Solutions for Storing and Feeding

BIOMASS
THE KAMENGO FEEDER AND KAMENGO DESIGNED BINS HAVE ESTABLISHED A PROVEN TRACK RECORD SINCE THE 1990s FOR RELIABLY HANDLING BIOMASS
Biomass waste is highly compactible and can easily gain the strength required to form a hang-up. The net result is a material that is unforgiving, where poor bin and feeder design will lead to chronic bridging and plugging.

WORKING WITH BIOMASS WASTE

Biomass waste is among the most difficult flowing materials. It is stringy and easily compactible. It will gain strength even at rest under its own weight - forming stable arches that lead to bridging and plugging.

The consistency of biomass waste is often quite variable. The material can include not only wood waste, straw, and bagasse but also construction debris, including stringy contaminants such as plastic. The net result is a material that is unforgiving, where poor bin and feeder design will lead to permanent, chronic bridging and plugging.

KAMENGO’S SCIENCE-BASED APPROACH

Starting in the early 1980s, Kamengo led an R&D effort to characterize the flow properties of fibrous materials, including biomass waste. Kamengo staff developed new testing equipment capable of characterizing the flow characteristics of stringy fibrous materials. The team then devised design protocols that use these flow characteristics to determine the bin, feeder and chute geometry required to promote reliable material flow. Designing using material flow characteristics has allowed Kamengo to design reliable hog fuel bins, feeders and chutes since the early 1990s.
DIFFICULT FLOWING MATERIALS SUCH AS BIOMASS REQUIRE A TRULY MASS FLOW FEEDER THAT NOT ONLY WITHDRAWS MATERIAL EVENLY FROM THE FULL BIN OUTLET, BUT ALSO DOES NOT COMPACT THE MATERIAL
WHY DO CONVENTIONAL FEEDERS PLUG?

WHAT IS HAPPENING INSIDE THE BIN?

Most feeders draw material primarily from the rear of the bin, with little material drawn from the front. This problem is particularly severe when handling low bulk density fibrous materials. With fibrous materials, the pulling action of the feeder is felt well above in the bin, resulting in severe compaction, and in extreme cases, distortion of the front bin wall.

PUTTING ENERGY TOWARDS THE WRONG PURPOSES

Most feeders withdraw material by developing a shear line at the hopper/feeder interface. This shearing action not only contributes to compaction of the stored material, but also results in excessive wear of mechanical parts.

To learn more about reliable bin and feeder design, visit our website at www.kamengo.com.

POOR FLOW PATTERN RESULTS IN HANG-UPS

The compacted and stagnant material at the front of the bin is a major cause of bridging and hang-ups. Also, with material drawn mainly from a small section at the rear of the bin, live storage is greatly reduced, and stable rat-holes are permitted to form, resulting in dangerous bin hang-ups.
How is the Kamengo Feeder different?

The Kamengo Feeder is different because it meters material evenly from the entire hopper outlet. With no stagnant pockets, the stored material is not afforded an opportunity to hang up.

Also, the Kamengo Feeder does not use brute force to extract material out of storage. Instead the Feeder relies on gravity and good bin geometry to reliably discharge the stored material. As such, the Feeder does not compact material, and thus allow it to gain strength and hang up. Also, because the Feeder does not put energy into shearing the material out of the bin, it requires far less power than a conventional feeder, saving energy and minimizing wear.

To learn more about the Kamengo Feeder visit our website at www.kamengo.com.

Key Features of the Kamengo Feeder

- Feed evenly from the entire opening of bin
- First-in, first-out flow pattern
- No material compaction
- Consistent metering of material
- No shearing of material
- Use gravity to discharge
- Low power
- Low wear
- Flexible design
**APPLICATIONS**

**BOILER FEED**

Kamengo’s first retrofit of a biomass boiler feed system was completed in 1993. Since then, over a dozen biomass boiler feed systems have been fitted with Kamengo Feeders. These systems continue to provide our clients reliable 24/7 operation.

There are two common Kamengo boiler feed arrangements. The first includes a Kamengo Feeder discharging biomass into a chute that leads directly to the boiler. The second includes a Kamengo Feeder discharging biomass into a screw conveyor, which brings the material to a smaller chute that leads to the boiler.

