



Metals Technologies

Solutions for sinter plants

Mechanical, automation, and electrical engineering from a single source – economically and ecologically advanced solutions

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 CO₂ 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.

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.



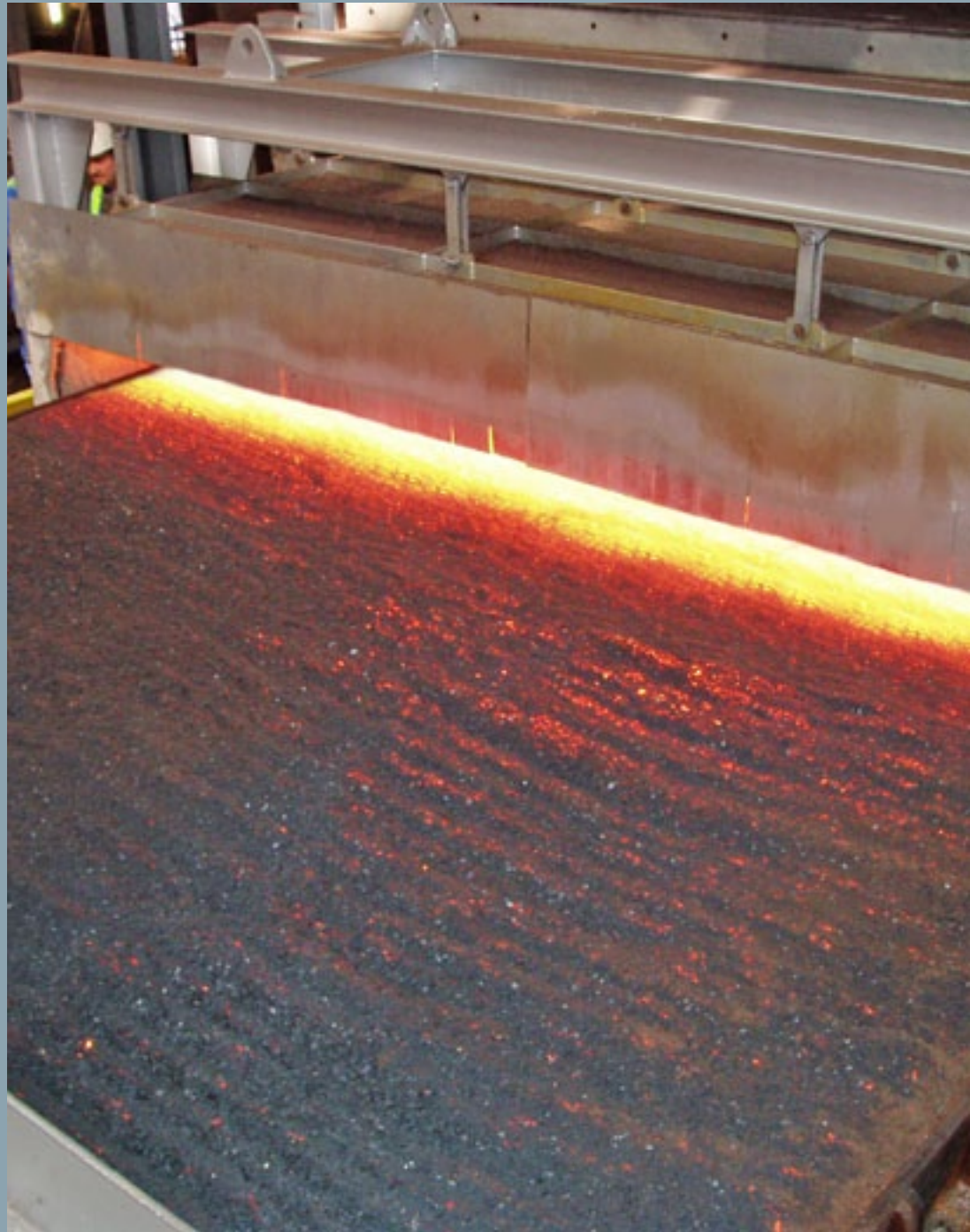
You expect ...

- High plant reliability and availability
- Flexibility in raw materials usage
- Production stability
- Energy-efficient operations

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... Siemens VAI.

