Tools for the job

FEATURES - OPERATIONS FOCUS

Operators setting up RDF (refuse-derived fuel) systems face many considerations when designing a system for maximum effectiveness.

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In most applications, RDF (refuse-derived fuel) systems require substantial investment and commitment. While there are small-tonnage operators, it is more typical to design systems with an incoming stream of 15-50 tons per hour.

Systems this size can be a better match to handle large volumes of waste being generated and they can produce enough fuel to make the production process worthwhile.

In speaking to sources for this feature, some indicated that the term “RDF” is, in some regions and markets, beginning to lose favor to emerging terms like PEF (pre-engineered fuel) or the term manufactured fuel.

Knowing what to expect

“It is extremely important to have an expected waste stream so you can define your equipment needs,” says Randy Baerg of Warren & Baerg Manufacturing Inc., Dinuba, Calif. “It is critical to then define what is in the expected waste stream so all of the correct equipment choices are made for a successful operation.”

“The better the waste stream is defined the easier it is to set up a system,” agrees Hartmut Bendfeldt, eFactor3 LLC, Charlotte, N.C. “Waste has seasonal changes and regional variations. It is important to get a good breakdown of the composition in order to size the equipment correctly. The seasonal changes don't really influence the design of the system,” he adds.

“MSW lines are complex as they have to sort a lot of different materials,” says Andreas Schwarz,

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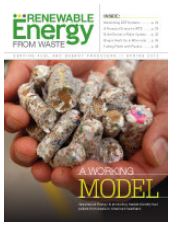

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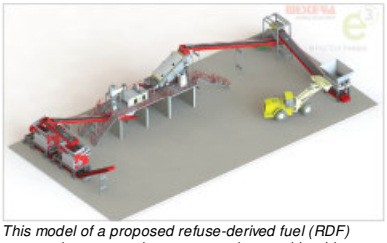
president of Lindner America LLC, Raleigh, N.C. The line described by Schwarz may consist of a grapple operator to sort out obvious stuff like bicycles, concrete blocks, etc. A primary shredder reduces material to foot-long pieces and opens bags. Next, a magnet removes ferrous materials and a screen removes sub-two inch materials (organics, glass, small stones, etc.).

Bendfeldt says a line designed for processing MSW can always process industrial waste streams. “Since industrial waste streams are better defined, the system can be simplified but it will not be possible to [convert an industrial line to process} MSW without modification of the line set up,” he points out. “If the spectrum of waste is known in the planning stages, the line can be designed to handle all streams that come to the facility,” he adds.

Brian Schellati, director of business development for Lubo USA, Stamford, Conn., says ferrous and nonferrous metals are the main contaminants in RDF that have value, but there are other combustible materials in MSW RDF that have value. The level of these valuable materials in residential or commercial MSW varies from location to location depending on how strong a recycling program is in a specific area. “Typical materials targeted at some plants are OCC, mixed or even high grade paper, PET and HDPE,” he says.



This model of a proposed refuse-derived fuel (RDF) preparation system demonstrates the considerable number of steps that can be involved. (Illustration courtesy of eFactor3.)

Wind sifting equipment will separate light, mid and heavy fractions with “lights” going to a secondary shredder, “mids” to an optical sorter to remove PVC, and the “heavies” sent to the landfill. An eddy current will take out nonferrous items. At the end is a secondary shredder to reduce the RDF material to a small size.

The type of sort line depends on whether the mix consists of MSW, C&D, industrial waste, pre- or post-consumer waste etc. Baerg says sort lines should have hand sort, separation for paper, cardboard, plastics, film plastics, food waste, green waste, metals (ferrous and nonferrous), glass, and grit. All of those items have value for recycling.

Schwarz says primary shredding is almost always required to open bags and reduce large pieces so they can pass through the sorting equipment. “Smaller pieces take less time in the final shredder, hence, output is increased,” he notes.

Primary size reduction removes inert materials before they hit the final shredder. Now that the stream is sorted, it is time to get a fuel-worthy product.

“From our experience we would always recommend a two-step shredding process,” Bendfeldt says. “Waste always contains negative surprises (like brake pads, engine components, etc.) that will damage any one-step shredding equipment. With the typical fuel specification of under one-inch or under two-inches it would not be possible to do any type of separation after the shredding process,” he says.

Baerg says multiple shredding stations are not always required and may not always be desirable. “Always go for the least amount of equipment and less capital investment for quicker return on your money,” he says.

“I think a big decision project developers face is whether they need to pelletize or not,” says Schellati.

As this market develops, Schellati says he expects plants to be more localized and closer to their end users, minimizing RDF transportation. “This can be seen in the European market,” he says.

A Little Knowledge

“You can’t know what you’ll get out of the waste stream if you don’t understand what is in it,” says Brian Wells, inside sales manager for Bulk Handling Systems (BHS), Eugene, Ore.

Making it pay

Break-even tonnage for RDF operations varies. “The answer depends on the financials of the back-end conversion technology,” Brian Wells, inside sales manager for Bulk Handling Systems (BHS), Eugene, Ore. Some newer technologies, such as plastics-to-oil, can be profitable on relatively low volumes of input…about 40 tons per day of plastics. Others will require massive volumes of fuel being fed around the clock in order to pencil out.

Typically there is a certain requirement for the amount of RDF produced (tons per hour or ton per day, for example) to meet a certain end user demand or contract.

