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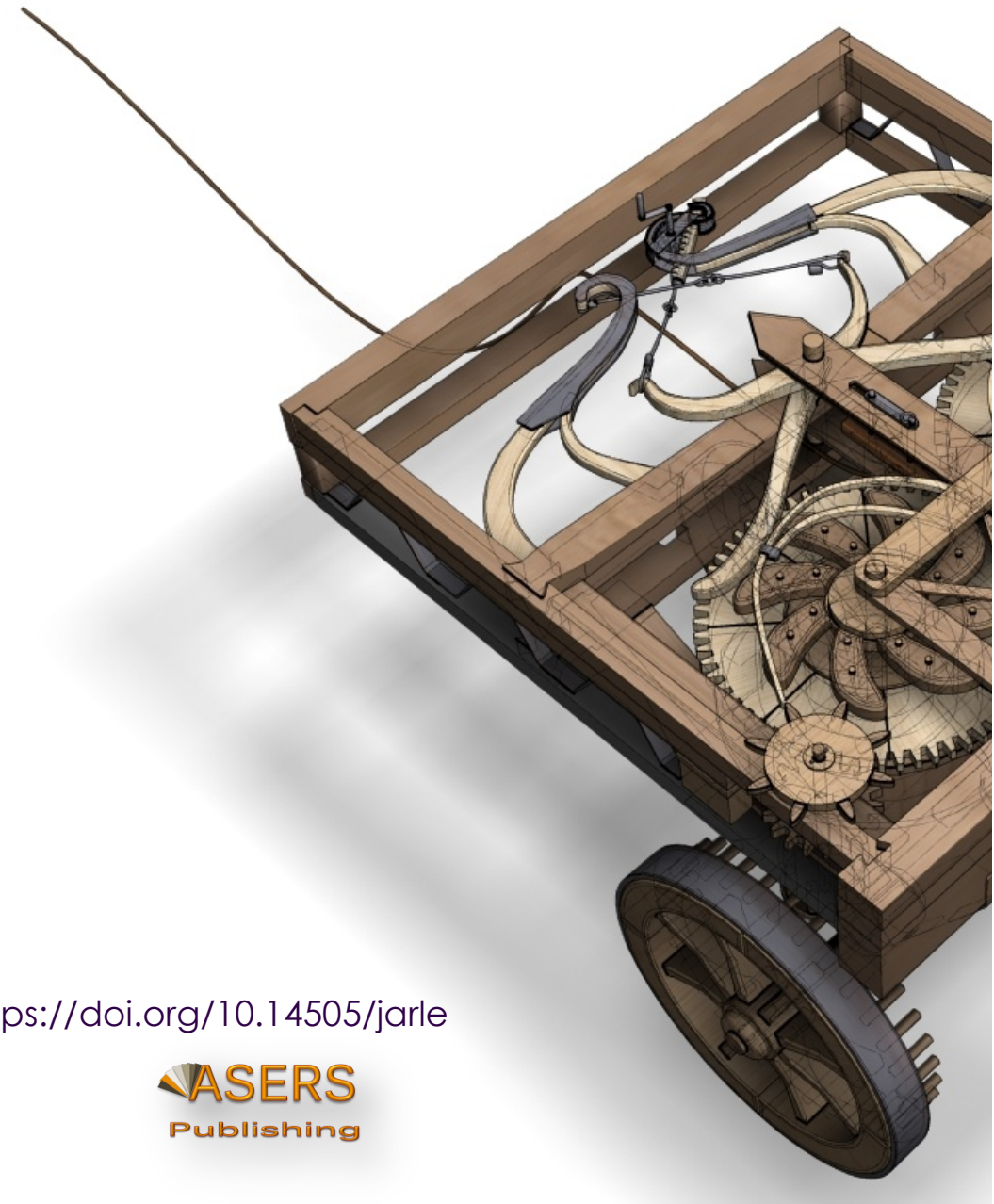

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Volume VIII, Issue 1(23), Spring 2017

Journal of Advanced Research in Law and Economics

Journal of Advanced Research in Law and Economics is designed to provide an outlet for theoretical and empirical research on the interface between economics and law. The Journal explores the various understandings that economic approaches shed on legal institutions.

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To explore the various understandings that economic approaches shed on legal institutions, the Review applies to legal issues the insights developed in economic disciplines such as microeconomics and game theory, finance, econometrics, and decision theory, as well as in related disciplines such as political economy and public choice, behavioral economics and social psychology. Also, *Journal of Advanced Research in Law and Economics* publishes research on a broad range of topics including the economic analysis of regulation and the behavior of regulated firms, the political economy of legislation and legislative processes, law and finance, corporate finance and governance, and industrial organization.

