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## Ash and Slag Waste as a Secondary Raw Material

P.V.Menshov<sup>a\*</sup>, Y.V.Khlupin<sup>a</sup>, O.I.Nalesnik<sup>a</sup>, A.V.Makarovskikh<sup>a</sup>

<sup>a</sup>National Research Tomsk Polytechnic University, Lenina ave. 30, Tomsk 634050, Russia

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### Abstract

In the process of industrial corporation activities a lot of waste, which pollutes the atmosphere, is generated, for example ash and slag. In Tomsk region, by estimates, ash stores occupy about 600 hectares, which contain about 25 million tons by weight. In Russian thermal power-stations ash disposal areas there are about 1.3 billion tons of ash, and only 10% of it is used. That is why this problem is topical enough. In this paper the scheme of producing ash ceramic bricks and complex ash and slag waste processing is shown. Besides, profitability of the project is presented.

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### 1. Introduction

In the process of energy corporation activities a lot of ash waste, which pollutes the atmosphere, is generated. As a result we have a lot of occupied territories. Effective processing of ash from energetic corporations working on coal will help to reduce negative influence on the environment and make better economic indexes of corporation. In general, ash is widely used in different productions and has a big market potential. There are

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\* Pavel Menshov. Tel.: +7-952-893-75-21; fax: +7-382-256-3865.

E-mail address: [pvm8@tpu.ru](mailto:pvm8@tpu.ru)

available technologies of ash utilization; some of them are commercially widely used. Additionally, in many countries interesting methods and techniques are being developed, and obviously some of them have a huge potential. At this stage our main aim is to create a complex scheme of ash and slag processing.

In Russian thermal power-stations ash disposal areas there are about 1.3 billion tons of ash. Annually power stations produce up to 30 million tons but only 3 million tons (10%) are recycled. Production of building materials (3-5%) is included in the process. According to expert estimates, the cost of 1 ton of ash and slag waste content ranges from 200 to 500 roubles or 5-7% of the cost of electricity and heat production on a coal power station. Reconstruction investments for ash dump utilization may reach 1 billion roubles in cost. Within 3-5 years the overflow of ash and slag waste will assume mass proportions, and this process has already begun.

Tomsk is not an exception. According to the open Internet resources, there are three ash dumps:

1. Old ash dumps at "Power Station"-2 that was put into operation in 1973 and located in the Ushaika valley. Currently, it doesn't operate. There are about 450 tons of ash waste on 35.8 hectares.
2. A new ash dump located in the valley of Malaya Kirgizska (Tomsk Severny station) was put into operation in 1986 and now in its area of 60.9 hectares there are about 1251 tons of ash waste (the information dated to 2003).
3. In Seversk near Chernilshiki village in the floodplain of Tom River, there are over 500 hectares of ash and slag, which constitute 24 million tons.

## 2. Use of ash and slag waste

Ash and slag waste (ASW) is a raw material for building material industry, which may successfully compete in a raw material market effectively substituting natural resources (GOST 25592-91, GOST 25818-91, TU 34-70-10347-81, GOST 530-95, GOST 25485-82, GOST 21520-89 and others). The use of ASW reduces the cost of building materials production (cement, dry mortar, concrete, mortar, concrete wall and foam concrete blocks, bricks, paving slabs, and other products) by 15-30 %.

The use of ASW is very diverse: for example backfilling mines, soil consolidation, creating mounds over landfills, vertical sealing walls to prevent seepage of wastewater from the landfill, soundproofing walls, agriculture, etc.

Examples can be found abroad. So, in Germany and Denmark in the building materials industry it is used nearly 100% of the annual output of ASW (in Germany ash and slag store is prohibited in law). Up to 70% of the annual output of ASW is used in the USA, the UK, Poland, China and other countries. Changes in the law of India in 1999, and then in 2003 led to increase in the volume of ASW utilization in the country from 29.6% (2003-2004) to 53% of annual output (2007-2008), which is about 70 million tons per year.

Ash and slag consist of many useful components, which may be used in different areas of human activity. In this paper recycling and obtaining useful components from ash are focused on. Ash contains a lot of useful components: aluminosilicate microspheres (1.2%), magnetite (5.9%), alumina ( $Al_2O_3$  (20-27%)), silica ( $SiO_2$  (49%)) or oxides of rare-earth metals (7%), which may be used in differently (Figure1). But slag is extracted at the first stage of complex processing and sent for slag stones production which has a wide application (Figure 2).

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