

Opportunities and prospects of the ukrainian metallurgy development

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Abstract

The production capacity, the economic situation and prospects of the mining and metallurgical complex of Ukraine was analyzed in the given article. The weakness of the competitive position of the Ukrainian enterprises in the domestic and foreign markets is shown. A major shortcoming of the current state of metallurgy is the limited influence of the state on its development. The government decisions of the last decade aimed at stabilizing the domestic and foreign markets of metal products were analyzed. The measures that will help to support the metallurgical industry of Ukraine during the current financial and economic crisis and in the long term was suggested.

Key words: METALLURGY, ECONOMICS, INDUSTRIAL POLICY, OPPORTUNITIES, DOMESTIC AND FOREIGN MARKETS, EXPORT

About ten years ago the mining and metallurgical complex (MMC) in Ukraine provided a more than 25% of gross domestic product and more than 40% of foreign exchange earnings. [1] However, in recent years, the volume of steel production and metal production began to decrease steadily. In 2013 the volume of steel production amounted to 32.7 and 27.2 million tons in 2014. Export earnings from sales abroad of Ukrainian metal products decreased in 2014 by about \$10 billion. It was expected [2], that even according to pessimistic forecasts the volume of steel production in the near future would be reduced to 26 million tons per year. However, the realities of 2015 indicate a decrease in Ukrainian steel output to about 23 million tons.

To explain these results exclusively MMC difficulties connected with carrying out the ATO in the Donetsk and Lugansk regions of Ukraine is incorrect, because negative trend of Ukrainian metallurgy development has been evident earlier [2-3]. For twenty

years of independence of Ukraine extremely insufficient attention has been paid and financial resources invested in the modernization and reconstruction of metallurgical production. It is the main reason for the fall of the MMC efficiency. As a result, Ukrainian metallurgy in technical and technological aspects is significantly behind even from Russian, our closest competitor [1-4]. For example, in Ukraine the energy intensity of the blast furnace is by 14-20%, steelmaking is by 16-40%, rolling is by 20-50% higher than in Europe and other technologically advanced countries of the world [5]. The absence of a balanced industrial policy within the state is the essential problem hindering the development of metallurgy in Ukraine. And this is despite the presence of high scientific and technical potential of Ukraine MMC.

Here is one telling example.

As is known, Ukraine exports ~ 40 million tons of the iron ore raw materials per year. In previous years the net profit from the export of one ton of ore reached

about \$ 100 and amounted to several billion dollars a year. However, these funds have not been invested in the reconstruction and modernization of the industry. Now the price of iron ore raw materials is decreased significantly and the resources to clearing the backlog of Ukraine MMC from the modern world level due to export of ore reduced to a minimum.

Another example of a mistaken industrial policy of the state is as follows.

The decrease in 2014-2015 of the export of the Ukrainian metal products and as a result, a reduction of almost 40% of the currency volume supplied to Ukraine negatively impact on the hryvnia exchange rate. It would appear that current situation obliges the government of Ukraine to focus on the search for and implementation of unused reserves in this area. However, experience shows that due to the lack of competence or unwillingness to change anything, the government's actions in the said direction are not lead to the desired results.

For decades Ukraine has been one of the Europe's largest stockist and exporters of metal scrap. At the end of the 2000s in Ukraine up to 8-11 million tons of ferrous metal scrap were stocked per year and export of these raw materials was reached 5 million tons. The scrap was enough with a surplus for the domestic steel industry and for the export. According to the Ukrainian Association of Secondary Metals (UAVtormet) in 2000 year 5.89 million tons of ferrous metal scrap were supplied to the domestic market and 5,188,000 million tons to export Ukraine exported about half of the stocked scrap metal. Export of metal scrap provided revenues to Ukraine of about 1 billion dollars.

It is well known that every state strives to increase its exports. However, in Ukraine the export volume of ferrous metal scrap since 2001 has been steadily contracted and amounted to 367 thousand tons in 2012 and only 255 thousand tons in 2013. One of the arguments by which the authorities have justified and justify today restriction on the export of metal scrap is that if removed restrictions on the export of this raw materials it would be not enough for domestic metallurgy. Therefore, the question arises: how much you need of ferrous metal scrap for the functioning of Ukrainian metallurgy including taking into account the prospects of development of the industry that will be discussed below.

Let us examine this question in detail.