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Rationalization of Raw Materials and Fuel and Energy Base of the Construction Industry of Kazakhstan Industrial Regions

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Abstract

The article deals with an actual problem - the rationalization of raw materials and fuel and energy base of the construction industry of Kazakhstan industrial regions. It covers the basic principles of rational use of natural resources and the comprehensive processing of mineral raw materials as elements of the state strategy, as well as statistics on investments aimed at environmental protection, sustainable use of natural resources of Kazakhstan and the relevant costs by types of environmental activities. The article sets forth the theoretical basis and practical recommendations on the effective organization of the raw material base of the construction industry as the most material intensive industry capable of utilizing the largest volumes of industrial waste as the main raw material and additives for the production of building materials. A number of examples of successful use of large-tonnage industrial waste instead of the traditional raw materials ensuring environmental, economic, organizational

and technological effects were provided. The measures for environmental protection and rational use of natural resources in the construction industry were recommended. The conditions for rational organization of the fuel and energy base of the construction industry, involving selection of the most efficient types of fuel, energy sources used in the construction production, as well as the most efficient schemes for providing energy resources to production processes, taking into account energy saving, were provided.

Keywords: raw materials base; construction industry; cost-effective use of resources; comprehensive processing of mineral raw materials; environmental protection; technogenic raw materials; fuel and energy base; fuel and energy types; energy supply for construction; temporary heat supply.

JEL Classification: K32; L70; L74.

Introduction

Rationalization of raw materials and fuel and energy base of the construction industry of Kazakhstan industrial regions is based on the state development strategy aimed at resource conservation, sustainable use of natural resources, and the comprehensive processing of mineral raw materials.

The fundamental strategic documents, along with the strengthening of the extractive industries define as an important strategic trend the accelerated development of enterprises, providing for a deeper processing of domestic raw materials through the use of modern technique, advanced technologies and efficient management.

Today, the issues of a deeper and comprehensive processing of raw materials focused on reducing the industrial waste are of particular concern. Moreover, it is important to find the possibilities of cost-effective utilization of already accumulated huge quantities of large-tonnage industrial waste.

One promising solution to this problem is the use of technogenic raw materials by the most resource-demanding industry – building materials industry, for which this resource base is virtually inexhaustible. The use of large-tonnage industrial waste instead of traditional raw materials together with the expansion and rationalization of the raw material base of construction industry may provide for the achievement of environmental, economic, organizational and technological effects.

In the context of deteriorating environmental situation and the competition, the construction organizations themselves increasingly face the need to plan the activities for nature protection and rational use of natural resources.

The efficiency of production primarily depends on the effective use of resources, including the energy resources. Economically justified reduction in specific consumption rates of all types of energy resources per production unit output, bringing them to the level of advanced countries and technologies, reduction of unproductive losses upon transfer and use of energy and energy resources, the maximum utilization of alternative and secondary energy sources are the main objectives of the state energy saving policy.

The rational organization of the fuel and energy base of the construction industry involves a selection of the most efficient types of fuel, energy sources used in the construction production, as well as the most efficient schemes for providing energy resources to production processes.

The main directions of possible energy savings shall be determined, common requirements for the rational design of construction site power supply shall be developed, the procedure and recommendations for the optimal selection of sources, structures and circuits supplying construction sites with electricity shall be established and developed.

Key objectives, composition of the systems, the design order and the optimal sources of temporary heat supply must be determined, the procedure and criteria for the rational design of temporary water supply to the construction sites must be specified.

1. Methodology and state strategy of rational use of natural resources and the comprehensive processing of mineral raw materials

Evaluation of Kazakhstan's resources and the basic guidelines for their management are reflected in the Address of the President of the Republic of Kazakhstan to the people of the country 'Strategy - 2030'. The fundamental document, along with the strengthening of the extractive industries defines as an important strategic trend the accelerated development of enterprises, providing for a deeper processing of domestic raw materials through the use of modern technique, advanced technologies and efficient management.

Today, the issues of a deeper and comprehensive processing of raw materials focused on reducing the industrial waste are of particular concern. Moreover, it is important to find the possibilities of cost-effective utilization of huge quantities of high-tonnage industrial waste that has already accumulated by now, such as coal mining overburden rocks, slag mixture from steam coal burning, waste of ferrous and non-ferrous metals, etc.

