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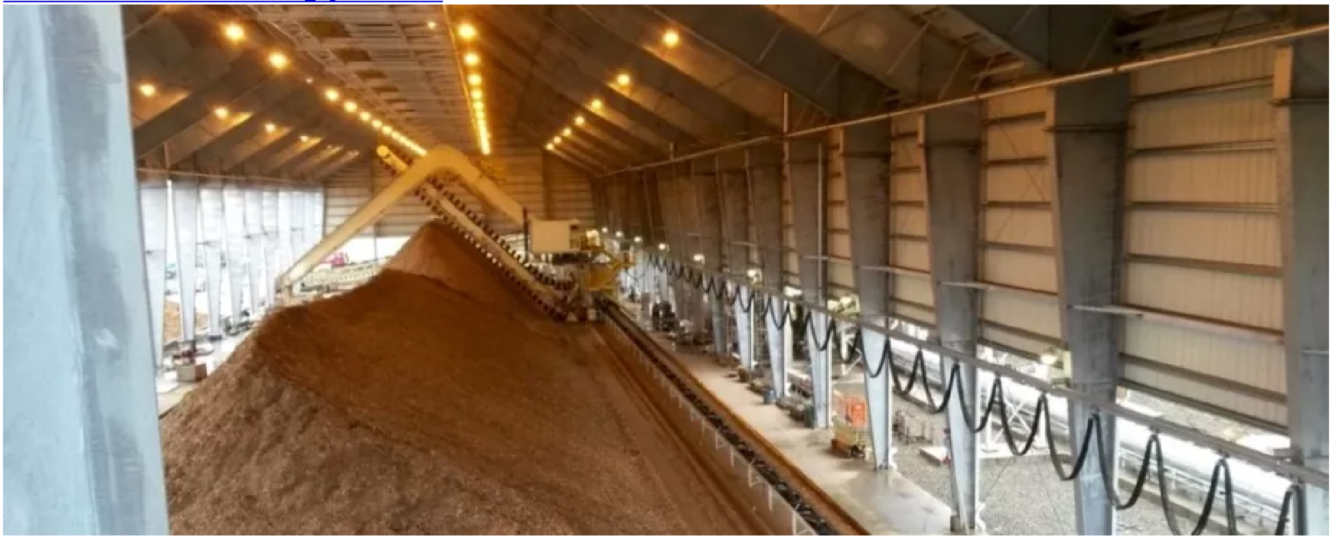

Technical Article

How to Handle the Fire’s Feed – Effective Utilization of Alternative Fuels

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During the most recent decades the utilization of (otherwise) waste materials and biomass as alternative fuels in the cement industry and power plants showed great growth figures. This article shows, how these materials can be handled.

(From the archive of ”bulk solids handling", article published in Vol. 36 (2016) No. 2/3 , ©2016 bulk-online.com)The utilization of alternative fuels within various industries has been on a path of rapid expansion for the last 20 to 30 years. For instance, cement producers have been pushing for a net negative fuel cost for decades, which only a few plants have truly achieved and the Southeastern U.S. has recently become the hotbed of biomass-based fuel sources for power generation or co-firing. As the world attempts to reduce its dependence on fossil-fuels, what was once considered waste has now become a driver for a rapidly expanding industry which is attempting to combat the global megatrend of climate change and resource scarcity.

