What are some tips for reducing my dust collection system’s energy consumption?

(Continued from last month.)

The two largest energy users in most dust collector systems are compressed air followed by the exhaust fan. Maximizing the efficiency in these two areas will save on energy consumption and overall maintenance. Here are some specific areas to investigate:

- **Reevaluate hood designs and pickup points,** focusing on the ability of the control point to contain dust at the source and not pull excess dust to the collector. This ensures that material stays in the process flow and the collector doesn’t clean the filter media more than necessary.

- **Maintain proper velocities in the ductwork** to convey the dust to the collector and not have it drop out in the ductwork. If the duct velocities are too low, then the dust will build up in the duct, increasing pressure drop through the system and wasting horsepower.

- **Control the filter media cleaning system** by optimizing the frequency, duration, and pulsing pressure. These should be examined after initial installation and fine-tuned after the collector has built up a sufficient dust cake. Also consider using an on-demand cleaning system so filters are cleaned only when a certain pressure drop occurs. This can be set up by adding a differential pressure switch to the system, allowing the cleaning frequency to be set at predetermined high and low setpoints.

- **Perform proper maintenance** on your dust collector on a continual basis, checking for failed pulse valves and solenoid valves or tubing or fitting leaks on the cleaning system.

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A properly planned and designed safe dust collection system for your process can minimize downtime and lower operation costs to enhance your bottom line. To run as economically as possible, you’ll want to address factors that heavily affect the total cost of operation.

The first factor to consider is compressed-air usage for the cleaning mechanism and pressure drop across the baghouse. Traditional pulse-jet baghouses are the most commonly used cleaning technology. They typically use high-pressure compressed air, have multiple diaphragm pulse valves, and are cleaned based on a set duration between pulses. A more efficient option is pulse-jet cleaning medium-pressure air instead of the traditional high pressure.

The second factor to consider is the amount of horsepower required to generate the cleaning air volume necessary to clean the filter bags. A traditional high-pressure pulse-jet baghouse will require a 15-horsepower air compressor with a dryer and filter to prevent an accumulation of condensate inside the filter’s air header. The same sized medium-pressure pulse-jet filter will require a 5-horsepower positive-displacement blower and no dryer. The air on the medium-pressure unit isn’t compressed and heated enough to cause condensation. In addition, adding on-demand cleaning can further enhance the savings of using medium-pressure technology. Another advantage of medium-pressure units is the incentives available from state governments and power companies to use the most energy-efficient equipment available. Always check to see if programs like this are available in your area—the reward may be more than you expect.

A third factor to consider is optimizing the pressure drop required to move air through the baghouse. Different inlet designs, such as tangential, involute, radial, and high entry, will require different energy levels to move the process air through them. The differences may only be slight, but it’s enough to have a significant impact on your fan’s amperage draw. Remember this pressure drop applies to every hour of every day that the fan is running. Make sure your dust collector supplier is giving you the most efficient inlet for your application and not just the cheapest option.

Finally, filter media is a significant air restriction in the baghouse. Each media has a specific purpose for a specific application and a specific dust. The various media also have different flowrate characteristics and air-cleaning efficiencies. The most effective way to determine the correct media is through testing. Acquiring a particle size analysis or even running the dust through a small-scale simulation is the best way to determine the proper media. Request that the baghouse be sized so that the air-to-media ratio is not too high as to cause high differential pressure. Bag life does vary by application, but, as a rule of thumb, if a baghouse is sized correctly, the bags should last a minimum of 1 to 2 years.

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Make sure you maintain the designed inside dimensions of the components through wear protection on key items subject to wear. Otherwise, holes patched from the outside dimension often produce pockets that increase pressure loss. Also, don’t mix steel pipe schedule sizes.

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One way to lower energy consumption is to replace the electrical controls with a variable-frequency drive. If you’re already using a variable-frequency drive, try installing an on-demand management system that will increase or decrease the motor speed based on dust collection system demand. Another method is to replace the constant filter-cleaning control system with a photohelic management system, which only cleans the filters when they’re dirty.

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