Decree of the President of the Republic of Kazakhstan 'Concerning Measures to Implement the Strategy for Development of Kazakhstan up to 2030' provides for the faster growth of domestic mineral resource base. The main priorities in this area include:

(a) introduction of new facilities at the existing fields;
(b) introduction of advanced equipment and technology of geological, geophysical and drilling operations;
(c) creation of man-made deposits inventory system on the basis of digital geographic information systems;
(d) development of standards and regulations;
(e) increasing the competitiveness and the introduction of advanced resource and energy saving technologies, the expansion of research activities and the creation of information systems;
(f) efficient use of available raw materials, involvement in the processing of waste and technogenic deposits;
(g) attracting direct foreign investments needed for the development of priority sectors;
(h) training of supervisory, engineering and technical, and scientific personnel in accordance with international standards;
(i) providing a stable regulatory framework, simplification of approval procedures and the implementation of investment projects.

The Constitution of the Republic of Kazakhstan says that the land and its subsoil, water, flora and fauna, and other natural resources are owned by the state. The land may also be privately owned on terms, conditions and within the limits established by law. But regardless of who will own the land and the natural resources, it is necessary to ensure their efficient use.

It is obvious that today the issues of rationalizing the raw materials and fuel and energy base of any manufacturing industry are closely linked to environmental issues. The Constitution of the Republic of Kazakhstan notes that the state aims to protect the environment favorable for human life and health, and the citizens of the Republic of Kazakhstan must preserve nature and protect natural resources.

The special importance of environmental issues and efficient environmental management is also emphasized in the Decree of the President of the Republic of Kazakhstan 'Concerning Measures to Implement the Strategy for Development of Kazakhstan up to 2030'. The main priorities in this area include:

(1) Creation of an effective environmental management and environmental protection system:
    (a) optimization of the organizational structure of the system of public administration and monitoring of the state of the environment and management of natural resources;
    (b) strengthening the environmental aspect in natural-resource and other legislation.
(2) Creating a framework for the balanced use of natural resources:
    (a) ecological zoning of the territory of the republic;
    (b) creation of a bank of public inventories of natural resources;
    (c) reducing the impact of economic activities on the environment through its comprehensive assessment and environmental audit;
    (d) introduction of resource-saving technologies;
    (e) development of a network of specially protected areas;
    (f) development of ecological tourism;
    (g) study and reproduction of natural resources;
    (h) recycling of industrial and household waste.
(3) Environmental education:
    (a) laying the foundations of environmental education and training;
    (b) awareness-building activities and promotion of ideas of environmental protection and efficient use of natural resources.

Together with the development of effective public strategy in the field of environmental protection and efficient use of natural resources, it is important to correctly identify the corresponding objectives of the enterprises.

Law of the Republic of Kazakhstan 'On Environmental Protection' regulates the rights and economic responsibility of the individual business entities for the efficient use of natural resources.

All industrial enterprises in the territory of the Republic of Kazakhstan, both currently existing and newly created ones, must comply with the modern environmental safety requirements. The Law 'On Environmental Impact Assessment in the Republic of Kazakhstan' regulates this aspect of the activity of the entities in the Republic of Kazakhstan.

Table 1 shows the statistical data on investments aimed at environmental protection and efficient use of natural resources of Kazakhstan by types of economic activity in the first half of the current decade (Environmental Protection and Sustainable Development of Kazakhstan 2010 – 2014, p. 53).

Table 1. Investments aimed at environmental protection and efficient use of natural resources by types of economic activities

Names of the main types of economic activities	Amounts of investments by years in current prices, tenge mln.			
	2011	2012	2013	2014
Total investments in environmental protection measures, of which:	70,539	75,149	77,500	103,492
Agriculture, forestry and fishery	0.7	-	108	80
Industry, including:	55,832	67,515	66,385	84,682
Mining and quarrying	23,953	36,649	38,825	53,294
Processing industries	22,770	17,193	6,742	16,622
Water supply; sewerage system, control over the waste collection and distribution	805	254	514	1,766
Construction	36	-	706	145
Transportation and warehousing	325	39	5	25
Public administration and defense; compulsory social security	4,739	2,894	7,162	9,828

We should note the positive dynamics of the total amount of investments in environmental protection for the period under review. However, for the majority of economic activities, these changes are characterized by considerable unevenness. In our opinion, this was influenced by the second wave of the global economic crisis, which had the especially strong effect on the resource-based economies, which include Kazakhstan.

Figure 1 is a graph that allows evaluating the costs on the environmental protection in the Republic of Kazakhstan by various types of environmental activities in 2014 (Environmental Protection and Sustainable Development of Kazakhstan 2010 – 2014, 52).

