SMS group Inc.
100 Sandusky Street
Pittsburgh, PA 15212, USA
Tel: 1 412-231-1200
www.sms-group.com

The path to green power supply

Energy for green steel production from SMS group's DC ECO GRID

The metals industry is on its way to replace the high CO2 emissions generated by the use of fossil fuels with renewable energies in order to achieve climate-neutral steel production. Rising prices for fossil fuels and the increase in CO2 taxes are further incentives for switching to a climate-friendly energy supply. Due to the increasing use of renewable energy in the form of hydropower, solar energy or wind energy, the AC grids currently used in the industry need to be adapted. By establishing DC grids, for example solar energy can be fed in directly – and thus more efficiently.

The DC ECO GRID from SMS group helps to provide a greener, more energy-efficient power supply for steel plants, both new and existing. In this way, DC ECO GRID creates a link between a more environmentally friendly metals industry and new green energy supply systems.

With the rise of renewable energy technologies that produce power in the form of direct current (DC) – which can be used directly by industrial machines – plant-internal DC grids can play a key role in decarbonizing industrial production. This is especially true for energy-intensive steel plants. Jens Haupt, SMS group Inc.'s Chief Sales Officer, comments, *"Our customers are starting to feel a push by steel consuming industries to decarbonize. Besides this motion, the Biden Administration is focusing on this as well. The necessary and needed transformation is picking up momentum quickly and each metallurgical plant or production facility of our customers is being subject to this transformation in both their core processes and of course by switching to a climate-friendly energy supply."*

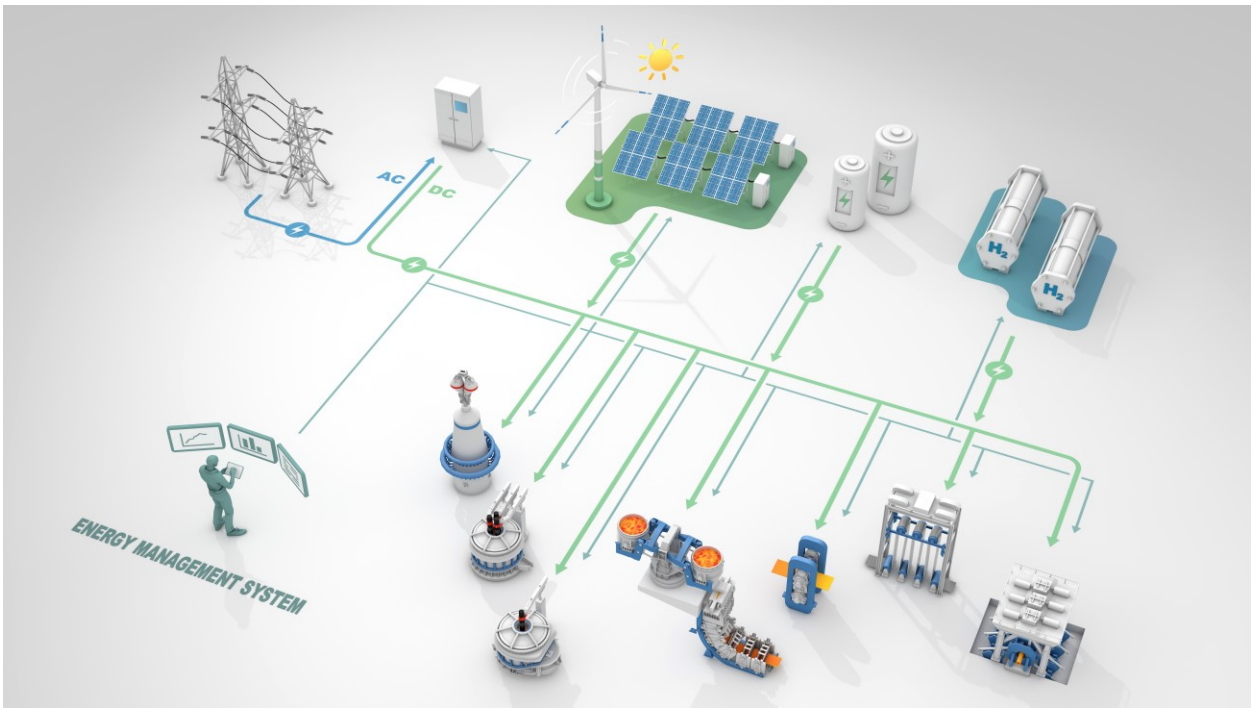
In an energy industry that has long relied on large coal and nuclear power plants as electricity suppliers, public power grids are mainly AC grids. For use by consumers in industrial grids, alternating current from these grids must first be converted into direct current. This process offers just few opportunities for energy recovery. That is why plant-internal DC microgrids are met with great interest in the steel industry.

