MASTERCLASS

The new Turbu-Flex™ burner

TURBU-FLEX™ BURNER IS A WORLD FIRST IN BURNER TECHNOLOGY. YOU CAN NOW EFFORTLESSLY ADAPT TO DIFFERENT FUELS WITH ONE BURNER.

This is a vital new breakthrough for cement plant operators and kiln engineers. Alternative Fuels (AF) are attractive as cost effective sources of fuel but have created challenges. FCT Combustion spoke with global customers to develop a deep understanding about these challenges.

The fundamentals are:

- Switching between different fuels can make it harder to manage quality.
- Fuel savings can be lost with lower production.
- It is difficult to maintain low rates of NOx emissions.

To address these challenges, FCT Combustion developed the Turbu-Flex™ burner, which is based on the successful Turbu-Jet AF burner, a technology that has delivered exceptional value for many years across hundreds of global installations.

The new Turbu-Flex™ burner has the flexibility to fire both 100% conventional solid fuel and very high levels of varying AF, while maintaining production output, quality and low NOx emissions under all circumstances, to truly realize the value of fuel cost reduction.

In short – realize the probability of AF, without compromising on plant operations.

Features and benefits:

- No moving parts in the burner or faceplate – to ensure trouble-free operation and ensure primary air injection is known precisely.
- AF Boost valve at the rear of the burner controls split to axial primary air for control of secondary air entrainment and flame temperature.
- Swirl valve is used to control the swirl number.
- Blower speed is used to control total primary air, and, hence, burner impulse.

The new Turbu-Flex™ burner has demonstrated in the field its ability to optimize the profitability of alternative fuel, with lowest possible fuel costs and optimal kiln performance. The first deployment has been firing on very high levels of Refuse Derived Fuels (RDF) in a cement processing plant since August 2017 and delivering exceptional results.

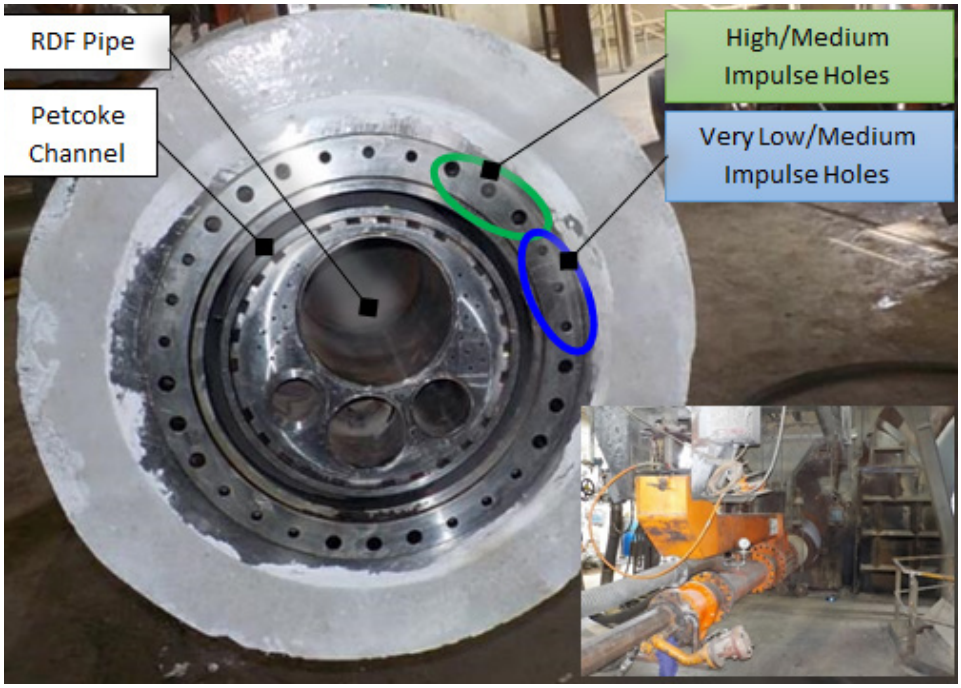


Figure 1: The first installed Turbu-Flex™ burner

Burner design based on proven and scientifically validated techniques.

FCT Combustion has been employing a variety of modeling techniques to develop burner designs since its inception in 1984. In particular, FCT Combustion uses Computational Fluid Dynamics (CFD) to compare the performance of different burner designs in rotary kilns. In order to develop the Turbu-Flex™ burner, they conducted an extensive CFD investigation that assessed the effect of the number, distribution and arrangement of axial and swirl primary air holes. These are the key design variables that control axial and swirl momentum and hence burner impulse, secondary air entrainment, mixing and flame shape.

