MAGALDI NEWS

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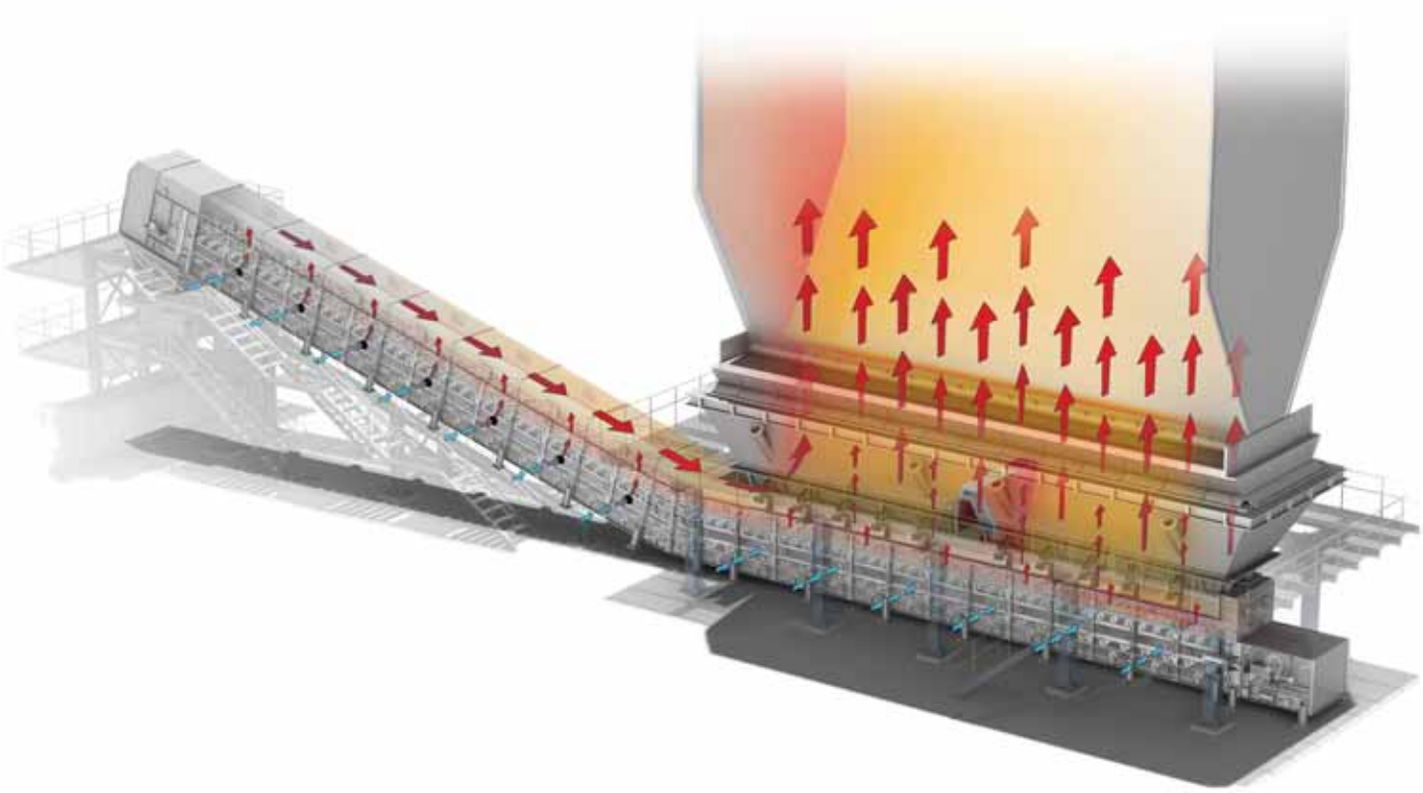
RECOVERING ENERGY



C O N T

FOCUS ON INNOVATION

MAC® EXPERIENCE AROUND THE WORLD

E N T S

BULK MATERIAL HANDLING EXPERIENCE

RENEWABLE ENERGY PROJECTS

At the dawn of the industrial age, plants were designed considering the natural resources as endless.
Today, the need to protect the environment and save natural resources is considered of paramount importance.
Back in the '30s, the innovative "Supercinghia Magaldi" was considered to be the most reliable and efficient transmission belt.
Simplicity, reliability and environmental protection are the basis of the present Magaldi products:

- *150 MAC® (Magaldi Ash Cooler) systems, installed worldwide, extract the bottom ash from boilers fired with fossil fuels, save water and recovery back to the boiler the energy from the ash heat and the unburned materials;*
- *800 Magaldi SUPERBELT®, installed worldwide, convey materials at high temperatures and now, with the innovative ECOBELT®, eliminating any dust emission into the environment;*
- *The innovative ECOBELT FA®, developed for mechanical handling of fly ash, requires only a quarter of auxiliary energy used by conventional pneumatic conveying systems;*
- *The MAP® systems, promoting the burning of biomass and RDF during extraction from the boilers, allow a coarse comminution of biomass with consequent energy saving and return a significant amount of thermal energy to the boiler.*

As per family tradition and with perseverance we continued to invest for decades in our Research Department with the creation of hundreds of international patents, most of them turned into successful industrial products.
We develop worldwide turn-key tailor-made solutions to handle, cool and dry high-temperature materials even in extremely severe ambient conditions.
If you need to handle and treat your "difficult" materials in a reliable and clean way, we will be very happy to cooperate with you and find together the most reliable and convenient system.

Mario Magaldi
President & CEO
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Germany

New MAP® System with controlled post-combustion for Gersteinwerk #K 770 MWe Boiler

by **Günter Baur,** *Magaldi Power GmbH General Manager* guenter.baur@magaldi.com

RWE has awarded Magaldi a contract for the turn-key installation of a complete dry bottom ash removal system able to afterburn the unburnt residuals from RDF cofiring in the boiler. The MAP® system has substituted the originally installed water cooled submerged scraper conveyor (SSC).

RWE Power AG operates at Gersteinwerk site four natural gas fired plants and one coal fired boiler equipped with an upstream gas turbine.
This combined natural gas and coal fired unit (#K) is in operation since 1974.
The 480 deg C hot exhaust gases from the gas turbine have enough oxygen content to be used for coal combustion in the boiler. With this technique a plant efficiency of 42% can be achieved.
The total output of the unit is 770 MWe composed of 112 MWe from the gas turbine and other 658 MWe from the boiler. The unit is operated in medium-load range.
RDF is co-fired in the boiler corresponding to a thermal input of 10%. The use of RDF leads to an increased content of unburned material in bottom ash, as well as to an increased amount of bottom ash.
The aim of the project was to eliminate a series of problems related to the SCC and to promote the post-combustion of the unburned

Fig. 1 RWE Gersteinwerk Power Plant.

Fig. 2 Post-combustion of RDF residue on the MAP® -Belt

Fig. 3 MAP® - Post-combustor on rails

Fig. 4 Postcooler conveyor with crusher station

residues from RDF in the bottom ash thus reducing the residual unburned matter in the bottom ash. The new system aimed at improving the bottom ash quality and the recovery of its energy back to the boiler, otherwise lost. The MAP® system is used to reduce the unburned carbon content significantly by means of post-combustion on the Superbelt® stainless steel belt. Thus, the bottom ash removal system becomes an integral part of the boiler furnace.

Magaldi made use of its experience from the successful operation of MAC® systems at ENEL's Fusina Power Plant (2x320 MWe) where also RDF is co-fired in the boilers (up to 5% of thermal input).

Even so, the Gersteinwerk MAP® system technical requirements were challenging:

a) The safe extraction of large ash amounts and ash big lumps.
   The operation mode of the boiler and upstream gas turbine with rapid load changes causes the sudden fall of up to 50 tons of ash out of the boiler which needs to be safely extracted by the bottom ash removal system.
b) The significant reduction of unburned carbon content in ash.
   The injected RDF was not burning out completely in the boiler furnace (average UBC content in bottom ash with SCC was 30 – 35% in weight). The MAP® system must contribute with further combustion corresponding to a heat release/ recovery in the order of up to 10 MWt to reduce the remaining RDF fraction below acceptable limit values. Apart from the use of ambient air, provisions have also been made for the use of additional hot air from the boiler secondary air duct to promote combustion.
c) The correct cooling of the bottom ash.
   After the heat release from post-combustion on the MAP® steel belt, the ash must be cooled down to allow its transportation on the existing rubber belt to the storage silo. Cooling is made with ambient air on the steel belt and also with limited water spray on ash using the evaporation heat for ash cooling.

The Magaldi scope of work comprises the use of the existing intermediate hopper (additionally equipped with bottom doors to close), the MAP®/Post-Combustor on wheels (to be removed during furnace inspections), crushers to grind the ash, a postcooler conveyor followed by an ash transfer tank with discharge equipment to feed the existing rubber belt.

The boiler has started with commercial operation on August 2011, the MAP® system currently is in the hot commissioning phase.

The results of these first months of operation are very encouraging: significant reduction of the unburned matter was realised, combined with reduced ash discharge temperature.

The MAP® system's unique capability was confirmed by:

- ensuring the boiler continuous operation in presence of severe post-combustion;
- improving the entire process of bottom ash handling;
- meeting safety and reliability standards;
- improving bottom ash quality to allow its reuse and/or a significant disposal cost reduction.

MAC®
Magaldi Ash Cooler

Unique system for "dry" extraction, air cooling and mechanical handling of bottom ash from pulverized coal-fired boilers. The MAC® system recovers a significant amount of energy back to the boiler (e.g. boiler throat radiation, ash sensible heat and ash enthalpy) and respects the environment since no water is required.

MAP®
Magaldi Ash Postcombustor

Development of the MAC® system to enhance and control the postcombustion of high carbon content bottom ash in case of biomass / RDF co-combustion in pulverized coal-fired boilers.
With the MAP®, the requirements for co-fuel particle size distribution and mixing conditions, imposed by the combustion process in the boiler, are less stringent and the operation of the co-fuel preparation system is simplified.

MAGALDI NEWS

Czech Republic

The MAC® system at Plzeňská Teplárenská: a never ending success story

by **Daniele Coppola,** *Magaldi Power S.p.A.* daniele.coppola@magaldi.com
and **Martin Kosik,** *SP Power s.r.o.* mkosik@sppower.cz

The dry bottom ash handling system reconstruction project on boiler K5 was successfully completed in 2010, realising all the promised benefits for biomass and RDF co-firing. Plzeňská Teplárenská a.s. opted for an identical solution on boiler K4 and awarded the contract to Magaldi Power S.p.A. and Energo IPT s.r.o. Installation of the second MAC® system was completed during the 2011 summer scheduled boiler outage.

The demand for green electricity is increasing worldwide and to control the carbon dioxide emissions the Czech Power Plant Plzeňská Teplárenská has begun direct co-firing with biomass, a carbon neutral fuel, at its coal-fired boilers K4 and K5.

Despite the significant advantages, direct biomass co-firing in pulverized-coal furnaces (PCFs) poses some challenges to the boiler operation. Typical problems experienced when co-firing biomass in PCFs are:

- an increased rate of slag deposit;
- an increased percentage of unburned materials in bottom ash. Coarse particles of biomass (greater than 1.0÷2.0 mm) do not have a residence time in the combustion chamber long enough to burn completely. That fraction falls down in the bottom hopper, thus increasing the unburned carbon content of bottom ash.

For those reasons, the co-firing operation in PCFs requires a thorough control on the co-fuel size distribution fed to the boiler; that

in turn implies a careful selection of the co-fuel preparation system, particularly of its milling stage. High power mills are normally necessary to obtain the suitable small particle size (1-2 mm) required by the combustion process. Due to the physical properties of the biomass, those mills are subject to significant wear and consequently high O&M costs. For the above reasons the selection of the most appropriate bottom ash handling system can be beneficial.

In PCFs conventional wet bottom ash handling systems are wasting water and energy. The same wet systems in case of biomass and/or RDF co-firing may suffer from additional operational troubles:

- co-fuel unburned light particles may float and progressively build up in the water bath below the boiler with risk of unpredictable fires;
- fines remain suspended in the water and may damage the water treatment equipment;
- heavy metals and other substances pollute the water;
- high O&M costs or even power production losses may occur because of the low wet bottom ash handling system availability.

When using a MAC® dry ash handling system those problems disappear and some of them are even converted into positive effects. The restrictions on co-fuel particle size can be relaxed thanks to the after-burning process that is realised in the bottom ash dry system. In that way, a twofold advantage can be obtained by minimising co-fuel preparation (milling and screening) and recovering a significant amount of the thermal energy from the post-combustion of unburned residues on the MAC® belt.

Low carbon unburned bottom ash can be easily sent to disposal or sold as byproduct.
The overall result is that operations related to biomass preparation, boiler firing and bottom ash extraction are optimized, with increased reliability, reduced O&M costs, higher efficiency, lower power demand, best water savings and increased environmental benefits.
At Plzeňská Teplárenská k4 and k5 (2x148 MWt) up to 10% in weight of fuel input to boiler comes from biomass, which is directly co-fired in each of the two boilers. Biomass is fed together with coal to the mills and then burned together with coal. During weekends, RDF from municipal waste, with normal rate up to 5% in weight, is also co-fired in the two boilers.
In order to optimize the boiler operation and overcome all problems related to the existing out-of-date submerged scraper conveyor (SSC), Plzeňská Teplárenská chose the Magaldi Power dry bottom ash technology.
Alstom s.r.o., based in Brno, successfully completed the installation of the first MAC® system during the scheduled outage of the boiler K5 in June 2010.
As soon as the K5 unit was put offline, the Alstom team dismantled the existing SSC and installed the MAC® system in the narrow spaces available in the boiler house. Underneath the combustion chamber a transition chute was installed to connect the MAC® to the boiler through a mechanical seal, a high temperature resistant compensator for the boiler thermal expansions.
The hot bottom ash is transported, at a continuous rate of approx. 1.1 t/h, and cooled down by the MAC® extractor which withstands the very high temperature caused by the after-burning of unburned residues from the boiler thanks to the use of the Superbelt® technology. Relevant thermal energy is taken back to the boiler. After a first crushing stage, furnace ashes are transported by an Ecobelt® conveyor to a secondary crusher and finally conveyed to the existing fly ash silo by means of a positive pressure pneumatic conveying system.
After the successful experience on the MAC® installed at unit k5, the trust in the Magaldi solution was confirmed by awarding the retrofit of the second unit K4, which was accomplished, on a turn-key basis, by Energo IPT s.r.o., winner of the tender for this project.
Energo IPT s.r.o. is based in Merovice nad Hanou and employs about 200 technicians. Energo IPT s.r.o. is specialized in manufacturing of steel structures, turbine frames and service for heating plants and power stations. SP Power s.r.o. is the company which carried out all installation works of the second MAC® system on the site.
The MAC® system installed at unit K4, identical to the one at unit K5, has been successfully running since July 2011.
The dry ash handling technology has greatly reduced the heat losses through the boiler throat with an average energy recovery evaluated at around 1.2 MWt per each boiler. Most of the heat recovery comes from the conversion of UBC in the bottom ash.
The retrofit of the entire bottom ash handling systems has made Plzeňská Teplárenská one of the most efficient, reliable and cost effective combined heating plant in the Czech Republic, able to comply with the increasing number of EU-level regulations concerning emission levels.

INTERVIEW WITH THE PLANT MANAGER (*)

Mr. Dongres, which have been the main reasons to retrofit your bottom ash handling systems with dry MAC® system?
Answer: The main reason for the reconstruction of the bottom ash system was the intention to reduce the ratio of unburned parts in the bottom ash and therefore to improve the efficiency of the boiler. Furthermore, another reason was the technical condition of the equipment, which had reached the end of its working life. Here, the endeavour was to improve the sealing of the bottom part of the combustion chamber and to minimize the inflow of false air and use the system of "afterburning" for improving the possibilities of burning alternative fuels such as pellets from biomass, RDF and others. Finally, the last reason was to finish the using of the following technology for processing and transport of bottom ash in the wet form.
Which have been the main features/advantages offered by the MAC® system and considered of interest for your power units?
Answer: We decided to buy the MAC® system because it fulfilled most of our requirements mentioned above.
How was the project execution?
Answer: The execution, delivery and erection was without serious technical or organizational problems.
Would you recommend the MAC® system to other heating plants' Directors?
Answer: Yes, of course, I can recommend this system to other clients.

