Alternative Fuels
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Challenges of NA Cement and Lime Producers to Increase Usage of AF

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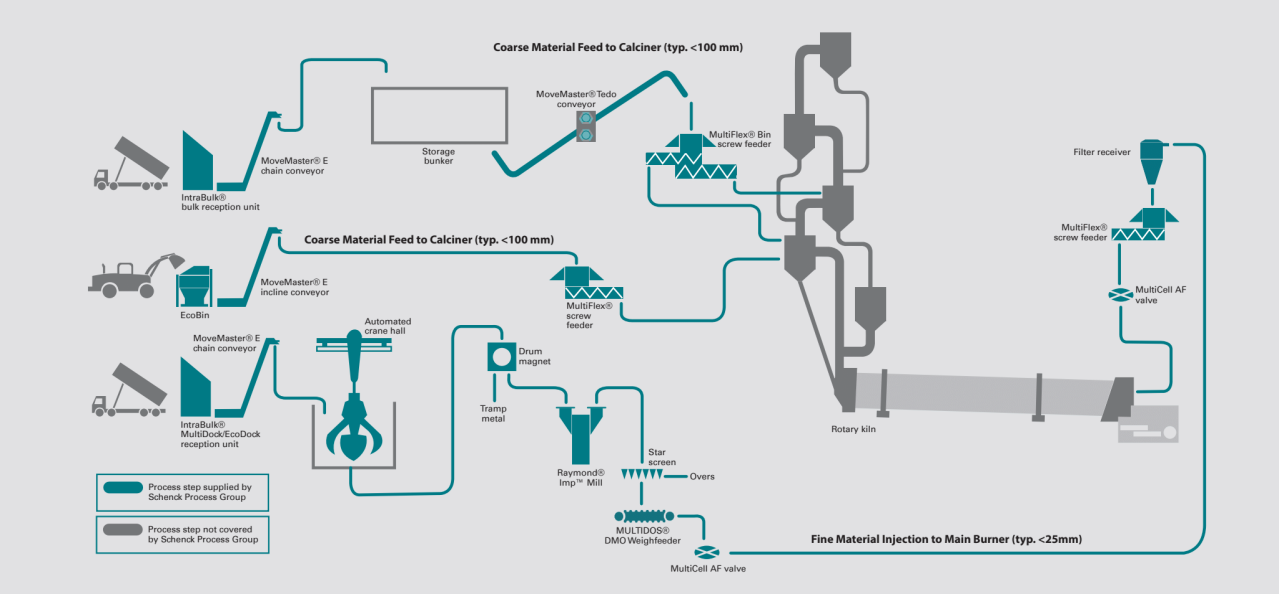
Equipment Considerations

1. Unstable fuel sources require flexible equipment and systems at the plant site
    1. Plants that have been metering a consistent material may need to accept more types
2. Reception, storage, conveying, metering and injection systems that can handle different classes of materials
    1. The power to meter TDF and shingles, but the volume to meter shredded plastic rejects
    2. Particle size
3. Cost to operate
    1. Labor
        1. Reception or trailer jockeying
        2. The cost of a shared front-end loader with other tasks in the plant may suffice for 2-3 tons/hr., but may not be cost affective for maintaining 10-15 tph.
    2. Maintenance cost
        1. Maintenance costs are not linear with increase in tonnage increases, but equipment choices will greatly affect maintenance costs
        2. Are machines operating near their max. capacity or under-utilized? Some machines require maintenance based on tons/fuel and some based on hrs. of operation.
        3. Uptime and reliability of equipment varies
4. Increased Volume
    1. Delivery traffic & logistics
        1. Just in time or leaving trailers at the plant
    2. Storage constraints
        1. Trailers vs. Buffer Bin vs. Large Storage Solutions

Challenges of US Cement and Lime Producers to Increase Usage of AF

Interphase with existing facilities

1. Lowest cost location to inject material
    1. Main burner or lance
        1. If you have a multi-channel burner already a simple pneumatic injection system located near the kiln may be to the simplest fastest ROI system
    2. Calciner
2. Real estate available
    1. Some plant sites are very limited in space available
3. Evaluate current systems for week link or choke point
    1. Often re-working or replacing one machine can increase the capacity of a system
4. Regional challenges
    1. Will the material you are evaluating unload from trucks when its -40C and convey through a system
    2. Can you stockpile material outside?



Common Mistakes Producers Make

General Mistakes

1. Using light duty equipment just because the density is lower than other materials in the plant
    1. To make AF a reliable fuel source for your plant you need heavy duty cement plant and mining grade equipment.
2. Repurposing equipment designed for other tasks in the cement plant
    1. “We took that old screw hopper, pulled it around front and dumped some TDF into it…..why can’t we get a consistent fuel feed out of it?”
3. Not investing in precision metering or weighing devise for your fuel control
4. Redundancy
    1. Having alternative reception systems to bypass sophisticated storage solutions
    2. Two rotary valves for a pneumatic injection system

