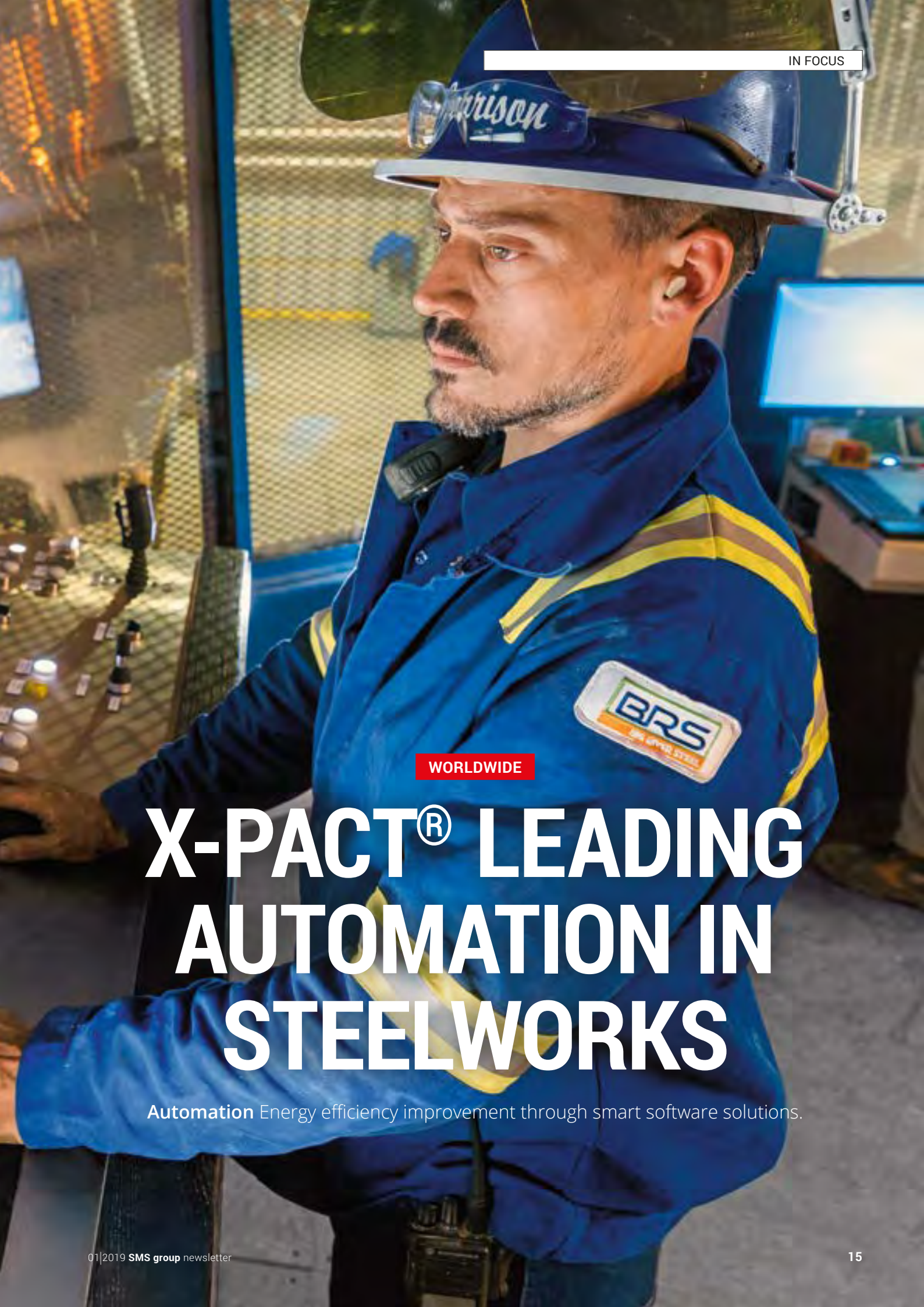


WORLDWIDE

X-PACT® LEADING AUTOMATION IN STEELWORKS

Automation Energy efficiency improvement through smart software solutions.

Steelmakers are today presented with the highly challenging task of operating their plants in such a way that while meeting the growing quality standards also the best possible energy efficiency is achieved. The operator has to see to it that the processes run without a hitch and the quality of production is as required. Measures taken to optimize the energy efficiency, such as coal injection into the EAF, selection of the optimal casting ladle for the existing thermal conditions, scheduling casting ladle maintenance and repair as well as tilting of the converter for the tap, should be performed fully automatically. Without manual intervention, errors are minimized or completely avoided. This provides the basis for efficient operation of all systems.

