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The SMS Electric Arc Furnace for Next Gen minimill

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In the blooming market of minimill plants, our latest plant at Hybar, Osceola, Arkansas, started up 630,000 tpy rebar production in September 2025, setting new benchmarks for productivity, performance, safety, and environmental emissions while fully meeting the requirements of a CMT minimill. This paper presents the latest EAF technologies, including the X-Pact® AURA DC power supply, Condoor®, X-Pact® Sampler, SafEBT equipment, as well as the Spray Systems design, and their impact on green steel production.

KEYWORDS: ELECTRIC STEELMAKING TECHNOLOGIES; CONTINUOUS MICROMILL; SMS CMT®; SMS X-PACT® AURA™ DC EAF; PRODUCTIVITY; POWER FEEDING; EFFICIENCY.

INTRODUCTION

SMS's newest facility for Hybar in Osceola, Arkansas, commissioned a 630,000 tpy rebar production plant in September 2025. Located strategically on the Mississippi River with direct access to a dedicated river port, the site is ideally positioned to serve as an ultra-regional supplier, supporting cost-efficient deliveries throughout the United States. The facility also features a 104 MW solar installation across a 1,300-acre site, representing the nation's largest behind-the-meter solar and battery storage system. As a result, Hybar has become the first—and currently the only—steel plant able to produce steel using 100% solar energy during daylight hours.

The development of a CMT® (Continuous Mill Technology) micromill of this scale [1, 3] requires the integration of innovative technologies into the project, including:

- an EDGE Electric Arc Furnace powered by the X-Pact® AURA™ DC power supply;
- a continuous caster equipped with a CONREX® large-corner, high-speed mold;
- a rolling mill featuring industry-leading solutions, including single-pass finishing through the individually driven MEERdrive® high-speed blocks.

This paper presents the key technology features of an Electric Arc Furnace designed for CMT® plants.

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DISCUSSION

Meltshop layout

The plant layout has been optimized to suit the selected site (figure 1). The equipment is arranged along a north-to-south axis, with the heavier and taller structures concentrated in the steelmaking area and the lighter, lower-profile installations located within the rolling mill section. A dedicated roll shop, along with a ladle and tundish relining area, is positioned adjacent to the main bay.

A fleet of overhead cranes supports plant operations across the facility. In the Electric Arc Furnace bay, two 233 t cranes handle scrap buckets, liquid steel transfers, and are designed to accommodate full shell replacement in a single-lift exchange procedure. The ladle and tundish maintenance area is equipped with a 60 t crane. In the rolling mill, 30 t and 20 t cranes serve the operations, while finished product handling is managed by two additional 30 t cranes.



Fig.1 - Plant view.

The steelmaking plant (figure 2) is located on the north side and has been configured to support single-bucket

charging, rapid-shell exchange, and a safe ladle maintenance cycle.

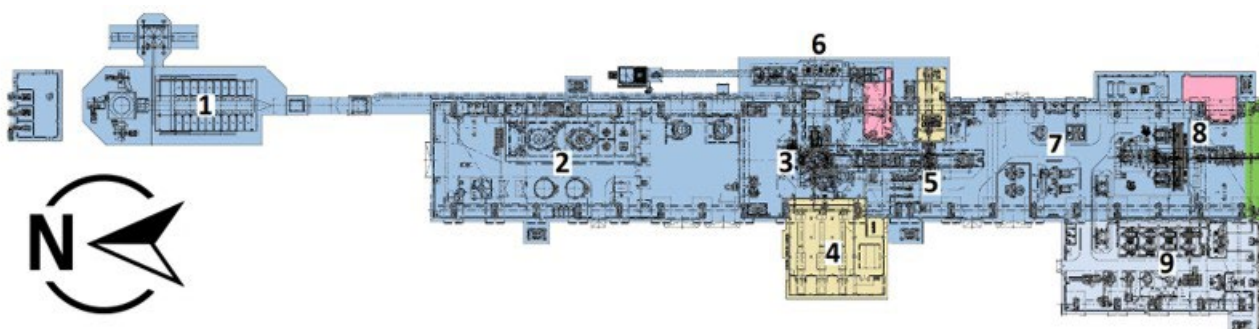


Fig.2 - Steelmaking area layout.

