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ANALYSIS OF THE NEW SINTER LINE IN HBIS GROUP SERBIA AND CREATING CONDITIONS FOR PRODUCTION IMPROVEMENT

Igor Zlatković[1a], Živko Đorović[1b]

[1] HBIS GROUP Serbia Iron & Steel d.o.o. Beograd, Serbia
[1a] izlatkovic@hbisserbia.rs, 0009-0006-9125-3063
[1b] zdjorovic@hbisserbia.rs, 0009-0000-4993-3440

Abstract

In order to create adequate conditions for increasing of production and improving the productivity of sinter, the multidisciplinary sinter production team of HBIS GROUP SERBIA IRON & STEEL analyse all technical and technological production parameters of the New Sinter Line. Trying to create conditions for increasing productivity through the analysis of production parameters and through an innovative approach, thus enabling the realization of a predetermined production plan, meeting the legal requirements for limiting the emission of polluting exhaust gases. With the new sinter line, three segments, which are the subject of this paper, has been improved:

1. *production - technological goal, which includes increasing sinter production, increasing productivity, improving the quality of produced sinter, rationalizing production, as well as reducing costs per unit of product,*
2. *rationalization of energy consumption and energy efficiency of the newly built Sinter plant*
3. *improvement of environmental protection through the technological process as well as the application of adequate technological systems for environmental protection within the New Sinter plant.*

1. INTRODUCTION

Sinter production is a pivotal step in iron-making, converting fine iron-bearing materials into a porous agglomerate (sinter) suitable for blast furnace feed. Efficient sinter strand operation affects raw material utilization, energy consumption and emissions. HBIS GROUP Serbia commissioned a modern sinter strand in Smederevo in 2022. This installation was designed for a theoretical capacity of 1.6 million tonnes per year and incorporates state-of-the-art combustion, air handling, dedusting and desulphurization systems [1-5].

Objectives of this paper are to:

1. Present the technical description of the sinter strand and its control/operation concept.
2. Summarize operational experience and discuss the best production year (2023).
3. Analyze energy usage and outline sustainability measures and opportunities for further improvement.

2. EXPERIMENTAL (PLANT DESCRIPTION AND OPERATIONAL METHODOLOGY)

2.1 Plant technical data and layout

Theoretical capacity: 1.6 million t/year (continuous operation). This corresponds to approximately 4,384 t/day or ~183 t/h (24/7 operation).
Layer height: 700 mm.
Ignition temperature: 1100 °C (set point for ignition furnace operation and start of sinter bed combustion).

Suction chambers: 22 chambers with average burn-through temperature of 350–360 °C; designed suction in the range 10–12 kPa.

Ignition furnace: 3 rows × 12 burners per row (36 burners total); fuel used exclusively: blast furnace gas.

Dedusting and gas cleaning: Electrostatic precipitator (ESP) for particulate capture and a desulphurization tower for SOx reduction.

Staffing and control: Machine crew of 6 operators (on-site maintenance/operation) and 3 SCADA operators who oversee material dosing, sinter strand parameters and sinter distribution to the blast furnace.

2.2 Operational methodology and data collection

Operational data discussed here were collected from the plant control system (SCADA), maintenance records and production logs. Key performance indicators (KPIs) include: throughput (t/day), fuel consumption (Nm^3 BF gas per tonne sinter), sinter quality indices (e.g. tumbler index, reducibility), emissions (particulate matter, SOx) and availability/downtime statistics. The best production year (2023) is used as a reference for performance analysis and benchmarking.

3. RESULTS AND DISCUSSION

3.1 Throughput and production performance

Theoretical capacity of 1.6 million t/year translates to an average continuous throughput of about 4,384 t/day (1,600,000 / 365) or roughly 183 t/h (24 h operation). During the plant's best production year (2023) the strand achieved its highest availability and production rates; operational practices that likely contributed to the success included tight process control via SCADA, optimized burner management in the ignition furnace (using only blast furnace gas), and effective dedusting and off-gas handling which minimized unplanned stoppages.

