



**STRATEGEM ICEBERG**

Industrial Solution India Pvt. Limited



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## **THE PERFECT SINTER PLANT**

SOLUTIONS FOR FULLY OPTIMIZED  
PLANT DESIGN, PROCESSES AND  
SYSTEMS

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# YOUR CHALLENGE

## ECONOMICAL AND ENVIRONMENTALLY COMPATIBLE SINTER PRODUCTION

### **DRASTIC CUTS IN COSTS AND ENERGY CONSUMPTION**

The increasing demand for iron and steel products, primarily driven by booming markets, substantially affects costs for raw materials, scrap, logistics, and energy. Steadily rising prices and intense competition among steelmakers has sharply reduced profits. To successfully produce under extreme cost pressure, all sinter plant operators must keep their plants running at peak performance while minimizing consumption of electric energy and solid fuel.

### **UNIFORM QUALITY**

The main overall goal of sinter plant operators is to achieve a high output of uniform sinter quality at low operational costs. As the main component in the blast-furnace burden, the production of high-quality sinter is crucial for assuring high, stable furnace productivity with a low consumption of reductants. Sinter quality begins with the proper selection and mixing of the raw materials. The chemical properties must be stabilized by an automatic adaptation of the raw material mix, which means that plant operators need an advanced system with the ability to quickly react to process fluctuations and aberrant situations like an inhomogeneous mixture, poor surface ignition, and incomplete burn-through of mixed materials.

### **FULFILLMENT OF ENVIRONMENTAL REQUIREMENTS**

Environmental regulations are growing increasingly stringent worldwide. This especially affects sinter plants with their high quantity of emissions, which is a focal point for the authorities responsible for environmental protection. Looming penalties in the form of CO<sub>2</sub> emission certificates represent a serious threat to long-term, sustainable growth. The reuse of waste materials and the reduction of environmental emissions from the sintering process is one of the most important steps for improving environmental compatibility, particularly because the sintering process is one of the major sources of emissions within a steel works. Continuous equipment modernization and pollution-control measures are required to reduce the volume of specific off-gas, dust, and other harmful emissions.

### **PLANT SAFETY AND RELIABILITY**

The sinter plant can no longer be seen as a separate or stand-alone production unit. Instead, it must be fully integrated with the blast furnace in order to generate the ideal burden for optimized production and cost efficiency. That means plant operators must consider the use of sophisticated tracking, diagnosis, and control models and an overall expert system to ensure a stable, reliable production.

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The sinter product must satisfy defined target values with respect to chemical, physical, and metallurgical properties deployed in the blast furnace. The traditional sintering process is very energy-intensive: there is great potential for the reduction of energy consumption, emissions, and costs.

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## YOU EXPECT

High plant reliability and availability

Flexibility in raw materials usage

Production stability

Energy-efficient operations

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# OUR SOLUTION

## FULLY OPTIMIZED SINTER PRODUCTION MEETING ALL REQUIREMENTS

### SUPERIOR TECHNOLOGY

Primetals Technologies offers advanced technological solutions to meet the growing requirements for cost effectiveness, productivity, reliability, and environmental compliance. With our pallet-width extension technology and Selective Waste Gas Recirculation System, for example, you can reduce the quantity of off-gas in your sinter plant by up to 50 percent. This significantly lowers not only environmental pollution but solid fuel consumption.

Using the intensive mixing and granulation system for raw mix preparation eliminates the blending yard, drastically reducing space requirements and thus sinter plant investment costs.

Primetals Technologies intensive mixing and granulation system, increases plant productivity and allows high bed heights for a large percentage of even fine ores. Using these technologies, plant operators can increase their sinter quality and thus reduce coke consumption and increase blast-furnace productivity.

### ADVANCED ELECTRICS AND AUTOMATION

Innovative basic automation, process control, and process optimization created by Primetals Technologies play a key role in a stable sintering process and also ensure high system availability. Our systems generate major improvements in productivity and sinter quality by combining reliable solutions for the power supply, drives, and automation with technology-specific applications.