With X-Pact® Leading Automation, SMS group offers a completely newly developed automation system which in addition to its innovative process and operator guidance also includes numerous features for energy efficiency improvement. For metallurgical processes, the use of these new features provides significant savings on electrical and fossil energy, as a rule resulting in a Return on Investment of distinctly below two years.

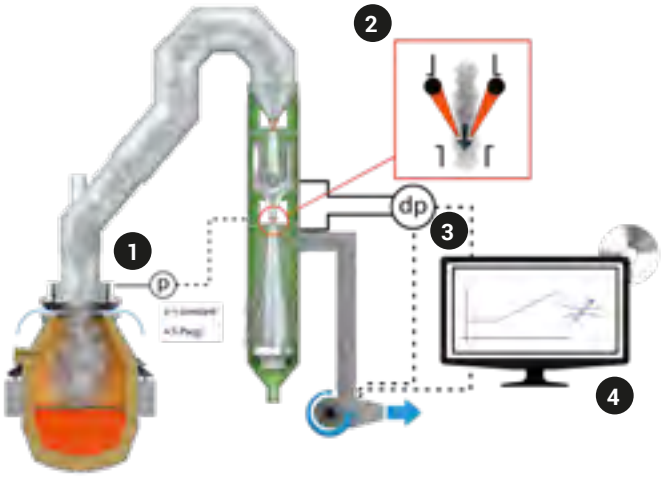
The modular structure of X-Pact® Leading Automation also allows individual assistance systems or optimization modules to be installed in existing plants as add-ons. Presented below is a selection of innovative applications in electrical and automation systems of metallurgical plants taking into account aspects such as energy and material costs, plant utilization and productivity.

X-Pact® Gas Cleaning Control – Mastering exhaust gases

Original situation

In the converter gas cleaning process (BAUMCO system) the rising primary gas is first cooled in a cooling-water or steam stack, then cleaned in a gas scrubber and from there, via the main fan unit, conveyed to a stack or a gas recovery system for extraction and further cleaning.

Varying operating states of the converter lead to varying pressure conditions in the exhaust gas duct. In order to ensure a sufficiently high flow rate at all stages, the induced-draft (ID) fan – arranged downstream of the cleaning process – as a rule operates at maximum speed. This results in high energy consumption and high costs. In such a situation, the venturi throat at the gas scrubber adjusts only the negative pressure at the mouth of the converter's adjustable skirts.



X-Pact® Gas Cleaning Control – Process illustration

1 Standard pressure measurement at the cover for volume reading

2 Venturi throat to adjust the volume in the gas cleaning plant

3 Differential pressure measurement via the venturi throat to adjust the speed of the induced-draft fan

4 Induced-draft fan, AC frequency-controlled via differential pressure and position of venturi throat

Innovation

SMS group has developed a dynamic control for the AC frequency-controlled ID fan and the venturi throat. The gas cleaning control system (an SMS group patent) adjusts the pressure to frequent and rapid pressure changes at the converter via the venturi throat, while adjustments to slower pressure variations are made via the ID fan.

Savings

- An at least 8 percent higher efficiency can be achieved by controlling the gas cleaning plant more efficiently.
- At least 2 percent more gas can be recovered as a result of the more precisely controlled process.
- The constant negative pressure at the converter mouth stabilizes decarburization and facilitates more precise end-point prediction in the process model. If applied in concert with the SMS group's BOF model, the X-Pact® Process Optimizer, even more improvements are achievable.

X-Pact® Gas Cleaning Assist – Optimization of energy consumption

Original situation

In steel mills, gas cleaning plants are used to extract dust-laden and partly toxic exhaust gases directly where they arise. This is to keep the concentration of emissions at the work places down to the allowable limits and, last but not least, contributes to the recovery of resources.

The set points for the valve positions are usually manually entered into the setting matrix. In order to securely achieve the required values at the extraction points, the respective values for the negative pressure in the various process stages are usually set too high (as they are not based on exact calculations). The values are also set higher than necessary to rule out the risk of leaking extracted gases.

Additionally, this way of adjustment makes the commissioning of the dedusting system a very time-consuming procedure.

In order for all these tasks to be performed with minimum energy input, SMS group has developed a new system for the energy-efficient control of dedusting plants.

