

ENERGY SAVING IN THE TIMBER INDUSTRY

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Abstract:

This article describes the energy saving opportunities in the timber industry by utilising wood residues for timber drying. It describes a project that BTG has carried out in Bulgaria which shows that through the implementation of a wood waste fired boiler in combination with a drying kiln, companies can dispose of their waste in an environmentally friendly way, while at the same time generating additional income for their plants. Payback times for the investments are typically two years only.

1. Introduction

In Bulgaria, abundant wood resources are available. Over 3.3 million hectares of forests are available, from which the Bulgarian wood industry did produce over 300,000 cubic meters of finished products in 2000. In generating these sawn products, ca 40% of the wood is discarded as waste, leading to a staggering 120,000 – 130,000 cubic meters of wood waste available for energy generation. At the same time, the majority of the woodworking enterprises use only a small portion of their waste for space heating in the winter, while the larger part is disposed of or distributed free-of-charge to employees. At the moment there is hardly any market for the commercial sale of waste wood. Furthermore, a number of woodworking enterprises are faced with the need to introduce new, modern drying and steaming equipment to improve the quality of their product. This opens up possibilities for implementation of wood-waste boilers.

2. The concept

While a number of sawmills have excess waste wood (such as shavings, sawdust and cut-offs), these have at the same time a need for drying capacity. Especially regarding markets in Western Europe, dried timber is a much higher valued product compared to the original sawn wood. Drying is an energy-intensive operation, although only relatively mild temperatures are needed, which makes it especially suitable for bioenergy generation in boilers. This concept is detailed in Figure 1 for a typical sawmill.

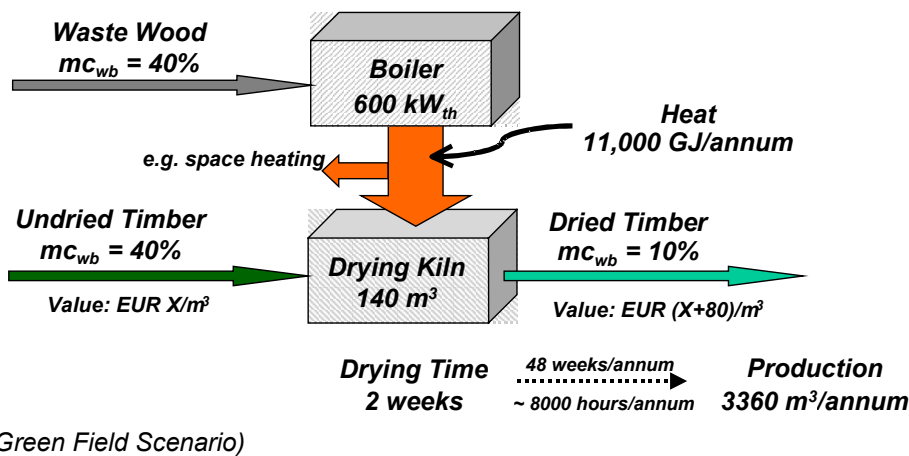


Figure 1 Application of a waste wood fired boiler for drying purposes at a typical sawmill. Undried timber, with a moisture content of 40% on a wet basis, is dried to a moisture content of 10% (wet basis).

Wood waste, at a moisture content of 40% (wet basis) is fed into a boiler. The boiler is used for the indirect supply of heat to the drying chambers, where timber is dried to a moisture content of 10% (wet basis). The added value is estimated at 80 Euro per cubic meter. Dependent on the size of the boiler, additional heat can be used for space heating. Modern wood-fired boiler can be fully automated, are efficient, and comply to the strictest emission regulations, through the use of advanced flue gas cleaning concepts. In Figure 2 an example of a typical wood-fired boiler is shown.



Figure 2 **3 MW_{th} wood-fired boiler, located in Scotland, used for heating of drying kilns**

3. Environmental benefits

Because waste wood is used, there are not only no costs associated with this fuel, but its use has also significant environmental benefits:

CO₂ savings by replacement of fossil fuels

Because of the replacement of fossil fuels for the provision of energy for the drying chambers with a renewable energy source, net CO₂ savings are accomplished.

Mitigation of methane emissions from landfills or wood stockpiles

Currently in Bulgaria, wood waste is commonly dumped in landfills or dedicated stockpiles. Apart from being a nuisance, these stockpiles emit significant quantities of methane, which is a greenhouse gas with an effect which is 21 times more powerful than CO₂ (IPCC, 1996).