### FULL-LINE SUPPLIER

Primetals Technologies integrated process knowledge makes it the only global, full-line supplier in the iron and steel industry. Our technologies meet client-specific requirements for new and existing plants, while our services provide you with both the advantages and the safety of full turnkey management. We are able execute a customized analysis to ultimately improve your plants performance, resulting in better operation and production of the overall steel works. From process and production analysis that examine sinter productivity, quality, raw materials, and end-product logistics to increased material recycling in the sintering process, which in turn enhances environmental protection we will suggest a number of easy-to-install, stand-alone, and practical solutions at relatively low cost to help our customers optimize operations, reduce costs, improve sinter quality, and improve operational safety.

### COST-EFFECTIVE MODERNIZATIONS AND CUSTOMIZED SERVICES

Modernizations are a cost-effective alternative to building an entirely new plant. This type of investment keeps your plant in the technological forefront while preserving its value and extending its lifecycle. Primetals Technologies offers customized metallurgical services, including very efficient upgrades or replacements, to bring your sinter plant in line with the latest technologies. Our lifecycle management spans the entire service life of the sinter plant, offering much more than just after-sales service.

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When it comes to major investments, there is no substitute for an experienced partner. Every step in the sintering process each plant area and piece of equipment, and their optimized design and the overall integration required for a high-performance sinter plant all add up to... Primetals Technologies.

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## ADVANTAGES OF PRIMETALS TECHNOLOGIES SINTER SOLUTIONS:

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**Extensive experience in the sintering process** building and modernizing sinter plants for over 5 decades

**Efficient project execution** with experienced and reliable project management

**Leading automation solutions** with unique process optimization and expert systems for a safe and reliable production

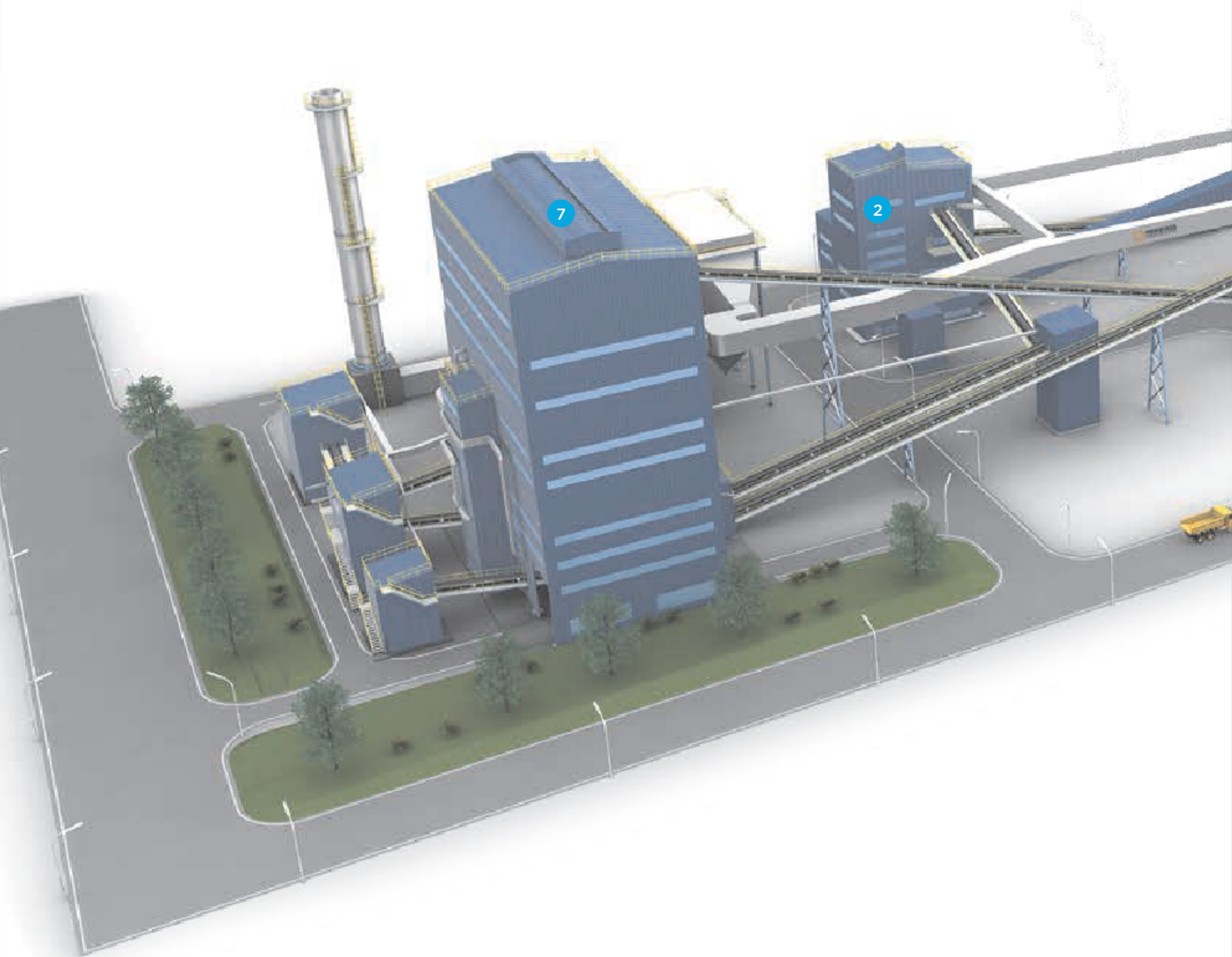
**Continuous improvement** upgrades and lifecycle support during operation of the sinter plant