This identified that grouping holes close together changes the secondary air entrainment, and hence, flame temperature and NOx. In particular, halving the number of axial air holes results in an ~7% increase in peak radiation and NOx and a further ~7% (peak radiation and NOx) when the holes are grouped together.

A burner with the flexibility for adjustment of axial air configuration can optimize combustion, depending on fuel and emissions requirements – i.e. a high number of axial holes can help suppress NOx formation, while a small number of holes grouped together is ideal for co-firing AF.

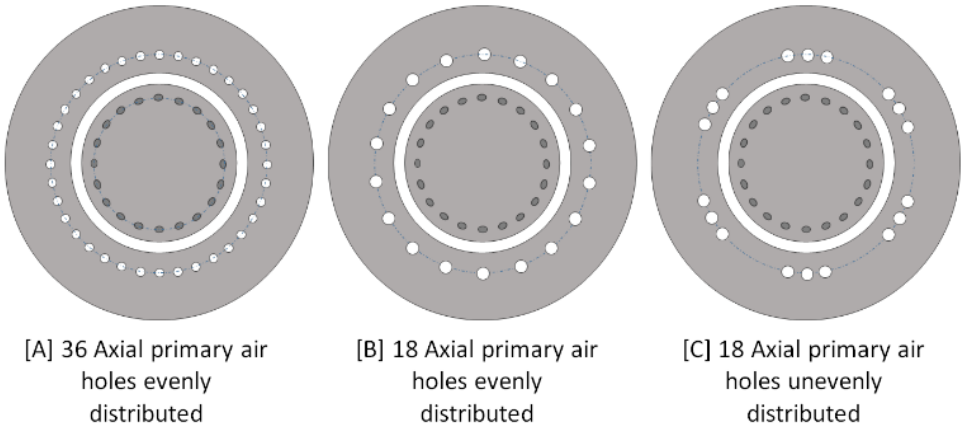


Figure 2: Axial primary air hole configurations

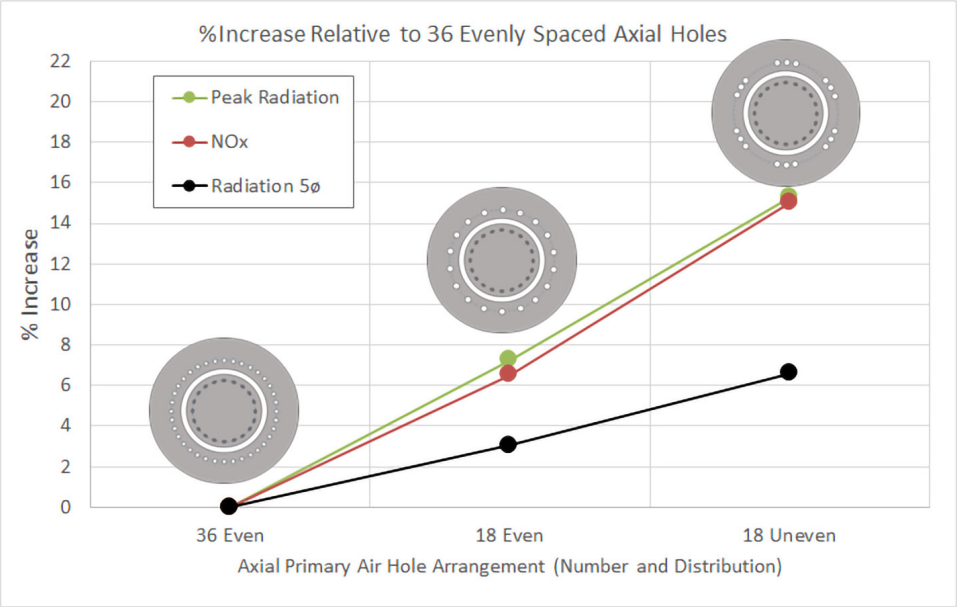
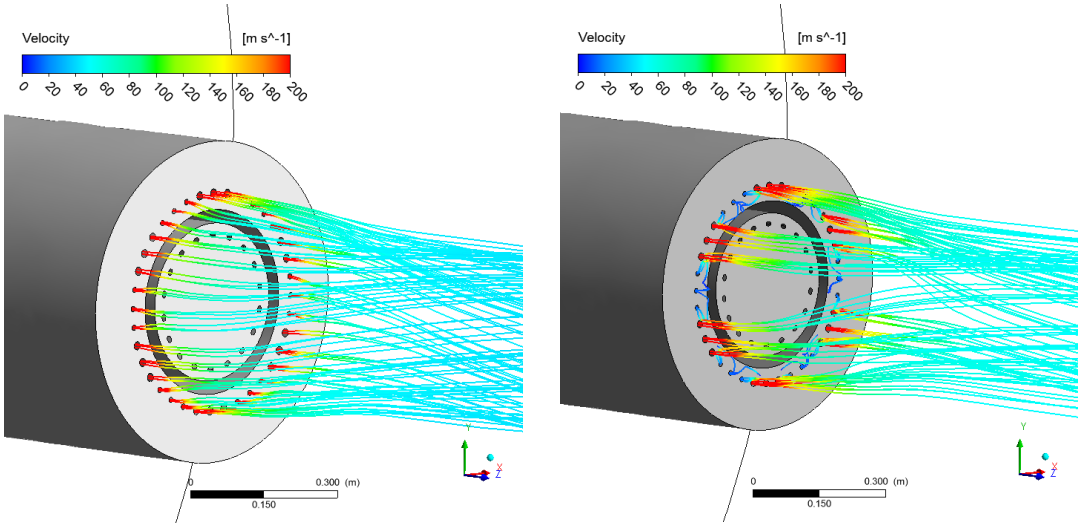