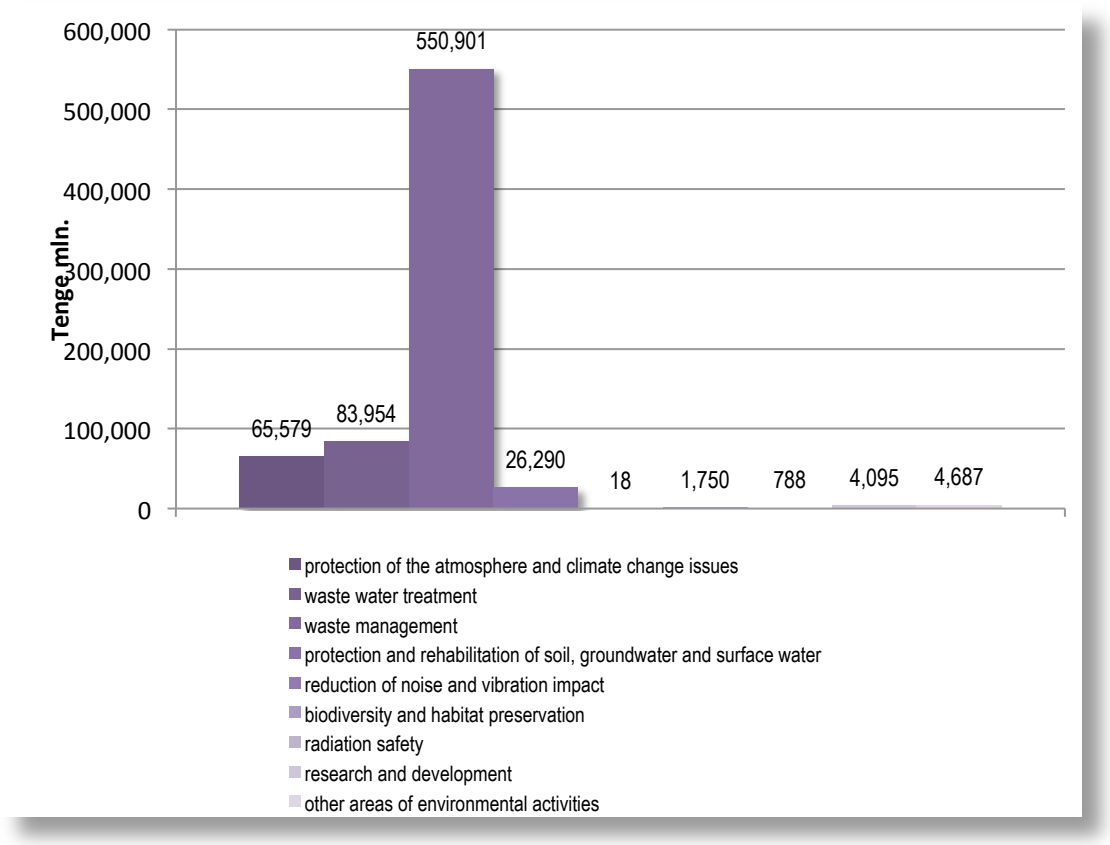

Figure 1. The environmental protection costs by types of environmental activities in 2014

These data indicate that the greatest costs on environmental protection in our country fall at waste management (storage, disposal, recycling), and then in decreasing order - the costs for wastewater treatment, air protection and the solution to the problem of climate change, as well as for protection and rehabilitation of soil, groundwater and surface water. The cost for the remaining environmental activities (Figure 1) is relatively small.

The efficient organization of raw materials, fuel and power base involves, above all, the right choice, and binding to sources of relevant resources, creation of the necessary communications network, efficient use of the resources involved and systematic monitoring of quantity and quality indicators.

2. The results of studies on the rationalization of fuel and energy base of construction enterprises

The efficient organization of the fuel and energy base of the construction industry involves a selection of the most efficient types of fuel, energy sources used in the construction production, as well as the most efficient schemes for providing energy resources to production processes.

The efficiency of production primarily depends on the effective use of resources, including the energy resources. Economically justified reduction in specific consumption rates of all types of energy resources per production unit output, bringing them to the level of advanced countries and technologies, reduction of unproductive losses upon transfer and use of energy and energy resources, the maximum utilization of alternative and secondary energy sources are the main objectives of the state energy saving policy (Baymukanov 2002, 55-57).

According to researchers (Primbetov and Sabirov 2000, Baymuratov 2000) Kazakhstan has significant reserves to increase the fuel and energy use efficiency. Three potential areas of energy saving can be identified.

The first very effective and low-cost area recommended for the initial stage of the implementation of energy saving policy is the efficient use of fuel and energy. By taking effective measure in this area, the need for fuel and energy may be reduced by 12 – 15%.