(*) Interview was conducted by Mr. Martin Kosik, project manager for retrofit project on both boilers.

South Korea

Yeosu: Fluimac® System for the 340 MWe CFB Boiler starts its operation

by **Fulvio Bassetti** *Engineering Manager* fulvio.bassetti@magaldi.com
by **Lorenzo Lepore** *Engineering Dept.* lorenzo.lepore@magaldi.com

In July 2011 the CFB boiler at Unit #2 of Yeosu Power Plant, owned by KOSEP – South Korea, was fired on coal and the Fluimac® System, the innovative Magaldi System for Dry Bed Ash extraction, started its operation. Fluimac System has given proven evidence of its dependability, low maintenance requirements and economical advantages due to Bed Ash heat recovery.

Emission reduction and energy saving, as well as water demand reduction, drove KOSEP, in agreement with DOOSAN, to upgrade the Bed Ash System for the new CFB Boiler at Yeosu Power Plant (Unit #2), by applying the Magaldi Fluimac® System, able to guarantee safety and dependable operations associated with the reduction of maintenance and operating costs.

On June 2011 the erection of Magaldi Fluimac® System at Yeosu Power Plant was completed and the boiler started its operations successfully.

In the Fluimac® System the hot ash is continuously extracted from CFB Boiler drain pipes and is uniformly distributed on the Superbelt®, the heavy-duty stainless steel belt capable of reliably performing the extraction process of hot ashes out of the boiler, without any need for water cooling.

In Yeosu Power Plant, a controlled amount of cooling air is drafted from the ambient into the Fluimac® System by means of dedicated fans. The air enters the Fluimac® System through the air inlet valves located along the conveyors casing and flows in countercurrent to the ash being conveyed on the steel belts.

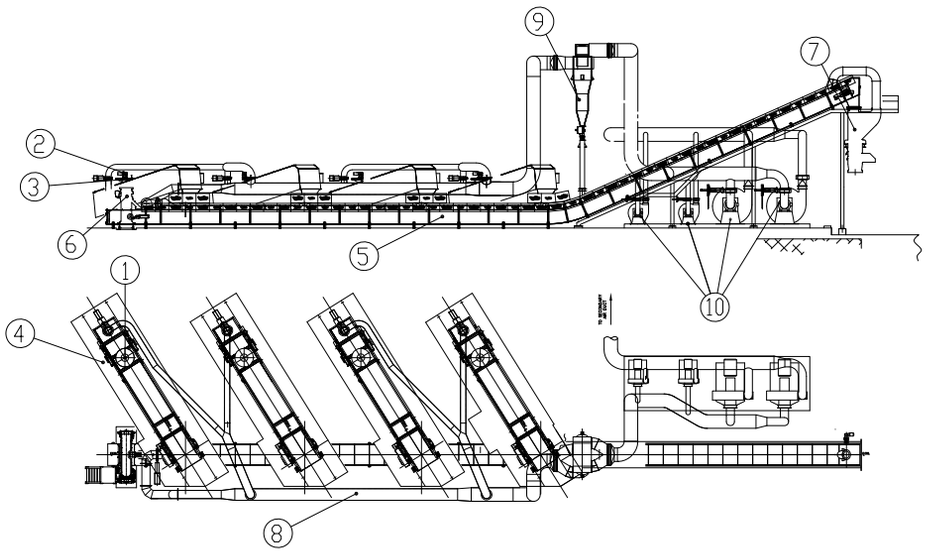
The cooling air takes heat from the hot ash, thanks to an efficient heat exchange realised along the transportation, and is then delivered to the boiler Secondary Air duct allowing for consequent heat recovery to the boiler.

The ash extraction rate in the Fluimac® extractor is adjustable by means of belt speed variation (belt is driven by frequency converter) assuring an accurate control of Boiler Bed material level. Cooling air flow is automatically regulated, according to the actual ash rate, in order to optimise the heat recovery and keep the air temperature at the desired values (180-230 °C).

Due to the absence of relative motion between ash and belt, the wear and tear problems are drastically reduced, compared to conventional water cooled screw conveyors.

Yeosu Fluimac® System consists of:

- Four (4) Fluimac® Conveyors. Each Fluimac® can extract up to 5.5 t/h of ash;
- One (1) Ecobelt conveyor, 22 t/h design conveying capacity, equipped with O-Chain® for fine ash recovery;
- One (1) Contact Cooler, for further ash temperature reduction during discharge into the following bucket elevator due to intimate contact between the ash and cooling air;
- Two (2) Cyclones for Cooling Air Dedusting before introduction into the secondary air duct: collected fines are discharged back to the Fluimac® system;
- Four (4) cooling air fans, of two different sizes, with relevant stand-by equipment, in order to adjust, for each operating condition (different ash rates), the proper air quantity, maximising fan efficiency and assuring a complete availability;



1. Drain pipe
2. Pneumatic Slide gate valve
3. Expansion Joint
4. Fluimac® Conveyor
5. Ecobelt® Conveyor
6. O-Chain®
7. Contact Cooler
8. Cooling air duct path
9. Cyclones
10. Cooling air fan

Yeosu Fluimac® Layout

• Cooling air ductworks connecting conveyors to cyclones and cooling air fans.

Compared to traditional water cooled bed ash extraction system (typically, water cooled screw coolers), the Fluimac® System has the following advantages:

• Absolute Dependability
  - The Magaldi Superbelt® damage-tolerant design ensures high availability, allowing for continuous boiler operation.
  - Minimum wear due to absence of relative movement between belt and ash. Continuous movement of hot and abrasive ash through screw and shell is the cause of high screw wear.
• No Water Usage
  - No water consumption.
  - No water treatment costs.
  - No need for water use related cooling water to be re-circulated or discharged.
  - Increased environmental protection.
• Recovery of Thermal Energy
  - Increased boiler efficiency, thanks to heat recovery from bed ash.
  - Coal consumption reduction.
  - CO2 emission reduction.
• Low Operating & Maintenance Costs
  - Minimum power demand.
  - Low maintenance costs.
  - Fully automatic operation.
  - The Magaldi Superbelt® expected operational life: more than 10 years.

Operational tests performed at Yeosu Power Plant during the summer 2011 confirmed the expected performances of the installed Fluimac® System: particularly a program of ash and air temperature measurements was conducted to determine the air cooling efficiency and heat recovery capability.

Major average parameters are summarised in the table, that shows ash discharge temperature, at the 6 t/h bed ash production rate, and a corresponding heat recovery to the boiler estimated at 1.3 MWt, realised thanks to the air cooling.

Test results (Summer 2011)

Ash rate	6 t/h.
Ash initial temperature	900 °C
Ash temperature at system discharge	120 °C
Calculated heat recovery	1.3 MWt

Currently, after the boiler start-up in July 2011, the Fluimac® System in Yeosu is correctly operating, to Customer satisfaction. According to the coal being burned, the bed ash average rate is in the range of 3-5 t/h; one or two Fluimac® extractors are normally in operation.

Magaldi Fluimac® System is confirming its several benefits, in terms of high dependability, heat recovery capability, low O&M costs, environmental protection, that nowadays are becoming increasingly important for Power Plant End-Users and designers.

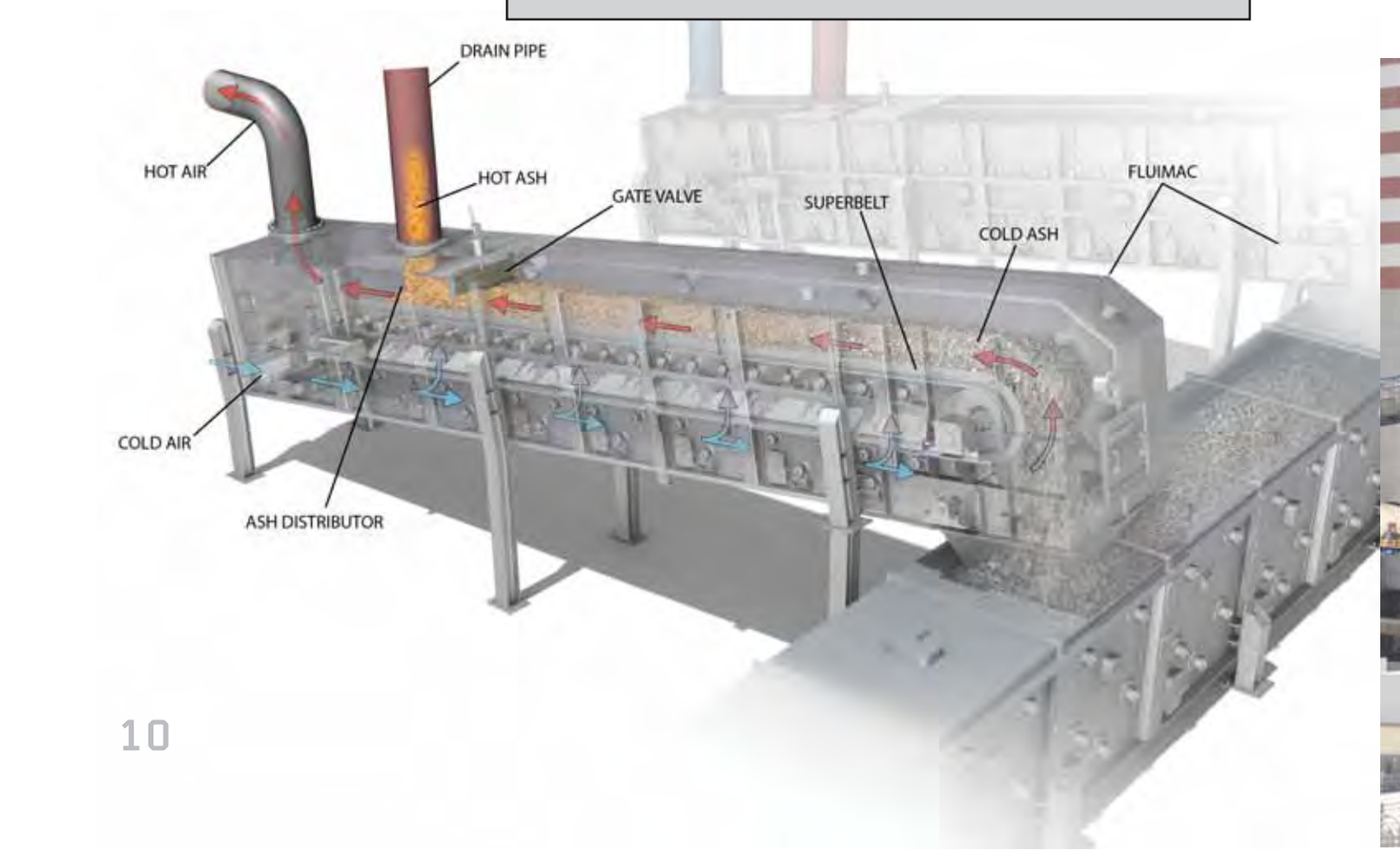
MAGALDI FLUIMAC SYSTEM
FLUIMAC SYSTEM FOR YEOSU UNIT #2 (1 x 340 MWe)

Overall data	
Boiler Capacity	1 x 340 MW_e
Fuel	Coal
Ash Rate	5.8 t/h (normal operation, worst coal) 11 t/h (design condition) 22 t/h (emergency condition)
Drain Pipe Number	4
Ash temperature in drain pipe	900 °C
Cooling air flow rate	14000 Nm^3/h (normal operation, worst coal) 26000 Nm^3/h (design condition)
Cooling air final temperature	200 – 250 °C
Potential heat recovery	Up to 1.2 MW_t (normal operation, worst coal) Up to 2.4 MW_t (design condition)

Extraction conveyor	
Quantity	4
Belt width	1200 mm
Length (C-C distance)	9800 mm
Inclination	10°
Main belt drive power	1.5 kW
Dust removing system	Spill Chain (drive 1.5 kW)

Secondary conveyor	
Quantity	1
Belt width	1200 mm
Length (C-C distance)	54800 mm
Inclination	24°
Main belt drive power	11 kW
Dust removing system	Scraper on main belt + O-Chain® (0.75kW)

Cooling Air Fans	
Quantity	4
Installed power	2 x 93kW (1W+1S)+2 x 186kW (1W+1S)
Pressure at S.A. interface point	806 mmH_2O
Dust suppression equipment	Cyclones



Italy

BIOMASS handling, pulverization and direct injection in large PCF power plants: a 320MWe class boiler application

by **Daniele Ricci,** *R&D Engineer*

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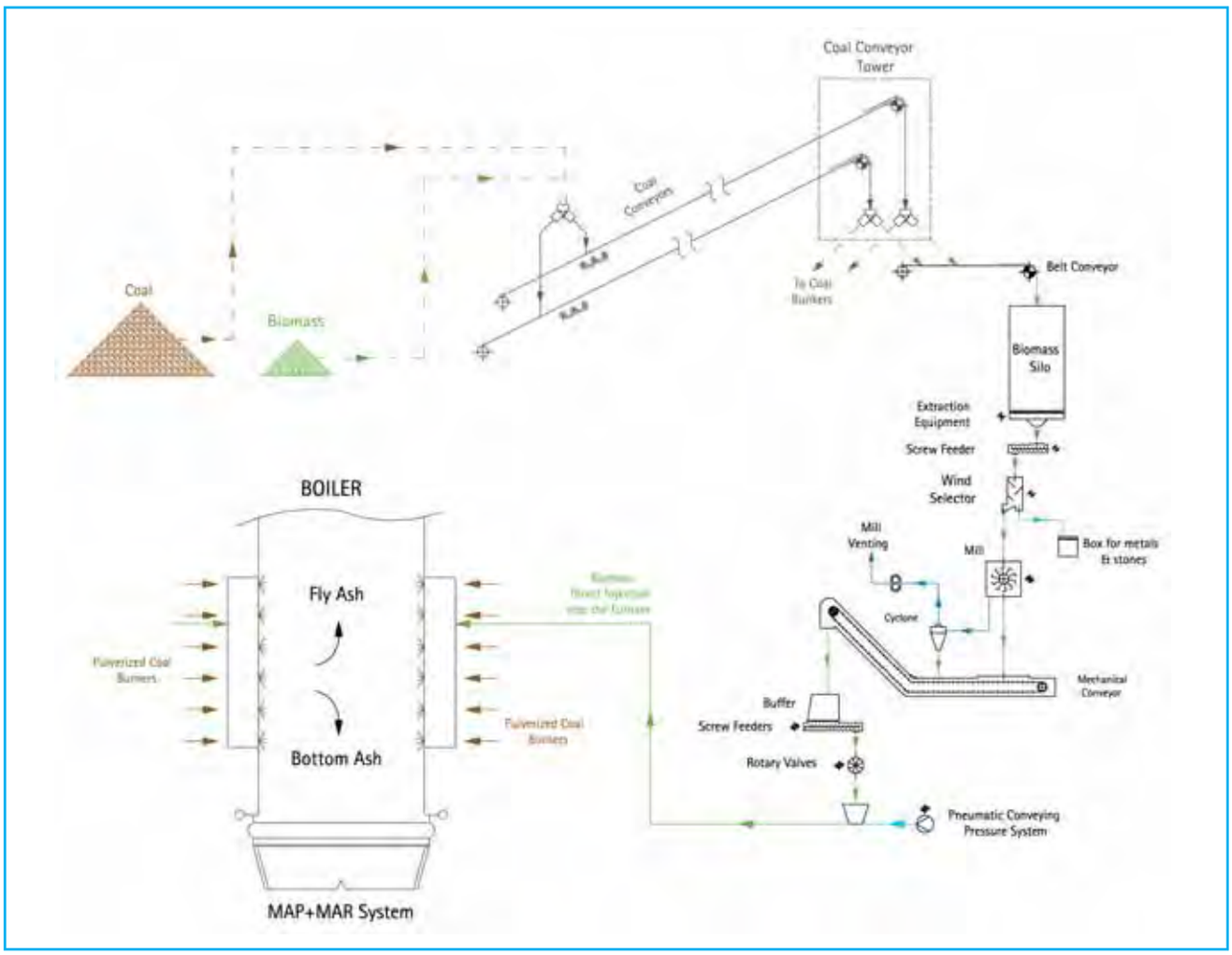
The co-combustion of coal and biomass / RDF (Refuse Derived Fuel) in large pulverized coal-fired (PCF) power plants, in the EU but also crossing the European borders, is a possible solution to satisfy the “green” energy demand.

