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CONCEPT OF SUSTAINABLE DEVELOPMENT IN METALLURGICAL WASTE TRANSPORT

Abstract:

The aim of this paper is to present by way of using a case study the on-going situation relating to the implementation of sustainable development within the area of metallurgical waste transport. A variety of activities have been undertaken within the area of metallurgy aiming at implementing sustainable development, especially through reducing the negative influence of the waste generated therein onto the natural environment. The most crucial changes relate to technological processes employed at the production stage; however, much is also done within the area of transport. The issue presented in the title of the paper will be discussed on the example of X enterprise, which deals in metallurgical waste processing. As far as technology in concerned, the enterprise in question implements innovative and environment friendly waste management methods. The considerations shall commence with addressing the question how the persons managing the company understand the notion of sustainable development and whether and to what extent the company implements this concept within the area of transport. An introductory analysis of the data obtained from the company makes it possible to propose a hypothesis relating to practical aspects of the implementation of the said concept: there continually arise contradictions of economic and environmental nature.

Keywords:

sustainable development in transport, transport of waste

JEL Classification: R49

Introduction

Progressive industrialization and globalization have brought about that the natural environment is at risk. A lot of products become increasingly complicated, also supply chains are increasingly longer, as a consequence of globalization. Among others, products coming from metallurgical industry cover such a longer distance from raw materials to finished goods. (Sinha et al., 2002, p. 95) This brings about the generation of a large amount of solid, liquid waste and waste gas in metallurgical industry. Waste generated during processing metal ores, apart from waste from chemical industry and energy industry, is the most toxic for humans and the environment. (Maj et al., 2010, p. 103) Processing of ores into finished products, e.g. made of steel, is associated with generating large amounts and types of waste, negatively influencing the natural environment. Some of this waste can be reused in the plant in other manufacturing processes, on the other hand, other waste must be processed or utilized outside the plant, in which it was generated. This is connected with the necessity of transportation.

So far, the issue of transport of waste from metallurgical industry has not been the subject of the separate study, particularly in the context of sustainable development. Any considerations in this field must be a derivative of the considerations concerning sustainable transport and transport of waste. Sustainable transport of waste from metallurgical industry is a particular case of both phenomena.

Metallurgical waste against other waste

Metallurgy belongs to the sectors of economy which generate most by-products. (Maj et al., 2010, p. 103) Metallurgical waste constitutes the sub-category of industrial waste which, in turn, is identified in opposition to municipal waste. Among industrial waste, the waste generated in metallurgy, in Poland, is classified in accordance with the Resolution on Waste Catalogue in group 10 – waste from thermal processes, in a subgroup 10 02 – waste from the iron and steel industry, 10 03 – waste from aluminum metallurgy, 10 04 – waste from lead metallurgy, 10 05 – waste from zinc metallurgy, 10 06 – waste from copper metallurgy , 10 08 – waste from other non-ferrous metallurgy, 10 09 – waste from casting of ferrous metals, 10 10 – waste from casting of non-ferrous metals, 10 11 – waste from manufacture of glass and 10 80 – waste from production of ferroalloys. Among waste generated in metallurgy, it is possible to identify two groups: the first one refers to waste generated as a result of the applied production technology (e.g. post-metallurgical slag or sulfurous acid generated as a by-product in copper metallurgy) and generated as a result of the activities aimed at the protection of the natural environment (generated as a result of purification of flue gas stream, such as sludge and dust from dedusting systems, waste from gas desulphurization systems, or sludge after neutralization of acidic waste). (Krajowy program zapobiegania powstawaniu odpadów, 2014, p. 81)

Metallurgical waste (dust and slag) in the largest quantities is used for technological purposes, including raw material additives in metallurgical and cement industry, it is also intended for recovery in the form of road aggregates. In 2013, in the structure of metallurgical waste the largest proportion amounted to steel slag and blast furnace slag – about 59.5%, scrap – about 5%, mill scale – about 4%, sludge - about 3%, spent refractories – about 1%, and other waste - about 27% (Figure). The generated waste is mostly subjected to the recovery processes (more than 93%), and the remaining part is neutralized and temporarily stored. (Raport Polski przemysł stalowy 2014, p. 34)

Sustainable transport as a part of the concept of sustainable development

Transport is the foundation of national economies, enabling economic growth. It is strictly correlated with the condition of the whole economy and often called the carrier system, the circulation system of the economy.(Rydzykowski, Wojewódzka-Król, 1997, p. 263) In the subject literature, there is clearly underlined the interdependence of the level of development of the national economy on the development of the transport system, and there is emphasized the fact that this sector provides services to other sectors of economy, such as construction or agriculture. (Gryko-Nikitin, 2010, p. 40) At the same time, transport poses a threat for the natural environment, human health and the functioning of ecosystems. Therefore, transport has become one of the areas of the activity which has been included in the concept of sustainable development.