The second area relates to the restructuring of the economy, changes in the pace of development of energy-intensive and less energy-intensive industries. For instance, it is known that the energy intensity of light

industry production, service industries, and construction is 8-10 times lower than that in the fuel and energy industries, and 12 – 15 times lower than that in the metal industry.

The third area implies introduction of energy saving technologies, processes, machines and equipment in the most energy-intensive industries and housing and utility infrastructure. In this regard it is possible to reduce the demand for energy by 25 – 30%. Typically, the implementation of these features is associated with specific financial and material costs. However, these costs are 2 – 4 times lower than those required for an equivalent increase in extraction and production of fuel and energy.

Power supply of the construction industry enterprises is most often considered in terms of their electricity and heat supply.

With the growth of the level of industrialization and mechanization of the construction works, the role of electricity supply – one of the key factors ensuring the normal course of the construction works – also grows. Designing the efficient temporary power supply can be regarded as one of the main problems in the site organization.

General requirements for the design of power supply for a construction project can be summarized as follows:

- providing electricity in the required amount and of the required quality (voltage, current frequency);
- flexibility of the circuitry - the consumer supply ability in all areas of construction;
- power supply reliability;
- minimization of costs for temporary devices and minimal losses in the network.

A certain order shall be followed in the design of the temporary power supply for construction, as follows:

(1) to calculate the electrical load;
(2) to define the number and capacity of transformer substations and other power sources;
(3) to identify the first category facilities requiring a backup power supply (dewatering, electrical heating of concrete hardening in winter conditions, etc.);
(4) to position the transformer substations, power and lighting networks, inventory electrical devices on the master plan; and
(5) to draw a power supply scheme.

The stationary sources, mobile transformer substations, temporary electrical power plants and inventory devices may be used for the power supply in the construction industry. The most effective is the electricity supply for the construction industry from the existing regional power lines through step-down transformer substations. The package transformer substation (PTS) selected in accordance with calculation is recommended to be located in the center of electrical loads on the master plan.

Temporary heat supply on the construction sites is provided for the following purposes:

- providing heat for technological processes (heating of concrete hardening in winter conditions, thawing of soil, etc.);
- heating and drying facilities under construction;
- heating, ventilation and hot water supply of temporary sanitary and administrative buildings (temporary accommodation units, showers, offices, etc.).

As a rule, temporary heating systems are designated for construction period only, and shall be dismantled at the end of construction. The temporary heating systems should include heating sources, temporary heating networks and terminal devices (heaters, units, boilers, fan heaters, etc.).

It is recommended to design temporary heating as follows:

(1) to calculate the heat demand of individual consumers and total consumption for the project as a whole;
(2) to identify the sources of heat supply and calculate the fuel demand;
(3) to calculate and design the heat pipelines routes; and
(4) to select local units (terminal devices), and devices for heating, drying, warming, steam supply, etc.

In construction, the existing or designed heating systems of boilers of the area, plant, or TPP under construction may be considered as the main sources of temporary heating. If the existing permanent heat sources are absent, unavailable, or insufficient, it is recommended to use temporary boiler (container, movable type, etc.), heating and ventilation units (electric fan heaters, heaters, heat generators, etc.), gas-cylinder installations, etc.

Rationalization of raw materials and fuel and energy base of the construction industry also requires the optimal design of temporary water supply for construction sites.

It is recommended to design temporary water supply as follows:

(1) to define the estimated water demand;
(2) to select the water supply source;
(3) to outline a scheme of water supply lines;
(4) to calculate the diameter of pipes and determine their exact location on the master plan.

The following may be sources of water supply at the construction site: the existing water lines with the arrangement of additional temporary structures (if necessary) – reservoirs, pumping stations, water towers, etc.; designed permanent water lines provided they are put into operation according to a permanent or temporary scheme when required; independent temporary water supply sources – ponds, artesian wells, etc.

The results of calculations for heat and electricity supply of the construction industry enterprises should be reflected in the relevant project materials. The construction organization project (COP) shall stipulate only common solutions for energy supply on the basis of calculations, by aggregate per 1 million tenge of construction and installation works. During drafting of the Work Execution Plan (WEP), it is recommended to make clarifications and detailing of the project of the construction provision with all kinds of resources.

3. Discussion of proposals on raising the efficiency of raw materials base organization in the construction industry

The construction industry is characterized by considerable material consumption. Costs for materials usually account for more than half of the total cost of the construction and assembly operations and about one-third of capital investments in the national economy as a whole. In its turn, the production of building materials is related to the extraction and processing of huge amounts of raw materials. Therefore, rationalization of the raw material base and reducing the weight of building materials and products allow reducing the complexity and the cost of construction, enlarging the structures, and reducing transport costs.

