UDC 621.9

Part 3

ASH AND SLAG HANDLING

3.7. Analytics

3.7.19. A role and a place of scientific and educational institutions in solution of coal ash handling problems in Russia

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ABSTRACT

Due to the increased technological impact on environment, a coal ash handling problem becomes more acute, and it's both a regional and a global one. At many Russian thermal power plants (TPPs) ash lagoons are close to their design filling, forcing power utilities to address the problem of coal ash handling.

Without the involvement of relevant scientific organizations, engaged in a system solution to coal ash handling problems, the staff of power plants and energy companies is not able to cope with the problem. Such organizations should be involved in activity at all phases of the project implementation, starting from development of the Technical Enquiry for running tender procedures for reconstruction of the existing and creation of the new ash removal systems (ARSs) at TPPs. Compulsory expertise of technical solutions at all phases of the project implementation is to be entered into the practice.

Development of ARS master plans should be based on the best available technologies in the field of coal ash handling. For using the world experience on application of the best available technologies it is necessary to arrange information provision of activity of TPPs, combusting coal and other types of solid fuel, based on a permanent system research on coal ash handling issues. The research results should be placed in the information system of an open access and used in programs of basic and additional education. Effective forms of information exchange between the countries world-wide on ash handling issues are holding of international conferences/workshops and participation in activities of the international organizations.

1. INTRODUCTION

Ash handling problem is more acute, since ash lagoons at the majority of TPPs, constructed in 1960-1970-ties, are very close to their design filling. Construction of the new ash lagoons is not only the economically unjustified expensive measure, but also causes irreparable damage to environment. In connection with the filling of ash lagoons under operation, there are two main ways to resolve the ash handling problem:

- construction of the new ash disposal sites, when the cost for each TPP would make several hundred million dollars together with devastation of hundreds of hectares of land,
- maximum shipment of ashes for their processing at enterprises of various economic sectors in accordance with their requirements and storage of the unclaimed ash by environmentally sound ways with minimal costs.

Thus, TPP owners are forced to choose one of the main options for the problem solution as the base and carry out in-variant working out of ARS master plans. A choice of the basic ash handling scenario is to be realized on the basis of assessment of ecological and economic indicators of the developed options of the general ash removal system. For this activity it is necessary to attract the specialized scientific organizations, engaged in the system solution of coal ash handling problems in order to apply the best available technologies used in the industrialized countries world-wide. It should be noted that at all stages of the project implementation an external independent expertise of technical solutions is to be conducted.

2. NECESSARY EXTERNAL CONDITIONS FOR EFFECTIVE ADDRESSING THE ASH

The main external conditions necessary for effective addressing coal ash handling problems include:

- availability of the integrated set of legal and regulatory documents, promoting the maximum beneficial use of ash and slag from power industry for replacing natural resources;
- sincere desire of the management of power companies – owners of coal-fired power plants to solve the ash problem and understanding of the fact that noone except them will solve it.
- conducting system research on ash handling issues and environmental activity of TPPs, as a whole;
- information provision of activities conducted in power companies and specialized organizations in the field of ash handling;
- existence of a system, ensuring compliance of the personnel qualification, working in power companies and specialized organizations with the state-of-the-art requirements;
- international cooperation on coal ash handling issues.

The first two conditions are obvious, therefore, they are not considered, focusing on other conditions.

2.1. Conducting system studies on ash handling problem and environmental activity of TPPs, as a whole

About creation of "Information and Analytical Centre "Ecology in Power Engineering" in Moscow Power Engineering Institute (IACEE MPEI) in 1999. Effective activity in any field is impossible without conducting systems research. Prior to IACEE MPEI foundation in universities and specialized institutions of the Russian energy sector there were no departments, conducting

system research on ash handling problems and environmental activity of TPPs, as a whole. The main activities of IACEE MPEI are as follows:

- conducting system studies on different aspects of ecology in power engineering;
- creating and constant updating of information environment in the field of nature protection technologies in energy sector in line with the modern requirements;
- organizing and holding the international scientific and practical conferences and workshops;
- conducting R&D and rendering scientific and technical services in the field of ecology in power engineering;
- developing and supporting the implementation of technical proposals for modernization of the existing and creation of the new reliable and economically effective systems with acceptable ecological performance;
- developing the legal, normative and technical documents on ash handling problem, as well as on creation of safe, economically effective and ecologically sound ash removal systems at TPPs and boiler-houses.