Advantages of Siemens VAI sinter solutions:

- **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** – driven by innovations and life-cycle support during operation of the sinter plant



Our solution: Fully optimized solutions for all requirements

Superior technology

Siemens VAI 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, 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 power consumption.

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

Siemens VAI's twin-layer charging system, in combination with the 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 Siemens VAI 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

Siemens VAI's 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 to execute a customized analysis to ultimately improve your plant's performance, resulting in better operation and production of the overall steel works. From process and production analyses 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.

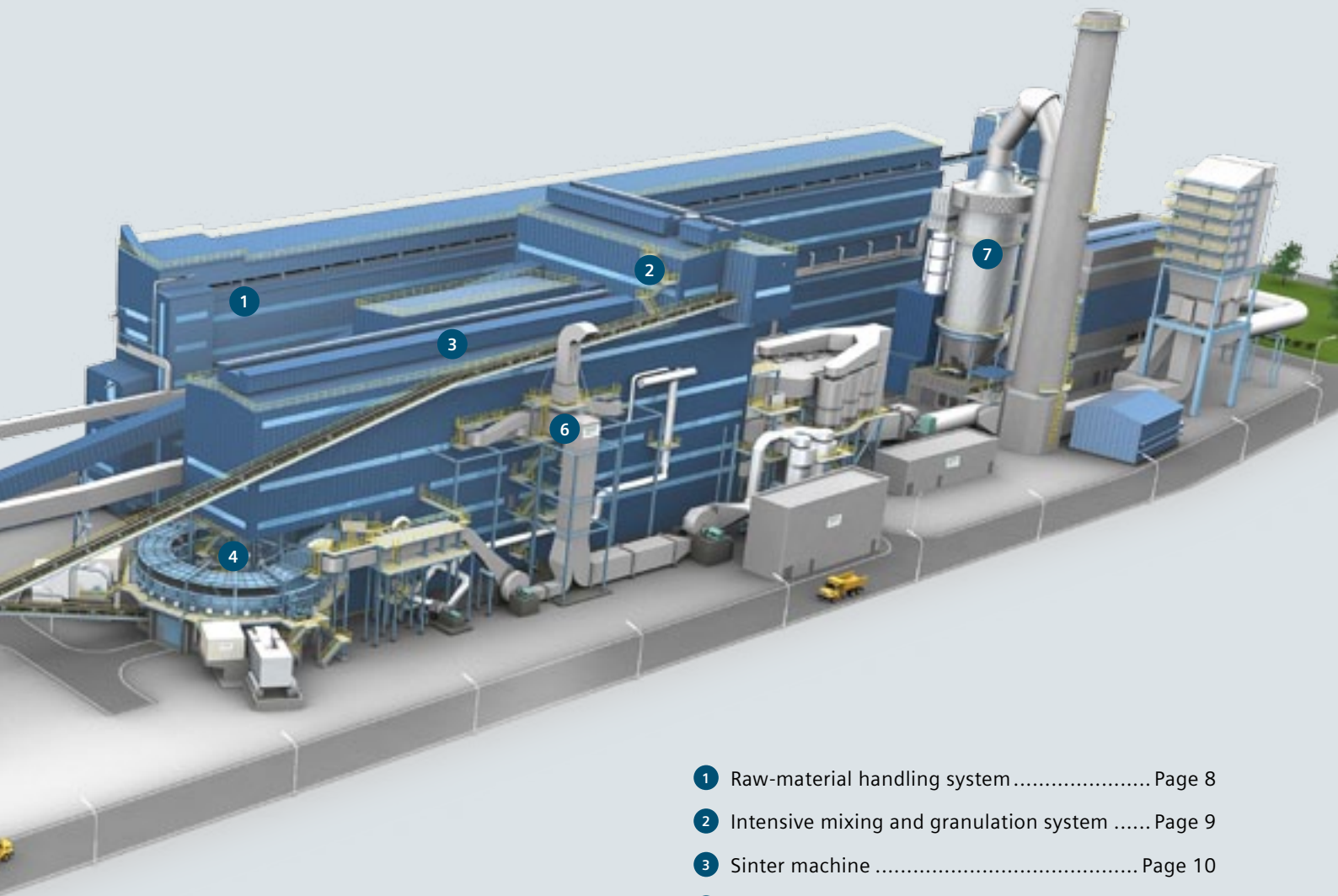
Effective modernizations and customized services

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 life-cycle. Siemens VAI offers customized metallurgical services, including very efficient upgrades or replacements, to bring your sinter plant in line with the latest technologies. Our life-cycle management spans the entire service life of the sinter plant, offering much more than just after-sales service.