The raw material base of the construction industry is considered to be the deposits of natural mineral resources, being the source raw material for the industrial production of building materials, components and structures, as well as large-tonnage industrial waste (waste rock, slag mixes, etc.) known as technogenic raw materials, meeting the quality requirements.

The development of scientific and technological progress and escalating environmental situation make the issue of efficient use of natural resources more urgent. Reduction of stocks of traditional raw materials determines the necessity to explore the possibility of the effective use of various industrial wastes. Their use as a primary raw material or the corrective additives in the production of building materials allows significantly expanding the resource base of the construction industry, reducing the consumption of process fuel, improving production efficiency, and contributing to the solution of environmental problems.

It was proved that the efficient utilization of industrial waste can cover up to 40% of the construction industry needs in raw materials. The use of industrial technogenic materials reduces the cost of construction materials by 10-30% as compared to their manufacture using the traditional raw materials, and thus capital savings can reach 35-50% (Mastafin 2015, 11–14).

The wastes of the coal industry are the most large-tonnage industrial wastes, which can be divided into two main groups: coal production waste (overburden and mine rocks) and coal washing wastes.

The issue of the use of coal wastes is of relevance, since their annual total output only in our and neighboring countries amounts to billions tons.

One promising solution to this problem is a more complete use of coal waste by the construction materials industry, for which this resource base is virtually inexhaustible.

Both in our country and beyond its borders much attention is paid to the research and design works aimed at the use of coal waste in the production of various construction materials (Kostin and Bezborodov 2001, 30-34; Terzić *et. al.* 2013, 159–180). A number of research projects are dedicated to the use of coal waste as the main raw material for the production of artificial porous aggregates for lightweight concrete.

During the preparation of the PhD thesis (Dontsov 1992) one of the authors of this paper has proved the possibility of production of clay gravel on the basis of coal mining overburden rocks, as well as considered the large-tonnage industrial waste of the Pavlodar region of Kazakhstan as the corrective and dusting additives improving the quality of expanded clay. The thesis also investigates the following:

- bauxite sludge, which is a waste product of alumina production from bauxite;
- pitchy dust, which is also a waste of alumina production, generated at the stage of red mud caking;
- steelmaking slag - a waste of metallurgical production;
- chlorinated briquettes – a waste of chemical production of aluminum chloride from kaolin;

- aluminum oxychloride, which is also a waste of the chemical production of aluminum chloride; and
- fly ash from the combustion of Ekibastuz coal.

The research results are protected by seven copyright certificates for inventions and are reflected in 34 publications.

The works of many researchers are concerned with the feasibility study on the use of industrial waste as the main raw materials and additives that improve the quality of building materials (Teixeira *et al.* 2014, Vichaphund *et al.* 2012, Oluwasola *et al.* 2014, Jitsangiam and Nikraz 2013). The authors (Lesovik and Evtushchenko 2002, 40-44) have presented the classification of industrial and pyrogenic wastes, taking into account the conditions of their formation, properties and uses. They have shown the influence of the structural instability of technogenic raw materials on the properties of the resulting composite.

Classification of industry by-products developed by I. Bozhenov is largely determined by the conditions of their formation (Bozhenov 1994). In this classification, the author proposes singling out the A class by-products that have not lost their natural properties (overburden rocks, refinement tailings, etc.), B class - artificial products, resulting from profound physical and chemical processes, and C class - products formed as a result of long-term storage in the dumps.

P.I. Bozhenov and a number of other authors think that the particular difficulty for the use of waste is that many by-products of the industry have significant technogenic heterogeneity largely affecting the properties of building materials derived from their use. Therefore, the widespread introduction of technogenic products in the production requires the development of a more detailed classification of waste as a potential raw material, taking into account not only the conditions of their formation, but also the nature of the change of their properties over time, as well as the recommended technologies for the production of building materials for each group of technogenic products.

The same conclusions were made by the researchers (Ryabov *et al.* 2014, 99–109) who found that when storing in the open air, physico-chemical properties of a waste and its processing characteristics changed to a constant value during a certain storage time, and then a potential raw material could even lose its useful properties. At the same time there were set new and refined the existing laws of the dynamics of the formation and utilization of waste of mining and metallurgical, thermal power and chemical-technology companies taking into account their toxicity and physico-chemical properties. There were developed methodical provisions ensuring the environmental safety of the production and the use of building materials derived from industrial waste.

Currently, in the context of continuous development of industrial production only the technological systems able to use all mined materials may be the prospective ones. Actually, only the construction industry, being the largest consumer of non-metallic materials, is able to process the majority of the waste generated. Therefore, the improvement of technology and the efficient use of resources in the production of building materials are impossible without a broad scientific basis of using technogenic products, to which many modern studies are devoted.