As a results of system studies fulfilled by IACEE MPEI, in 2007 the Publishing House of MPEI issued the information collection "State-of-the-art nature protection technologies in electric power engineering" [1], prepared by the leading Russian experts in accordance with the Program of implementation of environmental policy of RAO "UES of Russia" for 2006-2007. The handbook provides information on domestic and foreign environmental technologies that are used or may be applicable in the Russian power industry for reduction of industrial impact from power companies on environment.

On creation of the updated information environment in the field of nature protection technologies. Activity on creation and publication of the printed works such as the above-mentioned collection has been continuing long enough, causing part of materials may partially or even completely lose their currency. This is a natural lack of any volume technical printed matter due to the constant development of techniques and technologies. In this regard, in 2007 we put forward the idea of creation of the constantly updated public sites, which would reflect the results of system studies of domestic and foreign experience in solution of environmental problems in energy sector. Management of JSC RAO "UES of Russia" supported this idea and included into the Program for implementation of environmental policy of RAO "UES of Russia" for 2008 a task for developing the concept of creating two web-sites "State-of-the-art best available and advanced nature protection technologies in electric power engineering" (http://nst.e-apbe.ru) and "Coal combustion by-products from Thermal Power Plants of Russia" (http://ccp.e-apbe.ru). It should be noted that the National site "Coal combustion by-products from Thermal Power Plants of Russia" was immediately created as a part of the World-wide Coal Combustion Products Network (www.wwccpn.org). In June 2008, the work has been performed. The site was created by IACEE MPEI under the contract with the CJSC "UES Energy Efficiency Center". The supervisor of the work was the CJSC "Energy Forecasting Agency".

However, after the cessation of activity of the JSC "RAO UES of Russia" in July 2008 further work on completion of the two sites and their constant update was not possible not only due to a lack of funding, as it is, but due to the absence of any prospect of funding from the energy sector, as the industry. Other Ministries and departments are not interested in this project as well. This situation with updating the sites persisted until MPEI has got a status of the National Research University in 2010; the information about that will be reported below.

About organization and holding of international scientific conferences and workshops. In accordance with the main directions of IACEE MPEI activity the following events have been organized and held:

- I International scientific and practical conference "Ecology in power engineering - 2000";
- II International scientific and practical conference and exhibition "Ecology in power engineering - 2005";
- I International scientific and practical workshop "Ashes and slags from TPPs - removal, transport, processing, landfilling", Moscow, 2007;
- II International scientific and practical workshop "Ashes and slags from TPPs - removal, transport, processing, landfilling", Moscow, 2009;
- III International scientific and practical workshop "Ashes and slags from TPPs - removal, transport, processing, landfilling", Moscow, 2010;
- I International workshop in Poland "A practice of implementing technologies for use of ash and slag from power generation", 2010, Warsaw - Silesia (Poland).

In each of the International scientific and practical conferences "Ecology in Power Engineering" about 300 experts from Russia and other countries from all over the world attended. Conducting these activities at an adequate level without significant financial support from the state and the branch is not possible. In addition, environmental activity of power utilities is so different, that for efficient, in terms of participants, holding the conferences a parallel work of at least eight sections should be provided. Because of the mentioned above reasons we decided to give up the idea of holding such global conferences and focus on conducting the international scientific and practical workshops on ash and slag handling in Russia and other countries world-wide.

Any substantively prepared international conference or workshop is a very effective information platform, the practical value of which can't be overestimated. For example, as a result of getting acquaintance of Assistant Director General of the JSC "TGC-11" Shevtsov V.R. with the head of Fly Ash Mission of the Government of India V. Kumar at the time of the II International scientific and practical workshop "Ashes and slags from TPPs - removal, transport, processing, landfilling" in April 2009, at the Kremlin in the presence of the Prime Minister of India Manmohan Singh and the Russian

President Dmitry Medvedev a Protocol of Intentions between Russia and India on use and safe management of fly ash has been signed on December 16, 2011. The protocol has been signed after bilateral talks at the highest level for the implementation of a mechanism in the Siberian Federal District, similar to the one developed by "Fly Ash Mission - India", in order to facilitate the development and application of technologies for fly ash utilization and safe management, including the import of technologies from India.