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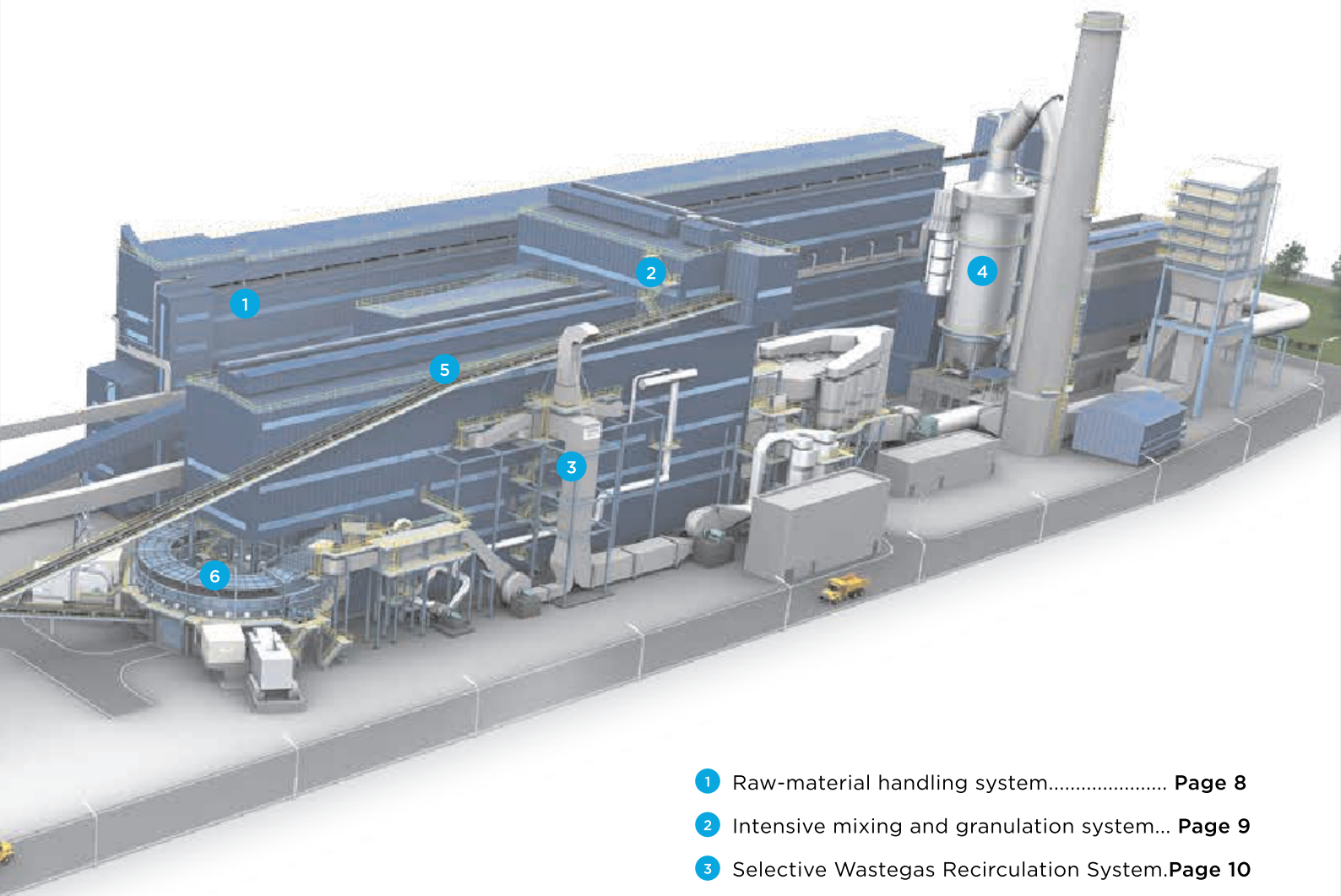
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## THE CUMULATIVE BENEFITS

