



**EFFICIENCY UP - COSTS DOWN
PRODUCE METALS WITH LESS
ENERGY INPUT**

WITH INTEGRATED SOLUTIONS FROM
YOUR LIFECYCLE PARTNER

MOVE UP TO A HIGHER ENERGY EFFICIENCY LEVEL – WITH SUPPORT FROM YOUR LIFECYCLE PARTNER

Achieve higher output with less input: As one of the world's leading lifecycle partners for the metallurgical industry, we offer you a comprehensive technology, modernization, product and services portfolio as well as integrated automation and environmental solutions covering the entire lifecycle of your plant. All this results in improved energy efficiency and increased competitiveness for your business.



EFFICIENCY UP

Reduce energy cost impact and bring profitability to the top

TECHNOLOGY UP

Achieve overall improvements through our unique process know-how

SUSTAINABILITY UP

Benefit from a fast return on investment through effective energy savings

ENVIRONMENTAL RESPONSIBILITY UP

Comply with highest environmental standards

ENERGY COSTS DOWN

Produce steel by using less input materials and energy. We support you with solutions that deliver impressive results. We help you reduce your energy-related costs to the maximum.

LIFECYCLE COSTS DOWN

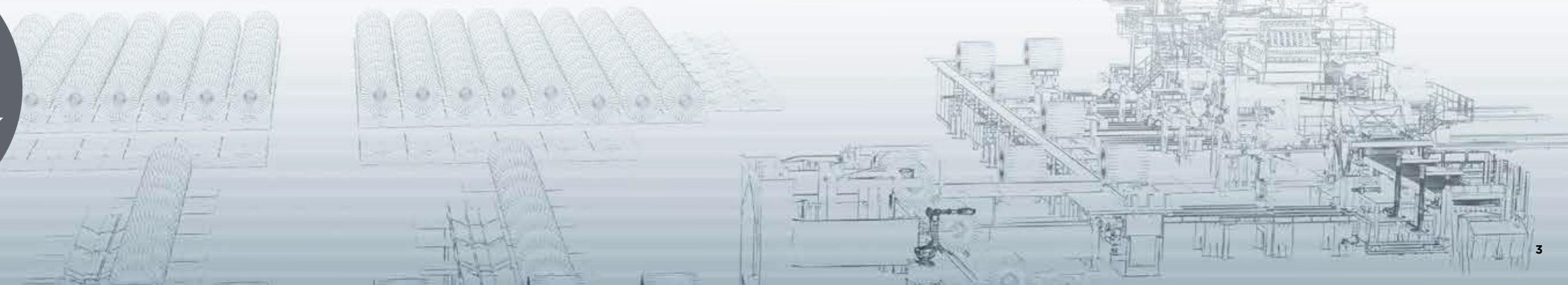
As your lifecycle partner, Primetals Technologies contributes not only with technology but also with services, automation solutions, plant upgrades and modernization – all this in an effort to make steel manufacturing more energy-efficient. The basis is our unique know-how.

PAYBACK TIME DOWN

Our own analysis models enable us to detect the full potential of energy savings achievable in your plant and to recommend the most effective measures. The result is: Investment costs payback within very short time.

EMISSIONS DOWN

Use waste heat and waste materials as a resource and, what is more, meet the strictest environmental regulations. With innovative waste heat recovery systems from Primetals Technologies, you can significantly reduce the CO₂ footprint of your plant.



GET THE BEST OUT OF YOUR PLANT - FOLLOW THREE ESSENTIAL STEPS TOWARDS MORE ENERGY EFFICIENCY

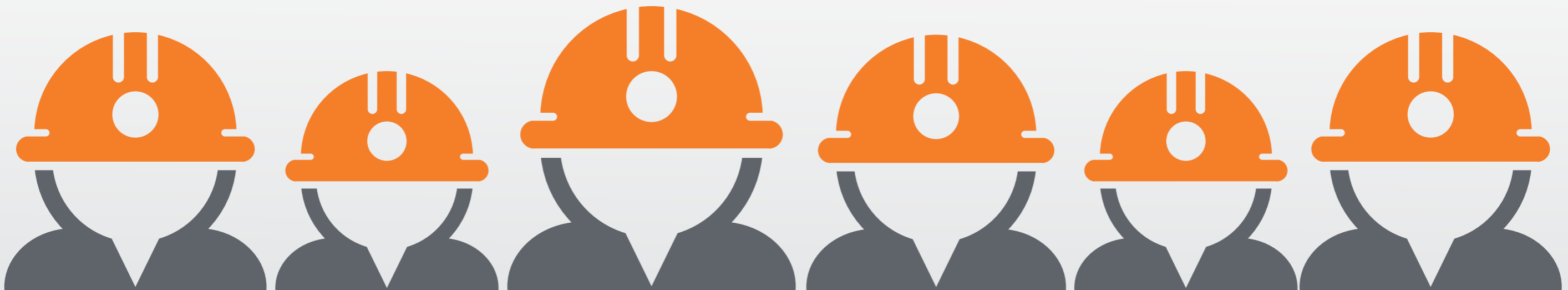
PRIMETALS TECHNOLOGIES OFFERS A THREE-STEP APPROACH

ENERGY CHECK	FEASIBILITY STUDY	SPECIFIC IMPROVEMENT
FIND	EVALUATE	ELABORATE
<p>Quick energy benchmarking based on installed base, main raw materials</p> <ul style="list-style-type: none"> • 1 week on site + • 1 month for analysis 	<p>Detailed investigation of energy saving potential</p> <ul style="list-style-type: none"> • 2-3 weeks on site + • 2-3 months for analysis 	<p>Plant-specific efficiency measures, feasibility</p> <ul style="list-style-type: none"> • 2-3 week on site/plant + • 2-3 months for analysis
<p>In the first step, we benchmark the overall performance of the major process units. Based on this survey of process facilities and auxiliary plants, weak spots can be detected and quick wins highlighted. First indications of related payback times are provided for the identified opportunities for energy-efficiency improvement.</p>	<p>An energy feasibility study is a detailed system analysis based on the performance indicators of your facilities. From this analysis, potentials for energy optimization as well as possibilities to reduce energy losses can be derived. A detailed quantification of potential benefits is calculated; furthermore, synergies and side effects are indicated.</p> <p>We substantiate the economic feasibility of the identified measures, providing a decision basis for prioritization.</p> <p>Finally, we jointly develop an "Energy Master Plan" - an energy strategy recommendation - for the improvement steps, as well as an integrated energy management concept.</p>	<p>In this type of study detailed proposals for the selected customized energy efficiency measures are developed. The proposals comprise a detailed technical elaboration and a feasibility calculation for the investment, including technical specification, investment costs, and quantified energy savings. Interactions and side effects of the proposed solution in relation to the entire process along the production route are taken into account, providing the basis for subsequent project implementation.</p>



PRODUCE UNDER OPTIMAL CONDITIONS -
 WITH A PARTNER WHO HAS FULL CONTROL IN
 ALL AREAS

EFFICIENT PLANT TECHNOLOGY	CONVERT WASTE ENERGY INTO PROFIT	MODERNIZATION PACKAGES AND EQUIPMENT	ENERGY PROCESS AUTOMATION AND OPTIMIZATION
BENEFIT FROM TOMORROW'S TECHNOLOGY TODAY	CONVERT WASTE ENERGY INTO PROFIT	KEEP PACE WITH CHALLENGING MARKET DEMANDS	ENSURE HIGH PLANT PERFORMANCE AT LOW CONVERSION COSTS
<p>Efficient advanced key production units such as advanced blast furnaces and integrated solutions like Corex, Finex and Arvedi ESP or the EAF Quantum have a major impact on the energy efficiency of a plant. Feasibility studies consider cross-process aspects in order to quantify the impact of major improvement steps.</p> <p>Please ask for separate brochures to learn more about the capabilities of efficient new key equipment.</p>	<p>Energy recovery solutions are tapping energy potentials from heat, offgas and pressure from various vessels and process units. If possible, the energy is directly fed back into the process, which usually offers the highest efficiency.</p> <p>Depending on the boundary conditions, generation of steam or electricity is possible. Once implemented, these solutions sustainably convert waste energy into profit.</p>	<p>Replacing outdated technology with newest drives is a simple and highly efficient measure to improve energy consumption of any plant.</p> <p>An even stronger effect is achieved with the implementation of a modern blower concept because the energy demand for generating pressurized cold blast is very high. A blower house concept from Primetals Technologies means significant cost and energy savings as well as a reduction of operating and maintenance costs.</p>	<p>Process optimization solutions enable well-defined operation of steelmaking processes close to optimal conditions. They collect and validate data and compensate deviations from the optimum. The result is high-performance operation with low conversion costs.</p> <p>Given their high saving potential in relation to the investment costs, these solutions typically feature very short amortization periods. In addition to the optimization of specific plants, cross-process solutions like production planning and energy management systems support and coordinate the local optimization systems.</p>



BOOST THE PROFITABILITY OF YOUR PLANT - WITH CUSTOMIZED FINANCIAL SOLUTIONS

Primetals Technologies offers competitive financing solutions for developing energy efficiency projects - with individual financing arrangements meeting your particular requirements.