Figure 3: Changes in NOx and radiation heat transfer to clinker for different axial primary air hole configurations, relative to 36 evenly spaced axial holes

A world first. Effortlessly adapt to different fuels with one burner.

FCT Combustion's solution is the Turbu-Flex™ burner in which the axial holes are in two groups, each with a separate air supply. With the turn of a single valve the burner changes from operating with many evenly distributed holes all at the same pressure to operating with a small number of holes grouped together and at high pressure. In other words, the burner changes from Standard Mode to AF Boost Mode of operation simply with the turn of a single valve.

Secondary air flow lines 2x burner diameters down stream of the burner tip. Lines colored by velocity.



Standard Mode **AF Boost Mode**

Figure 4: Standard Mode versus AF Boost Mode

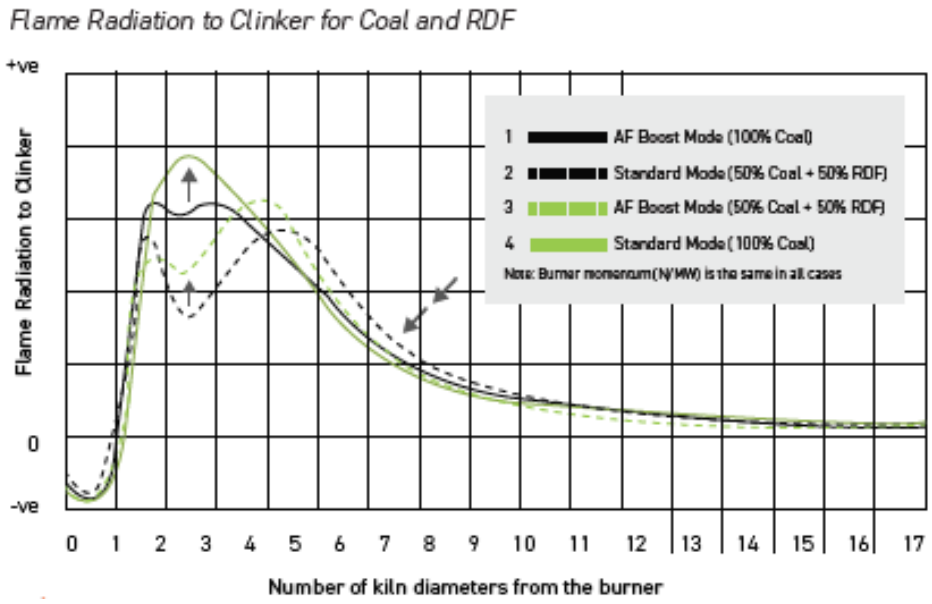


Figure 5: Flame radiation to clinker for coal and RDF

1. 100% coal firing in Standard Mode provides a very good radiation profile for high quality clinker production.
2. At 50% RDF co-firing in Standard Mode, the peak heat flux drops, and more heat is transferred to the clinker further up the kiln.
3. In AF Boost Mode, there is a 5% increase in radiation in the first 5 kiln diameters.
4. AF Boost Mode significantly increases peak radiation in the first 5 kiln diameters.
5. AF Boost Mode also significantly increases the peak radiation for 100% coal.

The benefits to plant managers are clear – with the flexibility to effortlessly switch between fuels, the new Turbu-Flex™ burner ensures lowest fuel costs and highest kiln performance.

With the Turbu-Flex™ burner changes in fuel can be made easily and with certainty about the outcome – as expressed in fuel use, NOx, and product quality – all from the one burner.