In 2013-2014 on the Ukrainian metallurgical plants 4.45 and 3.37 million tons of ferrous metal scrap (according to years) were delivered. It was stocked by ~ 5.5 million tons per year. For the production of the

planned amount of steel in Ukraine in general in 2013 and 2014 steelworkers have been used 13 and 12% of imported ferrous metal scrap. The relative reduction of the steelmakers need in import metal from ~ 18% per 1 ton of steel in 2000 to 12% in 2014-2015 is due to the gradual decommissioning of outdated open-hearth furnaces. Underline that we are talking only about the imported metal scrap to metallurgical plants. At the metallurgical plant when manufacturing the steel products so called recycling scrap is produced the amount of which at all plants is different and it depends on the composition of the equipment and the technology adopted.

The structure of the steel-making facilities in Ukraine in 2015 and subsequent years will not change. Steelmaking technology will remain the same. As a result of the actual production of steel in January-September of 2015 the volume of steel production in 2015 will amount to ~ 23 million tons. Hence, for smelting of such a large number of steel Ukrainian metallurgists will need $23 \times 0.12 = 2,76$ million tons of import metal scrap (we guided by index of 2014, that is equal to 12% of the needs of metallurgists in the scrap concerning volumes of steel produced). It turns out that if in 2015 will be stocked ~ 5.5 million tons of ferrous metal scrap, as it has been in 2013 and 2014, Ukraine can and should export about 2.5-3.0 million tons of these raw materials. Plans of the state bodies to resolve in 2015 export of ferrous metal scrap in the amount of just 1.25 million tons appears to be erroneous and prejudicial to the Ukrainian economy, because the export opportunities of Ukraine is not fully used. Note that in Russia demand for metal scrap is much greater than in Ukraine since Russian metallurgy in recent years significantly increased arc-furnace power [4, 6].

One of the fundamental points in the current implemented scheme the restrictions on export of ferrous metal scrap is that the Ministry of Economic Development and Trade of Ukraine (MEDT) determines the export volume of ferrous metal scrap on the basis of the forecast balance its stock, supply to the domestic market and export. For last years the forecast balances have not been coincide with the actual performance of the industry. The need for the metallurgical industry in imported to the enterprises metal scrap was overestimated by 20-25%. By the decisions based on inaccurate balances a real damage was made to the economy of Ukraine.

The restriction of the scrap export forced scrap collectors to sell it to the metallurgists at prices which are too low compared to the world by 25-30%, and even with deferment of payment of the raw materials

delivered to the plants. At the same time as a distraction from the core of the problem method it confirms that it is cheaper not to export the scrap but to process at Ukrainian plants in cast iron, steel, billets, slabs, wire rod and sell these metal products with the added-value. This putting the question in this case is not justifiable for the following reasons [7].

The question of what is more profitable - to recycle scrap metal at the Ukrainian plants or export it is admissible to put only in the case of shortage of this raw materials in the country. In other words you have to decide to send the raw material to the Ukrainian enterprises or to the export. But the situation in Ukraine does not require such a decision, since Ukraine overstocked with ferrous metals scrap. Ukrainian enterprises have unlimited opportunities to buy on the domestic market as much metal scrap as they need for steelmaking. Thus, all stocked scrap the metallurgy of Ukraine objectively unable to process due to the lack of the necessary steelmaking facilities. Excessive amounts of collected ferrous metal scrap, that in 2015 and in subsequent years will be more than 2 million tons need to be exported.

According to one of the main points of economic theory, every state should seek to export not energy products and raw materials, but products with high added value. This is correct as the matter of principle. However, on some metallurgical enterprises of Ukraine the cost of the processing of the ferrous scrap in the billets, slabs, fittings, wire rod are above the difference between the export prices of the called metal products and metal scrap on the world markets. So the answer to the question, what is more profitable to export the metal scrap in pure form or to export the semi-finished products (i. e, in fact, remelted ferrous metal scrap) is ambiguous, as it depends on the specific circumstances at the relevant time (the manufactory cost of each plant, the prices of the raw materials and the energy products, the environment of internal and external markets of semi-finished and finished products, etc.). Supporting the above estimates and the assumptions are presented in our publications [8,9]. Additionally, it is possible to tell that at one modern steel plant in Ukraine, the cost of producing a ton of billets is about \$ 210. And, coefficient of scrap metal consumption in one melt of steel is equal to 1.12-1.13. This means that the earnings from the export of one ton of billets should be compared with revenues from the export of 1,12-1,13 tons of scrap metal. As a result, with the current high costs of the metallurgical conversion on some plants often it is more profitable to export scrap than remelt and process it into the billets or slabs, and then export those semi-finished

products.