The cumulative benefits

As a leading supplier of complete sinter plants, Siemens VAI 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.





- 1 Raw-material handling system Page 8
- 2 Intensive mixing and granulation system Page 9
- 3 Sinter machine Page 10
- 4 Sinter cooler Page 11
- 5 Screening station Page 12
- 6 Selective waste-gas recirculation system Page 14
- 7 SIMETAL MEROS® Page 15

Raw-material handling system

Including proportioning-bins system – for a superior blend of the raw mix



Proportioning bins under construction



Material transport at its best

Raw-material bins

For the proportioning of the raw mix, Siemens VAI 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.

Stockyard and conveyor systems

Siemens VAI’s 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 plant’s 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

Intensive mixing and granulation system

For the highest homogeneity of raw-material mix



Raw material mix to granulation drum

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, Siemens VAI developed the intensive mixing and granulation system, which consists of an intensive mixer and granulation aggregate.

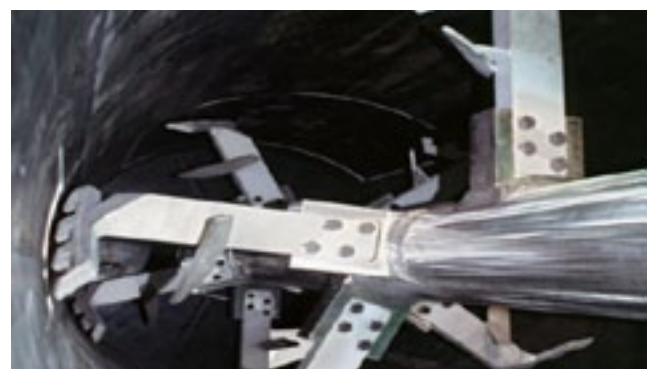
The sinter raw materials (like coarse as well fine iron ores, ultra-fine ores/pellet feed, additives, dusts, solid fuels, return fines, and recycled materials from the steel plant) are continuously fed into a high-speed intensive mixer where macro- and micro-mixing of the sinter raw mix takes place. 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.

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



Vertical intensive mixer



Horizontal intensive mixer and granulator

Sinter machine

Intelligent pallet-car design and ignition furnace for optimal sinter capacity



Pallet-car width extension



Ignition furnace

Pallet-car design and traveling grate

The Siemens VAI 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 Siemens VAI 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

Siemens VAI's 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 Siemens VAI 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 pre-assembly procedures for the ignition-furnace chamber.

Sinter cooler

Sophisticated design for highly efficient cooling and reduced energy consumption



Circular sinter cooler



Evenly distributed sinter

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 Siemens VAI's 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.

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, pre- and post-heating of raw mix/freshly ignited sinter
- Selective waste-gas recirculation, providing coke and CO₂ 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

Crushing and screening, 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 service expertise throughout the entire life-cycle of your sinter plant



Siemens VAI 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)