The Recent Past

As recently as 1986, Kurt E. Peray [1] suggested that solid fuels in rotary kilns were generally coals: Anthracite, bituminous, lignite and coke, and that “several pre-heater kilns in various parts of the world are being used to dispose of old automobile tires, wood chips and even garbage for introduction into the back end of the kiln".Alternative fuels have now taken their place in the proverbial front end of the kiln. The times when focusing on alternative fuels purely for financial sake are over. Yes, they still have their place, but a far larger constant has been added to the equation: new emissions regulations.In 2010, the US Environmental Protection Agency (EPA) finalized the National Emission Standards for Hazardous Air Pollutants (NESHAP) amendments to the standards for Portland cement manufacturing and emissions of mercury, total hydrocarbons (THC), hydrochloric acid (HCl) and particulate matter (PM). In 2013, these new regulations became law. This updated law, together with the New Source Performance Standards (NSPS) regulates NO_x, (nitrogen oxides) and SO_2 (sulfur dioxide), and required cement plants to be compliant with the new standards.After a number of lawsuits, modifications and amendments, mostly championed by the Portland Cement Association, all US cement plants should have demonstrated compliance as recently as September 9, 2015.But there's more. In August 2015, President Obama authorized the new "Clean Power Plan" to regulate CO_2 emissions from power plants. With the new emphasis on Greenhouse gasses and their supposed contribution to global warming, can the cement industry be far behind?Going back to Peray, utilizing coal as a fuel source under stoichiometric conditions in a cement kiln would lead to approximately 18% CO_2 in the stack if there were no evolution of CO_2 from the raw mix and as much as 28% when considering the CO_2 evolving from the raw mix.By their very nature, numerous alternative fuels and raw material additives have reduced chemical constituents that lead to a reduction of overall emissions, reduced fuel costs and the possibility of generating carbon offsets.Today, wood chips and biomass usage for one of the major world-wide cement producers contributes as much as 24.5% of their fuel input needs [2]. Consequently, the low heat values of alternative fuels now require larger handling and storage systems that are more flexible and permanent fixtures within the plant.

Case Studies

Plainfield Renewable Energy/Enova Energy Group

The Enova Energy Group embarked on a renewable energy project in Plainfield, Connecticut in 2011 to generate 37.5 MW of clean energy utilizing waste wood from construction and demolition debris, recycled wood pallets and land clearing materials. The biomass plant features a wood storage yard, fluidized bed gasification system, condensing steam turbine generator, cooling tower, ash silo, scrubber, bag house, electrical switchyard, storm water storage and treatment and balance of supporting plant systems. [3]**Bedeschi** America, Inc., was selected for the fuel handling system consisting of an over-head tripper/stacker and a portal reclaimer. Prepared fuel is delivered to the plant where the covered storage hall can house five days of fuel.The Bedeschi overhead tripper stacker (TRP 9/1200) utilizes a 1200 mm belt and the portal reclaimer (PAL P200/21+4) features blades with a length of 2 meters and a boom length of 25 meters (see figure on left-hand page). The project data are presented in Table 1.

Material	**Biomass**	
Bulk density	17-24 pcf	470-385 kg/m^3
Material size	4 in	100 mm
Moisture content	20% (surface moist.)	
Angle of repose	45°	
Total volume stored	4800 t	
Volume of the pile body (without end cones)	4400 t	
Number of piles	1	
Section of piles	1225 ft^2	113,8 m^2
Total length of piles	500 ft	150 m
Width of piles	70 ft	21,4 m
Height of piles	35 ft	10,7 m
Max. stacking capacity	300 st/h	272 t/h
Max. reclaiming capacity	100 st/h	91 t/h

Due to the potential of wood dust explosions, we were required to supply Class 2 / Div 2 electrical equipment, namely motors, switches and pump skids.

Middle-East Cement Plant

A Middle Eastern cement company asked Bedeschi SpA to propose a multi-fuel handling system for their facility which is capable of handling a diverse array of fuels. The system comprises of a receiving feeder, storage facilities and a bulk handling system complete with dust suppression.The fuels to be handled are: coal, petcoke, oil shale and olive residue, as presented in Table 2.

