

A black and white photograph showing a long, perspective view of industrial material handling equipment, likely a conveyor system with multiple parallel tracks or chutes, receding into the distance.

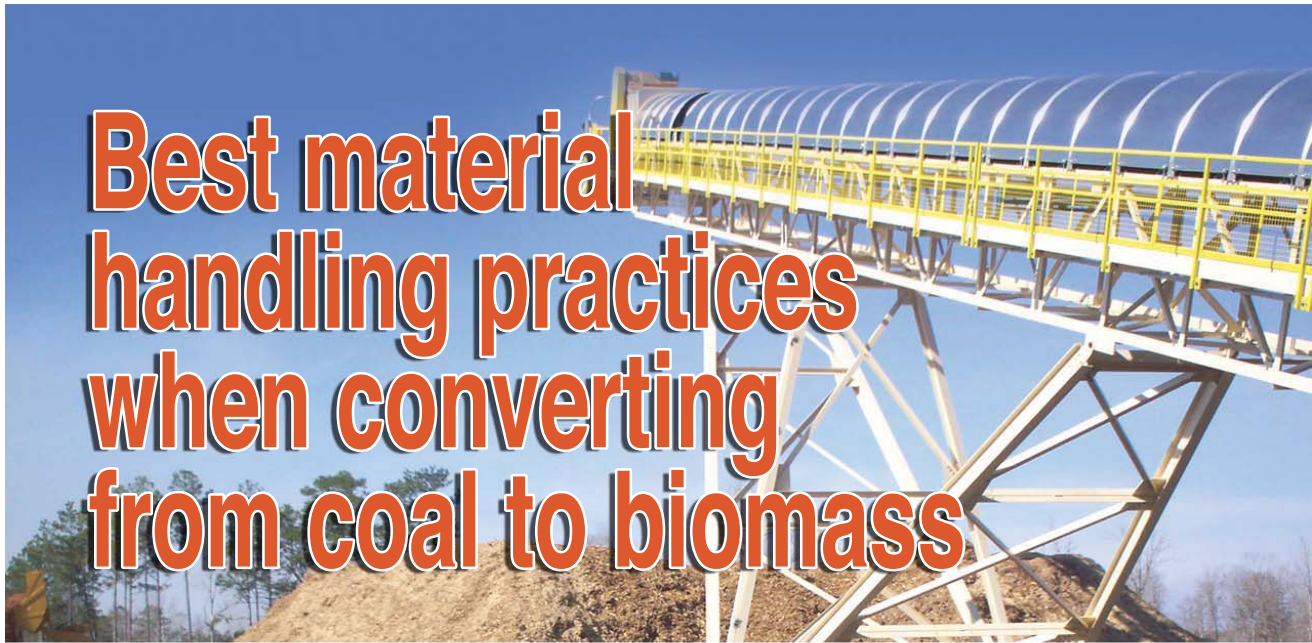
# **BEST MATERIAL HANDLING PRACTICES WHEN CONVERTING FROM COAL TO BIOMASS**

Cliff Moss, Vice President and Director of Materials Handling Division

A close-up, black and white photograph of industrial material handling equipment, showing a series of parallel metal tracks or chutes supported by vertical posts, with a material being transported along them.

## SYNOPSIS

Converting a coal-fired plant to a biomass or co-firing setup can be a strategy for addressing the rising costs of fossil fuels as well as tighter emissions regulations. When considering such a change, it's important to anticipate the potential effects of biomass fuels on the existing boiler and systems. This article discusses some of the common challenges, which can be addressed by working with a company that has both experience with biomass and the engineering capabilities to evaluate and modify existing systems.



# Best material handling practices when converting from coal to biomass

BY CLIFF MOSS

As coal prices continue to rise and environmental regulations become tighter, more facilities are considering a transition from traditional fossil fuels to biomass. While widespread conversion to biomass power has not happened yet, it is likely that regulations and political pressure will push coal-fired plants to convert to biomass. As the power industry prepares for this conversion, there are lessons it can learn from the pulp and paper industry's long history of working with biomass. After all, these facilities have been handling, processing and storing woody biomass and biomass fuels

for more than 100 years.

