trust, the project evolved from the original plan of replacing the existing oil boiler with biomass, into a large expansion of the kilning operations and the business in general. This technical knowledge and expertise provided ATS with the confidence that the plant would work and payback as designed and to take the plunge to invest in building new kilns to increase kilning capacity from 3,000m^3 to 8,000m^3 and create jobs – without this confidence investment may not have been made.

Construction began in December 2010, commissioning and handover of the plant was completed in August 2011.

The Newly Installed 750kW Biomass Boiler

2 x 12,500Litre Thermal Stores Being Moved into Position

Boiler House and Fuel Store under Construction

Projected Biomass Savings

The cost of processing the wood fuel at the site is estimated to be £20/tonne; the wood fuel at Sewstern has a calorific value of 4,100kWh/tonne (due to the low moisture content, circa 21%). With an average biomass boiler efficiency of 85%, the delivered heat cost via biomass is 0.6p/kWh. The biomass plant will generate over 3,000MWh of renewable heat per year; based on this, the annual income from the Renewable Heat Incentive will be over £93,000 per year, using the latest Medium Biomass tariff guidelines – this is calculated as shown below:

The boiler house and fuel store is shown below, with the on-site vehicle offloading wood fuel into the fuel store.

Technology	(kWh)	Tariff (p/kWh)	RHI Value per year
Medium scale biomass boiler	Tier 1 heat generation = 1,314hours x boiler Maximum Continuous Rating (750kW) = 985,500kWh	4.9	£48,300
Medium scale biomass boiler	Tier 2 = Annual heat generation less Tier 1 = 3,240,212kWh – 985,500kWh = 2,254,712kWh	2.0	£45,100
			£93,400

Technical Details

The biomass boiler solution comprises a 750kW moving grate boiler with 25,000litre thermal storage, sized to maximise the operational efficiency of the biomass system. The thermal store can be charged up in periods of lower site demand and then used to supply low and peak heat demands that are outside of the operational range of the boiler, in order to 'even out' the demand on the biomass boiler.

The 150m^3 fuel store comprises a moving floor extractor with feed auger to fuel the boiler; when full, this contains sufficient fuel for over seven days at maximum heating demand. The wood is chipped and tipped into the fuel store hopper by the on-site handling vehicles. The potential variability of self-supplied woodchip from the different on-site by-products, and total volumes involved in the fuel store, required the robust fuel delivery system that a walking floor provides. The walking floor fuel delivery system is shown below.

An auxiliary oil boiler is fully integrated into the heating system. Although the system is designed so that the biomass boiler and thermal storage can supply 100% of demand, the auxiliary oil boiler can be brought online as required in the event of biomass system failure.

The biomass heating system and auxiliary boiler are fully integrated via a bespoke automatic control and monitoring system, which ensures that the temperatures supplied to the heat distribution network are as required for kiln operation, whilst minimising heat losses and maximising the seasonal efficiency of the biomass plant. The control system also has remote monitoring capabilities to allow the system performance data to be accessed, analysed and stored via an internet connection. The information recorded includes site heat consumption for RHI payments, and instant notification of system alarms, which are also sent via SMS to notify the operators that attention is required.

Completed Boiler House and Fuel Store Receiving Delivery

Walking Floor Fuel Extractor

The project was part financed by a Carbon Trust Loan towards the cost of the biomass boiler; the £100,000 loan was interest free and repaid over two years. A breakdown of the project costs is shown below:

Project Costs for 750kW Biomass Boiler Plant	
750kW Wood chip boiler and ancillaries	£122,000
Fuel feed system	£20,000
Accumulator tanks	£20,000
Flue system	£18,000
Transport and delivery	£10,000
Boiler house and civils works	£189,000
Mechanical installation	£192,000
Electrical installation	£40,000
Controls	£8,000
Wood chip store	£39,000
Design and build of new kilns	£340,000
Conversion of existing kilns from steam to hot water	£53,000
Design and project management	£6,000
Total project costs	**£1,057,000**

A summary of the main project facts are tabulated below.

The performance and savings of the biomass boiler system are compared against the alternative approach of the 3,000MWh/yr thermal consumption of the expanded business being provided by an 84% efficient oil boiler.

Component		Unit	Note
Biomass Boiler Installation	1no. 750kW		Installed by Econergy
Auxiliary Plant	1no. 700kW		Using heating oil
Biomass Fuel Source	Self-supply		Wood co-products from on site timber processing
Biomass Fuel Consumption	930	tonnes/yr	At circa 21% moisture content
Biomass Fuel Expenditure	£18,595	£/yr	Cost for on site chipping – £20/tonne
Fuel Store Size	150	m^3	
Co2 Emissions Saved	900	t/yr	Based on expanded kilning capacity
Installed	2010/2011		
Capital Cost	£1,057,000		Includes installation of new kilns
Carbon Trust Loan	£100,000		0% interest, repayable in two years
Annual Savings of Fossil Fuel	350,000	litres/yr	
Annual savings on Fossil Fuel Costs	£191,000		Based on expanded kilning capacity
Estimated Annual RHI Income	£93,400		RHI scheme to launch in November 2011
Payback	4.2	years	This is the payback for the whole expansion (i.e. biomass boiler AND new kilns) and does not include any revenue from additional output capacity.

“We are very happy with the completed project which has not only enabled us to significantly expand our business and create jobs but also to make huge savings in our annual running costs and offer our clients an ultra-low carbon building material. We could not have achieved this without the support of the Carbon Trust and the technical expertise of Sustainable Energy Ltd.”

Andy Lodowski
Managing Director of ATS commented