Innovation

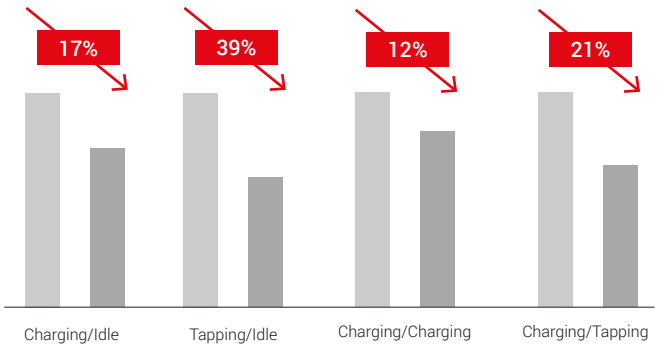
A calculation module provides empirically determined values for the optimal valve positions in the duct network.

As network resistances are taken into account, the set points can be determined with very high accuracy.

Thanks to the variable negative pressure ahead of the filter (according to the extraction rate required by the fans), excellent energy efficiency is achieved. By measuring the electricity consumption at a fixed negative pressure ahead of the filter, it is possible to measure depositing dust in the ducts. A rising specific electricity consumption is an indicator of blocked ducts.

Measuring the negative pressure ahead of the filter is the only measurement required.

A special feature of the system is the auto-cleaning function, i.e. the cleaning of the ducts at regular intervals by increasing the extraction volume. During periods of low extraction requirements, specific duct sections are subjected to extraction, removing part of the deposited dust.



Process Savings — Examples

Typical savings achieved by X-Pact® Gas Cleaning Assist during the various stages of the BOF process.

X-Pact® Temperature Assist – Temperature forecasts save energy

Original situation

Liquid steel is usually transferred in steel ladles. A refractory lining inside the ladle shields the steel armor from the enormous heat. The lining of a ladle with a design capacity of 280 tons weighs approximately 43 tons.

The steel temperature is an important quality parameter and it directly interacts with the big mass of the refractory material. Therefore, there is a direct relationship between the temperature loss and the energy content of the total mass of a ladle.

Innovation

The numerical temperature model developed by SMS group calculates the energy content (enthalpy) of all ladles, taking into consideration process situations such as ladle heating, transfer in the empty and filled state, tapping in the primary metallurgy process area, secondary metallurgy treatment as well as casting with and without ladle cover. Besides the calculation of the current energy content, two further predictive calculations can be performed:

- Forecast of the target temperature of the ladle furnace that ensures that the optimal casting temperature window is hit, and
- Forecast of the tapping temperature for optimized ladle use.

These two models help operators to significantly improve the temperature control of their steel ladles and, with it, the temperature control of the liquid steel.

Savings

The Ladle-Tracking temperature model can forecast temperature losses. For example, it is possible to precisely calculate in advance the target temperatures the liquid steel should ▸

have at the transfer point to the ladle furnace. Thus the usual practice of superheating can be dispensed with. This reduces the tap-to-tap times of the melting unit and optimizes energy use. The result are enormous cost savings.

X-Pact® FEOS – Cost optimization for the EAF process

Original situation

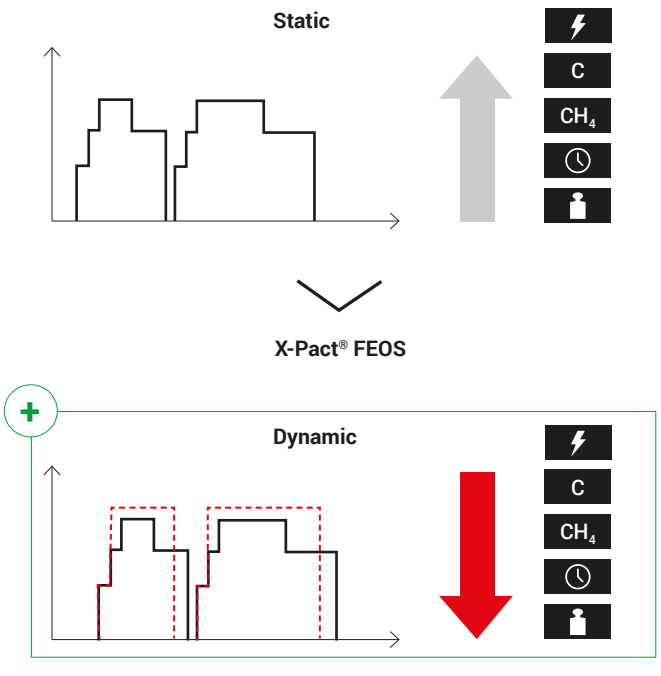
The electric arc furnace process is static. Operation follows strictly defined process patterns for electricity, coal and natural gas input. The coal needed for the process-relevant practice of slag foaming is usually added manually.