On the basis of the latest environmental agreements and considering the stipulation of the Treaty after the UN Framework Convention on Climate Change (Rio de Janeiro 1992) and the Kyoto Protocol (1997), demand for energy from renewable sources has increased to meet the commitments for environmental pollution and sustainable development.



The exploitation of renewable energy sources does not necessarily lead to the construction of new plants. A sound and important alternative to new plants is represented by the co-firing of biomass or RDF in large PCF power plants. This option is an efficient and effective solution to meet the green energy demand since:

1. The time for the conversion to co-firing of an existing coal-fired plant is far less than required to build a new biomass / RDF fired plant.
2. The investment for co-firing is negligible compared to the whole plant since it is possible to use the systems already installed to produce energy from fossil fuels.
3. The substitution of carbon neutral biomass for coal can give significant reductions in CO_2 emissions.

Considering the above , an Italian power plant has awarded to Magaldi the engineering and E&C of a biomass handling, pulverization and direct injection system. This power plant has 2x320 MW_e coal-fired Units, provided each with a tangential firing boiler (manufacturer Franco Tosi upon CE licence) and six coal pulverizers (one in stand-by).
In 2010 one Unit has been upgraded to co-fire –imported biomass up to 5% of the thermal input. Since this biomass has a high LHV (~ 4,000 kcal/kg) and a very low ash content (~ 1.30% on “as received” basis), the feeding rate to the combustion chamber will range from 8 to 9 t/h @ ECR. The commissioning of the system was carried out in 2011.
The biomass rate has been designed in the range 10 ÷ 20 t/h, depending on the required fineness at the injection point to the boiler and considering the possibility in the future that the power plant may require the permit to double the thermal input.
To date, the majority of the biomass co-firing activity in Europe has been by pre-mixing the biomass with the coal in the coal handling system, and processing the mixed fuel through the installed coal mills and firing equipment. But the max-

imum achievable co-milling ratio, and hence the level of co-firing without significant mill throughput constraints, is limited (1 ÷ 2% in general) and depends on the design of the coal mill and the nature of the biomass material.

Since this is a retrofit application on an existing large PCF boiler, it has clearly influenced the technical approach to co-firing in terms of the biomass feeding means to the boiler.

For this project Magaldi has chosen the direct injection co-firing, so by-passing the installed coal mills in order to provide high co-firing ratios, and using a pneumatic conveyor from the handling / milling system to the boiler. The milled biomass is injected in the combustion chamber at the fifth burner level, particularly between the weak coal burner and the concentrated coal one at each corner of the boiler.

From the technical point of view, this approach has several advantages among which:

- It is technically robust and cost-effective to co-fire biomass at high ratios (≥ 5%).
- There are no requirements for significant modification of the boiler draught plant, secondary air duct, etc.
- There is no influence on the installed coal mills.
- The biomass co-firing is supported by a stable coal flame.
- If there are problems with co-firing, the biomass handling / milling system can be turned off and isolated rapidly at any time, then the boiler load can be picked up on coal firing.

As shown in the enclosed layout, the biomass is stored in a corner of the coal yard and it is conveyed to the Unit using the existing coal conveyors. Then the material is:

1. discharged on a short belt conveyor to load a flat-bottom silo, having a volume big enough (500 m^3) to satisfy the daily biomass feeding rate @ ECR;
2. extracted from the silo through a strong sliding scraper-extractor;
3. dosed in two removers for ferrous and heavy (e.g. stones) pollutants;
4. pulverized by a dedicated mill to a size that will combust efficiently in a pulverized fuel flame;
5. pneumatically conveyed and directly injected in the combustion chamber at the fifth burner level.

The facility to handle, store, mill and pneumatically convey the biomass material is provided with a fire-extinguishing system and all necessary explosion protection devices.

The co-combustion in PCF power plants nevertheless requires a thorough control of the co-fuel size distribution fed to the boiler. High power mills are generally necessary to obtain the suitable small particle size (d < 1.0÷2.0 mm) required by the combustion process in the boiler furnace. Due to the physical properties of the biomass / RDF, those mills are typically subject to significant wear and consequently high O&M costs.

For the above reasons the selection of the most appropriate bottom ash handling system can be beneficial. In case bottom ash contains high percentages of unburnt carbon residues, the MAP® Magaldi Ash Postcombustor, a development of the MAC® Magaldi Ash Cooler, enhances the unburnt carbon conversion, producing low carbon bottom ash. So the requirements for co-fuel particle size distribution and mixing conditions, imposed by the combustion process in the boiler, are less stringent and the operation of the co-fuel preparation system is facilitated.

Biomass / RDF co-firing can lead to large environmental and economic advantages since the power plant will be able to achieve its targets on “green” energy production, getting tradeable green certificates, and on the CO_2 emission reductions. These principal drivers are increasing biomass use in new and existing PCF boilers since co-firing is a very attractive option for biomass utilization and for the delivery of renewable energy, in terms of the capital investment requirement, security of supply, power generation efficiency and generation cost. This is recognized by a number of the EU Member States and other Governments, which have introduced specific policy instruments to encourage energy recovery from biomass and, in some cases, co-firing activities at both existing and future PCF power plants.

Why to install the Magaldi Ecobelt® instead of drag chain conveyors?

by **Alfonso Pirro,** *Area Manager*
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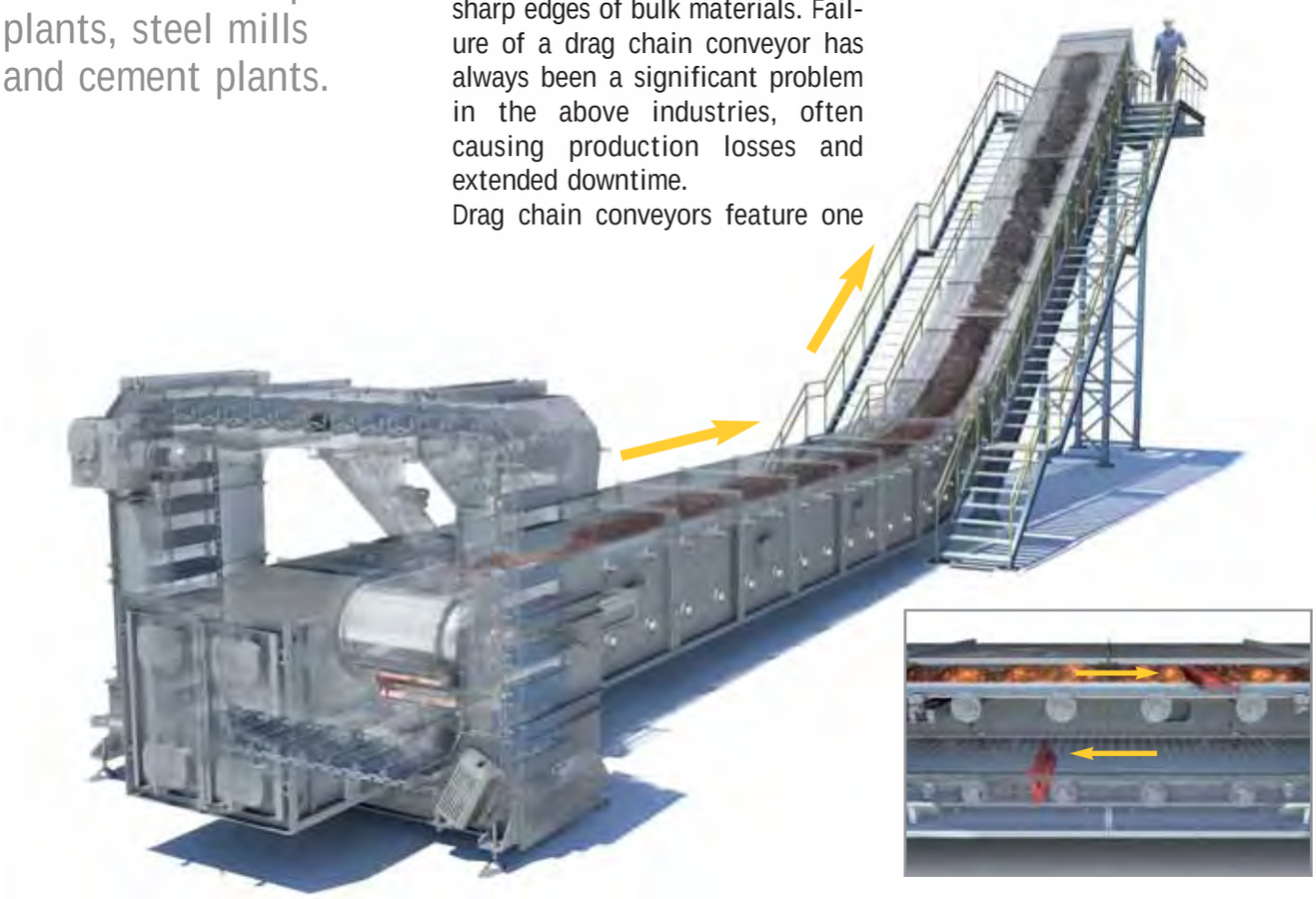
Dependability of bulk material handling is a key issue to ensure the highest productivity in several industries, especially in case of continuous production processes as for coal-fired power plants, steel mills and cement plants.

The Magaldi Ecobelt® is the ideal conveyor for handling hot materials, aggressive chemicals, and heavy or sharp products, ensuring a safe and environmentally friendly operation.
Conventional conveyors, such as drag chain conveyors, suffer from several operational problems due to high temperatures, heavy loads, abrasiveness, corrosiveness or sharp edges of bulk materials. Failure of a drag chain conveyor has always been a significant problem in the above industries, often causing production losses and extended downtime.
Drag chain conveyors feature one or more endless strands of heavy duty chain that drags a bed of bulk material over hardened wear blocks or smooth hardened plate through an enclosed casing.
This type of conveyor cannot guarantee continuous operation when transporting extremely hot and / or abrasive materials with a wide grain size range since their resistance, both mechanical and thermal, is not sufficient. If an unex-



pected failure occurs to just one component (link, sprocket, etc.), drag chain conveyors suddenly stop the production line for the whole period necessary to repair the breakdown. The major causes of component breakage are the abrasion and corrosion characteristics of handled materials. This high wear is caused by the relative motion between the conveyor parts and the handled abrasive material. Drag chain conveyors are not appropriate for moving larger objects since they are very likely to get jammed, leading to increased incidence of maintenance and repair. These conveyors can encounter other problems such as the tendency of the chain to jump the sprocket teeth, due to excessive chain stretch / elongation, or the misalignment of multiple chain strands caused by uneven wear and / or tension.

Nowadays the above losses, associated with unexpected and frequent downtimes of material conveyors, are not acceptable.

The Magaldi Ecobelt® overcomes the limitations of conventional conveyors such as drag chains.

The Magaldi Ecobelt® key component is the Magaldi Superbelt®, designed completely enclosed in a steel casing, suitable to prevent dust dispersion to the environment. A simple mechanical self-cleaning device removes the fine residuals from the bottom of the casing.

The Magaldi O-Chain® is a chain conveyor enclosed in an independent casing, tailored around the Magaldi Ecobelt® tail section. Its function is to receive the fine residuals, taken from the Ecobelt® bottom by the self-cleaning device, and to reload them onto the Magaldi Superbelt®.

The Magaldi Superbelt®, the steel belt successfully used to convey difficult materials in industries where high dependability is essential, overcomes the frequent problems encountered by drag chain conveyors.

The Magaldi Superbelt® allows the conveying of extremely hot, dusty, sharp and abrasive materials, even if containing fines or lumps, over long distances and with steep inclinations. High temperatures and tear issues are solved thanks to the patented method of connecting the pans to the mesh belt, that leaves all elements free to expand in any direction. Wear is negligible, since material is slowly conveyed with no relative motion against steel parts. Power demand for conveying and noise are at minimum levels. In most cases the Magaldi Superbelt® operational life exceeds 10 years.

Maintenance on the Magaldi Ecobelt® is very easy. All idler supports are installed outside the casing, allowing trouble-free inspection at any time and lubrication with the belt in operation. The other elements are designed for continuous operation and can be checked during preventive maintenance, over a multi-year schedule. The Magaldi Ecobelt® can continuously work for years with reduced O&M costs, always maintaining its high dependability.

The Magaldi Ecobelt® is ideal for transportation and, if necessary, controlled cooling of:

- Hot & bulk materials.
- Dry bottom & fly ash from PC fired boilers.
- Dry bed ash from FBC boilers.
- Dry biomass ash from boilers burning biomass alone or co-fired with coal.
- Dry RDF (Refuse Derived Fuel) ash from co-fired PC boilers.
- Biomass and RDF.
- Cement clinker.
- Core and foundry sand.
- DRI (Direct Reduced Iron) pellets.
- Coke, pellets, slugs for the metallurgical industry.

Application range:

- Conveyed material temperature up to 1,000 °C.
- Inner ambient temperature up to 700 °C.
- Size of the conveyed material from fines up to big lumps.
- Conveying capacity up to 200 m3/h.
- Transportation distance over 200 m.
- Angle of inclination up to 60°.

The Magaldi R&D dept. performs experimental tests in the Magaldi test facility for any type of material. Custom-made technical solutions can be studied to solve specific problems for your severe applications.

The following table shows the main differences between Magaldi Ecobelt® and drag chain conveyor:

ECOBELT® CONVEYOR	DRAG CHAIN CONVEYORS
Reliability	
That is the key feature thanks to the Magaldi Superbelt® technology. Even if the belt is locally damaged, it continues to operate without danger of unexpected failures till the next maintenance outage. Magaldi guarantees no sudden breaks of the Superbelt® for 5 years.	A chain breakage cannot be predicted. Any chain can suddenly break in its weakest point. In case of chain breakage, the conveyor stops with consequent production losses.
Temperature resistance	
The Magaldi Superbelt® withstands higher temperatures than drag chain conveyors, since all elements are manufactured from steel and are free to expand in any direction, without distortion. Moreover, all rotating components are installed outside the conveyor casing.	Drag chain conveyors have a limited resistance to high temperatures. Temperatures over 250 °C (482 °F) cause loss in hardness of chains and sprockets.
Ability to handle big lumps od any hardness	
The Magaldi Ecobelt® can be sized to handle any big and hard lump. It is available in widths that range from 300 mm (1 ft) to 1,200 mm (4 ft).	Drag chain conveyors operate fine well when the bulk material grain size is very small. If the material is coarser or contains also some hard particles, with a size comparable to the clearance among the scrapers and the inside walls or the bottom of the casing, impingements or blockages or permanent sets can occur. In that case the chain will be subject to overload with consequent possible and sudden breakages.
Inclination ability	
The Magaldi Ecobelt® can incline up to 60°. In that case the belt is provided with transversal cleats to form a sort of “bucket” conveyor that can efficiently transport any type of bulk materials.	Inclination highly reduces the capacity of drag chain conveyors.
Wear resistance	
The Magaldi Ecobelt® simply transports any type of bulk materials without dragging them. Abrasive materials do not affect the belt life span since there is no relative motion among the handled material and the belt pans during conveyance. Even in the heaviest applications the Magaldi Superbelt® operational life can exceed 10 years	Drag chain conveyors continuously “drag” the bulk materials inside the casing through the scrapers, resulting in a quick wearing of those components. Regular maintenance is therefore required and the component life span can be very short, depending on the handled material abrasiveness.
Operational cost	
The Magaldi Ecobelt® requires less power than drag chain conveyors. It lasts longer and requires less spare parts stock.	Drag chain conveyors require high installed power due to the friction between the transported material and the casing. Moreover, those conveyors need a complete set of spare parts (chain and sprockets) to deal with a sudden breakage.
Noise level	
The Magaldi Ecobelt® noise is simply at the minimum levels: < 65 dB(A)	Drag chain conveyors can have high sound pressure levels due to the material dragging inside the casing and the mechanical engagement between chains and sprockets.

