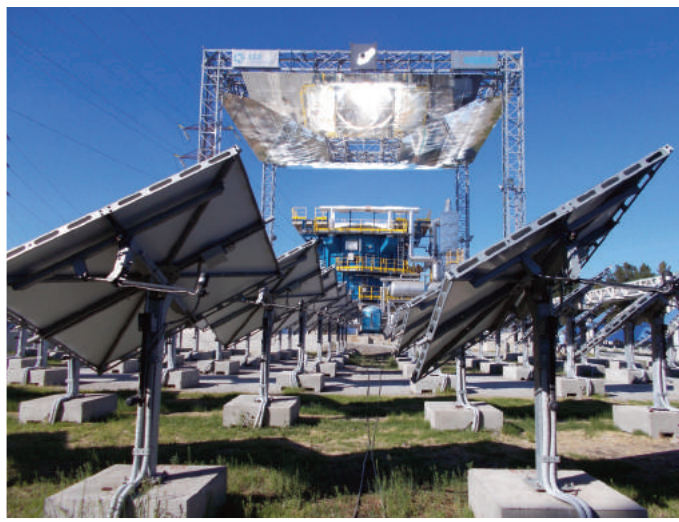




Ninety years
of dependability and innovation

NEWS_N°19

1929 2019 90

MAGALDI®
Dependable technologies

1929
2019

MAGALDI®
Dependable technologies

NINETY YEARS OF DEPENDABILITY AND INNOVATION

NEWS_N°19

EDITORIAL

2019 will be a special year for Magaldi Group as we are is going to celebrate first 90 years of activity with new orders that confirm our leadership in handling materials under the toughest process conditions, in industries where high dependability is essential.

Since the incorporation in 1929, we have built our solid reputation and our worldwide leadership, proposing ourselves not as a mere supplier but as a reliable technology partner able to provide the highest quality and take care of customer needs at every stage of the project.

Reliability, technological innovation, care for the environment and for the workers' health already convinced over 1.000 Companies worldwide to adopt our dependable solutions.
The growing number of references achieved in a wide range of businesses - from foundries to steel mills, from coal-fired power plants to waste-to-energy plants, biomass, cement and mineral processing plants, among others - bears witness to how the team is passionate about its work and faces challenges by taking advantage of the deep know-how acquired over decades of activity.

The amount of projects carried out worldwide grows in parallel with the wide portfolio of technical solutions constantly developed.
Every year, we invests about 3,5% of our annual revenue in R&D, seeking knowledge to develop, design and enhance production processes and technologies.
Innovation and dependability are the keywords driving the Company's entrepreneurial approach, oriented to balance the requested creativity for innovating with a strong sensitivity to Customers and market requests.
From the Supercinghia – the first patented belt conveyor made of buffalo leather strips – ever more technologies have been developed and patented, becoming benchmark products.
Furthermore, the propensity to face new challenges has recently attracted the R&D efforts on renewables. In particular, a breakthrough CSP technology with TES (thermal energy

storage), able to revolutionize the solar power business, has been developed and it is ready for market uptake.

But our commitment to Customers cannot be reduced to supply technologies. It continues over time thanks to our subsidiaries located in the U.S. (Magaldi Technologies LLC), India (Magaldi Power Pvt Ltd), Germany (Magaldi Power GmbH) and Australia (Magaldi Power Pty Ltd), that promote the spread of our proprietary technologies and guarantee a post-sales assistance able to promptly and efficiently respond to requests for technical support and/or spare parts supply all over the world.
Regular visits made by a team of highly-qualified professionals to oversee the proper functioning of installed systems contribute to forge long lasting relationships with our Customers, so to become a valued extension of their business.

Strongly anchored in the past but always looking towards the future, Magaldi Group is going to celebrate this special anniversary that projects us towards new challenges and exciting opportunities.

FRONT ROW: CAV. MARIO MAGALDI
BACK ROW: PAOLO, MRS. EMMA PAOLILLO MAGALDI, RAFFAELLO AND LETIZIA

2

DRY TECHNOLOGIES TO MEET EPA STANDARDS. PLANT SCHERER'S EXPERIENCE

MAGALDI TECHNOLOGIES, LLC RECEIVED AN ORDER FOR ELG & CCR RELATED FULLY DRY BOTTOM ASH HANDLING SYSTEMS FOR THE LARGEST COAL FIRED POWER STATION IN THE STATES.

In 2015, Georgia Power announced that it would close all its ponds to comply with the Coal Combustion Residuals (CCR) rule from the EPA. The first step was looking for technologies able to comply with EPA standards: Magaldi environmentally-friendly dry ash conveying solutions have been the choice.

PLANT SCHERER, THE LARGEST COAL-FIRED POWER STATION IN THE STATES

With an installed coal-fired generation capacity of nearly 3,600 MW, Robert W. Scherer (Scherer) Plant is amongst the largest electricity generation facilities in the United States, the largest power station to be fueled exclusively by coal.

Plant Scherer is located in Juliette, Georgia (Monroe County), just north of Macon and approximately 70 miles south of the Magaldi Technology, LLC offices in Atlanta.

The plant began commercial operation in 1982. The nameplate rating for the Unit 1 is 820 MW, whereas the other three units have a 915 MW capacity. At full capacity, the facility burns roughly 2,200 tons of coal every hour.

To maintain a steady supply of fuel for the plant, coal is continually delivered by trains from the Powder River Basin (PRB), 1,800 miles away in Wyoming, using a sophisticated coal-handling system.

Georgia Power, which operates the plant for its seven owners, is the largest subsidiary of Southern Company, one of the nation's largest generators of electricity. In addition to Georgia Power, other co-owners of the units include Oglethorpe Power Corporation, Florida Power & Light, MEAG Power, Gulf Power, Jacksonville Electric Authority and Dalton Utilities.

Over the years, as environmental standards have changed, Plant Scherer has added some of the most modern control technologies available, including low-NOx burners, scrubbers, selective catalytic reduction systems and baghouses, which equip the units with the latest environmental controls to reduce emissions of sulfur dioxide, nitrogen oxides and mercury.

These best-available technologies (BATs) have brought the facility into the 21st century, giving it a bright future for many years to come and making Plant Scherer the 2017 Powder River Basin Coal Users' Group Plant of the Year.

MAGALDI DRY TECHNOLOGY TO MEET EPA STANDARDS

Among the several important capital improvement projects in BATs, in December 2016, Magaldi Technologies, LLC received the order to engineer and supply its patented, environmentally-friendly dry ash conveying solution - the MAC® system -, for lower costs and emissions and increased efficiency to convert the bottom ash handling system of all four units.

The new equipment helps the utility to comply with the U.S. Environmental Protection Agency's (EPA) Effluent Limitation Guidelines (ELG) and Coal Combustion Residuals (CCR) regulations.

The four units reclaimed bottom ash by mixing it with water to form a slurry which was then further pumped to ash retention ponds, together with ash collected at the economizer and SCR hoppers, and the coal mill rejects.

For fully dry cooling and handling of the furnace bottom ash, the MAC® system technology will be installed underneath each steam generator.

The MAC® system represents an eco-friendly system that completely eliminates water usage utilizing only ambient air for bottom ash cooling. Air streams along the conveyors and in counter flow to hot ash, transferring heat back into the combustion chamber.

Magaldi's solution consists of a mechanical seal to compensate the thermal movements of the boiler, a transition hopper with hydraulically operated valves and the MAC® extractor. The MAC®conveyor automatically transports and cools bottom ash by drawing ambient air along the conveyor and effectively transferring heat back into the boiler.
A crushing stage reduces the size of the bottom ash down to nominal 3" for further transportation and cooling into a secondary conveyor.
Particular attention was dedicated to the design of the crushers in order to ensure automatic handling of big ash lumps that PRB coal burning may often produce.
A pneumatic conveying system transports the cooled bottom ash, along with the other boiler ash from economizer and the SCR, to two brand new silos able to offer more than three days storage capacity and located away from the plant.

The MAC® system at Plant Scherer is a significant upgrade that dramatically improves the local environment. The new dry technology also increases combustion efficiency by reducing thermal energy losses, re-entraining unburnt carbon and therefore reducing CO_2 emissions and subsequently operating costs. Moreover, all problems associated with wet PRB (high calcium) bottom ash are avoided.

As a result of well-coordinated working processes and committed teamwork, the installation of the first two units has been finished within the planned time frame and by mid-2019 all units will be operating the new dry systems, thus keeping Plant Scherer the absolute forerunner in environmentally-friendly state-of-art technology.

Units size: 3x915 MWe +1x820 MWe
Project type: Retrofit
Ash rate: 5.2 t/h
Ash rate max: 13.6 t/h
Burned fuel: PRB (Powder River Basin)

INTERVIEW WITH JOHNNY HOWZE III, SCHERER PLANT MANAGER

Johnny serves as plant manager for Georgia Power's Plant Scherer in Juliette.
In this role, he is responsible for providing overall leadership for operations of four coal-fired units

"In 2015, Georgia Power announced that it would permanently close all of its 29 ash ponds across the state in response to new federal regulations including the Coal Combustion Residuals (CCR) rule from the Environmental Protection Agency (EPA). The first step in our closing process at Plant Scherer was evaluating several potential projects and vendors that could help us meet EPA standards.

We had previously studied the Magaldi Ash extractor technology since our ash ponds were already approaching the end of their lifespan. So, we were aware that it was a viable option for us. And as more CCR rules came forward, the Magaldi's ability to deal with ash transport water made it stand out more during our evaluations. Eliminating that water became a priority as we thought about the future of the plant. The less ash transport water we had to manage, the better off our plant would be.

Other options we studied would have required us to add jobs and increase our operations and maintenance budgets. But with the installation of the Magaldi system, no additional jobs would be necessary. And after many hours spent intensively studying Magaldi technology and meeting with Magaldi leadership, we believed that the system would be less maintenance intensive than any other technology on the market.

For all those reasons, choosing the Magaldi Ash extractor was the best decision for Plant Scherer.
As a plant manager, this was one of my most important decisions – a 20-year decision.

Hours of simulator training, and the on-going installation of the first system, have reinforced that we made the right decision. We are pleased with our decision to install Magaldi technology on all four units. It is a change from how we have traditionally operated our boilers. This new technology has made our plants better from a safety, operations, maintenance, and housekeeping standpoint. I recommend the Magaldi Ash extractor technology to anyone seeking cleaner, more efficient CCR technologies."

Johnny Howze

3

TWO SUPERMAC® SYSTEMS STRENGTHEN MAGALDI PRESENCE IN MEXICO

ON JUNE 8TH 2018 THE BIGGEST EVER SINGLE CONTRACT FOR MAGALDI WAS SIGNED IN GUADALAJARA

Mexico has been a land of great opportunities for Magaldi since 1999 and the Carbon II project represents an excellent example of such kind.

The plant, located in the north of the Country near the city of Piedras Negras (Cohauilla), was commissioned in 1993-1996. It features 4x350MW units burning local coal: the first two boilers were supplied by MHI while Foster Wheeler supplied the last two.
Due to the extremely high ash content of the burned coal, the plant ash management system has always suffered from performance problems, especially the bottom ash handling system of unit #1 and #2, utilizing a water impounded hopper to transport the bottom ash to the nearby hydrobins. The necessity of improvement was perceived by the plant management since the early days.

The evolution of the project was not straightforward nor linear for Magaldi. It roots back to 2010-2012, when the plant still belonged to the "Gerentia de Noreste" of the Mexican state-owned utility Comisión Federal de Electricidad (CFE) in Monterrey.
By that time, the contacts between Magaldi and the plant management were focused on drafting the best possible layout for a SuperMAC® system, able to handle the massive amount of bottom ash produced by the unit #1 and #2, together with economizers and pre-heater ash.
Several different solutions were conceived and thoroughly discussed; eventually, thanks to the strong support of the plant management, final layouts were ultimately frozen.

The project anyway suffered some additional delays, leading eventually to 2014 and to the start of the Mexican Reform of the Energy Sector, promoted by President Pena Nieto.
The come into force of the reform produced a stall for the project which lasted for almost two years. In this period of time the ownership of the plant was transferred to one of the newly-established GenCo, the CFE Generación II based in Guadalajara while in the meantime the problems of the bottom ash handling system in the plant continue worsening, due to the aging of the heavily exploited installations.

From a layout point of view, both Carbon II units foresee the capability of conveying the dry bottom ash, the economizers ash and the pre-heaters ash to a local 250cum silo (one silo per unit).
From these silos, the ash is first discharged onto dedicated rubber belt conveyors –also included in Magaldi scope- and eventually onto the main rubber conveyor collecting all the ashes produced by the plant.

The layout of the Unit #1 system was somehow easier to be developed, as the relatively wide space available offered the possibility of comfortably placing the local silo.

The situation for Unit #2 was different: the highly congested space below and around the boiler (mainly due to the very close position of Unit #3) required a delicate analysis as very few layout solutions were possible. At the end of an accurate study and thanks to the strong support of the plant management, it was eventually possible to identify the best technical solution, foreseeing a post cooler conveyor climbing over the electric and control building, reaching at its top an height of more than 37 meters from the ground: the highest ever for a post cooler handling bottom ash.

By 2016, the new management of the CFE Generaciòn II, with the full support of the Corporate in Mexico City, decided to restart the project and a new campaign of detailed site survey was conducted by Magaldi experts, again with the strong support of the plant management.

By mid 2017, all the technical issues had been faced and solved and the new complete layouts were ready.

The acquisition process was also long lasting: given the size and the magnitude of the project, CFE decided to produce a thorough investigation of the market in order to check if other possible suppliers could be available for such heavy-duty dry bottom ash handling systems.
Market for possible alternative solutions was therefore surveyed and the process ended up with a public tender issued in April 2018.
Upon issuance of the tender, all engineering was reviewed, further detailed investigations were carried out and technical solutions were sharpened. Magaldi participated to the tender and was eventually awarded the contract, which was signed in Guadalajara on June 8th, 2018.

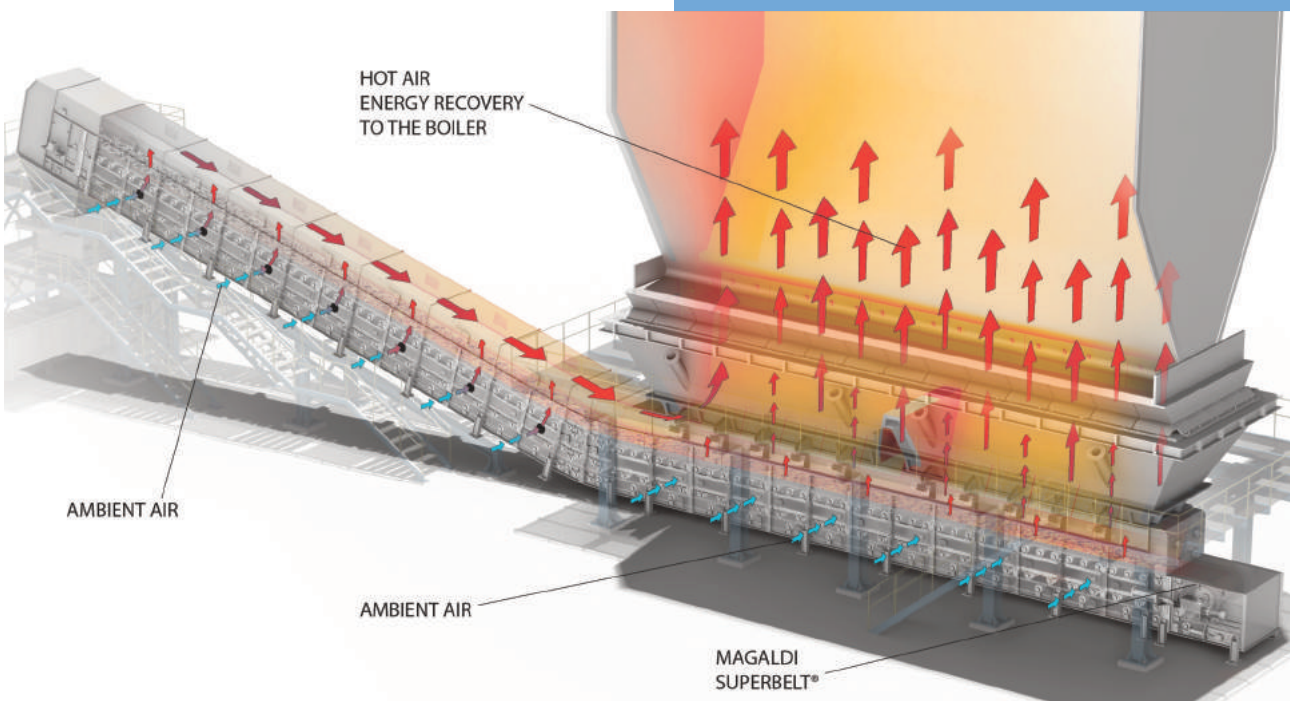
The plant is featuring some state-of-the-art solutions for handling and cooling very large quantities of bottom ash, all comprised in the SuperMAC® concept, including heavy-duty extractors, crushers and post coolers of latest generation, contact coolers, controlled cooling airflows.

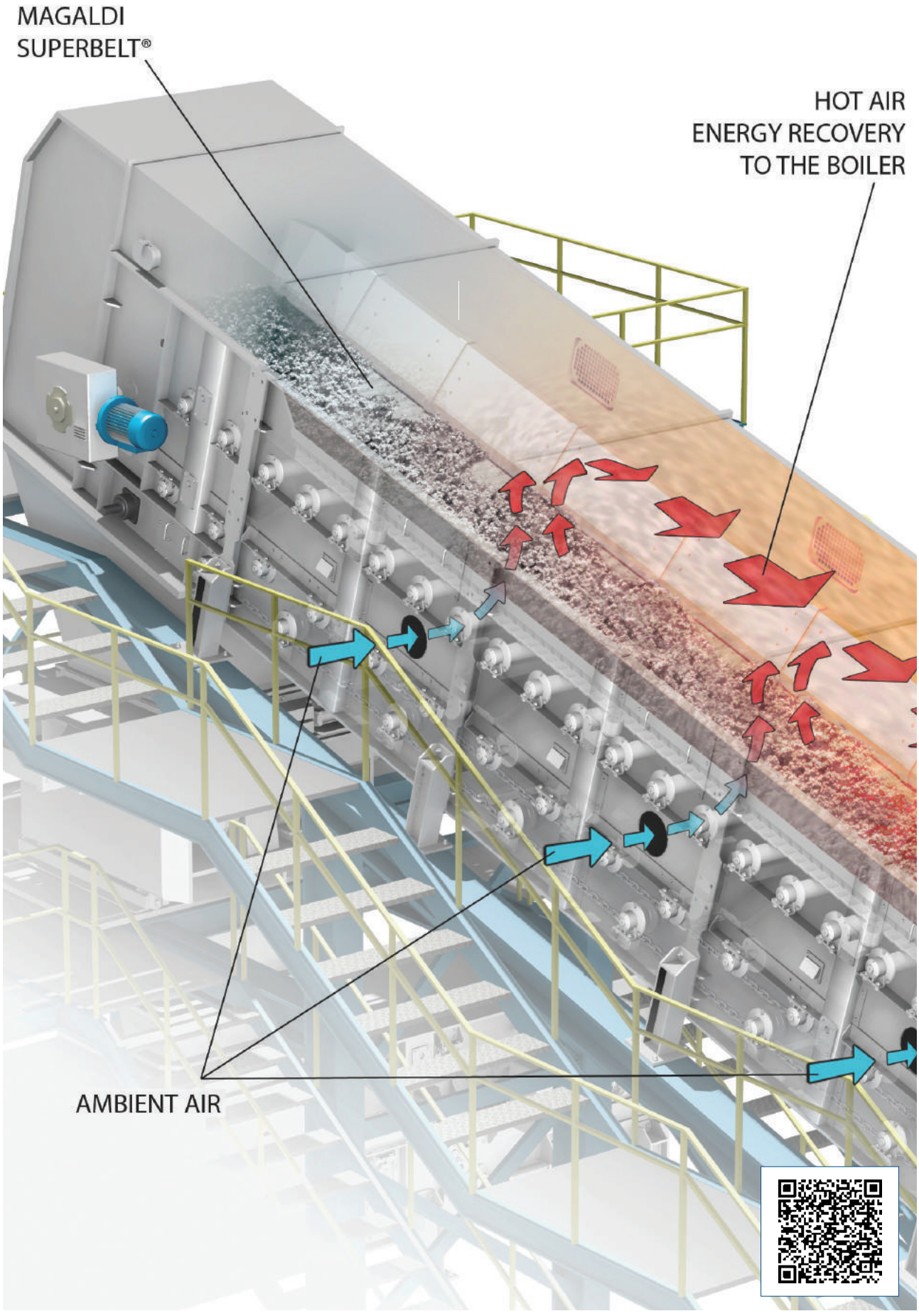
The installation of the units is scheduled to be started in early 2019 and commissioning is planned for mid 2019 (unit #2) and end of 2019 (unit #1).

THE REFORM OF THE MEXICAN POWER SECTOR

The reform of the Mexican power sector, aimed at a complete transformation of the Mexican electricity sector, was launched by an initiative of President Enrique Peña and was officially presented to the Congress of the Union of Mexican States in August 2013.
The reform came into force on December 20th, 2013.

The "Ley de la Industria Eléctrica" (LIE, Law of the Electric Industry) has the purpose to promote the sustainable development of the electric industry and to guarantee its continuous, efficient and reliable operation, as well as the execution of the obligations of public and universal service, of clean energy production and of reduction of polluting emissions.
The 38,000 MW of new capacity that the National Electric System (SEN) will require in next 10 years will be installed in regime of free competition, through the new "Mercado Eléctrico Mayorista" (MEM). In a similar manner, for the users having a minimum demand (initially →3MW, representing more than 20% from the total consumption of energy to national level) it will be possible to acquire electric power from CFE or from private companies through not regulated rates, thus encouraging the competition among the different suppliers.
The "Ley de la CFE" (Law of the CFE) has the object of regulating the organization, administration, procedures, operation, control and evaluation of the Comision Federal de Electricidad, which is turned into a productive company of the State, as well as to establish its special regime regarding subsidiaries and productive companies, payments, acquisitions, leases, services and works, responsibilities, budget.
Through this law, CFE will become a productive company of the State. It will be endowed flexibility of decisions at Corporate level and adequate business moto compete in equal terms within the course of the new electric sector.




MAGALDI
SUPERBELT®
HOT AIR
ENERGY RECOVERY
TO THE BOILER
AMBIENT AIR

MAGALDI DRY TECHNOLOGY TO FACE "EL NIÑO" PHENOMENON

THE ENVIRONMENTALLY-FRIENDLY SOLUTION FOR TERMOZIPA POWER PLANT

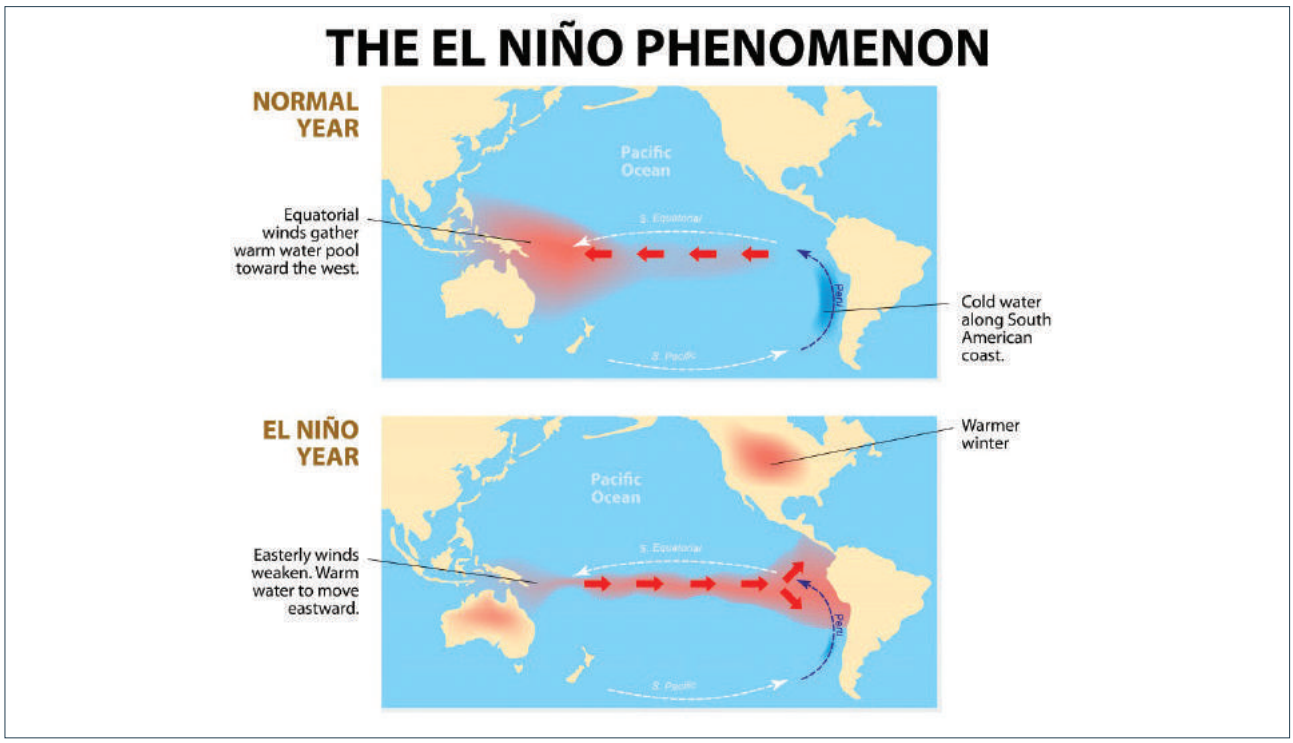
Emgesa S.A. awarded Magaldi to supply its Dry Bottom Ash Handling technology to be installed at Termozipa Power Plant, in Colombia, as dependable and environmentally-friendly solution to face "El Niño" phenomenon.

THE COLOMBIAN ELECTRICITY SECTOR VS. "EL NIÑO"

Historically, the main source of power in Colombia is hydropower: 80% of the Country's electricity is generated from hydroelectric power and the remaining 20% comes from thermal energy.
During periods of drought, hydroelectric plants tend to protect water reservoirs and thermal plants – mainly based on gas and coal - start to operate, reaching a generation peak of 40% of the total demand.

In recent years, Colombia has faced its most challenging energy crisis due to catastrophic effects procured by "El Niño". This weather phenomenon represents the "warm phase" of a larger phenomenon known as "El Niño-Southern Oscillation" or "ENSO", causing the unusual warming of surface waters in the eastern tropical Pacific Ocean.
El Niño affected the Country, leading to extreme drought, high temperatures and forest fires, undermining the stability of the Country's energy supply.

To cope with this emergency, Colombian thermal power plants had to start generating electricity at the maximum output and plan investments to avoid experiencing the same difficulties in the future.
Emgesa S.A., one of the main player in the Colombian energy sector, decided to invest billions of Colombian pesos in maintenance and modernization of its thermal power stations to ensure the reliability of its operation for the next 20 years.



EMGESA ECO-FRIENDLY CHOICE FOR TERMOZIPA POWER PLANT

Operating as a subsidiary of the Italian ENEL Group, Emgesa S.A. is devoted to electric power generation and trading in Colombia where owns and manages 10 hydroelectric generation plants and 2 thermal electric power plants in the departments of Cundinamarca and Bolívar.

In 2017, Emgesa S.A. chose to entrust Magaldi with the supply of its dry bottom ash handling technology to be installed at the coal-fired Martín del Corral (Termozipa) Power Plant.

Located in the industrial area of Tocancipa, Termozipa Power Plant has a total installed generation capacity of 236 MWe: unit #2 is designed for a gross electrical output at nominal load of 38 MWe while units #3, #4 and #5 have a gross electrical output of 66 MWe each.
All generation units are based on a pulverized coal-fired (PC) boilers configuration.

THE TECHNICAL SOLUTION

To carry out maintenance and modernization activities at Termozipa Power Plant, Emgesa S.A. was supported by a team of high qualified engineers from the Italian ENEL Group, who took care of assembly and test supervision to comply with the Customer's high safety standards.

As part of the improvement plan, Emgesa S.A. decided to retrofit the existing wet system by installing the Magaldi dry bottom ash handling technology.

The MAC® (Magaldi Ash Cooler) is a unique system for dry extraction, air cooling and mechanical handling of bottom ash from pulverized coal-fired boilers.

By using a small quantity of ambient air for cooling, the MAC® technology eliminates all serious problems associated with the use of water, in compliance with the most stringent environmental regulations and ensuring continuous operation without the risk of unexpected failures.
No boiler shutdowns are guaranteed by the "multi-link" design of the steel belt (Superbelt®) realised according to a "damage-tolerant" approach ensuring continuous ash removal, low wear, low power demand, long service-life, low O&M costs and safe operation.

At Termozipa Power Plant, four MAC® systems have been installed under units #2, #3, #4 and #5 to increase the plant dependability and generate clean energy.
The first MAC® system is fully operational since July 2018, the second one was installed last September while the start-up for the remaining two systems was respectively performed in November 2018 and January 2019.
Magaldi took care of the supply of the complete solution for bottom ash removal, from the boiler terminal points up to the discharge into open trucks, including electrical equipment, steel support structures and the BA storage silo.

Unit size: 3x66 MWe + 37.5 MWe
Project type: Retrofit
Ash rate: 1 t/h
Ash rate max: 1.6 t/h
Burned fuel: Coal

5

THE EUROPEAN INDUSTRIAL EMISSION DIRECTIVE N. 2010/75/EC

MAGALDI DRY BOTTOM ASH HANDLING SYSTEM AS BEST AVAILABLE TECHNOLOGY

The Magaldi Dry Bottom Ash Handling System is nowadays seen by EU Member States as the most advanced and recommended technique for bottom ash handling in LCP.

INTRODUCTION

In 2010, the European Union adopted Directive nr. 2010/75/EC which limits the emissions of polluting substances from industrial installations, safeguards human health and the environment.
Only power plants able to fulfil EU's strictest emission requirements are granted by national authorities to operate.
Art. 15 of Industrial European Directive (IED) nr. 2010/75/EC established the basis for setting permit conditions to operate power plants.
In particular, the Reference Document on Best Available Techniques (BREFs) for Large Combustion Plants (LCP) stated the necessity to adopt the dry Bottom Ash Handling System due to the lower environmental impact and the higher efficiency it can grant.

BEST AVAILABLE TECHNIQUES FOR LCP

The term BAT (Best Available Techniques) includes a number of available techniques which are the best for preventing or minimizing emissions and impacts on the environment.

- **"Best"** as most effective in achieving a high general level of environmental protection.
- **"Available"** refers to those techniques developed on a scale which allows implementation in the relevant industrial sector, under economically and technically viable conditions, taking into consideration costs and advantages, as long as they are reasonably accessible to operators.
- **"Techniques"** includes both the technology used and the way in which the installation is designed, built, maintained, operated and decommissioned.