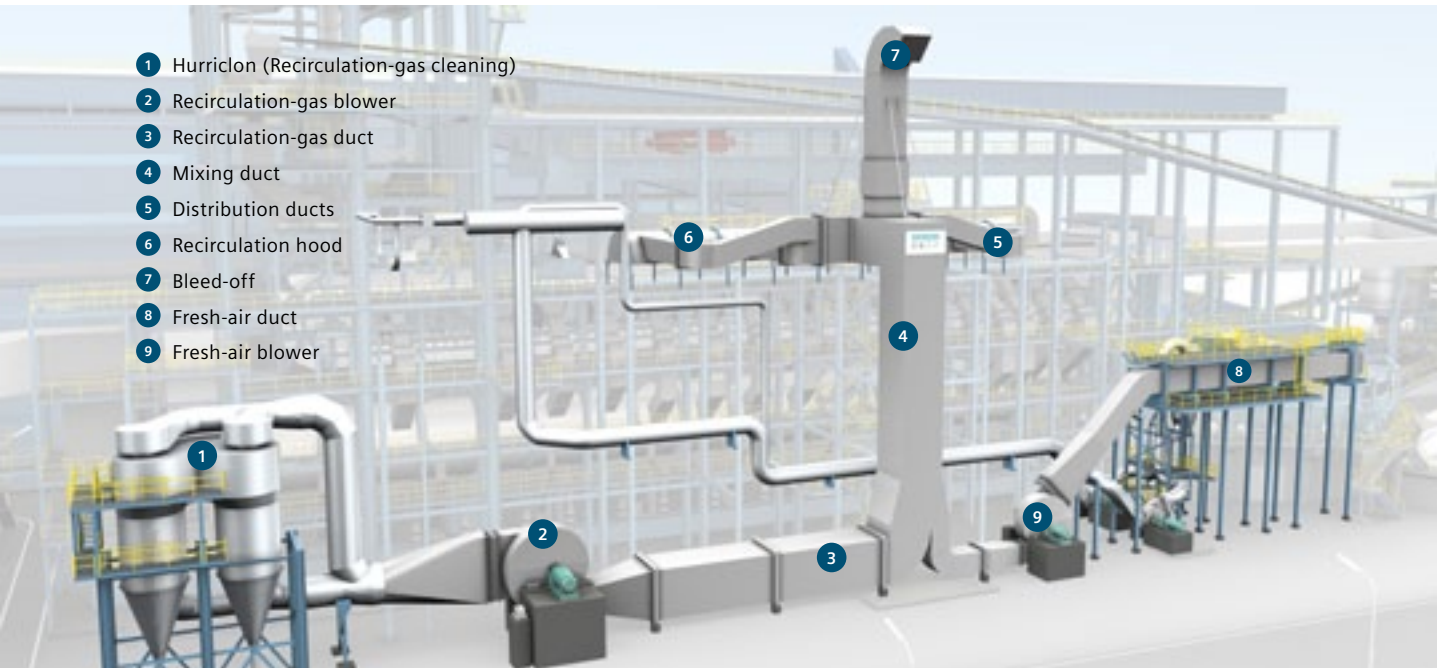
Main benefits:

- Definition of performance improvement potentials
- Increase in plant availability and productivity
- Operating cost reductions
- Extended plant life-cycle
- Fulfillment of the increasing demands of environmental, health, and safety regulations
- Siemens VAI's technological and service leadership
- Smooth operation with robust equipment
- Individual configurations with or without standby

Selective waste-gas recirculation system

Environmental expertise

- 1 Hurriclon (Recirculation-gas cleaning)
- 2 Recirculation-gas blower
- 3 Recirculation-gas duct
- 4 Mixing duct
- 5 Distribution ducts
- 6 Recirculation hood
- 7 Bleed-off
- 8 Fresh-air duct
- 9 Fresh-air blower



Selective waste-gas recirculation system

Selective waste-gas recirculation system

Siemens VAI has developed and implemented new technologies that enable environmental emissions from sinter production to be reduced to heretofore unattained levels. This has been achieved with the introduction of a selective waste-gas recirculation system in which the off-gas 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 primarily 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 Siemens VAI 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 CO₂ emissions
- Lower specific emissions of SO_x, NO_x, PCDD/PCDF, and heavy metals



Waste-gas recirculation hood



SIMETAL MEROS plant voestalpine Stahl, Linz, Austria

SIMETAL MEROS®

SIMETAL MEROS (= Maximized Emission Reduction Of Sintering) is an innovative technology developed by Siemens VAI 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. In 2005, a MEROS demonstration plant with a gas flow of approximately 100,000 m³/hour was successfully put into operation for voestalpine Stahl in Linz, Austria. Based on the knowledge acquired from this project, the technology has been recently upgraded.

Residuals utilization at sinter plants

Siemens VAI's 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 Ca(OH)₂, supported by NaOH during peak concentrations
- Reduced filter space requirements with eight-meter long filter bags

Electrics and automation for sinter plants

Get more from your ore



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

A milestone in sinter process control

The major objectives of a sinter automation system are to ensure stable production at the highest possible productivity level and consistent quality. With its process control features and process models, the SIMETAL Sinter VAiron system is the ultimate solution.