2.2. Information support of activities conducted in power companies and specialized organizations in the field of ash handling

The main purpose of information provision is not only to address the problems on ash handling and environmental activities in energy sector as a whole, but it is to create one of the necessary external conditions for development and implementation of effective environmental policy of power companies and enterprises. From the analysis of the coal ash handling problem follows that its effective solution is possible only in conjunction with the introduction of modern technologies of solid fuel combustion and flue gas cleaning.

Information support of environmental activities in energy sector is divided into external and internal. The internal information provision, otherwise known as the intra-corporate one, is arranged by the organizations themselves and is a separate wide subject, and, therefore, is not considered here. Various aspects relating only to external information support will be considered further.

Obligatory condition of the maximum objective external information support of environmental activities in energy sector is to conduct research on development and application of environmental techniques and technologies in energy companies all over the world, and use the results of their analysis in various directions of the external information support.

Directions of the external information support of environmental activities conducted in power companies:

1. creation and update of electronic information systems of the open access on environmental problems in power engineering;
2. creation of education and information electronic and printed materials.

The main objectives of the external information support of environmental activities in energy sector:

- free online acquaintance of any Russian or foreign user with the constantly updated information on development, introduction and use of nature protection equipment and technologies in the Russian power sector and all over the world;
- creation and constant update according to the state-of-the-art requirements of the information environment for development and realization of training, professional skills improvement and retraining programs in the field of nature protection technologies in power industry for experts from operating, design, research, regulatory and other enterprises and organizations;
- contribution in promotion in Russia of the best world available technologies on effective solution of environmental problems in power industry;
- promotion of increase in efficiency of conduting system research by the Russian and foreign experts on addressing environmental problems in power industry;
- providing the opportunities for information exchange on environmental issues in power industry between the Russian and foreign experts;
- assistance in establishing cooperation between the Russian and foreign companies and experts;
- formation of a favorable image of Russia in the field of environmental protection in power engineering all over the world due to maximum open objective informing the world community on activity of the Russian power companies on solution of ecological problems and use of by-products from organic fuel combustion for replacing natural raw materials.

2.3. Availability of the system for ensuring the compliance of qualification of personnel from power companies and specialized organizations with the current requirements

In 1997 a Center for improvement of professional skill and professional retraining “Ecology in Power Engineering" (CPPEE MPEI) has been established in MPEI. The base department is Boiler Plants and Ecology in Power Engineering Department.

The main reason of CPPEE MPEI creation was noncompliance of qualification of the personnel from power companies, operating coal-fired power plants, as well as the staff from design and other specialized organizations of the energy sector in application of modern environmental technologies, taking into account world experience, with the state-of-the-art requirements. The consequence of this was either the resistance to include the tasks for development and introduction of the modern environmental technologies in the industry R&D plans (existed at that time) and/or the use of positive results of the tested R&D in the projects on TPP technical reequipment or a lack of understanding of the operating personnel, how to use new techniques and technologies, already introduced at the power plant. A pleasant exception made few TPPs, where activity on collecting and analyzing the information on application of nature protection technologies in power engineering was systematically arranged. At introduction of new techniques and technologies MPEI employees in some form conducted the studies with the operational personnel. To eliminate this negatively influencing factor, MPEI management decided to establish CPPEE MPEI at the suggestion of Boiler Plants and Ecology in Power Engineering Department.

Courseware. In accordance with the state educational standard, the training center should have the necessary education materials for the curriculum. Unfortunately, at that time there were no materials,

which would completely correspond with the modern requirements, covering various aspects of environmental activity in energy sector. In 2003 MPEI Publishing House issued the manual "Ecology in power engineering" [2], intended for implementation of advanced training and professional training programs in the field of ecology in power engineering of the personnel from enterprises and organizations of RAO "UES of Russia", Fuel and Energy Complex, Municipal and Community Services and other sectors and agencies. The basis for the training manual made education materials, developed by the leading Russian experts - CPPEE MPEI teachers during 1998-2003 for programs of training and professional retraining of personnel from utilities of RAO "UES of Russia" and other economic sectors on the specialties "Thermal power plants," "Electric power systems and networks" and "Electric plants".

Since 1998 till 2011 in CPPEE MPEI 645 employees were trained and 224 employees from power companies and specialized organizations of the energy sector were retrained. However, despite of the fact that activity of CPPEE MPEI is certainly useful, it does not solve the whole problem of compliance of the power industry staff qualification in the field of nature protection technologies with the modern requirements.

