

## ASH AND SLAG HANDLING

## 3.7. Analytics

## 3.7.20. Forming a system of management of by-products from coal-fired thermal power plants

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## ABSTRACT

Management system of coal TPPs side production is being developed to organize ash-and-slag reprocessing and usage, it is a complex system with multi functional structure. Formation of this system includes detailed working out of every strategic direction, some of which resolve prevention of the planned damage others can resolve liquidation of accumulated ecological damage in a cost saving manner.

## INTRODUCTION

Every economic activity has its negative consequences as wastes which are mostly side production or in a process of reprocessing this wastes could become renewed resources. Management approach, governmental support at the level of government of Russia, administrative divisions of constituent entities of the Russian Federation, and municipal entities are needed for such system formation.

Renewing resources from coal TPPs ash-and-slag wastes presupposes a complex measures to be taken for renewing of wastes' quality features in accordance with applicable requirements as well as its normative and technical grounding as material items.

Using of the word "renewing" is not always justified when we talk about ash resources, another term "coal combustion products" (CCPs) accepted in most of the countries can be used meaning ash wastes after measures proving its row material qualities. That is why the word "renewing" concerning TPPs' ash-and-slag will loose its meaning when management system in question is created (Fig.1) because in the frameworks of this management system ash-and-slag resources become materials in demand for different enterprises after complex of measures and technological cycles.

Complex of measures of resources renewing means reasonable and technological decisions development as well as adopting legal, economical, ecological and normative-technical documents.

## 1.LEGAL ANALYSIS

Notwithstanding there are a lot of normative and technical documents stipulating ash-and-slag usage this documents are not popular. Studies of possible opportunities of ash-and-slag materials usage in economy are not developed in our country. Thus we shall start analyze and regulate side production turnover. Mentioned problems might be solved by present documentation change (legal and technical) as well as by creation a legal basis stipulating complex usage of ash-and-slag materials.

Today the basis for regulating wastes turnover is presented by Russian legislation and legislation of its constituent entities.

Following documents regulate this issue at the federal level:

1. Federal Law of 10.01.2002 No. 7-FZ "On environmental protection" (in reduction of 27.12.2009 No. 374-FZ) - general law covering such questions as licensing of businesses connected with wastes, payments for wastes usage, payments for environmental harm, stipulation of wastes storing;
2. Federal Law of 24.06.1998 No.89-FZ "On industrial and consumer wastes" determines the legal aspects of the treatment of industrial and consumer waste products for the purpose of the prevention hazardous impact of industrial and consumer waste products on human health and environment and its reutilization as raw materials for industrial use;
3. The tax Code of the Russian Federation stipulates tax deductions as a form of governmental support of the businesses aimed at environment defending;
4. Federal Law of 08.08.2001 No.128-FZ "On Licensing Certain Types of Activities" stipulates collection, usage, deactivation, transportation, landfilling of the wastes of I-IV class of danger (the activity on storing wastes of I-IV class of danger is not licensed, activity on collection, usage, disactivation, transportation and landfilling of wastes of V class of danger is not licensed as well);
5. Federal Law of 30.03.1999 No. 52-FZ "On the sanitary and epidemiological welfare of the population" states requirements for entrepreneurs and legal entities for sanitary norms control during dangerous wastes usage;
6. Federal Law of 23.11.1995 No. 174-FZ "On Ecological Expertise" stipulates issues on business correspondence to ecological requirements.

Analysis of the list of legal documents allows to make the following conclusion: present policy of ash-and-slag materials usage focuses on harm estimation and wastes isolation.

Thus there is no complex legal regulation concerning ash-and-slag wastes usage, there no documents stipulating public opinion concerning production, landfilling, reprocessing and usage of ash-and-slag wastes (materials) in different spheres of life.