There are many reasons conversions have been slow to materialize, but a common thread is the lack of familiarity with biomass fuel characteristics, particularly in the utility industry. As the promising transition to biomass fuels gains traction, the biomass industry must gain a better understanding of what it takes for plants to successfully convert from coal-firing to biomass-firing facilities.

Whether a plant is gearing up for a partial or total conversion to biomass fuels, there are fundamental considerations that project and plant managers need to take into account. From selecting the right engineering team, to understanding how biomass fuels will affect the boiler and its surrounding equipment, proper planning and understanding of common pitfalls will improve the likelihood of a successful coal-to-biomass plant conversion.

Selecting a firm that has a proven track record of biomass system design, fabrication and start-up experience is the first step. Depending on the scope of the conversion, make sure the firm has an engineering staff that is capable of handling the work load of the conversion. Many of the conversion projects are relatively small in size from a utility standpoint.

A common mistake is choosing a firm with only utility and coal-firing experience. Many of the traditional utility engineering firms are gearing up for the push to biomass firing, but they lack the experienced engineers in this area and the ability to move quickly enough on many of the relatively small conversion projects that normally range from 10-35 MW. Con-



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*Top: A radial stack reclaimer (above) may store 3-4 days worth of fuel, while an underpile reclaimer might only have 1-2 hours of fuel storage. Photos contributed by Process Barron.*

*Assembling the right equipment mix will mitigate many issues that plague facilities transitioning from coal to biomass fuels.*

sidering its long history of working with biomass, it's advantageous to select a firm that has worked with multiple plants in the pulp and paper industry.

These projects usually have very short project schedules, and are often best suited for equipment and system design/supply companies that can supply turn-key project aspects, such as design engineering, equipment supply, project management and installation services.

However, if the conversion is going to require major changes to the facility's set-up (tearing down walls, expanding foundations, etc.) a team with diverse engineering capabilities is critical. Partnering with an independent engineering firm to handle the civil, structural and environmental engineering challenges that come with major site expansions might ensure the smoothest transition. The engineering firm can then give direction and guidelines to the system and equipment providers.

Once engineering issues have been properly addressed, assembling the right equipment mix will mitigate many issues that have plagued transitioning facilities. It's important to know how to deal with the differences between handling coal and biomass. The materials handling and boiler equipment will endure much greater volume throughputs, erosion and corrosion from biomass due to additional particles like dirt and sand that are embedded in the fuels. Systems that aren't built to handle this type of debris battering will encounter major and recurring problems with the material handling process.

A reliable reclaimer system is essential to the biomass material handling process. Biomass materials like bark, wood chips and sawdust are often stored in large piles fed by transfer conveyors. At these piles, heavy duty reclaimers work to pull the fuel from the massive piles onto the boiler feed conveyor system. If the reclaimer is not properly equipped to deal with the heavy loads and feed capacity requirements, the conveyor system will



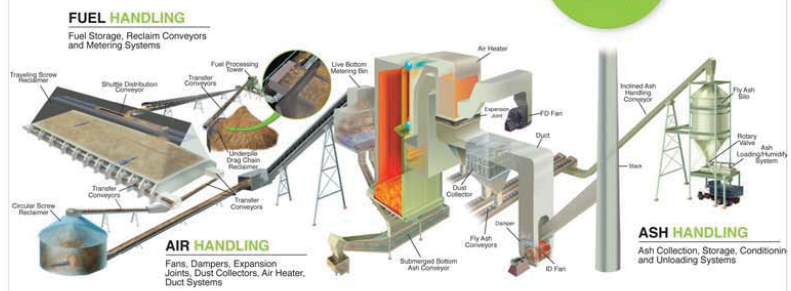
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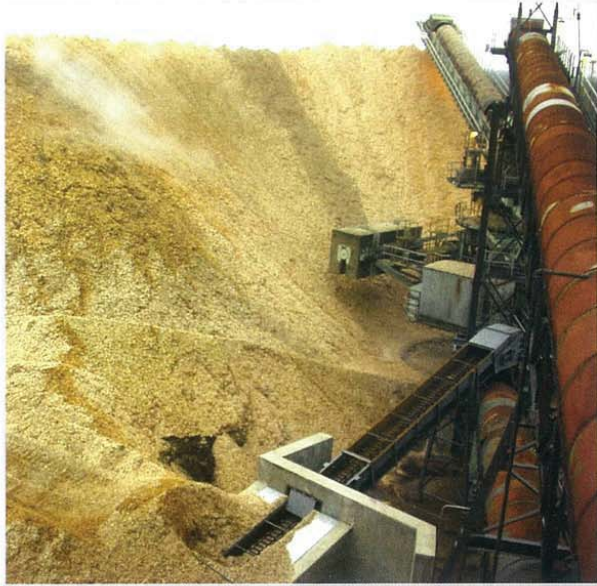
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A drag chain reclaimer (lower right) and a stacker reclaimer (top right) work together to maintain a consistent feed supply to the boiler.