This leads to higher than necessary coal consumption and energy input along with longer than necessary power-on and tap-to-tap times. In other words, potentials are left unused.

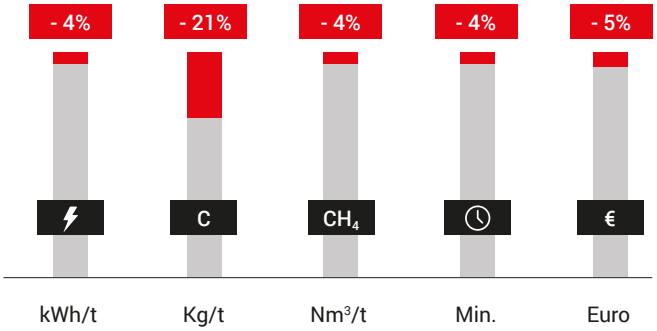
Innovation

FEOS (Furnace Energy Optimization System) optimizes the furnace process during running operation with respect to the maximum energy input while providing best possible protection of the refractory lining, and it determines the exact amount of coal needed for slag foaming.

SMS group has already achieved enormous savings by reducing the specific energy input and injected coal consumption in cooperation with its customers.



Cost savings with X-Pact® FEOS



Reducing tap-to-tap times and operating costs with X-Pact® FEOS.

Plant operators benefit right from the first heat after FEOS has been installed. During a cost-free test phase, FEOS demonstrates what savings potential is feasible. This test phase is used to thoroughly evaluate the benefits of FEOS, providing the customer a solid decision basis for his purchase. The customer can derive the savings potential from the comparison of the data measured before and after the installation of FEOS and decide whether it justifies the investment.

Savings

It has been determined that between two and four percent of energy can be saved with X-Pact® FEOS. The investment can pay back in less than four months.

Energy Demand Control – Optimization of energy procurement through energy demand forecast