At the level of process/technological controls (Level 1), the primary applications are:

- Raw material crushing and material bin filling
- Free configurable raw mix proportioning system
- Return fines ratio control
- Water addition and sinter mix moisture control for constant permeability
- Surge hopper level control
- Sinter mix charging control for constant and compression free material charge
- Air- and gas flow control for ignition burners
- Temperature and pressure stabilization for accurate ignition
- BTP and sinter machine speed control
- Cooler speed control
- Control of off-gas system

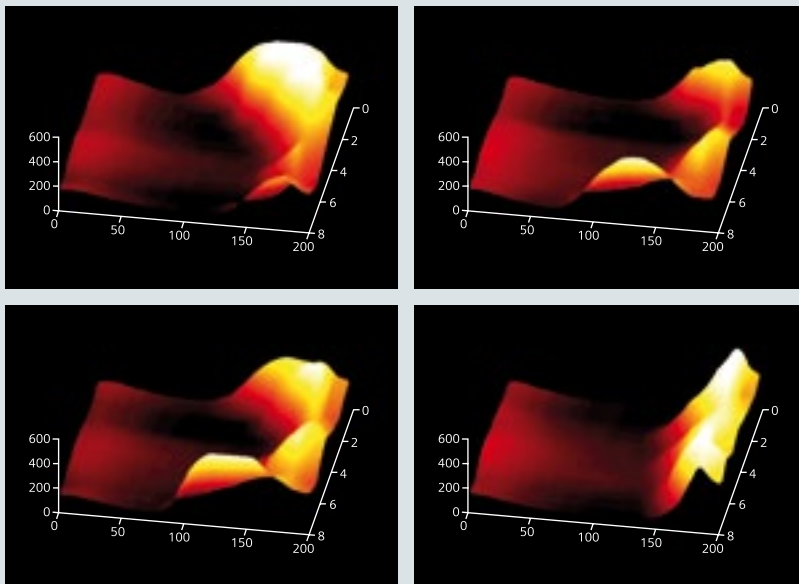
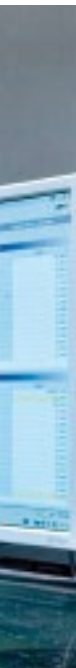
The leader in process optimization

The SIMETAL Sinter VAiron process optimization system – which features layers for information management, models, and an expert system – pre-processes raw data, evaluates active and historical data, and compares limit mismatches.

Its process models, which are based on our experts' integrated process knowledge, are perfectly suited to the requirements of state-of-the-art plant control.

Primary SIMETAL Sinter VAiron models:

- Stacking-plan model
- Ore-bed distribution model
- Raw-mix calculation model
- Permeability-calculation model
- Burn-through time prediction model
- Burn-through point calculation model
- Harmonic-diameter calculation model
- Productivity analysis
- Material tracking



The transversal burn-through point control supports a homogeneous flame front: Uniform sinter (as shown in the bottom right graph) is an important contribution to higher productivity

Closed-loop sinter expert system

The SIMETAL Sinter VAiron expert system ensures high productivity as well as low fuel consumption for your production process. Sintered material with stable chemical and physical properties is one of the main production goals. At the same time, the system supports the maintenance of environmental limits.

The one-of-a-kind expert system is capable of processing corrective actions in closed-loop operations. The calculated setpoints are automatically transferred to the process control system.

The expert system utilizes information at a very early stage of the production line in order to control the processes and use information gathered at a later stage to self-tune the control system. This results in high control accuracy and, at the same time, fast corrective actions.

Main features:

- Integrated solution for ore preparation and sinter process
- Control of constant chemical material composition
- Adjustment of coke consumption
- Optimization of sinter strand velocity
- Adjustment of material composition to maintain waste-gas limits for sulphur
- Transversal burn-through point control

Main benefits:

- Higher productivity
- Reduced fuel consumption as a result of optimal mix of charged materials
- Stable and shift-independent operation
- Stabilization of sinter basicity
- Stabilization of harmonic diameter of sinter
- Stabilization of production and utilization of sinter return fines