At the present stage of the evolution of industrial production the metallurgy is developing mainly along two strategic directions. The first is focused on large integrated plants (the annual production volume is from 3-5 million to 10 million tons and more of the finished products), which work on the technological scheme: ore - coal (coke) - iron - steel - rolling. The second is based on the EAF process in which the production chain is much shorter: scrap metal (or direct reduced iron - DRI) - steel - rolling. Mini-plants work on the same scheme (the annual production volume is about 1.0-1.5 million tons). We also note that in the last years in different locations around the world also many electro metallurgical micro-plants were built with relatively small capacity ranging from 50-100 thousand to 300-500 thousand tons of steel per year. The examples of the mini- and micro-metallurgical plants design in Ukraine are given in [10].

Selecting the direction of the development of metallurgy in each country depends on the source of raw materials, the energy supply, the transport infrastructure, the availability and cost of labor, as well as other conditions.

The basis of the Ukrainian metallurgy consists of mainly steel mills and integrated plants with design capacity of 3-5 million tons of steel per year and more, built many decades ago. These are "Ilyich Iron And Steel Works" and "Azovstal" in Mariupol, "ArcelorMittal Kryvyi Rih", "Alchevsk Metallurgical Plant", "Dneprovsky Integrated Iron&Steel Works named after Dzerzhinsky", "Zaporizhstal". Along with the operation of these large industrial facilities in Ukraine the electrometallurgical works with capacity up to 1.0-1.5 million tons of steel per year (eg. arc-furnace complex "Interpipe Steel" in Dnepropetrovsk) and several metallurgical microenterprises are in operation.

The metallurgical integrated plants, which are composed of the blast furnaces and the converters, can only work on the ore, without using scrap metal, which at such plants is an additional component of the raw materials. Production of iron ore raw materials in Ukraine in 2010-2012 exceeded the needs of metallurgical plants by 30-35% [5]. In recent years, due to a decrease in steel production the surplus of the iron ore raw materials increased. Therefore the search for its implementation in the internal market is relevant, but the unsolvable problem.

Most of the scrap metal used in steel production is working scrap produced at the own plant in the form of technological metal waste, including cutoff pieces. Efficiency of the use in the production of steel the

various raw materials at Iron and Steel works is determined, first of all, the prices of the iron ore (or pig iron) and the ferrous metal scrap. We note that the iron ore prices at the beginning of 2015 decreased by almost a half and this makes its use in the domestic market very profitable. The production cost of finished products at the integrated plants by 80% depends on the cost of pig iron, which in turn is mainly determined by the price of the iron ore raw materials.

An analysis of the environmental aspects of the various enterprises and accounting for environmental damage caused by mining and processing plants (by production of pellets, sinter) and the coke plants in Ukraine to the natural environment (NE) show [8], that emissions of plants with the full metallurgical cycle (especially producing steel by the open-hearth method) at greater extent pollute the air environment than the emissions from EAF plants working on the scrap metal. Omitting the details, in general it can be argued that the amount of pollution generated during the production of one ton of finished products on the mini- and micro- metallurgical plants is less than on the integrated plants, since the former have a cleaner environmentally forming than the plants operating on the conventional technology.

The key question in determining the economic feasibility and direction of development of various technologies of metallurgical production in Ukraine is the availability of the necessary raw materials base and energy products to implement these technologies.

The Ukrainian coals used to produce the coke and the pulverized coal preparation for blast furnaces have a high sulfur content entering from the iron into steel significantly impairs its properties. The task of producing pig iron with the lowest possible sulfur content does need to be addressed not through the procurement of imported low-sulfur coal, and by the use in the coke production of mainly Ukrainian coals and the desulfurization of pig iron in the special units [3]. Therefore, along with the widespread implementation of the plants with equipment for injection into blast furnace of the pulverized coal the one of the priorities of the Ukraine's steel industry should be the creation of systems for desulfurization, as it is done, for example, almost at all the major metallurgical works in China [8].