CHOOSE FROM A NUMBER OF SOLUTIONS

As part of our company's long-term partnership concept combining the most appropriate technical and financial solution for the customer's individual needs, Primetals Technologies offers a wide variety of financial concepts to accompany our technical solutions. In addition, we advise our customers on the relevant legal requirements pertaining to the chosen investment option on a case-by-case basis. All information provided is subject to local laws and regulations.

CHOOSE THE CONVENIENT USE-ORIENTED RENTAL OPTION TO REDUCE COSTS OF OWNERSHIP

With an operating lease, you only pay for the use and the depreciation of the energy-related investment and services, while Primetals Technologies bears the entire risk related to the residual value of the equipment at the end of the operating lease term.

YOUR BENEFITS

- Rentals are attractive
- Lower costs of ownership
- Tax advantage because lease is generally not included in the balance sheet

GAIN ADDITIONAL EARNINGS WITH ENERGY EFFICIENCY CONTRACTING

With our energy efficiency contract, our customers can gain additional earnings from the very beginning of operation. We identify energy saving potentials in your facilities that can be tapped by modernization and optimization. The required investment pays itself off thanks to energy and operating cost savings.

YOUR BENEFITS

- Increase in value
- Savings amortize the investment
- Earnings from the beginning of operation

'PAY AS YOU BENEFIT'

The monthly instalment is based on the cost savings achieved following the start-up of the respective product of Primetals Technologies.

YOUR BENEFITS

- Constant positive cash flow
- Payments structured your payments in line with the benefits of your investment
- Neutral balance sheet by classifying your payments as operating expenses

Competitive financing solutions to optimize your investment. Set up in collaboration with Primetals Technologies Financial Services, customized financing arrangements fully meet your requirements.

CUSTOMER BENEFITS



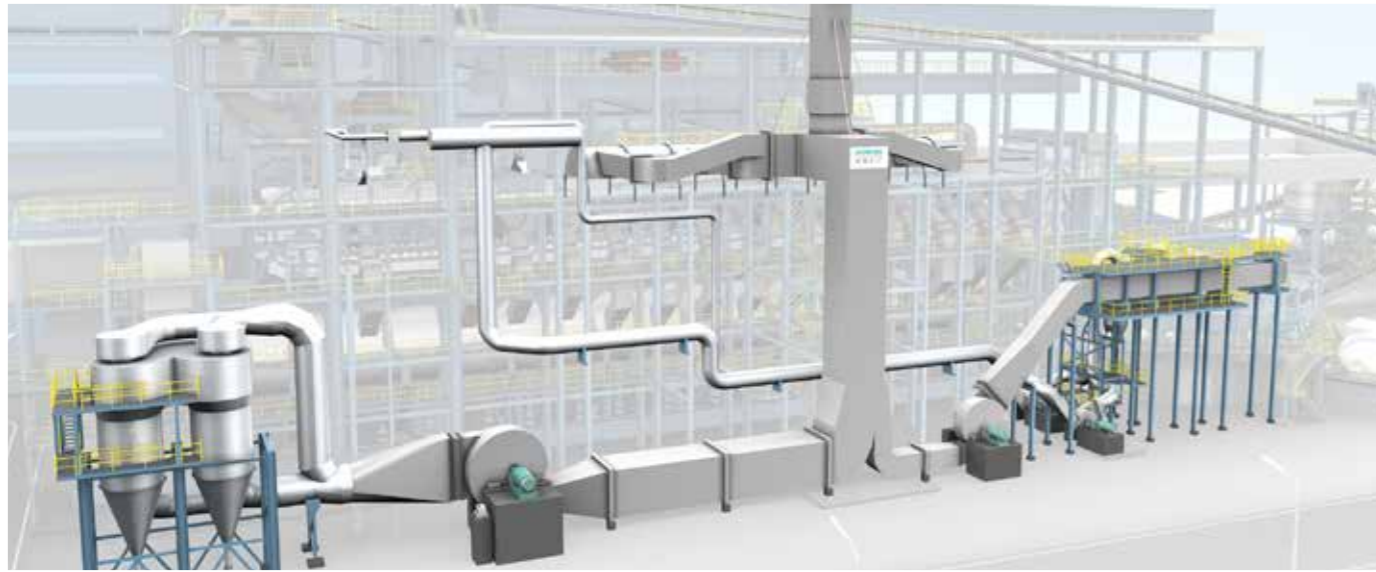
BENEFIT FROM PERFECT PERFORMANCE –
 WITH OUR KNOW-HOW ALONG THE PROCESS CHAIN

KNOW HOW



	SINTER PLANT	IRONMAKING
ELECTRICS & AUTOMATION PACKAGES	<ul style="list-style-type: none"> Sinter plant process optimization 	Process optimization for: <ul style="list-style-type: none"> Corex Finex Direct reduction plant Blast furnace and hot stoves
ENERGY RECOVERY	<ul style="list-style-type: none"> Waste heat recovery 	<ul style="list-style-type: none"> Stove heat exchanger Top gas recovery turbine TRT
MODERNIZATION PACKAGES/ EQUIPMENT	<ul style="list-style-type: none"> Selective waste gas recycling 	<ul style="list-style-type: none"> Efficient blowers Dry dedusting
PLANT TECHNOLOGIE		<ul style="list-style-type: none"> Corex Finex Direct reduction plant

CONVERTER STEELMAKING	ELECTRIC STEELMAKING	HOT ROLLING, COLD ROLLING, FINISHING/ PROCESSING LINES	ENERGY & AUXILIARY PLANTS
Process optimization for: <ul style="list-style-type: none"> LD(BOF) converter Ladle furnace 	<ul style="list-style-type: none"> EAF process optimization Holistic EAF optimization Electrode control system Foaming slag manager 	<ul style="list-style-type: none"> Green button technology Reheating furnace process optimization Balanced drive operation Mill pacing 	<ul style="list-style-type: none"> Energy management system
<ul style="list-style-type: none"> LD(BOF) waste heat recovery 	<ul style="list-style-type: none"> Energy recovery for EAF 	<ul style="list-style-type: none"> Reheating furnace waste heat recovery 	<ul style="list-style-type: none"> Natural gas pressure recovery turbine
<ul style="list-style-type: none"> Laser offgas analyzer LD(BOF) gas recovery Dry dedusting 	<ul style="list-style-type: none"> Contact-free temperature measurement Scrap preheating Direct hot charging 	<ul style="list-style-type: none"> Roll gap lubrication 	
<ul style="list-style-type: none"> Jet process 	<ul style="list-style-type: none"> Ultimate EAF Quantum Finger shaft furnace 	<ul style="list-style-type: none"> ISP/Arvedi ESP 	



Waste gas recirculation system



Schematic of waste heat recovery system for sinter cooler

ENERGY EFFICIENCY FOR SINTER MINIMIZING EMISSIONS TO UNATTAINED LEVELS

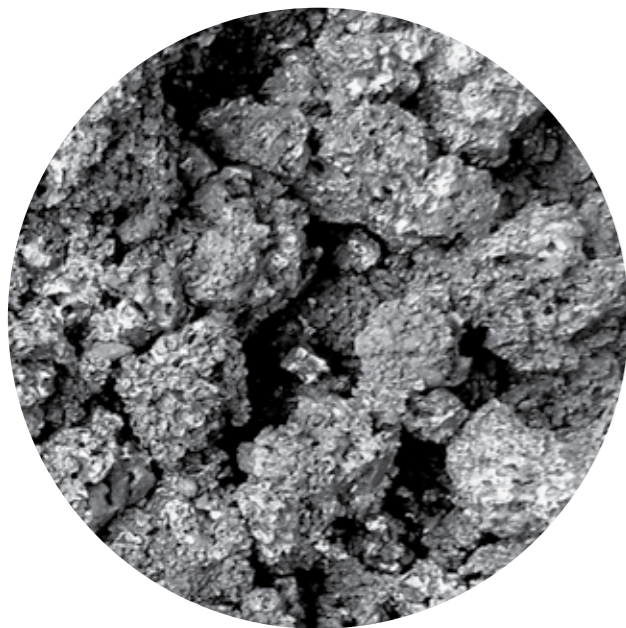
The sinter plant can no longer be seen as a separate or stand alone production unit, but it must be fully integrated with the blast furnace in order to generate the ideal burden for optimized production and cost efficiency. State-of-the-art sintering technology is therefore one of the key factors for energy efficient ironmaking.