**There is a need in drawing a line between such terms as "ash-and-slag wastes" and "ash-and-slag materials, process of transaction first into the second needs to be worked out. A list of documents and procedures verifying that ash-and-slag materials meet all the standards of construction materials and materials used in agriculture shall be made.**

**Usage of wastes of I-IV classes of danger is strictly stipulated but there no strict regulations and guidelines concerning usage of wastes of V class of danger.**

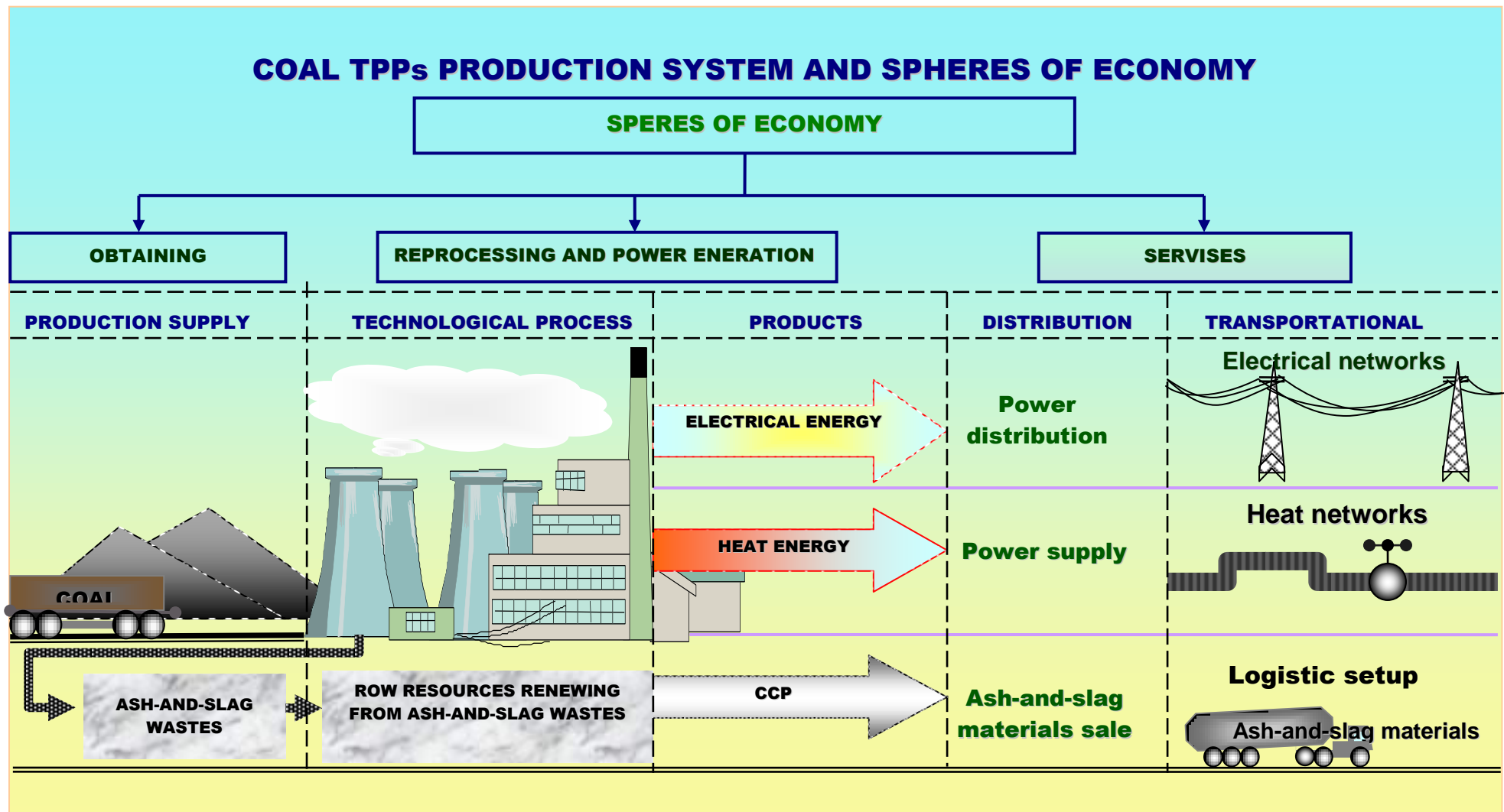


Fig. 1. Technological cycle of TPPs' ash-and-slag turnover

Problem of effective usage of ash-and-slag materials in different spheres of economy has a lot of goals and touches upon each spheres' interests as well as interests of social sphere, this problem is one of the factors of increasing economical marketability. At the same time the relationships arising during ash-and-slag materials reprocessing and usage are regulated by multiple normative and legal documents.

According to article 72 of the Constitution of the Russian Federation the joint jurisdiction of the Russian Federation and the subjects of the Russian Federation includes:

a) issues of possession, use and disposal of land, subsoil, water and other natural resources

б) nature utilization, protection of the environment and ensuring ecological safety; specially protected natural territories;

b) establishment of common principles of taxation and dues in the Russian Federation;

r) land, water, and forest legislation; legislation on subsoil and environmental protection.