3.2 Thermal design and combustion control

Ignition at 1100 °C and a layer height of 700 mm define the thermal regime of the sinter bed. The ignition furnace (3 rows × 12 burners) operating on blast furnace gas provides a homogeneous ignition front and reduces reliance on liquid or purchased fuels. Burn-through temperatures in the suction chambers (350–360 °C) are within typical industry ranges for stable burn-through and gas permeability. Suction levels (10–12 kPa) are moderate and indicate robust air management; consistent suction control is crucial for uniform burnt-hrough and sinter quality.

Proper burner staging, frequent calibration of nozzle flows and regular monitoring of BF gas composition ensure consistent heat input and avoid local overheating or under-ignition that would degrade sinter quality or increase energy consumption.

3.3 Dedusting and desulphurization performance

The modern ESP provides high-efficiency particulate removal from off-gases and protects downstream equipment (including the desulphurization tower) while reducing fugitive emissions. The desulphurization tower targets sulphur oxides—especially important given the use of blast furnace gas and the large throughput—reducing SOx releases and contributing to compliance with environmental regulations.

Key operational considerations:

ESP performance is dependent on gas temperature, humidity and dust load; maintaining optimal gas temperature is necessary for consistent capture efficiency.

The desulphurization tower efficiency depends on reagent quality, gas-liquid contact and residence time. Online monitoring of inlet and outlet SOx concentrations helps to maintain target removal efficiencies.

3.4 Energy usage and sustainability

Energy use in sintering stems primarily from the ignition furnace (fuel), off-gas handling (fans, dedusting), and auxiliary systems (dosing, conveyors, cooling). Using blast furnace gas as the exclusive fuel for the ignition furnace is a strong sustainability measure because it utilizes a by-product gas from iron-making that would otherwise require flaring or external treatment; this improves overall plant energy integration and reduces external fossil fuel consumption.

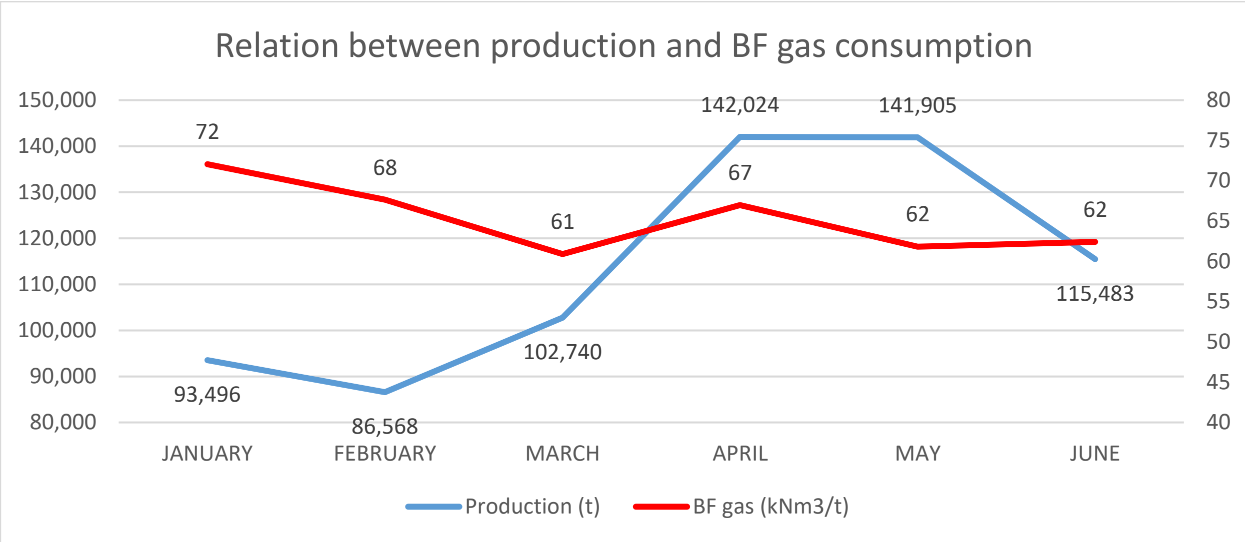

Figure 1. Production/BF gas consumption graph

Specific energy considerations and opportunities:

Fuel recycling and heat recovery: High-temperature off-gases (from ignition and burn-through) can be routed through waste-heat recovery systems to preheat combustion air, dry feed materials or generate low-pressure steam. Heat recovery reduces net primary fuel demand per tonne of sinter.

