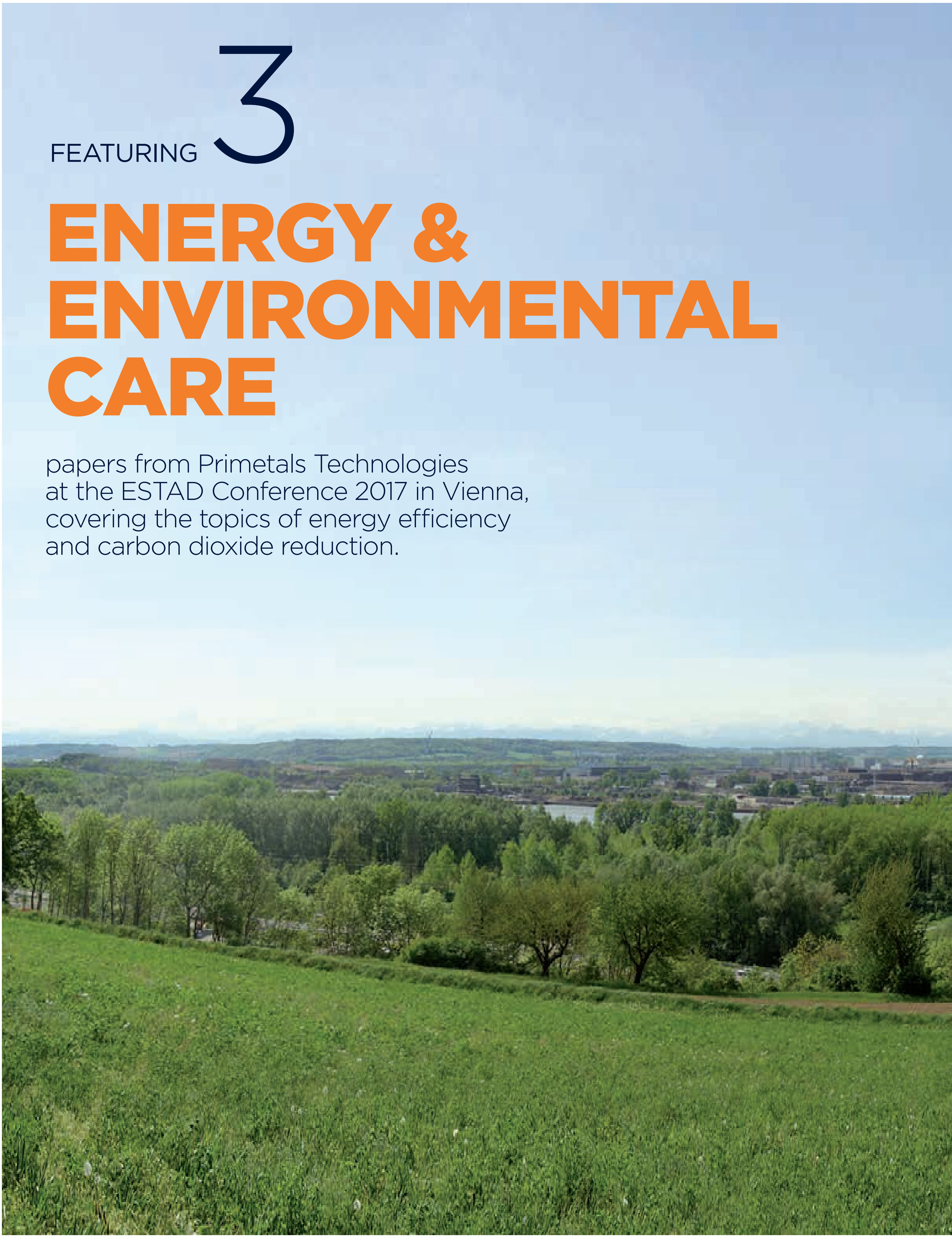
FEATURING 3

ENERGY & ENVIRONMENTAL CARE

papers from Primetals Technologies at the ESTAD Conference 2017 in Vienna, covering the topics of energy efficiency and carbon dioxide reduction.



The integrated iron- and steelworks of voestalpine Stahl, Linz, Austria

SINTER PLANT AND BASIC OXYGEN FURNACE WASTE-HEAT UTILIZATION – NEW CONFIGURATION WITH ORC MODULES FOR POWER GENERATION*

Paper number: 67
Principal author: Dr. Thomas Steinparzer

The demand for increasing energy efficiency and CO_2 reduction is one of the global megatrends of our times. Although the steel industry suffers from a volatile economic environment, steel plants welcome opportunities for sustainable cost reductions and are committed to finding healthy solutions for the environment. Considerable efforts are therefore being made to cut electrical power and energy costs in integrated steel plants, as these count among the biggest cost factors that can be influenced. In integrated iron- and steelmaking routes, the complex interrelationship between process energy demands, waste energy utilization, the use of natural- and metallurgical gases, the requirements for steam- and heating systems as well as for power generation must be carefully analyzed. Potential energy sources, such as the sinter plant, the cooling stack of basic oxygen furnaces (BOF) and reheating furnaces, can be assessed in order to develop a more fully integrated energy concept.

