

BURN AFTER READING

FIRING IMAGINATIONS AND ENGINEERING EXCELLENCE

FCT COMBUSTION NEWSLETTER: JUNE 2018

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It is hard to believe that we are approaching the mid-year point already in 2018 – doesn't time fly when you are having fun!

And what a year it has been so far!

Thanks to all of our customers who have made this the busiest year so far and our future customers who will keep our growth going. We will continue to serve you all to the best of our ability.

Our US office in Florida is serving customers throughout the Americas, along with the help of our Sao Paulo based staff. While burner systems and associated ancillaries are our core competency, some of our larger projects are involving greater scope of plant equipment supply including drier plant, Hot Gas Generators and fuel handling of various kinds. The growth in the Americas business has been spectacular.

FCT's largest office - the Asia Pacific office in Australia - has a renewed focus on the Asian region and with the help of agents have now won projects in China, Thailand, Malaysia, Vietnam and Australia. This is a growing market that we look forward to growing in and servicing our customers in the best possible way.

Our Turkish company continues to win and deliver Middle East based projects across a range of industries and is fast earning a reputation as a first- class supplier in the region. Several hot gas generators have been supplied as well as numerous complete burner systems.

The new boy on the block – our just established European office based in Vienna, Austria is beginning to grow and punching above its weight already. Projects have been recently won in Italy, France, Belgium, Poland, Turkey and the Ukraine, with more opportunities emerging.

As the company continues its growth, access and support for our customers is increasing and we aim to make FCT reliable and easy to work with.

New products that will help our customers meet their needs are in our R&D programs, and the new Turbu-Flex™ burner was released at the AFCM conference in Indonesia this month. The burner has better flexibility in dealing with a variety of fuels under a variety of conditions. More products are on the way.

I again thank all of our customers, associates, partners and of course staff without whom FCT would not exist.

I wish everyone the very best for the year that remains.

Enjoy the Read.

Managing Director
FCT International

Con Manias



PROJECTS ACROSS THE GLOBE

RECENTLY COMPLETED OR CURRENTLY ACTIVE PROJECTS ACROSS FCT COMBUSTION INCLUDE:

Americas

Lehigh Evansville, PA, USA. Kilns 1 and 2 - Gyro-Therm kiln burners for natural gas, coal/petcoke and SAF. The supply included BMS, valve trains, fans and other accessories. The system was commissioned successfully.

Undisclosed client, WI, USA. 40 MW complete hot gas generation system for operation at 3,000F without refractory lining. The supply includes valve train, BMS and fan.

Ash Grove, Durkee, OR, USA. Gyro-Therm kiln burner for natural gas firing.

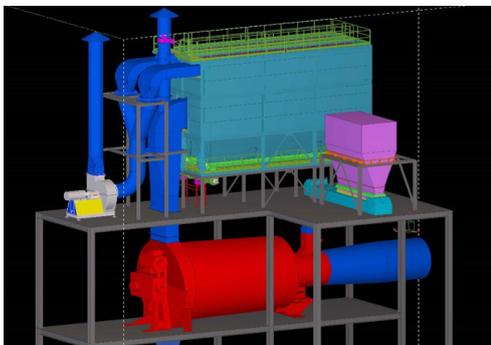
Lafarge Canada Exshaw, AB, Canada. Gyro-Therm kiln burner for natural gas firing.

Votorantim Cimentos, Vidal Ramos, Brazil. Upgrade on hot gas generator for improved burning efficiency.

Graymont Western Delta, UT. Trolley mounted pre-heating burner with fan, valve train, ignition and flame detection system.

Undisclosed client, Brazil. 36 burners systems including valve trains and local control panels.

UCEM, Chimborazo, Ecuador. Complete clay drying system, including fluidized bed hot gas generator with petcoke feeding, triple shell rotary dryer, bag filter and fans.



Clay drying system supply for Chimborazo plant, Ecuador.

CSN Cimentos – Arcos, Brazil. Turbu-Jet AF burners with blowers, ignition and flame detection systems.

Europe

Gorka Cement, Trzebinia Plant, Poland. Gyro-Therm burner with an automated control for a long wet cement kiln.

Undisclosed client, France. CFD of kiln with special attention on coating and refractory temperature and NOx generation.

CBR Cimenteries, Antoing Plant, Belgium. Burner modification to improve performance leading to higher output and lower specific fuel consumption. Also allows for oxygen usage and higher AF usage.

Kerneos, Le Teil Plant, France. New burner system for kiln producing high alumina clinker: including accessories, igniter, flame sensor, valve train, compressor and BMS. Main target is to modernize the plant and reduce NOx emissions.

Imerys, Vatutine, Ukraine. New burner system for kiln producing chamotte, including accessories, igniter, flame sensor, primary air fan and trolley. Main target is to increase the solid alternative fuels firing in the kiln while keeping emissions under control and to modernize the plant.