DECREASING SOLID FUEL CONSUMPTION BY UP TO 10% - SELECTIVE WASTE GAS RECIRCULATION SYSTEM

The selective waste gas recirculation system enables emission reductions in sinter production to previously unattained levels. Thanks to the advanced technology, the offgas from selected zones of the sinter machine is mixed with cooler off-air and/or ambient air and re-circulated to the sinter machine. The result is a significant reduction of the specific offgas volume by up to 50%. Specific investment and operating costs for gas-cleaning facilities can therefore be kept at acceptable levels. The selective waste gas recirculation system from Primetals Technologies can be installed in existing or greenfield plants.

YOUR BENEFITS

- Waste gas volume by up to 50%
- Specific solid fuel consumption decreased by up to 10%
- Decreased investment and operational costs for waste-gas-cleaning plant
- Lower CO₂ emissions (reduction by up to 10%)
- Lower emissions freight of SO_x, NO_x, PCDD/PCDF and heavy metals
- Extended battery service life



RECOVERING THE ENERGY - WASTE HEAT RECOVERY SYSTEM FOR SINTER COOLER

Optimum integration of the energy-recovery system in the energy network of a steelworks is decisive to ensure maximum economic feasibility. A payback time of less than three years, depending, of course, on plant size and local energy costs, is realistic. Considering the local conditions, the following process variants of the Sinter Cooler Waste Heat Recovery System can be designed and provided:

- Feed-in to the on-site steam network for various process applications
- Generation of additional electrical energy in an existing power plant
- On-site generation of electrical energy in an autonomous power block at the sinter plant
- Utilization of produced steam or hot water for district-heating
- Supply of steam to external consumers

YOUR BENEFITS

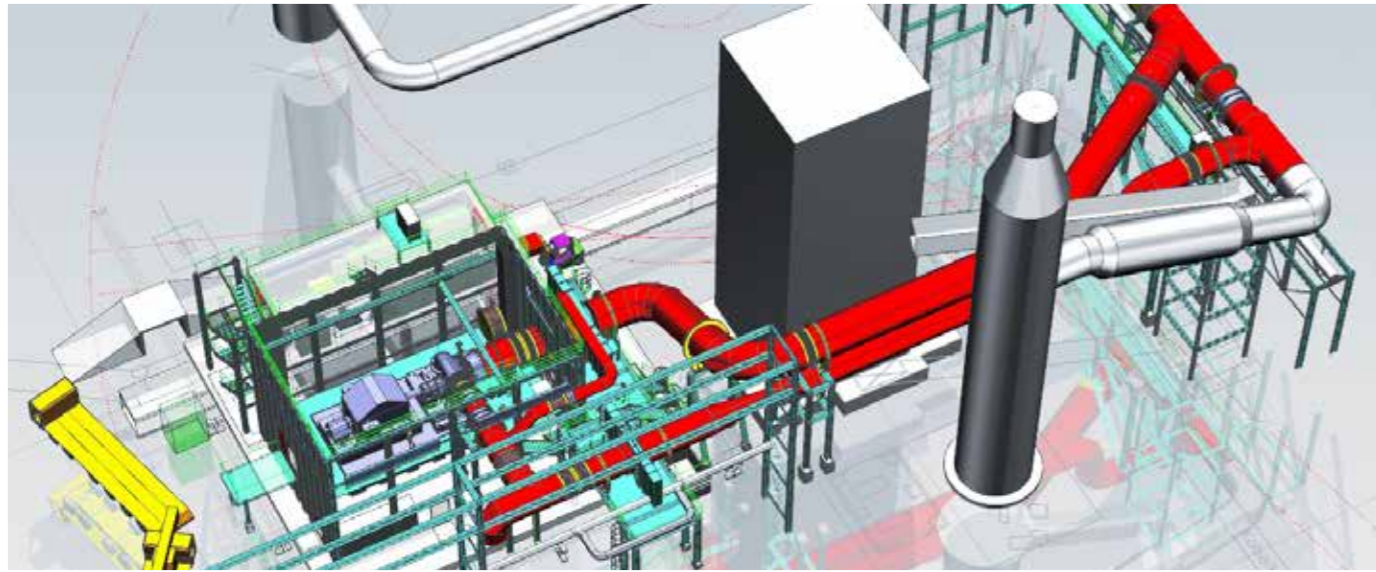
- Production of steam (50-80 kWh/t sinter) or electrical energy (15-25 kWhel/t sinter)
- Lower dust emissions
- Reduction of fuel consumption
- Reduction of CO₂ emissions
- Typical payback time below 3 years - depending on plant size and local energy costs

HIGHEST PRODUCTION QUALITY AND COST-OPTIMIZED OPERATION - SINTER OPTIMIZATION

This system enables major cost savings and process improvements without compromising raw material selection, sinter quality, energy efficiency, and productivity. Optimized raw mix calculation allows the production of sinter material of the highest quality, while at the same time effectively reducing fuel consumption. Furthermore, the system provides a complete history of process parameters including recipe, chemical and physical raw material properties, and process measurements for a comprehensive analysis of the sinter process. The result is smooth sintering operation around the clock, an increased equipment lifetime and reduced production costs.

YOUR BENEFITS

- Monitoring of process measurements and indices becomes more efficient
- Process control practices become more uniform by using fully closed-loop operation on the basis of all provided expert system rules
- Higher productivity (increase by up to 5%)
- Stabilization of product quality (decrease of standard deviation by 5-10%)
- Reduced fuel consumption (decrease by up to 3%)



TRT plant for blast furnace



BF Optimization - blast furnace control room

CONVERTING ENERGY INTO PROFIT ENERGY EFFICIENCY FOR BLAST FURNACES

In an integrated iron and steel making plant, the blast furnace and its auxiliary plants offer an important lever for pushing overall energy efficiency figures. The blast furnace process consumes upwards of 75% of the total energy in an integrated steel plant. While modifications of central design parameters usually require major investments, attractive upgrades and improvement packages can be found for many existing plants.

GAIN ADDITIONAL ENERGY INPUT FROM WASTE PRESSURE - BLAST FURNACE TOP GAS RECOVERY TURBINES (TRT)

The TRT recovers the pressure energy of the top gas of a blast furnace by controlled expansion to low clean gas pressure: Electrical energy from waste pressure without any additional energy input or CO₂ production can be gained.

YOUR BENEFITS

- Electrical energy from blast furnace top pressure (- 30-40 kWh/tHM)
- Quick-acting valves for changes in operation
- Precise blast furnace top pressure control even in case of unexpected TRT stoppage
- Less purchasing of electrical energy for the site or even exporting energy to a local grid
- Appropriate bypass system for ensuring continuous blast furnace operation



ENSURING SAFE AND COST-EFFICIENT OPERATION - BF OPTIMIZATION

The BF Optimization system was developed to operate the blast furnace in a standardized way at stable operating conditions. A closed-loop expert system corrects even small deviations by automatically executing the required counteractions. This leads to cost-efficient operation and energy-efficient production of hot metal (HM).