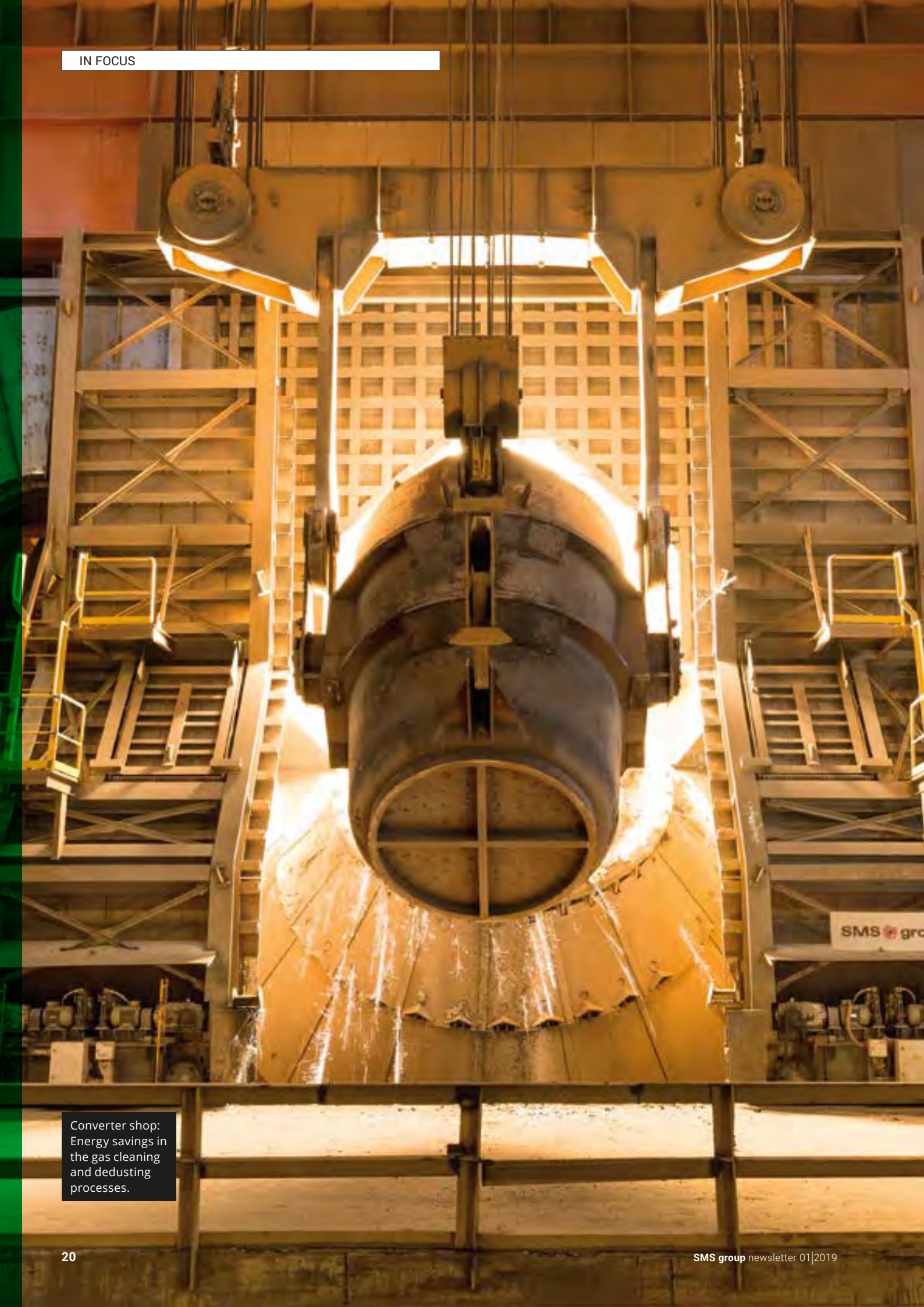
Original situation

Even today, electricity consumption plays a key role in steelmaking processes. Alongside the big "consumers", such as the electric arc furnace, numerous small electricity consuming components make up the total electricity demand of a steelmaking plant.

Innovation

The Energy Demand Control module developed by SMS group sums up, predicts and visualizes the energy consumed by all plant units and components. The module uses this information to control the energy use in a smart way, helping operators to meet threshold values and comply with limitations. With the Eco Mode add-on, it is possible to reduce the energy demand during idle times yet further. Being an integrated module of X-Pact® Leading Automation, Energy Demand Control acquires all available consumption data. Complemented by intelligent forecasting, the module also supports the discontinuous processes taking place at the various production stages, for example, the converter ▸

X-Pact® FEOS optimizes energy consumption in the EAF process.



Converter shop: Energy savings in the gas cleaning and dedusting processes.

process. A switch-off matrix adds to the energy savings by reducing the consumption by individual processes or switching them off completely – always in due consideration of the specifics of the respective process and clearly indicated to the operator.

Savings

The Energy Demand Control module, in concert with the Eco Mode add-on, actively supports the operator in reducing the number of electricity consuming units or switching them off completely whenever possible. Additionally, the system prevents the plant operator from exceeding the power demand limits stipulated in power purchase agreements and having to pay a penalty to the energy supplier for breach of contract.

X-Pact® MES 4.0 – Production planning under energy consumption aspects

The Meltshop Pacer software module calculates the optimal start and stop times of a heat in a steel plant along the EAF-LF-VD-CCM process route, taking into account current occupation and usage of the plants. Complex plant structures require powerful IT to calculate the optimal solution within the given time limits.

In situations in which the steelworks' capacity is not fully utilized, for example, during maintenance of a continuous casting machine, the operator may choose between two calculation variants:

- Equal distribution of the heats on all EAFs:
  This operation mode leads to all EAFs being permanently held at operating temperature. Should one EAF fail, one of the remaining units will be able to take over immediately. This entails higher energy consumption, but rules out the risk of having to interrupt casting in the event of failure of one of the EAFs.
- Distribution of the heats on the minimum possible number of EAFs:
  This mode saves energy, as only those furnaces required for the reduced CC capacity are being operated.
  Switching between both modes is uncomplicated. Therefore, in less critical situations, the operator may easily switch to the energy-saving variant. The Meltshop Pacer will automatically react when the casting machine goes back into operation.

Bottom line

X-Pact® Leading Automation is a modular and scalable system. The above presented modules can be used either as integral parts of a complete automation solution or as independent add-ons integrated into existing facilities. They interface with any conceivable communication formats.

This approach allows SMS group to achieve great savings with relatively modest investments. Products designed to achieve energy savings are expected to provide an ROI of less than two years. This can be easily achieved with the here presented modules. ◆

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X-Pact®
MES 4.0 module.