To reduce transfer distances and crane travel, SMS selected a compact layout in which the Electric Arc Furnace (EAF) and Ladle Furnace (LF) are aligned on the same axis

and share the same ladle car tracks (figure 3). A total of two electrically driven ladle cars is installed, ensuring both reliability and redundancy in the refining area.



Fig.3 - EAF and LF area layout.

This arrangement enables the use of a shared control room, from which operators can oversee both the Electric Arc Furnace and the Ladle Furnace (figure 4). Reducing personnel requirements while increasing the level of au-

tomation is a key factor in achieving the high productivity and operational success of the CMT® meltshop. The two operating platforms are connected by walkways, allowing smooth movement between the different work areas.

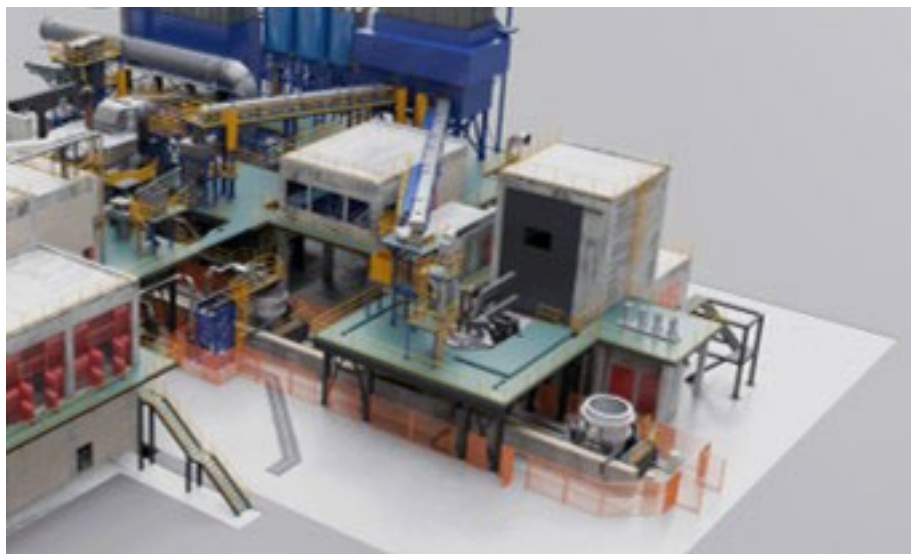


Fig.4 - EAF and LF area layout.

To further reduce the overall footprint, particular attention was given during the engineering phase to minimizing the area required for the Material Handling System (figure 5). The result is a compact arrangement featuring in-line silos and a single common loading point. Between the three lime, dololime, and carbon silos serving the EAF and the eight ferro-alloy silos dedicated to the tapping la-

dle and LF, space was also allocated for the installation of three additional silos for furnace carbon injection. In addition, all working platforms are interconnected, and operator access—where required—has been carefully designed to reduce travel distances and minimize time and effort.



	BIN No.	MATERIAL	BULK DENSITY (t/m ³)	SIZE (mm)	SPECIFIC CONSUMPTION (kg/tst)	BIN VOLUME (m ³)	DAILY CONSUMPTION (t)	EXPECTED CAPACITY (days)
"EAF 3"HOLE"	1	LIME (3"hole)	1.1	10-50	32.0	80	59.20	1.49
	2	"DOLOMITE (3"hole)"	1.2	10-50	25.0	80	46.25	2.07
	3	"CARBON (3"hole)"	1.0	10-50	15.0	80	27.75	2.88
LF / TAPPING	1	LIME LF/Tapping	1.1	3-10	8.0	16	15.60	1.13
	2	LIME LF/Tapping	1.1	3-10	8.0	16	15.60	1.13
	3	Flux	1.2	5-10	3.0	16	5.05	3.28
	4	CARBON	1.0	10-50	1.0	16	1.95	8.21
	5	FeSi	1.7	5-50	1.5	16	2.93	9.30
	6	SiMn (HC)	3.9	10-50	7.5	16	14.63	4.27
	7	FeMn (HC)	4.0	3-50	2.0	16	3.9	16.4
	8	Spare	/	/	/	16	/	/

Fig.5 - MHS main data.