Stable process conditions are indicated by reduced standard deviation of quality parameters such as hot metal temperature or silicon content and result in reduced fuel consumption of the blast furnace. Core modules are product quality and energy efficiency rules, the procedures for shutdown and start-up, the 3D hearth monitoring package and the burden distribution model. At the same time, data management and analysis tools provide process engineers with a sound information basis for further process optimization.

YOUR BENEFITS

- Reduction of fuel consumption by 5 kg/t HM
- Increased productivity (up to 3%) HM
- Reduced standard deviation of HM temperature and Si content (by 10%)
- Stabilization of operation by avoiding critical situations

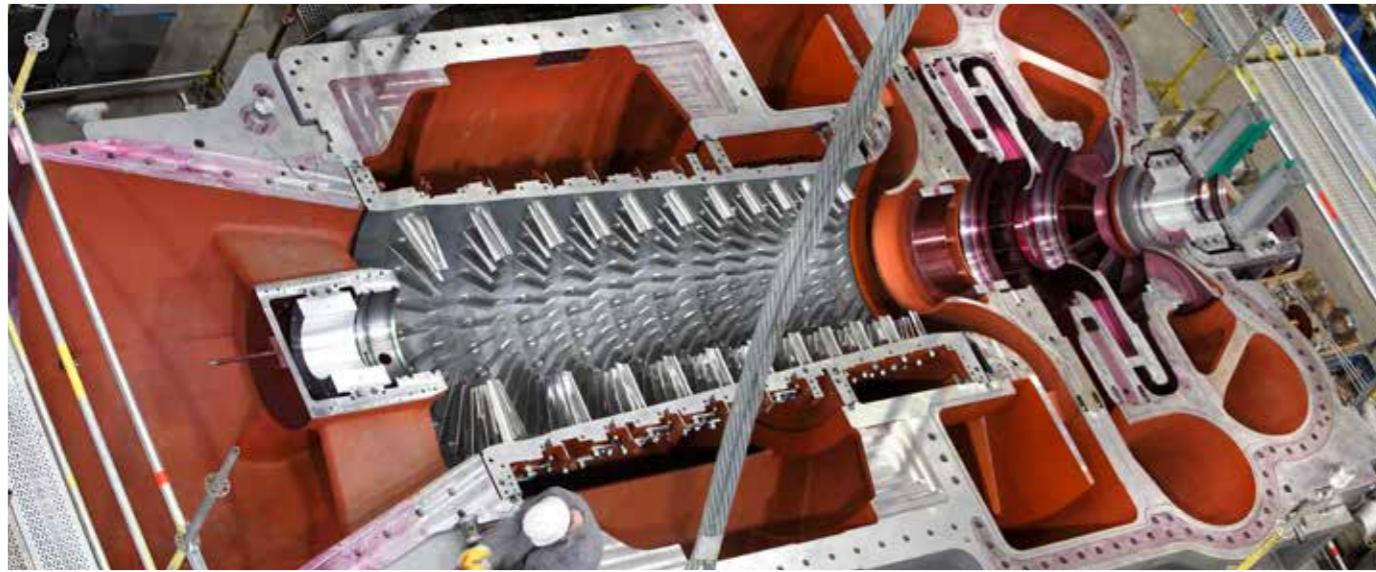
USING INTELLIGENT ASSISTANCE TO OPTIMIZE HEATING - HOT STOVES OPTIMIZATION SYSTEM

The hot stoves optimization system heats up the stoves in a standardized and optimized way, securing reliable supply of the blast furnace (BF) with blast with the suitable temperature and in the required quantity over the desired wind time. This proven solution uses self-learning capabilities for the optimized heating strategy according to the current energy load of the stove system and fully automatic and permanent waste O₂ and dome temperature control.

The hot stoves optimization solution was developed to fit 2, 3 or 4 hot stoves covering all conventional operational modes (serial, staggered parallel, 50/50 parallel). Its flexible design also supports all possible preheating solutions.

YOUR BENEFITS

- Increased blast temperature (up to 10°C)
- Decreased rich gas portion - reduction of energy costs by up to 3% less CO₂ emissions resulting from reduction of heating gas quantity
- Reduced BF fuel rate due to higher blast temperature



Commissioning of a blast furnace blower



Blast furnace stove heat recovery

ENERGY EFFICIENCY FOR BLAST FURNACES RUN YOUR PLANT UNDER OPTIMUM CONDITIONS

ACHIEVING ENERGY SAVINGS OF UP TO 50% - BLOWER HOUSE FOR BLAST FURNACE

Primetals Technologies is able to provide both electrical and steam-driven blowers. Our integrated approach takes into account the interaction between the blower house, the energy system and the power plant. For large blast furnaces requiring high volume flows, high end temperatures and pressures of up to 5.0 bar g, the axial blower is the perfect match.

Today, this product line allows for volume flow rates up to 1,400,000 Nm³/h. Control is achieved by either speed variation or adjustable guide vanes, or a combination of both. The design principle is a modular concept with a reliability proven over many years of operation.

YOUR BENEFITS

- Up to 50% savings in primary energy consumption with a corresponding reduction of CO₂ emissions
- Proven package for new plants and modernizations
- Low operating and maintenance costs
- Service lifecycle partnership with remote monitoring and 24-hour diagnostics/support capabilities
- Increased compressor life-time due to corrosion resistant material
- Highly efficient cooling system

MERIM - DRY BLAST FURNACE TOP GAS CLEANING: UP TO 30% MORE ELECTRICAL POWER FROM TRT

In the first step of the MERIM process, optimized coarse dust separation takes place in a cyclone. Due to the design of the cyclone, the recyclable fraction is enriched and the zinc-containing fraction landfilling is minimized.

The heart of the process is a set of pulse jet pressure filters, where fine dust removal takes place. In this step, the gas enters several pressure-resistant filter vessels, where the dust is collected on high-performance filter media. The removed dust is then discharged through the bottom of the filter and transported via a pneumatic conveying system to a collecting silo.

Waste water treatment is completely avoided, operating costs and space requirements are reduced and clean gas concentrations of currently unachieved levels can be reached. The patented temperature control unit for top gas control consists of a burden burner and a burden spray system and ensures a specific temperature range (usually 80-250°C) in order to prevent damages to the fabric filter and the gas ducts.

YOUR BENEFITS

A top gas recovery turbine (TRT) can generate 20 to 30% more electrical energy recovery compared to conventional wet dedusting systems due to higher process temperatures and lower pressure losses.

SAVING UP TO 10% OF FUEL GAS - HOT BLAST STOVE HEAT RECOVERY

Fuel gas demand can be reduced by a heat exchanger shifting the sensible heat from the waste gas in the stack to the combustion air and/or the fuel gas. Thus, combustion gas and air can be pre-heated to typically 150 to 180°C, with even higher values being attainable through the correct application of the available systems.

YOUR BENEFITS

- Up to 10% fuel gas savings
- Reduction of high-cost enrichment gases typically, by more than 50%
- Reduced CO, CO₂, SO_x emissions

SAVING UP TO 100% OF ENRICHMENT GAS - STOVE OXYGEN ENRICHMENT

Rich gas consumption can be significantly reduced by installing a stove oxygen enrichment system: Combustion air with 22-30% oxygen content increases the flame temperature without any enrichment gas. Flow and temperature of the flue gas as well as stove cycle times are controlled by this cost-efficient equipment.

YOUR BENEFITS

- Up to 100% enrichment gas savings
- Reduced hot metal costs by up to 2-3 \$/t of hot metal
- Significant hot blast temperature increase (up to 30-500°C) for plugged and damaged stoves

MINIMIZING COSTS FOR RAW MATERIALS - PULVERIZED COAL INJECTION

Equipping a blast furnace with tuyere level coal injection provides significant savings in raw material costs by replacing expensive metallurgical coke with less costly pulverized coal. Coal injection can also enhance productivity by suppressing the flame temperature within the raceway, thus allowing higher levels of oxygen enrichment.