SIMETAL Sinter VAiron expert system

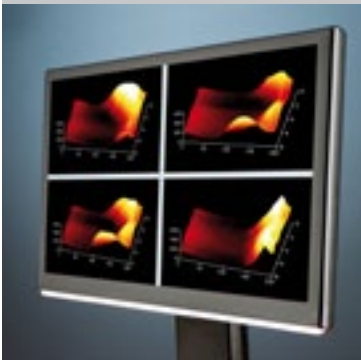
Expertise from experience

Selected success stories with sinter technologies



Environment-friendly sinter plant

- Customer: Dragon Steel Corporation, Taiwan
Type of plant: Sinter plant (248 m²)
Our solution: A sinter plant including intensive mixing and granulation system, twin-layer charging, grate-wings pallet cars, selective waste-gas recirculation, DeSOx and DeNOx, DeDioxin plant
The result: The most sophisticated, environment-friendly sinter plant with low consumption figures



Increase of productivity with reduced fuel consumption

- Customer: Nanjing Iron & Steel Group, Nanjing, China
Type of plant: Sinter plant no. 2 (360 m²)
Our solution: Installation of latest generation of SIMETAL Sinter VAiron automation system, including closed-loop expert system
The result: Decrease in total specific fuel consumption, increase in productivity, reduced sinter quality variation, reduction of internal return fines



Improved energy consumption through sophisticated cooling

- Customer: Rashtriya Ispat Nigam Ltd., Visakhapatnam, India
Type of plant: Sinter plant no. 1 (240 m²)
Our solution: Engineering and supply of circular dip-rail cooler and grate-wing cooler troughs: project management, supervision for construction and commissioning, featuring optimized segregation and charging chute
The result: In Decrease energy consumption and operational costs



Reduced emissions for long-term environmental compliance

- Customer: POSCO, Pohang, Rep. of Korea,
Type of plant: Sinter plant no. 3 (504 m²) and No. 4 (436 m²)
Our solution: Design, engineering, and supervisory services for the sinter plant's selective waste-gas recirculation system
The result: Lower CO₂ emissions



Higher output with advanced automation solutions

Customer: Jindal Steel & Power Limited (JSPL), India

Type of plant: Sinter plant (490 m²)

Our solution: A sinter plant including intensive mixing and granulation system, grate-wings pallet cars, selective waste-gas recirculation and SIMETAL Sinter VAiron level 2 expert system

The result: Most sophisticated, and one of the largest sinter plants with low consumption figures in India



Excellent mixing for highest homogeneity

Customer: Usiminas (Ipatinga and Cubatao site), Brazil

Type of plant: Sinter plants No. 1 and No. 2 (Ipatinga), Sinter plant No. 3 (Cubatao)

Our solution: Design, engineering, supply, and services for an intensive mixing and granulation system, including a dedusting and material handling system

The result: Enables the use of pellet feed in the sintering process for improved sinter quality



Higher performance at reduced cost

Customer: Corus, Port Talbot, UK

Type of plant: Sinter plant (390 m²)

Our solution: Enlargement of sintering area through grate width extension, overhaul of sinter cooler, replacement of mixing and granulation drum, and a new automation system for sinter plant

The result: Capacity increase to 4,900,000 t/a, lower electrical energy consumption, lower specific off-gas volume



Sinter capacity increased by 30 percent

Customer: voestalpine Stahl, Linz, Austria

Type of plant: Sinter plant 250 m²

Our solution: Enlargement of the sinter area by lengthening the sintering strand and installation of selective waste-gas recirculation system

The result: Increase in sinter capacity by 30 percent with the same quantity of off-gas

Read the QR
code with the
QR code reader
in your mobile!



Headquarters:

Siemens VAI
Metals Technologies GmbH
P.O. Box 4, Turmstrasse 44
4031 Linz, Austria
Phone: +43 732 6592-0
E-mail: contact.metals@siemens.com

www.siemens-vai.com/ironmaking

Order No. E10001-M3-A6-V3-7600
Dispo No.: 21661 K-No.: 28102 | Printed in Austria
SPS SVAI-09-00219 PA 06111. | © 06.2011, Siemens AG

The information provided in this brochure contains merely general descriptions or characteristics of performance which in actual case of use do not always apply as described or which may change as a result of further development of the products. An obligation to provide the respective characteristics shall only exist if expressly agreed in the terms of contract.

All rights reserved. Subject to change without prior notice.

SIMETAL and MEROS are trademarks of Siemens AG.



Through the voluntary acquisition of emission reduction certificates this print product actively contributes to environmental protection.