The shell maintenance area reflects the strong commitment of SMS and Hybar to safety and environmental performance. A movable hood above the lower-shell refractory de-bricking stand is directly connected to the secondary line of the approximately 1.5 million Nm³/h (approximately 900,000 scfm) Gas Cleaning Plant. The main baghouse, based on a pulse-jet design, is located immediately outside the maintenance area, reducing both distance and investment requirements while still providing an adequate safety margin for full-power EAF operation.

Between the shell maintenance area and the EAF operating platform, scrap buckets are transported by dedicated trailers. Hybar has opted for an external open scrap yard,

where the buckets are prepared before being dispatched to the meltshop bay. Scrap quality and weight recipes are managed by the automation system and exchanged in real time with the EAF process control system.

Electric Arc Furnace EDGE design

At the center of the steelmaking area is the EAF EDGE design, complemented by X-Pact® AURATM DC technology. SMS has standardized the size range and design of Electric Arc Furnaces for CMT® applications. The main furnace sizes currently available are as follows:

- heat size 35 t (38 sht) for CMT350;
- heat size 50 t (55 sht) for CMT550;
- heat size 70 t (77 sht) for CMT700.

The EDGE DC furnace for CMT® is equipped with side-wall-mounted modular oxygen injectors, eliminating the need for lance manipulators, furnace wall openings, and "open-door" operation. In future, the Conso® technologies installed at Hybar will be succeeded by new JetLite® combined burner injectors. Developed in close collaboration with steelmakers, this burner is designed to maximize user-friendliness while simplifying operation and maintenance.

With the Condoor®, the furnace can operate primarily with the slag door closed, reducing the ingress of excess air into the shell and thereby improving energy efficiency. The Condoor® is actuated by double-acting hydraulic cylinders and operated automatically. In combination with the X-Pact® Sampler robot, it also enables unmanned operation at the slag door (figure 6).



Fig.6 - Condoor® with X-Pact® Sampler.

Single-point roof lifting is a key element of the mechanical design. A single heavy-duty cylinder actuates lifting and lowering of the roof, enabling it to be disconnected without operator intervention, with the only exception being the decoupling of the water hoses. The following benefits are associated with this design:

- more space above the roof;
- faster delta refractories and delta ring replacement;
- faster roof and shell exchange procedure;
- lifting speed from 50 to 100 mm/s.

SMS partners with Systems Spray-Cooled™, delivering a state-of-the-art furnace body combined with the consolidated Spray-Cooled™ upper shell and roof design (figure 7).

The Spray-Cooled™ equipment includes the furnace sidewall, roof, and elbow. As part of the project, Systems supplied its new B.A.S.S. Multi-Element Bag Strainer™ system, which provides enhanced filtration and contributes to extended equipment life. The decision by SMS and Hybar to install Spray-Cooled™ equipment was driven by its advantages in safety, ease of maintenance, and environmental performance, making it one of the most sustainable furnace equipment solutions available.



Fig.7 - EAF EDGE design: Spray-Cooled™ upper shell and roof.

The DC configuration (figure 8) provides strong natural vertical stirring, which enhances bath mixing and improves temperature homogenization. This leads to shorter power on time and lower electrical energy consumption.

In addition, reduced carbon injection and natural gas usage help decrease emissions and minimize the overall CO₂ footprint.



Fig.8 - EDGE DC in operation.