YOUR BENEFITS

- Injection rates of 220 to 230 kg/tHM can be achieved on a regular basis
- 50 kg PCI/tHM leads to a productivity increase of approximately 10%
- Injecting of 130 kg/tHM saves 6.5 \$/tHM based on a coal-to-coke price differential of 50 \$/t



Converter pulpit at Taiyuan ISCO, China



LD(BOF) gas recovery system

ENERGY EFFICIENCY FOR LD(BOF) LESS ENERGY INPUT THAN EVER CONDITIONS

From the energy efficiency point of view, the most far-reaching measure in an oxygen steel plant consists in converter gas utilization.

Furthermore, process optimization in combination with sensor technology can generate very attractive savings due to stable process conditions, reduced oxygen demand and increased yield (by avoiding overblowing).

Two integrated solutions for saving energy and optimizing processes from Primetals Technologies will give you an impression of state-of-the-art technology.

SUBSTITUTING FOSSIL FUELS AND REDUCING EMISSIONS - WASTE GAS RECOVERY SYSTEM FOR DRY DEDUSTING SYSTEMS

LD(BOF) gas recovery integrates economic and ecologic aspects for LD(BOF) primary waste gas treatment. It reduces energy costs, brings a higher degree of efficiency and ensures a short pay-back time.

This technology allows for the substitution of fossil fuels, as well as for a significant reduction of energy costs and overall CO₂ emissions. The gas recovery system ensures high safety standards and a high degree of reliability which is owed to a special hydraulic unit in combination with advanced automation solutions provided by Primetals Technologies.

YOUR BENEFITS

- CO-gas recovery in the amount of 70-90 Nm³ CO/t of steel
- High plant availability
- High dedusting efficiency - clean gas dust content <20 mg/Nm³
- Low pressure loss thanks to advanced design, low specific consumption figures (3 kWh/t)
- Dry dust separation, no waste water treatment plant required
- Integrated safety functions meeting highest international safety standards



LD(BOF) PROCESS OPTIMIZATION

With LD(BOF) Optimization and Dynacon, Primetals Technologies offers two well-proven automation solutions for high product quality at low production costs. Depending on the available measuring devices, one or the other system can be applied: Whereas Dynacon uses continuous offgas measurement data for dynamic control and automatic stop of oxygen blowing, conventional LD(BOF) Optimization improves temperature and carbon hitting rates based on substance measurement.

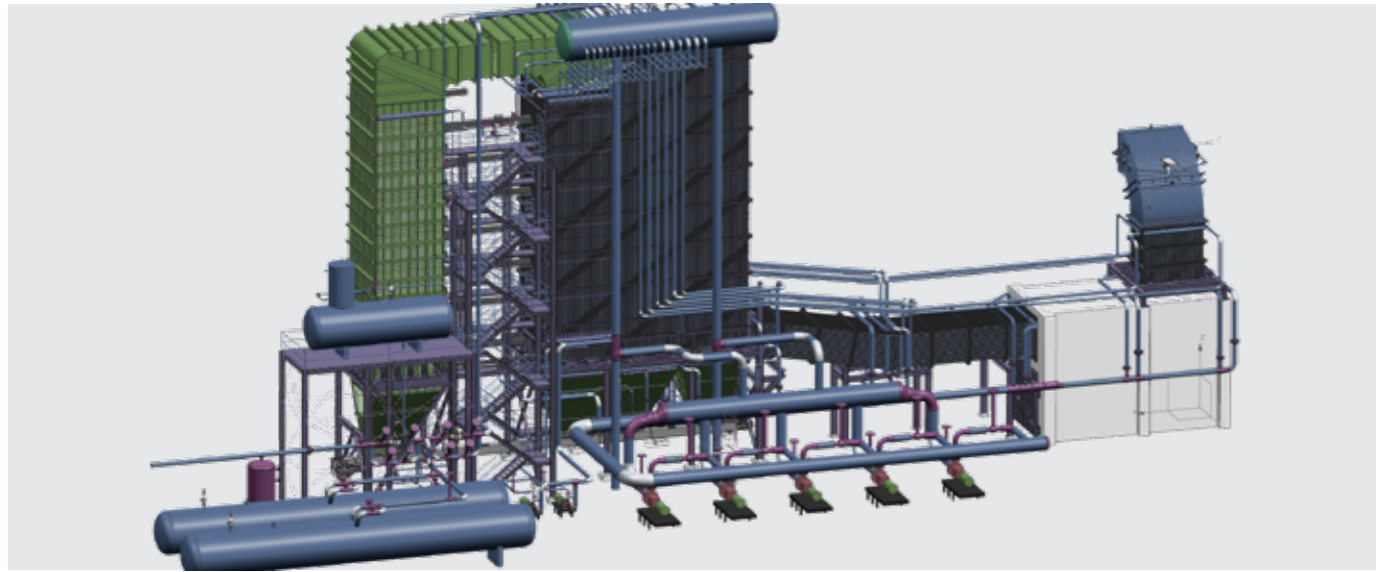
Both systems include advanced models in order to prepare, supervise, and dynamically optimize the converter process. Exact pre-calculation of required materials, comprehensive considering of all actual process parameters as well as dynamic control of oxygen blowing enable thermal and metallurgical control of converter steelmaking. Overheating of the steel bath can be eliminated and reblows are significantly reduced.

YOUR BENEFITS

- Increased productivity and yield
- Improved hitting rate for steel temperature and carbon content
- Reduced CO₂ emissions due to lower reblow rate and avoidance of overblowing
- Energy savings of up to 3%
- Lower consumption of raw materials and resources



Gas holder



Energy recovery for EAF

ENERGY RECOVERY FOR EAF GENERATING ENERGY WITHOUT ADDITIONAL COSTS

The electric arc furnace is a highly efficient recycler of steel scrap offering a large reduction in specific energy demand compared with integrated plants.

Modern EAF technology integrates optimization solutions for the entire steel production process. Additionally, it supports efficient utilization of electrical energy and other process additives. Latest process techniques, analyzing technologies and methods and automation solutions minimize the input of raw materials.

The energy efficiency of an EAF can be further improved by utilizing waste energy, for example by preheating the scrap as in a shaft furnace or by utilizing waste heat for generating steam and electrical power.

High energy performance is supported - including attractive amortization times - by improved electrode control, foaming slag practice and overall process management, as well as through reduced flicker and harmonic distortion designed to maintain the quality of the electrical power.

All these features limit the impact electrical steel plants have on the environment.

TURN HOT GASES INTO ELECTRICAL POWER - ENERGY RECOVERY FOR EAF

In the electric steelmaking process, the major part of unused energy is contained in the EAF exhaust gas.

About 1/3 of the total energy input of the furnace is lost through the offgas in the form of chemical energy and sensible heat. Due to high temperatures, high dust loads and batch operation energy recovery from EAF offgas is technically challenging. Energy can be recovered from the offgas by scrap preheating as in the finger shaft furnace or by generating steam for different applications (e.g. vacuum degassing).

As an alternative, we have developed a high-efficiency offgas waste heat recovery system, which can produce steam as the basis for 30-55 kWh/tls of "green" electrical energy. Energy peaks are smoothed with a heat storage concept.

The system is designed to be suitable for new plants as well as for refurbishment and improvement projects.

YOUR BENEFITS

- Generation of 30-55 kWh of electrical energy per ton of liquid steel



Reduced operational costs by contact-free measurement

CONTACT-FREE TEMPERATURE MEASUREMENT - ONE STEP CLOSER TO FULLY AUTOMATIC EAF STEELMAKING

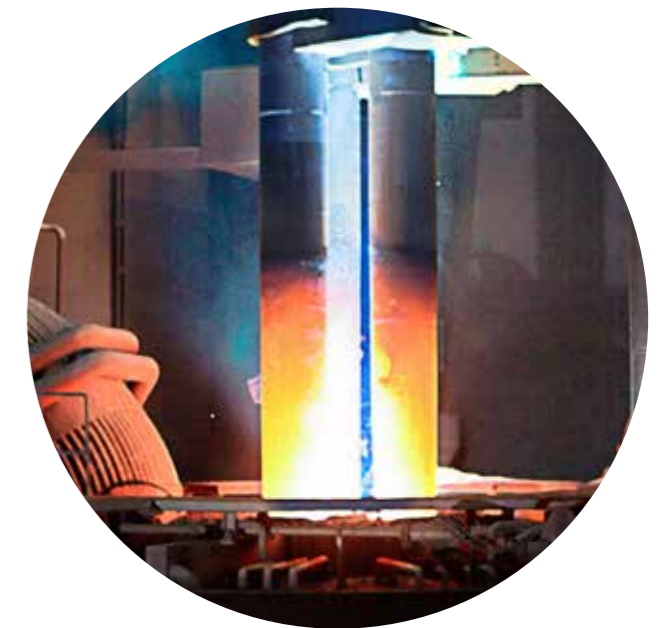
Contact-free temperature measurement for electrical steelmaking plants allows for the steel temperature to be measured using our supersonic injection technology. The advantages of this reliable and accurate measurement technology are increased productivity through shortening power-on and power-off time, reduced additional operating costs through eliminating expensive cartridges and improved operator safety through automating difficult and dangerous physical work.