> The Kamengo Feeder’s steady discharge and reliable flow will allow you to optimize the steam output of your boiler. Also, the energy and time previously spent unplugging your biomass bins can be directed to other productive tasks.
HOG FUEL BOILER FEED PROJECTS

BIOMASS BOILER STORAGE AND FEED RETROFIT (2014)
Tacoma, Washington, USA

The Tacoma installation is a retrofit where five screw feeders were replaced with five new surge bins and Kamengo Feeders. The mill was experiencing severe plugging problems with its screw feeders and could only operate its fuel feed system with very low levels of fuel in its bins. The Kamengo Feeders eliminated the plugging problems and now allow the fuel feed system’s new bins to run at full capacity. The Kamengo Feeder’s uniform steady discharge of fuel has improved fuel distribution, and boiler output and efficiency.

BIOMASS BOILER STORAGE AND FEED RETROFIT (1994)
Kamloops, British Columbia, Canada

The Kamloops installation includes the retrofit of the biomass feed system on two boilers. The first boiler was retrofitted with Kamengo Feeders in 1994 and the second was retrofitted in 1996. In both cases, the Kamengo Feeders replaced star feeders that would cause plugs in the bin and chutes below. Along with eliminating hang-ups, the Kamengo Feeders provide a more uniform steady discharge of biomass as compared to the pulsating action of the previous star feeders. The steady discharge of fuel improved fuel distribution and boiler efficiency.

BIOMASS BOILER STORAGE AND FEED (2007)
Benson, Minnesota, USA

The Benson, Minnesota installation is a feed system for a new boiler. The plant operation is particularly challenging because its primary fuel is wood waste mixed with straw and poultry litter. The result is a fuel that is not only fibrous and compactible, but also sticky and corrosive. This fuel mixture has proven problematic for screw feeders, but is handled with ease by the Kamengo Feeder. There are eight inlets into the boiler, with a Kamengo supplied bin, Kamengo Feeder, screw conveyor and chute for each inlet.
Kamengo has retrofitted several tall biomass day bins into mass flow bins fed by a Kamengo Feeder. Prior to these retrofits, the bins could only accept a few feet of fuel or would otherwise plug. With the Kamengo Feeder, these bins can be used to their full capacity. To retrofit the bins, Kamengo either replaced the bottom half of the bin with a mass flow hopper (as shown above), or installed insert plates inside the existing bin to introduce converging walls.

A mass flow hopper combined with a Kamengo Feeder will allow you to use the full capacity of your day bin without the fear of hang-ups. Also, with substantial reliable storage close to the boiler, your boiler operation will be less susceptible to interruptions caused by your reclaim system.
**HOG FUEL DAY BIN RETROFIT PROJECTS**

Port Townsend, Washington, USA

This Western Washington installation is a retrofit of a tall 4,000 cu-ft bin located in the boiler house. The circular bin was fitted with a vibrating cone and was prone to severe plugging such that only a fraction of the bin’s storage could be used. Kamengo retrofitted the bin with insert plates to convert it into a mass flow (first-in first-out) bin fed by a Kamengo Feeder. The bin is now used to its full capacity and provides reliable feed to the boiler.

**BIOMASS DAY BIN STORAGE AND FEED RETROFIT (2004)**
Bogalusa, Louisiana, USA

The Bogalusa, Louisiana installation is a retrofit of a circular biomass day bin that used a vibrating cone discharger. The 37-foot high bin is located just outside the boiler building and is intended to hold up to four hours of storage. The biomass at the Bogalusa mill is particularly challenging because it contains hickory bark and can be very stringy. Kamengo replaced the lower half of the bin with a rectangular mass flow hopper and Kamengo Feeder. The bin is now used to its full capacity and provides reliable feed to the boiler.
**APPLICATIONS**

**PILE RECLAIM**

A unique ability of the Kamengo Feeder is that the hopper/feeder can be made quite long and still reclaim fuel uniformly – drawing material evenly from the pile.

For biomass reclaim, Kamengo employs a converging mass flow hopper with an extra-wide outlet above the Feeder. Above the hopper, the material will funnel flow, forming its own hopper within the pile. The long outlet of the hopper is designed to exceed the critical piping dimension of biomass, ensuring the stored material will not rat-hole over the feeder. Also, the hopper outlet is designed to generously exceed the minimum outlet dimension for hog fuel, ensuring the stored material will not bridge over the feeder. The sloping walls of the hopper are fitted with a low-friction liner to ensure mass flow (a first-in, first-out flow pattern) within the hopper. The parameters that Kamengo uses to design a biomass reclaim system are based on extensive testing and field experience.