The X-Pact® AURATM DC power-feeding system (figure 9) [2] delivers a clean electrical load with low losses in the high-current circuit, a high-power factor, rapid electrode control, and low total harmonic distortion while also being designed for integration with renewable energy sources. The furnace is rated at an average of 46 MW and

features conductive arms connect-ed to the 24-inch electrode, which is controlled by the SMS SynReg® regulation system. In combination with the electrode regulation system, power electronics enable more flexible arc control than conventional AC and DC power systems.



Fig.9 - X-Pact® AURATM installation in the EAF power-feeding room.

Hybar meltshop main design data

The main characteristics of the CMT® meltshop currently in operation in Osceola are summa-rized below:

Tab.1 - Main design technical data.

Item	Value	Unit	Notes
EAF			
Heat size	50	t	
EAF volume	81	m³	Net volume
EAF diameter	5,500	mm	Inner shell
EAF electrode diameter	610	mm	
EBT hole diameter	140	mm	
Burners (qty. / power)	3 / 3.5	# / MW	
O2 injectors (qty. / flow)	3 / 2,000	# / Nm³/h	
C injector (qty. / flow)	3 / 40	# / kg/min	
AURA modules (qty. / max. current)	6 / 16	# / kA	
LF			
LF transformer	8 (+ 15%)	MVA	
LF heating rate	4.5	k/min	
LF electrode diameter	304.8	mm	

Hybar EAF operational data

The Hybar team and SMS group finalized the technology supply in August 2023. Most of the equipment was manufactured in Europe, with site deliveries taking place in stages throughout the second half of 2024. Erection activities continued during the first half of 2025 and were subsequently followed by commissioning with the following key 2025 milestones:

- September 14: First arc on the new X-Pact® AURATM DC furnace.
- September 16: First continuous cast achieved at an initial commissioning speed of 4.6 m/min and rolled in endless mode.
- October 9: Stable endless rolling practice established.
- October: First production shipments to customers.

At the end of 2025, with commissioning still ongoing, the plant achieved the following performances:

- 28 heats in 24 hours (75% of planned capacity), including 22 heats in full continuous rolling mode.
- Record tap-to-tap time of 33 minutes (nominal time improved by 10%).
- Liquid steel energy consumption of 380 kWh/t (nominal power consumption improved by 15%).
- Power factor > 0.96.

The plant is in the final commissioning phase with the defined performance improvements already demonstrated.

Next steps are continued commissioning, optimization to reach full rated capacity, and handover to sustained commercial operation.

EAF KPIs

Extended data was collected and analyzed throughout December 2025 and January 2026, primarily focusing on the performance of the EAF. It is worth mentioning that not all the preconditions were in place for full appraisal; nevertheless, the results of the site offered some evidence.

The X-Pact® AURATM system has delivered an exceptionally high level of reliability from day one. Full power was achieved after only three heats, reflecting the extensive development work behind the technology. Its ramp-up was faster than that of any comparable advanced solution previously introduced by SMS group.

Power on time

This performance is demonstrated by the stable and consistent power on time shown in figure 10, while the best shifts recorded power on times of 30 minutes or less, as illustrated in figure 11. At the same time, the EAF is not yet operating at full power, as the average power shown in figure 10 remains below 35 MW compared with the nominal 46 MW. This highlights the plant's significant remaining potential. SMS's target is to achieve a consistent power on time of below 30 minutes, which would position the Hybar EAF among the world's top performing furnaces.