Common Mistakes Producers Make

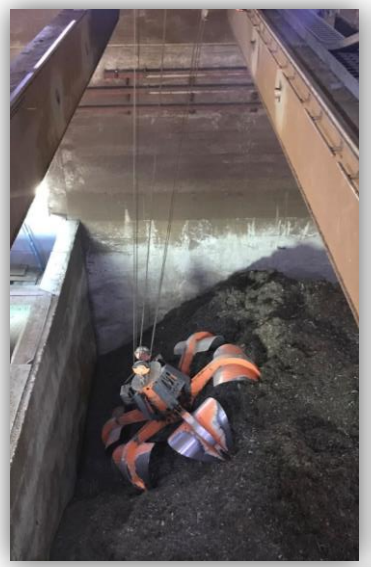
Reception:

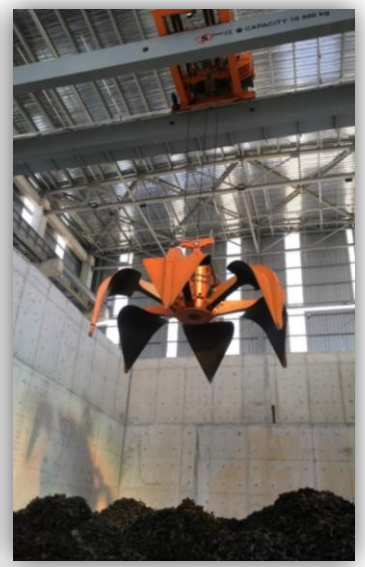
1. Using front end loaders
    1. High spillage
    2. Prone to damaging reception equipment
    3. Introduce contaminates to fuel stream
    4. A system can be created to efficiently use front end loaders
        1. Dedicated loader and dedicated operator
        2. Stays in the building or on the concrete storage pad
        3. Large reception hoppers
        4. More efficient at certain rates
2. Using low-cost, simple reception stations may result in:
    1. High spillage when a truck is replaced resulting in house keeping labor
    2. Dust emissions while unloading could create a hazardous area
3. Upgrading to a low spillage and low dust emission reception station may be higher capex, but may save you This may work when only receiving 1-2 trucks a day, but when you move multiple trucks per shift these may not be practical

Common Mistakes Producers Make

Storage

1. Stock piling material on the ground or in a building
    1. High dust emissions in building while unloading and moving material around
    2. Introducing contaminates into the system
    3. Moisture and weather affects on fuel
2. Using a storage system only capable of handling one type or class of materials
    1. "We bought this silo and used it for 5 years for sawdust, but now want to store RDF…"
    2. Not factoring compaction of fuel in storage
    3. 1st in 1st out or 1st in Last out
    4. Fire detection or monitoring, as well as explosion prevention or protection

