



ROMANIAN STEEL INDUSTRY THE THIRD YEAR OF EU INTEGRATION ENVIRONMENTAL ISSUE TO COMPLY THE EU STANDARDS AND REGULATIONS – BADISCHE STAHL-ENGINEERING “OFF GAS” CONCEPT

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Abstract:

This article presents Romanian steel industry production and environmental efforts in view to achieve the EU environmental standards and regulation and remain profitable. BSE – Badische Stahl Engineering - “off gas” concept means “High productivity and low emissions can go hand to hand”

Keywords:

Productivity, emissions, environmental standards, off gas,

1. INTRODUCTION

Environmental protection measures are very much shaped by the EU. The integral approach set forth in the Integrated Pollution Prevention and Control Directive (IPPC Directive) deserves special mention in this context. Best available techniques, subject to the conditions of the IPPC Directive, are described in a series of reference documents (BREF documents). The new development and improvement of available techniques also gives rise to changes in operating practice, not least as a result of new legislation and regulatory activities of the European Union and its member states

European Union has one of the most competitive steel industries of the world, Steel companies viable from an economic-financial point of view (restructured, modernized and revamped), complex fabrication structure with accent on the fabrication of high added value products; High technological level, innovation capacity, skilled labor force, organization, integration, most severe environment legislation in the world;

European Union represents the main action engine in the field of global policy of environment protection, including as concerns the climate changes.

Badische Stahlwerke GmbH (BSW), one of the most productive Mini Mills in the world, reached more than 2 million tons of good billets in 2007 operating with two conventional 90-ton electric arc furnaces (EAF). For more than 20 years BSW has been working hard to reduce their gaseous emissions with the focus on particulate matter, organic compounds and also carbon dioxide. BSE- Badische Stahl Engineering, belong to BSW, is little sister and all the research and experiment are done practically in BSW before becoming “products”.

Operation of a steel plant on a very high productivity level is the basic for high efficiency and low cost. Beside the traditional key figures of a steelmaker we realize all over the world, that the stakeholders can no longer ignore the environmental standards. Especially the off-gas has a huge impact on a “clean” production. If we look at the present debates, it is clear for the industry that one of the challenges will be the reduction of global greenhouse gases.

This paper shows which level of emissions could be reached without having any disadvantage on productivity and gives an overview of various standards and practices in Europe and worldwide.

2. ROMANIA – MEMBER OF EU(27)

Main indicators of EU 27 steel industry for 2007 are presented in Table1. Romanian Steel Industry in restructuring, modernizing and revamping, have the capacity to produce by two processes: converter 71% and electric 29% the structure and quantity (Table 2).

We must mention that 96.5 % of the weight was continuous cast steel.

European and worldwide recognition of Romanian steel industry with a capacity of 9.15 mil. Tons / year. 65.8% of capacity is converter steel making, especially for flat products. We must

mentioned that all the companies have 100% capacities for continuous casting of crude steel.
The Romanian steel industry is owned by large international steel producing groups (Table 3).

Table 1. Main indicators of EU 27 and Romania steel industry (2007)

Crt. No	Indicator	Europe	Romania	%
1	Production capacities (crude steel)	244	9.1	3.73
2	Crude steel production	210	6.2	2.95
	- converter		4.4	
	- electric		1.9	
3	Continuous cast steel	200	6.1	3.05
4	Hot rolled production	172	5.5	3.20
	- flat	103	1.9	1.84
	- long	69	3.7	5.36
5	Steel tubes production	32	0.8	2.50
	- seamless	49	0.6	1.22
	- welded		0.2	
6	Domestic consumption of steel products	182	4.7	2.58

Table 2. Romanian steel industry ownership and production (2007)

Company	Production capacities - k tons -	Process	Production 2007 - % -
ArcelorMittal	6950	Converter	75.9
- Galati	6000	Electric	71.1
- Hunedoara	950		4.8
MECHEL (Targoviste and Campia Turzii)	1015	Electric	7.8
MECHEL - DUCTIL STEEL (Otelu Rosu)	300	Electric	5.6
TMK (Resita)	450	Electric	5.6
TENARIS (Calarasi)	400	Electric	5.1
TOTAL	9115		100

ArcelorMittal and MECHEL possesses nowadays 93 % of steel making capacity and 89.3% of the crude steel production (2007).