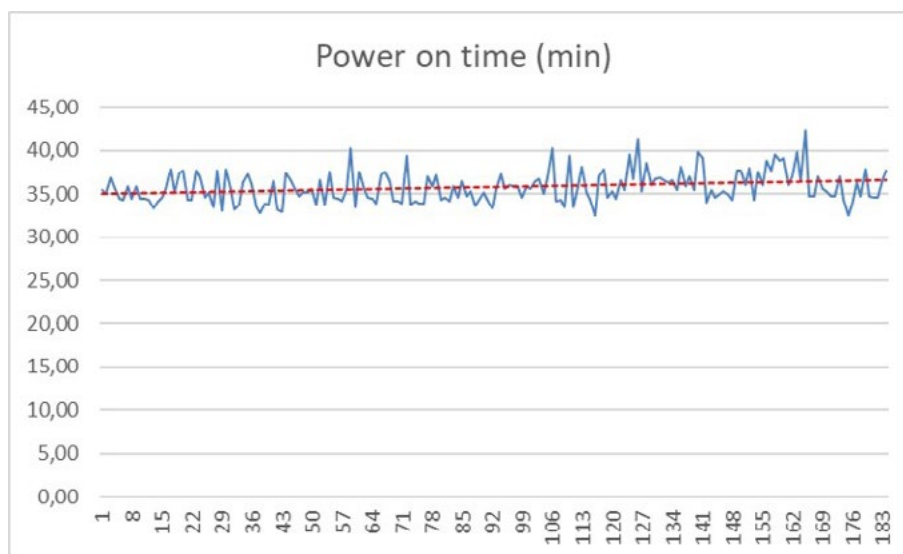


Fig.10 - December-January: Power on time.

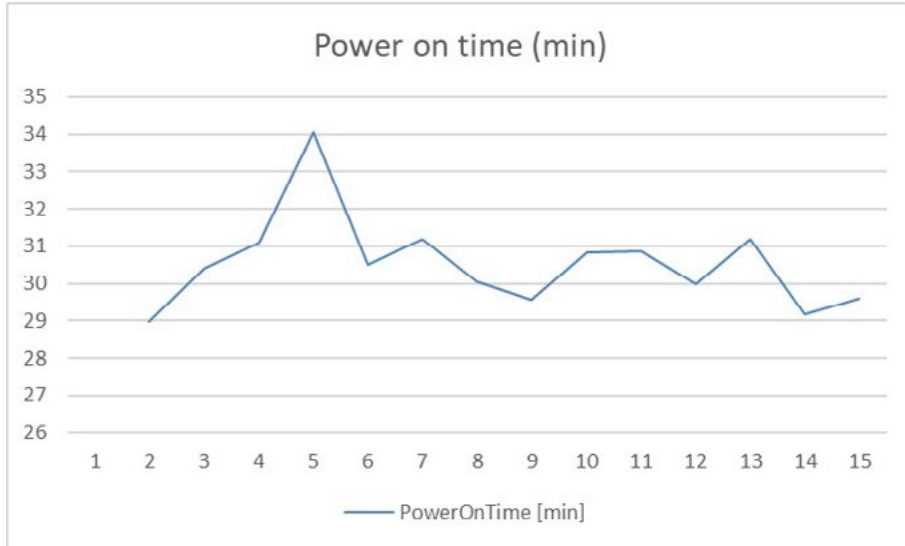


Fig.11 - One shift: Power on time.

Electrical energy consumption

The analysis of electrical energy consumption indicates a stable operating trend, with average values in the range of 370-400 kWh/tls and best heats achieving figures well below 360 kWh/tls (figure 12). These results are comparable to those reported for most U.S. sidewall horizontal scrap preheating installations. This represents a signifi-

cant achievement, confirming both the soundness of the design and the effectiveness of the selected technologies. The data should, however, be evaluated in relation to the quality of the scrap charged into the furnace: the proportion of return scrap has increased in recent periods, and the influence of heavier, denser material should therefore be considered when interpreting these figures.