India

India: an overview

by **Debasish Chakraberty**, *Magaldi Power India Pvt. Ltd. Country Manager* debasish.chakraberty@magaldi.com

The past year was a significant one for Magaldi Power India Pvt Ltd. We took meaningful strides and bagged some significant orders in order to establish ourselves firmly in India.

The results demonstrated once again that our Company has the right strategy, the right people and the right products and systems to succeed in today's market. The solid results were achieved against strong economic and competitive headwinds. What is particularly pleasing and which made the past year remarkable is that we believe our results and actions demonstrate that we are well on the way to establish ourselves as a strong, reliable and consistent earnings-growth company.

We believe that our success is due to our ability to connect with our customers/prospective customers, by providing them with a wide variety of options to meet their requirements.

Being the only universally proven technology for Dry Bottom Ashes, our operational experience coupled with our technical strength and the large amount of R&D work carried out on field, enabled us to offer a suitable solutions to every customer, after allaying all their apprehensions.

Knowledge of our technology has percolated to all parts of our country; reference to Dry Bottom Ash Handling Systems immediately brings the name of Magaldi to the minds of all customers.

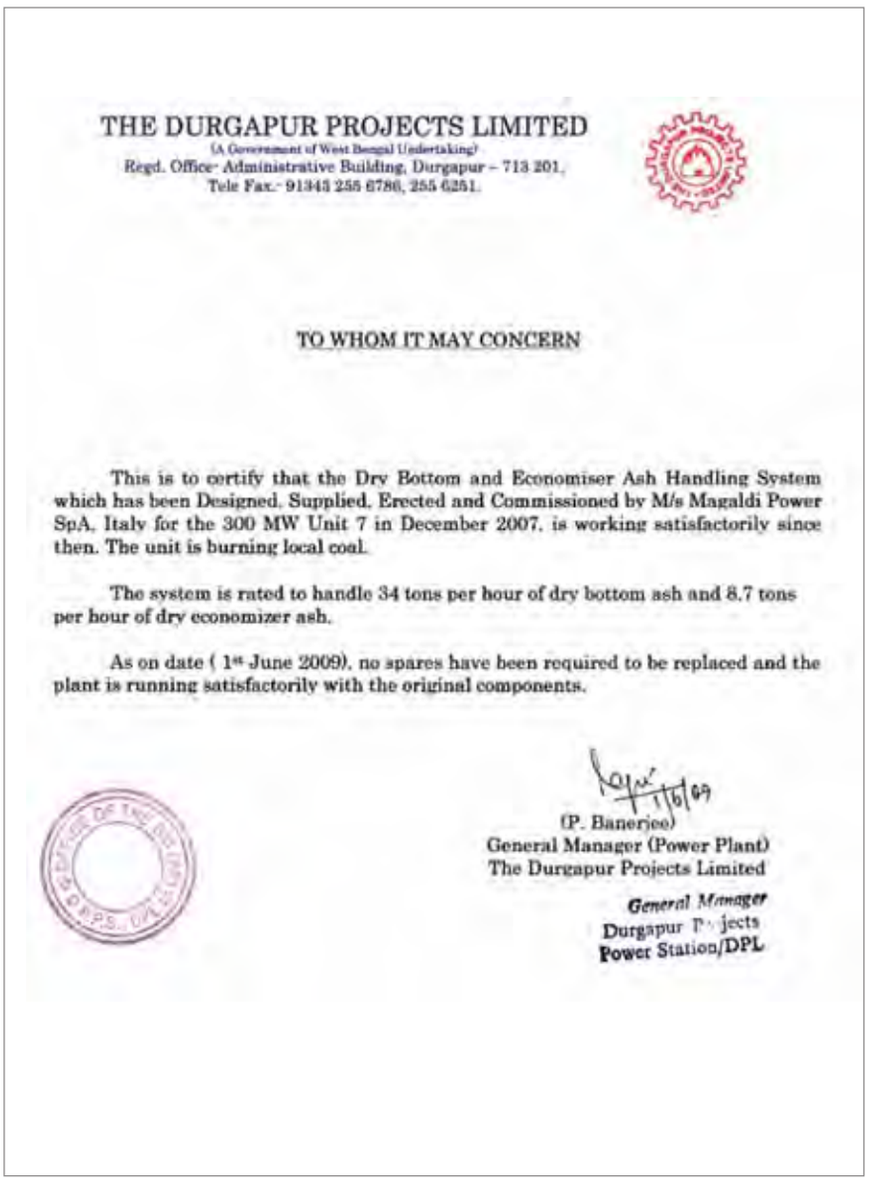
We have prevailed whenever there has been fair competition; customers do not wish to take the next best choices as "the seemingly inconsequential small system below the boiler needs to be extremely dependable and proven under Indian conditions".

It would be pertinent to mention at this juncture the drivers which have helped our client to "Zero in and Lock onto" only our MAC® system (an acronym for Magaldi Ash Cooler).

- First and foremost being a technology which not only has traversed to all corners of the globe but also the fact that it is a technology which has evolved slowly and steadily since the

early 80s, based on inputs from the field operating plants in conjunction with very proactive R&D. The technology which is in place today combines the best of theory with practice and each new installation adds more. This is the strength of this very dependable MAC® technology which has been developed "in house" and not "borrowed" (a euphemism) from others!

- Experience of handling large volumes of Indian ash since 2007 have given us new insights and consequent improvements. Development has been very rational and structured by starting with smaller units and being fully satisfied with the efficacy of the system before going on to higher sized units. Indian coal has very large volumes of ash and therefore this system was applied first below a 300 MW unit (DPL Durgapur Unit 7) and the performance analysed under extremely trying conditions with the worst range of local coals, some being extremely slagging and generating copious clinkering. Fully satisfied and armed with this experience we shall be shortly gaining higher capacity power station orders.
- The MAC® system has been used below all leading boiler manufacturer's in the world. Till date there has not been a single instance of boiler outage attributable to our system.
- Usage of water has been completely eliminated from the bottom ash handling process leading to a "Zero Discharge and an extremely Environ-



THE DURGAPUR PROJECTS LIMITED
(A Government of West Bengal Undertaking)
Regd. Office- Administrative Building, Durgapur – 713 201.
Tele Fax.- 91343 255 6786, 255 6251.

TO WHOM IT MAY CONCERN

This is to certify that the Dry Bottom and Economiser Ash Handling System which has been Designed, Supplied, Erected and Commissioned by M/s Magaldi Power SpA, Italy for the 300 MW Unit 7 in December 2007, is working satisfactorily since then. The unit is burning local coal.

The system is rated to handle 34 tons per hour of dry bottom ash and 8.7 tons per hour of dry economizer ash.

As on date (1st June 2009), no spares have been required to be replaced and the plant is running satisfactorily with the original components.

1/6/09
(P. Banerjee)
General Manager (Power Plant)
The Durgapur Projects Limited

General Manager
Durgapur Projects
Power Station/DPL

mentally Friendly System".

- Coastal based plants depend on treated sea water for their process requirement and this very high expense adds on to the operational costs; usage of the MAC® system curtails this expensive treatment substantially.
- Dry ash collection drastically reduces the size of the ash ponds.
- The MAC® system is able to reduce the unburned carbon levels of the bottom ash and this makes it eligible for cement manufacture. The cement plant in turn can earn "carbon credits" since usage of bottom ash in cement manufacture eliminates a considerable amount of the major environmental hazard, carbon di-oxide. When both bottom and fly ash are used in cement manufacture ash pond requirement is completely eliminated.
- The MAC® system entails considerable savings in O&M costs vis-à-vis traditional wet systems.
- The MAC® system can increase the efficiency of the boiler fractionally; this further reduces carbon di-oxide emissions from the plant.

A combination of the above have been reasons for our clients to choose the MAC® system.

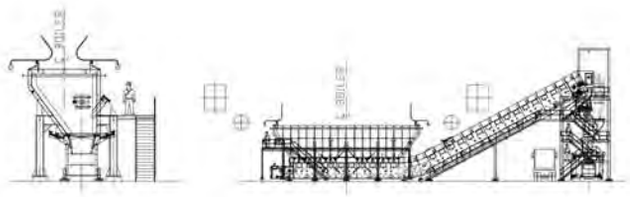
4 nos MAC® systems at JSW Ratnagiri (4 x 300 MW Units) are under operation. Results of performance tests conducted for the units prove that in practice there has been very much improvements in all parameters. Same holds true for the other MAC® systems under operation in India, DPL Unit 7 & OPG Power Unit 1.

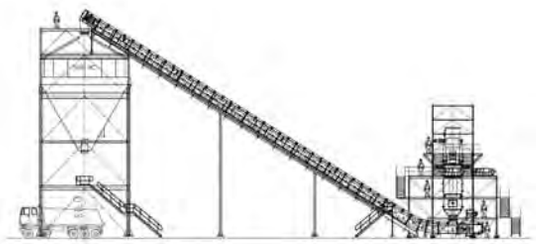
The recent performance certificate from DPL Durgapur (our system has been operating since December 2007) speaks volumes about our system dependability and efficacy. We have realised the order for DPL's Unit 8 also in December 2011.

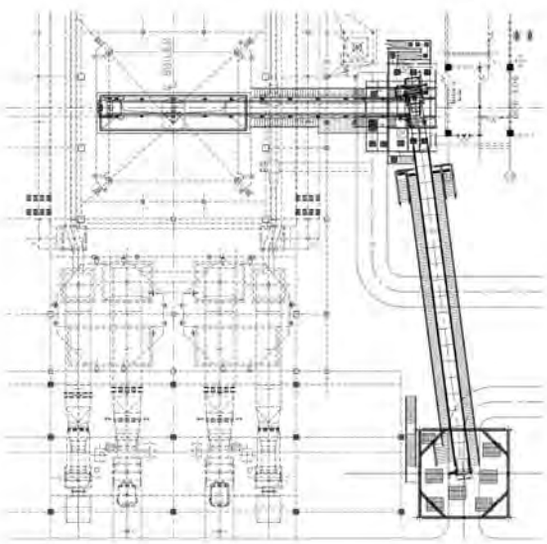
OPG Power is another very satisfied customer, and have placed repeat orders on us for their Units 2&3; boilers are being supplied by Ansaldo.

RKM Power Gen, 4 x 360 MW Units at Chattisgarh have given us the orders for the Dry Bottom Ash Handling System for all their 4 units; boilers being supplied by Western Power, China.

GMR Energy gave us the order for the dry bottom ash handling system for

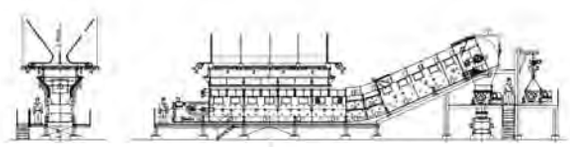


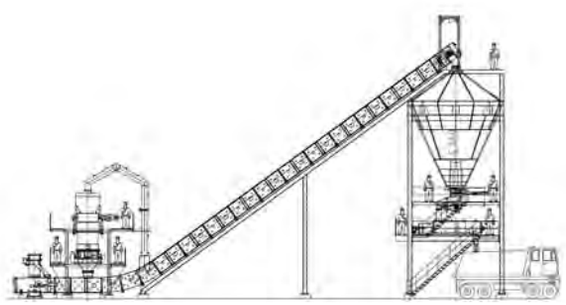


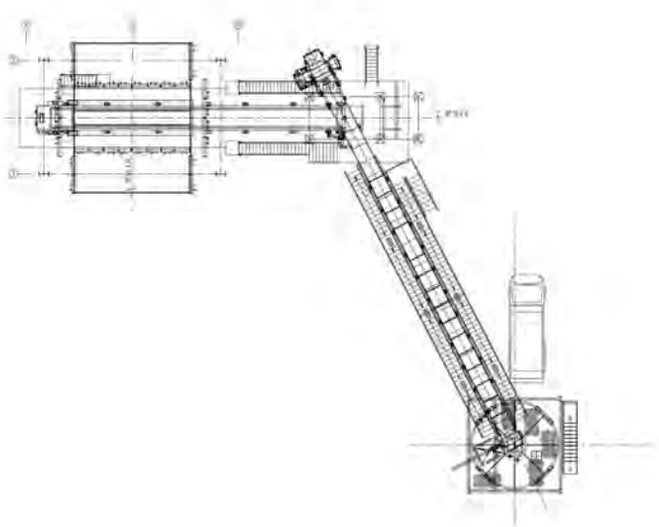


R.K.M.
UCCHPINDA POWER PLANT

Owner	R.K.M. Powergen Pvt. Ltd.
Units	#1, #2, #3, #4 (4x360 MWe)
Location	Ucchpinda, Chhattisgarh
Fuel	Coal
Bottom ash rate	20 – 36 t/h

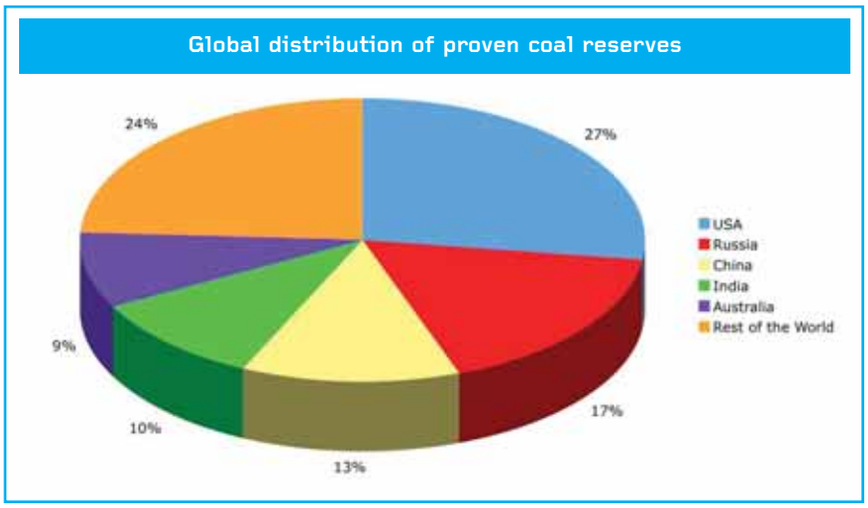






GMR
KANTAKAPALLI PLANT

Owner:	SARDA Metals & Alloys Ltd.
Units:	#1 (1 x 80 MWe)
Location:	Kantakapalli, Andhra Pradesh
Fuel:	Coal
Bottom ash rate:	1,5 – 5 t/h



their 2 x 300 MW Units for their EMCO project in Chattisgarh. Sarda Metals & Alloys Pvt Ltd gave us the order for the first unit of their captive Power Station for their alloy complex at Visakhapatnam, A.P. Additional units would be added over the next years.

Aditya Aluminium would be incorporating our MAC® systems for their captive power project (6 x 150 MW) for their smelter at Lapanga Orissa.

We were preferred by these discerning customers and "glorified apron conveyors" and "cheap copies" found no takers!

A major step has been the acceptance by BHEL to use our technology below their boilers. Our system would be applied below BHEL boilers at DPL Unit 8 and for the Aditya Aluminium units.

Our first orders in India for Mill Reject Systems were obtained in the past year for RKM Power Gen's 4 x 360 MW Units, while the Superbelt® Systems and Ecomag Systems for handling hot and abrasive bulk materials have also received special attention from several leading names of the Indian Industry.

Munjal Kiriu have placed orders on us for 4 Superbelts® for their foundry at Maneswar, Haryana (2 nos charging conveyors, 1 no casting carrying conveyor and 1 no sorting conveyor); out of these 2 units have already been commissioned and are under operation.

Overall it has been a challenging year but a very satisfying one, which goads us to greater goals in the future. Once our manufacturing facilities are in place we would be able to take even larger strides in all fields.