Erdemir Mining Industry & Trade – Ermaden Group, Sivas, Turkey. New burner system for iron ore pelletizing kiln including accessories, natural gas and fuel oil valve trains and BMS engineering. Main target is to modernize the plant and allow simultaneous usage of fuel oil and natural gas while keeping emissions under control.



Asia-Pacific

Undisclosed client, China. 56 iron ore pellet kiln burner systems firing coke oven gas.

Vinacomin, Quan Trieu Cement Plant, Vietnam. Turbu-Jet AF burner firing low calorific value coal with fuel oil.

Cement Industries of Malaysia Berhad (CIMA), Perlis Plant, Malaysia. Turbu-Jet AF burner with primary air blower and trolley assessment for kiln line no. 2.

SinoSteel Equipment and Engineering Company, Algeria. 30 iron ore pellet kiln burner systems including valve trains and BMS systems.



The Turbu-Jet AF burner for the CIMA Perlis plant.

PEOPLE OF FCT

IN THE SPOTLIGHT



Dr Renata Favalli - CFD Modeller, FCT Combustion Asia-Pacific

With her passion for Computational Fluid Dynamics (CFD), Renata is a highly skilled and valued member of the FCT Combustion team.

Renata attained her Ph.D. in Science from IPEN at the University of Sao Paulo, before becoming a Post-Doctorate Fellow at the Imperial College in London in 2003.

Since then, Renata has held CFD specialist positions in companies such as Dynamis and Greco, as well as working as a teacher and researcher in Brazil. As an expert in her field, she is the author of many articles featured in academic journals and industry publications.

Renata brought her wealth of knowledge and experience to FCT Combustion in June 2017, and her expertise contributes significantly to the success of many of our projects across the globe.

CONFERENCE HIGHLIGHTS AND UPCOMING EVENTS

Americas

Adriano Greco, CEO FCT Combustion Inc, was pleased to attend the **Alternative Raw Materials and Fuels Conference in Cancun in February.**

FCT Combustion presented and exhibited at the **60th Annual IEEE-IAS/PCA Cement Industry Technical Conference in Nashville, May 6-10.**



Jon Forinton and Adriano Greco at the AFARM 2018 conference.



Con Manias and Richard Khan of FCT with customers at the 60th Annual IEEE-IAS/PCA Cement Industry Technical Conference.

Europe

FCT Industries' Managing Director, Con Manias, and Joel Maia, Technical Director FCT Combustion GmbH, attended the **12th Global CemFuels Conference & Exhibition in Berlin on February 20 and 21.**

The annual conference is an excellent opportunity for those within the cement and lime industries to keep abreast of the latest innovations regarding the use of alternative fuels.

Mr Manias was awarded the accolade of 'CemFuels Personality of the Year' at the event, in recognition of his significant impact and achievements within the industry.

With previous recipients including industry leaders such as Sebastian Rosin of Artritor Ltd (2017) and Jan Theulen of HeidelbergCement (2016), Mr Manias is certainly among good company in winning the award.



Jon Forinton and Adriano Greco at the AFARM 2018 conference.



Adriano Greco and Con Manias at the 60th Annual IEEE-IAS/PCA Cement Industry Technical Conference.

Asia-Pacific

FCT Combustion Asia Pacific CEO, Jordan Parham, and Asia Pacific General Manager, Roger Hassold, attended the **25th AFCM Technical Symposium 2018 in Indonesia in April.**

Mr Hassold gave a well-received presentation featuring FCT Combustion's latest innovation, the Turbu-Flex™ burner. Attendees were excited to learn about the Turbu-Flex's convenient ability to effortlessly adapt to different fuels within the one burner, saving plant operators time and money.

Other recent highlights include:

- Jordan Parham attended ASEAN-SME Conference in Sydney in March.
- An Indonesian trade mission visited FCT's Adelaide offices in May.
- Roger Hassold met with Dr Nguyen Quang Cung, President of the Vietnamese National Cement Association, on March 9.

Upcoming events include:

- Roger Hassold will be presenting at the Cemtech Asia Conference in Hanoi, June 24-27.
- Jordan Parham will be attending the International Lithium Conference in Perth, June 27-28.



Roger Hassold and Jordan Parham with Hendrio Harmel and Ferry Sarvino of PT Semen Padang at AFCM 2018.



Roger Hassold receiving a gift of appreciation for his presentation at AFCM 2018.

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.