Optimization of BF gas use: Continuous monitoring of BF gas calorific value and adaptive burner control can optimize energy input. Using only BF gas eliminates natural gas use, lowering the carbon footprint of sinter ignition.

Electrical energy: Efficient energy management is one of the key factors in modern sinter plant operation. While the sinter strand represents the dominant consumer of electricity during production, significant savings can be achieved by focusing on consumption patterns when the strand is not in operation. In many cases, auxiliary equipment such as blowers, pumps, conveyors, cooling fans, or dust extraction units continue to run even when the strand is idle. This practice leads to unnecessary energy losses and increased operational costs.

At HBIS GROUP Serbia, particular attention is placed on eliminating non-essential electricity consumption during downtime. A systematic approach has been introduced, where equipment is categorized into critical and non-critical groups. Critical equipment required for maintaining safe conditions, such as cooling water circulation or essential instrumentation, remains active. All other equipment is subject to controlled shutdown through predefined operating procedures and automated interlocks tied to the strand’s operational status.

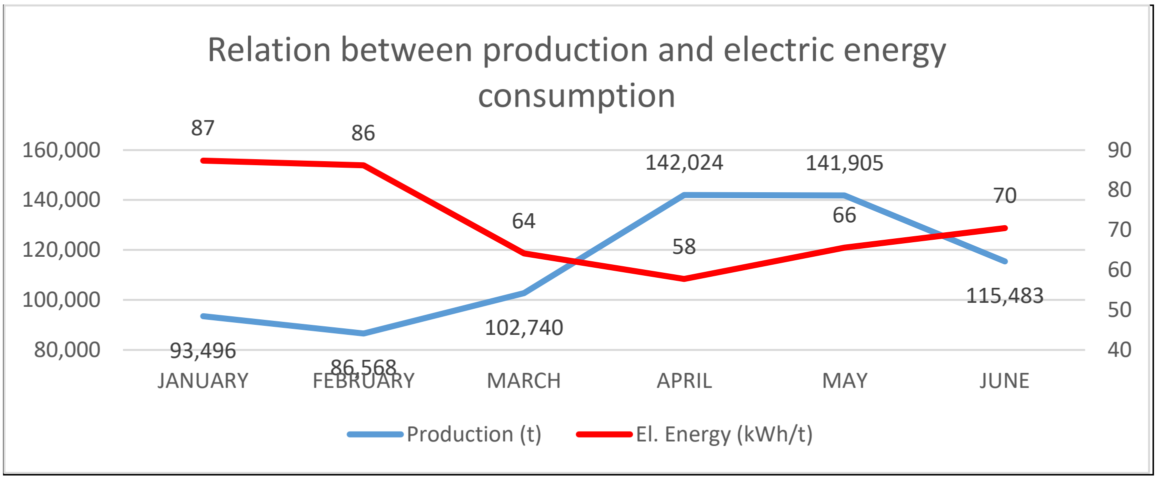

Figure 2. El. Energy consumption/Production graph

This strategy ensures that only the devices directly needed for strand operation are consuming power, while auxiliary units are automatically disconnected during idle periods. In addition to lowering electricity consumption, this approach reduces mechanical wear, prolongs equipment life, and lowers maintenance requirements. By managing electricity in this way, the plant minimizes its environmental footprint and strengthens overall production efficiency, without compromising safety or process stability.

Process control and SCADA: The plant SCADA system that controls material dosing and distribution to the blast furnace contributes to energy savings by stabilizing the sintering process, reducing overuse of fuel due to poor bed permeability or insufficient ignition.

The circular cooler's off-gas represents the largest single source of recoverable sensible heat on the new sinter strand. In the next phase, this heat will be captured from the early cooling zones and routed to a waste-heat boiler to generate low-pressure steam and hot water. The recovered energy will be used to preheat ignition hood/combustion air, condition boiler-feedwater. This integration cuts natural-gas consumption on the strand, lowers specific CO_2 emissions, and stabilizes strand thermal balance—supporting higher productivity and more consistent burn-through.

Sustainability impacts:
Utilization of BF gas reduces external fuel consumption and CO_2 emissions associated with purchased fuels.