The BATs for a given industrial sector are described in the BREF, which is the result of an information exchange between EU Member States, the industries concerned, non-governmental organizations promoting environmental protection and the European Commission.

COMMISSION IMPLEMENTING DECISION (EU) 2017/1442 OF 31ST JULY 2017

In July 2017, the final LCP BREFs with revised BAT conclusions were finally adopted by the EU. Since then, all EU Member States' competent authorities will have four years to ensure that:

- all permit conditions have been updated to reflect the new BAT conclusions;
- all installations comply with the new permit conditions.

The BREFs BAT conclusions for large combustion plants are binding: within 4 years from 31/7/2017 it is recommended to all existing plants to replace the wet ash handling systems with dry ones.
The BAT conclusions always allow to use different techniques if the one proposed cannot be applied due to objective reasons. Local permitting authorities will halways have the last word.

LARGE COMBUSTION PLANT (LCP) MEANS:

- plants for the combustion of fuels with a total rated thermal input of 50 MW or more;
- gasification of coal or other fuels in installations with a total rated thermal input of 20 MW or more;
- disposal or recovery of waste in waste co-incineration plants for non-hazardous waste with a capacity exceeding 3 tons per hour or for hazardous waste with a capacity exceeding 10 tonnes per day.

FROM THE WET SYSTEM TO THE MAC® DRY BOTTOM ASH HANDLING SYSTEM

In 1980s, Magaldi invented the Dry Bottom Ash Handling (DBAH) technology as alternative solution to the more polluting and less performing wet technologies.

In Wet Bottom Ash Handling Systems (WBAHS), bottom ash, including its content of unburned particles, is quenched in a water bath. Burn-out of unburned carbon is stopped abruptly when ash falls in the water bath. Therefore, relevant unburned chemical energy is lost.
Conversely, the MAC® (Magaldi Ash Cooler) system is able to recover energy from bottom ash, avoid the use of water as cooling medium, reduce maintenance costs and improve boiler efficiency.

In fact, it is a unique system for dry extraction, air cooling and mechanical handling of bottom ash from pulverized coal-fired boilers.

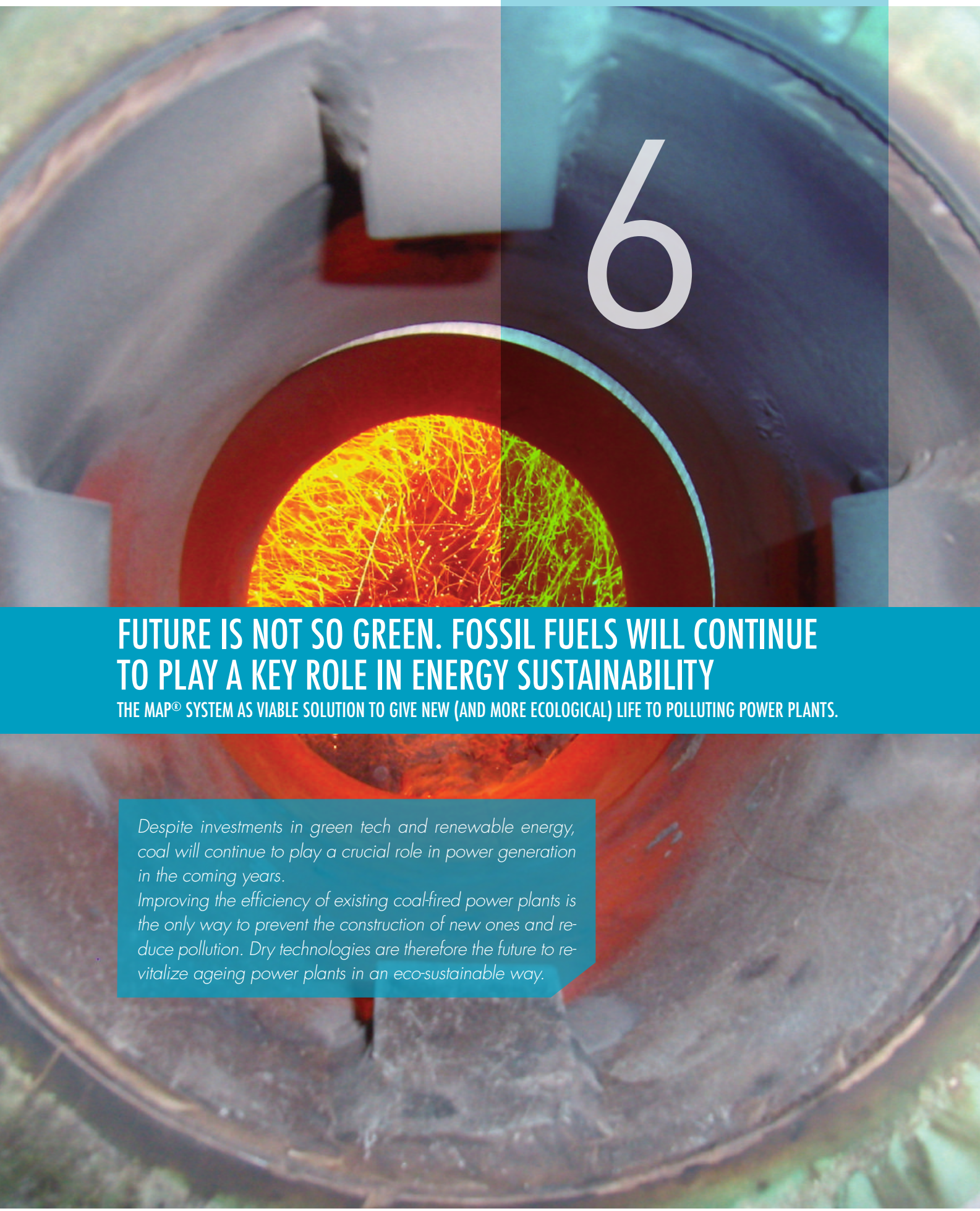
The absence of water allows carbon to continue the combustion process also below the boiler throat: unburned material is able to keep burning, thus recovering back to the boiler relevant heat, otherwise lost in the water quenching.

Ash cooling is carried out by ambient air, naturally drawn into the system by the negative pressure of the furnace. This flow of hot air creates a hot and oxidizing atmosphere in the lower part of the boiler (immediately above the boiler throat), which promotes reduction in UBC, and recovers a significant amount of energy in the form of ash sensible heat, ash chemical energy from unburned particles and boiler radiation flux through the throat.

Compared to conventional wet systems, the MAC® is able to improve boiler efficiency by a factor in the range 0.1÷0.6%, depending on the coal properties and ash rates, calculated within the framework of ASME PTC4-2013.

It also guarantees high reliability - as proven by millions of trouble-free operating hours - thanks to its construction features and the use of the Superbelt®, a steel belt conveyor characterized by a damage-tolerant design that eliminates any risk of sudden failures, otherwise always occurring, especially with hot and abrasive materials, when using chain conveyors.

To date Magaldi has installed 230 dry systems worldwide (of which 35% in Europe) under utility and industrial boilers of any size and burning any kind of solid fuel, thus establishing itself as technology provider committed to relentless improvement and forward-thinking sustainability.



6

FUTURE IS NOT SO GREEN. FOSSIL FUELS WILL CONTINUE TO PLAY A KEY ROLE IN ENERGY SUSTAINABILITY

THE MAP® SYSTEM AS VIABLE SOLUTION TO GIVE NEW (AND MORE ECOLOGICAL) LIFE TO POLLUTING POWER PLANTS.

Despite investments in green tech and renewable energy, coal will continue to play a crucial role in power generation in the coming years.
Improving the efficiency of existing coal-fired power plants is the only way to prevent the construction of new ones and reduce pollution. Dry technologies are therefore the future to revitalize ageing power plants in an eco-sustainable way.

ELECTRICITY GENERATION WILL STILL DEPEND ON FOSSIL FUELS

Electricity generation through the use of fossil fuels is a foundational pillar to modern society.
As a recent study by VGB Powertech is reporting, one quarter of the global population today have no access to electricity. With global population increasing by 78 million people, electricity consumption and demand will grow up very fast in the next years.

According to IEA (the International Energy Agency), in the next 25 years fossil fuels will continue to cover most of the electricity demand. In 2040 they will still account for about 30% to 60% of electricity generation worldwide.
Renewable energy sources will of course play a growing role likewise nuclear power which will maintain an important position in the global energy generation.
The most effective way of benefitting from continuing to use fossil fuel plants while reducing GHG emissions has proven to be by increasing the energy efficiency of existing power plants.

There is a direct, inverse correlation between running a fossil fuel fired power generator at higher efficiency and reducing the generator's CO_2 emissions. It can be assumed that for each 1% increase in efficiency of a coal burning power plant there is a 2-3% reduction of CO_2 emissions.

Improving energy efficiency has been a focus of intensive energy research over the past two decades, which produced as a result technological innovation.

In Eastern Europe, many Countries still rely on coal-fired power plants equipped with obsolete technologies never upgraded due to lack of investment funds.
In Ukraine, for example, nearly 75% of its thermal power capacity is more than 40 years old with a thermal power fleet that runs at an average load capacity of 31.5%.
To solve this problem, new goals aiming at increasing the energy efficiency of coal-fired installations have been set.

LIGNITE POWER STATIONS ARE THE LARGEST INDIVIDUAL SOURCES OF ATMOSPHERIC EMISSIONS

Historically, electricity production has been built upon fossil fuels because of their abundance and low cost.
Power plant technologies needed to convert fossil fuels into electricity also become widespread because easy to construct without high CAPEX and therefore suitable for economies of scale.

With the growth in electricity demand and production and the need for secure and stable supply, fossil fuels will deeply be engrained into the energy foundation on which modern societies are built upon. However, the high carbon content of fossil fuels makes them a

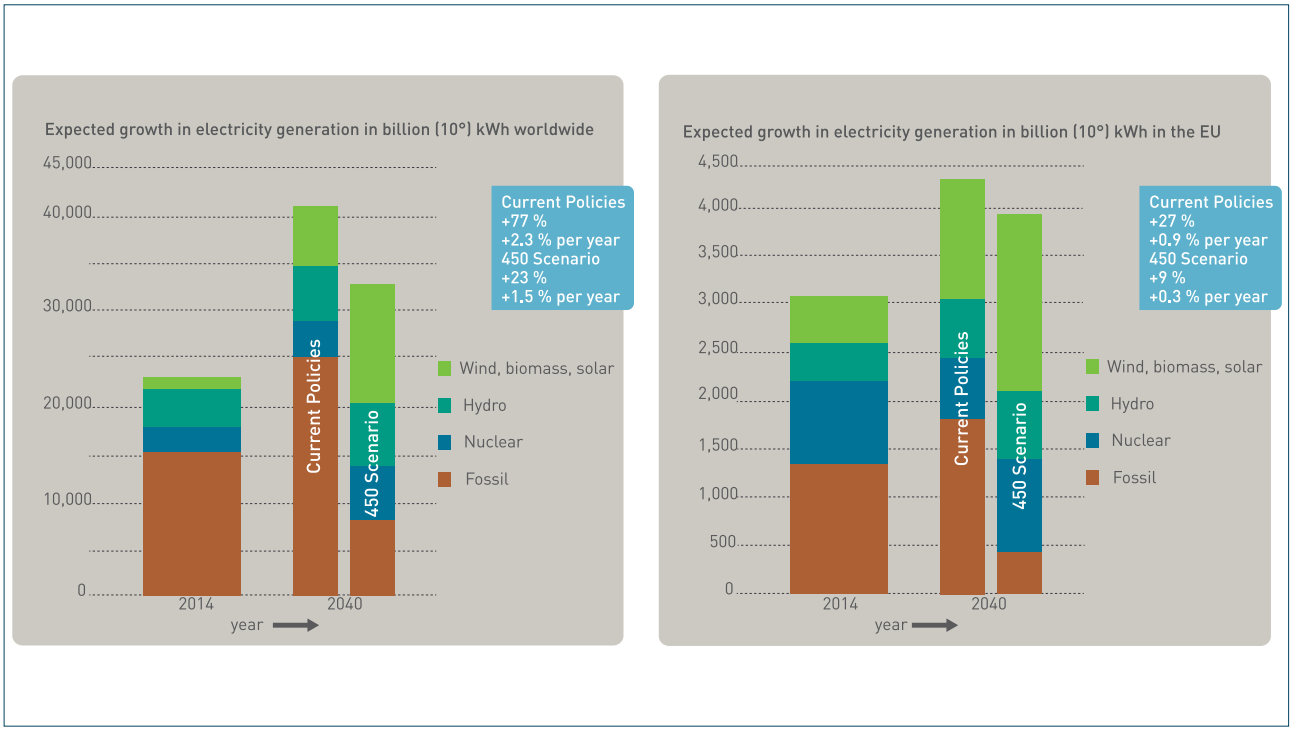


Figure 1: expected growth in electricity generation.

major contributor to rising CO_2 levels in the atmosphere.

European fossil fuel reserves account for only 3,5% of the known reserves worldwide, consisting mainly of lignite and hard coal. Europe's dependency on imported coal will grow in the next years because of decreasing energy reserves that can be produced at a competitive price.
In some European countries where lignite is produced at a high rate, it remains the only fuel that can still be mined in the long term (see figure 2 below, source Eurocoal).

Burning inferior-grade lignite delivers less energy than hard coal, natural gas or even firewood. As a result, considerable amounts of fuel – three times the quantity of regular black coal per Watt – are required for electricity generation with consequent carbon dioxide emissions increase.
Lignite power stations are, therefore, the largest individual sources of CO_2, mercury, particulate matter and other airborne pollutants.

MAP® SYSTEM: THE BEST AND ENVIRONMENTALLY-FRIENDLY CHOICE TO UPDATE AND IMPROVE THE EFFICIENCY OF "OLD AND TIRED" POWER PLANTS

Among the patented technologies designed by Magaldi to improve the overall effectiveness of coal-fired power plants, we can find the MAP® (Magaldi Ash Post-combustor).
Conceived as development of the MAC® dry system, the MAP® is able to extract, convey and cool bottom

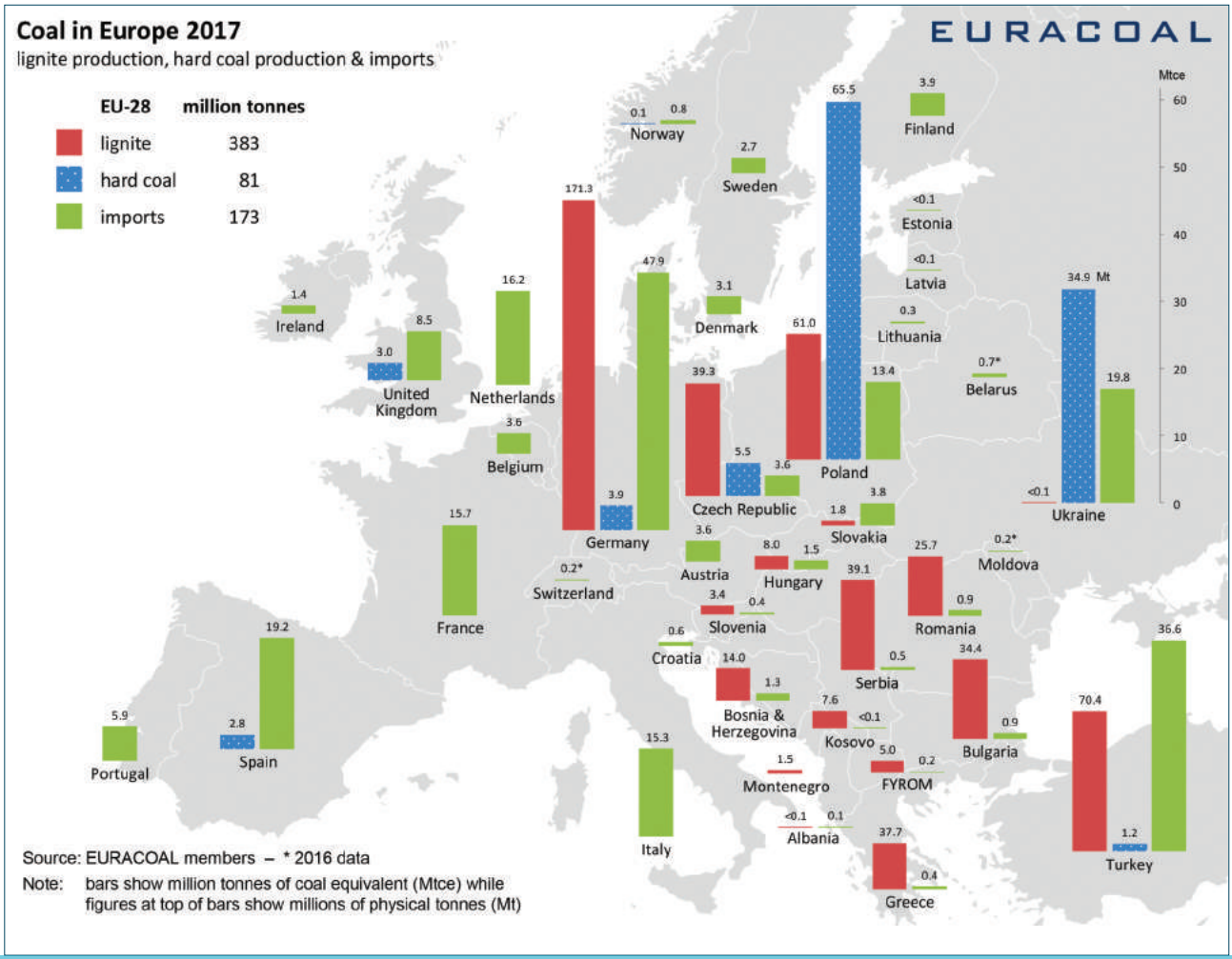


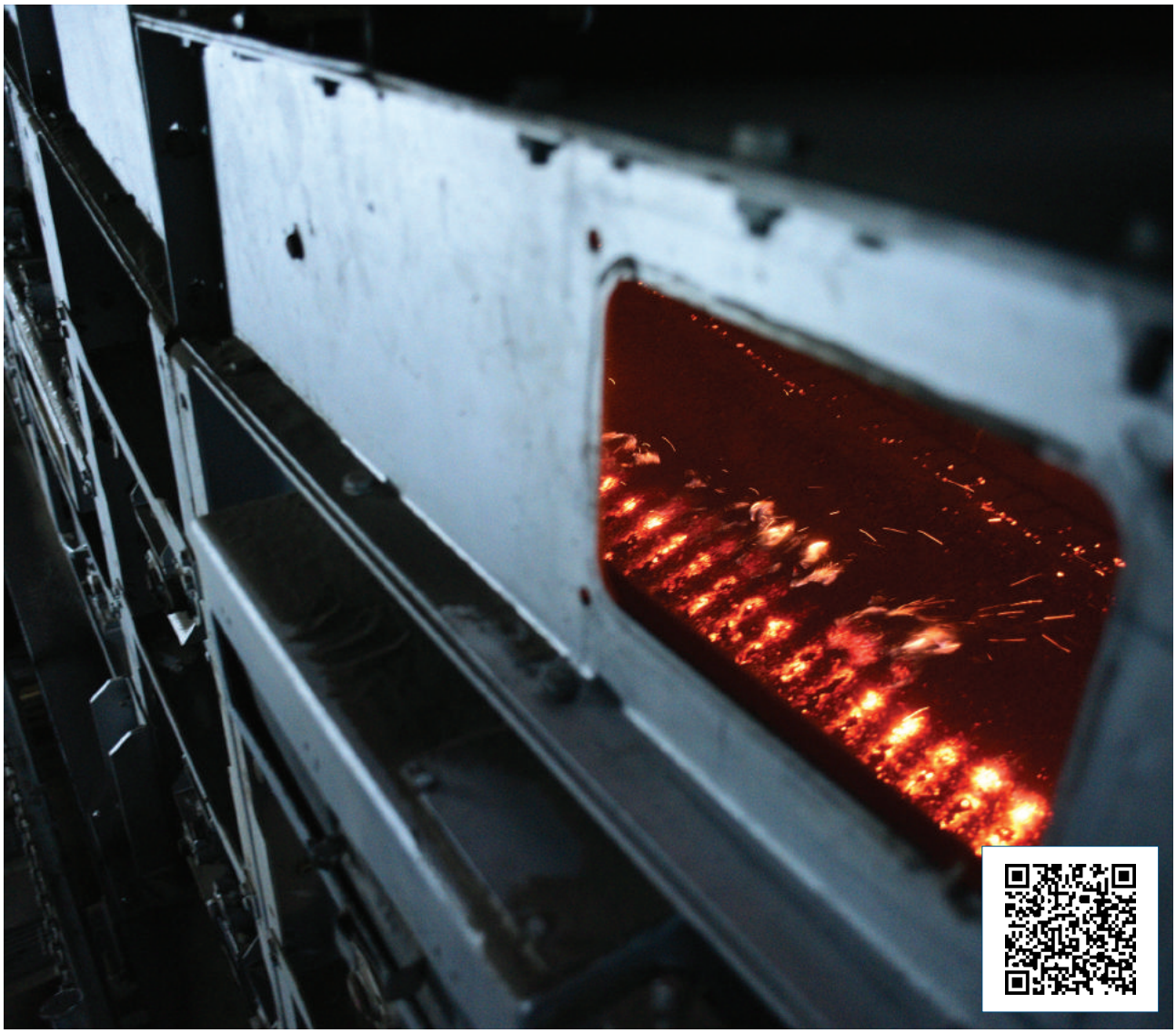
Figure 2: coal in Europe, 2017 production rates

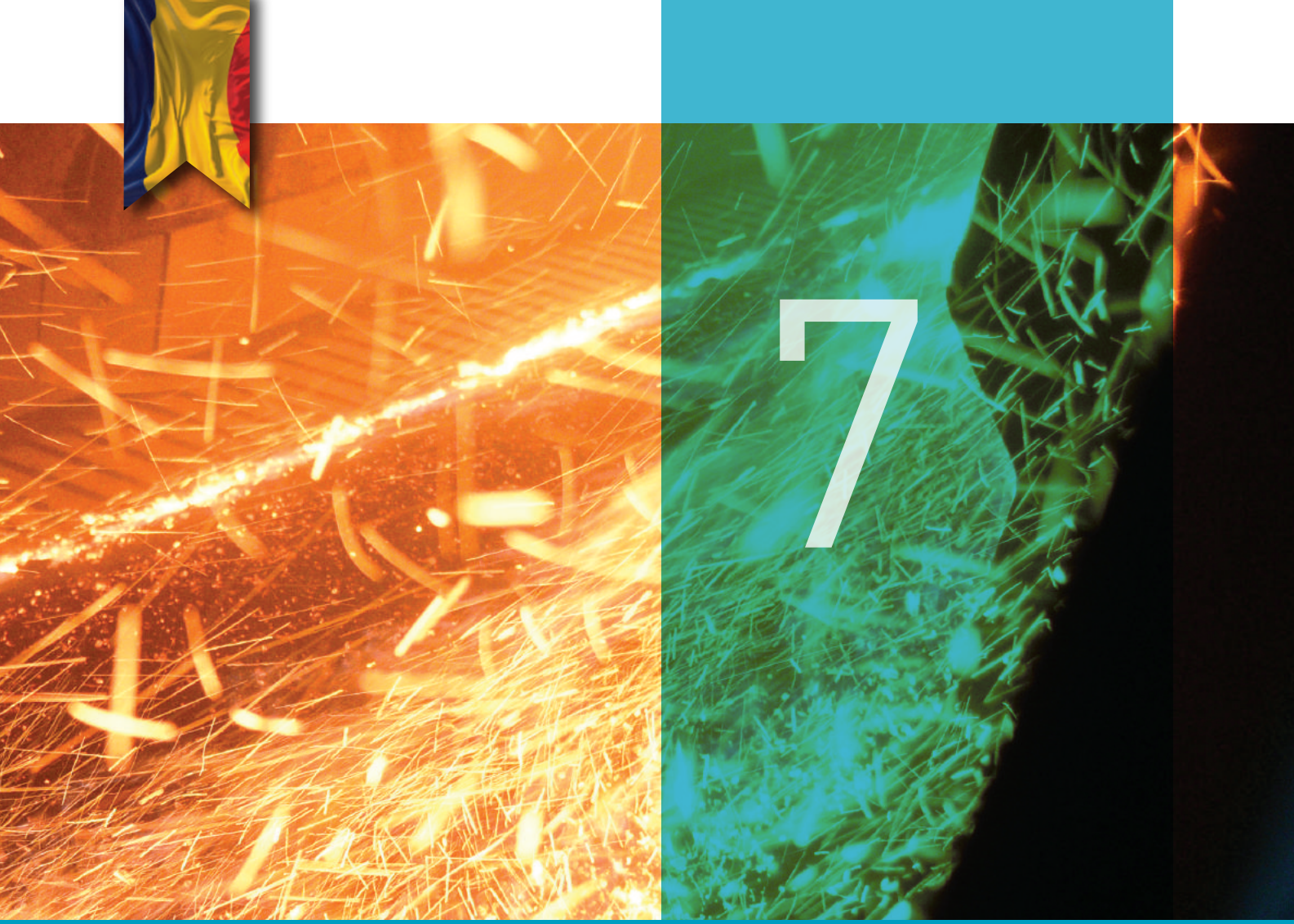
ash in a completely dry way and, in addition, to control and enhance the post-combustion process of unburnt particles on the steel belt (Superbelt®).

It perfectly suits all applications with high unburnt content in BA. This is typical with PC boilers burning lignite or in case of co-combustion with fuels having slower combustion kinetics (e.g. biomass, RDF).
When the fraction of coarser lignite/biomass/RDF (d>1.0÷2.0 mm) remains in the combustion chamber for a time not long enough to burn completely, it falls down into the bottom hopper, appreciably increasing the content of unburnt carbon in bottom ash.
The MAP® system is able to enhance its oxidation, reducing the restrictions on co-fuel size distribution and mixing conditions. The unburned carbon (UBC) content of ash is reduced by a percentage that varies from 15 to 40%, corresponding to a huge generation of energy on the belt.
Thanks to the strong UBC reduction obtained, the MAP® system is able to recover and send back to the boiler all the chemical energy contained in bottom ash, otherwise lost in the water bath of conventional wet systems, leading to a substantial boiler efficiency increase which in turn will imply a reduction of GHG emissions.

As it was clear analyzing the yields of power plants that decided to take advantage of the dry technology, the MAP® system provides additional benefits such as:

- No "overheating" problems that affect chain conveyors;
- Unburnt carbon content in BA decrease. A better BA quality;
- Enhanced lignite/biomass/RDF post-combustion on the belt;
- Increased boiler efficiency;
- Increased maximum size of lignite/biomass/RDF particles feeding the combustion chamber;
- Reduced power consumption.





7

ROMANIA BIDS ON UPGRADING AGEING COAL-FIRED POWER PLANTS TO ALIGN WITH EU STANDARDS

IȘALNIȚA LIGNITE-FIRED PLANT TO BENEFIT FROM MAGALDI DRY ASH POST-COMBUSTION SYSTEM, DRAMATICALLY REDUCING FUEL CONSUMPTION AND CO_2 EMISSIONS.

The Romanian power plant achieved an increase in efficiency of more than 2% as a result of the wet-to-dry conversion of the bottom ash handling systems. The MAP® technology installed for dry BA extraction and afterburning process allowed to eliminate the use of methane as auxiliary fuel to ensure a stable combustion process, reduce lignite consumption and CO_2 emissions.

MODERNIZATION AND EFFICIENCY PROGRAM IN ROMANIA

According to a Greenpeace report, more than half of Romania's 28 coal-fired plants are operating without environmental permits or are missing important upgrades that would make them less polluting.
Although more than a third of the Country's electricity is produced by ageing technologies that are at the core of the majority of Romanian power plants, the Energy Ministry said they will continue to do so for some time because clean energy alternatives take time to develop.

But power companies are in the grip of the constraints imposed by the European Union which has set stricter limits on emissions, giving power stations until 2021 to comply.
For Romanian coal-fired power plants, the route is taken: conform to environmental and energy efficiency requirements or shutdown.

The Energy Strategy outlined by government authorities has confirmed the role of traditional fuel (lignite, hard coal, oil, gas) in the energy mix, as long as power plants will get in line with technology advances made in the rest of the European Union.
To do so and in order to implement the UE 2004/8/CE directive (later amended by UE-92/42/CE) referring to measures for increasing energy efficiency by upgrading the energy production facilities, the Romanian government has launched a program including aids for investments, exemption, drop-off taxes and green certificates.

Several power plants, including Işalnita lignite-fired power station, have taken advantage of these incentives to start maintenance and upgrade works.

NATIONAL INCENTIVES TO MODERNIZE IŞALNIŢA LIGNITE-FIRED POWER STATION

Sucursala Electrocentrala Işalniţa is a large lignite-fired thermal power plant located in Dolj County, approx.10 km north west from Craiova. It is owned by Societatea Complexul Energetic Oltenia S.A. (CE Oltenia), which is the sole lignite producer in Romania and one of the major players in the energy services sector.

Driven by the need to modernize the plant and enjoying incentives provided by the Government, in 2016 CE Oltenia decided to invest in the refurbishment works of the bottom ash discharge installation systems at Unit 7 (315 MWe) and signed a contract with GE Power Romania for the turnkey supply of the above system.
Unit 7 includes two steam generators with 510 t/h capacity and, under maximum load, each boiler burns 220 t/h of lignite. Methane was also used as flame to support fuel, with a contribution to heat of maximum 10% (corresponding to 4500 Nm^3/h).
The plant was suffering from frequent failures of the Submerged Chain Conveyor (SCC) which caused boiler shut downs and consequent high maintenance costs.
A big amount of water was used by the SCC and high power consuming equipment were necessary to re-circulate and treat water. Furthermore, the SCC was installed in a pit below the ground - a dirty and dangerous environment - where a mix of water and ash was permanently lying on the pit floor.
CE Oltenia also had to face problems related to the combustion process which generated very high UBC content (up to 55%) so that a higher amount of methane, used to have a stable combustion process, significantly increased the power generation unit cost.
For all those reasons, the Company was looking for an alternative technology able to:

- reduce operating and maintenance costs;
- eliminate water consumption rate;
- improve system availability;
- increase boiler efficiency and decrease fuel consumption;
- cut the amount of methane admixture in the combustion process from 4.5 - 5.5% to a max. value of 1.5%.

To achieve these goals, GE Power Romania choose in turn Magaldi to supply its dry bottom ash handling technology.

MAGALDI ASH POST-COMBUSTOR: INCREASE IN BOILER EFFICIENCY, DECREASED EMISSIONS AND REDUCTION IN FUEL CONSUMPTION AMONG THE BENEFITS PROVIDED

Magaldi has been the first Company worldwide to develop in 1980s the Dry Bottom Ash Handling (DBAH) technology, known as MAC® (Magaldi Ash Cooler).
In the MAC® system, the absence of water allows unburned material to keep burning even after the boiler throat and to send back to the boiler relevant heat which would otherwise be lost in water quenching.

