The extensive product portfolio supplied by DCC now includes reheating furnaces, heat-treating furnaces, continuous and static furnaces, free-flame and controlled atmosphere furnaces, etc. This accommodates investigations into a wide range of combustion plants and burners; for this reason DCC created the Combustion Research Centre (CRC) and quickly launched the first phase of tests. Soon, excellent results had been achieved on burners for reheating furnaces; it also made it possible to extend the company’s furnace portfolio.

In 2016 new furnaces were introduced into the CRC, which further enriched the company’s range of activities.

Over the years, the market has been pushing industrial furnace builders to reduce fuel consumption and nitrogen oxide emissions, therefore, high-efficiency burners (such as auto-recuperative and regenerative burners) have been developed, and together with new combustion techniques such as mild or flameless combustion, these are able to slash the release of harmful substances into the atmosphere. Primarily, the CRC is a hub and organized structure where burners can be studied, modified and adapted to the diverse and ever-growing needs of clients worldwide, and also helps them to keep pace with the expansion of DCC’s furnace portfolio.
Our business not only involves selling innovative products that satisfy market requirements: we also design and create them, become familiar with them and develop new products; thanks to the Research Centre, DCC develops its technology independently. Inside the CRC, burners for diverse furnaces can be studied, the performance of existing burners can be optimized, and thus new bonds can be formed with existing clients, demonstrating that DCC is not simply a company that deals with engineering but also one that develops new thermal business within its structure.

In a very short time the CRC has become a laboratory where customized burners are developed for furnace revamps of important clients, such as ArcelorMittal Fos-Sur-Mer (three, 350-tph walking-beam furnaces); Çemtas (walking-beam furnace and heat-treatment furnace); ArcelorMittal Liege (vertical annealing furnace for strip treatment), and where we receive visits from clients interested in following the development of their products.

Today, the macro-trends of the thermal business call for using low calorific fuels (blast furnace gas, coke oven gas, mixed, etc.) deriving from the primary iron- and steel-making processes targeting a reduction in consumption and emissions, in both existing plants and new operations.

On the other hand, heat treatment is pushing the quality of the finished products toward improved mechanical properties and accurate investigation of thermal cycles. During 2016, activities in the CRC were extended to incor-
ENHANCING R&D TO KEEP AHEAD OF COMPETITION

1 Furnace No. 2 for burners testing for reheating and treatment furnaces (100 - 800 kW).
2 Furnace No. 3 for burners testing for treatment furnaces (30 - 150 kW), both FF and TT.
3 Furnace No. 1 for testing both roof and lateral burners for reheating furnaces (300 - 3,000 kW).
4 Radiant tube furnace for testing different tube shapes and burners.
5 Control room.
porate the study of all the equipment necessary to offer maximum plant flexibility, and to approach the world of processing lines and heat treatment (in a controlled atmosphere) by introducing the concept of system development: burner + recuperator + radiant tube, and no longer one single element or burner. Recently, for this reason, three more new furnaces have been installed.

The Research Centre now houses four testing furnaces that are fed either with natural gas or technical gas, a water cooling system, two combustion fans, a waste gas duct, cameras to supervise the combustion process, a liquid fuel plant, an oxygen feeding system, and all other systems necessary to perform tests on free-flame or radiant tube burners. Each of the four furnaces is distinguished by its thermal capacity and dimensions. The main furnace can house both lateral and roof burners with a maximum power of 3,000 kW; the intermediate furnace can accommodate burners with reduced power down to 800 kW -typical for free-flame heat-treatment furnaces- and is dimensioned to test wet and dry tunnel furnace rolls, including the relative thermal dispersion. Two smaller furnaces are used to test free-flame burners with a maximum power of 100 kW, and radiant tubes of any shape, such as U, W, P, 2P, and straight.

In order to simulate the feedstock inside the furnace chamber and to cool it, all the furnaces are equipped with a water cooling system that can drain up to 2,000 kW at temperatures up to 1,300 °C. As for the furnaces functioning in the free-flame mode, the thermal load is simulated by a number of water-cooled tubes that may vary according to the draining power. For this same reason the radiant tube furnace has been designed with a water-cooled plate heat dispersal system, which can simulate the passage of a 1,400 mm wide cold strip.

The plant’s automation system was realized in collaboration with Danieli Automation, while software developed for this particular application respects the technology of the plant to allow testing new regulation systems. To simulate the conditions of the plant where the burners are to be installed, the system can be fed either with natural gas or chemically obtained technical gas prepared in cylinders or tanks with liquid fuels. In the future, oxygen generation plants will be available and a series of burners able to work with enriched air and pure oxygen will be developed and manufactured, so clients will be able to use the oxygen available in their plant for their reheating furnaces. When investigating the theoretical approach, the method used for burner development is based on fluid dynamic simulation of the component in relation to the fluid dynamics of the furnace chamber and the heating quality of the products to be treated. Then, the prototype for testing is constructed; the conditions requested for use, power, flame type, consumption and emissions are taken into consideration, and the prototype is subsequently approved for installation at the plant.

**OBJECTIVES**

Commitment and consistency are DCC’s main propellers and alongside the CRC new challenges related to the market can be investigated. An ever-expanding furnace portfolio that embraces different plant types, such as furnaces for lines (automotive) and treatment furnaces for steel and aluminium (automotive and aeronautic - AMS certification) incorporates a process of constant improvement, allowing us to offer “tailored” solutions that optimize both investment and plant production costs.

Activities performed at the Combustion Research Centre have proven to be essential to DCC because they make it possible to demonstrate the outstanding performance of our customized products, which are differentiated and dimensioned to match individual client's specific plant requirements. These activities also demonstrate how important it is to industrialize these products while respecting progressively stringent norms and standards imposed across the world. We continue to maintain a high regard for the environment in our quest to further reduce the release of harmful substances into the atmosphere.

Our view is that the CRC has lead the company along a path that sees us more and more involved in the process of researching innovative components related to the entire thermal process prior to installation.