Effective ESP and desulphurization control particulate and SOx emissions, improving local air quality and regulatory compliance.

Opportunities for further CO_2 reduction include waste-heat recovery, electrification of auxiliary systems using low-carbon grid electricity, and process optimization to reduce specific energy consumption (GJ/t).

3.5 Economical advantage

One of the key advantages of modern sinter strand technology is the direct correlation between productivity and production cost. With higher strand utilization and improved process stability, the fixed operational expenses—such as labor, maintenance, and energy consumption of auxiliary equipment—are distributed over a larger output. This results in a lower cost per ton of sinter produced. The increase of productivity on the new sinter strand not only ensures higher annual output, but also creates a sustainable reduction in production costs, strengthening the competitiveness of the steel plant in a highly demanding market.

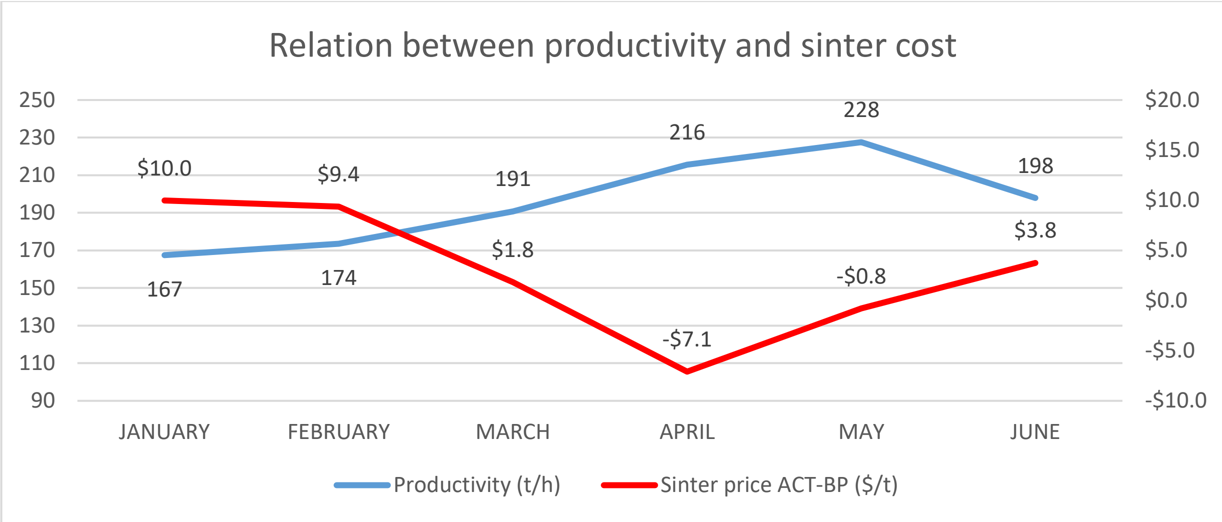

Figure 3. Productivity/cost difference

3.6 Operational staffing and automation

A compact machine crew (6) supported by 3 SCADA operators reflects a high degree of automation. Centralized SCADA control of dosing, strand speed, distributor control and off-gas handling enables consistent product quality and energy-efficient operation. Key human factors considerations include operator training, alarm management and clear procedures for manual interventions.

4. CONCLUSION

The new sinter strand at HBIS GROUP Serbia, commissioned in 2022 and achieving its best production year in 2023, demonstrates modern sinter technology integrated with energy-conscious practices. Principal conclusions:

1. The strand’s theoretical capacity of 1.6 million t/year (~4,384 t/day, ~183 t/h) positions it as a high-throughput unit; robust suction management (10–12 kPa) and burnthrough temperatures (350–360 °C) indicate stable combustion and gas permeability.
2. The ignition furnace design) that uses only blast furnace gas is an important sustainability feature, enabling internal fuel recycling and reduced external fuel dependence.
3. Modern dedusting (ESP) and desulphurization minimize particulate and SOx emissions, aligning with environmental standards and supporting sustainable development goals.
4. Energy efficiency can be further improved through waste-heat recovery, fine-tuning of BF gas utilization and continued process automation and operator training.

Overall, the plant represents a strong step toward integrated, energy-aware sinter production for HBIS GROUP Serbia.

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