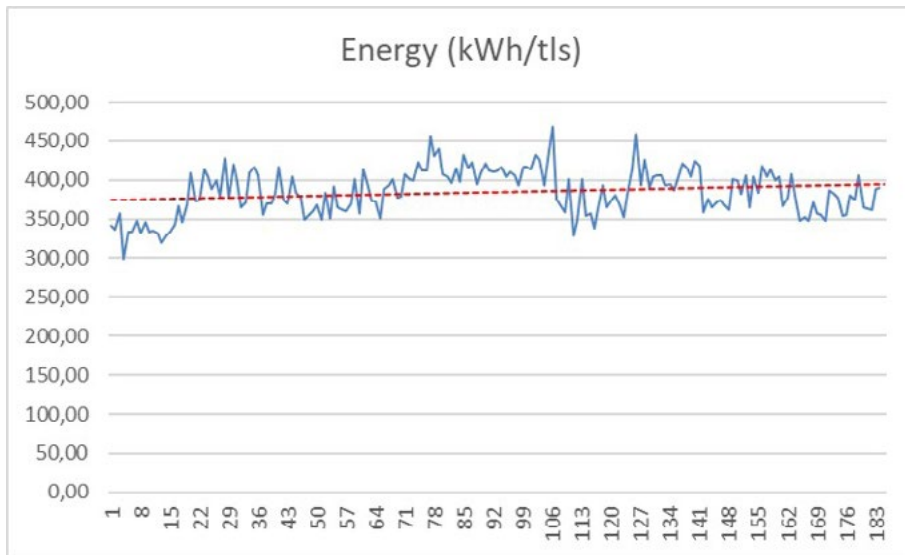


Fig.12 - December/January: Electrical consumption vs. scrap type.

Natural gas

Natural gas consumption has been consistently maintained below 5 Nm³/tls (see figure 13). During the latter part of January, a further significant reduction was achieved, bringing consumption well below 4 Nm³/tls (see figure 14). This represents a notable performance,

particularly in view of the single-bucket operating practice and the furnace size. With an appropriate balance between electrical energy input and burner input, the furnace can melt the single bucket efficiently and initiate oxygen lancing at a very early stage.

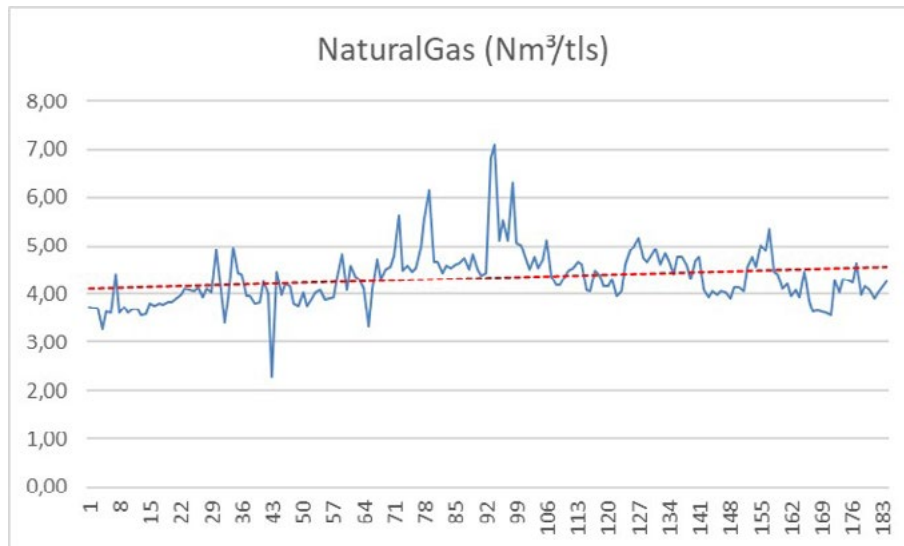


Fig.13 - December/January: Natural gas consumption vs. scrap type.