As a leading supplier of complete sinter plants, Primetals Technologies provides engineering, design, and equipment as well as integrated automation solutions. Specific technology packages for superior sinter production and quality, plant availability, and cost effectiveness are highlighted below.







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# RAW-MATERIAL HANDLING SYSTEM FOR A SUPERIOR BLEND OF THE RAW MIX



Proportioning bins under construction

## RAW-MATERIAL BINS

For the proportioning of the raw mix, Primetals Technologies has engineered specially designed raw-material bins. The bins are designed to avoid bridging of the materials within the bins and to reduce the segregation of coarse and fine particles during charging and discharging. Segregation in the bins during charging and discharging occurs in different ways at different bin fill levels. A higher number of bins allows for the simultaneous discharge of a single ore type from at least two bins with different fill levels, which compensates for the varying segregation of the coarse and fine ore particles during charging and discharging.

The discharge of raw materials by dosing weigh feeders from the bins is controlled by the real-time dosing system. With this control system, the desired mixture composition will conform to predetermined ratios throughout the entire operation. Specially designed bins for handling very fine iron ores preventing, bridging and minimizing potential outflow problems.



Material transport at its best

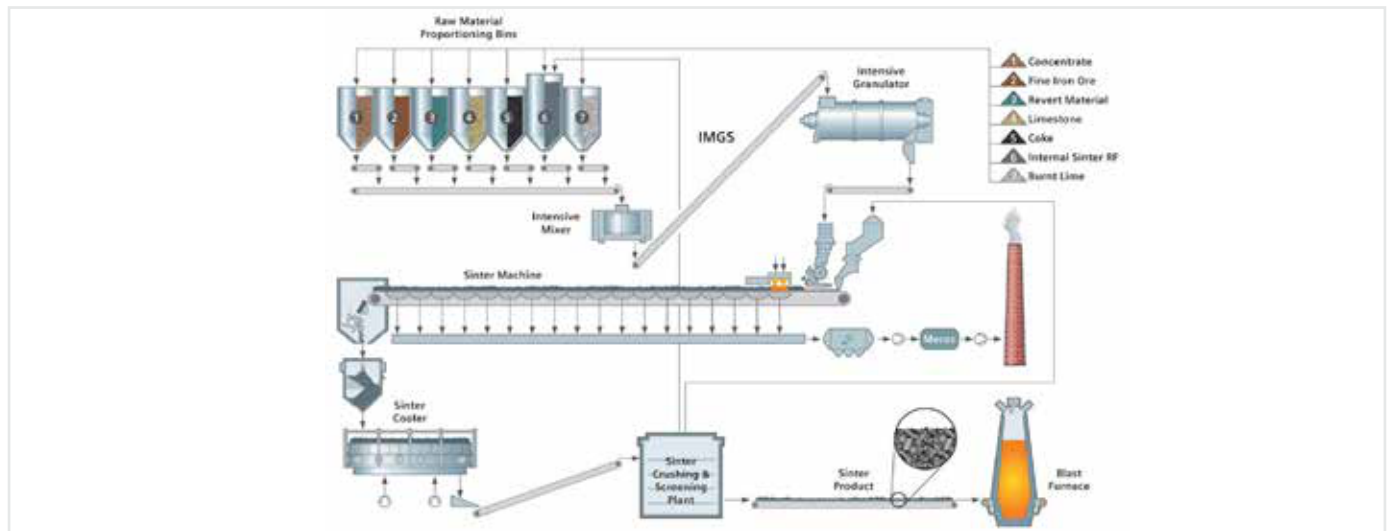
## STOCKYARD AND CONVEYOR SYSTEMS

Primetals Technologies robust and powerful equipment for the stockyard (stockpiles, stacker, reclaimer/bridge reclaimer), and belt conveyor systems ensure a reliable and efficient piling, reclamation, and transfer of different bulk materials (including iron ore, iron concentrate, limestone, and coke) to the stockpiles and to or from the sintering process. All material-handling systems are designed to minimize and optimize the overall handling operation. The result: a significant decrease in investment costs, improved overall logistic process, and homogenized material quantities. The ability to blend different products gives plant operators much more flexibility in securing their plants future. And all solutions are available from a single source.

## MAIN BENEFITS

- Excellent homogeneity of the raw mix
- Higher precision in the proportioning of raw materials
- Greater flexibility in changing raw-material
- Recipes in the shortest possible time

# IMGS<sup>(R)</sup> MIXING AND GRANULATION SYSTEM FOR THE HIGHEST HOMOGENEITY OF RAW-MATERIAL MIX



Raw material mix to intensive granulator