In order to make the most of this potential, Magaldi has developed a specific system - the MAP® (Magaldi Ash Post-combustor) - capable of controlling and enhancing the post-combustion process in power plants burning lignite or fuels having slow combustion kinetics with consequent high unburned content in bottom ash.
To get an idea of what happens in both the MAC® and MAP® systems, we can ideally divide the process into three zones, from below the boiler throat up to the discharge of the MAC®/MAP® systems (see figure below):

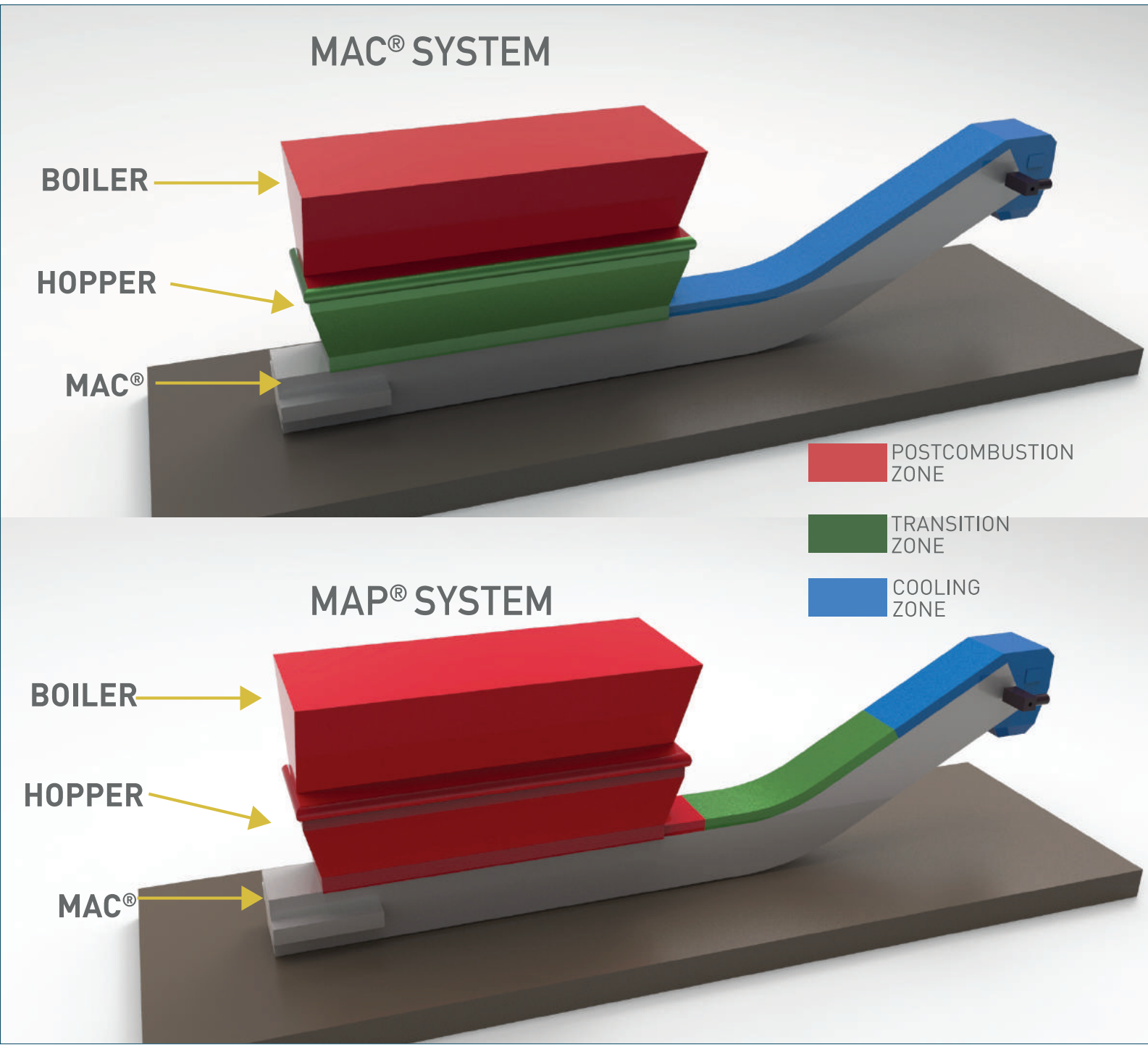
1) the "post-combustion" zone, where heat released from combustion of unburned residues is prevalent compared the cooling;
2) the "transition" area, in which both processes are more or less equivalent and there is no major change in temperature;
3) the "cooling" zone, in which combustion is almost completed and cooling takes place.

Depending on whether it is a MAC® or a MAP® system, the extent of these zones is different.

Unlike the MAC®, in the MAP® system:

- post-combustion continues on the belt, which is subject to higher temperatures;
- higher air rate is required to provide oxygen for post-combustion and to remove heat so generated. Air flows shall be optimized to improve post-combustion and cooling on the belt conveyor and to promote an intimate contact between oxygen in the air and unburned particles;
- the post-combustion process is designed considering the data provided from thermogravimetric analysis performed on ash and unburned samples;
- the post-combustion process is controlled by varying main parameters involved: the belt speed (which allows to modify the permanence time of the unburnt particles on the belt in the post-combustion zone), the amount of cooling air rate and cooling water rate (using appropriate spraying systems).

To implement the post-combustion control additional sensors and actuators are required.



THE MAP® SYSTEM CONFIGURATION AT IŞALNIŢA

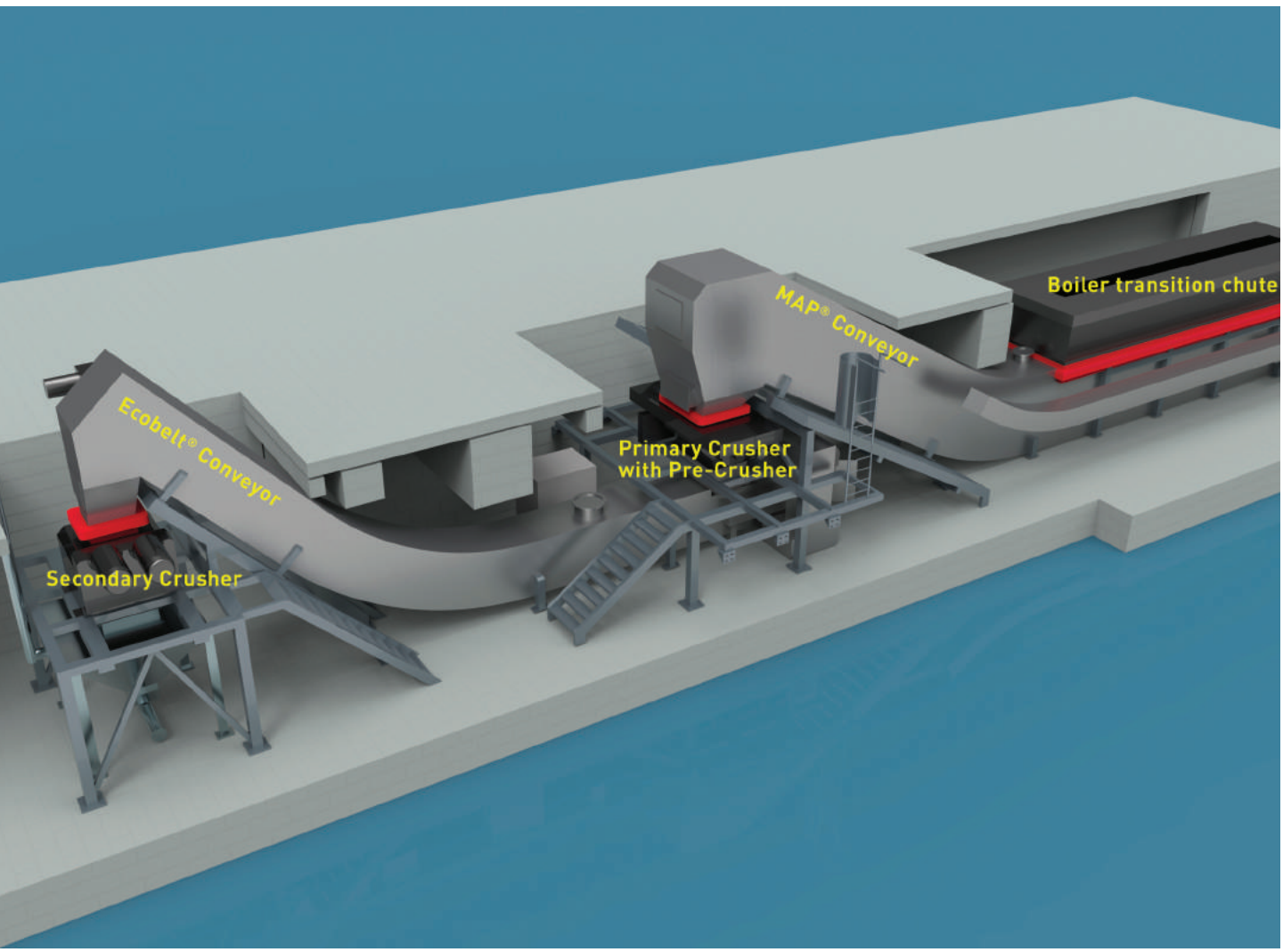
Installed below boilers 7A and 7B, the MAP® system includes:

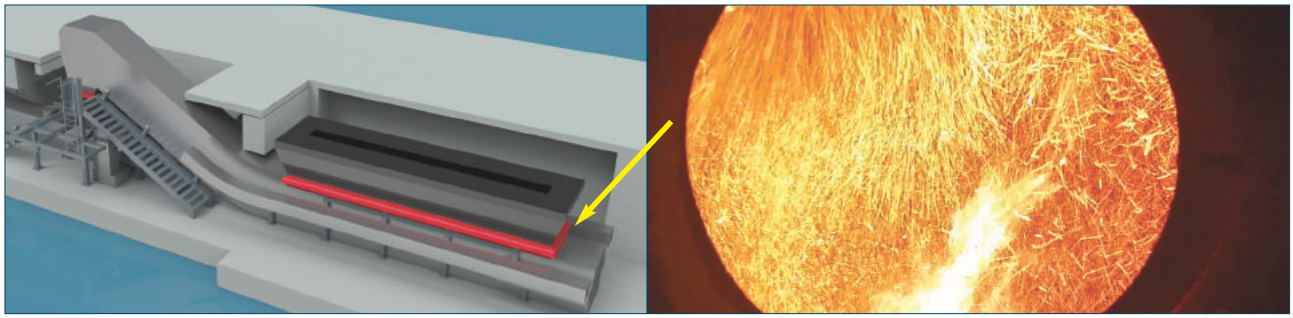
- the MAP® conveyor, connected to the existing boiler transition chute via a mechanical joint, to extract and promote post-combustion of bottom ash;
- the Pre-Crusher and Primary Crusher to reduce the ash particle size;
- an Ecobelt® conveyor, installed downstream the MAP® conveyor, for further ash transportation and cooling;
- a double roll Secondary Crusher to further reduce ash particle size up to 14 mm for the downstream slurry and high concentration slurry disposal systems.

Bottom ash falling from the transition chute is collected and conveyed in a dry way thus allowing to continue the combustion process. On the contrary, with the wet system, combustion is immediately interrupted when ash falls into the water basin.

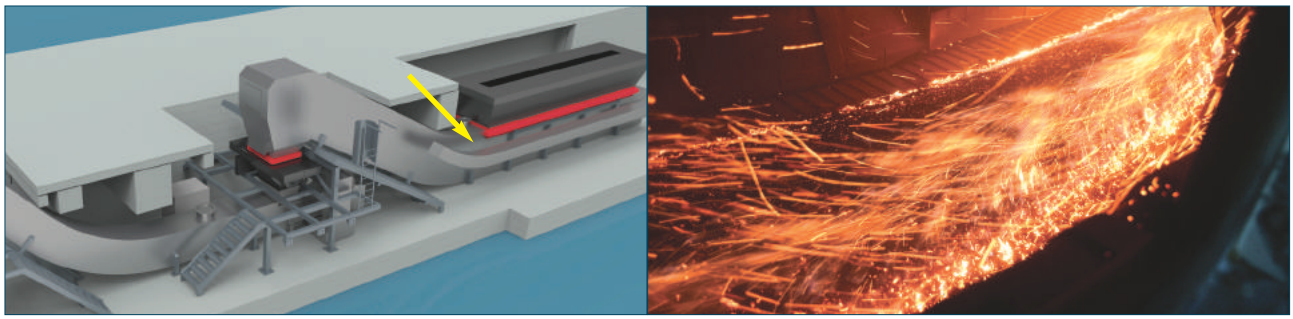
The MAP® extractor has been specifically designed to withstand heavy conditions and high temperature generated by the post-combustion process. In particular, steel skirt-boards have been replaced by refractory material and sensors while actuators and a spraying water system have been installed to control post-combustion.
Additionally, the Superbelt® (the patented steel belt running inside the MAP®) has been equipped with special slots to optimize the airflow passing through the ash and allow oxygen to reach hot residual carbon particles. In fact, drafted by the boiler negative pressure, ambient air enters through air intake valves placed on the casing below the belt. Flowing though the slots, air crosses the ash layer from bottom to top, thus creating an intimate contact between air and ash. Additional air flows above the belt. Both air flows entering the MAP® system can be adjusted.

The post-combustion process takes place throughout the whole transport up to the Ecobelt® (secondary) conveyor where combustion is almost extinguished. At this stage, ash is dry and cold (temperature lower than 100°C).

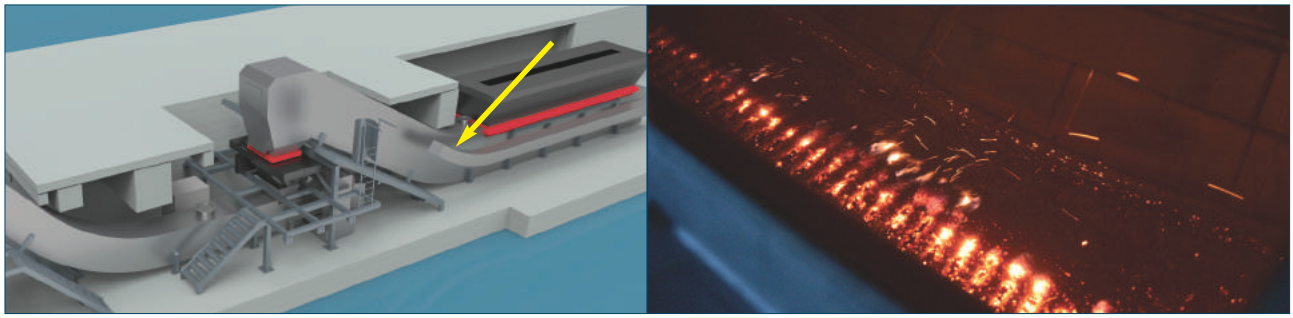




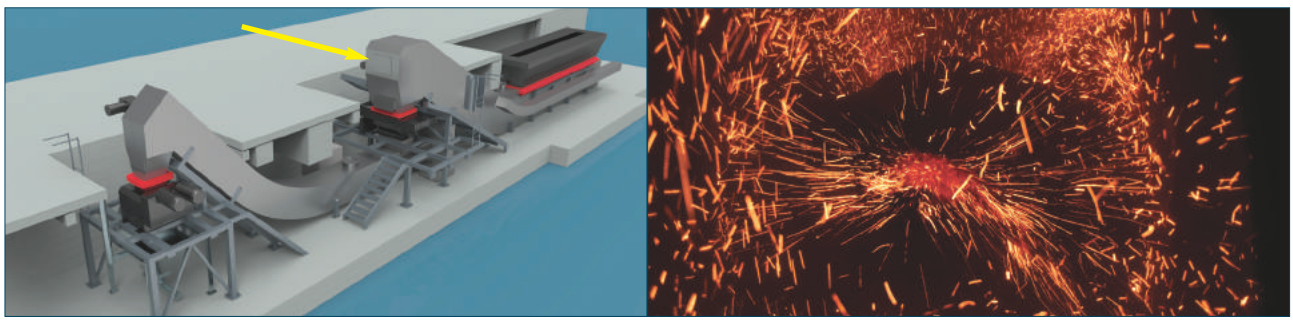
MAP® Post-Combustion from conveyor tail



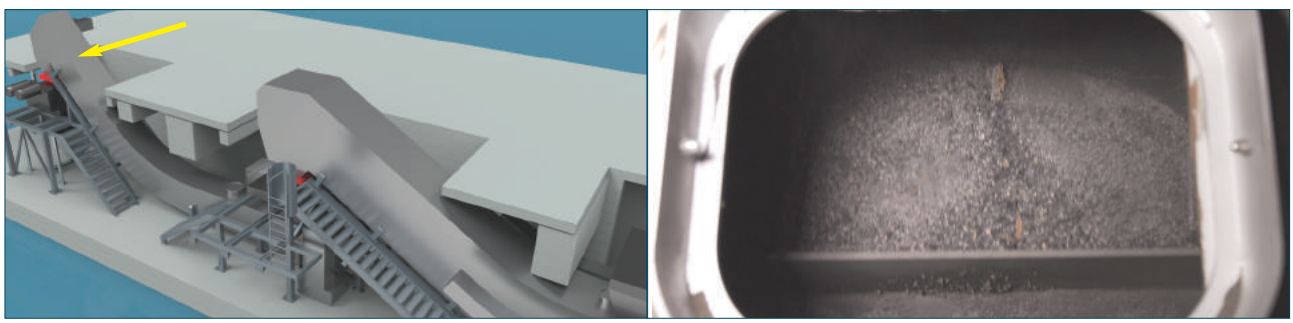
MAP® Post-Combustion on the Superbelt® (after Bottom Ash hopper)



MAP® Post-combustion on the Superbelt® (inclined section)



MAP® head section: Bottom Ash discharge



Bottom ash (extinguished and dry) on secondary conveyor Superbelt®

The MAP® system installed at Işalnita has been able to achieve a reduction in UBC content ranging from 15% up to 40%. This reduction corresponds to a significant generation of chemical energy which is recovered back to the furnace, thus increasing its efficiency of 2÷4 % (depending on operating conditions) and implying in turn a reduction of GHG emissions.

These data have been confirmed by tests performed by a third part Company (ICEMENRG -Rumanian National Research and Development Institute for Energy) comparing unburned residues and heat recovery before and after the wet-to-dry conversion.
All tests showed a reduction in the unburned residues from 32% ÷ 58% to 7% ÷ 15%.

Unburned residues – SCC system	**32% ÷ 58%**
Unburned residues - MAP® system	**7% ÷ 15%**
Heat recovery	**7.8 ÷ 21.1 MWt**

To summarize, thanks to the installation of the MAP® system, the Customer is benefitting from a drastic reduction in methane consumption. With the SCC, the average methane consumption for each boiler was 2000 Nm^3/h reaching up to 4500 Nm^3/h during the worst operating conditions.
After the MAP® installation, the use of methane has been dramatically reduced or completely eliminated in most operating conditions.
Considering 5000 operating hours for each boiler, methane saving is between 10 - 22.5 millions Nm^3 per year.

Additional advantages achieved with Magaldi dry technology concern:

- reduction in lignite consumption thanks to the boiler efficiency increase;
- higher combustion flame stability due to the contribution of hot air from bottom ash;
- decrease in water consumption and a cleaner ash handling area;
- higher dependability and lower O&M costs.

Unit size: 165 MWe
Project type: Retrofit
Ash rate: 6 t/h
Ash rate max: 10 t/h
Burned fuel: Lignite

Interview to Mr. Octavian Mitroi (Işalniţa Power Plant Senior Operations Engineer)

Which have been the main reasons to retrofit the wet bottom ash handling system with Magaldi MAP® system?

…Magaldi MAP® system was the optimum solution for us because costs of integration in boiler infrastructure was minimum. Also this system is one of the most advanced technique for the bottom ash handling; with very good references from the power plants from all over the world

MAP® system in Işalniţa

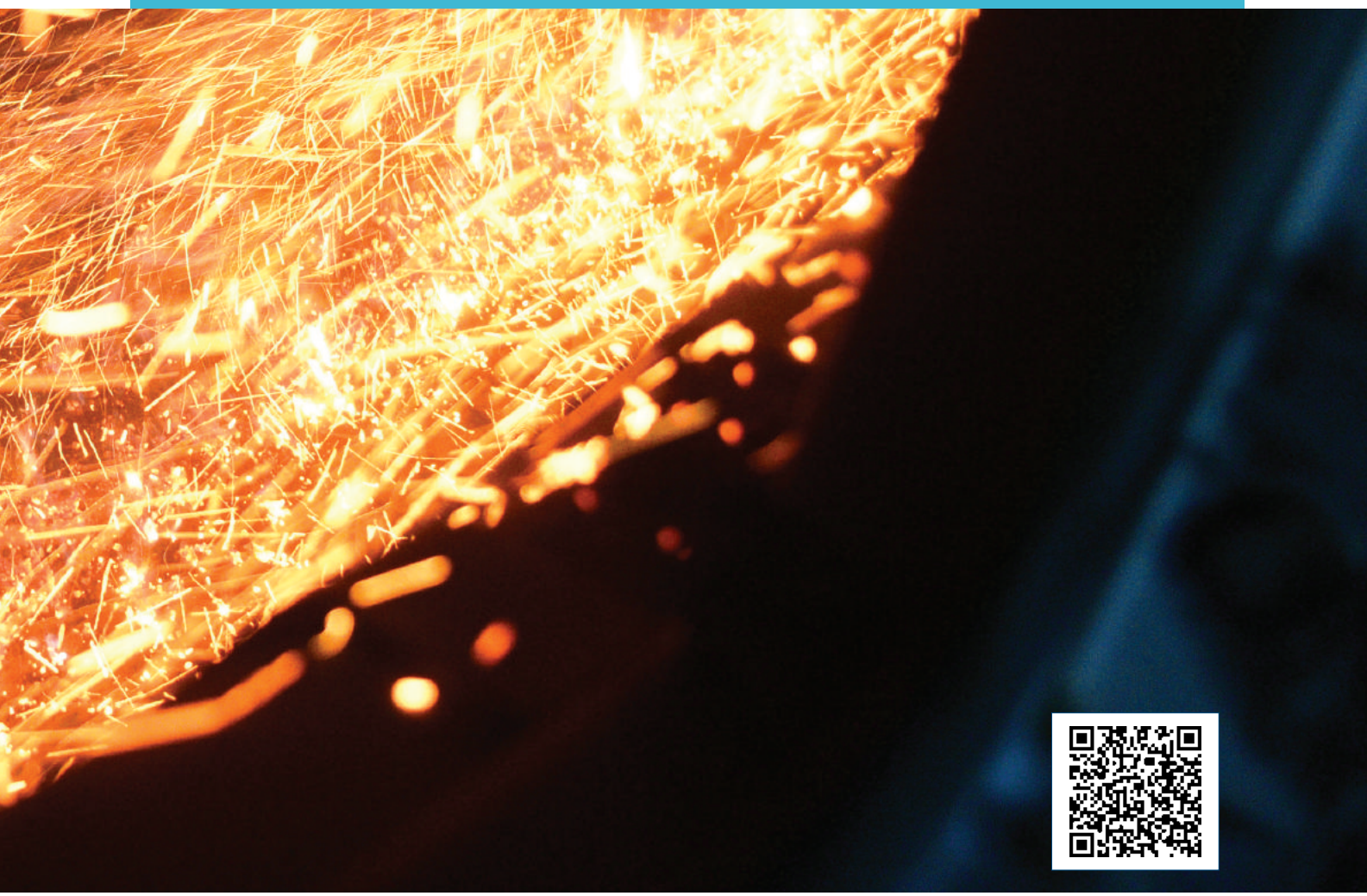
…We are very satisfied because the dry technology increase of the boiler efficiency and decrease of the power plant fuel by the postcombustion of unburned fuel in the bottom ash; it's a system with high reliability and low costs of maintenance, easy to operate from HMI interface.

What are the main advantages offered by the MAP® system in Işalniţa Power Plant?

…One of the main advantages, beside of fuel consumption reduction, is the decrease of the natural gas consumption, in the combustion process, from the value of 4,5-5,5% to a maximum value of 1,5% following the installation of the new dry bottom ash handling system.

Would you recommend the MAP® for other Power plants in case of high unburned content in Bottom Ash?

Certainly, as I mention Magaldi MAP® is one of the best technique for the bottom ash handling, Magaldi team can offer good solutions from the particularly case (like in our power plant) and assure technical support in and after warranty time.



8

LODGE'S RECIPE TO COMPLY WITH THE OSHA SILICA STANDARD

THE SUPERBELT® TECHNOLOGY TO REDUCE SAND LEAKAGE AND ENVIRONMENTAL CONTAMINATION FROM CRYSTALLINE SILICA IN FOUNDRY.

As part of a project to reduce workers' exposure to crystalline silica dust in its iron foundry in Tennessee, the cookware manufacturer Lodge chose Magaldi to provide a viable alternative to the conventional vibratory technology for casting conveying.

SILICA DUST GENERATION IN FOUNDRIES

Last June 23rd, the U.S. Occupational Safety and Health Administration (OSHA) issued its final rule for minimizing workers' exposure to respirable crystalline silica.

Silica dust represents one of the greatest risks to the health of foundry workers since the prolonged exposure to excessive concentrations of respirable, free crystalline silica dust can cause lung disease silicosis. .
In foundries, major operations producing fine silica dust are mould and core making, shakeout, castings cleaning and sand conditioning for re-use. Silica exposure can also occur during abrasive blasting and furnace maintenance.
Evaluation and control of such operations therefore deserve particular attention.

According to the OSHA's Crystalline Silica Rule, employers must protect workers from respirable crystalline silica exposure above the permissible exposure limit (PEL) of 50 µg/m3 of air, averaged over an 8-hour day.
With the new PEL already established, foundries are required to maximize their compliance efforts by implementing all measures necessary to keep operators away from noisy and dusty working conditions. This represents a big challenge, especially for steel and iron foundries where employees are often exposed to harsh working conditions due to the casting methods performed.

The most effective way for foundries to make the workplace safer and healthier is therefore to employ leading-edge technologies able to raise efficiency, reduce dust and spillage, and contribute to meet (and exceed) safety regulations.

SILICA CONTAINMENT IN MATERIAL HANDLING SYSTEMS: SUPERBELT® TECHNOLOGY VS. VIBRATING CONVEYORS

According to the American Foundry Society (AFS), in incidences of airborne-silica exposure, 25% can be attributed to the material handling of silica-bearing castings. In fact, the concentration of free silica in the air varies with the chemical composition of quartz sand, the physical state of sand (whether wet or dry), the efficiency of dust control and the handling process.

Of the foundry process variables affecting silica exposure potential, the material handling of silica-bearing materials is the most effective since dust control is facilitated when these materials are contained and prevented from falling on the floor, traversed by workers and vehicles.
During material handling, significant dust emissions can potentially be caused by:

- → conveyor belt spillage;
- → return belt shedding of dusty residue attached to castings;
- → dust dispersion due to vibratory conveyors.

Because of its operating model based on vibrations and shaking, the use of vibrating technology increases the potential that a large volume of silica dust will escape and dirty the surface area.

In addition to dust dispersion, this kind of technology gives rise to considerable noise levels, with potentially harmful effects on the hearing of exposed workers. In fact, noise is generated not only by the conveyor itself but also by the impact of the parts on the conveyor.
Unlike vibrating technologies, the Superbelt® offers a substantial contribution to the silica issue. Thanks to its smooth operation without vibrations or shaking, the Superbelt® conveyor is able to avoid dust dispersion into the environment and guarantee a longer service life since the absence of self-destructive shakings drastically reduce spare parts consumption.
Furthermore, designed to withstand heavy duty processing operations, the Superbelt® allows to use manipulators directly on the belt for sorting and de-gating operations thus removing operators from the environment and decreasing their exposure to silica dust.
As regards noise pollution, Magaldi technologies run at a noise level <80 dB(A). In this way, background noise is reduced and the workplace becomes healthier and more comfortable.

LODGE'S RECIPE: INCREASE SAFETY BY IMPROVING THE MATERIAL HANDLING SYSTEM

In 2016, with the OSHA silica rule on the horizon, the U.S. cast iron cookware manufacturer Lodge Ma-

nufacturing Co. got in touch with Magaldi to jointly evaluate the best solution to convey castings whilst reducing workers' exposure to silica dust in its foundry located in South Pittsburg, Tennessee.
Due to consumer demand exceeding the foundry capacity, Lodge was willing to start an expansion project to nearly double its capacity to make cast iron. The problem of airborne silica dust control could not be ignored.

Keeping in due consideration budget, existing installations and building layouts as major constraints, Magaldi was able to offer a viable and dependable alternative to conventional vibratory conveyors by providing its Superbelt® technology.

Since 2017, Lodge foundry is equipped with two Superbelt® that convey media (at a rate of up 150 t/h) back to the Didion drum.
A further set of Superbelt® conveyors has been installed to load the shot-blasting machine. In fact, the second major source of airborne silica dust is the sand still attached to castings headed toward the shot-blasting system.
Currently, Lodge is reaping the benefits of a dependable conveying solution that proved to be an effective alternative to conventional technologies.

Superbelt® 1 Length: 42.700 mm
Width: 1.200 mm
Height: 0 mm

Superbelt® 2 Length: 14.200 mm
Width: 1.200 mm
Height: 100 mm

Superbelt® 3 Length: 12.290 mm
Width: 1.200 mm
Height: 100 mm

Capacity: 16 t/h each
Temperature: 25 °C
Handled Material: Castings

9

THE SUPERBELT® TECHNOLOGY TO KEEP UP THE PACE WITH VICTAULIC'S DEMANDING PRODUCTION REQUIREMENTS

THE BEST WAY TO AVOID ACCIDENTAL OUTAGES, MINIMIZE DOWNTIME AND CONSEQUENT PRODUCTION LOSSES.

In 2015, Magaldi was involved in a project to replace a vibratory conveyor causing excessive downtimes of the scrap charging line in the Victaulic foundry in Alburtis, PA.

INCREASE PROFITABILITY AND PRODUCTIVITY BY ELIMINATING UNSCHEDULED STOPPAGE

Every second that a plant is down, throughput stops and a lot of money is wasted.

Downtime costs consist not only in loss of production of actual goods but also include loss in staff productivity, unexpected costs of repairing equipment, time spent to rescheduling and, not less important, a damage to the company's reputation.
In some cases, the cost of frequent unscheduled stoppages may cause the company to go out of business if it would miss important deadlines or be unavailable to customers at a critical moment.
The only way to avoid negative consequences of downtime is to adopt equipment able to run smoothly and dependably.