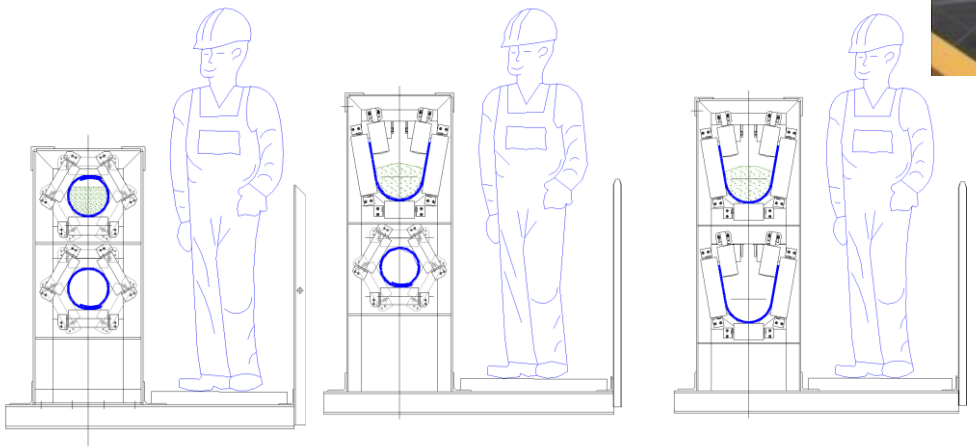




Common Mistakes Producers Make

Conveying

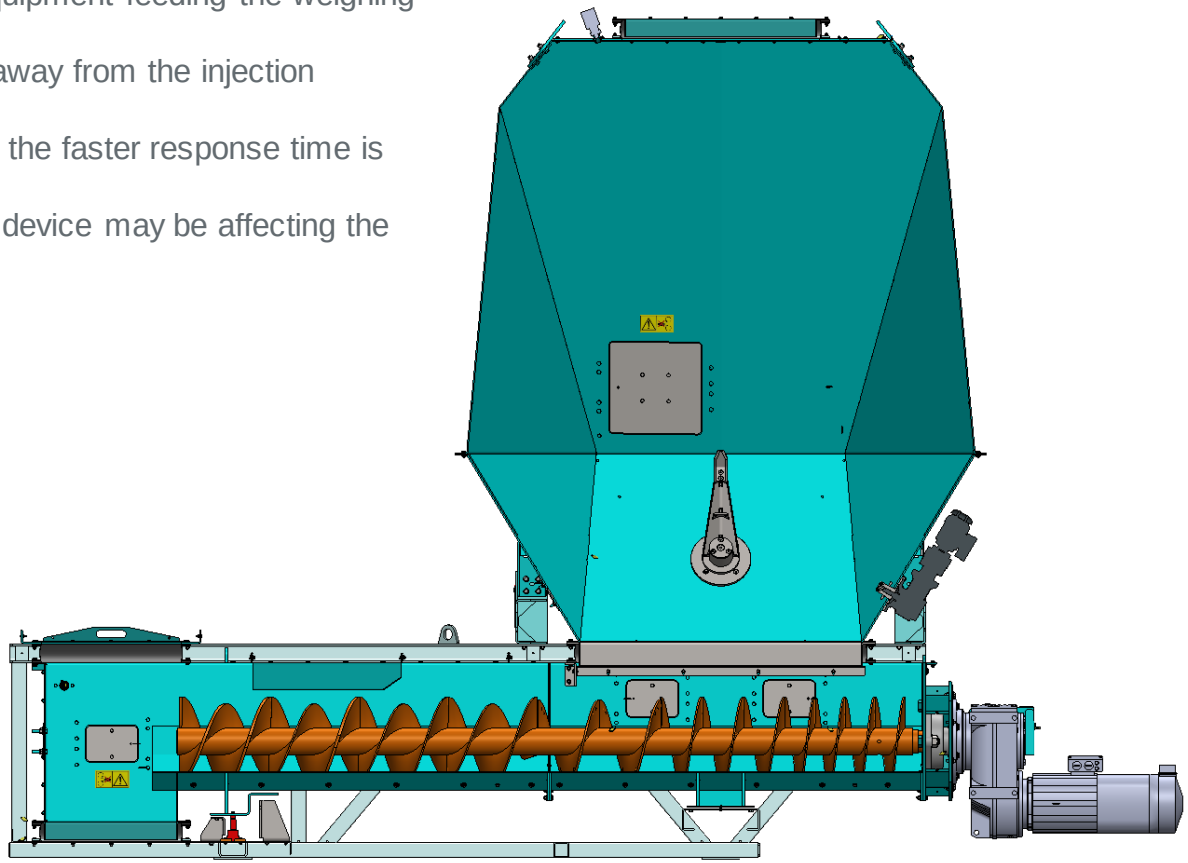
1. Using conveyors that don't contain dust or don't have features to keep the plant clean
2. Often wind can blow AF off of a conventional idler conveyor even with corrugated galvanized covers
3. Too many transfer points
4. Pay attention to dribble back on the return circuit. Many AF materials are hard to clean from the belt
5. Use pneumatic if practical



Common Mistakes Producers Make

Metering

1. Sacrificing accuracy or consistency by feeder choice or location in the system
    1. It is often the control of the equipment feeding the weighing device that is overlooked
2. Often the metering device is too far away from the injection location.
    1. As substitution rates increase the faster response time is needed for all fuels.
    2. Equipment after the metering device may be affecting the performance of the system



Common Mistakes Producers Make

Injection

1. No using magnets or screens before pneumatic systems
    1. Small investments will pay for themselves in preventing down time or costly maintenance/repairs
2. Overlooking pneumatic when it may be very practical
3. Using pneumatic too long or with the wrong materials when a mechanical system may make sense
4. Maintaining pneumatic conveying best practice principles
    1. No inclines
    2. Long sweep elbows
    3. Mindful of particle size
    4. AR elbows

	Pipe	Horizontal Distance	Vertical Distance	Elbows	Max. TPH	SCFM	3D Max. Particle Size	2D Max. Particle Size
MainBurner/Lance	4	75	25	3	6.75	761	0.80	1.33
MainBurner/Lance	5	75	25	3	8.5	949	1.00	1.67
Calciner	6	75	75	4	11.5	1250	1.20	2.00
Calciner	8	75	75	4	17.5	2073	1.60	2.67
Calciner	10	75	75	4	26	3022	2.00	3.33
Limits:								
4:1 or 5 PSIG at valve								
4500 ft/min pick up velocity								

Common Problems with Various Fuel Sources in NA

1. Contaminants
    1. Screening
    2. Ferrous metal removal
    3. Non-Ferrous metal removal
    4. Frozen material
    5. Contaminants coming into stream from trailers or front-end loaders
2. Raw fuels
    1. Many plants having to source direct from supplier and prepare themselves
    2. NA Vs. Europe
        1. Some technologies working in Europe may struggle here in NA and we need to use caution
        2. Few 3rd party fuel suppliers providing quality control and consistent product

Common Problems with Various Fuel Sources in NA

1. Inconsistency
    1. Fuel sources drying up or costs changing
    2. Difference in “RDF” from supplier A vs. B
2. Logistics
    1. Too long to unload a truck OR who unloads the truck
        1. Dump and Go system or trailer jockeying
    2. Don’t be too restrictive on type of trucks
3. Density Variations
    1. The same equipment may need to meter plastic rejects and tire chunks, mixed or not
    2. Total range or equipment
        1. Ton/hr range multiplied by density range < 20:1
        2. Will have to sacrifice low range stability as max. rate is pushed higher and higher.

Thank you for your time!

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