THE FUTURE OF FUELS

Hannes Uttinger and Christina Kastner, A Tec Production & Service GmbH, Austria, discuss maximising solid alternative fuel firing with new technology made in Austria.

Introduction

With the world's cement industry constantly looking for ways to cut production-energy costs, there has been a strong move towards the use of alternative fuels (AF) over the last couple of years.

Co-processing of waste in cement kilns is already being widely employed across Europe, but nevertheless, the potential for further uptake is still large. One of the greatest advantages for the cement industry is the reduction of its fossil fuel consumption and therefore a reduction of environmental impact. Firing with materials, such as municipal solid waste (MSW), plastics, sewage sludge, biofuels, waste wood, used tyres, and other biomass, is on the increase, replacing more expensive traditional fuels such as coal. Latest studies show, for example, that if European cement plants increased their usage of AF up to 95% emissions of 41 million tpy of CO_2 could be avoided.

But achieving this goal means overcoming several barries. On the one hand, there are infrastructural, political, and environmental hurdles; on the other hand, technical and economic ones. AF materials tend to have a high moisture content with a wide range of particle sizes that must be homogenised before they can be used for firing. There have been a few key innivations over the last couple of years showing that it is technologically and economically feasible to further increase this substitution rate, possibly as high as 95%.

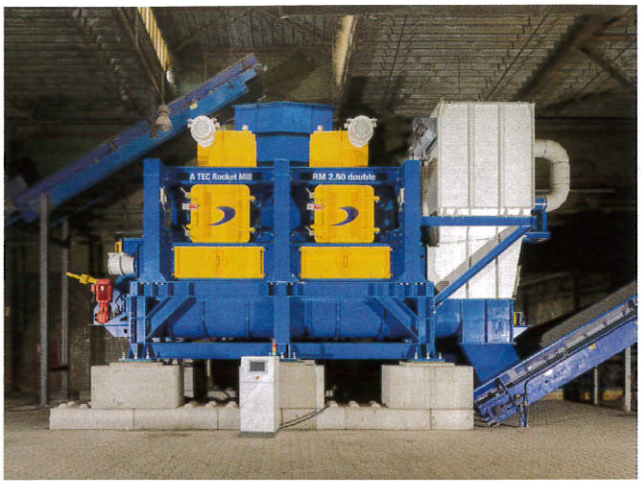

Figure 1. The A TEC Rocket Mill RM 2.50 double.

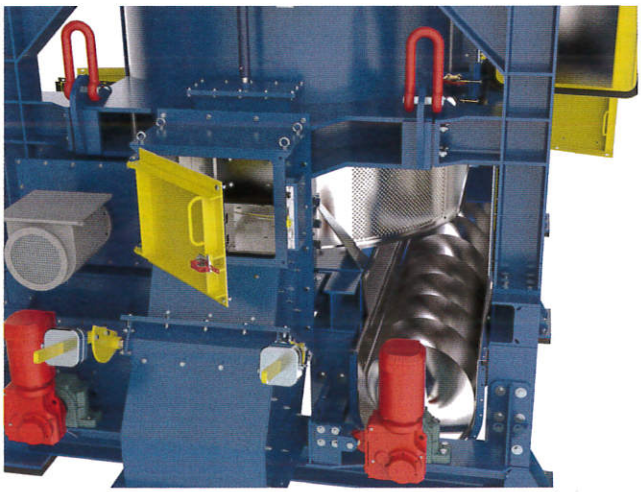

Figure 2. Details from the A TEC Rocket Mill RM 2.50 double.

Figure 3. Solid AF produced by the Rocket Mill.

One of these innovations is the Rocket Mill RM 2.50 double®, which was developed by A TEC Production & Service GmbH. With its high reduction ratio, the Rocket Mill® produces AF particles ready for firing in one step. Easy to operate and maintain, it offers lower operating costs than a complete shredder system, while allowing cement producers to achieve high fuel-substitution rates in their kilns and calciners.

First steps from waste to fuel

A first step towards optimising the production of highly calorific residue-derived fuels for the cement industry was made in 2014. The cement producer, and long-time partner of A TEC for innovative solutions, w&p, Wietersdorf plant in Klein St. Paul, Austria, wanted to increase the substitution rate on the main burner from 40% up to more than 90% with solid AF. Subsequently, a prototype of A TEC's mill was installed. The motivation for such a goal was a significant cost reduction, due to the high substitution rate of fossil fuels. The pilot project was successful in terms of CO_2 savings and the reduction of environmental impacts. During that time, A TEC worked on the further development of the mill's technology and was able to launch the first double chamber mill – the Rocket Mill 2.50 double® – in 2016.