Excellent homogeneity and high permeability of the sinter raw mix are decisive factors in achieving high sinter productivity and quality with reduced consumption of energy. With a conventional mixing drum, only a very limited homogeneity of the sinter raw mix can be obtained. To remedy this problem, Primetals Technologies developed the intensive mixing and granulation system, which consists of an intensive mixer and granulation aggregate. The sinter raw materials (like coarse as well as fine iron ores, ultra-fine ores/pellet feed, additives, dusts, solid fuels, return fines, and recycled materials from the steel plant) are continuously fed into a high-speed intensive mixer where macro- and micro-mixing of the sinter raw mix takes place. After the mixer, the material is transported to the drum or intensive granulator where the material granulation takes place. The mixing devices can be individually adjusted to changing requirements. Sinter pot grate tests can be preformed with actual raw materials in order to back up the envisaged plant performance with proposed equipment.

## MAIN BENEFITS

- Excellent homogeneity as a result of turbulent mixing and improved preparation of the sinter raw mix
- Capacity to mix higher ratios of iron-ore ultra-fines (pellet feed)
- Improved sinter quality with reduced standard deviations (greater homogeneity)
- Reduced coke consumption
- Pre-blending/blending yards are not needed
- Nodulizing phase at the intensive granulator is possible
- Predictable plant performance due to pot grate tests



Vertical intensive mixer



Horizontal intensive mixer



# UNMATCHED EMISSION REDUCTION

## ENVIRONMENTAL EMISSIONS FROM SINTER PRODUCTION REDUCED TO UNATTAINED LEVELS



Selective Waste Gas Recirculation System

### SELECTIVE WASTE-GAS RECIRCULATION SYSTEM

Primetals Technologies has developed and implemented new technologies that enable environmental emissions from sinter production to be reduced to therefore unattained levels. This has been achieved with the introduction of a Selective Waste Gas Recirculation System in which the offgas from selected zones of the sinter machine is mixed with cooler off-air and is then recirculated to the sinter strand. The selective waste-gas recirculation system was developed initially to keep the off-gas volume at a constant level while increasing the sintering capacity and decreasing specific emissions. This allows investment and operating costs for gas-cleaning facilities to be held at acceptable levels. The selective waste-gas recirculation system from Primetals Technologies can be installed in existing or in greenfield plants with or without capacity increase.