According to article 76 part 1 of the Constitution of the Russian Federation on the issues under the joint jurisdiction of the Russian Federation and the subjects of the Russian Federation federal constitutional laws and federal laws shall be adopted. There is an analogical statement in the article 27 of the Charter (Main Law) of Omsk Region: at this laws and other legal documents of Omsk region cannot converse to federal laws concerning subjects of joint jurisdiction of the Russian Federation and Omsk region. At this laws and other legal documents of Omsk region cannot converse to federal laws concerning subjects of joint jurisdiction of the Russian Federation and Omsk region In case of such divergence the federal law to be applied.

Thus we can conclude that normative and legal issues of ash-and-slag mixtures turnover are regulated by federal legislation of the Russian Federation.

Analysis of the legislation of the Russian Federation stipulating ash-and-slag wastes issues shows that in most of the constituent entities of the Russian Federation this issues are not being considered. Only legislation of Moscow, Irkutsk and Smolensk regions has a focus on reprocessing and turnover of ash-and-slag materials.

It could be stated that the main method of stipulating relationships concerning ash-and-slag materials is programs creation.

So legal basis formation justifying TPPs ash-and-slag materials usage can be created only by local programs like "Usage and reprocessing of TPPs' ash-and-slag materials" adoption. According to art. 4.1 FZ No. 89-FZ and definition given in "Wastes classes of danger" (adopted FZ No.309-FZ of 30.12.2008) wastes of V class of danger are considered practically safe. There is also a definition for a side product given in intergovernmental standard of CIS countries GOST 30772-2001 for normative and technical regulation of governmental decisions concerning wastes utilization:

**It. 3.16 # Side product #:** is an additional product formed during production process formation of which is not a goal of the production but this product might be applicable in other production as raw material or as a ready product.

*Commentary.* Side product is not a waste!

## 2. MAIN STRATEGIC DIRECTIONS OF SIDE PRODUCTION MANAGEMENT

**Solution is** to form innovation system of coal TPPs' side production management, in other words include part of not-used natural resources into a turnover (Fig. 2).

Management system of side production is being developed to organize ash-and-slag reprocessing and usage, it is a complex system with multi functional structure. Thus options considering consists of working out every strategic directions in details:

- side production management structure formation;
- studying and development of the market;
- technical preparation of the enterprises for side production collection and sale;
- investment friendly and effective resources usage.

## 3. TPPS' ASH-AND-SLAG MATERIALS USAGE STRUCTURE ORGANIZATION

Present organizational structure of OJSC "TGC-11" as of the other generation companies doesn't meet resource saving standards of the present time in conditions of the market economy.

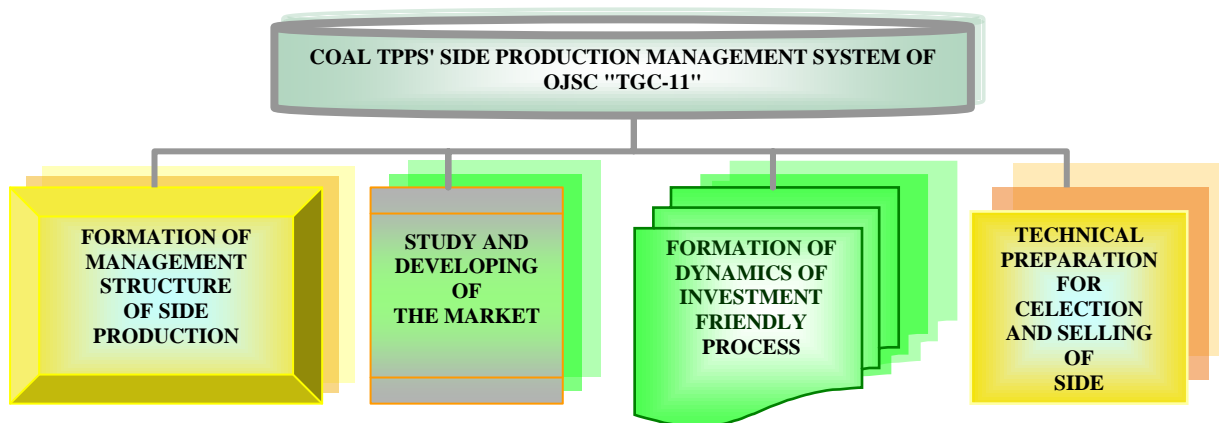


Fig. 2. Structure of strategic directions of OJSC "TGC-11" resource saving system formation

In order to make ash-and-slag wastes be ash-and-slag materials in accordance with Russian legislation a lot of legal and technological documents shall be developed, a lot of events held.