For instance, the efficient heat soundproof glass-ceramic material has been obtained from industrial wastes, representing highly-crystallized silicate melts (Chinnam *et al.* 2015, 11–16). Another highly effective insulation material (foam glass) was obtained on the basis of a technogenic waste of nonferrous metallurgy (Kanaev 2011, 254-257).

The results of studies (Sidikova 2016, 50-52) have shown that the floatation waste of tungsten-molybdenum ore enrichment may be used as the main raw material for the production of building ceramics, and facing tile in particular. This will allow expanding the raw material base of ceramic production, reducing the baking temperature and the cost of ceramic building materials and products.

Currently, chemical and food industry facilities produce hundreds of thousands of tons of gypsum-containing wastes. Most studies focus on the processing and disposal of phosphogypsum as the most large-scale waste from processing of apatite and phosphorite ores. The issue of processing of cytrogypsum – the waste of food citric acid production has also been addressed. As a result, the new composite building materials (Lukyanova and Starostina 2013, 818– 822) have been obtained on the basis of the modified gypsum binders.

The studies (Andreyeva and Burenina 2009, Bazarov *et al.* 2012, Dokuchaev 2015) allowed finding the possibility to use argillous raw material and wood waste for the production of small-piece construction composite materials. There have been obtained new plasticizing additives for the concrete on the basis of paper and coal industry waste – lignosulphonates and humate reagents from brown coal. There was shown the feasibility of use of heat-treated and neutralized waste of galvanic production as mineral fillers for building materials based on recycled polypropylene.

In the context of deteriorating environmental situation and the competition, the construction organizations

themselves increasingly face the need to plan the activities for nature protection and efficient use of natural resources. Such a plan should include specific measures to eliminate the negative impact of construction industry on the environment. However, it is necessary to identify opportunities for sustainable use of incidental natural resources obtained during construction and installation works (mostly during the preparatory period and ground development). A number of interesting studies (Volland *et al.* 2014, Volland and Brötz 2015, Esin and Yüksek 2013, Chinda 2016, Sangiorgim *et al.* 2015) have been conducted in this direction.

The following measures for the environmental protection and efficient use of natural resources may be recommended to civil construction entities:

- preservation of vegetation in areas allocated for development and utilization of demolished vegetation (trees and shrubs);
- preservation of topsoil and its use for land reclamation after the completion of works;
- timely cleaning and landscaping after construction;
- transfer of the most noise-generating works on the day shift;
- container shipping, storage and supply to jobs of bulk and low-strength materials (cement-sand mixtures, expanded clay, glass, wall tiles, etc.);
- efficient use of incidental non-metallic minerals (stone, gravel, clay, sand, peat, etc.) obtained in the production of the earthworks.

The effectiveness of the above measures in the first approximation is to obtain an environmental impact by reducing the negative impact of production on the environment. The final effect has a complex socio-economic nature and is expressed in social production efficiency increase.

It is well known that measures on environmental protection require certain material costs. Cost-effectiveness of their implementation should be set in the respective plans by comparing the economic results and associated costs.

Conclusion

Rationalization of raw materials and fuel and energy base of the construction industry of Kazakhstan industrial regions is one of the most important strategic objectives of regional development. Its successful solution will allow making a major contribution to ensuring the environmental safety and the transition to a sustainable economic development of the state in general.

No wonder that the efficient use of natural resources and the comprehensive processing of mineral raw materials are considered as the state strategy elements, which, along with the strengthening of the extractive industries define as an important strategic trend the accelerated development of enterprises, providing for a deeper processing of domestic raw materials through the use of modern technique, advanced technologies and efficient management.

The largest contribution to the issue of disposal of high-tonnage industrial waste can be made by the most material-intensive industry – building materials industry, for which this resource base is virtually inexhaustible. The use of technogenic raw materials instead of the traditional ones together with the expansion and rationalization of the raw material base of construction industry may provide for the achievement of environmental, economic, organizational and technological effects.

The research and analysis of the positive domestic and foreign experience allowed to develop key recommendations for the efficient implementation of the raw material base of construction industry based on wider application of technogenic raw materials, deep processing of domestic raw materials, efficient use of resources, and the disposal of accumulated large-tonnage waste of domestic industry.

There were developed the proposals for the efficient organization of the fuel and energy base of the construction industry, involving a selection of the most efficient types of fuel, energy sources used in the construction production, as well as the most efficient schemes for providing energy resources to production processes.

