

Case Study

Wave of the Future: Dried Palm Fronds a Prickly Bioenergy Source Dust collection system is a vital part of the processing stream



Problem: A bioenergy facility converting biomass feedstock into biofuel and electrical power needed a dust collection system to capture the resulting particulates from the palm frond drying process, which had a low bulk density and potential combustibility.

Solution: Sly LLC installed a dust collection system and baghouse with special modifications designed to manage the lightweight, potentially combustible particulates resulting from drying the biomass feedstock, in this case, palm fronds. The baghouse incorporated a higher rear inlet for particulate collection and explosion-proof venting. In addition, the baghouse was constructed to withstand 140 MPH winds for a facility located in a region subject to severe weather.

The global bioenergy market, fueled by sustainability goals to reduce dependence on fossil fuels, is forecasted to grow by more than \$80 billion by 2027, or a CAGR (Compound Annual Growth Rate) above 7%. Bioenergy facilities typically rely on more than one type of biomass feedstock to ensure a consistent supply of material, consisting of plants, wood or waste. One bioenergy plant utilizing palm fronds as biomass feedstock for electricity production needed a dust collection system to capture particulates resulting from the drying process used to transform palm fronds into a suitable fuel.

Carrier Vibrating, the parent company of Sly, LLC, supplied a fluidized bed dryer to bring the palm fronds to a suitable moisture level. Sly baghouses for dust collection are designed to work well with Carrier systems. This corporate synergy enabled the bioenergy facility to leverage the expertise of both firms for a complete solution to create renewable energy.

Among the different energy or biomass material streams for this bioenergy plant is one dedicated solely to waste biomass (yard and wood waste). As power plants continue to explore various potential feedstock sources for biomass fuel purposes, it helps to work with a company with a proven track record. Sly has been in the dust collection business since 1874 and can tailor and modify its equipment to capture particulates safely and effectively, no matter what the substrate.

Palm Fronds Pose a Prickly Problem as Green Waste

Palm trees shed their greenery or leaves, which turn into withered fronds after falling on the ground. These fronds are considered yard waste. Many green waste facilities reject them. Among the challenges palm fronds present for green waste management are size, thorns, and messy seeds. The biggest challenge, however, is the fibrous nature of palm fronds, with their wiry strands capable of wrapping around machinery to the point of breaking it and causing shutdowns.

In addition, the palm fronds' fibrous nature also slows decomposition, taking up to 50 years to fully biodegrade. Due to this lengthy biodegradation timeframe, the fronds often end up in landfills, with municipalities either banning them outright from green waste facilities or charging extra for their disposal.

What use remains for palm fronds? It is now being used as biomass for energy generation to produce electricity or fuel. Studies have shown that biochar from oil palm fronds, for example, compared to low-grade sub-bituminous coal (LGSBC), has a higher heating value (28.05 MJ/kg) than that of LGSBC, as well as a higher fuel ratio and atomic ratio.

Cellulosic ethanol can be produced from this waste in a biorefinery through gasification, fermentation, and distillation. Ethanol can be used in E-85 fuels. A biorefinery or bioenergy plant diverts thousands of tons of waste away from landfills. In addition to the cellulosic ethanol produced, the electricity generated in a biorefinery can power itself and sell additional power to the electric grid.

The Sly LLC solution for biorefineries

Sly LLC can provide reliable dust collection equipment, whether wet or dry, nuisance or process dust, which captures the airborne particles resulting from biomass drying and processing for use as alternative energy sources.

The palm frond processing stream consisted of a Carrier Vibrating Fluid Bed Dryer and Sly Dust Collector.

- *Design air flow rate: 60,765 acfm*
- *Design temperature: 188F (and +/-20" WG, design pressure)*
- *Filter media square footage: 10,748*
- *Air-to-cloth ratio: 5.65:1*
- *Explosion relief vents: Five 36-inch square*
- *Baghouse Discharge: 70o trough hopper with 12-inch screw conveyor*

A specially designed inlet was needed to accommodate the lightweight nature of the palm frond dust once dried. The low bulk density of the materials called for a high rear inlet rather than a traditional hopper inlet. This design modification would be considered for other lightweight biomass feedstocks, such as paper or cardboard from commercial waste, helping eliminate interstitial velocity concerns.

Baghouse construction included a walk-in plenum for easy access to the bags—714 of them, in 16-ounce SIPE x 10-foot long, grounded bags. The walk-in plenum lets the operator open a single door to pull the bags inside and away from the elements.

As a final change, the baghouse is rated for winds of up to 140 MPH, as the facility processing the palm fronds is in a region prone to hurricanes. The baghouse has larger beams, cross-braced so that the beams will flex but not separate or bend in fierce winds.

Not a design modification but a necessity, facilities processing biomass feedstock for fuel require explosion relief venting, with the number of vents in proportion to the size of the baghouse and the nature of the material.

Sly manufactures a full line of industrial nuisance and process collectors for collectors and bag houses, cartridge collectors, wet scrubbers for particulate collection, retractable dustless bulk loading spouts and aftermarket parts for their own and competitors' dust collectors. Through synergy with sister companies such as Carrier Vibrating Equipment, Heyl Patterson and S. Howes, Sly can offer companies a comprehensive line of equipment supporting biomass drying and processing applications. For complete system design and delivery from a single source, contact Sly today.