“Depending on the estimated material input characterization it can be determined how much material the system would need to process in tons per hour,” Schellati says. So, if a plant needed to produce 15 tons per hour of RDF and it was estimated that the material input should yield about 50% combustible material, then the system would have to be designed for 30 or more tons per hour throughput.

“The more throughput the better the economics play out,” Schellati says, “but a sweet spot seems to be in the 25-50 tons per hour range.”

“Most projects we look at are in excess of 100,000 tons per year of inbound MSW,” says Wells.

Baerg says that if clean industrial paper and some clean film plastics come from single or several sources, break-even could be as little as 5,000 to 10,000 tons per year. “This would also cover industries producing a regular trim/production waste flow at one-half to two tons per hour while operating, with a high cost of disposal,” Baerg says.

The dirtier the product and the more equipment required to clean up and grind the material the more tonnage is required to make the facility profitable.

“MSW streams might contain 30 to 50 percent RDF,” Schwarz says. He figures that a 50 ton per hour stream, might produce up to 25 percent RDF. Depending on the final size, this requires one or two final shredders.

“As there are many variables, we estimate capacity figures based on experience. No formulas are available to solve this problem,” he says.

The BTU value of the RDF product must be high enough to compete on some level with existing available fuels. “If the ash content is too high, users will not want to use the RDF in their system,” Baerg says.”No matter what the BTU value or ash content look like, if the user can’t get permitted to burn RDF due to high emissions there is no market for it,” Baerg warns.

Any accounting, Bendfeldt says, depends on variables like input material, cost of electricity, labor costs, etc. In general, To some extent, the most basic mass burn processes can handle just about anything.

“Once you move into technologies that require a more engineered and defined fuel product, you must understand the raw material you’re dealing with,” Wells comments. The high volume and BTU requirements of some of the available technologies demand a defined fuel product.

“If the materials that are required to produce that fuel are not present in adequate volumes in your waste stream, the project will fail,” Wells warns.

Additionally, he says today’s MRF technology is highly automated and each piece of equipment must be sized properly to ensure efficiency at every step. “Defining the waste stream is an important step in allowing that to be successful.”

Wells points out that conversion technologies will have specifications for what material size and range of size they need in order to operate properly. Shredding will be applied in order to deliver appropriately sized fuel stock. Multiple shredding steps are required when small particle sizes are required at high throughput rates. The first shredder may make a rough size reduction, and the finish shredder will perform the final cut.

RDF, and more specifically engineered fuel, will have specific requirements that must be met in order for the conversion process to work properly. Items that may need to be sampled include moisture content, chloride content and BTU content. Each of these can

Bendfeldt says, the processing cost per ton (fixed and variable) ranges from $10-25 per ton.

“Once a line is designed we have formulas to calculate these costs for the specific line,” he adds.

Simple lines can be designed for 120-150 tons per day. More complex systems can process 250-300 tons. “If volumes go way beyond these numbers it would be wise to build multiple lines for redundancy purposes,” he says, noting that no matter what the equipment is, the waste stream will put heavy wear on to the equipment. This makes routine maintenance very important.

Basically, you will need to have a flexible enough operation to produce RDF with various compositions and finished states.

have a big impact on the process.

“An RDF/PEF facility will take samples on a continuous basis to ensure that the incoming waste qualities and the produced fuel meet the specification of the end user,” remarks Hartmut Bendfeldt, eFactor3 LLC, Charlotte, N.C.

Designing a MRF that will produce an RDF product from a stream of municipal solid waste is not simple. “The expertise required comes from experience, detailed knowledge of waste streams, and deep understanding of the equipment that is utilized in the process. It’s not really something that can be distilled down to a simple formula,” Wells says, and most other manufacturers would agree with that.The best result is going to come from engaging a company that is both an equipment manufacturer and system designer/integrator.

“Each project is different, and each one will require a customized design that is tailored to the end goals of the client,” Wells says. “If somebody tells you there is a one-size-fits-all approach, this means they are trying to sell you a product and not a solution,” he cautions.

Better Prospects

Vendors are constantly developing better and more productive shredders. Looking ahead, Schwarz sees customers demanding fractions as small as one-quarter inch—at the same or higher output. This is not an issue in the U.S. at this point, he adds.

Schellati says it is always wise to minimize risk by setting up multiple material outlets. Many cement kilns or power plants can take much more than a single RDF plant can produce.

“Some developing RDF projects are trying to setup multiple markets and doing so by batch running and blending to meet different fuel specifications,” Schellati finds. Material monitoring or analyzing equipment is required to accomplish this.

“It’s important to have long-term contracts with waste suppliers and fuel users to create investment security,” Bendfeldt says. He advises recyclers to keep the KISS rule (keep it simple, stupid) in mind: “Sophisticated technology and waste don't go hand in hand. Focus on the main stream of material. It is better to send rejects to the landfill than to get the last piece of plastic from the stream.”

Wells adds a final word of advice: “If you are going into this venture, do so with your head up and your eyes open. Make sure you choose your partners wisely and work with those in the industry who have proven solutions. The cheapest option is most likely not the most profitable.”

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Fueling the System

Factors to consider when preparing material RDF systems are reviewed in the online sidebar “Fueling the System” at www.REWmag.com/0412-rew-fueling-the-system.aspx.

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