After 1989 in the framework of restructuring process:

- ✚ were closed and dismantled over 8 mil. tons of crude steel making capacities;
- ✚ were closed and dismantled over 10 mil. tons of rolling capacities;
- ✚ the personnel number in steel industry diminished from 150 thousand persons up to 37 thousand persons in 2007;
- ✚ it increased the weight of continuous cast steel from 36.7% in 1989 up to 96.5% in 2007;
- ✚ the labor productivity was in 2007 of 326 t. steel/man

The crude steel production of Romanian steel industry, realized in the last years was of 6.2 mil. Tons, out of which cast steel production reached 6 mil. tons in 2007 and production of hot rolled products established in the last years at 5.5 mil. Tons (Figure 1.).

PRODUCTION EVOLUTION

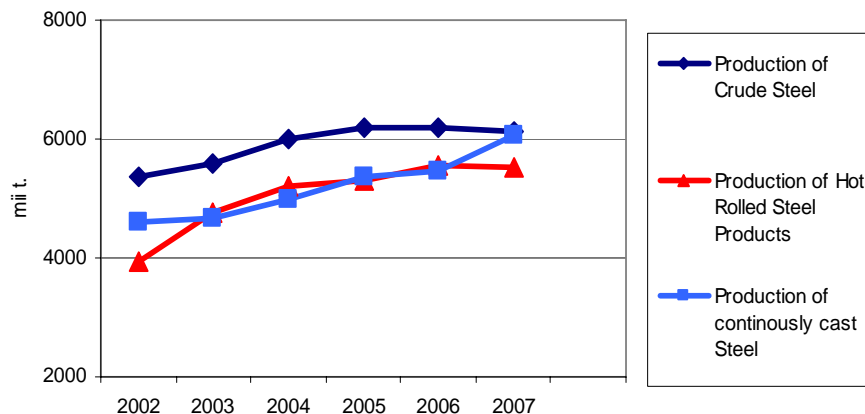


Figure 1. Main indicators of steel production

Romania transposed totally EU legislation in the field of environment. The IPPC Directive was transposed in the Romanian legislation by the GED no. 34/2002, approved by the Law no. 645/2002. Deadlines for conformation with The Romanian Steel Companies din Romania, develop investment programs to comply with IPPC requirements up to the deadline approved by the EC (IPPC Directive for the steel companies with transition periods accepted by EC between 31.12.2012-31.12.2015) inside the Conformity Programs negotiated with environment authorities

3. DESCRIPTION OF THE EXPERIMENTAL SETUP

3.1. Typical emissions from STEEL PLANTS

Emissions from EAF steel plants are linked to the input material. All organics and heavy metals are entering the process via the scrap and are therefore difficult to control.

Dust is generated during meltdown of scrap through vaporization of metals mainly in the electric arc. Inorganic gaze generation is linked to the process itself. Normally emissions from stacks are given in concentrations (mg/Nm³). Since off-gas volume flow can vary significantly for different fume systems it is difficult to compare emissions from different installations. For this reason so called emission factors have been defined. An emission factor is the average emission rate of a given pollutant for a given source, relative to units of activity. For a steel plant this is for example the emitted weight of a pollutant per ton of steel produced like 100 g of EAF dust per ton of steel.

On the other hand the legal situation concerning limiting values for certain pollutants is very confusing. There is not a single limiting value for a pollutant which all industrialized countries in the world would have in common. The European Union is on the way to harmonize the environmental laws but is still far away from common limiting emission values.

The only way to get the full picture is to compare emission factors with the range of emission factors throughout the industry. The data basis so far is not very big but the IPPC office of the European Union is publishing emission factors in the so-called “Best available techniques reference document for the Iron and Steel industry” (BREF document).

3.2. Environmental performance and productivity of BSW

BSW – located at Kehl/Germany - is a so-called mini-mill founded 1968 by Willi Korff. The steelmaking facilities comprehend an EAF melt shop with two 90-t-EAF equipped with 90 MVA transformers, an average tap-to tap time in 2007 of 39.8 min and a productivity of 135 t/h, having produced 2.17 tons of billets in 2007. BSW is using state of the art equipment for their fume extraction systems. The generated off-gases are sucked off directly from the furnaces through the forth hole as well as by a melt shop ventilation system with a combined capacity of 1.8 million Nm³/h and cleaned in the de-dusting systems with a filter area of 38,000 m². Schematic drawing for off-gas system at BSW is shown in figure 2.

