# PRODUCTION OF STEEL AND ENVIRONMENTAL REQUIREMENTS

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**Abstract**

In this paper, the problems of steel production have been illustrated, particularly the state and dynamics inherent in the groups of 28 countries - the largest producers in the world. Likewise, the ranking of the 25 largest enterprises producing steel has been presented. Furthermore, the chosen methods for the streamlining of steel production have been outlined. In particular, the environmental aspects of the functioning of steel producers have been illustrated.

**Keywords:** Production of steel, ranking of steel producers, environmental protection.

## 1. INTRODUCTION

The economic development of the world is determined by the production of a multitude of basic products. One of the most important goods is that of steel, whose universality of application has caused the constant rise in its production. For over a decade, it has been however characterized by certain changes in the sphere of steel production. It is essential to emphasize that the processes of the concentration of steel production in the world is taking place, which is confirmed by the change in the ranking list of the 25 largest producers of steel. Enterprises producing steel are implementing various methods to streamline production. The area of particular interest for steel producers is that of environmental protection with regard to the binding ecological requirements.

## 2. ANALYSIS OF STEEL PRODUCTION

The processes of manufacturing steel are realized in enterprises of varying sizes in terms of scale. The past few years have given rise to takeovers, consolidation or liquidation of enterprises in the steel industry. In order to illustrate the process of the concentration of production, a ranking list of the largest steel producers has been presented, together with an evaluation of the group of the largest steel producers (**Table 1**).

The data presented indicates that in 2000 the largest enterprises produced approximately 28 million tons of steel. These were the two enterprises of Nippon Steel and POSCO. A similar quantity of between 20 million tons and 24 million tons of steel was manufactured by four enterprises. In terms of the production of between 7 million tons and 17 million tons of steel, 19 enterprises are listed. The enterprise Gerdau with its level of production of 7.1 million tons of steel is found in 25th position on the ranking list of the largest producers producing approximately 25% of the quantity of production of Nippon Steel, giving it first place in terms of the largest producers of steel. The difference between the largest producer of steel, namely Nippon Steel and the smallest one on the said ranking list, Gerdau, is at a ratio of four to one.

A completely different situation occurred with relation to the ranking list of the 25 largest enterprises producing steel in the world in 2013. The first position was held by ArcelorMittal with production at the level of 96.1 million tons of steel. This quantity was over 3 times greater with relation to Nippon Steel that was in first place the ranking list in 2000. The group of enterprises producing between 50 million and 31 million tons of steel consists of nine producers in total. The remaining producers, manufacturing between 25 million tons and 14 million tons of steel are concentrated in a group of 15 enterprises.

A characteristic phenomenon of the period of 2000-2013 is the growth in the process of the concentration of steel production. This process is first and foremost caused by the merging of enterprises, e.g. Arcelor with Mittal, or Nippon Steel with Sumitomo Metal Corporation. These changes are also the result of the dynamic growth in steel production among Chinese enterprises.

**Table 1** Ranking of largest steel producers in the world in 2000 and 2013

| No. | Producers of raw steel in the world in 2000 | Quantity of production in millions of tons | Producers of raw steel in the world in 2013 | Quantity of production in millions of tons |
|---|---|---|---|---|
| 1 | Nippon Steel | 28.4 | ArcelorMittal | 96.1 |
| 2 | POSCO | 27.7 | Nippon Steel&Sumitomo Metal Corporation | 50.1 |
| 3 | Arbed | 24.1 | Hebei Steel Group | 45.8 |
| 4 | Ispat International | 22.4 | BaosteelGroup | 43.9 |
| 5 | Usinor | 21.0 | Wuhan Steel Group | 39.3 |
| 6 | Corus | 20.0 | POSCO | 38.4 |
| 7 | Thyssen Krupp | 17.7 | ShagangGroup | 35.1 |
| 8 | Shanghai Baosteel | 17.7 | AnsteelGroup | 33.7 |
| 9 | NKK | 16.0 | ShougangGroup | 31.5 |
| 10 | Riva | 15.6 | JFE | 31.2 |
| 11 | Kawasaki | 13.0 | Tata Steel Group | 25.3 |
| 12 | Sumitomo | 11.6 | Shandong Steel Group | 22.8 |
| 13 | SAIL | 10.9 | U. S. Steel Corporation | 20.4 |
| 14 | USX | 10.7 | Nucor Corporation | 20.2 |
| 15 | Magnitogorsk | 10.0 | Tianjin Bohai Steel | 19.3 |
| 16 | Nucor | 10.0 | Gerdau | 19.0 |
| 17 | China Steel | 10.0 | Maanshan Steel | 18.8 |
| 18 | Severstal | 9.6 | Hyundai Steel | 17.2 |
| 19 | Betlehem Steel | 9.1 | Benxi Ste | 16.8 |
| 20 | Anshan | 8.8 | EvrazGroup | 16.1 |
| 21 | Novolipetsk | 8.2 | ThyssenKrupp | 15.9 |
| 22 | Shougang | 8.0 | Severstal | 15.7 |
| 23 | BHP | 7.5 | NLMK | 15.5 |
| 24 | LTV | 7.4 | ValinGroup | 15.0 |
| 25 | Gerdau | 7.1 | Metinvest | 14.3 |
| 26 | | | JianlongGroup | 14.3 |