With reference to sustainable development, it is assumed that sustainable transport should develop economic, social and ecological goals. However, as the subject literature indicates, although the concept of “sustainable development” and “sustainable transport” have been the focus of attention for a longer period of time, their domain specification through indicators is advanced in varying degrees, e.g. in relation to the concept of sustainable energy, sustainable development of tourism, sustainable production and consumption.(Borys, 2008, p. 5, Litman, 2015) In the literature, there is emphasized a multitude of definitions of sustainable development and difficulties concerning its measurement.(Jeon & Amekudzi, 2005, p. 31) In the framework of sustainable development of transport, there are discussed the issues of public transport, alternative fuels, pollution resulting from transport, including carbon dioxide emissions and changes in the way of transportation. The most well-known definition of sustainable transport is the definition of OECD of 1996, according to which sustainable transport does not endanger public health or ecosystems and meets mobility needs consistent with (a) use of renewable resources at below their rates of regeneration and (b) use of non-renewable resources at below the rates of development of renewable substitutes.(OECD Proceedings, 1996)

However, the concept of sustainable transport is, most of all, referred to the strategy of the transport policy in individual states, particularly in the EU. This, among others, means such formation of the transport policy of the state that guarantees emphasizing some modes of transport in the carriage of loads or the promotion of intermodal transport. Sustainable transport is also discussed in the context of development of cities and public transport. In this sense, sustainable transport, among others, amounts to an increase in competitiveness of public transport. A separate issue is the way of the implementation of the concept of sustainable development and the measurement of the degree of sustainability, and also the introduction of sustainable development in individual areas of transport.

Transport of industrial waste in Poland in the context of sustainable development

Transport of waste is the issue which, in Poland, is not considered as a separate thematic problem, especially in the context of sustainable development. However, the fact that transport of industrial waste should be sustainable *implicite* results from the records of the strategic documents of the State, concerning transport policy. In accordance with the document *Transport Development Strategy until 2020,* the achievement of the main transport goal, in the perspective of 2020 and further in Poland, is connected with the development of five specific objectives, relevant to each mode of transport. This refers to:

- creating modern and consistent network of transport infrastructure,
- improving the way of organization and management of transport system,
- improving safety of road users and carried goods,
- reducing negative impact of transport on the environment,
- constructing a rational model of funding infrastructural investments.(Strategia Rozwowju Transportu, 2013, p. 25)

Therefore, in the first place, the challenge for Poland is removing the arrears in expansion, modernization and revitalization of transport infrastructure and infrastructural connection of the most important growth centers with the areas of lower growth dynamics and incorporating them into the European transport network. It is also assessed that the level of impact of transport on the environment is significantly lower nowadays than in the nineties and that the basic problems connected with waste management have been tackled and the growth rate of energy consumption has been inhibited. In spite of this, in the field of transport, Poland still faces the necessity to finish the performance of a range of tasks in subsequent ecological policies of the State and other strategic documents adopted in previous years, as well as it has to meet new challenges. They partially result from the development of the paradigm of the environmental protection and sustainable development and, partially, on account of the need to react to new risks and threats, such as an increase in extreme weather

events. At the same time, recently, transport and, particularly, road transport has occupied a high position in the category of dominant pressure of sources on the environment.

In the area of transport of industrial waste, the issue of sustainable transport is also not particularly exposed. Waste transport itself is not a concept defined clearly in the regulations in force in Poland. The guidelines for transport of waste, including industrial waste, result from a range of laws and provisions, such as the Act on waste of 14 December 2012. However, it does not mean that, in the Act, there are no records concerning the principles one should be driven by while running a business consisting in transport of waste since the concept of transport of waste occurs in other definitions, namely, transportation of waste is one of the forms of managing it – Art. 3 section 1 item 2 of the Act on waste of 14 December 2012.

waste management – shall mean the collection, transport, treatment of waste, including the supervision of such operations, and the after-care disposal sites, and including actions taken as a dealer or broker in the waste trade

Another definition in which transport appears is the definition of collection of waste - Art. 3, section 3, item 13 of the Act on waste, which, in accordance with the definition, is the act preceding transport:

collection of waste – shall mean the collection of waste prior to transportation to treatment facilities (…)