After proving that ash-and-slag are materials good for economy usage the generation faces three following issues:

- Formation of the structure organizing resources renewal of ash-and-slag wastes its reprocessing and consuming;
- Formation of ash-and-slag demand, ash-and-slag selection and dispatch organization from present output and ash-and-slag ponds;
- investment attraction.

At this stage considering ash-and-slag materials turnover subdivisions or responsibility centers shall be created at OJSC "TGC-11" branches.

In order to achieve the goal of ash-and-slag mixtures usage we need to interest different parties with potential effectiveness and economical advantages of ash-and-slag mixtures usage in different spheres of economy. Ecological effect is presented by lowering negative impact on the environment, recovery of positive environmental balance thus using ash-and-slag mixtures can be profitable for all the members of the project.

Suppliers and consumers of ash-and-slag mixtures

feel economic effect.

Potential members of ash-and-slag system approach can be divided into three groups of interest.

**Advantage for ash-and-slag consumers** such as agricultural, industrial, construction companies and enterprises as well as for construction materials producers and other consumers.

There are following advantages:

- low resources cost decreasing;
- better quality production;
- increasing net profit by effective usage of investment resources;
- lower payments for natural resources usage.

**Administrative bodies including corporate entities of the Russian Federation where structural subdivisions of OJSC "TGC-11" operate** reveal interest in this issue because this system allows to save natural resources, lower negative impact on the environment, be another source of construction materials deficient in the region.

**Advantages for OJSC "TGC-11" as for ash-and-slag mixtures supplier:**

- wastes production cost decreasing;
- decreasing of the negative impact on the environment;
- profit increasing from ash-and-slag materials realization.

TPPs' side production management structures (Fig. 3) creation presupposes the following:

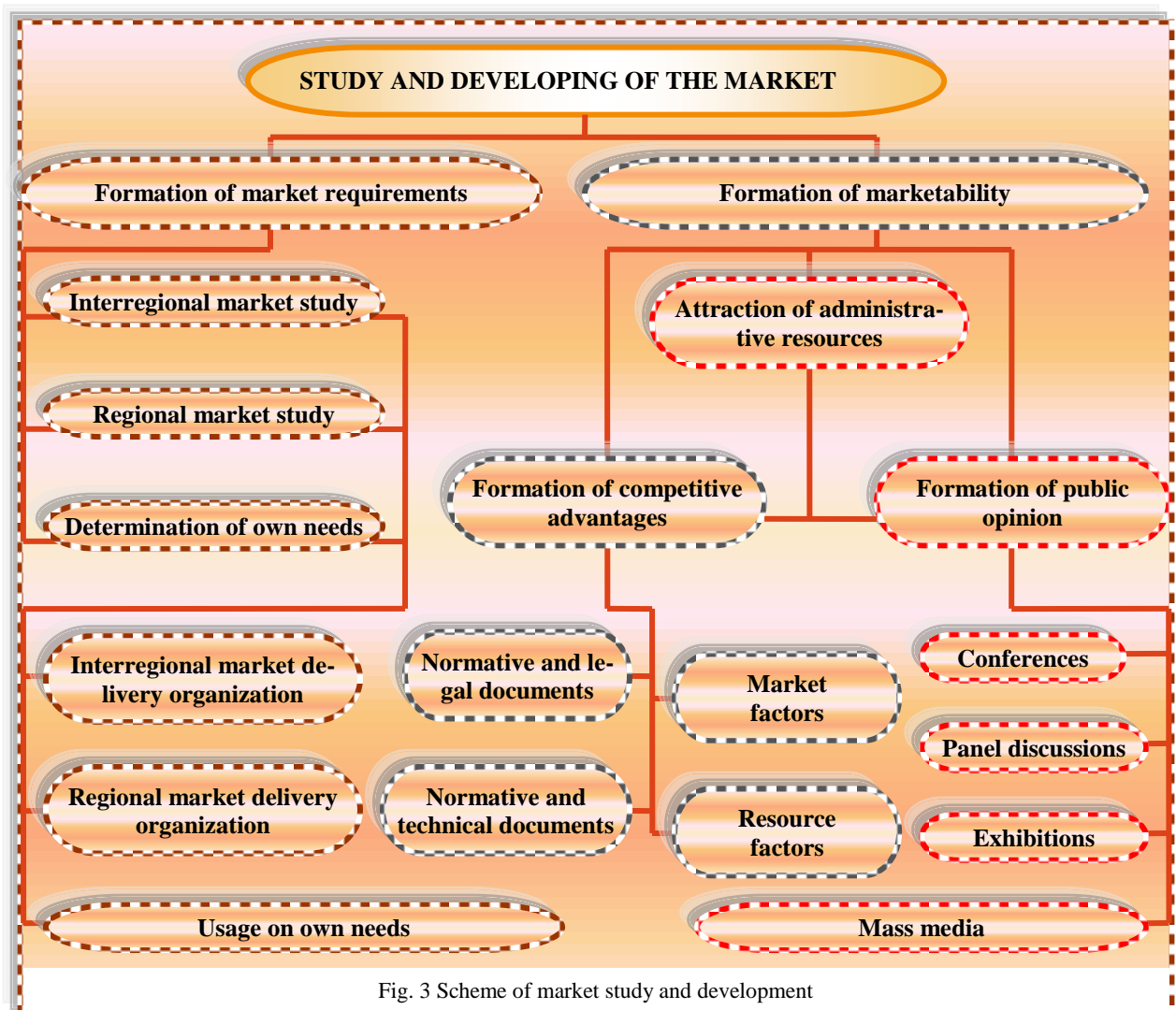


Fig. 3 Scheme of market study and development

- creation of the structures organizing side production management including subsidiaries, structural subdivisions and responsibility centers creation dealing with reprocessing and realization of ash-and-slag materials;
- regional working groups organization on a voluntary basis from competent specialists.

**Aim of the structure created:** side production management system organization where volumes of ash-and-slag material realization exceed volumes of annual ash-and-slag output

**Aims of the newly structure created:**

- structural enterprises technical readiness organization for collection and further dispatch of ash-and-slag materials in accordance with customers requests;
- formation of social opinion about profits of ash-and-slag materials usage;
- service normative technical and legal measures exceeding ash-and-slag materials marketability;
- cooperation with consumer-enterprises;
- formation of customers demand for ash-and-slag materials exceeding supply of TPPs.

#### 4. STUDY AND DEVELOPMENT OF THE MARKET

Setting up for market entering is the most important part of coal TPPs' side production innovation management system creation. setting up consists of 2 major stages marketability formation and market demand creation (fig. 3).

In order to determine potential market opportunities of delivery to inner and external regional markets of row materials shall be examined, ash-and-slag materials volumes calculations for own needs shall be made.

Up to 2010 OJSC has been focusing at studying and developing of the regional markets and location of subsidiaries enterprises. Fly ash realization was on focus which didn't solve ash-and-slag accumulation problem.

Today there is only fly ash demand of external regional markets, such ash is transported by railway hoppers. It is planned to implement big bags packing by 2013. Europe part of the Russian Federation is the main customer due to intensive construction works and natural resources deficit. Ash-and-slag materials demand is low in Siberian federal district and in the Far East because of its low marketability and natural resources proficiency.

Selection and dispatching of ash-and-slag mixtures are not considered because of economical ineffectiveness and lack of demand.

The most profitable ways of using ash-and-slag mixtures for own advantage is to use it in building construction and liquidation of subsurface management consequences.

There are following advantages: effective investments usage, natural resources saving, ash-and-slag accumulation decrease and ash ponds devastation.

Empty ash pond can be also used for ash-and-slag storage during low demand (autumn-winter season).

System approach on the basis of which the algorithm of suggested actions is created presents one of the most important directions of Omsk and Tomsk regions activities concerning natural resources saving, rational investment usage and renewing of positive environmental balance.

As it was already mentioned generation companies do not earn a lot on ash-and-slag mixtures sale the main part of net profit comes from lowering wastes storing costs. Most part of the profit is formed at the expense of coal production cost lowering as well as at the expense of prevention of planned and accumulated harm to the environment.

Prevention of the planned harm in the frameworks of the system is an environmental planned harm prevention caused by hard technological coal TPPs' wastes disposing which is solved by effective self and attracted investments resources of OJSC "TGC-11" during dry ash collection.