Foundries can experience unscheduled downtime due to inadequate equipment, unable to cope with problems such as material spillage, excessive wear caused by the harsh environment, health and safety risks for operators.

When carryback accumulates under the conveyor belt or spills onto the floor, the process shuts down for cleaning.
Likewise, the failure of a single component of a chain conveyor entails the conveyor to stop, causing a front end stoppage which has an adverse effect on production. And when the production stops, so do revenues and profits.
Another source of unscheduled downtime is when the potential risk of injury or illness exists: dust released in the air by vibratory conveyors is both a health and safety risk requiring plant to stop for maintenance and cleanup.

Frequent shutting down and starting up accumulates large amounts of wasted time and lost revenue.
Implementing reliable technologies is, therefore, a strategic investment to increase profitability and productivity by eliminating unscheduled repairs and production downtime.

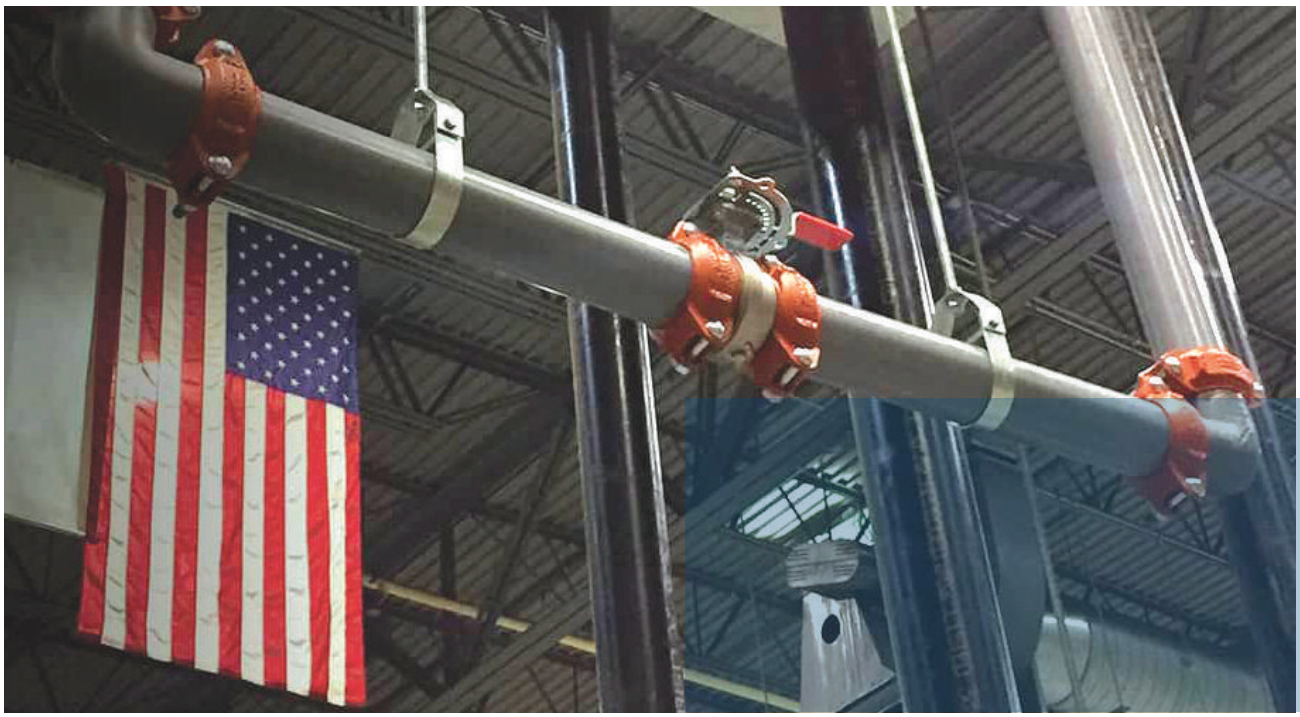
AIRBORNE DUST AND EXCESSIVE DOWNTIME AT THE ALBURTIS FOUNDRY

Victaulic is a a leading manufacturer of mechanical pipe joining & pipe union products.
Headquartered in Easton, the Company owns 15 manufacturing facilities, including a a foundry located in Alburtis, PA.
This foundry is capable of pouring grey iron and multiple grades of ductile iron using the most advanced engineering technologies.
With a continuous and high-volume production run, maximum dependability in each step of the manufacturing process is required.

In 2015, the foundry was experiencing excessive downtime because of a vibratory conveyor installed in the scrap charging bay.

Loaded by a magnet, a weighing feeder was used to feed a long vibratory conveyor transporting sprues and scraps to a charging machine.
The vibrating conveyor suffered continuous cracking and failures due to the material unbalanced distribution on the belt, resulting in plant unexpected shutdown.
In addition to productivity losses, the vibratory conveyor caused an unhealthy dust dispersion into the workplace despite being covered by a de-dusting tunnel to contain dust generated by vibrations.

As global leader in manufacturing dependable equipment for material handling, Magaldi was asked to provide a viable solution to solve Victaulic's problems.



VICTAULIC TO PUT AN END TO ITS PROBLEMS WITH THE SUPERBELT® TECHNOLOGY

At the beginning of 2016, Victaulic foundry was equipped with a Superbelt® P type conveyor to handle sprues and scraps from the scrap yard to the charging machine.
Installed in place of the existing vibratory conveyor, the Superbelt® solved both problems of dust pollution and frequent failures.
In fact, the Superbelt® technology is able to avoid costly unplanned stops thanks to its unique multi-link design of the belt, realized according to a "damage-tolerant" approach which ensures continuous 24/7 operation.
Compared to a conventional chain belt (single link), the Superbelt® double-wire mesh guarantees the conveyor will never stop. Even in case of a severe damage, the conveyor will continue to run without sudden failures and plant operators will schedule its maintenance according to operational needs.

Moreover, the Superbelt® does not suffer from wear and tear. The absence of chains, sprockets and scrapers guarantees a longer service life so that the belt is backed with a 3 years warranty although its expected lifespan is much longer, as proven by thousands of hours of continuous trouble-free operation.

A further peculiarity of the Superbelt® is its smooth operation without vibrations or shaking that allows to avoid dust dispersion. This feature made unnecessary to equip the conveyor with a cover to contain dust dispersion.

Since the Superbelt® does not require special foundations, in Alburtis there was the chance to reuse the same supporting structures of the replaced conveyor, properly sized.

Superbelt® Length: 25.000 mm
Width: 1.200 mm
Height: 5.000 mm
Capacity: 20 t/h
Temperature: Ambient
Handled Material: Sprues

10

MAGALDI TECHNOLOGIES TO KEEP OPERATING COSTS DOWN AND INCREASE PRODUCTIVITY IN FOUNDRY

KOHLER CHOSE THE SUPERBELT® SYSTEM TO SAVE MONEY AND MAXIMIZE FOUNDRY OPERATIONS

In 2018, the U.S. leader in kitchen and bath design entrusted Magaldi with the supply of a solution to perform castings conveying, de-gating and sorting in its iron foundry.

LOW COST EQUIPMENT: ADVANTAGES THAT BECOME DISADVANTAGES IN THE LONG RUN

In foundry, keeping costs down is crucial to market success and profitability.

By lowering costs, a company can increase productivity and turn a greater profit. A key element to achieve this goal is to adopt high-quality equipment.
An effective foundry can exist only if equipped with effective technologies designed to maximize operations while providing a long service life and low maintenance solutions to keep operation efficiently running.

When choosing a machine, it is crucial to consider not only the initial purchase price but also the cost of the machine over its useful life. If low cost equipment may save the company's accounts initially, it can reveal a bad investment in the long run, requiring ongoing maintenance, costly and urgent replacement to deal with production problems.

KOHLER: LOWERING COSTS WHILE IMPROVING PRODUCTIVITY

Founded in 1873, KOHLER Co. is an American manufacturing company based in the homonymous city of Kohler, in Wisconsin.
Best known for its plumbing products, the company has also opened its production to furniture, cabinetry, tile, engines and generators, doubling in size and stretching its global reach across six continents.

In North America, Kohler's manufacturing facilities produce a wide range of plumbing products for residential, commercial, industrial installations. Its largest facility is based in Kohler, where the Company has a cast iron foundry.
In 2017, the green sand foundry was interested by a modernization project aimed at reducing overall costs and improve material handling operations.
Among the investments, Kohler installed a rotating drum, two manipulators, some vibrating feeders and two steel belt conveyors.

Specialized in supplying high quality foundry equipment able to perform heavy-duty tasks on a continual basis, Magaldi was selected to provide its Superbelt® conveying technology.
The latter is properly designed to reliably perform one or more processes along the way, requiring little maintenance thus saving time and money.
Compared to cheaper technologies, the initial investment for the Superbelt® is amortized by minor requests for spare parts, a low power consumption (around one tenth of vibrating conveyors requirements) and a longer service life (the belt is guaranteed for 3 years but its expected lifespan is much longer).

In Kohler foundry, after shakeout operations carried out by a rotating drum, a Superbelt® conveyor at a 15° angle has been installed to convey castings (gray iron sinks) at about 752°F whilst hot fumes and dust are forced to enter a suction and filtering plant.
Discharged on a vibrating feeder, castings are then loaded on a second Superbelt® conveyor where degating and sorting activities are carried out. Two manipulators directly work on the belt which is made in manganese steel and designed to have a high impact resistance.
Finally, castings are discharged on the downstream

line. To prevent chipping, a special damped chute is installed to absorb the energy generated by the castings impact on it.

Hot commissioning is scheduled for January 2019.

Superbelt® 1 Length: 25.603 mm
Width: 1.600 mm
Height: 1.981 mm

Superbelt® 2 Length: 40.570 mm
Width: 1.600 mm
Height: 2.954 mm

Capacity: 36 t/h each
Temperature: 400 °C
Handled Material: Sink and bahtubs

11

ACCURIDE TO IMPROVE THE COOLING PROCESS AND DAMPEN ITS ENVIRONMENTAL IMPACT IN ROCKFORD FOUNDRY

THE MCC® SYSTEM WILL GUARANTEE AN OUTLET TEMPERATURE WELL BELOW THE CURRENT ONE PERFORMED BY THE EXISTING VIBRATING COOLER

In 2018, Accuride - leading supplier of wheel-end systems - approached Magaldi to find an alternative solution to the existing vibrating cooler installed at the Rockford iron foundry.
In 3 steps, the MCC® technology will replace the long conveyor, guaranteeing an outlet casting temperature of about 215°F, well below the current 400°F performed by the existing system.

MAGALDI TECHNOLOGY TO TROUBLESHOOT CASTING COOLING PROBLEMS IN ROCKFORD IRON FOUNDRY

Part of the Accuride Wheel End Solutions business unit, Rockford Operation is a leading supplier of wheel-end systems and components for the heavy- and medium-duty truck market.
In Rockford, IL, Accuride has its longest continuously-operating manufacturing plant, whose origins go back to the 1850s. The iron foundry manufactures and assembles Gunite®-branded product line including brake drums, hubs, rotors, slack adjusters and other wheel end components for the North American commercial vehicle industry.

Recently, Accuride approached Magaldi with the following dilemma: to find an alternative solution to the existing vibrating cooling system, responsible for poor cooling performance.
Moreover, the foundry needed to reduce excessive environmental issues – such as loud noise, crystalline silica dust contamination and high power consumption - related to the vibratory conveyor.

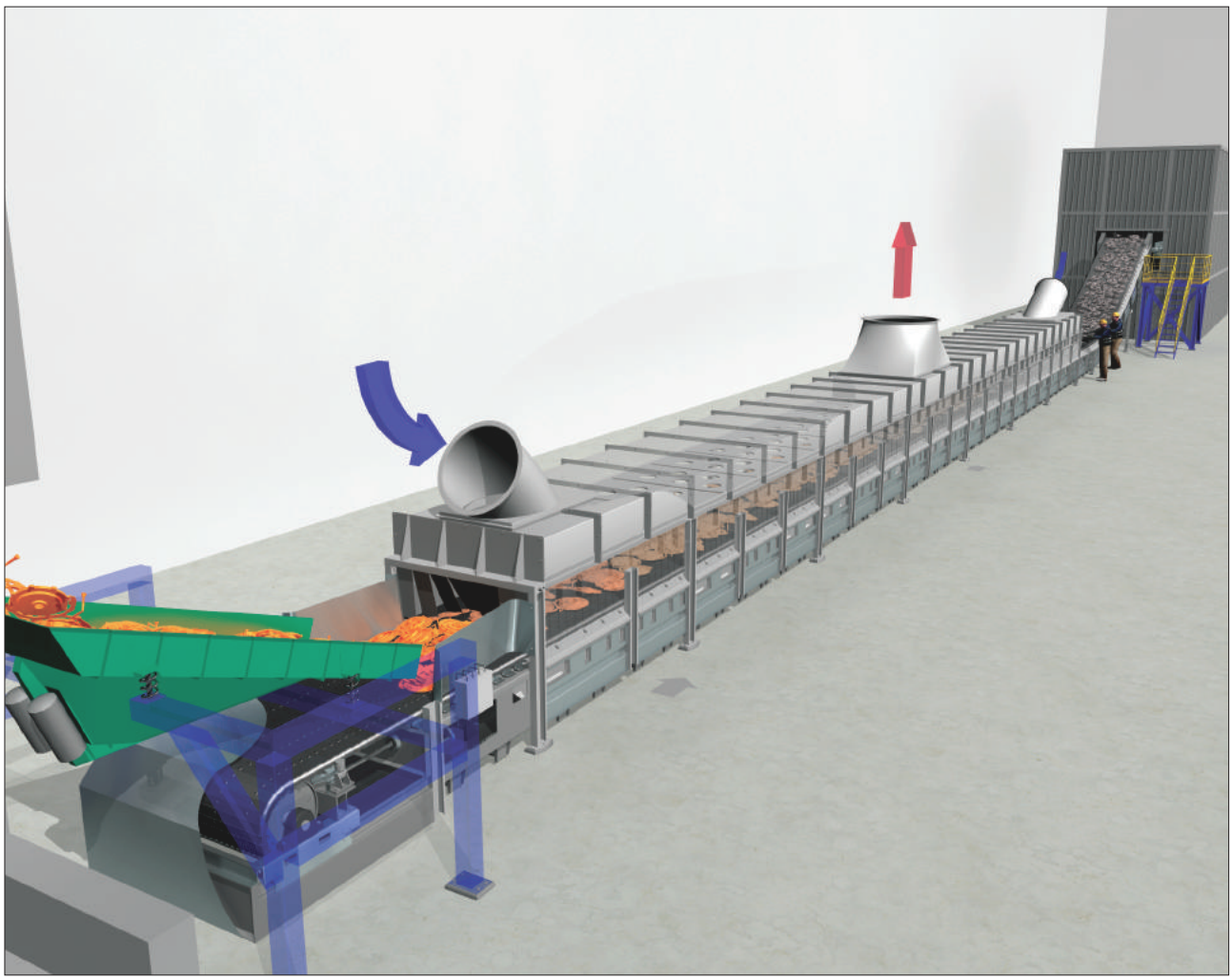
As heat was the main problem with the existing cooler, Magaldi concentrated its studies on customizing its cooling technology to meet the customer's specific needs.
Finite element analysis of casting samples were validated by cooling tests carried out in Magaldi's factory in Buccino so to offer a solution capable of guaranteeing a castings temperature of about 215°F at the end of the whole cooling line, well below the current 400°F performed by the vibrating cooler.

STEP 1: INSTALLATION OF THE FIRST MCC®

In Rockford foundry, the replacement of the long vibrating cooler will be performed in three distinct phases, one every two years.

Step n.1 consisted in revamping the first 100 ft. of the cooling line by installing a Magaldi Casting Cooler (MCC®), which proved to be the best option to cool material with extreme temperature.

After the shake-out, operators separate sprues from castings with hydraulic wedges. The removed sprue are recycled to be used in future melts while castings



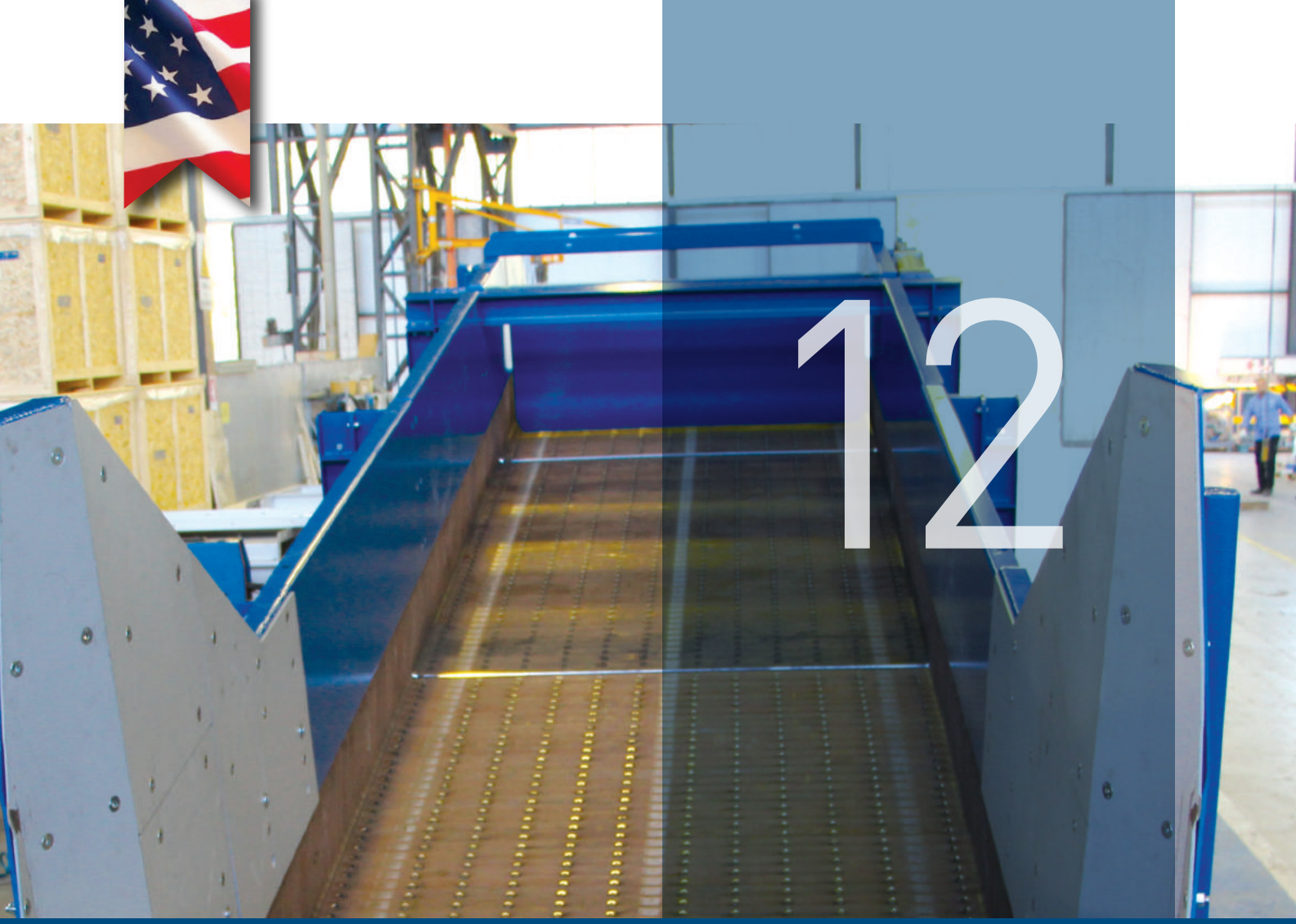
are discharged on the MCC® belt to start the cooling process.

The MCC® operates according to the basic principle of co-current and counter-current heat exchange mechanism between air and castings: two airflows are directed through the cooling hood, one in the same direction and the other in the opposite direction to the castings flow, so to cool them down.
Co-current air and counter-current airflows are realized by a dedicated fan placed at the hot air suction point, which forces cooling air to enter the hood through properly-sized inlet ducts. Airflows are then drawn through the cooling hood by an induced draft fan that ensures a proper negative pressure condition.
Thanks to this heat exchange mechanism - proven to be the most efficient and effective method of thermal transfer - the MCC® cools ductile iron wheels down from an initial temperature of 1,022°F to a final surface temperature equal to or below 675°F (in step 1).

The MCC® is also equipped with the MISS® (Magaldi Integrated Supervision System) to automatically control cooling parameters such as fan capacity, belt speed, airflows, etc.

Once the revamping of the whole system will be complete, the customer will be able to take full advantage of all benefits provided by Magaldi technology, mainly in terms of improved cooling performance but also in terms of lower power demand and better working environment with a noise level under 80 dB(A) and a reduced workers' exposure to crystalline silica dust.

MCC® Length: 26.000 mm
Width: 1.600 mm
Height: 1.600 mm
Capacity: 50 t/h
Temperature: 550°C
Handled Material: iron wheels



12

MAGALDI CUTTING-EDGE TECHNOLOGY FOR A SMOOTH FURNACE FEEDING

A RELIABLE CHARGE BUCKET FEED SYSTEM FOR WAUPACA MARINETTE DUCTILE IRON FOUNDRY

The U.S. firm was facing frequent line shutdowns due to a vibrating feeder used to load buckets with scrap for EAF feeding.
Magaldi offered its extensive experience in material handling, supplying an automated charge bucket feed system conceived to improve system performance by guaranteeing high reliability and low power consumption.

FURNACE CHARGING SYSTEMS: PROS AND CONS

With new generation furnaces characterized by increasingly shorter melt times, furnaces charging systems must be able to keep pace by working quicker and without unexpected failures.

In general, furnaces feeding can be performed by magnet cranes, buckets, vibrating conveyors or belt conveyors.
Cranes with magnetic lifting devices pick up charge materials from holding areas and move them to a weighing hopper or furnaces directly. Since the diameter of the magnet must not be larger than the diameter of the furnace opening, this limits the carrying capacity of the crane and may prevent charging from keeping pace with melting. Also, magnets may be more sensitive to furnace heat than other furnace charging systems.

Bucket charging systems require an adequate overhead space to accommodate it and its carrying mechanism. Hence, in case of tight spaces, they are not the appropriate solution. Moreover, they must be used with charge drying or preheating systems for safety.

As regards vibratory conveyors, the main problem is related to operators' safety: shaking and vibrations generate unhealthy dust and the noise amplified by materials 'jumping' on the belt worsens the working conditions.

The most versatile of all furnace charging systems are belt conveyors. They provide an effective way to move charge material from a lower level to a higher level, such as from a scrap storage area to a holding hopper on the melt deck. Additionally, they are fast, quiet and do not generate dust.

THE SUPERBELT® CONVEYOR DESIGNED FOR FURNACE FEEDING

Among the wide range of technical solutions developed by Magaldi for the foundry industry, there is a particular variation of the Superbelt® conveyor designed to guarantee dependable furnace feeding.

For such application, the Superbelt® conveyor is employed to move scrap and other charge materials to buckets, to the melt deck or directly into the furnace, in a quick and reliable way so to allow maximum utilization of the melting system.

Equipped with a variable speed drive and with weigh cells for accurate measurement of materials both at the loading and unloading points, the Superbelt® is able to provide precise metered flow for a smooth furnace feeding.
Furthermore, pre-heating can be performed directly on the belt thus saving time and maintaining a continuous melt schedule.
Its heavy-duty design allows for 24/7, year-round operation with minimal maintenance and a low power consumption (about one tenth of vibratory conveyors requirement).
Last but not least, the Superbelt® can be in fixed position for weighing and transferring charge materials or it can be mobile to serve different furnaces. Plus, its ability to reach steep inclinations (up to 35°) allows to reduce overall footprint.

WAUPACA MARINETTE: A DEPENDABLE FURNACE CHARGING SYSTEM TO REDUCE SHUTDOWNS AND INCREASE PRODUCTION SPEEDS

Waupaca Foundry, a Hitachi Metals Group company, is among the world's largest independent iron foundries.
The Company produces grey, ductile, austempered and compacted graphite iron castings for automotive, commercial vehicle, agriculture, and construction industries.
Headquartered in Waupaca (WI), the Company has foundry operations also in Marinette (WI), Tell City, (IN), Etowah (TN) and Lawrenceville (PA).

The Marinette foundry has a melt capacity of 75 tons per hour and it is able to run six different types of ductile iron at the same time in its electric melt furnaces.
In 2018, Magaldi was requested to replace a vibrating furnace charge feeder used to charge scrap into buckets.
The vibrating feeder, 20' long and moving on a mobile frame, was causing frequent failures thus slowing down the production process. Additionally, its power consumption was very high.
To meet the customer needs, Magaldi has designed a Superbelt® conveyor able to handle up to 270 tph of scrap and shredded materials.
To ensure the proper loading/unloading process, the conveyor will be operated with an automated control package, included in the scope of supply. The detection sensor located on the lateral skirt-board will detect the material on the belt and give an impulse to stop the Superbelt® and the vibrating feeder installed

upstream. Proceeding with a belt speed of about 0.05 m/s (to be set by a VFD), the Superbelt® will load the scrap buckets every 60 seconds.

Planned to be installed in July 2019, the system has been conceived to both achieve greater throughput and melt efficiency while consuming less energy.

Superbelt® Length: 6.510 mm
Width: 1.800 mm
Height: 5.241
Capacity: 270 t/h
Temperature: 200 °C
Handled Material: Gatings, sprues, scrap and pig iron

MAGALDI TECHNOLOGIES TO SECURE THE SUCCESS OF MTI'S LATEST INVESTMENT IN MEXICO

THE U.S. FIRM RELIED ON MAGALDI "SUPER" CASTING COOLING AND CONVEYING TECHNOLOGIES FOR ITS NEW IRON FOUNDRY

Metal Technologies, Inc. (MTI) invested in a greenfield foundry in San Luis Potosí, Mexico, and awarded Magaldi with a contract to supply its dependable technologies for castings cooling and conveying, sprue handling and castings sorting.

A BROAD PORTFOLIO OF CUSTOMIZED SOLUTIONS

Throughout its long company history, Magaldi has achieved a strong expertise in handling materials under the toughest process conditions (e.g. high temperatures, heavy loads, bulk, grain or abrasive materials) in industries where high dependability is essential.

For the metalcasting industry, Magaldi has developed a broad range of technological solutions to meet several operational needs whilst ensuring high dependability, better operating performance and lower O&M costs.
That's exactly the capability to respond in a reliable and effective way to different requirements in the foundry production process, which led Metal Technologies, Inc. (MTI) to choose Magaldi as technology partner for its project.

MTI TO ESTABLISH ITS MANUFACTURING CAPABILITY IN MEXICO

Recognizing the increasing importance of the Mexican automotive industry, MTI decided to invest in a greenfield foundry in San Luis Potosí to produce almost 100,000 tons per year of gray iron castings.
In 2015, MTI entrusted the engineering and project management to GEMCO Engineers BV which delivered the turnkey project, including installation and commissioning.

Two years later, Magaldi was awarded with a contract to supply its dependable technologies to carry out different operations.
In particular, Magaldi provided:

- an enhanced version of the MCC® (Magaldi Casting Cooler) – known as SuperMCC® – able to improve cooling performance thanks to a particular heat exchange mechanism among castings and forced cooling airflows;
- a Magaldi Spill Chain to be installed underneath the SuperMCC® for sand return conveying;
- a Superbelt® to convey sprue and reject castings from the sorting and knock-off area to outside;
- a Superbelt® conveyor for casting sorting downstream the shot-blasting machine.

MAGALDI "SUPER" CASTING COOLING TECHNOLOGY

After evaluating the Customer requirements, Magaldi decided to offer an enhanced casting cooling conveyor able to cool and convey castings in a tighter space.
According to the plant layout, a vibrating shake-out conveyor feeds the SuperMCC® with castings produced on the vertical green sand molding line.

The SuperMCC® has been designed to cool castings down from an inlet temperature of 600 °C to an outlet surface temperature of ≤100 °C thanks to an optimized cooling process. In fact, equipped with an air forced cooling tunnel held under negative pressure by a venting system, the SuperMCC® guarantees improved performance by means of an additional cooling air flow (cross flow) passing through specifically designed slots on the pans of the conveyor, that increases the cooling rate.

The cooling tunnel, 23 meters long, is equipped with two cold cooling air inlet points placed at the tunnel ends and with a hot air suction point at the middle of the tunnel.

Although the vibratory shake-out conveyor separates castings from sand, residues of the latter can remain on castings and accelerate the wear of the shot-blasting equipment. For this reason, a Magaldi Spill Chain has been installed underneath the SuperMCC® for sand return conveying.

The SuperMCC® is also provided with the MISS® (Magaldi Integrated Supervision System) to control equipment operations.
Optical pyrometers are installed in pairs respectively at the entrance, middle and exit of the cooling tunnel, to detect castings temperature along the transportation. Relevant signals are available to the MISS® in order to adjust, if necessary, inlet and/or outlet air flow rates (depending on detected castings temperature) and the SuperMCC® belt speed (depending on the casting type to be treated - ID code).

Compared to conventional vibrating coolers, the SuperMCC® guarantees:

- improved cooling performance with a shorter conveyor;
- higher dependability;
- no vibrations, no dust;
- noise level <80 dB(A);
- low spare parts requirements;
- low power consumption (about one tenth of vibrating conveyors requirements).