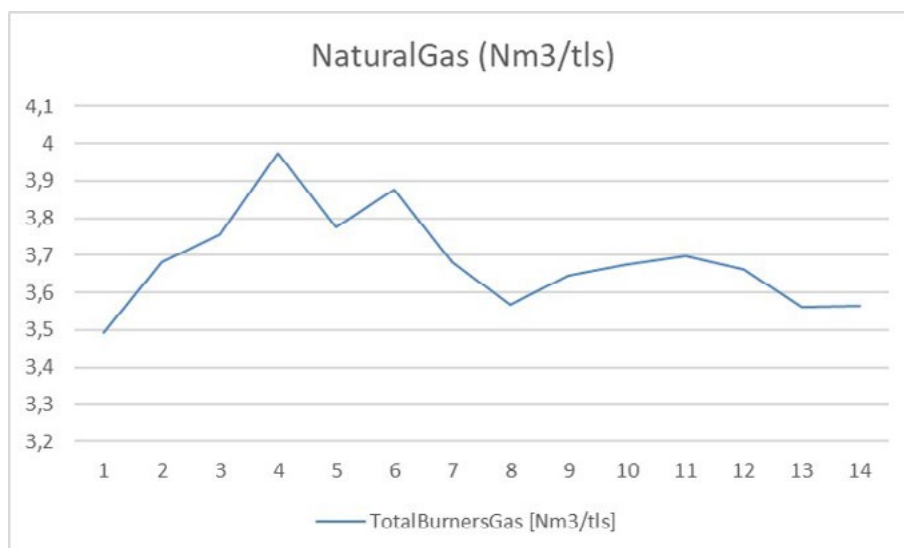


Fig.14 - One shift: natural gas consumption.

This further demonstrates the strong commitment of Hybar and SMS group to achieving the lowest CO₂ footprint ever recorded in rebar production.

Consolidated performance

To provide a clearer view of the consolidated performance, figure 15 illustrates the tap-to-tap time as a function of tapping weight and electrical energy consumption; it is also worth noting that the average tapping temperature is approximately 1,650 °C (3,002 °F).

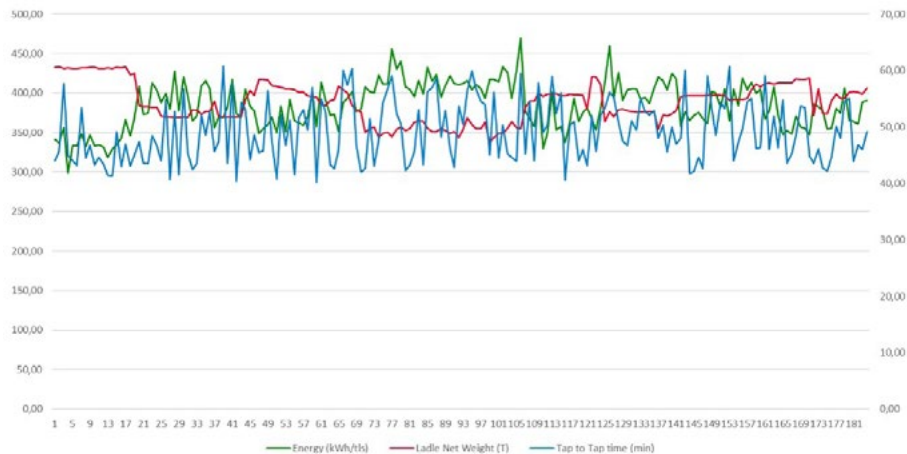


Fig.15 - December/January: EAF consistency.

SMS group and Hybar are now working closely together to further enhance performance and minimize variability in the key operating parameters. It is well understood that consistent production conditions are essential to ensuring stable, high-throughput rebar production.

CONCLUSIONS

The CMT® meltshop requires a customized design approach, and the Hybar furnace has confirmed the validity of the selected solutions. Although further improvements are still being pursued, the Electric Arc Furnace has already demonstrated outstanding performance and offers

a strong basis for continued development. Standardization of the CMT® meltshop concept across different production capacities will help reduce both engineering lead time and, more importantly, commissioning effort. The single-bucket EDGE configuration, combined with the X-Pact® AURA™ DC EAF technology, has proven to be a high-performing solution, achieving results comparable to those of the best U.S. horizontal scrap preheating systems. SMS group and Hybar will continue their close cooperation to further increase productivity and support the achievement of Hybar final targets.

REFERENCES

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