This article contains the results of the author's research carried out in the framework of the state budget R&D on: ‘The efficient organization of production and management in modern construction’ and published in fundamental scientific monograph (Dontsov 2004, 182–193), which received positive reviews from leading scholars and economists of the Republic of Kazakhstan.

The results of the research obtained and the recommendations developed have been successfully implemented in the educational process for training of engineers and economists, as well as used by the Department of Economy of Pavlodar region of Kazakhstan in the development of regional production strategy.

The authors hope that the proposals developed for the efficient use of natural resources and comprehensive processing of mineral raw materials, the effective organization of raw materials, and fuel and energy base of the construction industry will improve the efficiency of the construction industry in the industrial regions of Kazakhstan and will help solving their environmental problems.

Future trends of research in this area may be associated with a more active commercialization of the developed proposals that would allow clarifying their economic, environmental, organizational and technological and other efficiency.

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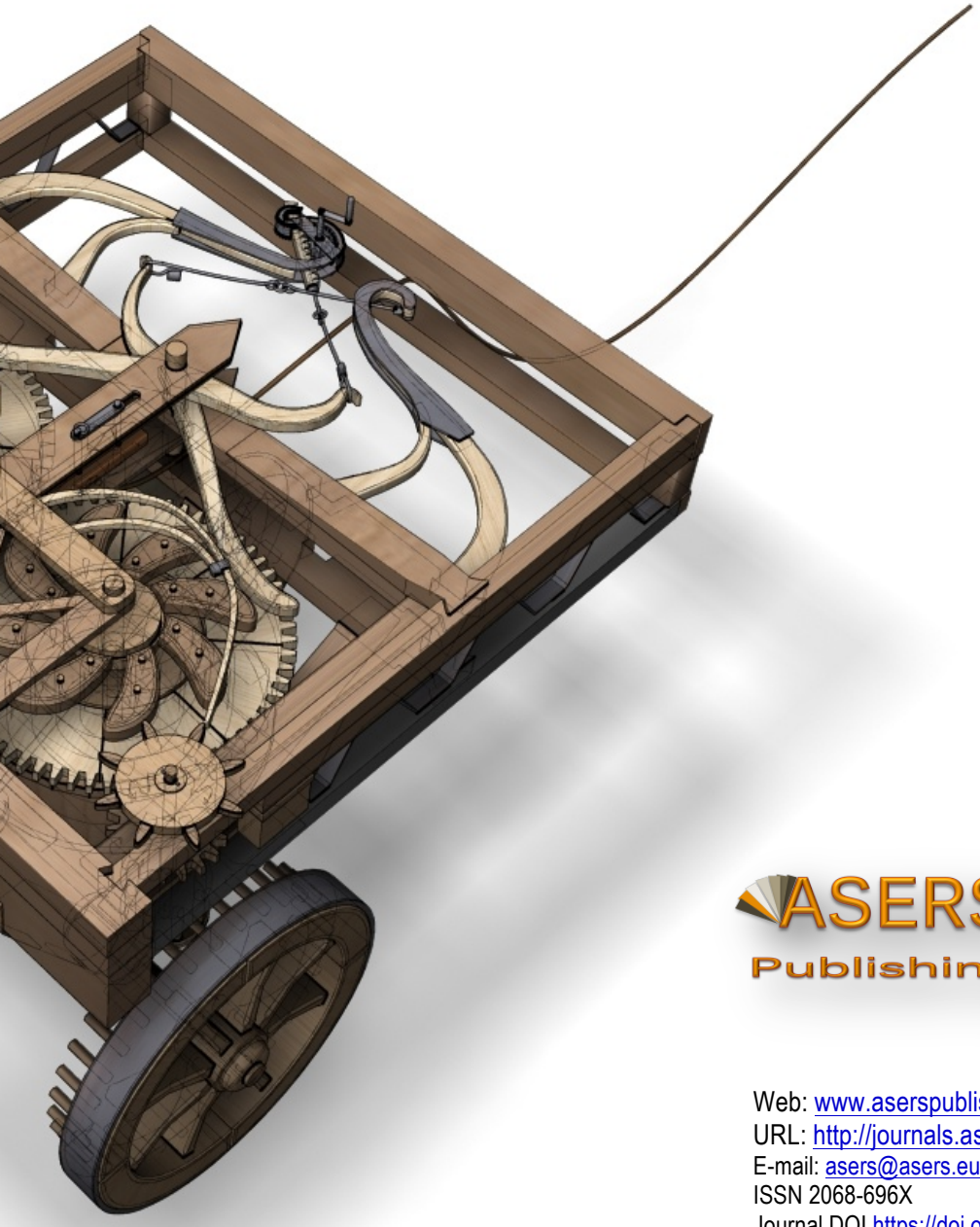

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