THE SUPERBELT® TECHNOLOGY TO HANDLE SPRUES AND SORT CASTINGS

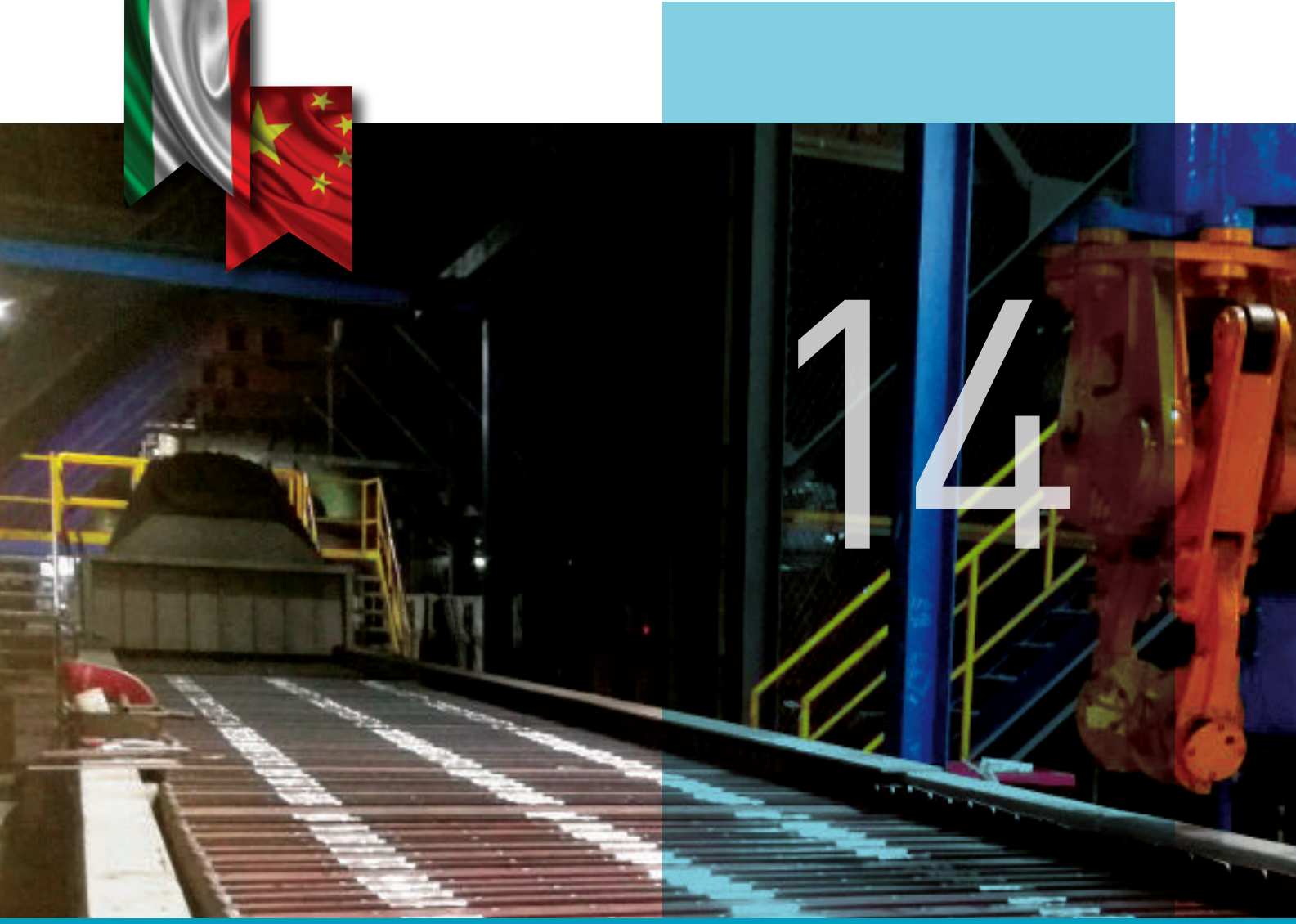
Once cooled, castings are discharged onto a reversible vibrating conveyor, installed perpendicular to the conveying direction of the SuperMCC®. At this stage, castings and sprue are separated and sprues are discharged onto a Superbelt® conveyor.
Designed with upstanding side walls to reliably handle sharp materials and to avoid spillage from remaining sand and metal parts, the Superbelt® moves sprue and reject castings from the shot-blasting to the re-melting area.

A further Superbelt® conveyor has been installed for castings sorting operations.
After shot-blasting, castings pass on a Superbelt® conveyor characterized by downfacing side walls that easily allow to slide castings off the belt.
Operators can work comfortably alongside the conveyor, taking-off castings for inspection operations and downstream processing.

Superbelt® Length: 18.000 mm
Width: 1.200 mm
Capacity: 10 t/h
Temperature: Ambient
Handled Material: Castings

Superbelt® Length: 15.000 mm
Width: 1.200 mm
Height: 5.000 mm
Capacity: 10 t/h
Temperature: Ambient
Handled Material: Sprues

MCC® Length: 30.000 mm
Width: 1.800 mm
Height: 2.000 mm
Capacity: 15 t/h
Temperature: 550°C
Handled Material: Castings



14

THE ECHO OF GREAT PERFORMANCES ACHIEVED BY MAGALDI TECHNOLOGIES RESOUNDS EVEN IN CHINA

MADE-IN-ITALY EXCELLENCE FOR THE CHINESE METAL-CASTING INDUSTRY: MAGALDI CASTING COOLING TECHNOLOGY TO IMPROVE PRODUCTION THROUGHPUT AND PROCESS PERFORMANCE IN HUA DONG TEKSID FOUNDRY

Hua Dong Teksid Automotive Foundry Co. Ltd chose the MCC® casting cooling technology for the Zhenjiang cast iron foundry to improve the production quality of cylinder blocks for the world's top automotive companies.

ASIAN AUTOMOTIVE MARKET ATTRACTS INVESTMENTS FROM MULTINATIONAL COMPANIES

In recent years, the foundry industry has seen a dramatic change in both technologies used and geographical production centers, assuming an increasingly global footprint.
Globalization and rapid changes in geographical distribution of global commodity chains and global production networks have led important manufacturing groups to build up new capacities mainly in Asia and North America.

In particular, the Asia Pacific region has become a magnet for multinational companies looking for new opportunities and to expand production and sales network.
The main "push" factor for this massive relocation of foundries in Asia is represented by the rapid raise of the automotive industry, increasingly demanding local presence. As a result, satellite activities – in particular aluminum and iron auto parts manufacturing - are experiencing a strong growth.

Currently, the Asia Pacific region is the fastest growing market for steel and iron castings. In 2020, it is expected that Asia will account for 65% of total casting production and China alone will cast around 45 million tons.

Since 2009, annual automotive production in China exceed that of the European Union the United States and Japan combined one. For this reason, even more companies are investing in partnerships with domestic manufacturers, in greenfield projects to build local manufacturing plants or to increase the productivity of existing plants.

Despite the fierce price competition from local technology supplier, investors continue to bet on quality as a key factor for competitive success in business.

MADE-IN-ITALY TECHNOLOGY FOR TEKSID HUA DONG AUTOMOTIVE FOUNDRY

The internationalization strategy carried out by the Italian Teksid industrial group, world leader in the ironworks industry, is based on a strong presence in Europe, Central and Latin America and in the Asian market.

In Asia, Teksid operates through its subsidiary Hua Dong Teksid Automotive Foundry Co. Ltd, a modern foundry located at the Zhenjiang Economic Development Zone of Jiangsu Province, in China.

Dedicated to manufacturing cast iron cylinder blocks, the foundry is run to become a domestically leading and internationally competitive cylinder block supplier, with an annual manufacturing target of 1.8 million pieces or 80,000 tons of variable blocks.

The only way to achieve this ambitious goal and get ready to deal with the challenging market requests is to use breakthrough technologies to maximize the plant productivity.

MCC® Length: 60.000 mm
Width: 1.800 mm
Height: 3.000 mm
Capacity: 17 t/h
Temperature: 690 °C
Handled Material: Engine blocks

With this aim in mind, in 2017 Teksid decided to equip the new moulding line with the Magaldi casting cooling technology.
The system to supply had to improve the plant performance in terms of enhanced casting cooling, increased productivity, optimized space management and implementation of higher quality and safety standards.
Customer expectations were fully met thanks to the MCC® (Magaldi Casting Cooler) system.

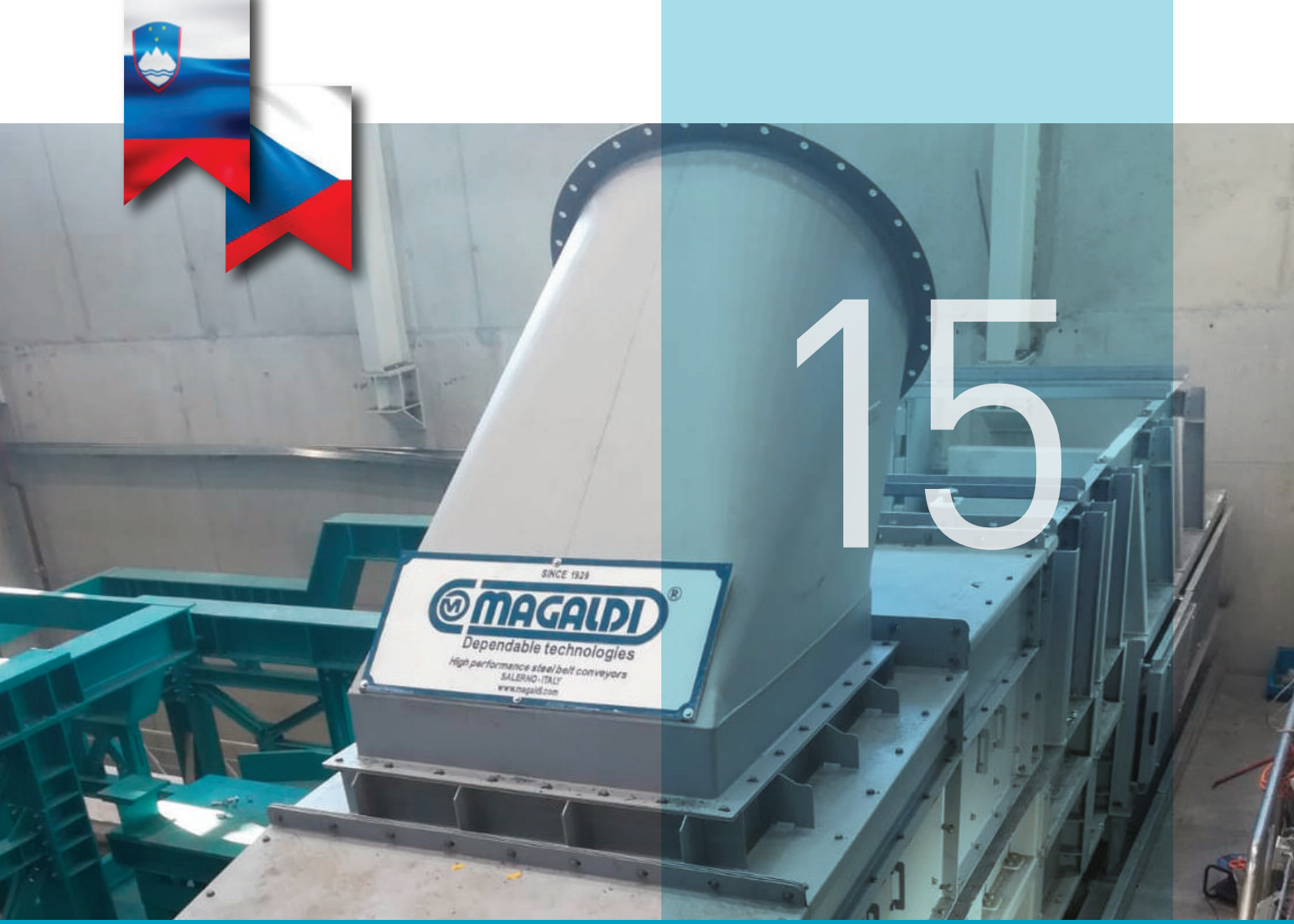
MCC® COOLING TECHNOLOGY: MULTIPLE SOLUTIONS IN A SINGLE SYSTEM

In the Zhenjiang foundry, two feeders properly distribute and place castings on the MCC®.
The feeders are equipped with a cooling tunnel that allows to start the cooling process before castings arrive on the MCC®, so to increase the overall performance of the cooling system.
In this way, a single 54 meters long cooling tunnel, held under negative pressure, is created. The airflow is sucked through the central duct, forcing air to enter at the MCC® open extremities. Passing through this tunnel, castings undergo a temperature drop from 450°C to 80°C.

The MCC® is equipped with the MISS® (Magaldi Integrated System), a supervising/monitoring software module that optimize cooling performance and minimize energy consumption.

Once cooled, castings can be de-gated by operators along the uncovered past of the belt. Moving slowly and operating with a noise level <80 dB(A), the belt can be used as comfortable working table, reducing the workers fatigue and increasing throughput.

Able to perform multiple tasks - all in a reliable way – the system provided by Magaldi has enabled Teksid to achieve efficient mass production, high level of automation and a strong system dependability and availability



15

THE OLD CONTINENT DOES NOT GIVE WAY TO EMERGING ECONOMIES

EASTERN EUROPEAN FOUNDRIES COUNT ON CUTTING-EDGE TECHNOLOGIES TO BE RIDING HIGH AND MEET THE GROWING MARKET DEMAND. AFTER POLAND, MAGALDI LANDS IN SLOVENIA AND CZECH REPUBLIC

Magaldi technology for castings cooling and conveying has recently made its way in Slovenia and Czech Republic with new orders from KOVIS and KASI.
Both foundries chose to secure the increase in production capacity with a system able to guarantee excellent cooling performance and an operator-friendly environment.

EASTERN EUROPE: THE FEATHER IN EUROPEAN FOUNDRY MARKET CAP

According to data provided by Eurostat, around 65% of global casting production is dominated by APAC regions, with China being the leader, followed by India, Korea and Singapore.
Despite the rapid rise of the emerging economies in the global foundry industry, the European metal-casting market does not step back and continues to play a strategic role in the international scenario, producing 15% of the world output.

Within Europe, Germany and Eastern European countries represent the main markets for the production of steel and iron castings.
In particular, foundries located in Eastern Europe derives their competitive advantages from low labor costs, strategic location connecting Western European markets and presence of major automotive brands.
Czech Republic, Poland, Hungary, Slovakia and Slovenia are the strongest metal-casting markets due to their skilled workforce, high export competitiveness, short delivery periods, low regulatory controls and accessibility to EU markets.
Therefore, Eastern Europe is considered a potential alternative as it provides buyers opportunities to save costs and get deliveries with shorter lead time.

STATE TO CO-FUND KOVIS PROJECT FOR FOUNDRY PRODUCTION CAPACITY EXPANSION. THE SLOVENIAN MARKET OPENS TO MAGALDI TECHNOLOGIES

With 40 years of tradition, KOVIS Group is one of the leading companies in Europe for the development and production of components for the railway industry, such (eg.brake discs, axle boxes and other parts).
Among the 4 companies of the Group, there is a foundry - KOVIS LIVARNA - manufacturing up to 13,000 tons/y of high-quality castings from ductile and grey cast iron.

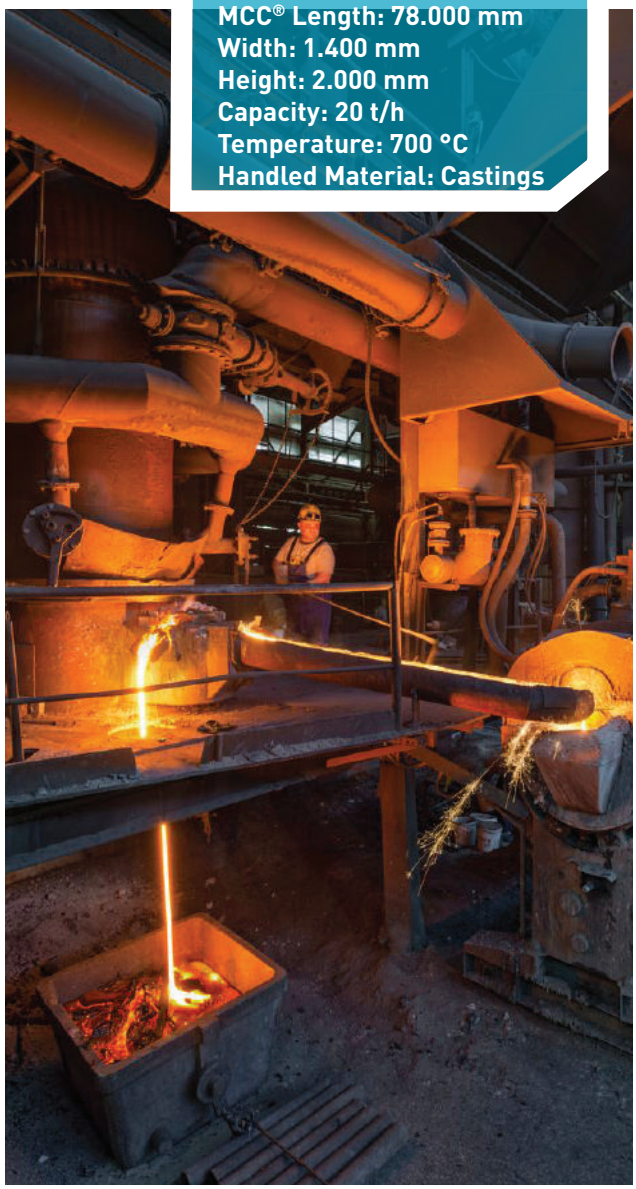
In the last years, due to the intensive development of the Company and the increase in sales on international markets, KOVIS decided to invest in renewing its facility located in Štore, with the aim of expanding the production capacity by early 2019.
The Company benefited from 2 million euros in state funding to implement the plant modernization project.
On May 2018, the Company signed a "State Support Agreement" with the Slovenian Minister of Economy, as part of the government development program for 2018-2020.
The investment covered tangible assets, including a new molding line and the automation of the melting department.

Within this project, KOVIS asked Magaldi to provide a technical solution to cool from 700°C to 70°C up to 80 cluster/hour (20 t/h of cast iron) of huge (Max. 1071 x 890 x 550 mm) and heavy (up to 633 kg) castings with a very high thermal module (up to 3,46 cm).

In few words, looking at the worst case (very hot temperature, high thermal module, huge and heavy castings), the solution to implement appeared very challenging.

Magaldi proposed to install an MCC® (Magaldi Casting Cooler) designed to bear heavy loads/impact forces and high thermal capacity castings while ensuring safe, continuous and reliable operation thanks to the unique damage-tolerant design of the belt (Superbelt®).

KOVIS FOUNDRY
MCC® Length: 78.000 mm
Width: 1.400 mm
Height: 2.000 mm
Capacity: 20 t/h
Temperature: 700 °C
Handled Material: Castings



Specifically developed for both a dependable handling/air cooling of castings and the maximum productivity, the MCC® is able to work in the most difficult conditions as high temperatures, heavy loads, abrasive or sharp castings. It can also perform as a valuable workstation for de-gating and sorting operations, avoiding the need for a further conveyor.

Deeply convinced of the cooling system reliability and supported in its choice by the excellent performances achieved practically every Country in the world, KOVIS awarded Magaldi a contract to design, manufacture and deliver by February 2019 an MCC®.
78 meters long and equipped with the MISS® (Magaldi Integrated Supervision System) to control cooling and conveying processes according to the customized logical design, the MCC® will cool and convey castings and sprues coming from the "L" shape shake-out line.

After cooling, a manipulator will deliver castings to the shot-blasting machine.

MCC®: AN OPERATOR-FRIENDLY SYSTEM FOR THE CZECH IRON FOUNDRY OF KASI

Established in 1992 with the aim of being the sole in Czech Republic to supply a broad range of sewage related products, KASI spol. s.r.o. is a leading manufacturer of sewage castings, street and yard grilles, adjustment rings and manhole covers for the construction industry.

In 2005, KASI decided to stop buying from China and India and provide customers with products entirely manufactured in its five main workshops.
To do so, in 2011 a new brand foundry was built to produce up to 22,000 tons/y of grey and ductile iron castings.
Located in the industrial area of Nový Bydžov – Zábědov, the plant is one of the five most modern foundries in Europe, equipped with the most state-of-the-art technology in the Country.
Nevertheless, the foundry suffers from a very tough and unhealthy environment caused by a vibrating cooling system which generates loud noise, vibrations and excessive material build-up and spillage.

Anyway, KASI's strategic decision to build a new foundry has resulted in an expansion into surrounding countries such as Poland, Austria, Germany and Slovakia. Furthermore, with eastern and southeastern countries beginning to develop sewage infrastructure for the very first time, new opportunities for further

KASI FOUNDRY
Superbelt® Length: 26.500 mm
Width: 1.600 mm
Height: 1.300 mm
Capacity: 12 t/h
Temperature: 100 °C
Handled Material: Castings

MCC® 1 Length: 36.500 mm
Width: 1.600 mm
Height: 1.950 mm

MCC® 2 Length: 26.500 mm
Width: 1.600 mm
Height: 2.200 mm
Capacity: 12 t/h each
Temperature: 650 °C
Handled Material: Castings

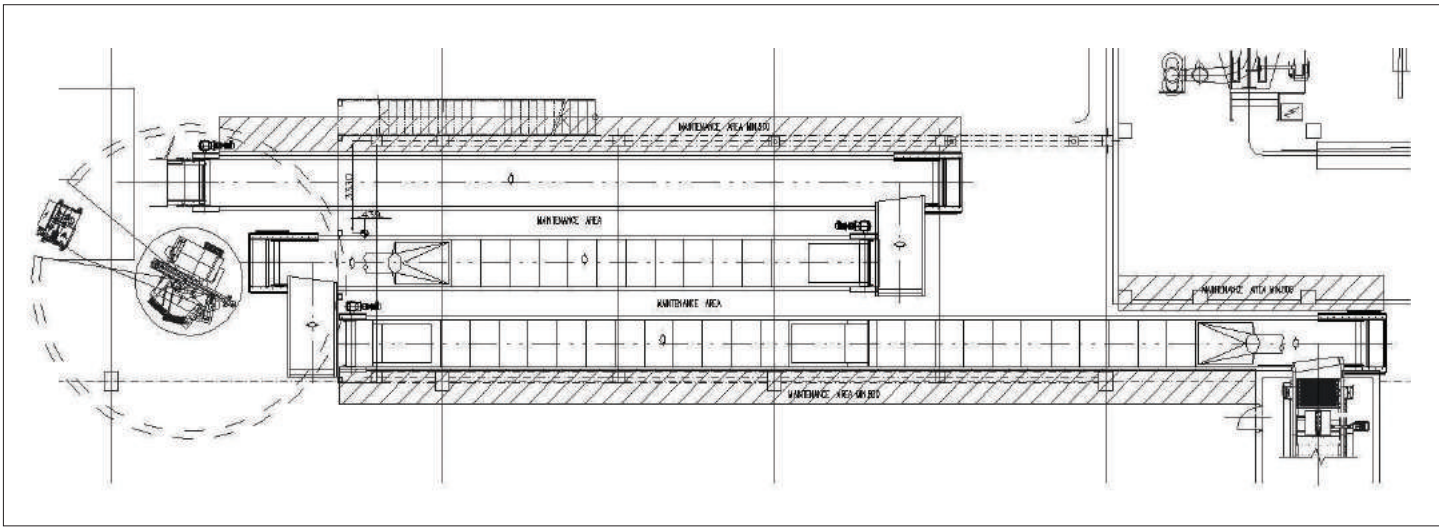
growth are rising.
In order to satisfy the upcoming requests from both the internal and the surrounding markets, KASI has decided to build a new facility in the industrial zone of Chvaletice.
Planned to be started-up by May 2019, the new grey and ductile iron foundry will have a capacity of 22,000 tons castings per annum and will be equipped with cutting-edge technologies.

In 2017, after reference visits and a tour of to the modern and fully automated workshop in Buccino (South of Italy), KASI decided to award the Italian firm with a contract for the supply of the whole cooling system for Chvaletice foundry.
Magaldi's scope of supply will include 2 MCC® systems, 2 cross transfer conveyors and a Superbelt® P type conveyor, as per the below layout.
Coming from a 90° cross shake-out, clusters at 600°C will be cooled down at less than 100°C to feed a discontinuous shot-blasting machine by means of a manipulator.

The MCC® systems will be equipped with the MISS® (Magaldi Integrated Supervision System) to keep the cooling process under control and vary belt speed and airflow, if necessary.

Compared to the vibrating cooling system in Nový Bydžov, Magaldi castings cooling technology will contribute to achieve an operator-friendly environment, without vibrations or dust/material dispersion and with a noise exposure level of 80 dB(A).

The start-up of the system is scheduled for March 2019.



16

SUPERBELT® TECHNOLOGY FOR SMOOTHER CASTING SORTING OPERATIONS

A MORE EFFECTIVE SOLUTION TO INCREASE PRODUCTIVITY BY IMPROVING OPERATORS' WORKING CONDITIONS IN LEAD TIME IRON FOUNDRY

For the Italian Lead Time foundry, a dependable solution to allow operators to sort castings in a smoother and more comfortable way, by eliminating loud noise and accumulation of castings on the belt caused by the malfunctioning of the existing vibratory conveyor.

BETTER EQUIPMENT MAKES WORKERS HEALTHIER, HAPPIER AND MORE PRODUCTIVE

Working on a conveyor line to sort post-blast material for processing is hard work.
For such a physically demanding job, it makes sense to take every measure possible to reduce workers' fatigue and create a workplace environment as comfortable as possible, so to increase workers' productivity.

Loud noise and continuous vibrations not only affect production but also lead to employees injuries and reduced performance. The installation of a better, more effective conveyor can solve those problems.
With this goal in mind, Magaldi has developed a version of the Superbelt® conveyor suitable for better sorting and de-gating operations.

Usually provided with turn-down sidewalls, the Superbelt® PR or HD type allows operators to easily move castings away from the belt by using the flat lateral chutes. In this way, it makes unnecessary for workers to stretch, pull and lift castings, thus reducing excessive and tiring movements.
Moving slowly, the flat surface of the belt also offers an ideal working table and allows to keep castings

Spread out on the surface, making it easier for pickers to identify and pick the designated castings.

In addition, the Superbelt® operates at a noise level <80 dB(A) and the absence of vibrations and shaking prevents the material from "bouncing" on the steel belt, further reducing background noise.
Finally, hydraulic wedges, compressed air guns or hammers, as well as manipulators, can be used directly on the belt as it is designed to withstand the harshest conditions.

CASTING SORTING: THE SUPERBELT® TECHNOLOGY TO BOOST FOUNDRY OUTPUT AND WORKERS PERFORMANCE IN LEAD TIME IRON FOUNDRY

The Italian Lead Time SpA is a modern foundry, boasting technologically advanced facilities to produce ductile iron castings.

The company is committed to heavily invest in continuous improvement of quality, health and safety for operators. For this reason, in March 2018 Magaldi was requested to supply its dependable conveying technology to be installed downstream the continuous shot-blasting machine to recover shot media and sort castings, previously performed by a vibratory conveyor.
The latter was causing very bad working conditions for operators, forced to work with a deafening noise due to items bouncing on the steel surface. Moreover, vibrations and shaking made it difficult to hook castings, with the consequent accumulation on the belt and often unexpected line shutdowns.

By installing the Superbelt® technology, the customer has been able to ensure better working conditions for operators working alongside the conveyor, thus improving their performance and the overall foundry productivity.

Installed downstream the shot-blasting machine, the Superbelt® was equipped with a static sieve placed at the head section of the conveyor in order to recover the shot media.
More than 70% of shot media passes through the grid and falls into a special box located underneath.

Sprues, runners and gates are, instead, conveyed and discharged into two bins to be then used to feed the furnace.

Unlike vibratory technology, low noise level, absence of vibrations and the ergonomic belt design make the Superbelt® an "operator-friendly" technology.

Superbelt® Length: 12.600 mm
Width: 1.600 mm
Height: 1.100 mm
Capacity: 20 t/h
Temperature: ←200 °C
Handled Material: Castings and Sprues

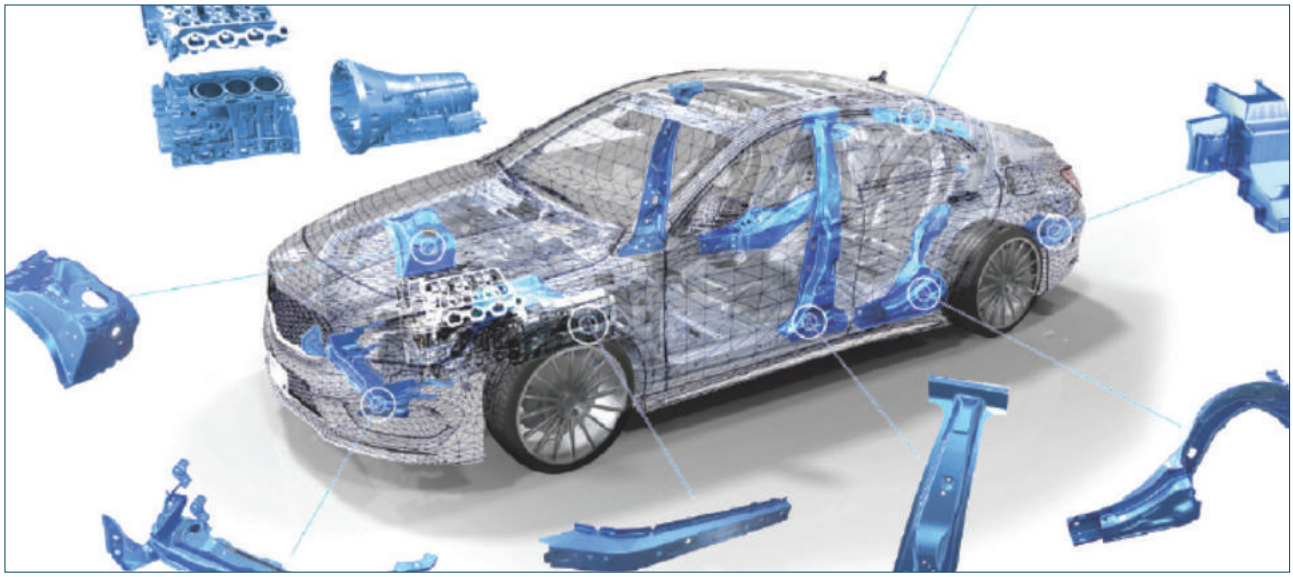

BEFORE


AFTER

17

A NEW CONCEPT IN HEAT TREATMENT: MAGALDI AIR QUENCHING SOLUTION FOR THE AUTOMOTIVE INDUSTRY

As technological development of its casting cooling technology, Magaldi designed and developed a new system able to perform the air quenching of aluminum castings with a cooling rate of 50° C/min. Aluminum re-heating is no longer necessary with consequent high benefits in terms of costs and time-saving.



T5 HEAT TREAT PROCESS FOR ALUMINUM AUTOMOTIVE COMPONENTS

In the last decades, the major automobile manufacturers have accepted the challenge of lightening vehicles by replacing also structural elements - previously considered steel based systems- with aluminum alloy parts.
Although lighter, these parts must be able to withstand important forces and guarantee high mechanical resistance. Consequently, it is necessary to rely on highly technological systems to maintain the aluminum components robustness.

Aluminum may experience improved mechanical strength properties when certain heat treatment processes are performed.
Heat treating refers to any of the heating and cooling operations performed to change the mechanical properties, the metallurgical structure or the residual stress state of a metal. When applied to aluminum, however, its use is frequently restricted to the specific operations employed to increase the alloys strength and hardness while minimizing distortion and residual stress.

A possible heat treatment is the Air Quenching, which is classified as "T5" heat treatment.

Quenching is the most critical step in the sequence of heat-treating operations. It consists in rapidly cooling a heated metal to some lower temperature, usually near room temperature, using a fluid as cooling medium. The quenching fluid can be either water, brine, oil, inert gases or air. The choice of the fluid depends on the required cooling rate which is determined by composition and size of the workpiece.
The T5 temper refers to the air quenched and artificially aged aluminum. Air quenching is carried out at temperature above ambient, typically in the range of 150-200°C, thanks to a stream of air directed over the workpiece to cool it down from above its critical temperature.
A quick cooling (hardening) from the molding temperature (about 450°C) to 150-200°C is necessary to improve productivity since aging time cannot be shorter.