RCB Temp uses a supersonic oxygen injection technology combined with analyzing and control units for contact-free temperature measurement. The units allow the temperature of liquid steel to be measured inside the furnace with doors closed, and offer major advantages over existing technologies. The results are far more accurate, with fewer unstable measurements, and allow monitoring of the steel temperature until the target tapping temperature is reached.

RCB Temp brings you one step closer to fully automatic steelmaking under safe and reliable operating conditions.

YOUR BENEFITS

- In terms of savings of electrical energy and cartridges, the cost-saving potential is approximately 1 €/t of liquid steel
- Safety improvements - the contact-free temperature measurement technology eliminates risks for operators during temperature measurement, as the slag door is closed
- Reduced tap-to-tap time, increased productivity - the right time for tapping can be determined more precisely
- Faster availability of temperature measurement results
- Attractive pay-back time due to low installation costs
- Can be installed during regular maintenance





Overview of EAF automation packages



Control pulpit for EAF steelmaking



Operation data processing

ENERGY EFFICIENCY FOR EAF USE LESS RESOURCES THAN EVER BEFORE

INCREASING MELTING POWER EFFICIENCY WITH MELT EXPERT - THE NEXT GENERATION OF ELECTRODE CONTROL SYSTEM

Melt Expert is the result of the fusion and consequent enhancement of its well-known predecessors Arcos and Simelt. Innovative functionality is opening new potentials for saving energy- and electrode consumption.

Auto adaptive correction of set-points as well as regulation behavior are important procedures to optimize the melting performance. Enhanced new algorithms assist to increase arc stability even during critical melting situations. A novel model for loop gain linearization is simplifying the parameter tuning process and thus shortening commissioning times.

Besides the core regulation functions, a main focus is set on improved reporting functionality and KPI indication. Most important process data is shown on individual screens and gives quick overview about actual system performance. The Melt Expert system includes on-board diagnostics of furnace equipment.

Mechanical, electrical and hydraulic parts related to the electrode control system are continuously monitored. Malfunctions and failures in these systems are detected in a very early stage which is an important tool for predictive maintenance and reduction of power off and down times.

YOUR BENEFITS

- Reduced energy consumption and increased melting efficiency due to auto-adaptive regulation algorithms
- Higher productivity ensured by automatic melting profiles and process parameter adaptation
- Highest reliability due to main focus on robustness and operational safety in an industrial environment
- Ensured process quality due to integrated process visualization, data recording and extensive evaluation modules
- Amortization within less than six months

SIGNIFICANT REDUCTION OF CARBON CONSUMPTION WITH ENHANCED FOAMING SLAG MANAGEMENT SOLUTIONS

Foaming Slag Management systems are advanced add-ons to the electrode control system and are enabling a fully automated foaming slag process. A sophisticated algorithm is controlling and optimizing the carbon injection based on the actual slag height inside the furnace.

The actual slag height can be determined either by means of structure borne sound analyses (Sonarc FSM) or by an optical camera targeted towards the slag door (OFSM). As a third option the classical evaluation of current harmonics is also available. With these three options we can provide high quality foaming slag management for any customer needs

YOUR BENEFITS

- Controlled and optimized foaming slag process
- Reduced specific electric energy and carbon consumption
- Shorter power-on times and increased productivity
- Reduced CO₂ emissions due to lower carbon and energy consumption
- Real improvement of foaming slag practice in electric arc furnaces

MAXIMIZING PROCESS EFFICIENCY - EAF PROCESS OPTIMIZATION

EAF Optimization is a completely integrated solution lowering production costs and energy consumption while maintaining quality standards. The solution is suitable for a wide range of steel grades, including carbon steels, stainless steels and special steels, and accommodates variable charging ratios of scrap, direct reduced iron and hot metal.

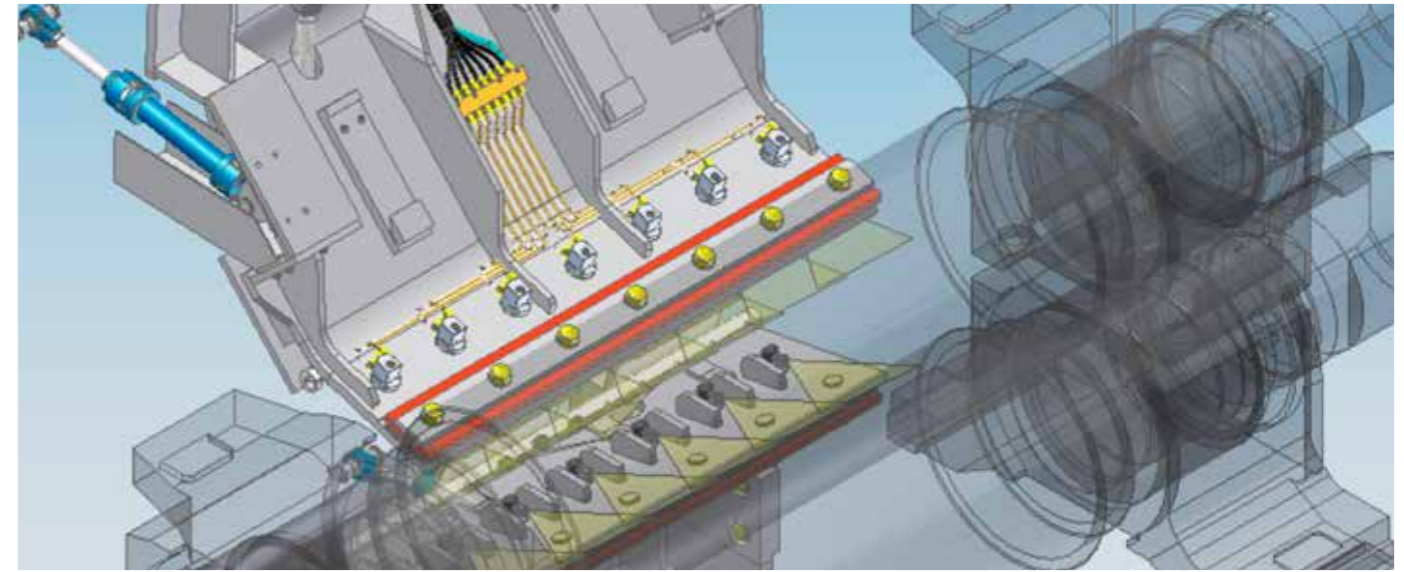
The holistic process optimization EAF Heatopt further takes into account offgas characteristics (analysis, flow) to dynamically control the oxygen and gas burners, carbon injectors as well as post-combustion burners in closed-loop operation.

YOUR BENEFITS

- Low production costs and high quality thanks to a well-proven automation system
- Lower consumption of raw materials and resources, reduced CO₂ emissions due to efficient carbon usage
- Reduced electrical energy consumption by up to 3% due to thermal supervision and optimization of the melting process
- Reduced tap-to-tap time due to standardized production practice
- Highest flexibility with respect to charge materials



Primetals Technologies Furnace Optimization



Lubrication equipment at the entry side of a finishing mill stand in a hot-strip mill

ENERGY EFFICIENCY FOR ROLLING ACHIEVING UP TO 20% INCREASE IN EFFICIENCY

The energy consumption of rolling mills and processing lines contributes to about 15% of the total energy consumption per ton of steel.

An important lever is optimized operation of reheating furnaces. Direct hot charging, optimized furnace control and heat recovery concepts lead to improved energy figures.