Material	**Coal**	**Petcoke**	**Oil shale**	**Olive residue**
Bulk density [t/m^3]	0,8	0,9	0,8	0,44
Material size [mm]	68	68	200	140
Moisture content [%]	12	12	6,5	18
Angle of repose [°]	38	38	38	27
Total volume stored [t]	3 × 10 000	2 × 7000	2 × 1500	2 × 1500

Section of piles [m^2]	187	187	187	122
Total length of pile [m]	75	50	24	38
Width of pile [m]	31	31	31	31
Height of piles [m]	12,1	12,1	12,1	7,9
Stacking rate [t/h]	200			
Reclaiming rate [t/h]	150			

The alternative fuels arrive via semi-truck and are loaded onto a surface feeder to an optional double roller crusher for sizing of the fuels, if required. From there, the fuels travel via belt conveyor to a tripper/stacker to properly build the 9 piles of fuel. A total of 50,000 tons of fuel are housed within the storage hall.Given the diversity of moisture within the fuels, a bucket-type portal reclaimer was determined to be the most effective for the duty. As is our standard, we prefer to utilize a bucket-type reclaimer when the moisture is in excess of 12%. In the case of this project, the fuels require minimal mixing and our reclaimer affords quick pile changes. Bedeschi supply to include:

- Surface Feeder CNT 14/2500
- Double Roller Crusher Type RL 450/1500 (optional)
- Stacker Type STK 22/800
- Reclaimer Type BEL P 250/30+4
- Belt Conveyors NG: 800/584 , 800/507, 650/104, 650/269
- Bag Filter (ATEX): 120 BV 100, 120 BV 64, 120 BV 64
- Electrical, automation and controls
-

Gob as a Fuel

Gob is a waste coal that is the low-energy discards of the coal mining industry. These waste coal piles accumulated mostly between 1900 and 1970 in western Pennsylvania, West Virginia and Kentucky [4]. These piles can contain millions of tons of low calorific value fuel that can potentially be recovered and processed in coal fired power plants or other energy intensive pyro-processing systems.The Virginia City hybrid energy center is just one example. The 585 megawatt coal-fired power plant will be generating electricity from millions of tons of waste coal that was not previously marketable [5]. See Table 3 .

Material	**Gob coal**	
Bulk density	50-67 pcf	800-1075 kg/m^3
Material size	2 in	50 mm
Moisture content	9% (surface moist.)	
Angle of repose	38°	

Total volume stored	780 00 t	
Number of piles	2	
Section of piles	3035 ft^2	282 m^2
Total length of pile	1253 ft	383 m
Width of pile	125 ft	38 m
Height of piles	48,5 ft	14,8 m
Max. stacking capacity	950 st/h	862 t/h
Max. reclaiming capacity	950 st/h	862 t/h

This project proved how just important the material assessment is. From the table below, one can see that the material as described by two of the owner’s engineers seems reasonably benign. Based upon this, the decision to provide a blade-type reclaimer was taken. Commissioning issues quickly led to a further and more complete investigation into the true nature of the material.The investigation revealed that the material being received at the plant contained a much as 32% clay. The clay tended to be non-flowing, highly compactable and exhibited angles of repose between 75º and 90°. The clay prohibited the coal from flowing from the secondary “pusher” boom to the primary reclaim boom. In addition, the compact clay forced the reclaim blades in to a more aggressive digging-mode, which exerted additional stresses and ultimately caused cracking in the blades.Ultimately, Bedeschi proposed a fix for the blades and the customer has more proactively managed their fuel resources. Given a proper evaluation of the materials, our equipment choice would have been a bucket-type reclaimer, and these issues would not have arisen.Bedeschi America’s scope includes:

- Dual Stacker with Tripper: STK 31/1200
- Dual Portal Reclaimers: PAL P 260/22+12
- Cabin with Control Panel
- Electrical, automation and controls

Summary

Today’s environment for earth-friendly fuels and raw materials requires overcoming ever-increasing challenges in the field of material handling. For over 100 years, Bedeschi has been handling sticky and high moisture clays for the tile and brick industries and continues to invest in product development to increase efficiency and enhance our product line for our world-wide customers. The global needs for common fuels of today and the anticipated fuels for tomorrow require an ever diligent company like Bedeschi to keep abreast of difficult material handling issues. We look forward to the challenges that will face us in the next centuries.

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