Mexico

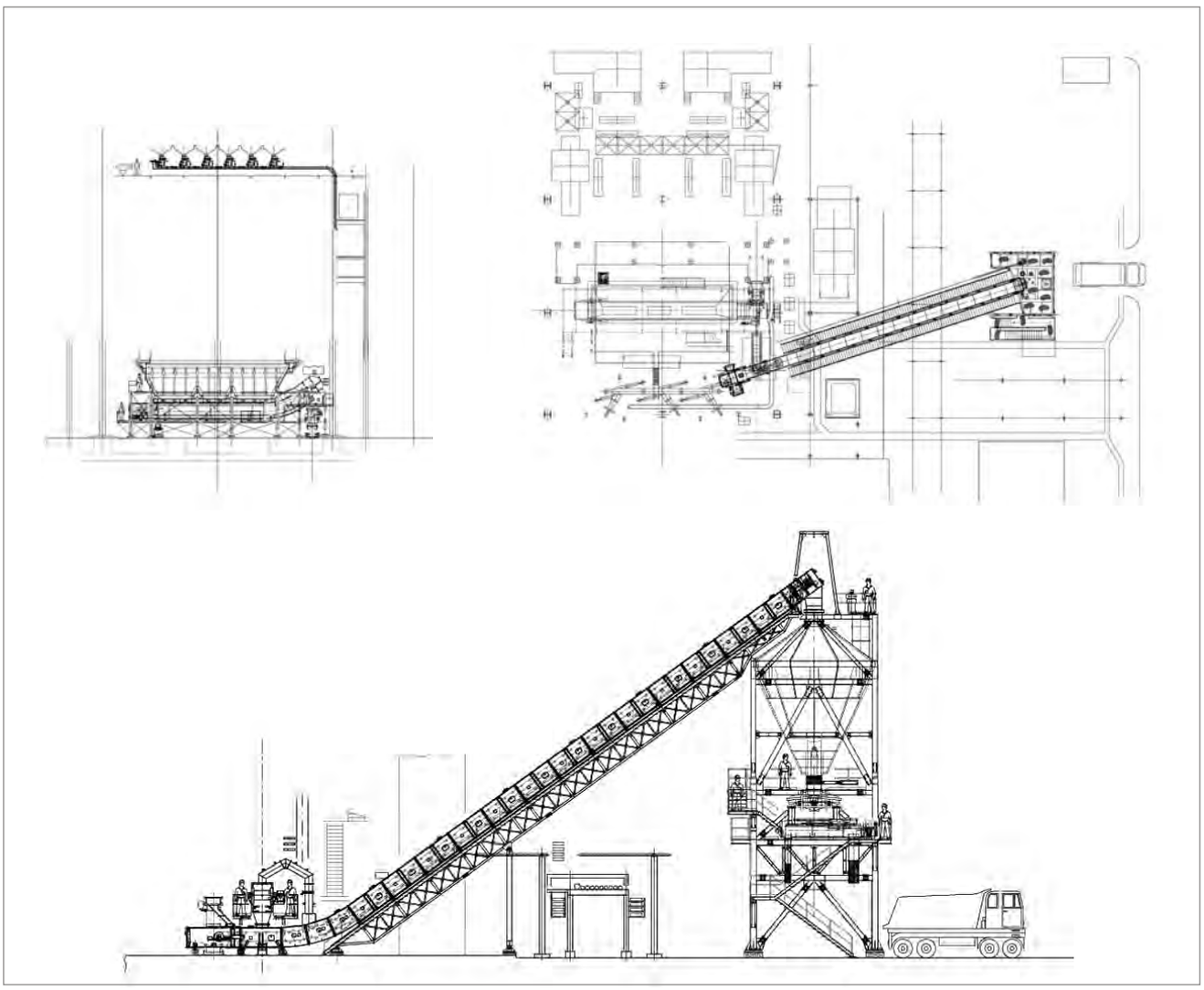
A significant revamping in Western Mexico Unit #1 and #2 of Plutarco Elias Calles power plant

by **Simone Savastano**, *Area Manager*
simone.savastano@magaldi.com

Back in 1998-1999 Comisión Federal de Electricidad (CFE), the Mexican state-owned utility, decided to undertake a complete retrofit of the bottom ash handling systems installed under #1 and #2 of Plutarco Elias Calles power plant, near Petacalco, in Michoacàn, Mexico, the largest coal-fired power plant in Latin America featuring six units of 350 MWe each with boilers supplied by Mitsubishi Heavy Industries.

By that time Magaldi Ricerche e Brevetti (Magaldi Power was to be founded later in 2002) was a subcontractor and supplied two MAC® dry ash handling systems to Mexcarbon, a consortium formed between Techint and Carbonser, as replacement of the previously existing wet ash handling systems.
Since then the MAC® extractors operated successfully, confirming that, thanks to their top performances ensured by the Magaldi Superbelt® design, CFE choice about the MAC® technology was the right one to obtain the most reliable and effective extraction of bottom ash along with significant water and energy savings merged with simple and safe operations.
Nevertheless, the operation of the downstream part of these dry bottom ash handling systems did not fully meet CFE expectations, due to the troublesome operation of some conventional equipment used in those systems, namely:

- Drag chain conveyors.
- Pneumatic conveying system over long distance.
- (also) Rubber belt conveyors for coal mill rejects handling.



Layout of bottom ash equipment, Unit #1

Downstream the MAC® extractor, the primary crushing stage and the Postcooler conveyor -that have been working to the Client satisfaction- two top quality drag chain conveyors were installed, one in operation and one as standby. These conveyors received bottom ash from a milling stage: this pulverized bottom ash (particle size below 8 mm) was fed to the drag chain conveyors and then loaded into a bin for subsequent long distance transportation to the final silo by means of a positive pressure pneumatic conveying system.
After system start-up and subsequent operational experience, it was evident that handling dry and hot bottom ash by means of those conventional conveyors (drag chain conveyor and pneumatic conveying system) was not the best option: being mostly composed of SiO2 and Al2O3 dry bottom ash from a coal fired boiler is a very abrasive material, often containing hard and sharp particles of various temperature and with a size distribution from fines to lumpy particles; moreover sometimes foreign parts, like steel pieces, might fall from the boiler along with ashes.
Notwithstanding the precautions that were used in the design (drag chain conveyors of best quality, equipment redundancy, material pulverisation), the drag chain conveyors were unavoidably subject to wear and tear problems of unacceptable magnitude. Due to the continuous movement of their chains and scrapers inside the abrasive ash, fast wear of conveyor chains and bottom plates was soon experienced. Worn chain caused derailment off the sprockets. Decrease of the wear resistance properties of chains and bottom plates occurred during time, due to the hot ash, leading to faster wear and consequent shorter life-time of parts. Material spillage out of the conveyor was suffered as a consequence of the bottom plates erosion. Bottom ash hard particles could block the scrapers, causing scrapers permanent distortion and conveying

stoppage.
Working with drag chain conveyor, even if made of the best quality, in such an adverse environment eventually led to frequent problems and necessity for repairs, with consequent interruption of the regular bottom ash transportation and relevant O&M costs.
The dependability of the drag chain conveyors was demonstrated to be significantly lower than the upstream MAC® and Postcooler conveyors, based on the Superbelt® technology.
In time, also the downstream long distance positive pressure pneumatic conveying system for milled bottom ash showed its operational limits, mostly due to the fast wear of the pressure vessel valves and of the conveying pipes, along with some troublesome operation for level probes and valve position sensors. The relative motion between abrasive ash and pipes and valves was the main cause of abrasion and problematic system operation.
Again, the difference in reliability of such pneumatic conveying system, compared to the upstream system made of the MAC® extractor and Postcooler was evident.
After such experience, the plant operators decided to stop the costly operation of the drag chain conveyors and pneumatic conveying system, leaving in operation only the upstream part of the system, made of the fully dependable MAC® extractor, temporarily discharging the bottom ash directly on the ground, to allow the boiler operation with minimum O&M interventions. However, collecting bottom ash discharged on the ground proved to be an operation of utmost discomfort.
This situation grew worse, so that eventually in 2010 CFE took the decision to renovate the entire system.
The above mentioned fully satisfactory performances of the two MAC® extractors installed in 1998 - despite being twelve years old - helped convince CFE to contact Magaldi Power for a study of the ground situation together with proposals for the best possible solution.
After a careful evaluation of the performances of each system component, CFE and Magaldi agreed that the new system configuration had to be based on mechanical conveyors featuring the Superbelt® technology and on a primary crushing stage.
Different layout alternatives were evaluated jointly by CFE and Magaldi engineers and, once the mutually agreed solution was reached, the contract for the complete supply was awarded to Magaldi Power. The first contract ever between Magaldi Power and Comisión Federal de Electricidad (CFE) was signed in Guadalajara in October 2010.
The new system configuration, decided by CFE and Magaldi, foresaw the obvious reuse of the original MAC® extractor, of the primary crusher and of the Postcooler (partially adapted) while a new Ecobelt® conveyor was included to deliver bottom ash into a new local silo, getting rid of the previously installed drag chain conveyors and pneumatic conveying system.
The scope of supply, not limited to the supply of the equipment but also including the steel support structures, the new local silos, the new electric and control system and all erection and commissioning activities, was also extended to the complete revamping of the coal mills rejects handling system.
The originally installed mills rejects handling system included the use of conventional rubber belt conveyors. This solution suffered from some serious problems, like frequent rubber belt–damage from tear and overheating, risk of fire, difficulties in material containment on the belt, leading to improper operation and significant O&M costs. Mill rejects are normally hot and sharp, and there is continuous formation of coal dust clouds with fire risk: they cannot be properly handled by rubber belt conveyors.
After consultations with Magaldi, CFE decided to install the MRS® system, the coal mill rejects handling system specially developed by Magaldi to overcome the problems typically encountered not only by the rubber belt conveyors but also by other conveying system like chain conveyors (drag chain or apron type), as well as by pneumatic or hydraulic conveying systems.
Also for this application the use of steel belt conveyors based on the Magaldi Superbelt® technology was the key element to eliminate the mentioned problems, guaranteeing safe and continuous transportation. A de-dusting system was also included to remove coal dust and fire and explosion hazards.
With this revamping project, the MAC® technology was proven and confirmed by CFE, after their direct experience from many years of operation. The originally installed systems were simplified and optimized, making use to the maximum possible extent of the field-proven, reliable and safe conveyors based on the Magaldi Superbelt® technology.
Bottom ash and mill rejects handling system dependability was maximized to ensure boiler's continuous operation and at the same time reducing O&M costs.
The financing of the project was completed thanks to a Buyer's credit scheme involving BNP Paribas and SACE, the Italian Export Credit Agency.
Works are due to be completed by summer of 2012.

Comisión Federal de Electricidad:
a new prestigious partner for Magaldi Power

The Comisión Federal de Electricidad (widely known as "la Comisión" or CFE) is a company created and owned by the Mexican government and is the Mexican electric monopoly. It is the dominant electric company and the second most powerful state-owned company in Mexico.
CFE generates, distributes and markets electric power for almost 33.8 million customers -this figure represents almost 100 million people-and incorporates more than a million new customers every year. The infrastructure to generate electric power is made up of 177 generating plants, having in 2010 an overall installed capacity of 51,081 MW.
CFE creates electric power using various technologies and various primary energy sources. It has thermoelectric, hydroelectric, coal-fired, geothermal and wind powered plants and facilities, as well as one nuclear power plant.

PLUTARCO ELIAS CALLES POWER PLANT

Owner:	Comisión Federal de Electricidad (CFE)
Units:	#1, #2 (2 x 350 MWe)
Location:	Petacalco
Fuel:	Coal
Bottom ash rate:	2,0 – 5,0 t/h

Mexico

Outstanding results for one of Magaldi biggest installations: Pacifico, 1x700MW

by **Simone Savastano**, *Area Manager* simone.savastano@magaldi.com

Back in 2006 a contract was placed from CFE on MHI for the EPC installation of what would became the first 700MW supercritical unit to be installed in Mexico: the new unit number # 7, which was also called “Pacifico” being located on the shores of this ocean.

The long years of trouble-free operations of MAC® systems installed under units #1 and #2 of Petacalco P.S. despite being eight years old convinced CFE to specify the Magaldi equipment for the removal of bottom ash, economizers ash, pre-heaters ash and mill’s rejects.

On March 2007 the contract for one of the biggest Magaldi installations ever was signed between Magaldi and MHI and included the supply of the equipment for the handling of bottom ash, economizers ash, air heater ash and mills rejects together with the rubber belt conveyors for delivering the ashes to the ash storage silo. Also the Magaldi fully automated integrated supervision system (MISS®) was part of the supply.

The installation of the entire unit by MHI was completed smoothly and trouble free and the unit was handed over to CFE on March 2010. Production started soon afterwards.

In July 2011 CFE performed an accurate analysis on the performances of the entire MHI supply over the past 12 months.

The results of such investigation where astounding as the plant offered an overall availability of 99.8%, the best result ever achieved by a MHI installation, even beating the 99% of the Kobe installation in Japan.

Magaldi Power was proud to be part of this result: all its equipments were able to perform perfectly in line with the performances of MHI supplies providing their contribution to the achievement of this remarkable result and helping the Pacifico unit to set a new benchmark in the performance of the coal-fired units.

PACIFICO: one of the biggest Magaldi installation

Boiler output at BMCR	700 MW, tangential firing
Total combustion air rate at BMCR	2386 t/h
Normal operating pressure of the boiler	-588Pa ± 98Pa
Expected bottom ash temperature (when crossing the boiler throat)	between 800-1500 °C

The complete Magaldi supply includes:

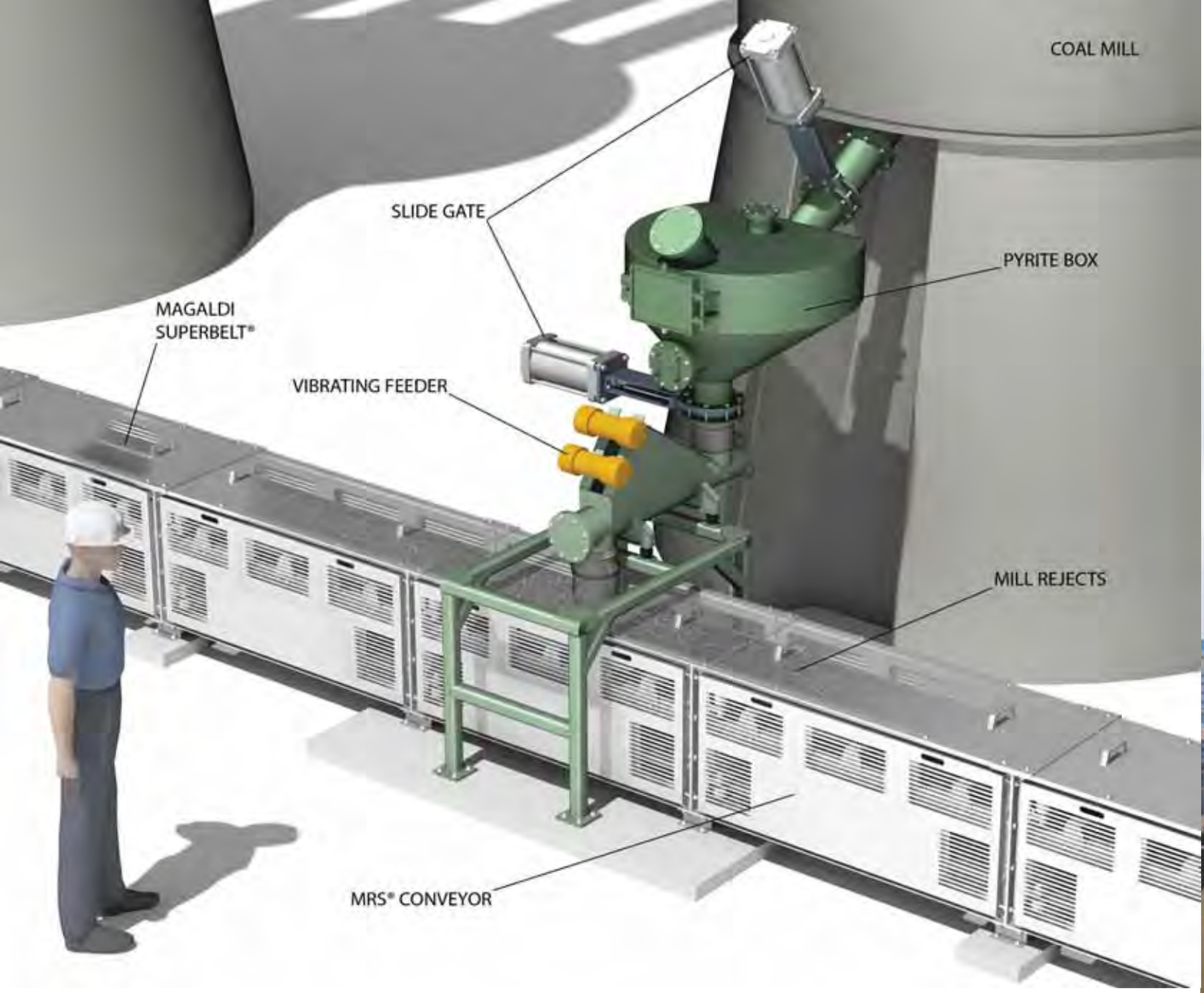
Mechanical Seal Bottom Ash Hopper Bottom Doors MAC® Pre crusher Primary Crusher Post Cooler Silo Vibrating Feeders Ash Humidifiers	BOTTOM ASH
Two-lines Ecomag Conveyors at economizers hoppers	ECONOMIZERS ASH
Pressure Vessels Pneumatic Line	AIR HEATER ASH
Complete Mills Rejects handling system	PYRITES
230mt Rubber Belt Conveyor for transportation of all collected material to the final ash storage silo	MATERIAL HANDLING