The SMS group solution:
An energy-efficient plant infrastructure from a single source
The expansion of renewable energies, however, requires greater flexibility of the power supply system. The need for constant balancing of supply and demand for a secure power supply leads to a greater use of electricity storage when the share of wind and solar energy increases. Both short-term storage and long-term storage are absolutely essential for intelligent load management, e.g. to be able to handle peak loads. In particular where the load clearly exceeds the infeed from renewable energies or, vice versa, the infeed from renewable energies

SMS group Inc.
100 Sandusky Street
Pittsburgh, PA 15212, USA
Tel: 1 412-231-1200
www.sms-group.com

temporarily exceeds the load, shifts as well as switch-overs of non-critical power applications must be managed.

SMS group's DC ECO GRID is able to connect all metallurgical plant units to an economical power grid. It comprises a central connection to the public AC grid, to the respectively available renewable energy sources, such as solar or wind energy, as well as energy storage units such as battery storage systems.



Green energy supply for plants in the metals industry with DC ECO GRID from SMS group

"As a systems supplier and system integrator of large-scale steel production plants, we combine all electrical consumers and power producers. Our DC ECO GRID connects them to hybrid power distribution grids, AC & DC, thus improving the plant's energy efficiency. It is the link between a green metals industry and new green energy supply systems. Combined with energy management consulting, business case definition and concept development as well as solution design and system integration, we provide an integrated solution – from a single source," says Gerald Mayr, Executive Vice President Electrics/Automation.

For the customers, SMS group's modern DC ECO GRID solution offers cost advantages, ensures constant reliability of the production facilities and enables future-oriented extensions for green steel production.

SMS group Inc.
100 Sandusky Street
Pittsburgh, PA 15212, USA
Tel: 1 412-231-1200
www.sms-group.com

Cost advantages

In the future, DC ECO GRID will connect large consumers in modern steelmaking plants, such as electric arc furnaces, rolling mills and strip processing lines, to the public power grid. With a plant-internal DC grid, production units can be connected to new hydrogen electrolysis units, powerful battery storage units and renewable energies. The connection is made via state-of-the-art power electronic rectifiers and inverters, which are connected to the DC grid. For example, frequency converters no longer require the rectifier components needed in an AC grid. In this way, savings are obtained as the infeed units can be omitted in the case of direct infeed from a DC grid. This also reduces the cost of cabling.

Reliability of production facilities

The reliability of the entire production line or individual production areas can be increased by integrating battery storage units and local power generation plants into the production facilities' power supply. In this way, production downtimes due to disturbances in the power grid are prevented. Supported by intelligent energy management systems, the production process can be optimized in terms of energy consumption.

The path to green steel production

Today, conventional metallurgical plants are usually supplied with different voltage levels via three-phase AC grids. Electrical losses due to the apparent power and high investments in flicker compensation and adaptation of the power factor are accompanied by a large space requirement for such plants. The owners of such plants rarely use renewable energies.

Since fewer rectifier components are required, DC ECO GRID allows for large energy savings. Unlike AC grids, in which the braking energy of the machines often goes to waste in the form of heat, DC grids allow for energy to be recuperated and fed back into the grid. With renewable energy sources and energy storage units connected directly to the DC ECO GRID, the plant is not only more flexible and independent of overall variations or power outages that might occur in the public grid, but also relies on CO2-neutral resources for green steel production.

Jens Haupt continues, *"The DC ECO GRID helps to provide a greener, more energy-efficient power supply for steel plants, both new and existing. Thanks to this concept, renewable power sources, energy storage systems and consumers can be connected directly with higher efficiency. DC ECO GRID creates a link between a more environmentally friendly metals industry and new green energy supply systems."*

SMS group Inc.
100 Sandusky Street
Pittsburgh, PA 15212, USA
Tel: 1 412-231-1200
www.sms-group.com

Know-how from SMS group for green power supply

As a systems integrator and supplier of large-scale metallurgical plants, SMS group can help to combine all consumers and power generators in order to operate distribution grids as DC ECO GRID or as a hybrid mix. These microgrids can be completely or partly converted into DC grids both for new plants and for modernization projects.