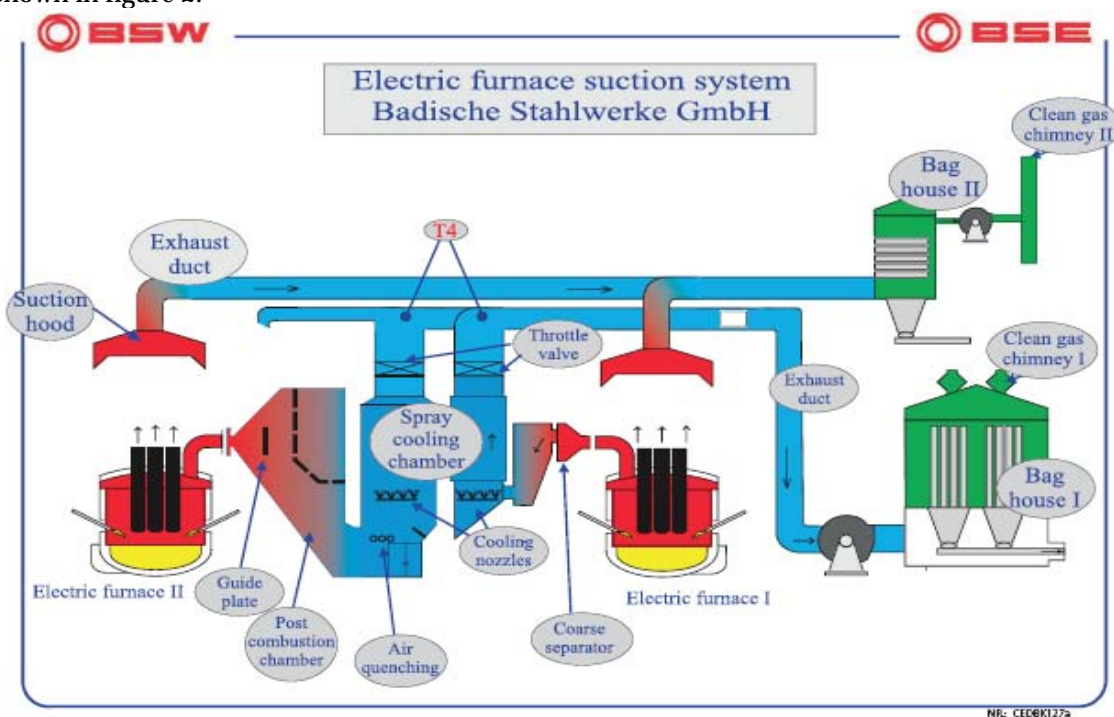


Figure 2: Schematic drawing of BSW's off-gas system

3.3. BSE “OFF GAS” concept

“OFF GAS” concept is optimal for our environment and companies efficiency, the necessary steps are:

- ✚ Analysis and optimization of shop ventilation and off-gas treatment by fluid dynamic models and Computational Fluid Dynamics (CFD)
- ✚ Concept, planning, supplier recommendation, quality control, implementation and supervision in a single source.

a). Fluid Dynamic Modeling

BSE throw this specialists, providing solution for optimal OFF-GAS treatment, making measurement in Steel Shop Melting building in representative points at different stages of steel production and with this dates analyze the emission quantity, intensity and directions, and base on fluid dynamic modeling methodology establish by Bender Corp of BSE group member (USA), establish the best concept and engineering for off gas system dedicated for each bay (Figure3. and Figure 4).



Figure 3. FLUID DYNAMIC MODELING- Charging



Figure 4. FLUID DYNAMIC MODELING –Taping

b). Computational Fluid Dynamics (CFD) - Simulation

The CFD simulation developed by BSE (Figure 5) means simulation of whole ductwork or single parts, temperature, velocity and flow parameters in view to determined the best technical solutions for off gas system. BSE developed:

“High Temperature Quenching (HTQ) System” (Figure 6):

- Most rapid off-gas cooling by atomized water
- Lower operation costs due to lowest pressure drop in the cooling system
- Low maintenance requirements
- Reduction of water-cooled ductwork

Main technological operations:

- Cooling of the gases from Direct Furnace Evacuation
- Injection of atomized water into water spray chamber
- Atomizing of the water by compressed air in spray lances
- Valve racks for water and compressed air