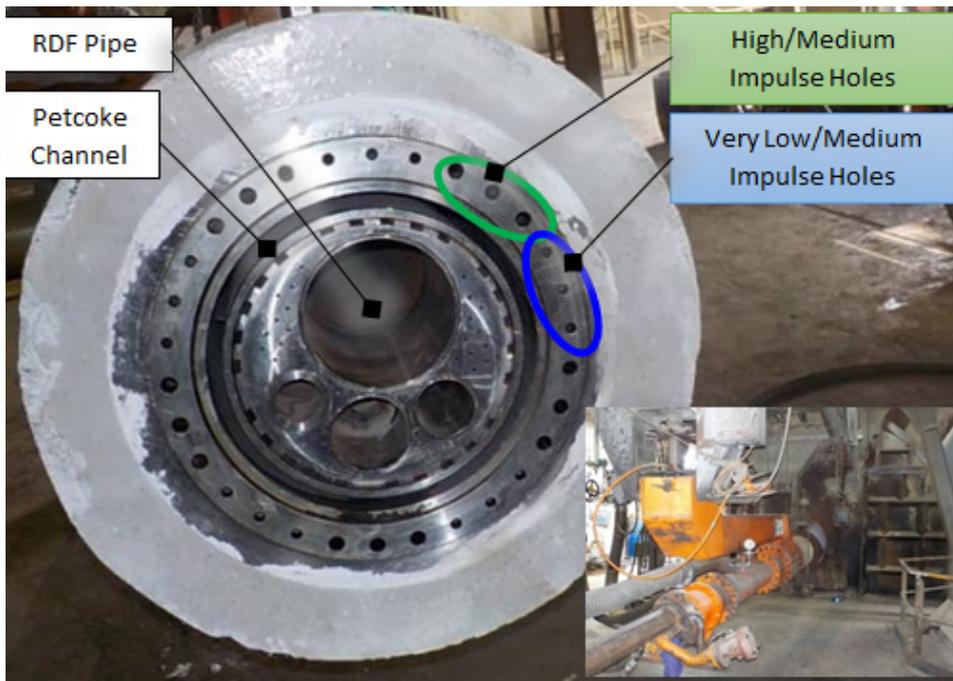


Figure 1: The first installed Turbu-Flex™ burner

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.