Components for connecting to the DC ECO GRID are designed and manufactured within the SMS family:

- **X-Pact® AURA for EAF** – The Advanced Unit Rectifier Assembly is designed to achieve efficient and stable power control to supply electric arc furnaces even in weak power grids. Compact modules of approximately 10-13 MW can be connected in parallel to achieve the desired furnace power rating.

- **X-Pact® Drives** as a standardized, modular drive solution meet the high demands of the metals industry – from steelmaking plants to rolling mills and strip processing lines. Common DC or AC bus designs cover power ranges from 0.75 kW up to 5,300 kW. With the X-Pact® Drive system, also DC/DC couplings can be implemented.

- **X-Pact® High Current** switch-mode rectifiers ensure a dynamic DC power supply up to 1,500 kW or 50,000 A for electrolytic strip processing, and enhance the plant performance in terms of residual ripple, control speed and control accuracy. X-Pact® High Current units can be retrofitted to existing lines, thus contributing to the reduction of the ecological impact of existing plants.

- **Torque Drive:** SMS group's innovative direct drive system allows the machine to achieve an overall efficiency of 98%. This energy-efficient, low-noise and extremely maintenance-friendly drive was specially developed for use in machine and plant engineering. In addition to the ecological aspect, the drive concept is characterized by its particularly high efficiency, which is achieved by the elimination of loss-inducing conversion stages and by being able to omit auxiliary units. Furthermore, the physical-electrical principle of a permanent magnet synchronous motor is much more efficient than that of an asynchronous motor. Integrated components of the direct drive in the mechanical application ensure maximum process-oriented, low-maintenance drive power.

- **EloMat™ converters for induction heating** from SMS ELOTHERM are used in numerous applications such as hardening, tempering, annealing, heating, welding and melting. Modern IGBTs and MOSFETs cover a wide range of frequencies and power levels. The power spectrum ranges from 120 to 4,500 kW per unit, with frequencies ranging from 1 to 600 kHz, thus creating the basis for efficient induction.

SMS group Inc.
100 Sandusky Street
Pittsburgh, PA 15212, USA
Tel: 1 412-231-1200
www.sms-group.com

- **X-Pact® Battery Storage** from SMS - LUX Automation can be produced using either new batteries or second-life batteries. With a modular capacity ranging from kW to MW, energy can be stored in the short and medium term. In addition, to ensure power grid stability, a "very fast" power reserve is available, which can be started up within milliseconds and provides for peak shaving.

- **Power-to-H2 electrolysis technology** from Sunfire, SMS group's strategic cooperation partner, ensures hydrogen production with renewable energy, substitutes fossil fuels and leads to a significant reduction of CO2 emissions across all sectors. Scalable 10 MW modules enable effective adaptation to large electrolysis capacities. The DC ECO GRID bus connects the Sunfire hydrogen electrolysis modules.

- An intelligent and modular **energy management system** integrates these resources to form a hybrid grid. SMS digital and Vetta jointly develop digital solutions for efficient energy management. The **Viridis Energy & Sustainability Platform** is a comprehensive management solution for steel plant operations. Viridis not only optimizes throughput and quality, but also energy costs and raw material use, and even reduces the emission of carbon, greenhouse gas and the waste volume. The system manages power contracts, simulates cash flows from production plants and optimizes contract execution to reduce energy and resource unit costs.

Conclusion:
Major advantages for the plant owners
The combination of power electronic units leads to higher energy and resource efficiency as well as improved grid stability in the entirety of metallurgical plants connected to the DC ECO GRID bus technology. Energy efficiency is improved by lower conversion and transport losses, energy recovery, direct use of renewable energy sources and the handling of load peaks by means of storage systems. The installation of such system components requires less copper for cables and bus bars. Lower equipment costs and less space requirements result in better resource efficiency, as, among other things, additional investments for adaptation of the power factor and flicker compensation are not required. The connection of new plants to existing weak grids is supported by the DC technology with the possibility of integrating battery storage and energy recovery systems to prevent production downtimes due to disturbances in the power grid. An intelligent energy management system controls the energy flows and thus helps to optimize energy procurement costs.

"SMS group is leading the way when it comes to Green Metals. We have made it our mission to achieve future-oriented green steel production and processing. With the numerous advantages of our DC ECO GRID, we motivate a change in systems and a shift of awareness in the energy supply of metallurgical plants", says Gerald Mayr.