TEMPER	DEFINITION
T1	Cooled from an elevated temperature shaping process and naturally aged
T2	Cooled from an elevated temperature-shaping process, cold worked and naturally aged
T3	Solution heat treated, cold worked, and naturally aged
T4	Solution heat treated and naturally aged
T5	Cooled from an elevated temperature-shaping process and artificially aged
T6	Solution heat treated and artificially aged
T7	Solution heat treated and artificially overaged
T8	Solution heat treated, cold worked, and artificially aged
T9	Solution heat treated, artificially aged, and cold worked
T10*	Cooled from an elevated temperature shaping process, cold worked, and artificially aged

*T10 is designated in ANSI H35.l (M) but not in EN 515 or ISO 2107

MCC® AL: A STATE-OF-THE-ART HEAT TREATING SYSTEM BASED ON AIR QUENCHING

Starting from its well-proven cooling technology, Magaldi has developed a more advanced version of the system capable of performing the air quenching heat treatment of aluminum castings.

The MCC® AL is a heat treatment system designed to allow the air quenching of aluminum castings, maintaining their dimensional stability while improving mechanical properties.
Installed downstream the molding line, the MCC® AL uses forced air blown onto the castings to cool them down passing from 460±20 °C to 100±50 °C in about 7 minutes, thus guaranteeing a cooling rate of 50° C/min.
In this way, there is no need for aluminum re-heating, with consequent benefits in terms of costs and time-saving.
The cooling recipes are customizable with times that can be set depending on the type of component to be treated.

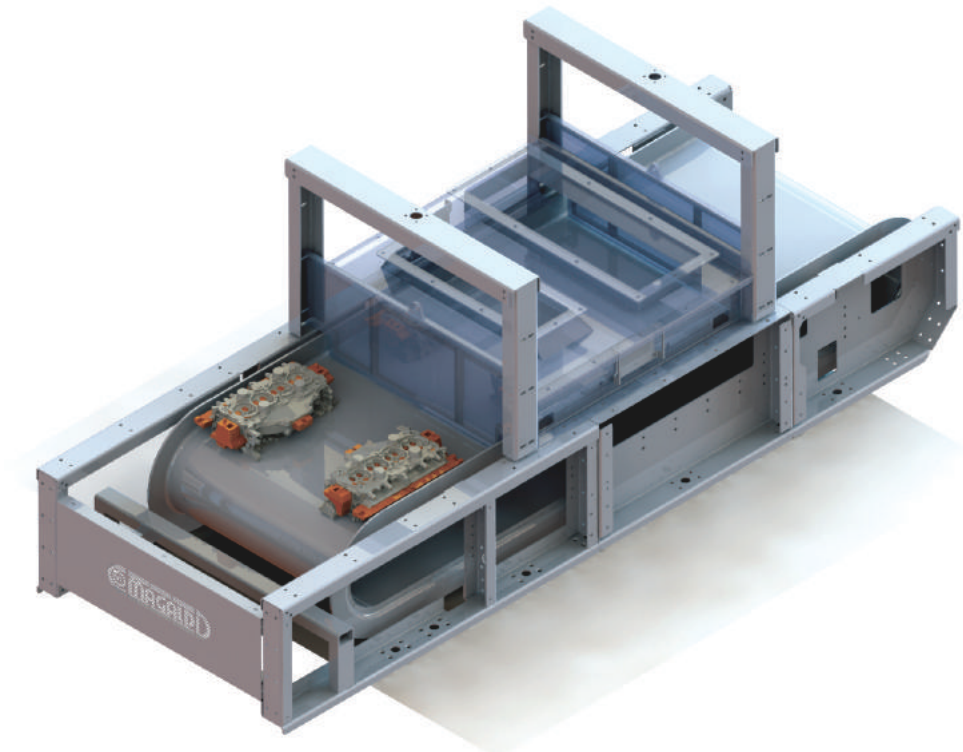
Typically, robots place castings onto the MCC® belt that conveys them in the cooling tunnel in few seconds. A pneumatically actuated door closes after casting loading (close chamber).
Castings are cooled by ambient air as quick as possible (typically 50°C/min). After that, a pneumatically actuated door opens and the belt conveys castings to the unloading position. Unloading activities can be performed by manipulators or operators.
Loose sand is collected in a box underneath the rotary brush.

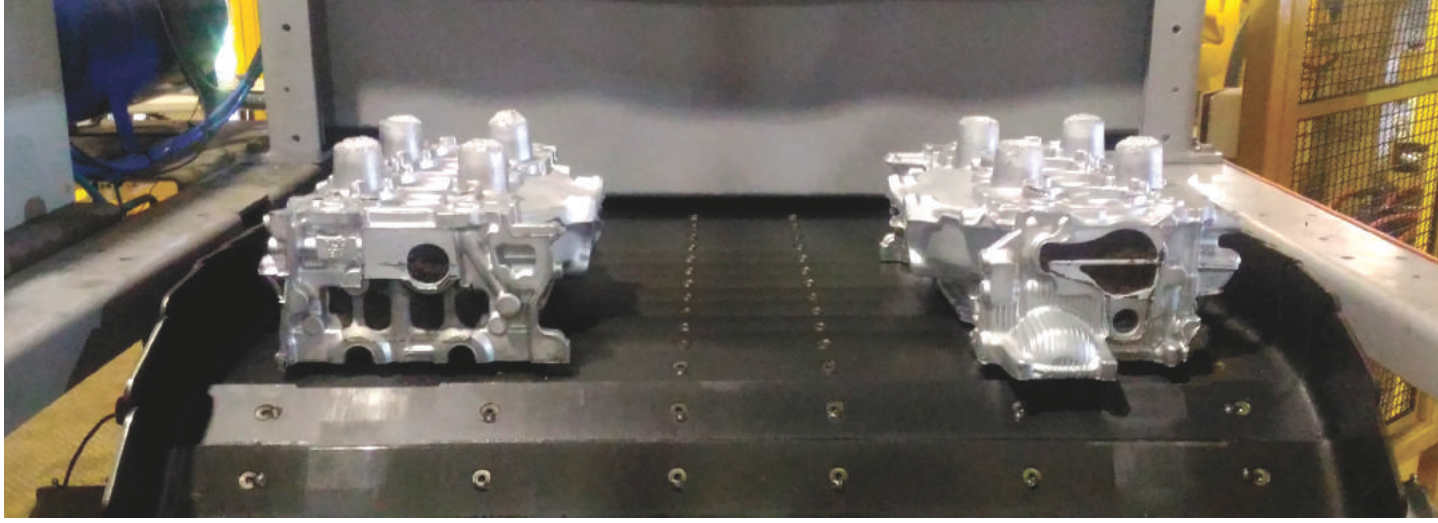
The MCC® AL is equipped with sensors that interface with both robot and operators for casting loading/unloading. In particular, it is provided with:

- optical pyrometers to monitor the surface temperature of aluminum castings inside the cooling tunnel;
- photoelectric sensors at the MCC® loading and unloading points to detect the presence of castings on the steel belt;
- frequency converter for the Superbelt® motor to adjust the belt speed, if required;
- frequency converter for each fan motor to vary the cooling air speed according to different operation conditions;
- One HMI (Human-Machine Interface) panel with a graphical interface.

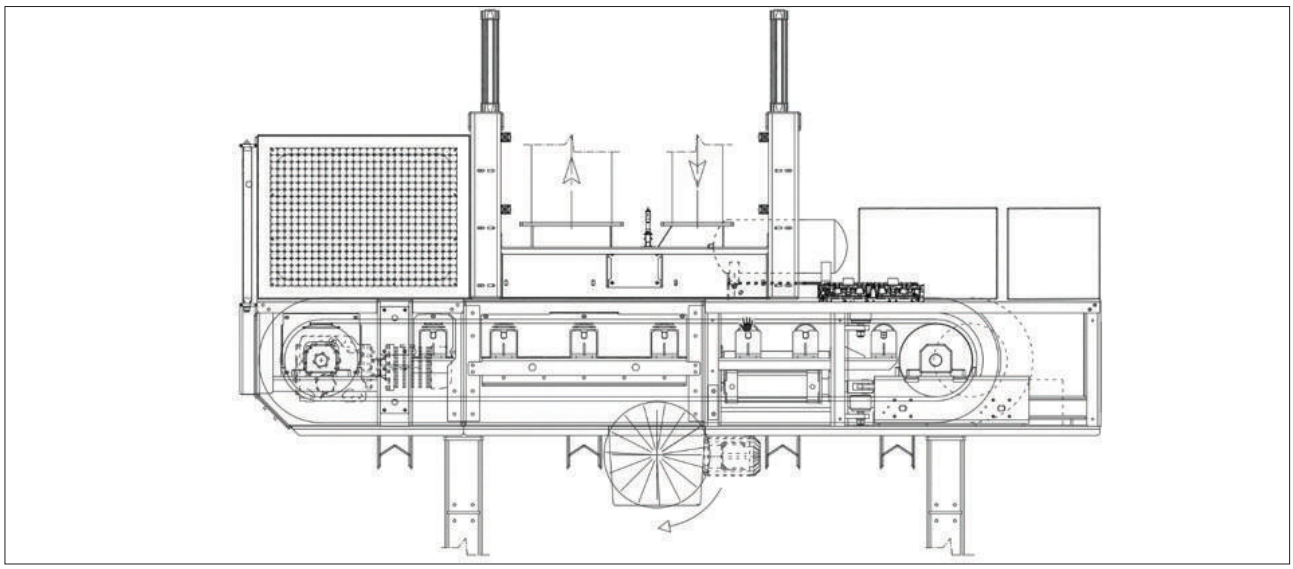
In order to monitor the proper functioning of the system, the MCC® AL can be also provided with the MISS® (Magaldi Integrated Supervision System) whose PLC allows to control all equipment. As a result, key parameters of the cooling process can be monitored and adjusted, and the MCC® belt can operate on a batch basis.

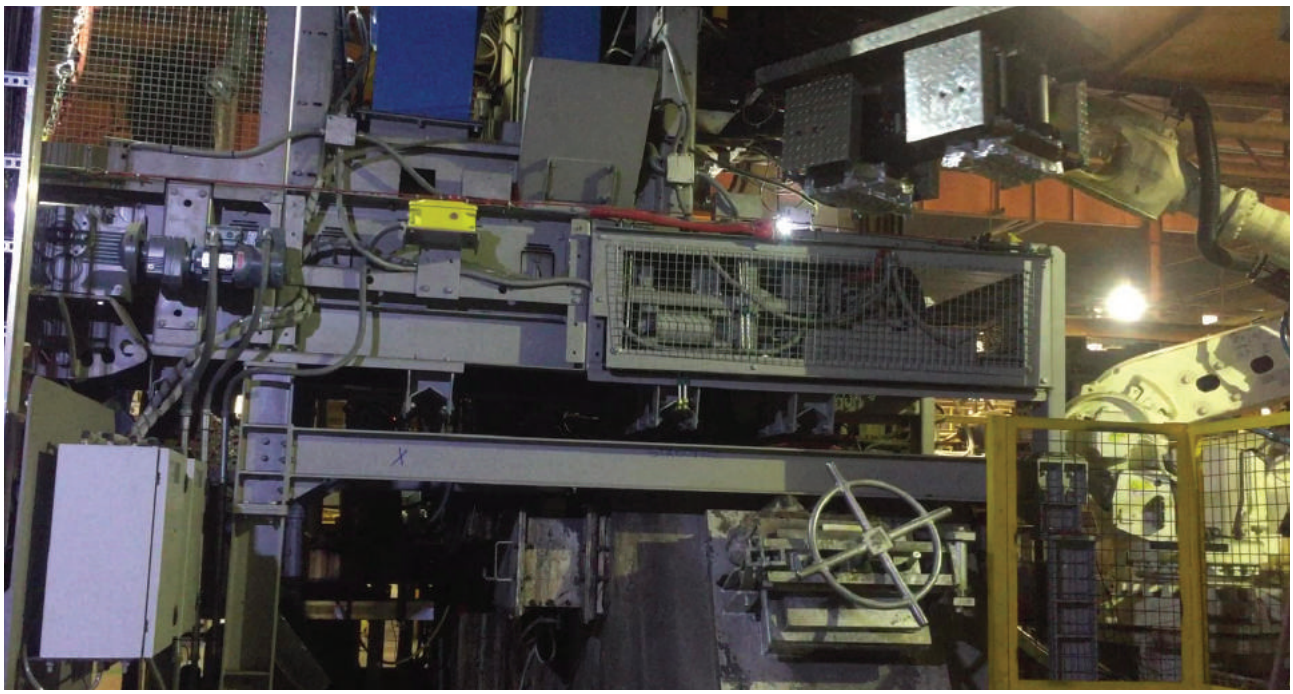
Compared to alternative technologies, the MCC® AL for air quenching heat treatment has proven to produce the following benefits:





- higher dependability (5 years mechanical warranty, no outage, low spares);
- guaranteed performance (outlet castings temperature);
- compact cooling (possibility to work in batch, etc.);





- integrated and tailored solutions (MISS®, pre-engineering, scanner 3D survey, etc.);
- energy saving (just 1 fan, low energy consumption).

FOUNDRY INDUSTRY OPENS ITS DOORS TO THE SPREAD OF MAGALDI AIR QUENCHING TECHNOLOGY

In 2016 a leading provider of light-weighting solutions for the global automotive industry, was looking for a reliable technology able to perform the air quenching of aluminum castings produced in its foundry.

Already in contact with the Italian firm for a previous project carried out in another of its foundries, the Customer requested Magaldi to supply its casting cooling technology (MCC®) to cool aluminum cylinder heads.

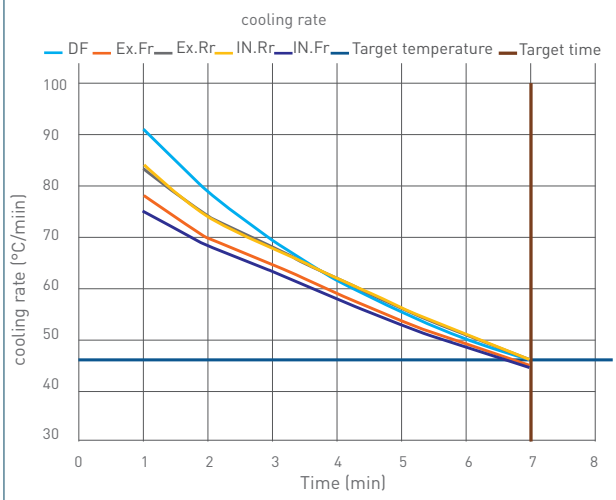
After theoretical studies and experimental tests carried out in its factory on real representative castings, Magaldi was able to design an air-cooling system able to completely fulfil all technical requirements.

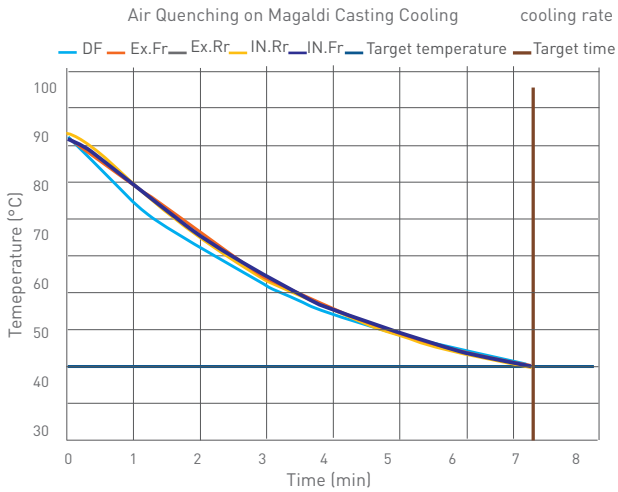
Six MCC® systems were installed to cool and convey aluminum castings from the relevant molding lines using low pressure machines, each producing about 300 cylinder heads per day.

During the project implementation, Magaldi had to install face two critical aspects:

- layout constraints, due to limited space to cool castings;
- air quenching process for the T5 heat treatment.

Due to the tight available space, there was the need to boost ambient air at a relatively high speed, as soon as castings enter the cooling tunnel. Two dedicated fans have been installed for the purpose: the first one is a forced draft type that sucks ambient air from outside the factory; the second one is an induced draft type that releases air outside after cooling aluminum castings down.
Designed with a center-to-center distance of only 2680 mm and a width of 1000 mm, the steel belt allows to accommodate two castings on the same lane. The system has been equipped with two pneumatically actuated gates, at the inlet and outlet of the cooling tunnel, that are in closed position during castings cooling.
The operation concept of the MCC® AL is based on a





The charts show both the temperature trend and the cooling rate trend over a period of 7 minutes and considering an ambient temperature above 30 °C. Temperature values are measured through 6 thermocouples immersed in the tested casting (used for a destructive test) and recorded by an external data acquisition system.

6 MCC® Length: 3.224 mm
Width: 1.000 mm
Capacity: 0,24 t/h each
Temperature: 420 °C
Handled Material: Aluminum cylinder heads

"batch" mode. Loaded by a robot equipped with a gripper, the belt automatically conveys castings inside the cooling tunnel. When they reach a given point inside the tunnel, the belt is stopped again and the pneumatically actuated gates are closed in order to perform the castings cooling.
After a preset time of max 7 minutes, gates are opened and the MCC® belt conveys castings outside the cooling tunnel. At this stage, the MCC® belt is stopped again to allow an operator to manually unload castings through a hoist.

The MISS® system, connected with the MCC®, allows to operate on a batch basis, to adjust and monitor the cooling process key parameters, acquire and record the surface temperatures of castings inside the cooling tunnel.

18

EXTREME RELIABILITY AND TIGHT DEADLINE FOR TURNKEY SUPPLY: MAGALDI'S CHALLENGING EXPERIENCE IN MARTINREA HONSEL FOUNDRY

THE ITALIAN FIRM AS THE ONLY TECHNOLOGY PARTNER ABLE TO GUARANTEE HIGH DEPENDABILITY, MAXIMUM AVAILABILITY AND OUTSTANDING PERFORMANCE IN MESCHEDE ALUMINUM FOUNDRY

To secure the plant productivity and avoid paying penalties imposed by a Customer in case of delivery delays, Martinrea Honsel chose to install a Super-belt® conveyor to transfer aluminum castings from die-casting machines to the de-coring area. In just 4 months, the conveyor was manufactured, installed and started-up, ensuring maximum availability and outstanding performance

THE IMPACT OF DOWNTIME ON THE METAL-CASTING INDUSTRY

Competing in a global economy means always staying ahead of competitors and efficiently meet the increasingly complex requirements set by demanding customers.
Foundries are not exempt from this effort to perform efficiently and faster in order to meet shorter lead times required by end users. As a result, lost production time must be minimized.

Downtime is the largest source of lost production time and it represents a real cost for the foundry. When unplanned downtime occurs, no value is being produced but the cost of overhead operations continues to grow, directly impacting the company's bottom line. In addition to a loss of productivity, when it leads to delays in supply, downtime also results in loss of costumer trust.
With such high costs at stake, to rely on technologies able to operate smoothly, ensuring continuous operation without the risk of equipment failures and breakdowns, is critical.

MARTINREA HONSEL BETS ON MAGALDI'S DEPENDABLE CONVEYING SOLUTIONS TO ACHIEVE ZERO UNSCHEDULED STOPPAGES AND COPE WITH INCREASINGLY SHORT LEAD TIMES

Martinrea is one of the world's largest producers of light-metal components for the automotive industry.
The production of its four main product lines (engine, transmission, structural and body parts) is carried out through Martinrea Honsel business unit, which represents the aluminum division of the company and operates state-of-the-art high pressure and low pressure casting plants in Mexico, Brazil, Germany, Spain and China.

With the acquisition of the aluminum business of Honsel, the Company has become a leader in the aluminum automotive parts market and broadened its customer base to major global car manufacturers. In particular, the Meschede foundry, in Germany, supplies approximately three quarters of Europe's premium car lines and the majority of Europe's heavy truck manufacturers.

The Meschede plant is at the forefront of die casting technology.
Thanks to the short times required by the high pressure die casting (HPDC) process, the foundry is able to produce large-volume components in mass serial production. To do so, fully automatic processes, short cycle times and systems running around the clock are necessary.

Driven by the need to equip the foundry with the most reliable conveying technology in order to prevent any line shutdown, thus delaying the provisions to an important customer, in 2017 Martinrea selected Magaldi as technology provider.
Critical in the choice of the Italian firm was its extensive experience in material handling, providing customized solutions that reflect years of technology research and development to meet the most stringent technical requirements under international norms and standards.

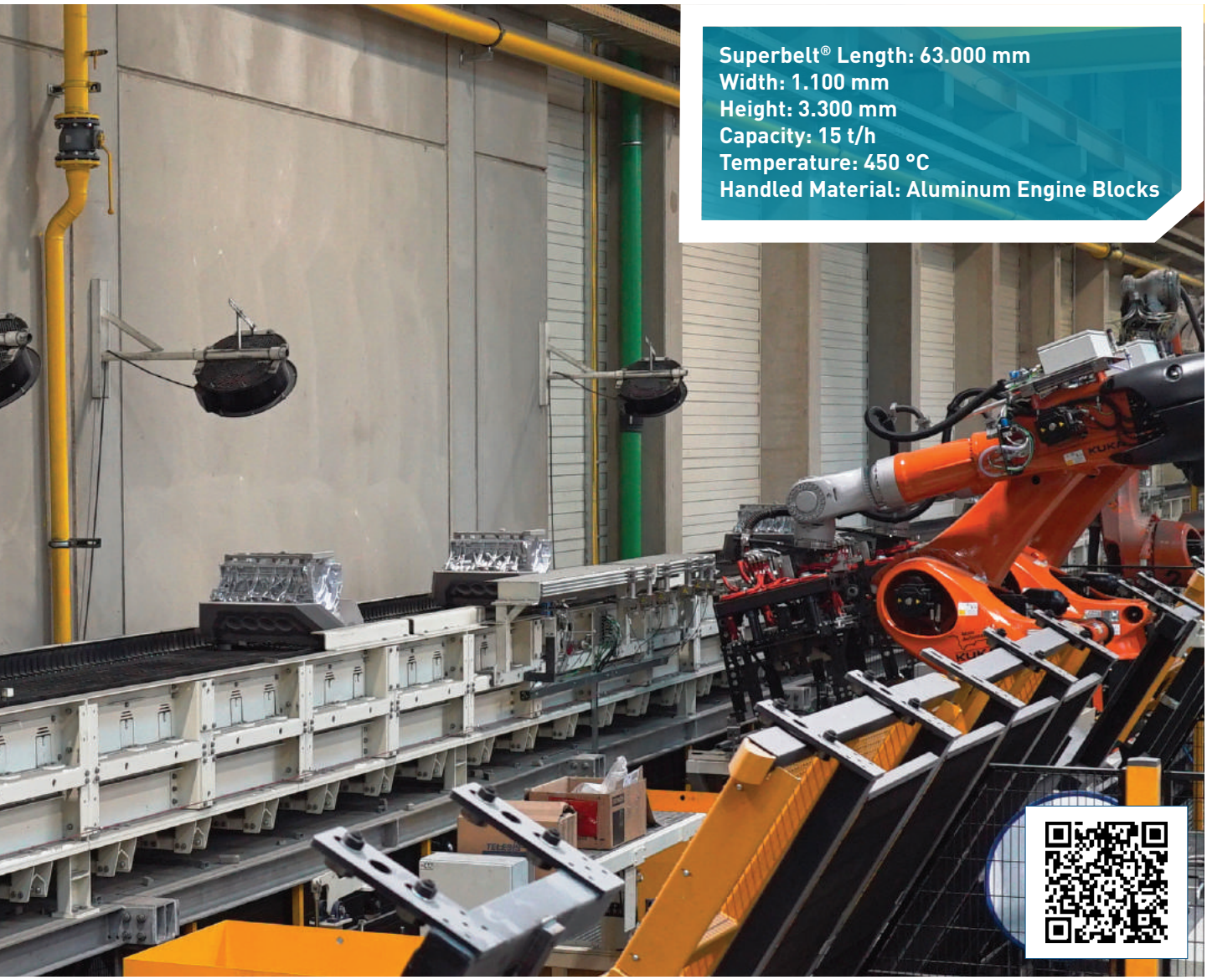
AVOID EQUIPMENT DOWNTIME AND INCREASE PROFITS THANKS TO THE SUPERBELT® CONVEYING SYSTEM

To fulfill the commitments made with one of its major customers and avoid to pay the severe penalties imposed on delivery times and castings quality, Martinrea Honsel decided to install the Magaldi conveying technology.

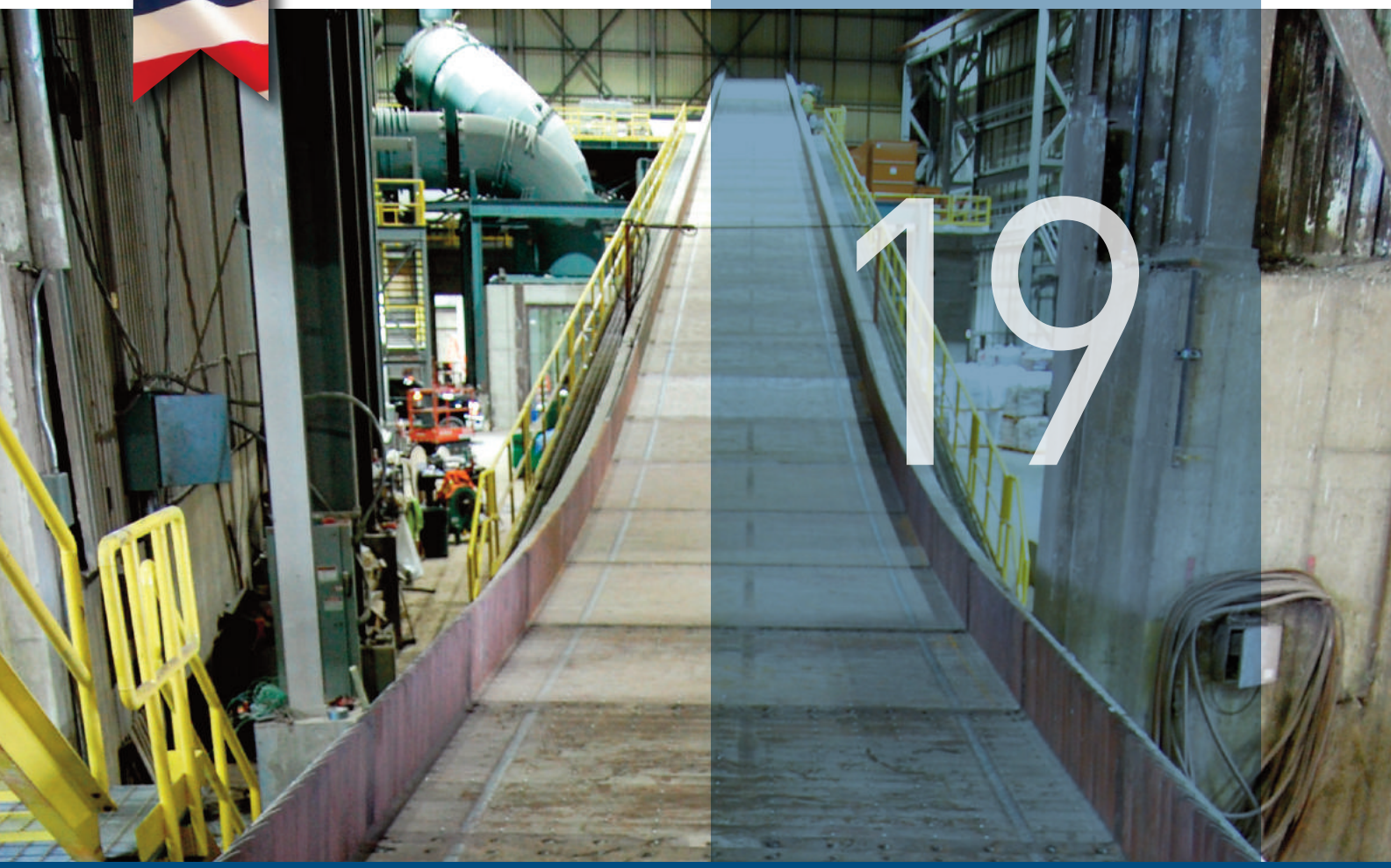
At Meschede foundry, a Superbelt® conveyor collects up to 15 t/h of aluminum engine blocks coming from 3 die-casting machines and transfers them to the decoring area.
Thanks to the multi-link design of the belt, realized according to a "damage-tolerant" approach, the Superbelt® is ensuring maximum availability and outstanding performance, thus increasing the profitability of the overall production system.

Furthermore, the Magaldi system was manufactured,

installed and started-up in record time. In only four months from the design approval, the whole team worked hard to deliver in time a project we are really proud of.



Superbelt® Length: 63.000 mm
Width: 1.100 mm
Height: 3.300 mm
Capacity: 15 t/h
Temperature: 450 °C
Handled Material: Aluminum Engine Blocks



19

MAGALDI: THE MOST CHALLENGING PROJECT IN THE STEEL INDUSTRY. RELIABLE SOLUTIONS FOR HEAVY LOADS AND HIGH TEMPERATURES

MAGALDI INSTALLED ITS BIGGEST CONVEYOR EVER DESIGNED IN CHARTER STEEL'S SAUKVILLE PLANT AND DOUBLED THE CHALLENGE WITH THE MELT SHOP IN OHIO

TIn 2017, Magaldi was engaged to supply a system able to convey up to 300 t/h of heavy steel scraps. Impressed by the Superbelt® technology features, the Customer requested a further conveyor to handle high-temperature shear scraps in the Ohio facility.

MAGALDI'S WIDE-RANGING EXPERTISE IN STEEL. THE SUPERBELT® HD TECHNOLOGY

With 90 years of experience in material handling, Magaldi can boast a wide range of technical solutions developed to master even the most difficult bulk materials whilst providing maximum process reliability and availability, high quality, reduced O&M costs, low energy consumption and environmentally-friendly processes.
These are the requirements demanded by the steel industry.

Over the years, integrated steelworks and electric steel mills from all over the world have decided to rely on Magaldi know-how and proven technologies to ensure the smooth processing of huge quantities of material - sometimes in large, heavy and/or sharp chunks or at extreme temperatures - in a harsh environment.
The harsher the environment, the more sturdy the conveyor needs to be.
For this reason, Magaldi has designed a steel belt conveyor able to withstand heavy shocks and impact loads.
The Superbelt® HD (Heavy Duty) is highly recommended in all steel plants for scrap handling and furnace loading, ensuring a reduction in the scrap handling cycle time compared to the use of magnets guided by cranes.