4. Economic viability

The economic viability of this application is illustrated with a sample case study. In this case a relatively small sawmill is chosen with a production capacity of 3,000 cubic meters of fresh, sawn beechwood. The company also produces significant amounts of sawdust, which are currently landfilled. Because the company wants to produce dried timber, it is decided that an investment is made into a drying chamber for the yearly production of 3,500 cubic meters of dried beechwood, implying a drying chamber volume of 140 cubic meters, heated by a 600 kW_{th} boiler.

In table 1 the results of the economic assessment are given.

Table 1: Economic assessment of a typical boiler-drying kiln combination in Bulgaria

Characteristics	Unit	Values
Capacity wood-fired boiler	[kW _{th}]	600
Efficiency	[%_LHV]	80%
Investment	[EUR]	300,000
Capacity factor	[%]	90%
Capacity drying kilns	[m ³]	140
Drying time	[weeks]	2
Investment	[EUR]	150,000
Running hours	[hours/annum]	8,000
O&M costs	[%_Investment]	10%
Moisture content residues	[%_wb]	50%
LHV residues	[MJ/kg]	8
Demand residues	[ton/annum]	2,430
Cost residues	[EUR/ton]	0
Production dried timber	[m ³ /annum]	3,500
Added value dried timber	[EUR/m ³]	75
Total Investment	[EUR]	450,000
O&M costs	[EUR/annum]	45,000
Added value drying	[EUR/annum]	262,500
Net benefits	[EUR/annum]	217,500
IRR	[%]	47.3%
Simple Payback Period	[years]	2.1

From this table it is clear that investment is significant, but the pay-back time is with a little over 2 years very good. This is mostly attributable to the residues, which are assumed to be freely available. The high amount of running hours (8,000 hours/year) of the drying chambers is critical for the economic viability, hence all plant logistics should be aimed to make maximum use of the drying capacity. Therefore it is considered that this high amount of running hours is feasible, also because the technology (boilers, drying kilns) is proven technology, designed for continuous operation.

In Figure 3 the sensitivity of the Internal Rate of Return (IRR) towards changes in some key parameters are shown. Both the added value of the dried timber and the fuel price

have a profound influence on the economic viability of the project, although the IRR remains well over 30% in all cases. Even in the case of three parameters turning negative, the IRR is still over 10%.

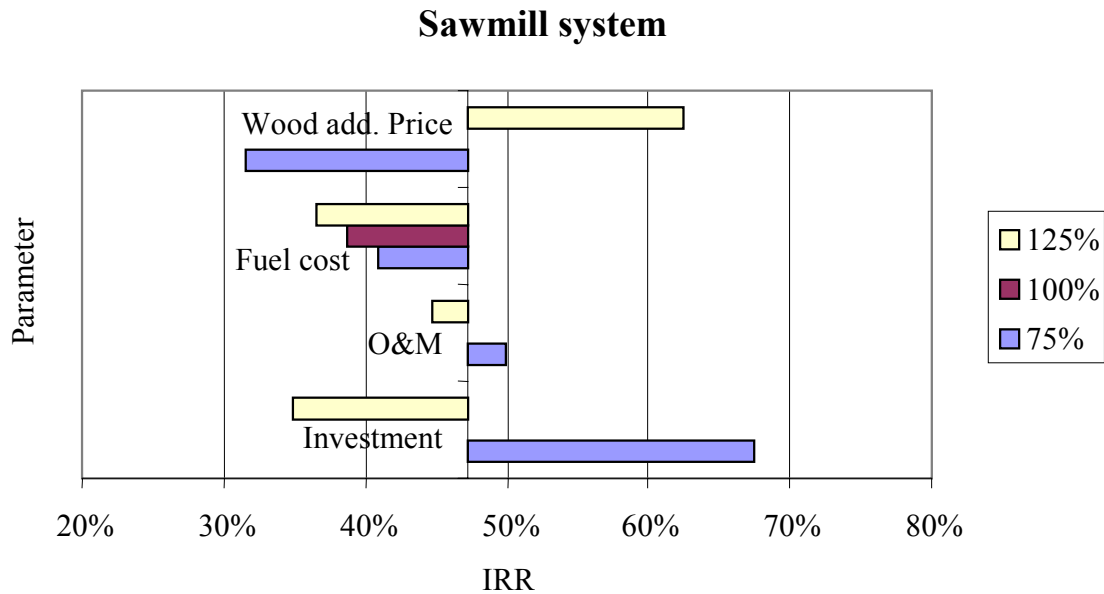


Figure 3 Sensitivity of the internal rate of return (IRR) towards changes in some key parameters for the boilers-drying kiln application case

5. Conclusions

Application of wood-fired boilers for timber drying can be financially very attractive. Investments show IRR's of more than 40% and pay back times of two years. Besides this, there are significant environmental benefits associated with the use of waste wood as a fuel.