The definition points out that waste must be transported from the site of collection to the site of treatment. It indicates that transport is considered as one of the actions prior to the actual recycling of waste, therefore, it is the preparatory and auxiliary activity. Specific provisions concerning transport of waste were specified in Art. 24 of the Act on waste of 14 December 2012. In accordance with these regulations, transport of waste is in compliance with the requirements of the environmental protection and safety and human life and health, particularly, in the way taking into account chemical and physical properties of waste, including the state of matter and risks waste can cause. The regulations also discuss the categories of hazardous waste. Such waste, irrespective of the source of origin, is subjected to the provisions in force in transport of hazardous waste. The other regulations concerning transport of waste distinguish “the party transporting waste” that the transport service is commissioned to. At present, the regulations concerning transport of waste are to be supplemented with the appropriate regulation of the competent minister, where there will be established specific requirements for transport of waste, including means of transportation and modes of transport, and labeling of means of transport, taking into account the properties of waste and its impact on the environment and the safety of human life and health. Moreover, the Act also contains the principle of proximity as the superior principle of waste management, according to which waste should be

processed first in the place of its occurrence or – if it must be transported – then, to the sites located closest to the place of its production. The planned regulation particularly indicates that the party transporting waste should conduct transport of waste in the way preventing the spread of the transported waste outside the means of transportation. Moreover, transport of waste should be conducted in the way to make the transported waste not move in the means of transportation. The most important instruments of intervention should be the proposal to introduce labeling of means of transport aimed at the improvement in their identification. The introduction of such a requirement should contribute to improving the control of trade in waste in Poland.

Transport of metallurgical waste in the X company

The enterprise under consideration is located in Southern Poland and deals with processing of scrap and metallurgical waste, mainly aluminum dross. With the help of its own patent-protected technology, it converts it into valuable raw materials, useful in metallurgy. From the materials acquired in this way, it manufactures auxiliary products for metallurgy and foundry for e.g. refining steel. The customers of the company are foundries in the area of Poland and other countries of the EU.

Therefore, the enterprise receives waste from waste producers, mainly dross, whose source are mainly steelworks and foundries, including mainly aluminum foundries in Poland. A strategically important partner is also the company from the USA, which commissions the company the service of waste treatment. The company also processes scrap. Waste brought to the company is solid waste of different granularity.

While analyzing the issue of sustainable transport of metallurgical waste developed in the X company, it should be mentioned that the concept of sustainable development may penetrate enterprises in many different ways. Among the factors motivating enterprises to the implementation of the concept of sustainable development there are: legislation, organization and the social environment, other enterprises, but also willingness to increase competitiveness of own competitiveness and ethical motivation of individuals (Campbell, 2007;, Pedersen, Neergard, Pedersen & Gwozdz, 2013; Margolis & Walsh, 2003). The analyzed company declares the adoption of pro-environmental behavior from larger companies, which make their smaller contractors implement the environmental standards ISO, the possession of which is the standard nowadays. Another motivating factor – which is really strong – is the law in force which the companies must obviously comply with.

In the analyzed enterprise in the field of transportation, the factor in the form of legal regulations is the crucial one. The way of transport development, securing load, selection of vehicles is determined by the regulations in this field. Another important criterion when taking decisions concerning transport is the financial criterion. There

are preferred cost-effective solutions. Transport of waste is conducted with the help of means of road transport. Waste is carried to the plant with the company's own vehicles, most frequently in containers or self-discharging containers, often protected with a tarpaulin, which are frequently placed in the plants manufacturing waste and remain there until they are full. In this type of vehicles there are transported loose materials, lumpy scrap, steel chips, aluminum chips. Loose material is carried in bags of Big- Bag type.

The plants the waste comes from are at the average distance of 250 km from the company. However, it also happens that waste from plans located much further is brought to the company since it possesses appropriate technologies for processing particular types of waste as the crucial issue is not the distance but, most of all, the question who can process or utilize the specific type of waste since they possess the appropriate technology and relevant permits. The producer of waste is obliged to transfer it to the appropriate company if they themselves are not able to utilize it properly. Utilizing waste in the way compliant with the regulations becomes the venture requiring its transport to long distances and, at the same time, it is expensive. Let's remind that road transport is connected with carbon dioxide emissions and, in accordance with the principle of proximity, waste should be transported to the distances as small as possible. However, transporting waste – even to long distances, even if it brings about carbon dioxide emissions – is the solution which prevents the storage of waste i.e. the method which, in the EU, is regarded as the most undesirable method of waste disposal. The value of waste and the possibility of receiving valuable raw materials from it is rather important. This is the case of waste brought to the analyzed company from the USA. Waste covers a long maritime and land route, which generates high costs, however, generally, the venture turns out to be cost-effective as the analyzed company obtains valuable metal from waste. In case of such a type of waste, the principle of proximity obviously does not apply, however, it should be noticed that transporting it to the relevant companies allows for the recovery of scarce raw materials to the economic cycle.

Conclusions

The presented example of the X company, processing, collecting and transporting waste, indicates that the main determinant of the implementation of the concept of sustainable development in the area of transport of metallurgical waste are the regulations in force. They impose on the company the duty of waste transportation in accordance with safety requirements and the principles of the environmental protection. The X company transports waste in accordance with the relevant requirement, however, the most important criterion is the compliance with the law and the criterion of cost-effectiveness. Considering three areas of sustainable development, i.e. economic, social and ecological goals, it should be concluded that the economic goals are still the priority in this field and the others are developed as the side effect of the operation of the company compliant with legal regulations.

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