Efficient drives, demand-driven utilization of auxiliary drives and pumps, technological packages such as roll gap lubrication and, last but not least, state-of-the-art automation solutions are key technologies for energy-efficient operation – leading to direct reduction of the conversion costs.

MINIMIZING FUEL CONSUMPTION BY UP TO 15% - FURNACE OPTIMIZATION

Primetals Technologies Furnace Optimization is a complete hardware and software solution that provides the latest technology in supervisory control of reheating furnaces.

The system calculates optimal zone temperature setpoints and furnace production rates, taking into account varying target temperatures, planned and unplanned delays in rolling production, minimizing fuel consumption during idle times, and optimizing the ramp-up of setpoints in anticipation of further production.

YOUR BENEFITS

- Fuel consumption reduced by up to 15%
- Consideration of temperature feedback from mill
- Temperature deviations within discharged material < 1% from target
- Improved yield and surface quality because of reduced scale formation and decarburization
- Higher productivity through improved furnace pacing and optimized interface to mill pacing
- Improved quality due to reduced skid marks

REDUCING ROLLING FORCES, SAVING ENERGY AND IMPROVING QUALITY - WORK ROLL LUBRICATION

As a general trend, the potential for reducing roll forces and energy consumption increases as the final thickness of rolled products decreases and the material strength increases. Lubrication of the roll gap is designed to reduce friction between work rolls and the rolled material in hot-rolling mills as well as in cold mills. For each process, HM Work Roll Lubrication and Direct Application ensure the best achievable concentration of lubricant in the roll gap for hot and cold strip rolling, endless or batch processing and plate rolling of steel products.

All these work roll lubrication packages are well-proven and highly efficient package solutions for new and existing mills.

YOUR BENEFITS

- Reduction of the rolling torque leads to a decrease in specific energy consumption – for HM Work Roll Lubrication this figure can be up to 17%
- Very low oil and water consumption
- Improved strip surface quality as lubrication minimizes scale build-up and peeling of the work-roll surface
- Reduced work roll wear extends rolling campaigns between roll changes, thus increasing mill uptime
- Reduction of roll forces leads to better utilization of existing equipment and extension of the product mix

MINIMIZING ENERGY CONSUMPTION AND EMISSIONS - DRIVE SOLUTIONS

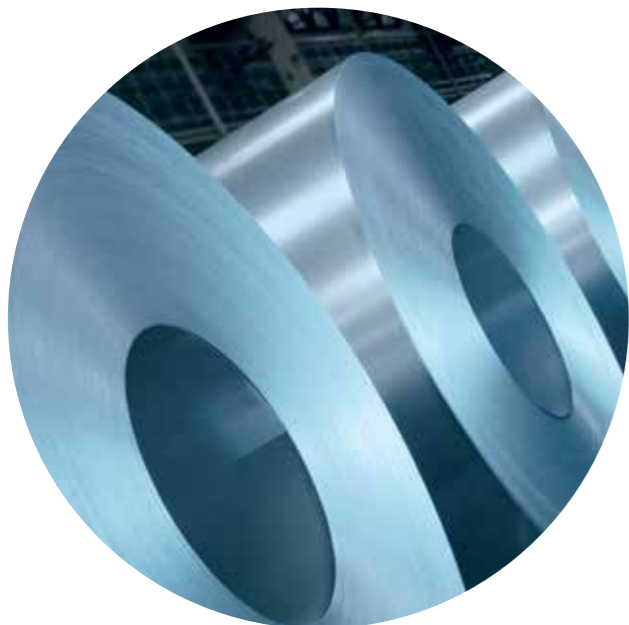
Drive solutions in modern rolling mills must maximize availability while minimizing energy consumption and emissions. Our innovative drive packages combine process technology with reliable, energy-efficient motor and drive solutions. Primetals Technologies also offers a wide range of migration packages for older systems.

IMPROVING AVAILABILITY AND ENERGY EFFICIENCY - CYCLOCONVERTER UPGRADES FOR LONG-TERM SPARES AVAILABILITY

Older cycloconverter drives will eventually become more and more prone to malfunction and no longer meet today's requirements for controller speed and precision or for quality-management process support. Primetals Technologies now offers Sinamics SL150 as an upgrade to older units for improved delivery performance and availability benefits, providing improved efficiency compared to older models.

YOUR BENEFITS

- Improved availability
- High energy efficiency
- Reduced maintenance
- High reliability
- Extended spare parts availability





Coil box in open position

ENERGY EFFICIENCY FOR HOT ROLLING HOLDING THE HEAT UP TO THE VERY END

ACHIEVING OPTIMUM CONTROL OF STRIP TEMPERATURE - ENCO PANELS

The passive Encopanel heat conservation system enables more accurate control of strip temperature, resulting in cost savings due to improved yield and energy savings.

By automatic selective raising or lowering of the heat retention panels more accurate control of the strip temperature is achieved. This solution also allows the strip-edge temperatures to be maintained at a higher level for rolling in the finishing mill, thereby avoiding edge cracking. As a special feature, bottom scale clearing panels will be mounted on specially designed carry-over bars which ensure that scale is discharged from the system to have a high-quality strip.

YOUR BENEFITS

- Reduced center-to-surface temperature gradients
- Reduced dropout temperature and emissions at reheating furnace - reduction of furnace gas consumption up to 14%
- Higher mill throughput due to higher transfer bar temperature
- Increased yield due to capability of rolling longer slabs
- Ideal for extending the product mix by introducing difficult-to-roll products such as high-nickel alloys and highly alloyed steels

SAVING ENERGY BY MINIMIZING TEMPERATURE LOSSES - COIL BOX

As an alternative to Encopanel, a coil box can be installed between roughing and finishing mill.

The coil box was developed to improve strip quality and to save energy through optimized power utilization. The related reduction of drive energy and rolling forces achieves substantial energy savings.

With a coil box the strip will be coiled after the last roughing mill pass, then moved to the uncoiling station and uncoiled for rolling in the finishing mill with the required speed. Thus, thinner and longer roughed strips can be created.

YOUR BENEFITS

- Thermal losses are reduced; therefore less reheating energy is required
- Up to 30% reduction of drive energy due to significant reduction of temperature related speed-ups
- Temperature differences are equalized - this leads to better thickness performance and surface quality
- Improved temperature lowers the required rolling forces and torques (up to 25% lower for stainless steel)



Coordinated plant shut down enables energy savings

HIGH PREMIUM HOT-ROLLED COILS AT LOWER INVESTMENT AND OPERATING COSTS - ARVEDI ESP

In the Arvedi ESP (Endless Strip Production) process hot-rolled coils are produced in a linked casting and rolling plant directly from liquid steel in a continuous and uninterrupted manufacturing process. A thin slab caster is connected to a high-reduction mill positioned directly after the caster. After reheating in an induction heater, rolling of the transfer bar is performed in a finishing mill followed by laminar strip cooling, cutting and coiling.

Arvedi ESP is the first plant worldwide which allows real endless rolling directly from liquid steel to hot-rolled coil, avoiding energy loss for the reheating of the slabs. Due to the endless process threading of the transfer bars into the rolling mill is avoided, allowing production of ultrathin gauges at a quality level that can even partially substitute cold rolling.

YOUR BENEFITS

- World's best energy balance for producing hot-rolled coil from liquid steel. Audited energy measurements show only 131.6 kWh/t for 1500 mm wide and 2 mm thick low carbon steel
- Lower direct and indirect emissions of greenhouse and noxious gases, amounting to a 39% reduction of CO₂ and a 88% reduction of NO_x
- The length of an Arvedi ESP line (180 m) is half the length of other concepts.

USING THE INTELLIGENT ENERGY SAVING SYSTEM - GREEN BUTTON

Priemtal's Technologies Green Button creates the base for centrally shutting down individual loads or even entire production units during downtimes and in a coordinated manner - flexibly, on short notice, and regardless of the manufacturer or device. This results in a significant advantage: Optimizing switching-off procedures saves energy even during short production breaks.