The Magaldi system was designed according to the following specifications:

	Bottom Ash	Eco Ash Line 1	Eco Ash Line 2	Air Heater Ash	Pyrites
Normal rate	8.68 t/h	1.74 t/h	1.74 t/h	1.74 t/h	1.2 t/h
Maximum rate	26.04 t/h	5.32 t/h	5.32 t/h	5.32 t/h	1.62 t/h

Pushing availability to the limits: Petacalco unit #7 (Pacifico)

Unit #7 of Petacalco power station (also called Pacifico), the first supercritical unit in middle and south Americas, was supplied to CFE by MHI and had its commissioning completed in March 2010.
The unit is equipped with state-of-the-art technologies such as low NOx burners, high fines pulverisers, advanced vertical furnace wall technology. During the first year of operations its performance has been outstanding, with an availability of 99.8%. Magaldi Power was honoured to have offered its contribution to this exceptional result by having supplied the bottom ash, the economizers ash, the preheaters ash and the mills rejects handling systems. The good performance of the latter convinced CFE to adopt the same system also for their units in Petacalco 1 and 2 (see the dedicated article and the aside box). The exceptional results of the unit were achieved also due to the performance of this equipment.
The Pacifico installation, a field test for the exceptional reliability of our equipment and another example of how seriously we take our mission to deliver “Dependable Technologies”.



Why a Magaldi MRS® mill reject system was selected in Pacifico?

Hydraulic sluice systems for mill rejects need high water flow, involving significant power consumption and O&M costs, along with environmental pollution. Tramp iron and big particles frequently cause conveying blockages, requiring manual intervention and risk of mill shutdown. Pneumatic conveying systems also require high power and are subject to similar problems. Closed mill rejects mechanical conveying systems, such as drag chain and steel plate or open rubber belt conveyors suffer from high wear, low reliability and uncontrolled pulverized coal dust settlement, with its associated fire and explosion risks.

Among the automatic removal systems, the Magaldi MRS® overcomes those limitations thanks to the "open execution" design and the dependable Magaldi Superbelt® technology. The Magaldi MRS® , based on the Superbelt® technology, easily and safely operates without creating any fire or explosion hazard.

MRS® main advantages:

- Easy mechanical handling through the well proven Magaldi Superbelt®, able to handle high temperatures and dusty, sharp and abrasive materials.
- Eliminate plugging problems, experienced in pneumatic and hydraulic sluice systems.
- Completely automatic operation, both in normal and emergency coal mill conditions.
- Low power demand for handling any mill rejects rate.
- Possibility to carry out visual inspections and maintenance during normal operation.
- Low wear, meaning high system dependability and low O&M costs.
- Compact design.

MAIN MRS® CONVEYOR DATA

Number of Coal Mills	6
Angle of Inclination	26°
Main Conveyor Width	500 mm
Main Conveyor Lenght	75 m
Belt Type	Magaldi Superbelt® "E" type

South Korea

Korean Market Overview

by **Ivano Pennella**, *Area Manager* ivano.pennella@magaldi.com

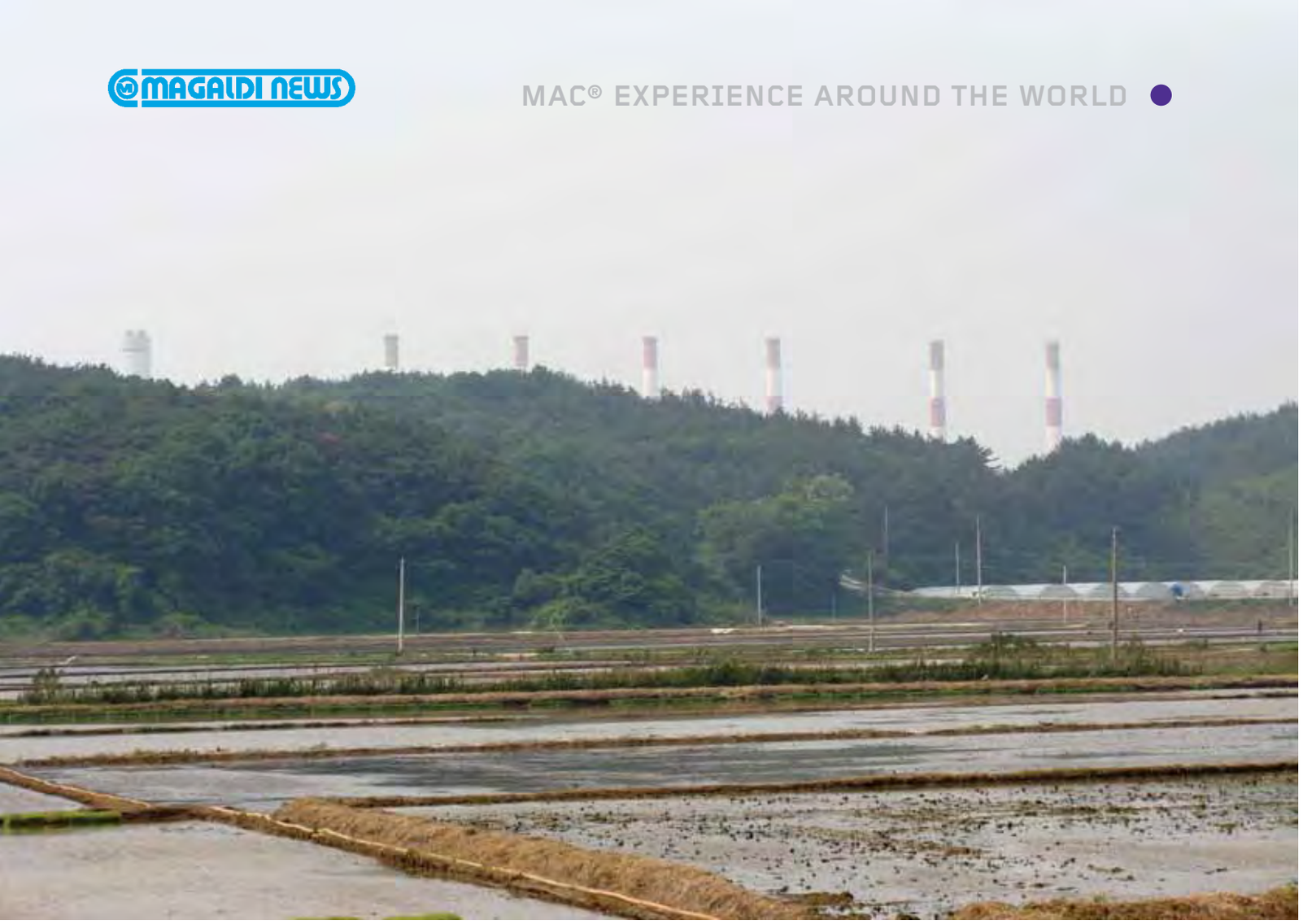
South Korea, one of the most important countries of Asia, is experiencing a boom: Asia's fourth largest economy is also one of the world's fastest growing.

In order to meet the domestic demand for electricity and ensure a reliable supply for the industrial development of the country economy, the power sector has grown rapidly to a total installed generating capacity of 76,078 MWe in July 2011 (KPX – Korea Power Exchange), distributed as shown in the table below.

Six generation companies, all wholly owned subsidiaries of Korean Electric Power Corporation (KEPCO), are the backbone of the Korean Electricity Generation Sector:

- Korea Hydro & Nuclear Power Co. Ltd (KHNP)
- Korea East-West Power Co. Ltd (EWP)
- Korea Midland Power Co. Ltd (KOMIPO)
- Korea South-West Power Co. Ltd. (KOSEP)

Type			MW	Unit
Hydro power and alternative			9,339	2,665
Thermal	Steam cycle	bituminous	23,080	44
		Anthracite	1,125	6
		Heavy oil	4,479	18
		LNG	888	4
		Sub-total	29,572	72
	Combined cycle		19,100	145
	Internal combustion		351	176
	Sub-Total		49,023	393
	Nuclear power		17,716	20
	Total		**76,078**	**3,543**



Rice fields surrounding a coal fired power station

- Korea Western Power Co. Ltd. (KOWEPO)
- Korea Southern Power Co. Ltd. (KOSPO)

KHNP controls all nuclear and hydro-generation assets, while the other five are fossil fuel generation companies.

KEPCO's dependency on oil for generation is now about 7% down from 90% in the 1970s, whereas dependency on nuclear and coal energy has greatly increased.

Starting from 2004, the Korean Power Sector has accepted the Magaldi technologies for the dry bottom ash handling in coal fired power plants, introduced in Korea through Kawasaki (partner of Magaldi Power in Japan). Presently the Magaldi products are marketed through Total Tech Corporation, representative of Magaldi Power in the country.

Thanks to the high performances, continuous, reliable and safe operations, boiler efficiency increase, low maintenance and eco-friendly characteristics, Magaldi has been selected again in 2009 by KOSEP with the award of the Fluimac® System for the 340 MWe CFB Boiler (DOOSAN HI) that was started up at the end of 2011 at Yeosu #2 Power Plant.

Recently, East-West Power Co., Ltd. (EWP) has selected Magaldi as supplier of the two dry bottom ash handling systems (MAC® systems) for the two new units 9 and 10 of Dangjin Power Plant (2 x 1000 MWe – boilers by BHK).

Dangjin PP is located 70 km southwest of Seoul and will become the state of the art of a new generation of power plants in Korea, featuring ultra-super-critical boilers and a plant efficiency never achieved before in conventional coal plants.

This project represents an outstanding achievement for Korea, for both the installed capacity and for the technological solutions implemented, which place Dangjin PP among the best performing plants in the world. Technically, the steam produced will be conveyed to the turbine at more than 250 bar at 600°C. High efficiency implies less fuel burned and reduced pollution loads as a consequence. The emission of carbon dioxide, the greenhouse gas produced by combustion, will be reduced by approx 16% compared with conventional plants.

To further reduce the environmental footprint of the plant and to help guarantee the best level of availabil-

ity, the Magaldi MAC® system was selected by EWP for the dry bottom ash handling.
The high performance of the plant in terms of energy consumption and its overall low environmental impact make Dangjin one of the most important "clean coal" installations and a technological benchmark for the future power plants in the world.
The energy infrastructure development plan in Korea focuses on coal as an important factor in the production of electricity, provided that the emissions are in compliance with demanding environmental standards. Coal has a future in the Country but only if its impact on the environment is minimized by the implementation of the best available technologies.
Magaldi dry bottom ash systems contribute to those requirements by ensuring high reliability, some increase in the efficiency of the boiler, eliminating water pollution and improving the quality of the bottom ash, thus facilitating its recycling.

DANGJIN POWER STATION

Owner:	East-West Power Co., Ltd. (EWP)
Units:	#9, #10 (2 x 1000 MWe)
Location:	Dangjin
Fuel:	Bituminous/ Sub-bituminous coal
Bottom ash rate:	6,8 – 10,1 t/h

DRY BOTTOM ASH SYSTEMS SUPPLIED BY MAGALDI POWER S.p.A. IN KOREA

Owner	Power Plant Unit	Boiler size (MWe)	Start Up	Magaldi System
KOWEPO	Taean unit 7 and 8	2x500	2007	No. 2 MAC®
KOSPO	Hadong unit 7 and 8	2x500	2009	No. 2 MAC®
KOSEP	Yonghung unit 3 and 4	2x870	2008	No. 2 MAC®
KOSEP	Yeosu unit 2 (CFBC)	1x340	2011	Fluimac®
EWP	Dangjin unit 9 and 10	2x1000	2015	No.2 MAC®

South Korea

Linkou Power Plant: bringing the dry bottom ash handling technology to Taiwan

by **Ivano Pennella**, *Area Manager* ivano.pennella@magaldi.com
by **Daniele Coppola**, *Area Manager* daniele.coppola@magaldi.com

The first installation of the MAC® – Magaldi Ash Cooler system in Taiwan will be at the coal-fired Linkou Thermal Power Plant. Magaldi Power S.p.A. was awarded a contract for the supply of three dry bottom ash handling systems for the new supercritical boilers at the Taiwan Power Corporation plant in Linkou.

The Linkou Thermal Power Plant is located in Linkou District in northern Taiwan, approximately 20 kilometers west from central Taipei. The Linkou renewal project will build a supercritical coal-fired thermal power plant on the existing site of a 2x300 MW subcritical plant in Taiwan. Taiwan's electricity needs have been increasing every year along with continuous economic growth supported by a robust external demand. The renewed Linkou power plant will meet electricity demand in Taipei and surrounding areas.

In 2011 Magaldi Power S.p.A. received an order from Mitsubishi Heavy Industries, Ltd. (MHI) for the supply of its dry bottom ash handling systems for the three new coal-fired supercritical

pressure power generation units, rated 800 Megawatts each, at the Taiwan Power Corporation's Linkou Thermal Power Plant.

The project calls for the construction of three power generation units to replace existing facilities at the plant, based on Taiwan's energy source development plan. The first two units are scheduled to commence commercial operation in November 2015 and November 2016, respectively; the last unit is slated to go on-stream in November 2020. MHI will be responsible for the manufacture and supply of the three boilers and three steam turbines.

Taipei Power Corporation is a state-owned utility and the sole integrated power transmission and distribution company in Taiwan.

The Linkou project will be the first power plant in Taiwan to employ the state-of-art technology developed by Magaldi Power S.p.A. Customer needs and benefits were the main drivers for the development of the new ash handling system.

The high reliability level of the MAC® system installed, together with MHI, at the Pacifico Thermal Power Plant in Mexico (1x700 MW) paved the way for the successful first implementation of the Magaldi Power S.p.A. technology in Taiwan.

The MAC® System proposed for the Linkou Project will start at the boiler's throat outlet where a bottom ash hopper, refractory lined, will be connected to the furnace via a mechanical seal. The bottom of the hopper will be equipped with hydraulic driven bottom doors able to insulate the MAC® extractor from the boiler and transform the hopper into a temporary ash storage volume.

At the MAC® extractor discharge, bottom ash grain size will be reduced in the crushing stage.

Further cooling and mechanical transportation of ash will be obtained by the Postcooler, a conveyor having a design similar to the MAC® extractor.

The bottom ash will be finally discharged into two storage silos for final disposal.

The MAC® System will cool down bottom ash to a temperature less than 150 °C by using only 1% of total combustion air which will be naturally drafted by the boiler negative pressure, without using any ancillary air fan.

The thermal boiler efficiency will improve thanks to the heat recovered by the cooling air; expected efficiency improvement will be in the range of 0,081÷0,212 %.

Relevant benefits in terms of boiler efficiency improvements, cooling water savings, auxiliary power reduction and environmental emissions thanks to MAC® System high reliability and dependability will guarantee complete client satisfaction.