not be able to provide a consistent feed supply to the boiler, resulting in poor, inconsistent power production. It is important that some redundancy and/or back-up be designed into the system in this area. This can be accomplished by having more than one reclaimer, each with the capacity to maintain full load to the boiler. Some facilities will have a primary reclaim conveyor which requires at most minimal loading from outside machinery, such as a front end loader. As a back-up, a secondary reclaimer is used, which requires more input from a front end loader and operator.

Biomass reclaimers come in numerous variations. Underpile drag chain reclaimers, screw reclaimers and radial stacker reclaimers are among the most common for biomass feed

systems. Each of these types of reclaimers varies in its ability on the amount of fuel storage that can be automatically reclaimed. For example, an underpile reclaimer might have 1-2 hours of biomass fuel storage to the boiler, and a radial stacker reclaimer might store 3-4 days worth of fuel. There are huge price differences in the two and many other options in between. It will typically boil down to the degree of automation the customer wants, and/or the amount of initial capital investment that is available. Many conversion projects with a minimal capital investment opt for a system that requires more initial manual operation, such as a front end loader to manually control the fuel storage and reclaiming. In any case, there will be some type of reclaimer involved that will control fuel flow to the boiler.

To ensure that the reclaimer will hold up under the constant demand, special abrasion materials should be used to protect it from erosion. Items such as shafts, bearings and drive components also need to be engineered to handle the high forces and stress requirements for handling biomass material. Motion sensors and plugged chute monitors also contribute to keeping the feed system operating reliably even when a problem occurs.

For plants that are gearing up for partial conversions, developing a co-firing system that syncs the processing of multiple biomass and solid fuel sources is critical to achieving efficient power production while remaining within emissions standards. Direct co-firing is the most basic method of combining biomass and coal fuels. Depending on the power production goals and available capital, there are several direct co-firing options.

At the most basic direct co-firing level, biomass can be mixed with coal before it even enters the boiler feed conveyor system. By combining a fuel early on, a plant is able utilize standard conveying and metering equipment. Biomass/wood pellets are a popular method of co-firing biomass and coal. The wood pellets have been processed to a state where they

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*On all biomass equipment, items such shafts, bearings and drive components need to be designed to withstand the high forces and stress of handling biomass fuels.*

have similar heating values as the coal, and most importantly, the pellets can pass through the boiler coal handling, pulverizing and burner equipment in conjunction with the coal. This is an excellent way to introduce biomass firing to an existing power plant with minimal capital investment.

The one big negative to this is the cost of processing the biomass in its raw state into an almost bone dry wood pellet. This added cost to the biomass fuel can sometimes reduce or eliminate the return on investment.

For facilities that want to fire biomass in its raw state and minimize fuel cost while maximizing production levels, there are separate biomass and coal handling options that require more equipment investment, but can produce significantly greater results long term. These systems involve distinct conveyor and metering equipment that are dedicated to biomass fuels. There also are distinct combustion technologies that can be dedicated to biomass fuels for the best combustion efficiency.

There are many options that must be considered when converting to biomass from coal. Finding a company(s) that has experience in this arena is very important to the future success or failure of a fuel conversion project. Decisions about initial capital investment, equipment reliability and maintainability and long-term fuel cost are a few of the many things that will need to be evaluated before the ground can be broken. There is a lot of experience out there if you know where to look.

*Cliff Moss is the vice president and director of Materials Handling Division at Process Barron in Pelham, Ala. With more than 20 years in the biomass field, Process Barron specializes in the design, manufacture, installation and maintenance of air, fuel and ash handling equipment for biomass systems. You may contact him by e-mailing [bpteditorial@woodwardbizmedia.com](mailto:bpteditorial@woodwardbizmedia.com).*



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