For all the time of CPPEE MPEI activity only 15 listeners of professional retraining programs defended their diplomas relating to ash handling issues. From this we can conclude about the attention of management of the vast majority of power companies and specialized organizations of the energy sector paid to this problem.

Experts' qualification on coal ash handling problem. Till now there are no high schools in Russia and other countries world-wide teaching the students on ash handling problem. There is a paradoxical situation, when the problem exists, but no experts in high schools are prepared. People become experts in this field as a result of any casual events occurring in their life. As a rule, such experts have fragmentary, non-systemic knowledge which are insufficient for effective solution of the coal ash handling problem. It is necessary to address the target preparation of the certified specialists in specialized secondary and higher education institutions. The situation is worsened due to reforming of the Russian educational system. After 2015, if nothing is changing in global in the Ministry of Education and Science of Russia, Bachelor's and Master's qualifications will be the main for graduates of Russian technical high schools, and the Engineers will not be prepared.

In addition to the target training of dedicated experts within the base education, a system of training and retraining of experts can and should be arranged.

For practical solution of a problem on target preparation of graduates it is necessary to complete the following primary tasks:

- define a need of various economy branches of the state in such experts;
- develop the Curricula of bachelors' and masters' training;
- select the interested basic educational institutions having training facilities and methodological framework, being to the maximum extent ready and meeting the above-stated Curricula, where it is possible to arrange such a preparation of experts with minimum expenses;
- make the required changes in educational standards;
- create education facilities for preparation of experts in the basic educational institutions selected in a corresponding order;
- start preparation of experts.

If we estimate a real time for becoming the first experts, it is possible to assume that it will occur in 8-10 years or even more after they start to make practical solutions on all the complex of problems. But time presses, though target preparation needs to be arranged all the same.

Creation of systems on professional skill improvement and professional retraining of experts does not require so much time. There are two possible alternatives here: improvement of professional skill and professional retraining.

Improvement of professional skill. Development of teaching materials for improving of experts' skill, in our opinion, will take no more than a year. Improvement of professional skill of experts in Russia could be arranged in CPPEE MPEI involving authoritative Russian and foreign experts. We believe that in other countries of the world educational institutions which could improve professional skill of experts will be also found. Duration of the professional skill improvement program can be different, but by experience of experts' training according to different programs for continuing professional education in order to achieve a desirable efficiency it shouldn't be less than 160 hours. In such a program execution and defense of the final work considering practical solution of any problem being sensitive for the organization in which the listener of the professional skill improvement program works, should be provided.

Professional retraining of experts. This is the most effective direction of dedicated expert' preparation. According to the Russian educational standard three basic modes are possible here:

- graduate courses;
- postgraduate study;
- professional retraining.

It should be noted that CPPEE MPEI has a practical experience in all three modes of study.

It should be noted that CPPEE MPEI has an experience in training on all three forms.

Graduate courses. Training process under this form begins at the last (fourth) year of the bachelor's study on a speciality "Thermal Power Plants". The bachelor conducts the final work connected with TPP ash and slag removal systems. Thus, professional retraining is combined with the basic education. During postgraduate studies there is a target preparation of the future expert in the field of ash and slag handling. At the same time

along with studies in CPPEE MPEI future masters are involved in performance of works under contracts with power companies, paying for their education. Total duration of preparation of such an expert makes three years (1 + 2 considering the last year of bachelor's study).

Postgraduate study. It is a form of preparation of highly skilled experts under the system: "Bachelor's programme→Master's programme→Postgraduate studies". During postgraduate studies a future expert most of his time (50% and more) is involved in activity on performance of works under contracts with power companies, paying for his postgraduate study. Total duration of professional retraining of such an expert makes six years (1 + 2 + 3 considering the last year of bachelor's studies).

Professional retraining. By experience of implementation of programs on professional retraining of experts from power enterprises, it was found out that the considerable part of engineers doesn't have the required profile power engineering education. Therefore, duration of effective professional retraining of experts on ash and slag handling should make not less than 1000 classroom hours that is possible at on-site and correspondence training during two years with the training program duration of about 2000 hours. Total duration of separation of the trainee from manufacture makes four months during two years.