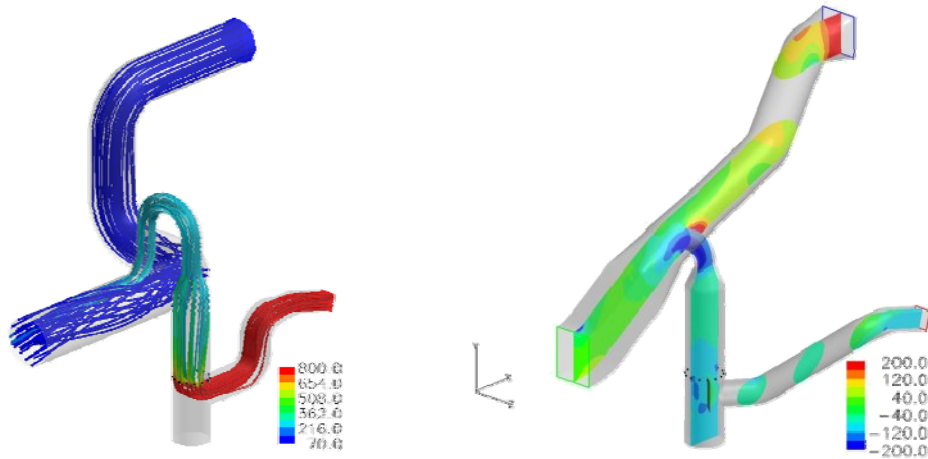


Figure 5. Simulation CFD – whole ductwork



Figure 6. High temperature quenching system



c). Filter technology

Baghouse specification is new and specific for each type of EAF and fan selection complete BSE's scope of off-gas concepts and engineering.

4.3. EMISSION OF PARTICULATE MATTER

In Germany the limiting value for dust emission for EAF plants is 5 mg/Nm³ (0,0021 gr/scf). With today's filter technology it is no problem to comply with this rule. Nevertheless BSW is measuring continuously the dust emissions on both the stacks. The results are reported to the authorities in real time. An example of the results of one year is shown in figure 9.

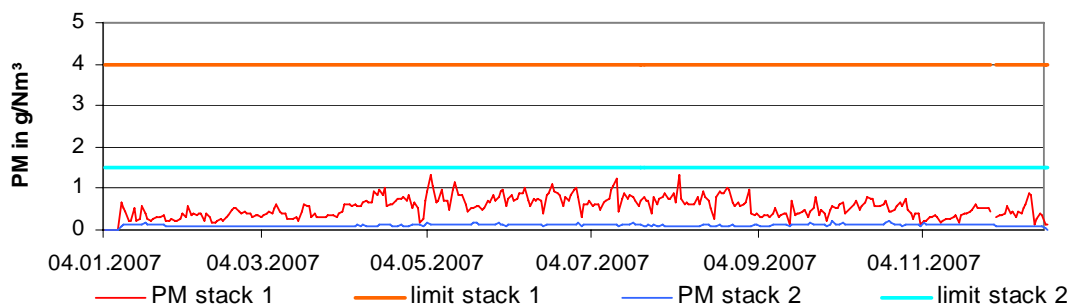


Figure 7. Continuous dust emissions of BSW at stack 1 & 2, 2007

The figures of BSW are far below any limiting values. In comparison with other steel plants BSW is again in the top flight of the emission factors. The comparison is shown in figure 10. The range of emission factors is very high. But with 0,008 mg/ton of steel BSW is very close to the minimum value.

The Romanian steel industry figures are between 20 to 30 mg/Nm³ at stack emission, but the steel workshop emission are not solved yet in any Steel shop in Romania, the dead line for this is the ending of IPPC compliance program, Table 5.

Romanian Technological and Environmental investment program, was negotiated for each Company. In Figure ... are indicators for investment between 2004-2008.

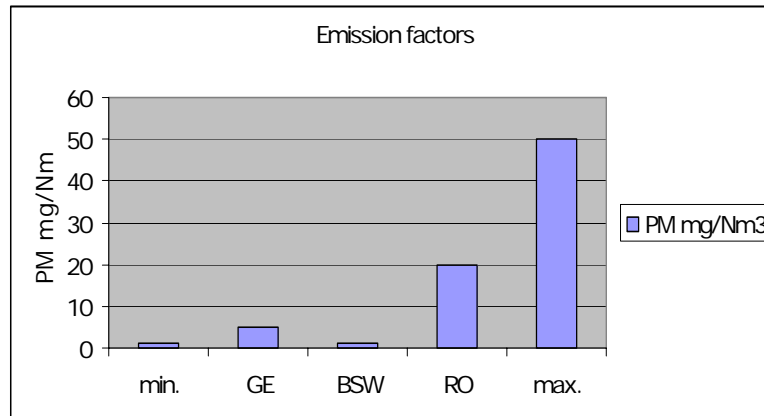


Figure 8: Comparison of emission factors for particulate matter

The Romanian Steel Companies from Romania, develop investment programs to comply with IPPC requirements up to the deadline approved by the EC, inside the Conformity Programs negotiated with environment authorities.

4. ANALYSIS OF RESULTS AND CONCLUSIONS

As shown in this paper high productivity of an EAF plant is possible without compromising on environmental performance, especially emissions. Of course some efforts and investments are necessary to operate today's technology in the right way especially in Eastern Europe. BSW is continuously investing in environment to be in compliance with latest rules and obligations. There are possibilities, however, to keep track of the costs for environmental efforts, and steel making can still be profitable in Europe.

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