### MAIN BENEFITS

- Waste-gas volume cut by up to 50 percent
- Specific solid-fuel consumption decreased up to 10 percent
- Lower investment and operating costs for waste-gas cleaning plant
- Level of productivity and sinter quality is maintained
- Decreased CO<sub>2</sub> emissions
- Lower specific emissions of SO<sub>x</sub>, NO<sub>x</sub>, PCDD/PCDF, and heavy metals
- Reduction of the freight (t/hour) up to 50% for SO<sub>x</sub>, NO<sub>x</sub>, Dust, PCDDFs, CO, CO<sub>2</sub>, etc



Gas-tight waste-gas recirculation hood





MEROS plant voestalpine Stahl, Linz, Austria

#### **MEROS®**

MEROS is an innovative technology developed by Primetals Technologies to reduce polluting emissions from sinter plants. Through the use of specific additives, the polluting components in the gas flow are combined and separated in a connected fabric filter. The process is semi-dry and therefore 100 percent effluent-free. The standard official limit values can be obtained through the installation of MEROS Technology.

#### **RESIDUALS UTILIZATION AT SINTER PLANTS**

Primetals Technologies approach increases the input of recycled materials into sinter plants, a proven economical route for the in-plant by-products of integrated steel works (like dusts, sludge, and scales). The resulting effects on sinter quality, emissions, and gas-cleaning facilities are taken into consideration as well. Limits on the emission of sinter waste gas and quality parameters of the sinter produced are the two most important limiting factors.

The typical benefits of this approach lie in the use of waste materials, which are normally rich in iron, flux, and fuel value. Therefore it is possible to generate savings in disposal costs, which are also cut by the replacement of raw materials.

#### **MAIN BENEFITS**

High removal efficiency for heavy metals, acid gases, and dioxin/VOC due to countercurrent flow injection of additives

Low quantity of recirculation dust, and therefore fewer filter pulse-cleaning cycles and less compressed air required for filter cleaning

Avoidance of system sticking due to dry dust recirculation

Reduced mechanical stress to the filter bags applying low-pressure cleaning pulses

Controlled and constant process temperature as the basis for efficient desulphurization

Flexible gas desulphurization with  $\text{Ca(OH)}_2$ , supported by NaOH during peak concentrations

Reduced filter space requirements with eight-meter long filter bags

# SINTER MACHINE

## SMART PALLET-CAR AND IGNITION FURNACE DESIGN FOR OPTIMAL SINTER CAPACITY



Pallet-car width extension

### PALLET-CAR DESIGN AND TRAVELING GRATE

The Primetals Technologies pallet design featuring grate-wing pallet cars offers a highly economical solution for application in new sinter plants as well as for increasing the capacity of existing plants. Gas-tight rim zone covers significantly reduce the volume of false air in the side-wall areas of the pallet cars compared with conventional designs. This leads to a major reduction in the quantity of waste gas and improved sintering at the side-wall areas. The result is a decreased quantity of return fines, contributing to enhanced sinter plant productivity. Pallet-car extension technology from Primetals Technologies represents a practical and economical solution for increasing the sintering area, and therefore sinter-plant production capacity, by up to 12 percent. This solution can be applied without modifying the supporting structure of the sinter machine.

### MAIN BENEFITS

- Short sinter-strand downtime for modification work (pre-assembly)
- Reduced false-air intake for improved sinter quality
- Reduced volume of waste-gas and therefore lower energy consumption
- Increased production up to 12 percent (when combined with other technology packages, a higher output can be obtained)



Ignition furnace

### IGNITION FURNACE

Primetals Technologies ignition furnace operates with intensive top burners for better heat distribution on the surface of the sinter strand; and, due to its special design, it also delivers lower fuel consumption compared with the conventional side-burner design. Typically Primetals Technologies ignition furnaces have an inner length of approximately 3,300 millimeters when retrofitted in an existing plant, which typically increases the active sintering area. The intensive ignition furnace with state-of-the-art top burners features an advanced flame monitoring and gas control and regulation. This enables steady and constant ignition with temperatures of approximately 1,200°C or above. An additional benefit is that a very short installation period is guaranteed thanks to the preassembly procedures for the ignition-furnace chamber.