YOUR BENEFITS

- Less energy consumption results in a reduction of CO₂ and other emissions
- Noise reduction
- Increased equipment lifetime
- Low investment cost for a fast ROI
- Reduced production cost



Control room

ENERGY EFFICIENCY THROUGH AUTOMATION BRINGING ENERGY UNDER INTELLIGENT CONTROL

Primetals Technologies offers a wide spectrum of electric and automation packages for steel works. Electrics, drives, basic automation, process control, technological packages, process optimization, expert systems as well as plant-spanning solutions are the basis for stable and energy-efficient production. Important effects are a reduction of specific energy consumption and production-related costs, as well as improved product quality due to highest system availability.

Plant-wide energy management solutions drastically reduce overall energy consumption, costs and environmental emissions within a steel works.

Optimized consumption of energy and raw materials, the application of advanced technological processes and maximum application of recovery/recycling solutions lead to major energy savings, reduced CO2 emissions, increased environmental compatibility and higher profits. Even at highly efficient plants, there is still a potential to achieve significant improvements.

Cross-process optimization measures and enhanced integration and coordination of technological processes and plants can play a key role in tapping additional energy and cost saving potentials.

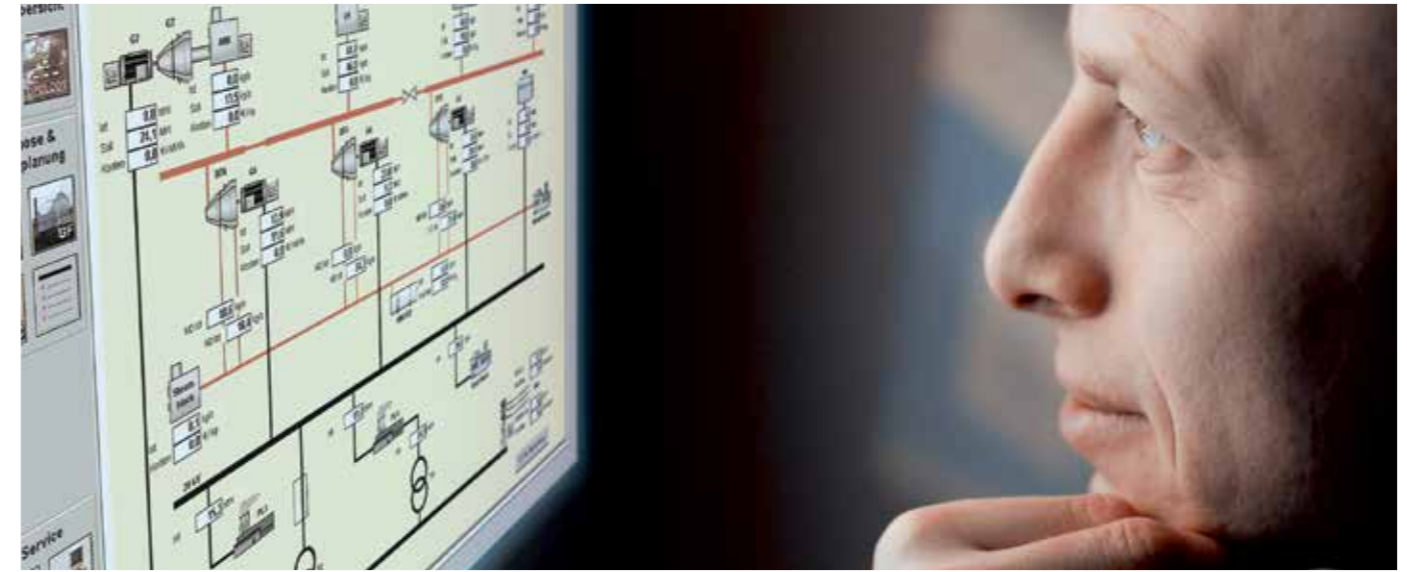
BOOST YOUR PLANT PERFORMANCE WITH MODERNIZATION PACKAGES

Primetals Technologies offers a wide range of automation modernization packages that can be implemented individually, for example in a modernization project to increase plant performance including energy saving functions, or as a package for a completely new facility.

Building on automation, plant and process engineering background, we have developed a range of migration packages and upgrade solutions. Designed to improve system performance and maintain asset value with limited investments, these solutions are structured for rapid installation with minimum downtime.

YOUR BENEFITS

- Proven optimization solutions help reduce emissions and energy costs
- Plant-wide energy management with analysis and optimization modules
- Both integrated and stand-alone solutions for all automation levels
- In-depth technological process modelling know-how
- In-house experience in software and hardware engineering for fastest project implementation and start-up



Energy management at a glance

ENERGY MANAGEMENT SYSTEM ENSURING MAXIMUM TRANSPARENCY

PREDICTING AND OPTIMIZING YOUR INDIVIDUAL ENERGY DEMANDS - ENERGY MANAGEMENT SYSTEM

The system is a modular, configurable and extendable solution. It supports improvement of energy efficiency with a clear focus on cutting energy-related costs. Flexible combination of energy management modules at different automation levels meet individual customer requirements, from small local solutions to large and complex energy networks.

Energy Management System creates transparency by allocating energy figures to individual consumers, single process steps, cost centers or product units. It supports optimal utilization of energy in the network, predicting and optimizing energy demands of various consumers and coordinating energy producers and consumers. In this way, load peaks and by-product gas flaring are minimized while high tariff rates are avoided.

The modular system covers the entire energy network covering all energy media (electricity, fuel, steam, process water and gases), energy suppliers, energy storage facilities, consumers and supply contracts, etc. as well as the respective production facilities. It offers a configurable modern graphical user interface; reports and documents can be made available enterprise-wide.

Energy Management System ensures energy transparency, energy forecasting, planning & optimization, supervision & control, monitoring & reporting.

YOUR BENEFITS

- Significant energy cost savings due to maximum transparency of energy demand, energy costs and consumption
- Reliable cost control through automated, KPI-based reporting
- Optimized load profiles due to planning and peak-shaving functions
- Prediction of energy demand based on empirical and first principle simulation models
- EN 16001- (ISO 50001-) compliant reporting and documentation



Typical pump arrangement

REDUCING LIFECYCLE COSTS BY UP TO 18% EFFICIENT DRIVES

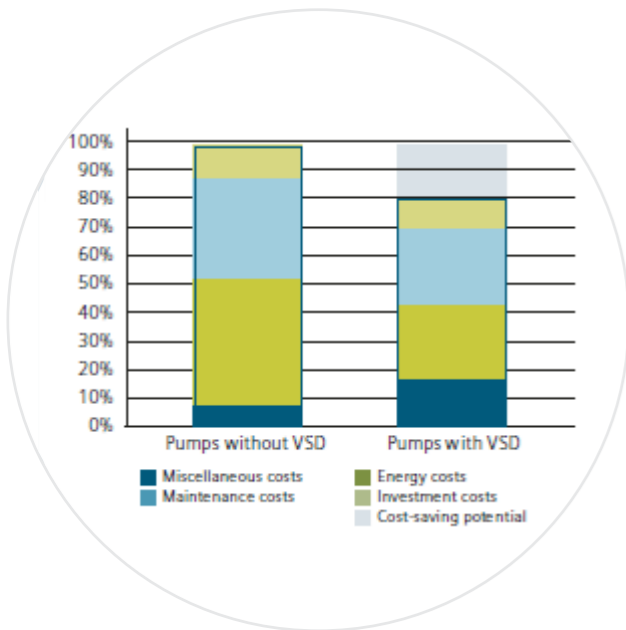
REDUCING ENERGY CONSUMPTION BY UP TO 50%

Variable speed drives (VSD) are a simple solution for improving the energy efficiency of auxiliary units such as fans and pump stations in metallurgical plants and rolling mills.

The installation of variable speed drives in pump stations can reduce a pump's lifecycle costs by up to 18%. Not only are energy costs reduced: Additional advantages can be obtained as a result of the "soft-starter effect", including the avoidance of water hammers, reduced stress on pipe systems, and the possibility to operate high-voltage motors on low-voltage networks. Although the installation of variable speed drives entails higher investment expenditures compared to a valve or throttle control system, the resulting electrical energy savings typically allow a ROI to be achieved within two years

YOUR BENEFITS

- Soft starter effect
- For pumps water hammers are avoided, reduced stress on pipe system
- Operation of high-voltage motors on low-voltage distribution possible
- Energy savings (up to 50%)
- Reduced maintenance costs



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