2.4. International cooperation on coal ash handling problem

2.4.1. International cooperation of the National Research University MPEI on ash handling problem.

World–wide Coal Combustion Products Network (www.wwccpn.org) was established under the initiative of the American Coal Ash Association (ACAA) in 1999 and is a result of effective non-state cooperation of internationally-recognized experts in handling coal combustion products (CCPs), from which coal ash from power plants and boiler-houses is the most large-capacity by-products. Putilov V.Y. is a member of the Coordinating Council from Russia, and Putilova I.V. is a member of the Working Group on Development of the World-wide Coal Combustion Products Network. WWCCPN members are constantly interacting with each other and other leading experts in CCP handling to discuss solutions of common problems, achievement of the best results in research and development and implementation of the new technologies for CCP use.

European Coal Combustion Products Association (ECOBA) was founded in 1990 by European energy producers to ensure the effective and high quality use of CCPs. IACEE MPEI actively cooperates with ECOBA and is its affiliated member since 2006. One of the main objectives of ECOBA is to promote exchange of information and documents on ash handling issues between the national and international organizations, including through participation in international scientific conferences and workshops presenting analytical reports on the EU state as a whole or its individual members.

Collaboration with foreign universities on ash slag handling issues. In 2011 an Agreement on cooperation in scientific and educational activities between the West Pomeranian University of Technology in Szczecin and National Research University "Moscow Power Engineering Institute" has been signed.

We have no information about the collaboration of other universities in Russia with foreign colleagues, but it seems that it could be very productive for ash handling problem solution, using ash both in traditional applications and in new ones, as well. Perhaps, it makes sense to create a section on cooperation of universities all over the world on ash handling issues in Information electronic constantly updated system of the open access "Best available and perspective nature protection technologies in the Russian power industry" (OIS BAT) [3]), which will be described in the next section.

3. ABOUT CREATION OF OIS BAT IN MPEI

3.1. Key reasons of creating OIS BAT in MPEI:

1. incomplete creation of the sites http://nst.e-apbe.ru and http://ccp.e-apbe.ru and a lack of funding of the system research for updating the sites after the cessation of activity of JSC "RAO UES of Russia" in July 2008;
2. nondiscretion in searching the funding sources to complete creation and subsequent updating of the websites http://nst.e-apbe.ru and http://ccp.e-apbe.ru, since they are owned and hosted by CJSC "Energy Forecasting Agency";
3. a possibility of budget funding under the MPE development program for creating OIS BAT, since in 2010 MPEI has got a status of the National Research University.

MPEI administration, working out the program of MPEI development for 2010 and further, included our proposal on creation of OIS BAT in Russian and English. The work on creation of the System has been performed in 2011. A leader of the project implementation was IACEE MPEI, the executor - JSC "Ekopolis". It should be noted that the section "Ash handling" of OIS BAT is a part of the World-wide Coal Combustion Products Network.

Information base of OIS BAT is as follows:

- results of the system research on ecological problems in power engineering;
- informational collection "State-of-the-art nature protection technologies in electric power engineering";
- Russian and foreign legal, normative and technical documents;
- proceedings of international scientific and technical workshops and conferences,
- reports of power companies on nature protection activities;
- publications in printed and electronic Mass Media.

While creating OIS BAT a possibility for adjustment and placement of new materials in the existing sections, as well as the addition of new sections or blocks with minimum financial and labor costs has been provided.

Functional capabilities of OIS BAT are as follows:

- allows to get free on-line access to all material of the systems by any Russian and foreign use;, the only condition is registration in the system;
- contributes in promoting in Russia the best world technologies in the field of environmental protection in power industry;
- provides an information base for more effective use of financial, material and human resources in solution of issues on improvement of environmental and economic indicators at construction of the new and modernization of the operating power utilities;
- improves the quality of training, improvement of professional skill and retraining in the field of environmental protection of experts involved in design, construction and operation of power utilities;
- promotes information exchange in the field of nature protection technologies and techniques in power industry between the experts all over the world;
- promotes an objective image of Russia in the field of environmental protection in power industry.

3.2. Brief description of OIS BAT

3.2.1. The structure of OIS BAT.

Main body: "Nature protection technologies":

- Full content;
- Air protection;
- Water protection;
- Ash handling;
- Complex technologies;
- Physical factors;
- Advanced technologies;
- Energy saving;
- Renewable energy.

Section: "News"

- Global news
- News

Sections:

- General issues;
- Conferences,
- Events,
- Partners,
- Financing of the System,
- Contacts.