### MAIN BENEFITS

- Better heat distribution on the surface of the sinter strand
- Lower fuel consumption compared with the conventional side-burner design
- Rapid and constant ignition
- Short installation period
- Increase of active sinter area due to shorter ignition furnace

# SINTER COOLER

## EFFICIENT COOLING AND REDUCED ENERGY CONSUMPTION



Evenly distributed sinter

### ADVANCED COOLER CHARGING CHUTE

The advanced design of the cooler charging chute ensures a more homogeneous distribution of the sinter onto the sinter cooler, keeping pieces with larger diameters near the bottom and the smaller at the top. This increases cooling performance, reduces fan power consumption, and prevents damage to associated equipment.

### CIRCULAR DIP-RAIL COOLER

The sinter cooler is designed based on Primetals Technologies patented grate-wing cooler trough technology to meet your requirements for higher efficiency and lower electrical energy consumption. The grate-wing design has special rubber seals between the moving cooler trough and the air-channel system that produce a more efficient utilization of the cooling air. Applying the new design to an existing conventional circular sinter cooler allows the cooling capacity to be increased by approximately 15 percent without increasing the cooling-air volume, and maintains the existing structure with minor modifications.



Sinter cooler heat recovery

### HEAT RECOVERY SYSTEM

To further improve sinter plant energy efficiency, we offer a number of different types of heat recovery systems that can be installed at the sinter cooler, where the sensible heat of the off-air is used to generate electric energy or process steam.

There are three possible heat-recovery options from the cooler:

- Preheating of combustion air for the ignition furnace and post-heating of the freshly ignited sinter

- Selective waste Gas Recirculation System, providing coke and CO<sub>2</sub> conservation

- Waste-heat recovery plant for steam and/or electric power generation

### MAIN BENEFITS

- Lower investment and operational costs

- Decrease in specific energy consumption

- Higher cooling efficiency, resulting in decreased volume of specific cooling air

- Smooth sinter handling

- Recovery of sensible heat at cooler

# SCREENING STATION FOR THE BEST SINTER PRODUCT



Typical screen

After being cooled, the sinter product is fed to the crushing and screening station. There the material is downsized to be used in three different applications: return fines to the sinter process, hearth layer, and blast furnace burden. The small grain particles are recirculated back to the sinter process, the mid-size particles are usually used as hearth layer to protect the pallet cars, and the larger-size particles are transported to the blast furnace.

## MAIN BENEFITS

- High efficiency (undersize/oversize grains <5 percent each)
- Reduced wear on pallet cars and increased permeability due to hearth layer
- Reduced maintenance downtime of the plant
- Smooth handling of the sinter material



Screening mats



# UNIQUE MODERNIZATION SERVICES

## COMPREHENSIVE EXPERTISE THROUGHOUT THE ENTIRE LIFECYCLE



Circular sinter cooler

Primetals Technologies has decades of experience in the sintering process and all the products and systems required to provide our customers with a full assessment of their sinter plant facilities and productivity. We can offer a unique range of services, including revamps, retrofits, and capacity-increase packages for a complete sinter-plant modernization. Plant modernization can include replacement of obsolete equipment, plant upgrades, and construction of new plant units with maximum leverage of the existing infrastructure.

To improve the efficiency of existing plants, we can provide a number of alternatives ranging from individual equipment replacement to extensive plant rehabilitation, adapted to each customer's individual needs.

### SINTER PLANT STUDIES

With each customer, we design a customized evaluation that analyzes all critical areas, requirements, and concerns. The outcome will be a proposal of a range of improvements and adaptations, with the overarching goal of enhancing plant performance and keeping your plant up-to-date and ready for present as well as future demands.

Our service portfolio includes:

- Raw-material and sinter pot tests
- Operational consultation and plant assessment (including startup and shutdown support)
- Cost-efficiency measures
- Economical and technical feasibility studies
- Research and analysis services
- Expert training on- and off-site
- Utilization of waste materials (residuals)

### MAIN BENEFITS

- Elaboration of performance improvement potentials
- Increase in plant availability and productivity
- Operating cost reductions
- Extended plant lifecycle
- Fulfillment of the increasing demands of environmental, health, and safety regulations
- Primetals Technologies technological and service leadership
- Smooth operation with robust equipment
- Individual configurations with or without standby

# SINTER PLANT PROCESS AUTOMATION

## MASTERING THE COMPLEXITY OF SINTER PLANT OPERATION



Sinter plant control room, voestalpine Stahl GmbH, Linz, Austria

### SINTER PROCESS CONTROL

Knowledge and experience accumulated by our specialists combined with innovative technologies are the decisive factors to lift your sinter plant to the next level of automation.