Main Technical Data of the Boiler

Boiler Capacity	3 x 800 MWe
Normal bottom ash production rate @ BMCR	7.5 t/h
Maximum bottom ash production rate @ BMCR	15.1 t/h
Cooling water saving	1,5 Million m^3/year

Poland - P.R. of China

Finishing and casting sorting for Brembo S.p.A

by **Alberto Lalia**, *Area Manager* alberto.lalia@magaldi.com

One of the main products of Magaldi Group is the Magaldi Superbelt®, a robust and dependable steel pan conveyor, successfully applied in hundreds of industrial conveying projects.
Typically, in a foundry the Superbelt® can be applied to several processes, like:

- Casting cooling
- Casting sorting
- De-gating
- Castings and sprue transportation
- Loading/unloading shotblasting
- Moulds transportation

Thanks to the absence of the lateral sidewalls, the "PRZ type" Superbelt® conveyor is specifically designed to improve the working conditions during the operations of de-gating and sorting: its flat surface allows the operators to drag the castings towards the lateral chutes of the belt without lifting them, maximizing the safety and comfort of the operators.

Brembo Poland

A new Magaldi Superbelt® PRZ type has been installed in the new line of the Brembo automotive foundry located in Dabrowa Gornicza – Poland.
In this foundry Brembo was already using two Magaldi Superbelt® conveyors PRZ type for the castings sorting and degating. The Magaldi Superbelt® PRZ was the solution to optimize the sorting operation, reducing the number of operators dedicated to this operation and the costs associated with it.
Brembo Poland foundry Superbelt® PRZ conveyors characteristics:

EQUIPMENT DATA	PROCESS DATA
Superbelt® type: PRZ/MN 1208-108	Material: castings (brake disks)
Centre distance: 16000 mm	Capacity: 24 t/h
Width: 1200 mm	Molds dim: 1100 x 1120 (horizontal molding line)
Installed power: 2,2 kW	Temperature: 30 °C

EQUIPMENT DATA	PROCESS DATA
Superbelt® type: PRZ/MN 1208-108	Material: castings (brake disks)
Centre distance: 25000 mm	Capacity: 24 t/h
Width: 1200 mm	Molds dim: 1100 x 1120 (horizontal molding line)
Installed power:3,0 kW	Temperature: 30 °C

EQUIPMENT DATA	PROCESS DATA
Superbelt® type: PRZ/MN 1208-108	Material: castings (brake disks)
Centre distance: 19000 mm	Capacity: 45 t/h
Width: 1200 mm	Molds dim: 1100 x 1120 (horizontal molding line)
Installed power:3,0 kW	Temperature: 30 °C

Brembo China

There is in Nanjing – China a new green field foundry made by Brembo. Also for this foundry Brembo decided to choose a Magaldi Superbelt® PRZ conveyor for castings handling.

Our main target has been to make the sorting and finishing operation more comfortable for the operators that had to work on the belt.

From the experience we had in Brembo Polish foundry, we confirmed our Magaldi Superbelt® PRZ for the shotblasting unloading and casting sorting processes. The cast brake disks are loaded on the conveyor from the continuous shotblasting machine where the operators will manually separate the castings from the sprues. This operation is made easy thanks to the flat surface of the Magaldi Superbelt®. Then the castings, after an inspection, are laterally sorted and loaded in different boxes.

Technical data of these two Superbelt® PRZ conveyors are as follows:

EQUIPMENT DATA	PROCESS DATA
Superbelt® type: PRZ/mn 1208-108	Material: castings (brake disks)
Centre distance: 15000 mm	Capacity: 30 t/h
Width: 1200 mm	Molds dim: 1100 x 1120 (horizontal molding line)
Installed power:2,2 kW	Temperature: 30 °C

EQUIPMENT DATA	PROCESS DATA
Superbelt® type: PRZ/mn 1208-108	Material: castings (brake disks)
Centre distance: 22000 mm	Capacity: 20 t/h
Width: 1200 mm	Molds dim: 1100 x 1120 (horizontal molding line)
Installed power:3,0 kW	Temperature: 30 °C

Magaldi is proud to be a qualified supplier of Brembo S.p.A. Customer repeated orders are a confirmation of his satisfaction, highlighting the quality and reliability offered by our Superbelt® conveyor products.

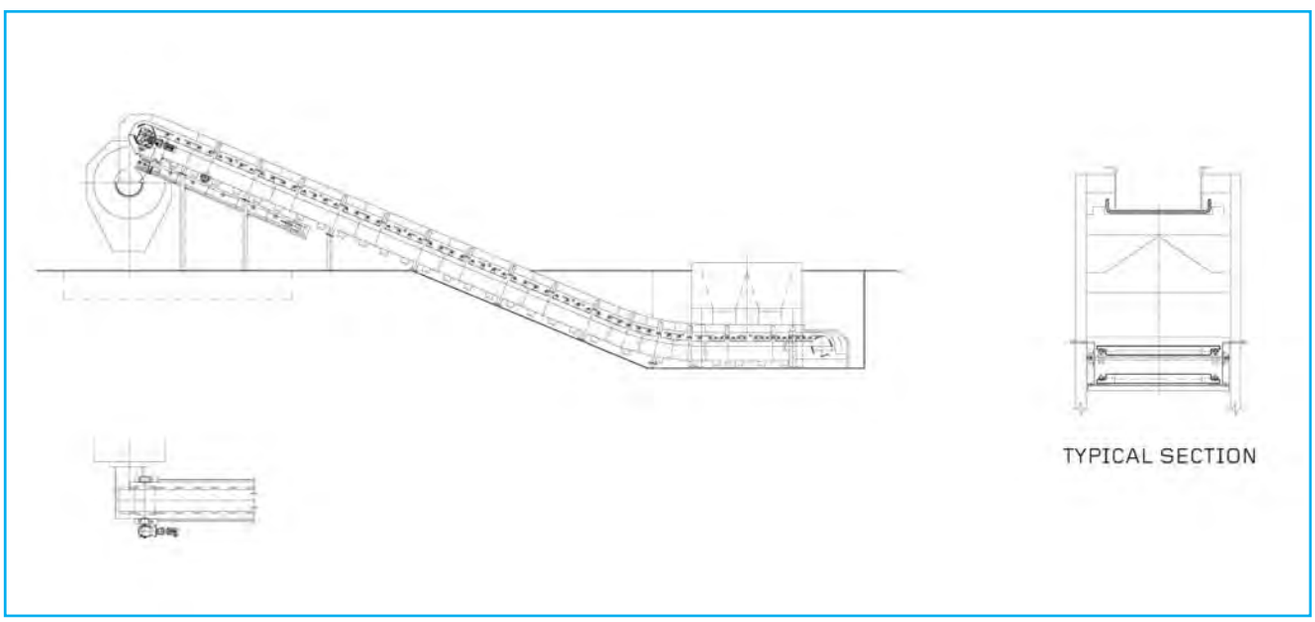
USA

ME GLOBAL - Vulcan Engineering

by **Alberto Lalia**, *Area Manager* alberto.lalia@magaldi.com

At the beginning of 2011 the engineering company Vulcan Eng. contacted Magaldi Industrie to cooperate in a project for a new hot sand transportation line, to be installed at a ME Global Inc foundry located in Tempe (AZ, USA).

The production of huge castings is made by a chemical moulding line. The hot sand is separated from the casting through a large vibrating shake-out (3 m x 3 m).
The foundry was asking for a dependable equipment to convey hot sand, able to work in heavy conditions, with minimum maintenance requirements, also suited to the very tight installation area.
Traditional methods to convey hot sand after the shake-out include rubber belt conveyors or coolers/classifiers with associated pneumatic conveying system. However, such traditional systems suffer from high temperature problems, wear issues, difficult operation due to non-homogeneous materials and sharp/hard particles, involving frequent maintenance interventions and high O&M costs.
Magaldi Industrie proposed to install a Magaldi Superbelt® conveyor, that ensures safe, continuous, reliable operation, thanks to its unique damage-tolerant design.
Just underneath the shake out the Magaldi Superbelt® conveyor, N type, now conveys hot sand, at a 30 t/h rate, 24 h/day. Peaks up to 50 t/h are present. The material is transported by the Magaldi Superbelt® conveyor at a temperature of 315°C (600 F) to the downstream cooling drum.
High temperatures and tear issues are resolved thanks to the patented method of connecting the pans to



the mesh belt, that leaves all elements free to expand in any direction. The Superbelt® design eliminates any risk of sudden failures, otherwise always present, especially with hot and abrasive materials, in the case of conveyors using rubber belts, chains or of pneumatic conveying systems. The Superbelt® conveyor is simply driven by the friction between the belt mesh and the head pulley; proper belt tension is maintained by a pneumatic take-up system mounted at the tail pulley. No risk of derailment of the Superbelt® is possible, as in the case of conveyors using chains and sprockets. Wear is negligible, since material is slowly conveyed with no relative motion against steel parts. The Superbelt® construction provides a virtually closed transportation channel, making the conveyor able to handle very fine and dusty material. No maintenance is necessary for normal operation. Even if a part of the Superbelt® steel mesh is damaged the conveyor does not need to stop and it is possible to wait the next scheduled shutdown for the maintenance activity.

At the bottom of the Magaldi Superbelt® conveyor an automatic cleaning device, named Magaldi Spill-Chain, has been installed to collect the carry back sand that can stick to the pans of the conveyor÷ ;a rotating mechanical brush helps cleaning the pans and let sand fall down to the Magaldi Spill-Chain, that in turn discharges it to the same unloading chute of the main conveyor.

The Magaldi Superbelt® conveyor was the final choice for the hot sand transportation at this ME Global foundry; the conveyor has been installed at the end of 2011.

Together, Vulcan Engineering and Magaldi Industrie reached the target to supply a successful project for the hot sand transportation to the final customer ME Global Inc.

USA

FLUOR - Showa Denko: high temperature (1100 °C) metallurgical coke conveying

by **Alberto Lalia**, *Area Manager* alberto.lalia@magaldi.com

Fluor Corporation was awarded for an engineering, procurement and construction contract by Showa Denko Carbon, Inc., (SDKC) to expand its graphite products manufacturing facility in Ridgeville, South Carolina. Located in Dorchester County, the SDKC plant produces graphite anodes for the steel and automotive supplier industries.

Showa Denko operated the graphite manufacturing plant in Ridgeville since 1988. The plant produces premium graphite electrodes for electric arc furnace steel production, and the expansion will allow the company to meet the increasing demand for its products.

In October 2011 Magaldi was contacted by Fluor to cooperate on this project for the development of a high temperature conveying stage related to the graphite anode fabrication process.

This process was studied and developed by SDKC and involves the use of high temperature material in the manufacturing of anodes. These latter are submerged in the refused metallurgical coke evacuated from the furnaces at very high temperature. There was therefore the need for a reliable conveying system able to work at these temperatures.

The Magaldi Superbelt® conveyor was chosen for its maximum reliability in the hot material transportation, with a capacity of approx. 100 t/h of hot metallurgical coke, at an average temperature of 1100 °C

The Magaldi Superbelt® belt choosen is made of stainless steel, able to withstand high temperature and it is normally used for high temperature material transportation. For instance, all the Magaldi Superbelt® used in MAC® (Magaldi Ash Cooler) systems for the extraction of hot bottom ashes in coal fired power stations, are all working at a temperature close to 1000°C.

Major design data sheet of the Magaldi Superbelt® are listed below:

Material:	Hot refused metallurgical coke
Material Temperature:	1100 °C
Material Grain size:	from fines to 50 mm
Conveyor Capacity:	100 t/h
C/C distance:	21000 mm
Belt Width:	1200 mm
Superbelt® material:	AISI 310
Installed power:	5.5 kW

The conveyor will be installed in April 2012 and Magaldi supervisors will be ensuring the correct set-up of all operational parameters, for another successful installation. With this project, once again, the Magaldi Superbelt® confirms to be the ideal conveyor for handling hot materials, for a safe and environmental friendly operation.

Australia

XSTRATA - Mount Isa Mines

An environmental friendly solution for the Hot lead sinter transportation

by **Alberto Lalia**, *Area Manager* alberto.lalia@magaldi.com

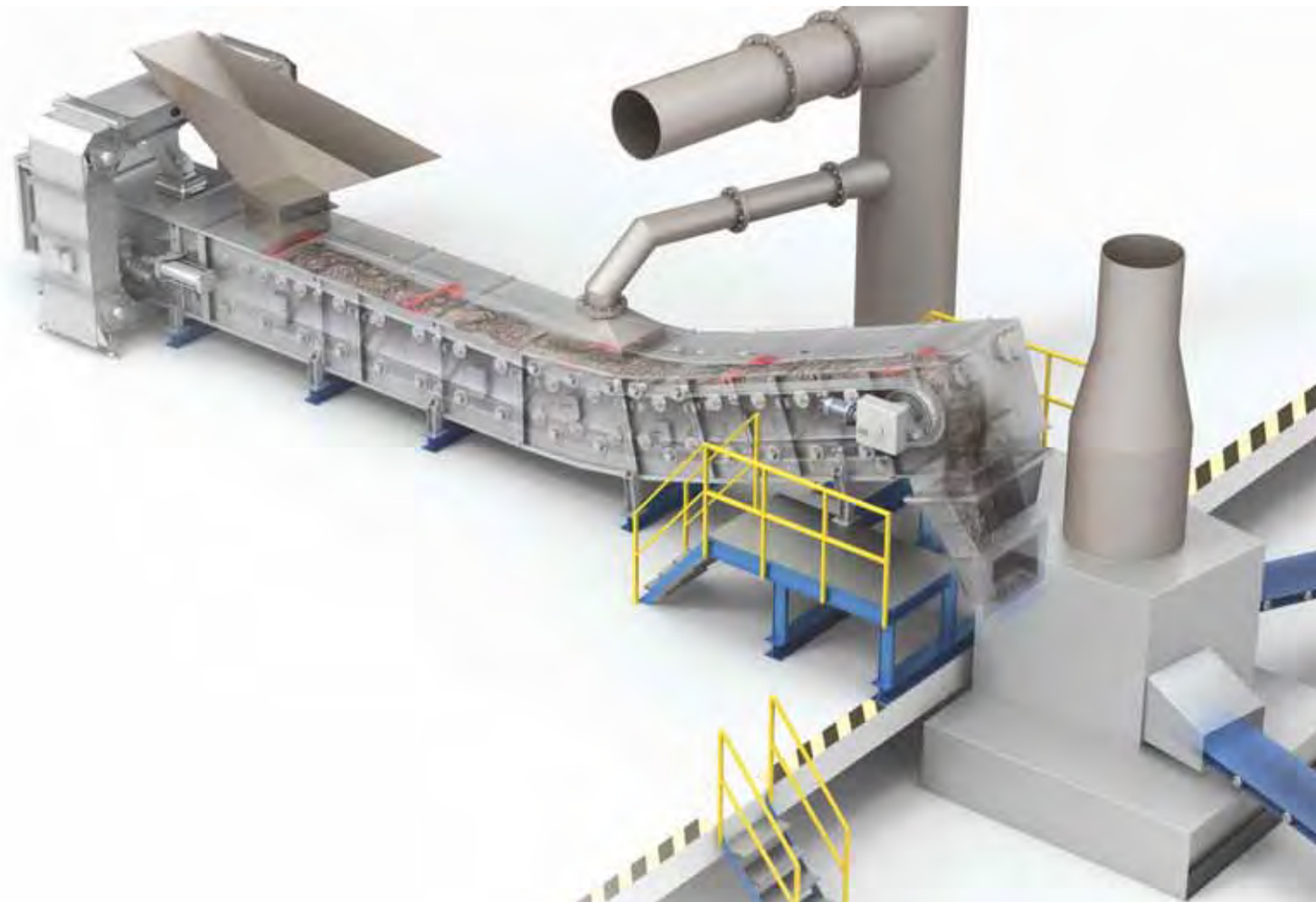
The Xstrata company installed in the 1990s a Magaldi Superbelt® conveyor for hot lead sinter transportation, in their Mount Isa Mines lead smelter plant.