Designed for heavy applications, the Superbelt® HD is a variation of the Superbelt® technology: a steel belt conveyor made of partially overlapping steel pans bolted on a steel double-wire mesh, that form a virtually sealed belt conveyor.
Its high reliability is guaranteed by the multi-link design of the belt, realized according to a "damage-tolerant" approach which ensures continuous operation without the risk of unexpected outages. In fact, the accidental damage of some belt components does not affect its dependability, ensuring a continuous operation. Immediate replacement of broken parts is not required and maintenance activities can be postponed and carried out during planned stoppages.
This features makes Magaldi systems less prone to failure, downtime and costly maintenance requirements.

In the "Heavy Duty" version, the Superbelt® is supported by carrying idlers across the entire width in order to withstand heavy mechanical loads. In impact areas, idlers can be closely spaced or mounted on a heavy duty shock absorber frame.
Moreover, the loading section and the belt itself can be made in steel Hardox to assure the highest resistance to both corrosion and deformation.
Wear is negligible since material is conveyed slowly, with no relative motion with steel parts.

SUPERBELT® HD FOR HEAVY SCRAP CONVEYING AT SAUKVILLE FACILITY

Member of the Charter Manufacturing family of companies, Charter Steel is an integrated steelmaker, whose capabilities include steel melting, bar and rod rolling, coil processing and wire drawing.
Built in 1978 and expanded several times, the Saukville plant in Wisconsin is home to corporate offices as well as a fully integrated mini mill that includes a melt shop, a rolling mill and a processing facility.
The modern melt shop produces high quality billets, investing in state-of-the-art technologies able to add value to their products.

In 2017, Magaldi was engaged by the Customer to supply a dependable system able to collect and convey about 210 t/h (with peaks up to 300 t/h) of scrap material.

Magaldi had to face one of the most demanding challenges carried out in the steel industry: to design and manufacture its biggest steel belt conveyor ever supplied.
Charged by a Tenova Consteel, the Superbelt® HD conveyor is 2.400mm wide, with belt pans in manganese steel (Hardox 400) and 400mm pan sidewalls placed for the entire length of the belt to avoid scrap losses.
The loading area is designed with special supports and carrying idlers coated with rubber rings, with a closer pitch, in order to withstand heavy impact loads.

A SUPERBELT® CONVEYOR FOR HIGH-TEMPERATURE SHEAR SCRAPS IN CUYAHOGA HEIGHTS

Charter Steel also operates a fully integrated mini mill

in Cuyahoga Heights, Ohio, that includes a state-of-the-art melt shop and a rolling mill.
Impressed by the Superbelt® technology and supported by Hatch as consulting engineering partner for the project, in 2018 Charter Steel decided to renew its trust in Magaldi and equip the Ohio facility with a system to convey shear scrap at high temperature.

In addition to bear heavy loads, the Superbelt® conveyor is also able to withstand temperatures higher than any other conveyor because its components are free to expand in any directions without permanent deformations. The take-up device automatically compensates for thermal expansions.

In Cuyahoga Heights, cropped bars will be conveyed from the shear up to the existing operating floor where material will be discharged in two buckets.

Magaldi will also provide a discharge chute capable of diverting bars into two buckets thus allowing to unload one bucket whilst the second one is being filled.

Designed with a 45° slope, the Superbelt® will convey two types of high-temperature (1,093°C) shear scraps: crop cuts in normal conditions and cobble cuts in upset conditions.
Based on the design data, the crop cuts rate will be 3.05 MTPH while, in upset conditions, the surge capacity required to convey cobble cuts will be 272.2 MTPH. In the latter case, the overall mill control system will automatically adjust the belt speed till the upset condition is overcome. For this reason, a frequency converter will be installed on the conveyor drive.

SAUKVILLE PLANT
Superbelt® HD Length: 70.000 mm
Width: 2.400 mm
Height: 12.000 mm
Capacity: 300 t/h
Temperature: Ambient
Handled Material: Steel Scraps

CUYAHOGA HEIGHTS PLANT
Superbelt® HD Length: 14.000 mm
Width: 1.600 mm
Height: 9.000 mm
Capacity: 3 t/h
Temperature: 1093 °C
Handled Material: Steel Scraps

20

THE SUPERBELT® CONVEYING TECHNOLOGY TO OPTIMIZE THE USE OF AVAILABLE SPACE AND CUT MATERIAL HANDLING COSTS

BY AUTOMATING SCRAP HANDLING, TENARIS TAMSA SUCCEEDED IN A MORE PRACTICAL AND PROFITABLE USE OF SCRAP YARD, LOWERING MATERIAL HANDLING COSTS.

The installation of a fixed and a pivoting steel belt conveyor for steel scrap transportation enabled the Mexican pipe manufacturer to take all advantage of the scrap yard space thus rationalizing the plant layout and minimizing handling costs.

THE IMPACT OF SPACE UTILIZATION IN MANUFACTURING OPERATIONS

To support company competitiveness by recovering margins of profitability, it is necessary to operate a constant rationalization of all plant processes, first of all those related to the handling of materials inside the plant.

Space is a key asset in any manufacturing operation. It's typically a scarce resource: not enough in the right place, too much in the wrong place. So companies have to constantly face the challenge to efficiently utilize space – and therefore reduce costs - while selecting material handling solutions that are specific to their applications and needs.
Only through the correct allocation, positioning and configuration of space - and therefore of equipment - inefficiency can be permanent avoided.

THE SUPERBELT® TECHNOLOGY TO CUT HANDLING COSTS AND IMPROVE SPACE ALLOCATION IN TENARIS TAMSA STEEL PIPE MILL

Tenaris Tamsa, the Tenaris' Industrial Center in Mexico, is one of the world's largest steel pipe manufacturers for the energy industry, with an annual production capacity of 1.2 million tons of seamless steel pipes.

In the Veracruz plant, the integrated production process starts with the manufacturing of steel from scrap and sponge iron, which are turned into billets and transformed into seamless steel pipes.
Scrap generated by cutting pipes to final commercial length is used to feed an Electric Arc Furnace.
Originally, steel scrap was transported in heavy-duty trucks to be dumped into charge buckets at the melt shop. As a result, Tenaris had to bear high costs for material handling and inefficiencies in the space management.

In order to solve those problems affecting the overall plant efficiency, in 2016 Tenaris Tamsa requested Magaldi a dependable solution to convey pressed tubular steel scrap (90%) and other metallic scrap (10%) from the new automatic shredding system to the scrap yard.
Magaldi offered a reliable solution by supplying 2 Superbelt® HD (Heavy Duty) conveyors:

- a fix steel belt conveyor, 48 m long;
- a pivoting conveyor, 13 m long.

The fixed conveyor is made of steel wear resistant provided with formed swells and reinforcing ribs. The loading point has been designed to withstand the impact of the falling material discharged from the existing shredding pivoting conveyor. Additio-

nally, both sides of the conveyor channel are lined with wear resistant plates in order to minimize friction and material jamming.

The second conveyor is designed to pivot with wheels over a curved steel rail. Thanks to its exclusively design, the conveyor gives the opportunity to discharge the conveyed material over a larger area of the scrap yard, thus optimizing the use of available space.

By mechanizing the scrap handling process with the installation of the Superbelt® HD conveyors,Tenaris Tamsa has been able to drive down handling costs and recapture otherwise unused space by improving the existing layout.

Superbelt® 1 Length: 49.215 mm
Width: 1.600 mm
Height: 9.315 mm

Superbelt® 2 Length: 12.600 mm
Width: 1.600 mm
Height: 8.250 mm

Capacity: 120 t/h each
Temperature: Ambient
Handled Material: Steel scraps

21

ALUMINUM RECYCLING: THE FOREFRONT FOR CREATING COMPETITIVE BUSINESS

MAGALDI ECOBELT® TECHNOLOGY TO IMPROVE ALUMINUM RECYCLING BY ALLOWING TO RE-USE THERMAL ENERGY FROM UPSTREAM PROCESSES

Magaldi repeated the successful experience achieved at Novelis' Nachterstedt Recycling Center, by supplying its Ecobelt® technology to handle hot aluminum shreds to Logan recycling plant in Kentucky.
With a continuous production of 20 t/h for the each line, the Ecobelt® systems connect in a reliable way two delacquering kilns with the downstream furnaces.

SECONDARY ALUMINUM SMELTING

Secondary Aluminum Smelting is the process of recycling aluminum scrap into aluminum that can be used and recycled over and over again in a true closed loop process.

The increased adoption of recycled aluminum has created significant economic and environmental benefits for both industry and consumers.
Currently, more than 90% of aluminum used in automotive and construction applications is recycled and the trend is constantly growing also in other industrial sectors because of the economic and environmental benefits it provides. In fact, secondary aluminum production not only needs less energy (recycling scrap aluminum requires only 5% of the energy used to make new aluminum), it also reduces landfill waste and greenhouse gas emissions.

Once collected and sorted, aluminum scrap is decoated - typically through the use of a rotary kiln - to remove coatings and contaminants.

From rotary de-coaters, hot shreds (at about 500 °C) are then conveyed to the recycling furnace and turned into molten aluminum to be casted into ingots or billets, ready for subsequent processing into new aluminum products.

THE ECOBELT® TECHNOLOGY TO HANDLE HOT RECYCLED ALUMINUM

Magaldi has developed a system able to reliably handle hot shreds (at about 500°C), connecting the rotary de-coater with the downstream melting furnace.

The Ecobelt® is a steel belt conveyor, completely enclosed in a steel casing, able to handle hot materials with aggressive chemicals, heavy or sharp products, ensuring a safe and environmentally-friendly operation.
Its ability to guarantee high reliability makes it the appropriate solution for secondary smelters and aluminum recycling facilities.

Usually employed to convey hot shreds, conventional apron-based conveyors enclosed in casings are not able to avoid heat dispersion.

Moreover, directly exposed to high temperatures and dusty material, bushings and chain links need frequent greasing to avoid excessive wear thus requiring frequent shutdowns to open the casing and lubricate. In addition, chain links and guide rails often break due to dust accumulation on the bottom of the conveyor.

Unlike apron-conveyors, the Ecobelt® prevents dust dispersion into the environment and ensures the lowest temperature drop thus allowing to re-use thermal energy released from upstream processes. In fact, its core technology is the Superbelt®, a steel belt conveyor made of partially overlapping steel pans bolted on a steel double-wire mesh, that form a virtually sealed belt conveyor.

Although enclosed in a steel casing, maintenance activities are very easy: all bearings are installed outside to allow trouble-free maintenance at any time and lubrication with the belt in operation. Furthermore, the

absence of chains, pinions and sprockets guarantees a low wear and tear and a longer service life.

THE EXPERIENCE AT LOGAN ALUMINUM RECYCLING CENTER

The successful experience achieved by Magaldi at Novelis Sheet Ingot GmbH paved the way for a new challenging experience in the aluminum recycling industry.

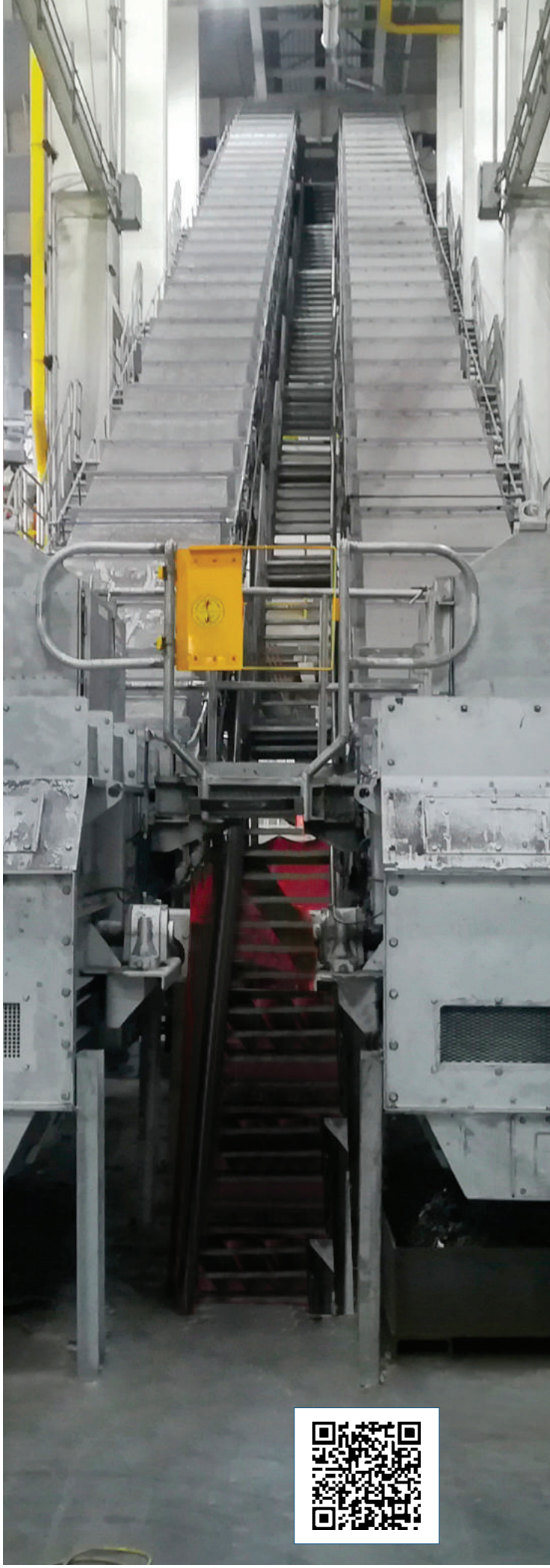
In September 2016, Logan Aluminum Inc. – leading manufacturer of flat rolled aluminum sheet for the beverage can market in U.S. - awarded Magaldi with a contract for the turn-key installation of a complete Hot Shred Conveyance System for its new Recycling Center located in Russelville, Kentucky.
Logan was looking for a dependable technology able to improve all aspects related to safety, process capability and spare parts requirements.
The attempt to use a chain conveyor had not been successful due to the inability to perform according to the plant requirements.

After simulating the plant operational conditions so to better customize the offer, Magaldi signed a contract to supply two Ecobelts® to convey 40 t/h of hot aluminum shreds from the delacquering kilns to the downstream melting furnaces.
The first Ecobelt® became operational on Summer 2017 while the second conveyor on October 2018.
In the same year, two further Ecobelt® systems were commissioned to handle up to 18 t/h each of aluminum at 560°C.

Ecobelt® Length: 44.000 mm
Width: 800 mm
Height: 5.000 mm
Capacity: 16 t/h
Temperature: 580°C
Handled Material: Aluminum shreds

Ecobelt® Length: 7.045 mm
Width: 800 mm
Height: 3.405 mm
Capacity: 18 t/h
Temperature: 560 °C
Handled Material: Aluminum shreds

Ecobelt® Length: 7.045 mm
Width: 800 mm
Height: 3.405 mm
Capacity: 18 t/h
Temperature: 560 °C
Handled Material: Aluminum shreds



22

WASTE-TO-ENERGY: THE WINNING STEP TO TURN WASTE INTO A RESOURCE

MAGALDI DRY ECOBELT® WA TECHNOLOGY TO SAVE WATER AND IMPROVE METAL RECOVERY IN INCINERATOR PLANTS. THE FIRST MAGALDI OPEN DAY DEDICATED TO WTE

Last October 2017, Acea Ambiente opened the doors of its Waste-to-Energy plant in San Vittore del Lazio (Italy) to host the Magaldi Open Day dedicated to WtE. Since 2016 the plant is equipped with the Magaldi system for dry extraction, cooling and conveying of bottom ash.

WASTE-TO-ENERGY: STATE-OF-ART TECHNOLOGIES TO MOVE BEYOND ITS "DIRTY" REPUTATION

Economic growth is extremely energy dependent. The continuous increase in the global energy demand has created pressure on the supply of new energy resources.
In fact, traditional sources are no longer able to withstand the energy requirement for the industrialized world. The steep increment in the utilization of fossil fuel in the past has resulted in an increase in pollution levels across the globe so that environmental protection is no longer an optional.
The search for a safe and renewable energy supply has become one of the main governments' alarms.

A further problem governments are facing is the growing waste generation.
Municipal solid waste (MSW) generation is highly linked with factors like economic growth and industrial development. While industrialized Countries generate a higher amount of MSW due to the better economic standard, in developing Countries, urban expansion, population growth and technological development are contribute to increase MSW generation.

Converting waste residues into electricity, heat or steam, the Waste-to-Energy (WtE) process can be considered as a potential alternative source of energy, economically viable and environmentally sustainable.
Developed Countries have already realized the potential of WtE technologies for an effective municipal solid waste management.
The development of advanced technologies for a cleaner and safer energy recovery process from waste has allowed to move beyond the "dirty" reputation of incinerators, allaying public fears to the point that ever more authorities are building WtE plants inside the urban setting (pic. 1).
Europe is said to be the largest market for WtE technologies (47.6%), having embraced Waste-to-Energy as a way to reduce landfill growth as well as dependence on imported fuels. More and more Countries are ready to walk the same path.

(Vienna Spittelau Incineration plant, pic.1)

THE ECOBELT® WA TECHNOLOGY TO SUPPORT ENVIRONMENTAL PROTECTION AND IMPROVE THE ENERGY RECOVERY PROCESS IN WTE PLANTS

Waste-to-Energy is one of the most effective alternative energy options to reduce CO_2 emissions and replace fossil fuels. It consists in generating energy in the form of electricity and/or heat from the primary treatment of waste.

Burning in grate fired boilers at temperatures between 750°C and 1100°C, organic elements in MSW are destructed and converted into energy. The incineration process is capable of reducing the volume of waste entering the landfill by approximately 85%.
But WtE isn't just a trash disposal method. It's a way to recover valuable resources: green energy but also ferrous, non-ferrous and precious metals. In fact, about 90% of metals contained in bottom ash can be recove-

red while the remaining clinker can be reused as road material.

For years, wet bottom ash handling has been the standard for WtE plants. Bottom ash (BA) produced by incineration process was discharged into a water bath for quenching and downstream handling in a wet state.
However, a growing emphasis on environmentally-friendly issues is causing many plants to reconsider their production process – including ash handling - in order to comply with the stringent environmental regulations. As a result, dry bottom ash handling systems are replacing the polluting wet technology.

Magaldi has been the first company worldwide to introduce the dry bottom ash handling technology, using ambient air instead of water during the extraction and cooling phases.
Specifically designed for WtE plants, the Ecobelt® WA (Waste Ash) system allows the dry removal of heterogeneous hot materials from grate boilers. By replacing water with air as primary cooling medium, the result is an effective environmental risk mitigation and a lower cost because there is no need to dispose of or treat water.

Completely enclosed in a dust-proof steel casing to prevent any spillage of material into the environment, the Ecobelt® WA promotes an intimate contact between air and ash particles, that maximizes the cooling process and the unburnt carbon conversion.
Ambient air enters the equipment through accurately sized inlet valves located along the conveyor while suitably designed skirtboards and special curtains/flaps hinged to the conveyor cover allow the ash passage whilst preventing uncontrolled air backflow to the furnace. Cooling air can be vented to the secondary air fan inlet and then injected into the combustion chamber so that a relevant amount of energy, mainly in the form of ash sensible heat, can be recovered to increase boiler efficiency.

In addition, the Ecobelt® WA system increases the yields of the downstream metals recovery system, minimizing metals landfilling and providing high-quality raw materials.
Since the incineration process cleans and separates metals from organic components, a dry extraction approach is the key factor to allow a more effective metal separation from inert matter. In fact, avoiding the reaction of bottom ash with water, metals can be recovered in their highest quality as well as in fine particle size (as 0.2 mm).

MAGALDI WTE OPEN DAY. THE EXPERIENCE OF SAN VITTORE DEL LAZIO WTE PLANT

Last October 2017, the Italian multi-utility Acea SpA open the door of its WtE plant in San Vittore del Lazio to the Magaldi WtE Open Day.
The event hosted the main national and international players operating in the WtE business. More than 120 guests from major Italian firms (Herambiente, A2A, Iren Energia, Falck Renewables, among others), as well as international guests from Japan (Kawasaki Heavy Industries) to Azerbaijan (Tamiz Shahar JSC), from France (CNIM) to Germany (Doosan Lentjes GmbH), took part to the technical debate on the benefits provided by the dry system and, in particular, by the Ecobelt® WA technology.

The decision to organize the event in San Vittore del Lazio was not accidental.
Designed to thermally convert 397,200 tons per year of SSF (secondary solid fuel), the WtE plant is provided with 3x54 MWth combustion lines. Since 2016, the twin incineration lines #2 and #3 are equipped with the Magaldi dry technology.

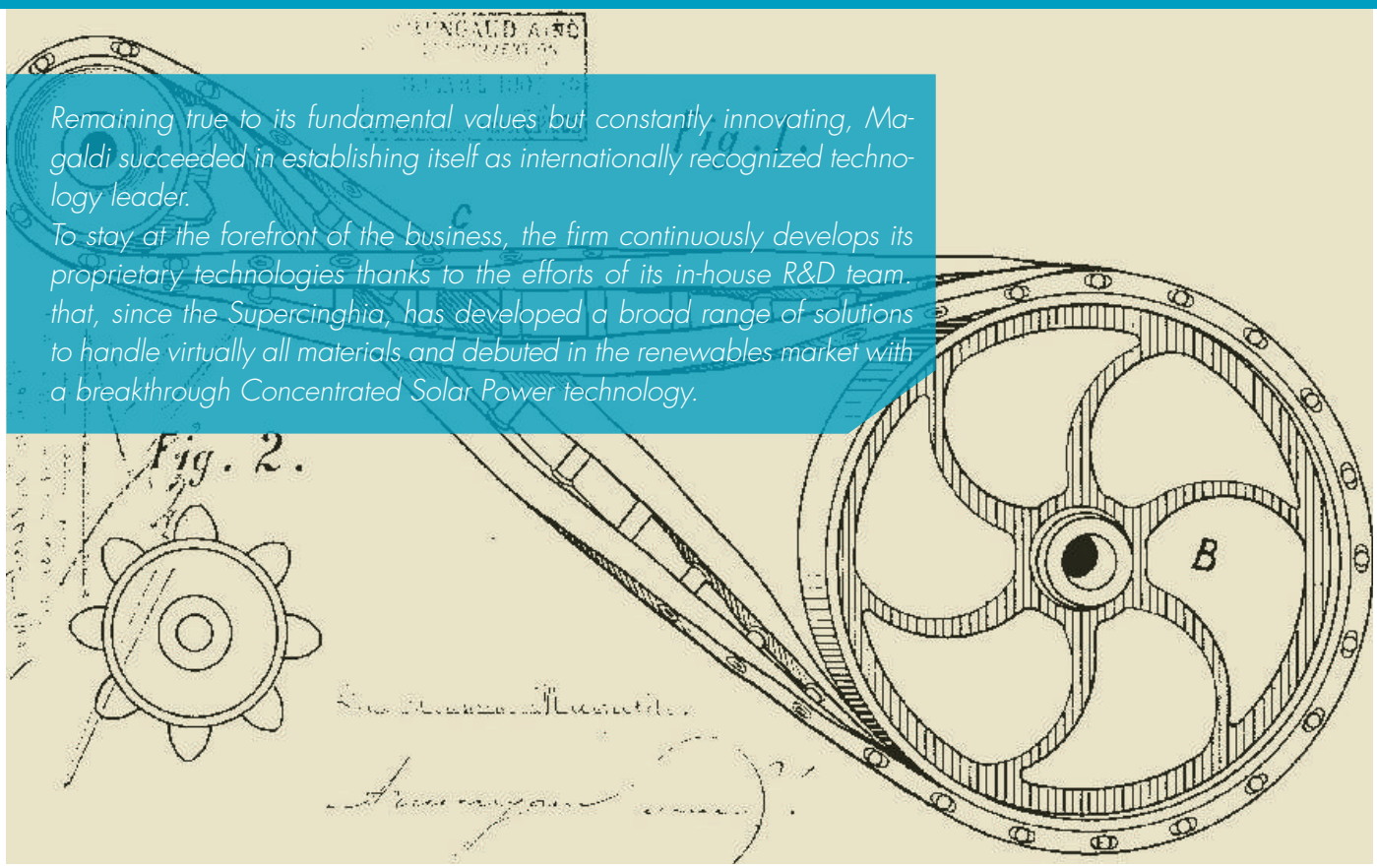
Magaldi realized the wet-to-dry conversion of the bottom ash handling system, replacing two submerged chain conveyors (SCC) handling wet ash from the discharge of the combustion grate to a temporary storage pit.
The existing wet conveyors were causing serious problems. First of all, a large amount of waste had to be disposed due to the high percentage (>25%) of water in the slag/ash. Moreover, frequent clogging adversely affected the normal operation with consequent safety problems. Added to this, uncontrolled combustion and impossibility of carrying out maintenance with the system in operation.

Using ambient air as cooling media, the Ecobelt® WA conveyors have allowed to eliminate the use of water to extract and cool both bottom ash and siftings thus cutting costs for ash/slag disposal and water treatment.
Before the discharge into the pit, ash is conditioned by using a quantity of water <7.5% to keep dust down and allow a safe transportation to the treatment plant.

INNOVATION BY TRADITION: 90 YEARS OF MARKET EXCELLENCE

Remaining true to its fundamental values but constantly innovating, Magaldi succeeded in establishing itself as internationally recognized technology leader.

To stay at the forefront of the business, the firm continuously develops its proprietary technologies thanks to the efforts of its in-house R&D team. that, since the Supercinghia, has developed a broad range of solutions to handle virtually all materials and debuted in the renewables market with a breakthrough Concentrated Solar Power technology.



MAGALDI INVESTS IN R&D TO DRIVE INNOVATION AND DEPENDABILITY

Since 1929, innovation and dependability are the cornerstone on which Magaldi has built its success story.
A long-standing tradition of innovation and knowledge has consolidated its global footprint and made the company a preferred technology partner that enjoys the trust of a wide range of customers worldwide.

Right from our customers, the innovation process begins: we listen their wishes, make their challenges our own and draw on expertise and know-how of our in-house R&D team to develop exciting solutions able to add value to any customer.

Magaldi does not sell products, it provides dependable solutions. That is why we invest about 3% of our turnover in research and innovation every year, in order to continuously confirm and expand our technological pioneering role and to turn ideas into viable technologies. In fact, innovating is more than inventing: we strive to ensure our customers could see the commercial value in our solutions, getting benefits higher than their cost.

Since the first invention - the Magaldi Supercinghia - from which the whole story of the company originated, more than 20 patents for proprietary technologies have been registered, generating approximately 400 patent applications worldwide.

Dependability is the other cornerstone of Magaldi entrepreneurial philosophy. It sums up:

- **availability**, as readiness for correct service. All Magaldi systems are developed to guarantee maximum availability and to perform around the clock;
- **reliability**, as continuity to run without sudden failures. The Superbelt® - core technology of all Magaldi solutions - has been conceived and designed to prevent any line shutdown, even if something breaks. Its construction features allow to continue running and to schedule maintenance according to production needs;
- **maintainability**. By developing new solutions or improving the existing ones, Magaldi does not neglect the aspect of maintainability. Even conveyors enclosed in steel casings are designed to allow operators to safely and comfortably maintain the system from outside. Moreover, all components are chosen to guarantee maximum resistance to wear and external stress, for a minimum requirement for spare parts;
- **safety**, for operators and for the environment. Magaldi cares about health and safety not only of its operators but also of those who will use its technologies. That's why we develop solutions that contribute to a safer and healthier workplace environment, lowering the exposure of operators to harmful agents (e.g. crystalline silica sand) and possible accidents.

Magaldi also continuously explores ways to do more for the environment. Its dry technologies developed for solid-fuel power plants have revolutionized the power sector and introduced a viable and eco-friendly solution, alternative to conventional polluting technologies.

Designing technologies with dependability is our way to ensure their success.

NINETY YEARS OF SUPERCINGHIA

At the beginning buffalo leathers, then leather strips tanned with chrome to increase their resistance, finally steel belt. Hence, the story of a company representing a successful example of that family capitalism that is the pride of the Italian entrepreneurship.

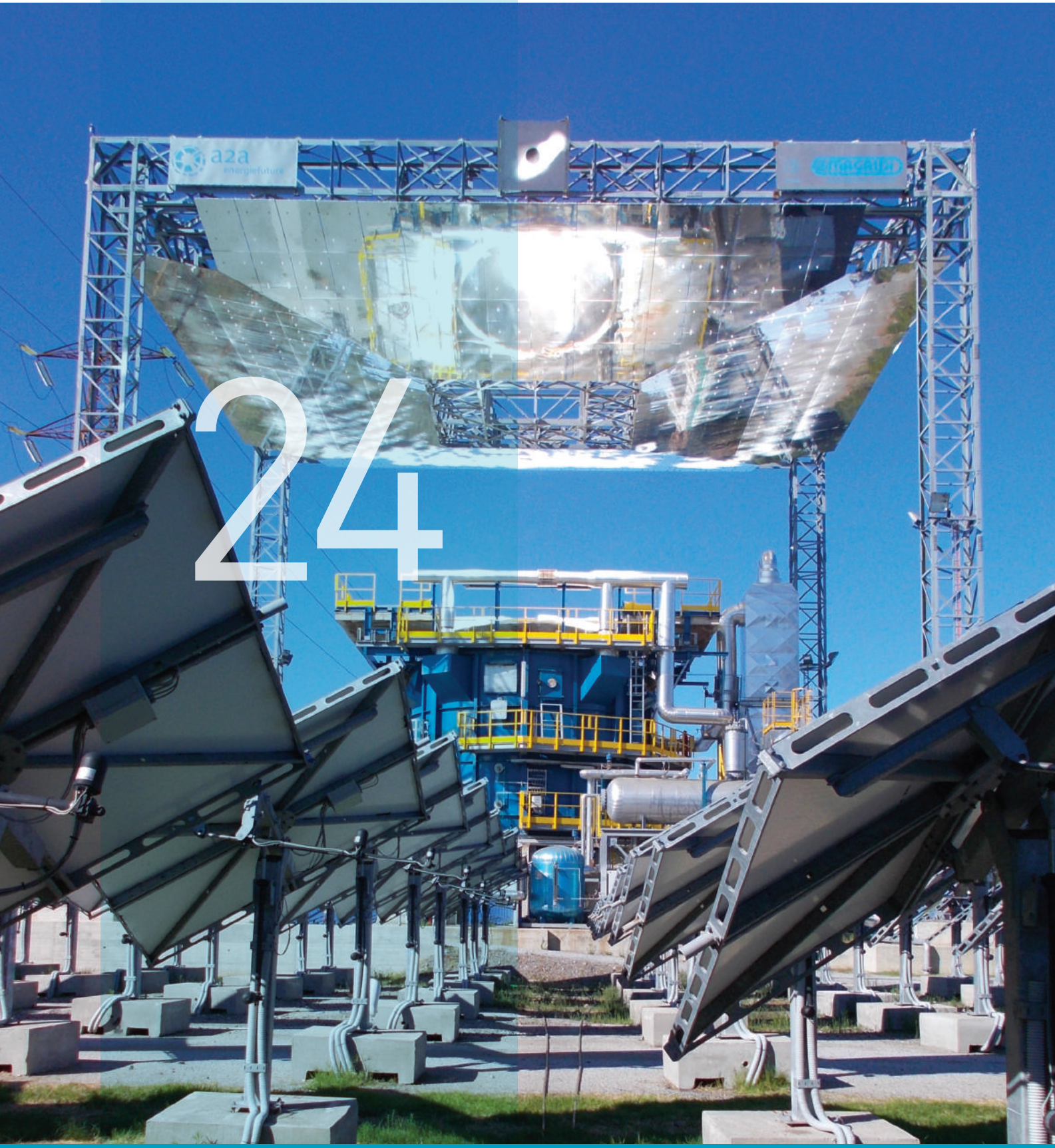
Designed and patented by Emilio Magaldi in 1901 as power transmission belt, the Supercinghia marked the starting point of Magaldi's entrepreneurial activity.
In 1929, Paolo Magaldi turned the family workshop activity into an industrial business.
Made of buffalo leather strips placed side by side and connected with metal rivets, the Supercinghia immediately penetrated the market thank to its extremely reliability and virtually indestructibility. The accidental breaking of a single strip did not spread to the entire width of the belt and did not require immediate replacement. On the contrary, belts made of wide strips of leather with joints placed very closely could suddenly break under stress in their weakest point, thus interrupting operations and posing hazards to workers.