Understanding our business as being partner to our clients, we deliver a proven and cost-effective solution from one single source.

We can draw on substantial engineering and operation know-how covering the complete sinter plant life-cycle. Our many years of experience in realizing sinter plant automation projects all over the world enable us to master all upcoming challenges immediately and to the point.

The efficiency of the automation strongly depends on the proper instrumentation. We provide the right instruments at the proper place and fit them seamlessly in our automation solution.

A reliable process control system is the basis for your transition to Industry 4.0. Established and efficient techniques such as server virtualization increase system flexibility and availability and help you to save hardware-, and maintenance costs. The latest industrial Ethernet technologies and proven hardware architecture warrant a maximum performance while keeping the highest IT security levels. Particularly when the technical and strategic course is set to allow a business to efficiently make the move to become a Smart Factory.

The concepts of flexible thinking, bold innovation and intelligent measurements will play an ever more important role in the future to ensure a flexible and trouble-free production.

### SINTER PROCESS OPTIMIZATION

Sinter process optimization is an innovative process optimization system that lifts plant automation to a completely new level. Our solution is based on a well-tested and proven basis system which guarantees the highest availability and efficiently combines data-acquisition, -processing and -visualization. Over the last 20 years the system has demonstrated its reliability and cost savings in more than 60 installations all over the world.

A broad spectrum of raw data sources (front-end signals, amount of material charged, laboratory data, events, model results, cost data), is stored over the whole plant lifetime. Specialized tools are provided where process information can be linked to analysis data and burden matrices. Flexible interfaces, modularization and state-of-the-art software architecture provide the means to easily adapt and maintain the system in an ever changing environment with respect to raw materials, operation philosophy and connectivity to 3rd party systems.

On top of the robust basis system numerous interacting process models support the operators and metallurgical engineers in their daily decisions. Plant specific requirements are incorporated into these metallurgical process models.

End-to-end transparency in real-time through up-to-date data visualization and metallurgical process models lead to better collaboration, improved workflows and reduced errors while supporting decision-making.



### CLOSED-LOOP SINTER EXPERT SYSTEM

The closed-loop sinter expert system was designed according to the principle As few actions as possible, as many as necessary with the target to enable an optimized sinter operation requiring minimal operator interactions.

The expert system - which is designed as a rule based decision system - counteracts process fluctuations caused by changes in the raw mix composition and quality, human factors or process conditions. The sooner the system responds to an abnormal or changing process situation, the smoother the overall sinter operation will be. The accurate timing of control activities and anticipation of disturbances are of utmost importance to avoid critical process conditions and to maintain a high production rate at low costs.

After numerous successful installations Primetals Technologies is in a position to guarantee significant improvements of the product quality and reduction of fuel consumption with the available raw materials.

At shell, we sustainably optimize and control your assets for life-cycle value through the integration of numerous packages to forge a bridge from the intelligent closed-loop controls to a fully automatic product analyzing equipment.



### ADVANTAGES OF OUR SINTER PROCESS AUTOMATION SOLUTION

**High productivity** keep the sinter plant running at peak performance while minimizing consumption of electric energy and fuel

**Product quality** maintain the chemical properties of sinter at the desired levels

**Reduced fuel consumption** as a result of the precise mixing of charged materials - the quantity of return fines is ideally controlled considering the thermal conditions of the sinter on the strand

**Stable and shift-independent operation** best-practice sinter operation 24 hours a day to ensure efficient production

**Easy integration** a comprehensive range of metallurgical models and packages that can be easily integrated into any existing automation environment

**Fast response to market demands** to react quickly and flexible on market requirements as well as on unexpected situations.

**Lifecycle service service and support** for upcoming system extensions after startup guarantee sustainable benefits

**Quick amortization** the standard period can be expected to be less than one year

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