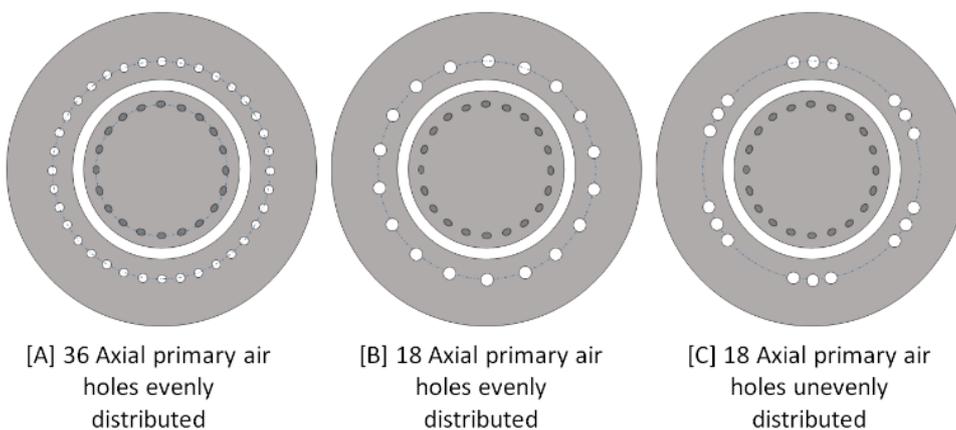


Figure 2: Axial primary air hole configurations

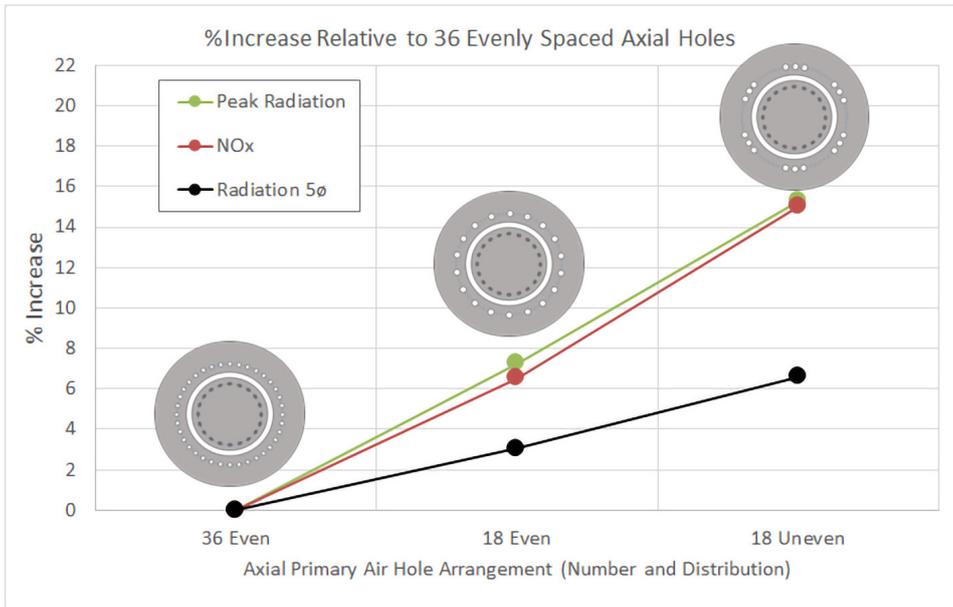


Figure 3: Changes in NOx and radiation heat transfer to clinker for different axial primary air hole configurations, relative to 36 evenly spaced axial holes

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.

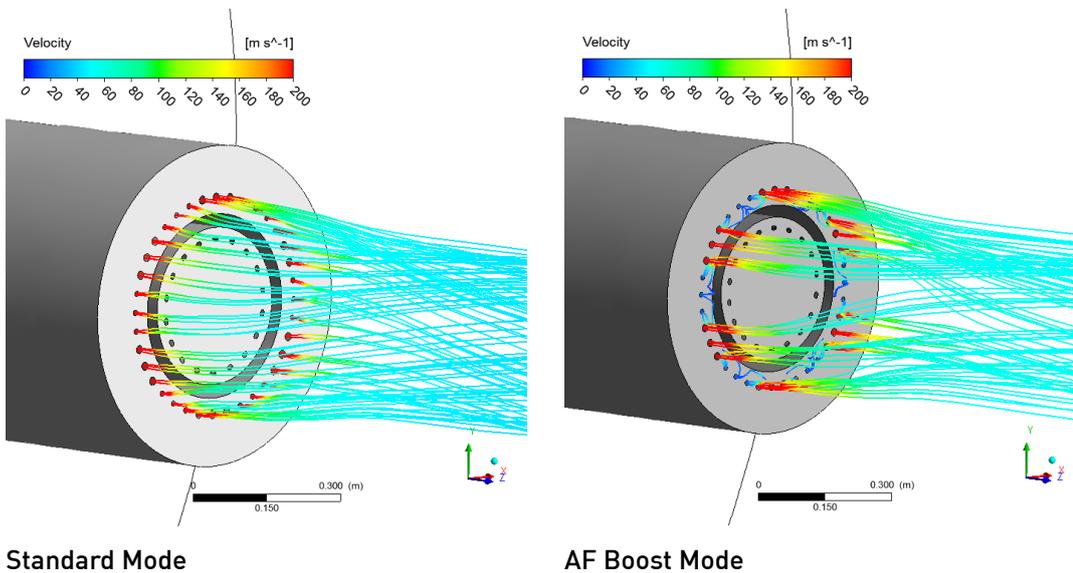


Figure 4: Standard Mode versus AF Boost Mode

Flame Radiation to Clinker for Coal and RDF

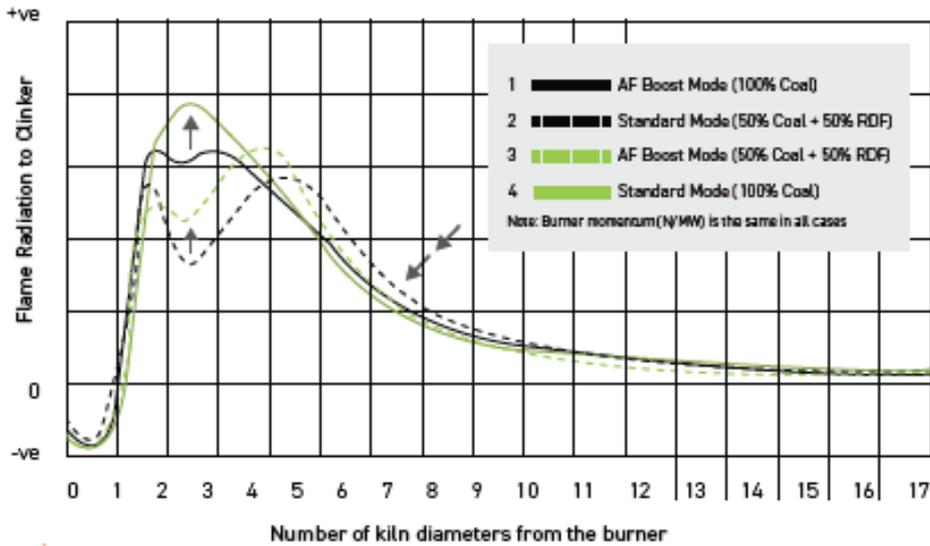


Figure 5: Flame radiation to clinker for coal and RDF

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.