But inventiveness was not limited to develop new products. In 1930, Paolo patented a technique for cutting the buffalo leather skin in a spiral, so to produce a single strip 100-150 m long. In this way, there was no need for hundreds of joints required in previous productions, and the Supercinghia Magaldi was even more reliable.

Magaldi perceived the potential of the Supercinghia and over time perfected it to become even more reliable, with the result of extending its area of application to many different business sectors, all facing the need to handle materials in severe process conditions.
Thus, the Supercinghia evolved in the steel Superbelt® conveyor. Summing up dependability, quality and innovation, the Superbelt® is currently the jewel in Magaldi's crown since it represents the core technology of all its systems.

Nevertheless, the Supercinghia never lost market and it is still used today for steel sheets conveying in different applications (e.g. sheet metal stamping lines, cut-to-length lines, coil wrapping machines, etc.), providing higher reliability and a longer service life (more than 10 years!) when compared to conventional rubber or fabric conveyor belts.

The Portuguese Volkswagen Autoeuropa, for example, is still benefitting from 8 Supercinghia, installed 17 years ago and used to reliably convey car doors and other automotive components.
Likewise, in the Italian SidAstico SpA, a sheet cutting machine is equipped with the same Supercinghia installed 18 years ago and so many others installed all over the world.



24

THE LAST FRONTIER OF INNOVATION BY MAGALDI: STEM®, GREEN POWER WHERE AND WHEN YOU NEED

THE LAST FRONTIER OF INNOVATION BY MAGALDI: STEM®, GREEN POWER WHERE AND WHEN YOU NEED

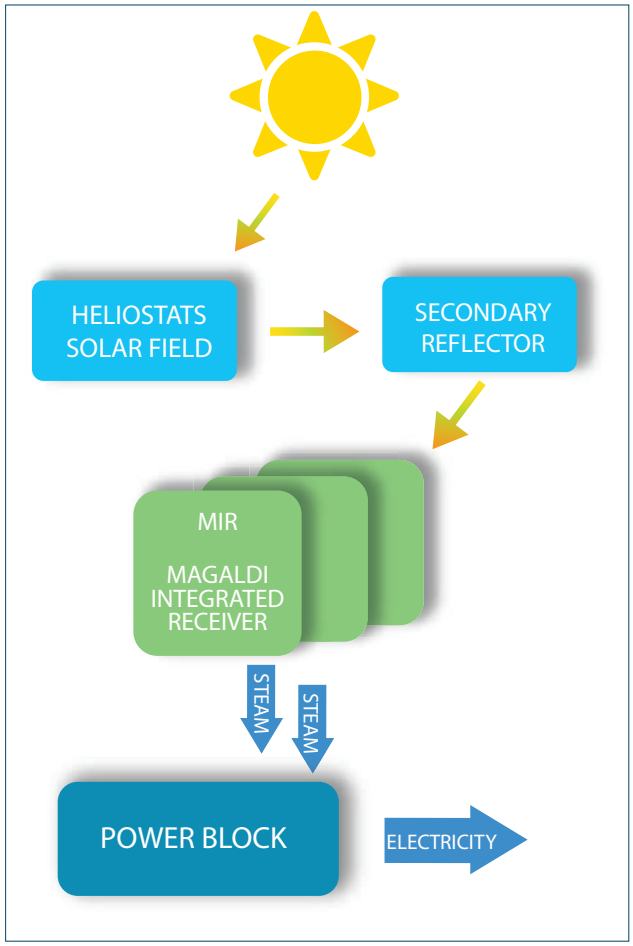
Magaldi history continues to be written over time thanks to the ability of the company to strengthen its presence on the markets, but also to identify new opportunities for growth.
The last frontier of innovation developed by Magaldi is a new type of Concentrated Solar Power system.

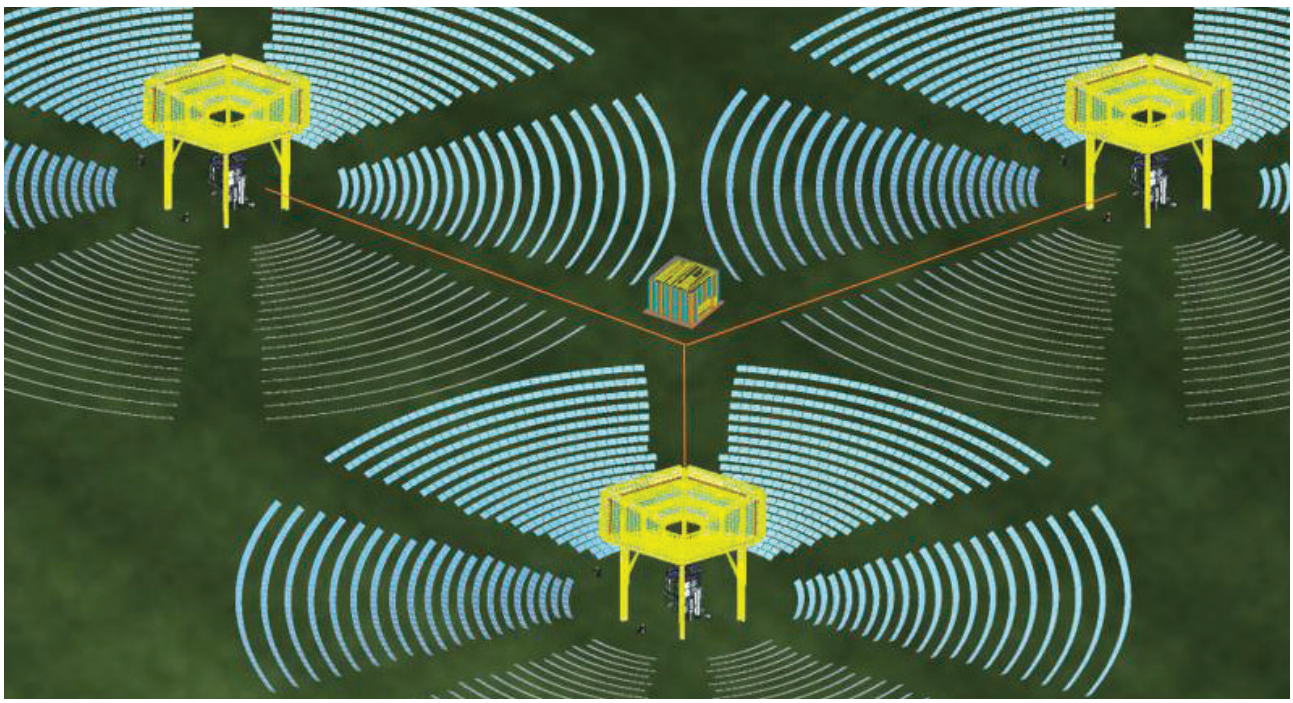
Solar Thermo Electric Magaldi (STEM®) represents a technological breakthrough in the Concentrated Solar Power (CSP) sector.
Its technology is characterized by three major innovative features:

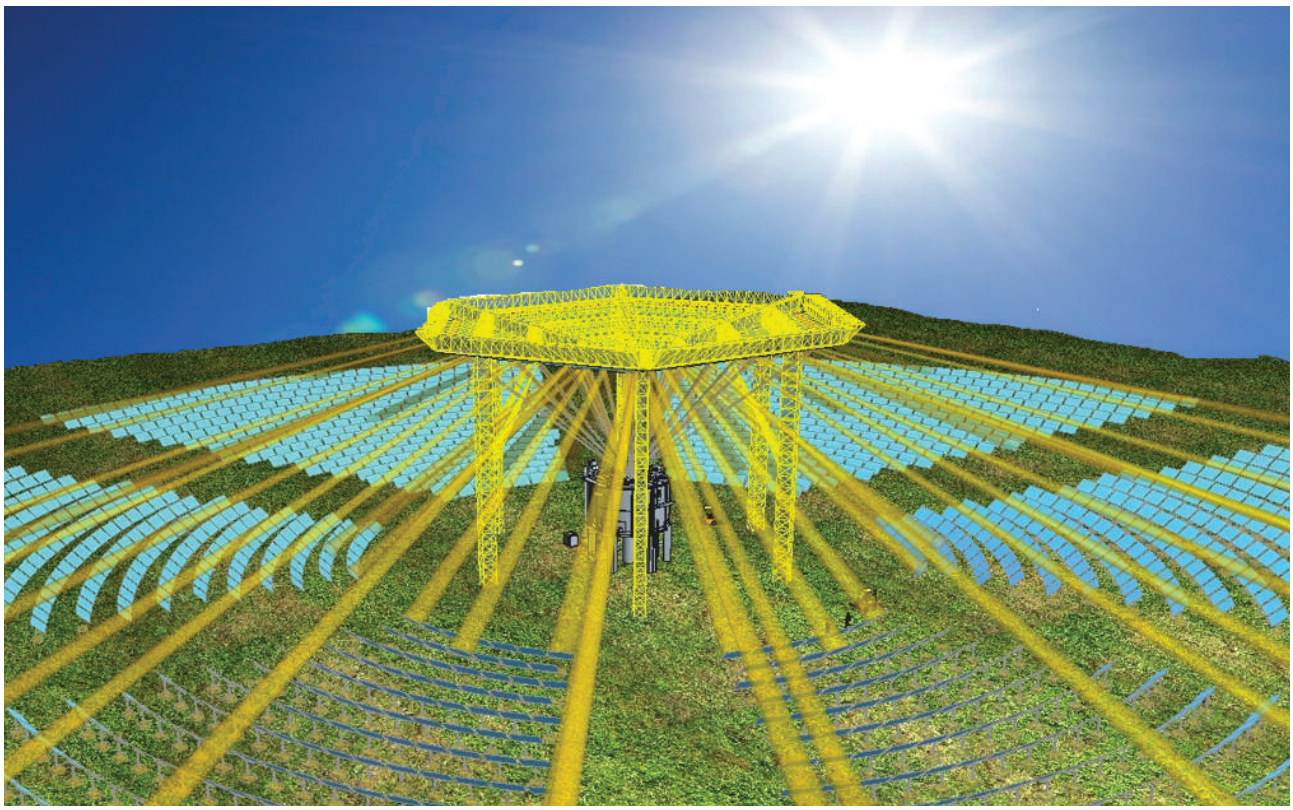
- the solar receiver and the thermal energy storage and heat transfer devices are integrated in a single piece of equipment, the Magaldi Integrated Receiver - MIR. The MIR is equipped with an innovative solid particles fluidized bed and incorporates the functions of solar radiation capture, storage of thermal energy (as sensible heat of solid particles) and heat transfer to the steam;
- the optical system is equipped with beam down configuration, allowing the solar receiver (MIR) to be based on the ground;
- the system is modular and scalable, allowing to build up an installation of the required size by connecting several STEM® modules in series or in parallel, in order to reach the needed output of steam.

A STEM® module is made of:

- heliostats field;
- secondary reflector;
- integrated solar receiver;
- fluidizing air system;
- automation and control system.

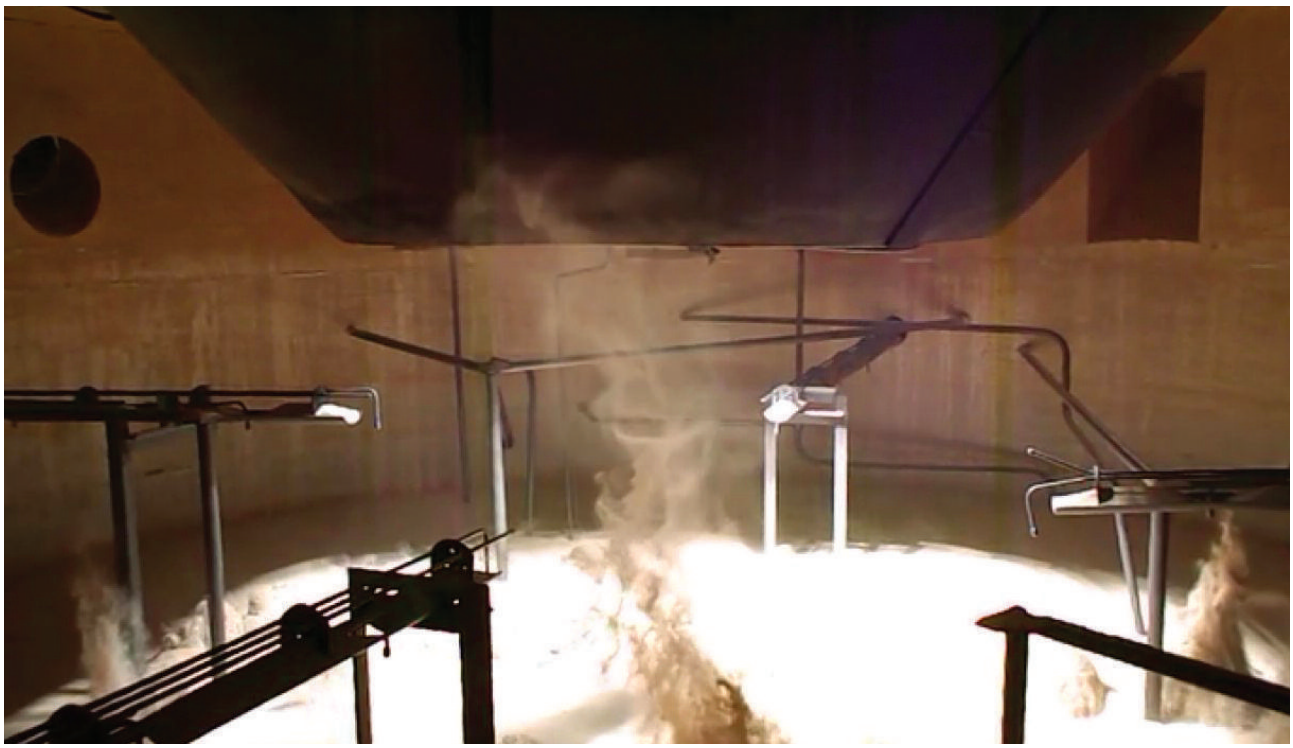






Solar radiation is captured by heliostats and concentrated on a secondary reflector, which directs it into a central solar receiver (MIR) containing a fluidized bed of silica sand. The MIR contains also heat exchangers within the fluidized sand bed for superheated steam generation.
The solid particles fluidized bed, directly irradiated by sunrays:

- guarantees unique capacity of absorbing intensive and variable solar power flux, with intrinsic safety,
- ensures high thermal diffusivity in the storage medium, with operating temperatures higher than those presently available for other CSP



technologies,
- allows effective thermal power storage and transfer to the heat exchangers, immersed in the fluidized bed, for the steam generation.

Combining different functions into a single integrated solar receiver and using low cost materials (sand and air) for the fluidized bed enables a cost effective CSP solution, avoiding the need for separate hot and cold tanks and a heat exchanger vessel.

Magaldi STEM® has been designed having a keen eye to environment, using components completely recyclable and eco-compatible.

STEM® is capable of delivering an energy trifecta - electricity, high-quality heat and energy storage - thus providing on-demand generation of steam for a number of civil and industrial applications that, thanks to its thermal energy storage capabilities, can be dispatched also after sunset or during cloudy periods.
A number of STEM® modules, assembled in one system, can work in series or in parallel, allowing a flexible and dependable steam generation, tunable

according to the user needs.
The high storage capacity of STEM makes it ideal to produce green electricity on demand, or as part of a 24/7 continuous cycle, also in combination with other renewable sources such as PV.
The subsequent addition of more modules in the system or of more systems in the same area, gives the possibility to boost production, following changes in power demand over time.

STEM® can be considered as a permanent infrastructure for distributed power production in all the sunny areas of the world.
Although STEM® already represents a disruptive technology, it is not time to stop looking for ways to make it even better, so Magaldi continues to set new challenging objectives and raise the bar higher and higher.

The energy radiated by the sun in just one second is enough to cover our energy needs for half a billion years.

Mr. Tim Flannery

«Concentrated Solar Thermal (CST) will play a vital role in limiting greenhouse emissions, in growing food sustainably and in cleaning up polluted soil and water – potentially all at the same time»

«STEM® (Solar Thermo Electric Magaldi) is fundamentally different from other CSP technologies: a key aspect is its simplicity»

«it consists of nothing but steel, glass and sand, and being modular it can be built at any scale»

«the basic unit has the potential to be modified to suit different purposes, depending on whether more heat or electricity is required and how much storage is needed.»

«There is no doubt humanity is nearing a crisis point. Old ways of doing things, from growing food to providing energy and manufacturing the countless things we feel we need, have proved to be so damaging to human health and the environment that within a few decades they must be no more. Entirely new methods of providing life's essentials must be devised to take their place»

(Tim Flannery, ***Sunlight and seaweed*** *– The Text Publishing)*

EMPLOYEES AND CUSTOMERS ARE OUR MOST VALUABLE ASSET!


INDUSTRIE
MUELLER
CIFUNSA
MH VALVE COMPANY
FEDERAL MOGUL
CHARTER MANUFACTURING
TenarisTamsa
MetalTechnologies
CBMM
RYOBI
Lafarge Holcim
MOUNTAIN CEMENT COMPANY
KASI
Fundiciones Urbina S.A.
IGIS
SKF
DAIMLER
VOLVO TRUCKS
Kovis
brembo
THE RELIABLE BRAND SINCE 1964 ALAMO
FAGOR
Zanardi Fonderie
SOCOCIM Industries
COMPONENTA
PORTLAND BLUE CIRCLE CEMENT
SIDERÚRGICA SEVILLANA
Brakes India Private Limited
FONDINOR
Safond-Martini
ALOUETTE
AMERICAN CASTINGS
ILVA
SCANIA
CEMEX
Feralpi Group
BRADKEN
ACCURIDE
nemak
RICO AUTO INDUSTRIES
SAKTHI PORTUGAL
Fuchosa
Dotson IRON CASTINGS
+GF+ GEORG FISCHER
Ferrotech
GREDE
Buzzi Unicem
DANA
HEIDELBERG CEMENT
Fucoli Somepal
fonderiacorrà
GM POWERTRAIN
fonderia COLLIGNON
FONDERIE PALMIERI
FAGOR Fagor Ederlan Taldia, S.Coop.
VDP FONDERIA
BROCKMOOR
BETSAIDE
COMPONENTA
ROLL'N CASTING
RIFOMETAL
SOLLAC Méditerranée
TISAMATIC
BROOK HANSEN
M. BUSCH
FONDERIE DI MONTORSO
ESTAMCAL
elecmetal
EVERCAST
KOHLER
SANLUIS RASSINI
PAROLA E LURAGHI
SMS INNSE SMS group
MUNJAL KIRIU
fonderia smanteria S.p.A.
tenova
ArcelorMittal
GAUSS
Teksid Hierro de México
LOGAN ALUMINUM
Victaulic
ADITYA BIRLA NOVELIS
itagawa
indsur
VULCAN ENGINEERING CO.
Chauffagekar Industrial Co.
regali brasil
EKF
Rassini
weg
Volkswagen
Hua Dong Teksid
SMS group
MARTINREA
BLACKHAWK
Schmiedeberger Gießerei GmbH
LODGE CAST IRON
waupaca
MONTUPET
COLACEM
FERAMO ACE
POWER
Kawasaki
CFE Comisión Federal de Electricidad
GEORGIA POWER A SOUTHERN COMPANY
KOMIPO
COMPLEXUL ENERGETIC OLTENIA
SK E&C
endesa emgesa
Delta electricity
isken
Nova Scotia POWER An Emera Company
四国電力株式会社
ENERGETIKA TRINEC
Alliant Energy
Florida Power
Public Power Corporation S.A. - Hellas
CS energy
SUMITOMO METALS
BAOSTEEL
a2a Energia
J-POWER
Tirreno Power
KOSPO
edelnor
edp
SOGAMA
Eraring energy
Macquarie Generation
endesa
JSW Energy
Millmerran Power
steag ENERGY SERVICES
enel
BASIN ELECTRIC POWER COOPERATIVE
Kansal Electric Power
OPG Power Ventures Plc
PLZEŇSKÁ TEPLÁRENSKÁ
R.K.M PowerGen Pvt. Ltd.
ADITYA BIRLA HINDALCO
SVEZ ENERGY INTERNATIONAL
RWE
Electrabel GDF SUEZ
SARDA
Colbún
CENAL
KOMIPO
Zürich Recycling
stx Heavy Industries
enel Green Power
COSEP
U. S. Steel Košice
WBPDCL
KEZO
EWP
KOBELCO KOBE STEEL, LTD.
Tohoku Electric Power Co., Inc.
J-POWER
acea
GE.S.P.I.
HMEL
ENERJİSA
ABFALLVERWERTUNG HORGEN
omnicane
KOREA WESTERN POWER CO., Ltd.

BROOK Hansen

Brook Hansen

MAGALDI INDUSTRIE S.r.l.
219, via Irno

84135 SALERNO
ITALIE

Raon l'Etape, le 20 OCTOBRE 1997

Messieurs,

Nous tenons à vous dire la satisfaction que nous avons d'avoir installé ce matériel dans notre usine.

A ce jour, nous l'avons utilisé dans toutes les conditions, peut-être même celles proches de la saturation, avec bonheur.

L'appareil se comporte très bien et apporte une grande souplesse et une économie non négligeable. Le personnel utilise encore des marteaux (3 kg) pour séparer les jets des pièces sur le tapis, sans dommage.

Il a déjà convoyé des grappes de pièces massives, rouges, sans difficulté, offrant pour ces pièces une zone de refroidissement suffisante pour les travailler ensuite.

Nous ne constatons aucun passage de sa

Nous ne regrettons qu'une cho
de vitesse - ce que nous ferons certainement d
le temps de refroidissement, et la répartition d

C'est un excellent matériel, q
collègues fondeurs ou forgerons.

Nous vous prions d'agréer, Mo

Hansen

CFE Una empresa de clase mundial

Gerencia Regional de Producción Occidente
Subgerencia Reg. de Gen. Termoeléctrica Occidente
C.T. Pdte. Plutarco Elías Calles
Superintendencia General

"2013, Año de la Libertad y la República"

Oficio - HECC0-O-0257/2013

Petacalco, Gro., a 18 de febrero del 2013

Asunto: CARTA DE RECOMENDACIÓN.

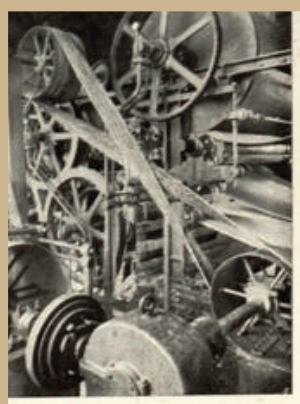
Sr. MICHELE CORRADO
MAGALDI POWER, S.p.A.
Presente

Le informamos nuestra total satisfacción con la adquisición de los Sistemas MRS y MAC para las Unidades 1, 2 y 7 de esta Central Termoeléctrica Presidente Plutarco Elías Calles, que han sido suministrados por la Compañía Magaldi Power SpA en el último año.

Atentamente

Firma Digital SAO

Firma Digitalizada SAO ingresada por Ignacio Carrizales Martinez
Ing. Ignacio Carrizales Martinez
Superintendente General



MAGALDI
Molto
Meglio
Parlano
i Clienti

L'ing. Gianni Ferrier, direttore dello Stabilimento di Isola Liri della Soc. delle Cartiere Meridionali, ci ha confermato che le SUPERCINGHIE ORIGINALI MAGALDI fornite negli anni 1936 e 1937 e garantite per cinque anni, sono tuttora in funzione sebbene avessero lavorato **24 ore al giorno per oltre 15 anni.**

Poi ha soggiunto: « Tutte le altre cinghie, si sono spesso spezzate improvvisamente cagionandoci un danno di oltre 100.000 lire per ogni fermata ». Tale durata eccezionale l'attribuiamo, tra l'altro, alla mancanza di perdita di giri per slittamento, sicchè la « SUPERCINGHIA ORIGINALE MAGALDI » per il motore da 300 HP che fu pagata 5.800 lire, costa alla Società L. **1,20 per cavallo trasmesso e per anno di lavoro.**

Il Gr. Uff. Pericle Castellani, amministratore delegato della Società Forniture Industriali, ci ha dichiarato: « Io vi conosco già da molto tempo prima di questa fornitura di 4 cinghioni per motori da 250 HP... ».

« Rappresento in Italia ed in esclusiva la Gherckens che, per un **laminatoio da 1100/2200 HP** della Acciaieria F., costruì un bel cinghione triplo da mm. 900 « Ebbene, dopo una settimana di prove e di tentativi diversi fummo costretti a ripigliarcelo e a rimandarlo in Germania, mentre il laminatoio potè funzionare con l'impiego della « Supercinghia » da Voi fornita ».

SOLLAC Atlantique
GROUPE USINOR

Magaldi Ind
Via Irno, 219
84135 Saler
ITALIE

Dunkerque le 6 Décembre 1999

C'est avec plaisir et conformément à votre demande que nous vous in
courrier.

Il s'agit du bilan après l'installation d'une bande MAGALDI type Superbe
s'est effectué en Septembre 1998 dans le circuit manutention
d'agglomération N° 3 de SOLLAC DUNKERQUE. Production annuelle
Tonnes d'Agglomérè destiné à l'élaboration de la fonte.

Le matériel de fourniture MAGALDI est du type Dosomètre avec pesage
travaille 24H par jour, 354 jours, avec un débit maximum de 500 t/h.

Les produits manutentionnés sont des fines d'agglomérè qui proviennent
sur chaîne, ainsi que du criblage à chaud et du criblage à froid.
Ces fines sont recyclées et réinjectées dans le mélange avec une préci
cette précision permet de régler et d'optimiser la consommation en cor
fabriquer l'agglomérè. Le combustible pouvant représenter 20% du coût
l'agglomérè.

Les contraintes qui devaient être réglées étaient de 2 natures:
- a) La température
- b) La précision de pesage

A) Le Dosomètre en place précédemment était du type bande caoutchou
de température pouvant atteindre 300°, celle-ci devait être remplacée
an avec des arrêts complets d'installation. (Temps moyen de remplac
et 8 heures)

B) La précision de pesage du Dosomètre à bande caoutchouc était de
Dosomètre MAGALDI (bande Superbelt) l'amélioration de la précisio
a pu être ramenée à 0,1% et a ainsi permis de diminuer la cons
combustible nécessaire à la fabrication de l'agglomér

TISAMATIC

GRUPO INDUSTRIAL SALTILLO

TO WHOM IT MAY CONCERN

This is to certify that the **Magaldi Casting Cooler** (MCC) working with the **Magaldi Integrated Supervision System** (MISS) which have been Designed, Supplied, Erected, Commissioned by Magaldi Industrie SrL (Italy) for our new two green sand lines foundry in September 2013, is working satisfactorily since then. The foundry is based in San Luis de Potosi (Mexico) and is producing automotive castings.

The system is rated to handle 16 tons per hour of gray and ductile iron castings and to cool down from about 650 degrees Celsius to below 70 degrees Celsius them.

The cooling performance of the system and the belt mechanical failure have been guaranteed by Magaldi.

To date (23 July 2014) no problems happened and the system is running according to our expectations.

Luis Carlos Cisneros Rincon
(Gerente corporativo de Proyectos)
Grupo Industrial Saltillo

Millmerran Power

Millmerran Operating Company Pty Ltd
ABN 68 083 536 181
431 Moffatt Reserve
MILLMERRAN QLD 4357
PO Box 196
MILLMERRAN QLD 4357
Tel: +61 7 4612 0300
Fax: +61 7 4612 0300

23 October 2012

Operational experience with Magaldi dry bottom ash system

To Whom It May Concern,

This letter confirms that Magaldi Power Pty Ltd was commissioned by Millmerran Operating Company, to design, manufacture and install two dry bottom ash handling systems at Millmerran Power Station, South East Queensland.

At Millmerran Power Station, ash is transported and processed, with Magaldi systems, from each of the 426 MW coal fired boilers at a capacity rate of 15t/h with a maximum capacity ash rate of 40t/h.

The first system was commissioned in 2009 and a second in 2010. Following commissioning, both systems have operated at a high level of reliability, and have met design intent. Since commissioning it has never been necessary to shut down the boilers due to any Magaldi system failure.

Kind Regards

Michael Winter
Plant Manager

関西電力

September 9, 2011

To whom it may concern:

This is to certify that the Dry Bottom Ash Handling System (MAC) which has been designed, supplied, erected and commissioned by M/s Kawasaki Heavy Industries (now Kawasaki Engineering) for Maizuru power station #2, 900MW in August 2010, is working satisfactorily since then and that the MAC has not caused unscheduled boiler shutdown for 8000 hours operation per year as average.

The unit is burning imported bituminous coal.

北澤 京介
Kyosuke KITAZAWA

Manager, maintenance section
Maizuru power station
Kansai Electric Power Co., Inc

MAGALDI POWER S.P.A.
ADMINISTRATIVE OFFICE:
26, Piazza di Pietra
00186 ROMA - ITALY

HEADQUARTERS
219, Via Irno
84135 SALERNO
ITALY
PH +39 089 688 111
group@magaldi.com

MAGALDI TECHNOLOGIES LLC
370 Great
Southwest Prkwy
Suite B
Atlanta GA 30336
USA
PH +1 800 620 6921
magaldiusa@magaldi.com

MAGALDI POWER INDIA PVT LTD
Flat 8, 4th Floor
147 Lake Gardens
700 045 Kolkata
INDIA
magaldiindia@magaldi.com

MAGALDI POWER PTY LTD
magaldiaustralia@magaldi.com

MAGALDI POWER GMBH
magaldigermany@magaldi.com

1929 2019 MAGALDI® Dependable technologies

www.magaldi.com