USING SSAT FOR A WOOD WASTE BOILER

Bill Moir
Steam Engineering Inc.
Vancouver, Washington

This Is a Case Study at International Paper Company
New Boston, Texas.

In 2000 the New Boston Lumber Mill dried 109 million board feet of lumber. The facility had a wood waste fired boiler rated at 50,000 lbs/hr of steam peak load. Listed below is operating data associated with the above level of production.

Boiler Rating	50,000 lbs/hr
Boiler Operating Pressure	165 psig
Average boiler operating hours per year	8,700 hrs.
Average boiler steam load	41,600 lbs/hr
Average boiler stack temperature	450°F
Average boiler flue gas oxygen	9%
Average steam to dry 1 board foot of lumber	3.3 lbs
Heat input to the boiler	58.0 MMBtu/hr
Fuel Required	5.5 green tons/hr

The Company wanted to increase production to 137 million board feet per year and contacted Steam Engineering to see if the boiler could produce sufficient steam to add an additional dry kiln. At 3.3 lbs per board foot of lumber the average boiler output would have to increase to 52,000 lbs/hr to dry the required lumber volume. At 52,000 lbs/hr of steam the boiler would need 6.9 green tons of fuel per hour and a heat input of 72.7 MMBtu/hr.

STEAM SYSTEM EFFICIENCY

$$\frac{\text{Output}}{\text{Input}} \times 100 = \% \text{ Efficiency}$$

$$\frac{(\%\text{Efficiency})(\text{Input})}{100} = \text{Output}$$

If we improve the system efficiency and hold the input constant we can increase the output of the boiler. The output of the boiler is the average steam production.

We used the U.S. Department of Energy "Steam System Assessment Tool" (SSAT) software to analyze opportunities to improve the steam system. The following identified opportunities were installed.

1. A mixing air system to enhance combustion and allow the boiler to operate at reduced levels of excess combustion air or flue gas oxygen.
2. A feed water economizer to improve boiler efficiency. By using some of the heat in the boiler stack gases to increase the boiler feed water temperature we

were able to further increase the boiler efficiency.

3. A new high temperature condensate system to improve steam system efficiency. The condensate was previously collected in a vented condensate tank and now the condensate is returned directly to a deaerator operating at higher pressure. The energy in the hot condensate is used to deaerate the boiler makeup water. This use of wasted energy displaces the steam previously used for deaeration.
4. Steam load management controls to reduce spikes in the plant steam load.
5. New feed water pumps to handle the hotter feed water, the result of returning condensate from the kilns directly to the deaerator.

The results were immediate and the facility now dries in excess of 137 million board feet per year with the following characteristics.

Boiler Rating	60,000 lbs/hr
Boiler Operating Pressure	165 psig
Average boiler operating hours per year	8,700 hrs.
Average boiler steam load	48,100 lbs/hr
Average boiler stack temperature	320°F
Average boiler flue gas oxygen	4%
Average steam to dry 1 board foot of lumber	3.1 lbs
Heat input to the boiler	58.9 MMBtu/hr
Fuel require	5.6 green tons/hr

1. The plant uses 3.1 lbs of steam per board foot of lumber dried. Deaerator steam is replaced with the flash steam from the dry kiln condensate.
2. The average steam production has increased to 48,100 lbs/hr and all of that steam is used in the dry kilns no steam is used for deaeration.
3. The average makeup water demand is 5,500 gal/day.
4. The kilns operate at a steam pressure of 135 psig.
5. The steam system operates on 96% return condensate.
6. The boiler requires 0.4% blowdown.
7. Chemical treatment costs were reduced because the plant uses less makeup water.
8. The facility also sells hog fuel on a consistent basis.

This is an extremely efficient dry kiln steam system operation and the principals applied at this location can be used at most lumber drying operations.