The sawmill industry, along with all other industry in the United States, is facing two problems which have drastically affected the manner in which a facility is operated. These problems are: (1) The Energy Crisis (2) Disposal of Waste.

The energy crisis has had an affect in two ways, one being the dramatic rise in the price of fossil fuels, and the other being the fact that in many areas, one or more types of fuels are not available at any price. This second circumstance has meant that an alternate fuel is then used, whose price is much higher, and whose long range supply may also be in doubt.

The waste disposal problem has arisen because traditional methods of disposal such as teepee burners and land fill have been curtailed due to the resulting air and/or water pollution which they produce. While selective markets exist for specific types of wood residue, not all types of residue can be continuously marketed year round. This leaves the mill with a disposal problem.

However, based upon the energy contained in the wood, the most economically advantageous usage of most wood residue is as fuel, since a 200 cubic foot "unit" of hog fuel contains approximately 14 million BTU's of energy, or 140 therms. This is the same amount of energy as that contained in 98 gallons of No. 2 oil or 153 gallons of propane. At current market prices for these fuels, the "unit" of hog fuel has a high value as fuel.

Moore Oregon began searching for a solution to these problems about four years ago. The logical solution for our customers was to provide a means for more extensive and efficient use of their raw material, wood fiber, and at the same time reduce their fossil fuel requirements (and therefore reduce their operation costs). In the process, the amount of waste would be reduced, aiming at efficiently using 100% of the wood fiber entering the plant. An additional implied requirement for the system was that it must be economically feasible, and more realistically, economically attractive for the customer to use it.

The system which was arrived at is the burning of prepared wood fiber in suspension in a forced vortex burner under controlled conditions, with the resulting heat being clean and readily usable. Today we will present the application of the forced vortex burner as a heat source for a direct fired lumber dry kiln.

The basic equipment required for a direct fired dry kiln using a forced vortex burner is shown on the next slide (Figure 1). It includes: (1) The supply and return ducts, (2) The recirculation fan, (3) The forced vortex burner with its combustion air blower and slag removal conveyer.

As shown in the next slide (Figure 2) the equipment is housed inside an overhead control room, typically located at one end of the kiln, similar to the location of the burner on a fossil fuel direct fired dry kiln. The recirculation fan is now located between the return duct and the burner rather than between the burner and the supply duct as has been done in the past. This means that the recirculation fan now is moving air at a much
lower temperature than before, thus allowing the use of a smaller fan and a lower horsepower motor resulting in an overall saving in operation costs.

The rate at which the burner produces heat is controlled by a conventional dry kiln instrument. The rate at which fuel is fed into the burner is modulated based upon the demand for heat in the kiln. The high pressure pneumatic feeding system for the burner provides virtually instantaneous response to the requirements for changes in the rate at which the burner converts the wood fuel into heat.

The maintenance requirements of the burner system are very low, and its location inside the control room provides easy access when maintenance is required. The surface of the burner housing has a low enough temperature that your hand can be placed upon it without any discomfort.

The dry kiln is operated in the same manner as other direct fired dry kilns. The wood fired burner performs very similarly to a gas or oil burner, and after a 10 to 30 minute warmup period, operates on a self sustaining basis with no pilot flame or other sustaining flame required.

Equipment for slagging out up to 80 per cent of the non combustibles in the fuel can be added to the burner, which results in a very small percent of noncombustibles being passed from the burner. Thus, the heat is clean and readily usable for the kiln.

The fuel for the burner is required to be at a 15% moisture content on a wet basis, with a particle size of 1/8" minus. The source of this type of wood waste is typically the surfacing and trimming operations of a mill. Additional dry wood fuel may also exist if further processing of dried lumber is performed at the plant site.

This slide (Figure 3) shows the typical fuel preparation and handling system for dry wood, and includes:

1. A hammerhog
2. Dry wood storage with a cyclone for pollution abatement
3. A screw conveyor to the hammermill
4. A hammermill with a 1/8" minus screen
5. A pneumatic conveyor to the surge bin
6. A surge bin with a cyclone and bag house
7. A metering bin with infeed conveyor and outfeed high pressure feeding system
8. Fuel feed pipe to the burner

If a sufficient quantity of dry material is not available, then a green fuel preparation system is required. Such a system is shown on the next slide (Figure 4) and it can be compared to the refining processes which are required to convert crude oil into the more useful forms of fuel with which we are familiar. The fortunate thing for us is that our raw material refining system does not require a multi-million dollar investment, but rather is suitable for the individual plant to own and operate.

The green fuel preparation system contains:

1. A green fuel storage bin and screw conveyor
2. A rotary dryer with a cyclone
3. A forced vortex burner
4. A hammermill
5. A dry fuel storage bin with a cyclone and bag house
6. A metering bin for the burner on the rotary dryer and a metering bin for the burner on each dry kiln.
A most attractive facet of direct firing a dry kiln is that the overall thermal efficiency is higher than that of a steam heated kiln, since most of the energy produced by the burner is ducted directly into the kiln, and is available in the form of heat to evaporate the water that is in the lumber. With a steam heated kiln, whatever energy that is lost in the boiler while steam is being generated is never available to provide heat in the kiln. Since the efficiency of most boilers is below 80 per cent, at least 20 per cent of the energy in the fuel provides no heat to dry the lumber.

A dilemma facing many current kiln owners is that they already have a sizable investment in their equipment, which is in top operating condition and does not need to be replaced. If the current kilns are direct fired, in many cases the forced vortex burner can be installed in place of the gas or oil burner. Since the operation of the forced vortex burner closely parallels that of a fossil fuel burner, the kilns can be operated in their usual manner.

If however, the existing kilns are steam heated, addition of the forced vortex burner is generally not advised. This is because extensive modifications would be required, at a cost which might approach the price of a new direct fired kiln. In such a case, we recommend the use of a forced vortex burner on a package boiler, (Figure 5) either the one in existence at the mill, or a new boiler specifically designed for use with the wood burner. While the typical energy losses for a boiler will exist, the operator will still have the most efficient means of converting wood into heat at his disposal.

Summary

The use of a forced vortex burner, operating with prepared wood waste as its primary fuel, to direct fire a lumber dry kiln, provides a solution to the problems of finding an alternative to replace fossil fuels and lowering the levels of air and water pollution, by more efficient use of wood fiber and by the reduction of the amount of residue which must be disposed.

The accompanying high thermal efficiency means that less wood fiber will be utilized for fuel. With the other markets open for the wood fiber which remains after the lumber is cut, high thermal efficiency allows the operator to obtain maximum economic efficiency from the raw material for which he is paying an ever increasing price.