Contents of all the sections and materials of the System can be seen after the only condition - registration of the user. Since the workshop is devoted to addressing the ash handling issues, a content of the section "Ash handling" is presented below:

3.1. Coal-fired power plants;
3.2. Ash and slag handling systems at TPPs;
3.3. Ash and slag properties;
3.4. Beneficiation and ash management;
3.5. Applications of ash and slag from power coals;
3.6. Handling solid by-products from combustion of other fuels;
3.7. Analytics;
3.8. Legal and normative documents;
References to the 3rd part.

3.2.2. A format of materials submission**.** For forming an objective opinion on advantages and disadvantages of the applied or proposed for application the state-of-the-art best available and advanced nature protection technologies in power engineering, the minimal required data are as follows:

1. ***A name of the technology (analytical material or normative and technical document)*** should reflect its essence, be brief and precise.
2. ***Description of the technology (analytical material or normative and technical document)*** should be brief under the text and contain a minimum quantity of schemes (Figures), sufficient for understanding an essence of the technology (analytical material or normative and technical document) without disclosing the KNOW-HOW and the data, making a trade secret.
3. ***Full text of the normative and technical document*** should be resulted without changes, as in the primary source**.**
4. ***Type and capacity of power-generating equipment*** at which it is recommended or possible to apply the considered technology. Here types and passport capacities of power-generating equipment, where technologies are introduced, are specified. Power-generating equipment, where application of these technologies is possible, and also necessary conditions for their implementation are separately specified.
5. ***Scope of the technology (normative and technical document)*** should contain precisely specified limits**.**
6. ***Technology application restrictions.*** Here restrictions, revealed during implementation and operation, both skilled, and industrial, are specified. There can be recommendatory data resulted, as well.
7. ***Advantages and disadvantages of the considered technology.*** This part contains data on change of parameters before and after implementation of the technology:
   - technological (specific parameters of the fuel rate for electric and thermal energy generation, reliability, efficiency, a warranty period of maintenance, etc.);
   - economic (the cost price of thermal or electric energy generation, expense or change of expenses per unit of coal combustion by-products handling, etc.);
   - ecological (environmental effect at the power plant site and at the zone of power enterprise impact, use of natural resources, etc.);
   - social (improvement of working conditions and decrease of attendants' traumatism; creation of new work stations in the zone of power installation arrangement, etc.);
   - other parameters describing application of the technology.
8. ***Installations of technology implementation.*** Here legal names of power enterprises (branches), numbers or names of equipment accepted at the

power enterprise and other data, allowing to identify a place of technology introduction, are specified.

9. ***Data on presence/absence of copyrights to the applied technology, developers and/or legal owners of technology.*** As developers or legal owners of the technology or separate key developments used in the considered technology, both organizations and natural persons can be specified that should follow from patents, utility model certificates or other resulted documents.
10. ***Data on developers.*** Developers of the document should be specified in the normative and technical documents.
11. ***List of information sources.*** As information sources there can be used scientific and technical mass-media, printed and electronic; instructions of manufacturers approved when due hereunder normative-technical and other documents, specifying full output information, using that the information source can be defined.
12. ***The author (authors).*** At the end of the paper it is necessary to specify: the author (authors) of the information, a place of their work, a scientific degree, contact data (phone, fax, e-mail).

3.2.3. Selection of information for updating OIS BAT. Materials, submitted for their placing in OIS BAT, are selected by the Editorial Board, formed from the authoritative experts in various directions of nature protection activity in power engineering. A list of members of the Editorial Board is available at: http://osi.ecopower.ru/images/stories/redkolleg_eng.pdf.

3.2.4. Copyright. To avoid possible confusion with regard to protecting one's copyright on the data from the materials, placed in OIS BAT, the authors of materials submitted to the Editorial Board, represent a mandatory permissions for publication. In the permission among other things they write that "... by giving permission to place the above mentioned papers in printing and electronic Media, we are taking the complete responsibility for the absence of information being of a trade secret or know-how of the presented technologies.

3.4. Financing of the System

The main problem, associated with the project operation of OIS BAT, is financing the system research on ecology in power engineering and reflecting the results of research, conducted by the leading experts in this field. For productive work of the Editorial Board of the System funding is also required. Possible extreme options for information access and corresponding sources of funding are the following:

Option №1.