When the direct local use of waste heat is limited, the best option is to convert the waste heat to mechanical-electrical power in a Rankine cycle. Electrical power generation is an especially attractive option for steel plant operators since it can easily be connected to the existing power grid of the steel plant. Such units must be compactly designed as stand-alone systems in order to fit into the existing steel plant layout, and operational costs have to be kept to a minimum.

The objective of this paper is to demonstrate economically feasible opportunities for energy recovery in sinter coolers and basic oxygen furnaces. The focus is placed on electrical power generation via ORC (Organic Rankine Cycle) modules, while at the same time achieving CO_2 reductions by utilizing waste heat from the process. Typical plant arrangements of such solutions are presented in the paper, as well as basic economic calculations.

*This paper was written together with Turboden s.r.l., a Mitsubishi Heavy Industries company that specializes in the development, production and supply of Organic Rankine Cycle modules.

CARBON RECYCLING AT ITS BEST – UTILIZATION OF BY-PRODUCTS FROM PROCESS-GAS FERMENTATION

Paper number: 69
Principal author: Tobias Plattner

Technological solutions that allow process gases from the iron and steel industry to be utilized in other production facilities, such as in the chemical industry, are becoming more and more attractive. With the use of a microbiological process, it is now possible to convert the available energy contained in carbon- and hydrogen-rich offgases from coke ovens, blast furnaces, direct-reduction plants and LD (BOF) converters into liquid-based energy sources.

LanzaTech and Primetals Technologies offer a unique microbial fermentation system to produce chemicals, most commonly ethanol, from the process gas of metallurgical plants. An integrated fermentation system with additional downstream facilities is required to treat the fermentation product and waste streams to generate a number of by-products that are usable for various applications such as for the generation of electrical or thermal power. By returning the by-products to an integrated steelworks, the fermentation system can be operated as a zero-waste facility that compensates for portions of external input materials such as natural gas or carbon-based materials.

Example of a LanzaTech gas fermentation plant in China

Industrial implementation of an EAF waste-heat recovery system for steam generation at Acciaieria Arvedi S.p.A., Cremona, Italy

WASTE HEAT RECOVERY FOR THE EAF – INNOVATIVE CONCEPTS AND INDUSTRIAL IMPLEMENTATION

Paper number: 70
Principal author: Paul Trunner

Over the last years, waste heat recovery in the steel industry has attracted ever-increasing attention. Environmental regulations and public funding, as well as required revamps of old dedusting systems, have led steel plant operators to discuss and evaluate possibilities for recovering waste heat.

The development of a waste-heat recovery plant requires extensive knowledge and long-term experience with the entire plant, including the water-steam cycle, the EAF (electric arc furnace) process, dedusting systems and downstream waste-heat consumers. Primetals Technologies provides innovative and reliable waste-heat recovery solutions for the EAF, which are presented in this paper.

An innovative waste-heat recovery plant is also introduced, which was installed at Acciaieria Arvedi S.p.a., Italy. Waste heat is used to produce steam for two pickling lines located at a considerable distance from the EAF. The substitution of the existing gas-fired boilers led to a decisive reduction of operating costs for the steel plant. Another heat-recovery plant was installed at the electric arc furnace of Höganäs in Sweden, where hot water at high pressure is produced and utilized for the local district-heating system. The industrial implementations of waste-heat recovery systems for the EAF are presented in detail, along with the operational results achieved.

ENERGY & ENVIRONMENTAL CARE HIGHLIGHTS OF PRIMETALS TECHNOLOGIES

Energy efficiency
- Generation of up to 100 kg of steam per ton of liquid steel from the LD (BOF) process with waste-heat recovery
- Up to 25 kWh electric power generation per ton of sinter with waste-heat recovery from the shaft cooler
- Up to 11% energy savings of the total energy input for minimills
- Up to 40% energy savings for electrostatic precipitators with Precon
- Up to 30% reduced energy consumption for secondary emission control with a dynamic process-control system
- Generation of up to 450 kg of steam per ton of blast furnace slag with the Dry Slag Granulation process (DSG)
- Production of up to 0.23 kg ethanol per Nm^3 feed gas (CO/H_2) with the bio-fermentation of waste-gas from metallurgical plants

Emissions
- Less than 3 mg/Nm^3 particulate emissions from bag-filter systems
- Less than 0.1 ng/Nm^3 I-TEQ PCDD/F (dioxins/ furans) emissions from any type of metallurgical plant
- Up to 98% SO_x and 90% NO_x reductions in the waste gas from sinter plants with Meros technology
- Zero-waste water discharge with dry-type waste-gas dedusting/gas-cleaning solutions
- Up to 99% plant reliability and availability of any type of ECO gas-cleaning plant
- 65% lower specific CO_2 emissions in the direct-reduction route compared with the integrated blast furnace route
- 65% reduction of specific CO_2 emissions in the direct-reduction route compared to the integrated blast furnace route
- Up to 50% reduction of waste gas with Selective Waste Gas Recirculation (SWGR) in sinter plants

By-products
- Up to 3% raw material savings with the briquetting and recycling of oxide fines (sludges, dust, scale)
- Up to 2% metal-yield improvement with the valorization of steelmaking slags (metallic oxide recovery)
- Up to 15% boost in cokemaking productivity with the fine-coal-briquetting process
- 60% (and higher) upgrading of iron content of mining tailings via tailings beneficiation