The metallurgy of Ukraine is the largest consumer of electricity. It is obvious that in the near future as the main sources of energy will remain thermal and nuclear power plants (NPP), and all other types of generation will be of secondary importance. However, the nuclear power industry in Ukraine depends on Russian supplies of the nuclear fuel elements, and

by 2026 the majority of the Ukrainian nuclear power plants units will use a planned resource. Both of these circumstances give rise to certain risks of functioning of the Ukrainian metallurgical enterprises especially ferroalloy and EAF plants.

Taking into account the tightening of requirements for industrial facilities by the level of environmental pollution, as well as the above-mentioned difficulties and risks in providing the metallurgical production with carbonized coal and electricity, it can responsibly be claimed that the construction of the new Ukrainian integrated metallurgical complex is unrealistic in the foreseeable future. The reconstruction and technical modernization of the built long ago and still existing metallurgical plants is relevant [2-3, 10-11]. As the example of the enterprise need the modernization can serve "Zaporizhstal" plant, which has long hatched plans of the introduction of the oxygen-converter method of steel production to replace the obsolete open-hearth furnace. Radical modernization requires the wide-strip hot-rolling mills at 1680 mill of "Zaporizhstal" and 1700 mill of the Ilyich Iron and Steel Works in Mariupol.

The decisive factor when considering the need for building of a new mining and metallurgical plant in Ukraine is also a lack of adequate demand for steel products of mass production from the domestic market. At the current stage of the national economy development the domestic market consumes only about 20% of the Ukrainian metal rolling. Invest in the huge financial resources in the construction of metallurgical plant with full-scale without having an internal market for products and focusing only on the displacement of competitors in foreign markets, no investor would agree.

Thus, the prospects of construction of metallurgical EAF mini- and micro- plants in Ukraine appear to be more optimistic than building of the integrated metallurgical combine.

When choosing the location for the new steel mini-plant first attention should be paid to the western region of Ukraine, which includes the Lviv, Ivano-Frankivsk, Ternopil, Volyn, Rivne, Khmelnytsky, Chernivtsi and the Zakarpattia regions. There are no metallurgical enterprises, and at the same time, there is demand for section rolling metal products. Promising for the construction of a mini metallurgical plant is Kiev and Kiev region, which accounts up to 40% of consumption of rolled metal for construction application. However, the projected [10] to meet these needs for the mini-plant in Bila Tserkva has not yet been built for various reasons. The construction of such a plant in the south-east of Ukraine is hardly advisable,

since the needs of the region in the fittings and wire rod covered with a large supply of products produced on existing here large metallurgical plants.

The need for the organization in Ukraine production of hot- and cold-rolled steel sheet using a thin slab casting technology is under the discussion, because there is no large consumers of sheet steel and in particular auto body sheet in the domestic market. However, Ukraine annually imports more than 500 thousand tons of flat rolled with coating and approximately 100 thousand tons of cold-rolled sheet steel for their application. Therefore, the organization of production of sheet metal based on thin slab technology is worthy of consideration, if the finished products of the enterprise will be metal with coating. However, it should be noted that, apparently, is more expedient to develop the production of steel sheet with coating on the metallurgical plant "Zaporizhstal" and Mariupol Ilyich Iron and Steel Works, which already have the experience and the technical capabilities.

The attractiveness of the western region for the development of metallurgical production is due to the fact that in the case of the construction of a new metallurgical mini-plant with capacity of 300-500 million tons electrical steel per year the load on the grid system in the region will increase not to the critical level, especially if the enterprise is located near Khmelnytsky or Rivne NPP.

And finally western region of Ukraine is quite possible able to provide the necessary amount for such plant stocked scrap metal. According to the results of studies carried out the SE "Ukrainian Industry Expertise" the share of this region in total Ukraine stocked scrap metal is about 10-15%. In 2013, for example, in eight western regions of Ukraine were collected ~ 750 thousand tons of ferrous scrap, that overlaps with a large supply the demand for it of the EAF mini-plant.

Conclusion

Metallurgy of Ukraine will develop along the way of the reconstruction of the integrated plants, and probably the construction of EAF section rolling mini-plants with capacity of 300-500 thousand tons per year. Advantages of the mini-plants, primarily of the environmental character are due to the lack in technological chain of intermediate process stages such as the preparation of coal and iron ore raw materials, agglomeration and the blast-furnace production and the coke production. The most perspective is arranging the plant in western Ukraine in close proximity to energy resources and the potential consumers of finished products.

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