Access: *paid for all groups of users.*

Sources of funding*: organizations and enterprises of all patterns of ownership and natural persons.*

The option validity*: the option has no right to exist, because it contradicts the right of access of each member of the global community to information on problems of mankind survival.*

Option №2.

Access: *free for all the users.*

Sources of funding*: basic and additional.*

Basic sources of funding*: budget and off-budget funds of the Ministry of Energy, Ministry of Industry and Trade, Ministry of Education and Science, Ministry of Natural Resources, Ministry of Regional Development, regional ecological foundations and funds from environmental programs of power companies.*

Additional possible sources of funding: *specialized firms wishing to participate in respective rankings, funds and donations from environmentally responsible organizations, ecological foundations, and individuals.*

The option validity*: highest at responsible attitude of not only the executives of the Ministry of Energy, Ministry of Industry and Trade, Ministry of Education and Science, Ministry of Natural Resources and Ministry of Regional Development, power companies and regional ecological foundations, but also at the financial support of other environmentally responsible organizations, enterprises and foundations, regardless of their ownership.*

Comments on possible funding sources.

Some companies are willing to place information about their technologies, which is advertising, in essence, and they are ready to pay for it, and even maybe quite a nice sum. However, we are not an advertising agency and will not under any circumstances use this source of funding, as it is known that 'He who pays the piper calls the tune". Our goal is in maximum objective informing of all users about the best available environmental technologies in power engineering, and any advertising - it is big or small lie! Thus, we believe that the financing option # 2 is the most correct.

There is currently no any certainty in further sustainable funding of the System, although in 2012 the situation with funding started to change for the best:

- under MPEI development program (Ministry of Education and Science) 800.0 thousand rubles have been appropriated in 2012;
- donations for maintaining the System and holding the IV International scientific and practical workshop "Ashes from TPPs - removal, transport, processing, landfilling" for the total amount of 650 thousand rubles have been transferred in 2012, including:
  - ***Omega Minerals Group*** (Germany, 280,0 thousand rubles.);
  - ***OJSC "TGC-11"*** (Russia, 200,0 thousand rubles);
  - ***CJSC "INET"*** (Russia, 90,0 thousand rubles);
  - ***Beijing Guodian Futong Science & Technology Development Co., Ltd*** (China, 80,0 thousand rubles).

5. CONCLUSION

1. Conducting the system research on ash handling issues and environmental activities of TPPs, as a whole is a basis for the effective solution of ash handling problem.
2. Creation of the system for ensuring the compliance of personnel qualification from power companies and

specialized organizations with the modern requirements for ash handling issues is needed;

3. International cooperation is an essential condition for taking into account the best practices of the countries world-wide to address the ash handling and ecological problems in general.
4. Constantly updated OIS BAT is a necessary information resource for effective addressing the ash handling issues, and ecological problems in energy engineering in general because of the following reasons:
   - all the interested parties can get an easy access to the objective information concerning the international experience on application of the best available nature protection technologies in power industry;
   - it helps to make the informed choice when making decisions, taking into account all aspects of implementation and use of the best available nature protection technologies in power industry of Russia and other countries all over the world, instead of spending useless time for looking at advertizing brochures;
   - it complicates making the corruptive decisions on retrofit of the existing and construction of the new thermal power plants due to upgrading the understanding of ways of addressing ash handling issues and environment problems, in general, not only by employees of power companies and specialized organizations of the power sector, but also by representatives of supervisory authorities and the public;
   - makes it possible to reduce the risks of financial costs for re-development of the already known, but often issued as new technical solutions and introduction of low-effective technical solutions;
5. provides an update information environment in the field of nature protection technologies in power engineering for development and implementation of primary and secondary education programs for specialists from high schools and other educational Centers, as well as internal corporate training centers.
6. OIS BAT currently has and should maintain the open access for all users, since the environmental preservation is a national problem of the global scale, and the obstruction of any person, interested in getting the most objective information on possibilities of reducing the technological impact from the power sector, is a crime against humanity.
7. An effective solution of OIS BAT funding is possible only due to responsible attitude of not only the executives of the Ministry of Energy, Ministry of Industry and Trade, Ministry of Education and Science, Ministry of Natural Resources and Ministry of Regional Development, power companies and regional ecological foundations, but also due to financial support of other environmentally responsible organizations, enterprises and foundations regardless of their ownership.

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