Source: Top Steel Producers 1988 to 2005, Published by: Ali- Muhammad JAN 02, 2011; www.worldsteel.org Jan, 2015

## 3. CHOSEN METHODS OF STREAMLINING THE PRODUCTION OF STEEL

In the steel industry, methods that ensure the increased competiveness of enterprises are much sought after [1]. The greatest concerns of the steel industry are of particular interest. One of the most interesting methods applied is that of the Total Productive Maintenance (TPM), which is identified with serving the maintenance of the machinery parks of the enterprises in question. This service is executed by the operators and personnel

of the maintenance department. Within the framework of the afore-mentioned activities the management of productivity and quality of production are also deserving of mention. Processes undertaken that are aimed at the optimization of the work of machines and equipment as the basis of deliberations is the assumption of the possibilities of improving the competitive position of enterprises in the case of the efficiency of the machines and equipment. The level of efficiency is decided by the attainment of the so-called three zeros. These zeros should be characterized as follows: breakdowns, shortfalls and accidents at work. The authors in describing the aforesaid method, namely G. Mazur, J. Obrzud, present the concept of maintenance in the further sections of this paper within the framework of Arcelor Mittal Poland (A.M.P.) that has been implemented there since 2009 as an element of the Main Plan of Improvement, which has been directed at first and foremost the reliability of equipment. It is essential to emphasize that the program of ARMP (Asset Reliability Management Programme) is executed in all the plants of the European sector of flat products of Arcelor Mittal. [2]

The program of ARMP shall be presented in further deliberations, basing on four axes that include organization, improvement of reliability, implementation of standardization of repair work, as well as management of spare parts. In the following stage, the matrix of criticality shall be prepared in the fields of production, quality, costs of delivery, safety, the environment and motivation. A particular element in the evaluation was attributed to the aim of objectification of the results. The matrix of risk which is prepared in the subsequent stages of the adopted method is of particular significance. Furthermore, evaluation has been carried out on breakdowns in Arcelor Mittal.

The participation of the operators in the process of avoiding breakdowns also merits mentioning. This contribution relates to activities in terms of the preventive inspections of equipment, improving the control of equipment and development of the decision-making skills and competences in the area of production. [3]

Analysis of the processes of production also relates to Vitkovice Steel as a company. The essence of the problem boiled down to the relations in the sphere of the assortment structure and the individual operating time of machines. Following the execution of further approximation and propositions of solutions, the data entered into the following table was attained. In the comment it is stated that ...”in the case of the remaining planned production volume it would be necessary to intake and release in terms of preference according to orders from the category A or B in the relevant month.” [4]

In the case whereby the remaining operational time of the cutting machines (the available plant capacity) does not match the planned production volume, it would be necessary to intake and release in terms of preference according to the orders from the category A or B in the relevant month.

**Table 2** Production output in the Vitkovice Steel

| Category | Output (kg . hour-1) | Frequency (%) |
|---|---|---|
| A | P > 2000 | 21.75 |
| B | 2000 ≥ P> 500 | 51.07 |
| C | P ≤ 500 | 27.18 |

Source: Lenort R., Staś D., Sobek J., Feliks J.: Solution of intake and release of orders to production process based on the example of a flame-cut shape production plant. [in:]. Wybrane zagadnienia logistyki stosowanej. Polska Akademia Nauk, Warszawa, 2007.