Prevention of the accumulated harm in the frameworks of the system is an environmental accumulated harm prevention caused by hard technological coal TPPs' wastes disposing which is solved by rational self and attracted investments resources of OJSC "TGC-11" by including accumulated ash from ash ponds into a turnover.

Thus ash-and-slag materials usage is profitable not only for generation companies but for constituent entities of the Russian Federation as well.

For technological decision taking and main directions of ash-and-slag materials determination the objects assuring large OJSC "TGC-11" ash-and-slag volumes usage for the period of 2011-2020.

Considering climatic conditions mentioned in previous publications and great volumes of accumulated ash at the ash ponds top management of OJSC "TGC-11" noted that accumulated ash-and-slag mixtures can be effectively used in different economy spheres.

Analysis showed main directions of OJSC "TGC-11" ash-and-slag large volumes usage:

- liquidation of subsoil management;
- landscape horizon reclamation;
- road construction;
- usage in agriculture;
- usage on own needs.

In order to show that ash-and-slag usage can be investment friendly Perspective Plan of large-tonnage usage of ash-and-slag of OJCS "TGC-11" TPPs for the period from 2011 to 2020 was created. The Plan also demonstrates main directions of ash-and-slag usage.

According to calculations on the basis of which the Perspective Plan was created landscape reclamation takes the first place according to volumes of ash-and-slag used (537.6 ha with the usage of 17.150 mill tons of ash-and-slag).

Second place takes liquidation of subsoil management where for renewing of 336.8 ha of land 10.018 mill tons are needed.

Third place takes road construction where 4.05 mill tons of ash-and-slag can be used instead of natural resources at 44.6 km of good roads at this saving 101.25 ha

of land, which haven't been taken into account up to this moment.

Agriculture takes the fourth place. We can use about 2.52 mill tons of ash-and-slag mixtures for bettering lands as melioration fertilizer.

Unfortunately ash-and-slag wastes accumulation increase at the ash ponds proves that ash-and-slag mixtures are not used as a raw materials for aluminum and silicon oxides and rare-earth metals extraction.

For justifying ash-and-slag materials usage in different spheres of economy and its marketability increasing there was a "Perspective Plan of large-tonnage usage of ash-and-slag of OJCS "TGC-11" TPPs" for the period from 2011 to 2020" developed in OJSC "TGC-11". The Plan was developed on the basis of "Conception of OJSC "TGC-11" TPPs' side production management system" (developed by specialists of OJSC "TGC-11" and OJSC "Energy efficiency center of Inter RAO UES) and results of R&D made by the following Universities:

- OmSU named after F.M. Dostoyevsky (Law faculty) - the analysis of normative and legal documents and laws was made, technology of ash-and-slag as a raw product usage in order to obtain valuable elements was developed (Chemistry faculty), in the framework of this a discovery was made and a patent is being documented at the present.
- SibADI (Roads engineering Department) developed STO "Ash-and-slag materials of Omsk TPPs

for road construction" and STO "Ash-and-slag materials for vertical planning of the territory";

- OmSAU named after P.A. Stolypin (soil sciences department) developed technology of OJSC "TGC-11" TPPs' ash-and-slag usage in agriculture".

## REFERENCES

1. **Materials** of scientific and practical Conference "Innovation system of lowering resource capacity of coal OJSC TGK-11 TPPs production", Omsk, February 2011. Scientific and technological magazine "Westnik AELPS", volume 17, number 2 .
2. **V.R. Shevtsov**. "Perspective Plan of large-tonnage usage of ash-and-slag of OJCS "TGC-11" TPPs" for the period from 2011 to 2020".
3. **III International** Scientific and Practical Workshop "Ashes from TPPs: removal, transport, processing, landfilling": – Moscow, April 22-23, 2010 – M.: Publishing house of MPEI. – 140 pages with graphic.
4. **M.S. Fokin**. Report of OmSU (Law faculty) on research work "Analytical and research work for a legal document creation and propositions to the documents of the Legislative Assembly and Government of Omsk region in the sphere of natural resources saving by way of Omsk TPPs' ash-and-slag materials usage" by agreement #05.525.326.10 of 29.12.2010.

**S.I. Kozhemyako, V.R. Shevtsov**. Forming a system of management of by-products from coal-fired thermal power plants // Proceedings of the IV scientific and practical workshop "Ashes from TPPs: removal, transport, processing, landfilling", Moscow, April 19–20, 2012 — M.: MPEI-Publishers, 2012. P. 146 – 151.