The lead sinter is a toxic, abrasive and hot material that had to be transported by the Magaldi Superbelt® onto a wet mixer, where the blending of lead sinter with lead slurry concentrate and other raw materials was realized to be fed in the lead furnace.

The Magaldi Superbelt® conveyor has been in service for over 20 years, ensuring reliable and continuous transportation of 100 t/h of hot sinter. Major design data sheet of the Magaldi Superbelt® are listed below:

Material:	Hot lead sinter
Material Temperature:	600 °C
Material Grain size:	from fines to 200 mm
Conveyor Capacity:	100 t/h
C/C distance:	11000 mm
Belt Width:	800 mm
Superbelt® material:	Carbon steel
Installed power:	4 kW

The conveyor has been running well for more than 20 years with high satisfaction of the Customer.



Nevertheless, Customer and Magaldi met in Mount Isa and identified some areas of further improvement:

- The hot lead sinter, being a toxic material, needs a completely closed conveyor, able to prevent dust dispersion in the environment, ensuring the same reliability of the already installed Superbelt®.
- The material production of the plant is planned to increase from 100 t/h up to 250 t/h, therefore a higher capacity conveyor was necessary.
- Additionally, a problem had to be solved regarding the steam formation due to the water introduced into the mixer located downstream the Superbelt® conveyor, where hot sinter is discharged. The fine part of the sinter, made sticky by the steam, was causing irregular wear to the head section of the Magaldi Superbelt® conveyor. Therefore a solution was requested.

In the constant good relationship that Magaldi had developed with the Customer, a solution based on the use of the Magaldi Ecobelt® conveyor, equipped with O-Chain®, was investigated and found to be the most appropriate to meet the above mentioned Customer requests, maintaining at the same time all the unique benefits, reliability at first, of the existing Superbelt® conveyor.
The Magaldi Ecobelt® key component is again the Magaldi Superbelt® steel belt, but designed completely enclosed in a steel casing, suitable to prevent dust dispersion to the environment. A simple mechanical self-cleaning device removes the fine residuals from the bottom of the casing. The Magaldi O-Chain® is a chain conveyor enclosed in an independent casing, tailored around the Magaldi Ecobelt® tail section. Its function is to receive the fine residuals, taken from the Ecobelt® bottom by the self-cleaning device, and to reload them onto the Magaldi Superbelt®.
The Magaldi Ecobelt®, featuring the Superbelt® steel belt completely enclosed in a dust-tight casing, was selected as the ideal conveyor to transport the toxic sinter in respect of the environment and for the safety of the operators.
The requested increase of conveying capacity was met by applying a larger belt, a 1200 mm useful width Superbelt®, in place of the previous 800 mm Superbelt®.
The steam related problems were solved by a different arrangement of the conveyor head section, located outside the area where the steam is generated, and by creating a suitable natural air-barrier against the steam entrance through the Ecobelt® discharge chute. The existing dedusting system installed above the mixer will be optimized by the Customer to draft air from the Ecobelt® discharge chute so creating the proper air-barrier. The negative pressure in the Magaldi Ecobelt® will also help to keep the dust inside the Ecobelt® casing without spillages.

The new Ecobelt® design data are the following:

Material:	Hot lead sinter
Material Temperature:	600 °C
Material Grain size:	from fines to 200 mm
Conveyor Capacity:	250 t/h
C/C distance:	11000 mm
Belt Width:	1200 mm
Superbelt® material:	Stainless steel
Belt Installed power:	4 kW
O-Chain® installed power:	0.75 kW

With this new installation, the Magaldi Ecobelt® is confirmed to be the ideal conveyor for handling hot materials, aggressive chemicals, heavy or sharp products, ensuring a safe and environmental friendly operation.

ARTICLE PUBLISHED BY AUSTRALIAN BULK HANDLING REVIEW: NOVEMBER/DECEMBER 2011

Magaldi seeking agent for cement sector

Magaldi of Italy, a specialist in the handling of hot materials, is seeking an Australian agent to help further its ambitions in the cement sector.

The men from Magaldi (L to R) Domenico Antonelli, Paolo Magaldi and Alberto Lalia.

150m long Magaldi Ecobelt® conveyor in Millmerran Power Station for ash transportation.

A 45° inclined Magaldi Ecobelt® conveyor in Venice Fusina Power Station.

The Magaldi Ecobelt® installed in Xstrata's Mount Isa lead smelter plant.

Paolo Magaldi, son of the Magaldi family, and his colleagues added a touch of Italian flair to BULKEX.

Founded in 1929, the family-run Magaldi has developed a speciality in the handling of hot materials, in power stations, cement, sinterisation and steel plants.

"We're recognised in the power market for technology to cool down and extract in a dry way the bottom ash from coal fired power stations", said Paolo.

"The difference between Magaldi and traditional pan conveyors is that we have eliminated chains and sprockets that can be weak components causing unforeseen shutdowns".

Magaldi, with 240 staff globally, has 800 belts in operation round the world. Its belts are guaranteed for three years with an expected life of ten years. Its products are patented and developed in-house.

"We have a branch office in Sydney, a service engineer and warehouse", said Paolo. "We are looking for an agent, not for the electricity sector but for cement where we need an agent to help market the product. We are trying to go wider in Australia".

Local customers for the company's products include the Bluewaters Power Station in Queensland and Bradken.

At Bluewaters, IHI and Aurecon selected Magaldi's Mac® extractor connected to a boiler through a mechanical seal and ash transition chute. The collected bottom ash is discharged from the extractor through a pre-crusher and a primary crusher onto a postcooler conveyor and from there to a silo to which grits from economizers are also loaded via an auxiliary pneumatic conveying system. All this equipment was part of the Magaldi supplied plant.

At Millmerann, Magaldi supplied its longest Ecobelt®, in which the company's Superbelt® is completely enclosed in a tight steel casing to avoid dust dispersion. Magaldi retrofitted its system in place of an existing submerged chain conveyor which was extracting bottom ash.

More recently, Bradken ordered an Ecobelt® conveyor equipped with Magaldi's O-Chain®, the latter being a patented fines recovery system.

The 28 metre system is inclined at 53 degrees and can handle 80 tonnes per hour of furanic sand for a shake-out in a foundry.

Contact: Paolo Magaldi, email: paolo.magaldi@magaldi.com

Italy

From prototype plant to industrial plant: Magaldi Ecobelt® DRI in Lucchini steelworks of Piombino

by **Monica Di Domenico**, *R&D Engineer* monica.didomenico@magaldi.com

The Magaldi Ecobelt® DRI conveyor is the ideal and reliable conveyor for handling very hot and reactive bulk materials, like Direct Reduced Iron (DRI) produced from Rotating Hearth Furnaces (RHF) before further processing stages. Since DRI is extremely reactive and prone to re-oxidation on contact with air, the DRI handling process demands an inert atmosphere inside the conveyor to avoid the material oxidation.

Downstream of the direct reduction process, a further stage may consist of briquetting or smelting hot DRI pellets. In the former case the Magaldi Ecobelt® DRI has the function to cool down the DRI pellets, since the working temperature of the briquetting machine is generally in the range 500÷700 °C. In the latter case the higher the DRI pellet temperature, the higher the energy saving from Electric Arc Furnaces (EAF) to smelt the pellets.

The first prototype plant based on Magaldi Ecobelt® DRI configuration was installed in Piombino (Italy), Lucchini Steelworks, in July 2002.

After the achievement of a reliable and satisfactory performance of the first prototype, Magaldi was asked to modify the Ecobelt® DRI prototype plant layout and scale it up to an industrial plant.

In the Piombino steelwork plant, after the direct reduction process stage in the RHF, the green pellets are loaded as DRI pellets to the Magaldi Ecobelt® DRI at a temperature of 1000 °C and conveyed to the briquetting machine. During transportation on Magaldi Ecobelt®, DRI pellets are cooled down to the briquetting range temperature of 650°C - 750°C.

Inert atmosphere is achieved inside the isolated metal casing of the Magaldi Ecobelt® thanks to a continuous purge of nitrogen through inlet points distributed with regular pitch along the conveyor length. Cold nitrogen purge is designed to contribute to the DRI pellets cooling.

The Magaldi Ecobelt® configuration consists of two zones:

- the upper zone is kept hot at a temperature close to the DRI pellet with inner casing insulation thickness designed to allow a safe operation;
- the lower zone contains water cooled carrying idlers to keep cold the area.

The cleaning device connected to the Magaldi Ecobelt® is a short spill chain positioned under the loading point to collect fine particles slipping for gravity on the metal casing bottom.

The main process data are the following ones:

DRI pellets rate	6.6 t/h
Inlet temperature	1000°C
Outlet temperature (max)	750°C
Conveyor length	24384 mm
Total Elevation	15000 mm
Conveyor slope	First step 15° second step 39°

Magaldi Ecobelt® advantages are:

- Eco-friendly: no material spillages mean no environmental contamination.
- No degradation or re-oxidation of DRI pellets as far as the conveyor discharge.
- Performance at the highest level of reliability and safety.
- Low maintenance and power demand.
- Compact design and safety operation.

RRS: a success story in the Renewable Energy sector

by **Paolo Magaldi**, *RRS CEO* paolo.magaldi@magaldi.com

RRS, the company of Magaldi Group operating in the RE (Renewable Energy) business, gained a significant success in the past three years for large photovoltaic power plants (greater than 500 kW) installed on the roofs of industrial buildings and factories.

Despite the difficult moment due to the market slowdown for the Italian government decision to reduce the PV (photovoltaic) sector feed-in tariff, RRS was able to obtain more contracts, some of them for the highly qualified techniques proposed (fully industrial integration), some others for the very short installation time given.

In addition to the photovoltaic power plants, RRS is interested to expand RE business to new sectors like mini-hydro (small hydroelectric power generation systems, up to few MW's) and production of energy using biomass as main fuel.

Salerno, a large new multi-section photovoltaic system with strong innovative features

In the first months of 2011 RRS signed a contract to install a photovoltaic plant on the roofs of Salerno plant of AGC Flat Glass Italia, a large glass factory built in the early '60s and located in Salerno industrial area.

The factory spans over tens of thousands of square meters with an additional area of about 10,000 square meters of reclaimed land. Glass Power Roccasecca Salerno S.r.l. – a JV between Green Invest, a Belgian

investment fund dedicated to renewable energy production, and AGC Glass Europe S.A. - acquired the surface rights of such AGC Italian factory roofs, and RRS prepared a project to build a large plant, 3.3 MWp, on their Salerno plant.

RRS proposal was selected over many others, since the special architectural innovations brought were providing the Customer with a certain number of advantages: in fact RRS with their particular "shed skylight" design was offering:

- an integration with the existing structures to comply with the new anti-seismic regulations;
- a presence of large areas of transparent polycarbonate to light up the factory;
- a full compatibility with current fire-fighting regulations as they may leave open their space in case of high surface temperatures over 150°;
- a ventilation of the underlying surfaces and a greater exchange of air with increased efficiency of photovoltaic modules as all the sheds face south and are 12° tilted.

After the contract signature in 1 July 2011, the first three sections for a total of 1,657 kWp have been installed and connected to the grid in only two months, getting the tariff allocated for that month.

To achieve this important result, RRS installed more than 6600 photovoltaic modules in less than 30 days, manufacturing and installing 230 tonnes of steel structures, specifically designed to be bound to the roof support structure. The steel structures were connected to the roof with threaded rods introduced in 2000 holes and then sealed. The structures of the "shed skylight" have an "active"surface for the PV modules facing south and a north-facing "passive" transparent polycarbonate surface.

The active surface has an inclination of 12° and increases the efficiency of the modules.

The north-facing surface (polycarbonate) allows the entry of large amounts of light and, in case of fire, when the temperature exceeds 150°, sublimates leaving tens of square meters openings without weakening the steel structures and preventing the roof collapse.

To achieve the project delivery commitment, planned in two months after the order, RRS utilized an average of 50 person per day in two shifts. The entire work was completed on time with zero accidents.

Particular attention was given to the plant monitoring and control system providing:

- control of every single string;
- the inverter control;
- control of meters and transformers;
- comparison of the actual energy produced versus the expected one.

Pyranometers are evaluating the energy radiated in different directions and calculate the energy expected with that particular radiation. Then, collected data are compared with a special software with the production numbers (recorded by counters placed upstream of the inverter dedicated to the three existing sections). If the energy produced is significantly less than the one expected and all systems are correctly operating, the system alerts via e-mail the control team, to clean photovoltaic modules and bring them to their maximum efficiency.

The system also automatically alerts equipment malfunctioning. With an updated design, RRS can provide its' customers not only of the best PV technologies available today, but also of a continuous support in their operation to get the quicker return on their investment.

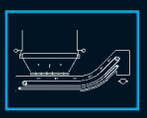
To date, RRS has installed over 11 MW of photovoltaic systems on factory roofs, giving to its customers the possibility to produce energy at costs tending to zero.

An increased attention to clean energy

Magaldi Group has always been dedicated for a clean and better world and a sustainable future: from the saving of the water obtained through dry bottom ash system, the Magaldi Ash Cooler, to the efficiency increase of coal-fired power plants and the recycle of materials and energy otherwise lost.

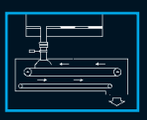
A particular attention was given in the recent years to the Renewable Energy with a focus on new technologies and products: different types of components and systems developed as "green products" were constantly monitored to evaluate their practical application by a dedicated Magaldi team, particularly in hydropower and biomass generation.

MAGALDI®
Dependable technologies

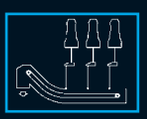


MAC – Magaldi Ash Cooler
Dry bottom ash extraction system

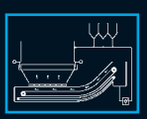
SUPERMAC
Extraction and air/water cooling system
for large quantities of heavy ashes



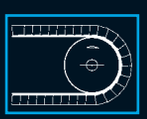
Magaldi Fluimac
Dry ash extraction system for fluid bed boilers



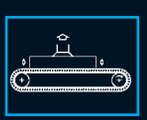
MAGALDI MRS – Magaldi Mill Rejects System
Dry coal mill rejects handling system



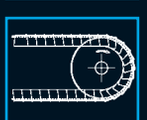
MAR – Magaldi Ash Recycling
Dry extraction and recycling of bottom and fly ash



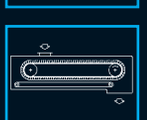
Magaldi Superbelt
Dependable steel belt conveyor



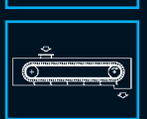
MCC – Magaldi Casting Cooler
Magaldi Superbelt for forced air casting cooling



Magaldi Superbelt PR/PRZ
Magaldi Superbelt for casting sorting over sprues

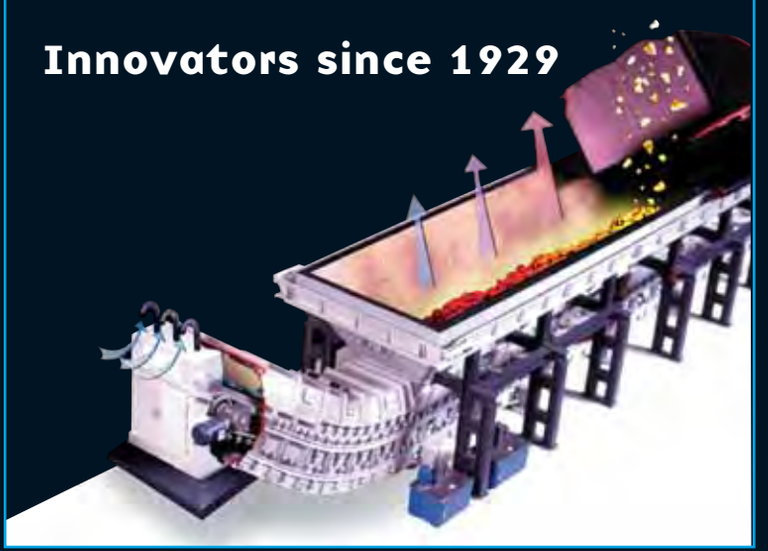


Magaldi Ecomag
Dust proof Magaldi Superbelt conveyor



Magaldi Ecobelt
Enclosed self cleaning Superbelt conveyor

Innovators since 1929



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