## 4. ENVIRONMENTAL ASPECTS OF THE FUNCTIONING OF ENTERPRISES PRODUCING STEEL

The functioning of enterprises producing steel is acknowledged to be detrimental to the natural environment. The basis of this claim is the Kyoto Protocol in Europe. This protocol started in 2005 and imposed obligations to reduce the pollution of the environment on the enterprises producing steel. A typical example of this type of

activity is displayed by Arcelor which …" believes the current implementation of CO2 allocations on a national scale is not intelligent for multinational companies, even endangering industry and creating an unfair distortion of competition , which may drive integrated steel production out of Europe".[5]

Arcelor believes the current implementation of CO2 allocations on a national scale is not intelligent for multinational companies, and may even endanger the industry itself by creating an unfair distortion of competition, which may in turn drive integrated steel production out of Europe [6]. The newly created European Steel Technology Platform is now a vehicle for technological research in reducing CO2 emissions and providing dialogue to ensure fairness in terms of the future rules of the game.

## 5. ENVIRONMENT ENERGY AND GLOBAL WARMING- CHALLENGES FOR STEEL: THE ARCELOR CASE

However, the company cannot discard the backup solution of producing steel semis outside Europe. Keeping this alternative open is and shall remain one of Arcelor`s major considerations in its growth strategy. The growing trend of production in the enterprises of the steel industry is causing the necessity of sustainable growth [7]. Sustainable growth concentrates on the pro-ecological activities that eliminate the negative impact of the steel industry on the environment [8]. The most important activities are as follows [9]: realization of investment, as a result of which new processes are implemented and new products of a pro-ecological nature are created,

- reduction of emissions of greenhouse gases in the production processes of steel,
- improvement of the efficiency of the utilization of raw materials, materials, water and reduction of waste,
- reduction of singular use of primary and secondary energy,
- improvement of recycling,
- implementation of systems of environmental management.

Pro-ecological activities of enterprises are emerging by means of the implementation of dematerialization of production. In these activities, an enterprise tries to utilize the resources of the natural environment. For instance, it implements the system of Voluntary Environmental Obligations towards Clean Production (VEC-CP), within the framework of which the principle of prevention is applied. It is thus possible to prevent the occurrence of pollution during the course of the initial decision to start up production. In such a case, the implementation of technology which saves raw materials and other materials, while also being low in terms of waste and emissions generation becomes more realistic. [10]

Interesting research in the field of pro-ecological management has been carried out by T. Nitkiewicz. The author in question distinguished the alternatives by encompassing ecological undertakings that were defined as follows [11]:

- implementation of eco-innovations that are characterized by such ecological processes that restrict the negative consequences of the impact of manufacturing enterprises on the environment,
- acceptance of the principles of eco-designing, in accordance to which protection of the environment is taken into account at the stage of designing,
- execution of the certification of the goods with ecological labels as a result of having the rights to ecological markings,
- application of a regional material market as a result of the utilization of materials that are more efficient and environmentally friendly,
- investing pro-ecologically by means of purchasing a new machinery park with improved environmental parameters, as well as repair and modernization of the facilities that do not fulfil the pro-ecological requirements,
- environmental management in accordance with the ISO 14001 norms and EMAS standards, while also integrated systems,

- cooperation and realization of projects of a pro-ecological nature,
- process restructuring in manufacturing enterprises that mainly involves the implementation of recycling and segregation of waste.

The problem of environmental pollution in terms of the aspect of the competences held is indicated by J. Zyra. The author in question particularly emphasizes the significance of technical competences that help in the process of market and environmental adaptation. [12] Hence, the strategy of the producers of steel is important, within the framework of which it may ensure competitiveness. [13]

The deliberations presented underline the significance of steel production in the economic development of the world and thus certain countries in particular. Likewise, they indicate the necessity to perceive the negative consequences, namely the impact of steel producers on the environment. Producers of steel are systematically initiating undertakings that restrict the negative effects of manufacturing activity with the aim of improving the state of the natural environment of mankind.

## 6. CONCLUSION

The analysis presented in the sphere of the production of steel confirms the importance of this product in the global economy. Despite the prevailing crisis, the trend of steel production is constantly rising and a similar trend is foreseen for the upcoming years. It is essential to note the increase in the concentration of production in the group of the largest producers of steel in the world. This fact may significantly affect the increase in outlays towards environmental protection due to the negative impact of steel producers on the natural environment. The increase in the ecological requirements shall force steel producers to undertake action that is environmentally friendly.

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