A Kamengo Feeder pile reclaim system consumes a fraction of the energy required by competing conventional alternatives, while providing a reliable steady discharge that ensures your boiler is running on biomass.
HOG FUEL PILE RECLAIM PROJECTS

BIOMASS PILE RECLAIM AND FEED RETROFIT (2003)
Kamloops, British Columbia, Canada

The retrofit of the below ground reclaim system at the Kamloops mill replaced an existing chain reclaimer with a Kamengo Feeder. The retrofit involved installing a new mass flow hopper and Kamengo Feeder within the existing concrete bunker. The mill's previous chain reclaimer had to be spoon fed as the hopper would plug or the chain would get overloaded. With the Kamengo Feeder, the mill is able to maintain a 40-foot tall pile containing over 15,000 cu-ft of hog fuel over the reclaim system.

BIOMASS PILE RECLAIM (2005)
Northern British Columbia, Canada

This installation includes two 36-foot long Kamengo Feeders that were installed as part of a new co-generation project. The Kamengo reclaimers provide up to 8 hours of live storage of biomass fuel. A unique aspect of this mill's fuel feed system is the absence of metering bins/feeders at the boiler. In place of the metering bins, the mill uses the two Kamengo reclaimers to control the fuel feed to the boiler.
STAND-BY RECLAIM

When a plant’s fuel reclaim system goes down, the profitability of the plant goes with it. And because a reclaim system is often composed of an array of mechanical components, it is not unusual for it to take days to get the system up and running after an outage. A stand-by reclaim system can be used to keep the boiler burning biomass rather than gas when the main reclaim system goes down.

Kamengo offers a simple and economical stand-by reclaim system that includes a front-end loaded hopper and Kamengo Feeder. The stand-by reclaim system can sit in-line with or convey material onto the main biomass conveyor leading to the boiler. Kamengo has delivered several front-end loaded hoppers and feeders handling difficult flowing materials.

▱ A Kamengo stand-by reclaim system ensures that your plant will maintain the capability of delivering a steady, reliable stream of biomass to the boiler when the reclaim system goes down.
Kamengo has delivered several tall bins for handling fibrous material, including a 50-foot tall 17,000 cu-ft bin handling biomass in Northern British Columbia.

Storing fibrous biomass in a tall mass flow bin is made possible by the Kamengo Feeder, which does not compact the stored material as well as withdraws the stored material evenly from the full bin outlet. A single tall bin is an economical storage and feed option for loading trucks as its volume can replace up to three conventional clam shell bins.

The Kamengo Feeder and tall bin can deliver consistent metering of material as compared to a clam shell bin which suffers from material hang-ups and poorly controlled material discharge. Also, a Kamengo Feeder and tall bin have proven that they can load more material in a given truck trailer than a conventional alternative, reducing transportation costs.
WHAT MAKES KAMENGO DIFFERENT IS THE TOOL KIT WE HAVE AT OUR DISPOSAL TO SOLVE COMPLEX MATERIALS HANDLING CHALLENGES
KAMENGO SPECIALIZES IN THE STORAGE AND FEED OF DIFFICULT FLOWING BULK MATERIALS

What makes Kamengo different is the tool kit we use to solve complex materials handling challenges:

Equipment To Characterize The Flow Properties Of Fibrous And Cohesive Materials

In the 1980’s Kamengo developed new testing equipment capable of characterizing the flow properties of stringy, fibrous and cohesive materials.

Design Protocols To Determine Correct Bin, Feeder And Chute Geometry

Kamengo has developed design protocols that use a material’s flow properties to determine the bin, feeder and chute geometry required to promote reliable material flow. Correct equipment geometry will deny a stored material the conditions it needs to gain in strength and hang-up.

The Kamengo Feeder: A Design Advantage

The flow properties of difficult flowing materials often demand a fully live bin. A fully live bin is very difficult to achieve with a conventional feeder, but is easily achieved with a Kamengo Feeder.

Skilled Design Practice

Over the past 25 years, Kamengo has developed a design practice capable of tackling complex projects, including retrofits of storage and feed arrangements that suffer from plugging. Kamengo has the engineering capability to deliver complete packages of materials handling equipment including storage bins, feeders, chutes, structural work, and conveyors. We have delivered solutions for biomass, ore concentrates, fly and wet bottom ash, wood chips, pellets, and FGD gypsum.

The Kamengo Feeder: Proven Solution For Handling Difficult Flowing Bulk Materials

The Kamengo Feeder resolves many of the shortcomings of conventional feeders. The Feeder withdraws material evenly from the full discharge opening of the hopper and does not compact stored material, resulting in a fully live bin. With installations running 24/7 for more than 20 years, the Kamengo Feeder has proven that it is a reliable solution for handling difficult flowing materials.

We invite you to explore how Kamengo can apply its specialized tool kit to solve your materials handling challenges.