Drying and grinding in one step

A TEC's Rocket Mill consists of two robustly-designed grinding circular chambers, each of which is equipped with horizontally rotating chains and perforated screens. Since the Rocket Mill can accept feed up to 250 mm in size, only one pre-shredding or pre-sorting step is usually needed.

In operation, the feed is fragmented through impact with the rapidly rotating chains, as well as through inter-particle collisions. The screens surrounding the crushing chamber only allow particles of the required size to pass through. Any uncrushable material is automatically removed via slide gates from the chamber.

The output material from the Rocket Mill has advantages in terms of its fuel properties. The process creates particles with a high specific surface that improves ignition and combustion characteristics, while the heat generated within the mill helps to reduce the inherent moisture content of the feed from typically 25% to 15% in the fine material. Inorganics are separated from the AF during the shredding process and can be discharged during operation via slide gates.

Featuring twin crushing chambers, each powered by a 315 kW direct electric drive, the Rocket Mill® can produce up to 10 tph of AF, with a final size less than 15 mm. It is also possible to produce larger material, e.g. for a calciner with short retention times. This only requires a change of the screens, which can be easily done within two hours. The effect is a significant increase of throughput.

Maintaining the mill is easy and cost effective. A complete change-out of a set of wear parts takes less than two hours. The screens have a life time of

FROM WASTE TO FUEL

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around 1000 hours and the chains 200 – 250 hours, depending on the material being crushed.

Installation at a waste treatment plant

The Austrian company, FCC Austria Abfall Service AG, installed A TEC's Rocket Mill in its treatment plant in Wr. Neustadt in 2016. The aim was to optimise the production of a highly calorific residue-derived fuels for the cement industry. All in all, the installation process took about two weeks. The mill was fabricated by A TEC's plant construction site in Eberstein.

Figure 4. Solid AF produced by a conventional shredder.

Figure 5. Relation of the mill's output material to a coin.

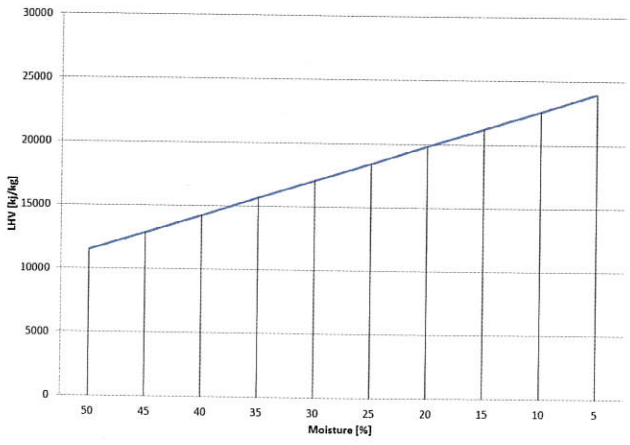

Figure 6. Relation between lower heat value and moisture.

FCC used pre-sorted household and commercial waste, which is preshredded before entering the mill. This is followed by air separation and magnetic separation to ensure that only the wastewater fraction enters the Rocket Mill.

The mill in Wiener Neustadt operates with a screen of 15 mm and a size reduction from 250 mm to 15 mm can be ensured. Different output fuel particle sizes would be easily produced.

The solid AF from the Rocket Mill has three main advantages.

Change of physical properties

Due to the mill using a 15 mm screen opening, approximately 50% of the produced solid AF is smaller than 5 mm. The crushing process creates particles with a higher specific surface that improves ignition and combustion characteristics (Figure 3, Figure 4 and Figure 5).

Drying while crushing

A 10% drying effect occurs during the grinding process. For example, if the input material's moisture content is 25%, it will decrease to approximately 15% after passing through the mill. This drying is performed using the heat generated during the crushing process. Additionally, hot gas from the pyroprocess can be injected into the mill, which results in additional drying of the solid AF. Drying the material has a beneficial effect in its ignition in the kiln, as well as in the flame temperature, as the lower heat value of the solid AF is increased (Figure 3).

Robust design

One advantage of this new technology is the separation of the ferrous and non-ferrous metals, as well as heavy 3D particles, from the AF during the shredding process.

The drying effect, combined with the robust design, results in an increase of the lower heating value.

Operational experience

Following the commissioning of the Rocket Mill RM 2.50 double in November 2016, the output material has already been tested by a cement plant near the FCC plant. The results were satisfying. The test showed that an immediate increase of the AF rate was possible, while retaining the clinker quality. Before using the high-quality output material from A TEC's Rocket Mill, the existing rate could not be further increased because the clinker quality would have suffered. A second test is planned in March 2017.